Appendix
to ED Decision 2018/001/R
Subject 050 — METEOROLOGY

RELATED NPA: 2016-03(D) — RMT.0595 — 6.2.2018

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1. Summary of the outcome of the consultation

Please refer to the Explanatory Note to Decision 2018/001/R.

2. Individual comments and responses

In responding to comments, a standard terminology has been applied to attest EASA's position. This terminology is as follows:

(a) **Accepted** — EASA agrees with the comment and any proposed amendment is wholly transferred to the revised text.

(b) **Partially accepted** — EASA either agrees partially with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.

(c) **Noted** — EASA acknowledges the comment but no change to the existing text is considered necessary.

(d) **Not accepted** — The comment or proposed amendment is not shared by EASA.

comment	*241-D* comment by: *René Meier, Europe Air Sports* Check
response	Noted.

comment	*272-D* comment by: *CAA-NL* Enclosed the comments of the Netherlands on the **Notice of Proposed Amendment 2016-03 (D)** Subject 050 *050 01 03 01 Barometric pressure, isobars* *LO (03) Describe the principle of the barometers (mercury barometer, aneroid barometer). Not necessary to be examined* We are of the opinion that at least the aneroid barometer is basic knowledge for a pilot, because it is used in an aircraft for pressure and so for altitude measurement. *050 01 03 02 Pressure variation with height, contours (isohypses)* The principle of the Isohypse in Aviation is one of basic and essential knowledge. Above the surface are no isobars, only isohypses: they determine the speed and direction of the wind. Deleting the isohypse makes it impossible for a pilot to understand the upper air, the flightlevel etc. He/she will no longer understand the variation in true altitude when flying a fixed Flightlevel. The windplot in briefing charts is depicted from charts with isohypses! Also see 050-02-02-01 LO (05) Isohypse must remain! LO *(02) X Describe qualitatively quantitatively the variation of the barometric lapse rate*. This proposed change has big consequences. At least in Holland is made an agreement some years ago, to use 27ft (8m) as lapse rate in ALL SUBJECTS of the Theoretical Knowledge (TK). At least all altimeter questions must be revised! 050 02 02 01 Primary cause of wind, pressure gradient, Coriolis force, gradient wind Gradient Wind should remain in the LO's. Mainly all flying above the friction layer happens with the Gradient Wind! There is a great practical use and so a basic knowledge for pilots.

LO (07) Explain the gradient wind effect and indicate how the gradient wind differs from the geostrophic wind in cyclonic and anticyclonic circulation.
Gradient Wind should remain. It explains the flow pattern from anticyclones to cyclones and differs greatly from geostrophic wind, which almost never flows in true atmosphere in the upper air. It is necessary for understanding the atmosphere.

050 03 01 02 Mixing ratio Intentionally left blank
Deleting Mixing Ratio makes it difficult to explain and understand several other humidity issues. In aviation humidity and the amount of water(vapour) is essential in several aspects, not only Meteorology. Basic knowledge for a pilot.

050 04 01 02 04
Delete fractus, humullis, mediocris, congestus, calvus and capillatus as those have no importance for pilots.

050 05 01 01 Process of development of precipitation
Deleting LO (01, 02 and 03) makes it impossible to understand the principles of "warm" and "cold" clouds. This will have a great effect on understanding icing and several kinds of precipitation. This is essential in aviation!

050 06 02 01 General aspects
We suggest not to delete roughly knowing Seasonal Latitudes of the most important front (The Polar front).This is basic knowledge in meteorology.

050 06 02 03 Cold front, associated clouds and weather
LO(03) Explain the seasonal differences in the weather at cold fronts.
Cold fronts are more relevant in aviation than warm fronts, especially because cold fronts can develop heavy thunderstorms and squall-lines in summertime. So we propose not deleting Cold fronts here.

050 09 05 01 Properties and occurrence
LO (04) Compare the occurrence of tornadoes in Europe with the occurrence in other locations, especially in the United States of America
Heavy thunderstorms with Tornadoes are of great importance in some parts of the World. We are of the opinion that this is basic knowledge for an intercontinental pilot.

050 09 05 01 03
Delete Fiujita scale. Not relevant for pilots as every tormado has to be avoided

050 09 07 00 Stratospheric conditions
Why change 20 km height in FL650 in 50-01 and deleting the conditions up there?

050 09 08 03 01/02
Do not delete, necessary to understand formation of valley inversions in relation to the next LO 050 050 09 08 03 03

050 10 02 02 Surface charts
Recognise the following weather systems on a surface weather chart (analysed and forecast): ridges, cols and troughs; fronts; frontal side, warm sector and rear side of mid-latitude frontal lows; high- and low-pressure areas

"Col" is a principal surface pressure pattern between two highs and two lows. It often exits, has special surface weather properties in winter (eg Fog) and summer and should not be deleted.

050 10 02 03 Upper-air charts
LO (01) Define 'constant-pressure chart'.
LO (02) Define 'isohypse (contour line)'.
Define 'isotherm'.

It is too essential for understanding flying in the upper air, windspeed and direction etc. Flying on Flightlevel and changing constantly your true altitude, is essential.
See also 050 02 02 01 LO(05) Isohypse

050 10 04 01
… Rewrite the LO's in this item as the repetition of the '- ' make the LO's unclear.

IN GENERAL:
The proposed changes in the LO's will have a great impact on the whole Question Bank. A lot of Q'ens must be revised or even deleted! Our estimate is: possible up to 15 or 20% of the Q'ens must be deleted.
Some of the proposed changes will even have a negative effect on Aviation Safety.
All questions in the data base must be checked to the new LO's
We are very positive over bringing in "Deposition" in 050-03-02-01 and "Ice Cristal Icing' in 050-09-01-04.

061 General navigation
General remarks.
The title of this subject should not be changed, delete 'and inertial' as these LO's belong to 022. Transfer is not logical and will give a lot of unnecessary extra costs for all stakeholders.
061 06 01 00 should not be in Gen Nav and the proposed transfer from 022 is not appropriate. In a former revision of the LO's in the twentieth century Inertial Navigation was transferred from 061 to 022.
061 01 04 02 01/04/05/06/07 and 061 061 01 04 03 01/02/04, 061 02 01 00 .. Terrestial Magnetism and its limitations as variation, inclination and deviation for use by navigators. It is part of the basic navigation principles and belonged to General Navigation for long. These LO's should not be transferred to 022.
061 04 02 04/05 and 061 05 02 00 ..
It has to be realised that the technique of navigation is part of the subject General Navigation. The application of the technique is done in other subjects as 033. So most of the proposed transfers to 033 should not be done.
The part with mental calculations state that ECQB exam questions should be answered with rules that approximate the correct answers. For example it is assumed that the EWC is equal to the wind component along the track, which is not correct. It is even stated that answers, which are c calculated in a correct with trigonometrics and a calculator would be marked as not correct. This is unacceptable. In the theory instruction it is realistic to teach the candidates how to get the correct values. In subject 100 KSA it is possible to deal with rules of thumb to get the approximations as used by mental calculation.

The parts stating what to do when one is unsure of the position and lost position do not belong to LO's.
061 03 03 05 01 Do not delete Radio bearings are as important as VOR radials in the next LO.

	Plotting is relevant for understanding and can be used for preparation of a flight plan. 061 04 01 03 01 Due to cross out of wind velocity the LO is not complete. 061 04 04 01 03 Do not delete as this is important for mental calculations. **062 Radio Navigation** The range of signals with a frequency of 30 MHz and higher is now only stated in the VDF LO's. For VOR. DME and RADAR no LO about the range is left. It should be stated also for those nav aids and 062 02 03 03 02 should not be deleted. For DME it can be stated in 062 02 04 03 and for RADAR in 062 03 01 00. 062 07 04 01 PBN In this item no LO is stated about systematic errors, random errors, drms, R95 and the graph of Gauss. Pilots have to understand what it means to have a 95% accuracy. At least the relevant NSE's have to mentioned for the different navaids as stated in ICAO Annex 10, NDB and VOR 5°, DME 0.2 NM, GNSS depending of the aids to improve the accuracy.
response	Thank you for your extensive feedback, which has been greatly appreciated. EASA has carefully assessed all the comments received. EASA is aware of the fact that the European Central Question Bank has to be checked to the new LOs and that a lot of questions must be revised or even deleted. EASA does not agree that some of the proposed changes will have a negative effect on aviation safety but that the efficiency of the examinations will be higher by focusing on the knowledge that is relevant for pilots. Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number. Regarding your comment referring to LO 050 01 03 01 (03): Accepted. EASA agrees that at least the aneroid barometer is basic knowledge for a pilot. The LO will be retained and marked as BK. Regarding your comment referring to LO 050 01 03 02: Accepted. EASA agrees and the headline will read again: Pressure variation with height, contours (isohypses). In comment 35-D, the same issue was raised regarding this LO. Regarding your comment referring to LO 050 02 02 01 (05): Not accepted. As a consequence of the change in 50 01 03 02, 'isohypse' will not be deleted. Regarding your comment referring to LO 050 01 03 02 (02): Not accepted. EASA is of the opinion that 30 ft/hPa will be used in all exams. Mainly the 050 questions have to be changed. Regarding your comment referring to LO 050 02 02 01: Accepted. EASA agrees that mainly all flying above the friction layer happens with the gradient wind. There is a great practical use and so it is basic knowledge for pilots. The headline of 50 02 02 01 will be retained: 'Primary cause of wind, pressure gradient, Coriolis force, gradient wind'. As a consequence, LO (07) will not be deleted. In a separate mail (Blatter), the same comment was raised regarding this LO. Regarding your comment referring to LO 050 03 01 02: Not accepted. EASA is of the opinion that mixing ratio knowledge is not relevant for pilots. Relative humidity is relevant.

Regarding your comment referring to LO 050 04 01 02 (04): Partially accepted.

EASA agrees that fractus, humilis and mediocris have no importance for pilots — they will be deleted from LO (04); congestus, calvus and capillatus are indicators for an unstable atmosphere with the possibility of Cbs and corresponding flight hazards and therefore will be part of the LO.

The text will be amended as follows:

Describe and identify by shape the following species and supplementary features: *castellanus, lenticularis, ~~fractus, humilis, mediocris,~~ congestus, calvus, capillatus* and *virga*.

In comment 37-D, the same issue was raised regarding this LO.

Regarding your comment referring to Subject 050 05 01 01: Accepted.

EASA agrees that it would be impossible to understand the principles of 'warm' and 'cold' clouds which will have a great effect on understanding icing and several kinds of precipitation. LOs (01) to (03) will be retained.

In comments 71-D and 311-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 06 02 01: Accepted.

EASA agrees not to delete the approximate seasonal latitudes of the polar front. LO (03) will be retained as LO 050 06 02 01 (04) is.

In comment 71-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 06 02 03 (03): Accepted.

EASA agrees that cold fronts are more relevant for aviation than warm fronts, because cold fronts can develop heavy thunderstorms and squall-lines in summertime. LO (03) will be retained.

In comments 79-D and 314-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 09 05 01 (04): Accepted.

EASA agrees that heavy thunderstorms with tornadoes are of great importance for pilots wherever they will occur. LO (04) will be retained.

Regarding your comment referring to LO 050 09 05 01 (03): Accepted.

EASA agrees as every tornado has to be avoided. In LO (03), '(including the Fujita Scale)' has to be deleted.

In comments 22-D and 38-D, the same issue was raised regarding this LO.

The text will be amended as follows:

Describe the typical features of a tornado such as appearance, season, time of day, stage of development, speed of movement and wind speed ~~(including Fujita scale).~~

Regarding your comment referring to Subject 050 09 07 00: Accepted.

EASA is of the opinion that the ISA is defined up to FL 650 and that relevant condition and flight hazards in the lower stratosphere should be known by pilots.

The entire Subject 050 09 07 00 'Stratospheric conditions' will be retained.

In comment 272-D, the same issue was raised regarding this subject.

Regarding your comment referring to LOs 050 09 08 03 (01) and (02): Accepted.

EASA agrees that both LOs are necessary to understand formation of valley inversions in order to describe the effects of valley inversions on an aircraft in flight. Both LOs will be retained.

In comment 39-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 10 02 02 (01): Accepted.

EASA agrees that 'cols' (a principal surface pressure pattern between two highs and two lows) often exists, and has special surface weather properties in winter (e.g. fog) and summer. 'Col' will be retained within LO 050 10 02 02 (01).

In comment 266-D, the same issue was raised regarding this LO.

Regarding your comment referring to Subject 050 10 02 03: Accepted.

EASA agrees that 'upper-air charts' are too essential for understanding flying in the upper air, wind speed and direction as well as flying on flight level and changing constantly the true altitude of the aircraft. LOs (01) to (04) will be retained.

In comments 40-D, 71-D and 328-D, the same issue was raised regarding this LO.

Regarding your comment referring to Subject 050 10 04 01: Accepted.

EASA agrees that the LOs of 050 10 04 01 have to be rewritten in order to avoid confusion.

The text will be amended as follows:

~~— Name the main objectives of the world area forecast system:~~

~~— world area forecast centres (upper-air forecasts).~~

Name the world area forecast centres (WAFCs) as the provider for the upper-air forecasts: WAFCs prepare upper-air gridded forecasts of upper winds; upper-air temperature and humidity; direction, speed and flight level of maximum wind; flight level and temperature of tropopause, areas of cumulonimbus clouds, icing, clear-air and in-cloud turbulence, and geopotential altitude of flight levels.

~~— Name the main objectives of the world area forecast system:~~

~~— meteorological offices (aerodrome forecasts, briefing documents).~~

— Name the meteorological (MET) offices as the provider for aerodrome forecasts and briefing documents.

~~— Name the main objectives of the world area forecast system:~~

~~— meteorological watch offices (SIGMET, AIRMET).~~

Name the meteorological watch offices (MWOs) as the provider for SIGMET and AIRMET.

~~— Name the main objectives of the world area forecast system:~~

~~— aeronautical meteorological stations (METAR, MET reports).~~

Name the aeronautical meteorological stations as the provider for METAR and MET reports.

~~— Name the main objectives of the world area forecast system:~~

~~— volcanic ash advisory centres.~~

Name the volcanic ash advisory centres (VAACs) as the provider for forecasts of volcanic ash clouds.

~~— Name the main objectives of the world area forecast system:~~

~~— tropical cyclone advisory centres.~~

Name the tropical cyclone advisory centres (TCACs) as the provider for forecasts of tropical cyclones.

In comments 41-D and 71-D, the same comment regarding this LO was raised.

comment *293-D* comment by: *Luftfahrt-Bundesamt*

	The LBA has no comments on NPA 2016-03 (D).
response	Noted. Thank you for providing this general comment on the NPA.

comment *294-D* comment by: *European Cockpit Association*

- Overall, ECA acknowledges there has been reorganization of the way some Learning Objectives (LOs) are presented. The splits / moves are visible, and it seems to add clarity and make logical sense.
- At the same time, the review shows a **misunderstanding of the concept of Competency-based-training (CBT)**, and therefore puts an almost exclusive focus on checking/assessment provision, **with very few**, if not no, provision on area 100 KSA **training**. In particular, no provision is proposed to develop the trainee's relevant *Core Competencies* through the relevant de-briefings.
- Moreover, as CBT is to be the new standard for training and licensing purposes, it is essential that there is a **common and coordinated logic sustaining the relevant EASA Rulemaking activities** to avoid duplication, overlaps, and conflicting provisions. In that respect, there should be only one basis for the definition and implementation of Competencies Frameworks throughout the whole Part FCL, and potentially all Aviation Personnel Licensing and Training provisions.
- Furthermore, with the introduction of CBT, Learning Objectives should emphasize - with regard to e.g. operational procedures - on the importance of the policy update of certain documents and procedures. New students should be able to keep up with the continuous development of new documents or updates of old ones. Therefore, it is not only necessary to know certain information (e.g. which documents to keep on board) but also to know the sources of amendments and future developments. Especially concerning long-range operations, pilots are usually further down the career path and the time of flight school is much in the past.
- We agree with the need to establish the **minimum amount/percentage of classroom instruction**. However, it is not clear how we can define *the minimum* percentage of classroom instruction. This issue is of particular importance as the classroom instruction, in general, is necessary to check the competencies of the student.
- We further fear that the lack of **consistency between the *Competencies* developed by an ATO and an airline** will create not only extra cost, but also a potential mismatch between the pilot profile required by the airline and the one provided by the ATO. This may cause some pilots being hired and subsequently dismissed by the airline due to their competency level being inappropriate. This will create not only an extra financial burden, but also a significant social cost for pilots-to-be.
- We **welcome** the **improvements in certain fields**, e.g. **subject Instrumentation** (022) where we see a good update of the learning objectives, removing irrelevant topics and adding useful new ones. In particular addition of FMA's, Fly by Wire, general **improved automation knowledge** and unreliable airspeed are a positive change. At the same time, we are missing knowledge requirements on the implementation of HUD displays on more next-gen aircraft as the B787/737Max/A350/etc.
- The introduction of ***Threat and Error Management* (TEM) is welcomed**. It does add a physical/operational dimension to a subject that some find not very practical. If performed properly it helps the student to think in terms of *understanding => recognition => prevention/recovery*, as per UPRT.
- We further **welcome** the **introduction of the *Fatigue and stress management chapter.*** However, ECA is surprised not to find a new Learning Objective demanding

explanation of the **components of FRMS**, given the emphasis put on this subject in the foreword. The student should be able to describe FRMS and explain the main components of it.

- Similar refers to the ***Peer Support Programs (PSP).*** It is for the benefit of both ATPL and CPL holder to know of the existence of PSP programs and their importance for the safety-culture of an operator.
- Finally, there seems to be a global search for clarification of theoretical notions, which can only be welcomed if it is in addition to the explanation of the notion itself (and not just vulgarization with less resulting knowledge / understanding).

response

Noted.

Thank you for providing this general comment referring to CBT.

EASA would like to refer to its responses regarding CTB in other CRD parts of this NPA.

comment

353-D comment by: *GNSS Centre of Excellence*

Many changes in subject 062 are in consensus with our findings. We agree with most removals and additions in this chapter. In removals part we even identified several more Los which may be removed - 062 01 01 06 and 07. These Los are connected with modulation and we suggest to remove them, or if they are found important to add to these Los several other modulations used in aviation. But it is matter of discussion if this knowledge has any practical use.

But our most important issue with whole NPA is connected with GNSS, part of 062. We found that there are completely missing information about all GNSS signals and services planned in nearest future. L5 E5 and LC will be probably in operation earlier that this NPA will turn in AMC.

Signal on L5 frequency is meant to be new standard for aviation. Glonas will introduce own SBAS system. Multi constellation of several GNSS system will solve problems with achievability and will change the flight planning process, etc. These information are essential and important and shall be incorporated in theoretical training. Specific proposed Los are in second part of this document.

Similarly in area of other GNSS we agree with removal of information of no practical value but we strongly urge to add information about differences of other GNSS systems.

For example information about SBAS usage of other GNSS. Information about types of signals and information incorporated in these signals of Galileo, Glonas and Beidou. I tis essential to know which information is GNSS providing to allow pilot to use them most properly.

Galileo systems is removed from LO completely even the fact that in multi constellation is already usable today.

We found these technical information usable for practical flying and we recommend that this chapter of LO shall be changed properly.

Information about antenna shadowing shall be more stressed.

Advanced RNP is covered vaguely, for system which shall be most important in future.

Other issue in 062 is inadequate explanation of several types of RNAV/RNP operation. We are not sure if this agenda is part of subject 010 or 062, but in this NPA we find information about PBN little underestimated. Number of Los of PBN in compare with classical navigation seems still inadequate, with fact that PBN will, and in many regions already is, the most used navigation way.

Whole chapter of 062 connected to GNSS is changed importantly and number of removals

	and changes made these LO break away from the concept.
response	Noted. Thank you for providing this general comment referring to Subject 062. EASA would like to refer you to its responses regarding Subject 062 in the CRD part for 062 (CRD to NPA 2016-03(D)).

comment	*355-D* comment by: *Rogerio Pinheiro* *Dear Sirs,* *APTTA – Associação Portuguesa de Transporte e Trabalho Aéreo is pleased to submit its comments regarding NPA 2016-03 (D).* *1) 050 METEOROLOGY* *- Regarding the concrete question about LO 050 09 07 00 'Stratospheric conditions' it is our understanding that it can be removed from program (practical use).* *2) 061 GENERAL AND INERTIAL NAVIGATION* *- Contrary to Compasses, is not rational the transference of Terrestrial Magnetism and of the airplane to 022; the definition and handling of Mag VAR and Compass DEV becomes decontextualized.* *- It seems counter-productive and not rational to ban the GRID Navigation with the simple and fallacious argument that it has "no practical use"; Polar Navigation has nowadays a vital influence on transcontinental routes and is supported by GRID Nav; basic concepts and procedures, should have been kept, notably to interpret the maps of enroute navigation of operators flying by poles (Lufthansa's maps are an example.)* *- It is not true that the "speed factor" has no practical use; the definition should have been maintained, since it serves as basis for several mental processes* *- It is not rational to change the altitude calculations (TA, IA, CA) for 050, since the CRP-5 also calculates them; Simplified mathematical method is a way to crosscheck; on the other hand, the altitude, in its various forms, is a navigation variable (VFR and IFR);* *- It is not comprehensible that the navigation procedures in taking off and descending have been altered to 033 (obviously, the enroute procedures were maintained); It would be perfectly rational to definitely assume a model that considered the discipline 033 as integrating the navigation knowledge (general and Radio), Meteo, Performance and Mass & Balance, needed for flight planning (VFR and IFR) as well as the monitoring flight ; It does not make sense to carry over navigation concepts for 033, as is the case with Meteo, Perf and M & B; it makes no sense to continue to have the concepts and calculation of PET / CP, PNR / PSR and RA out of 061; 033 would apply them in planning and monitoring of the flight.* *3) Subject 062 — RADIO NAVIGATION* *- The VLF band, although it has no aeronautical applications, is part of the radio spectrum, and should not have been omitted, since the LO establishes a "List the bands of the frequency spectrum"; we also consider that the LO should be identified as "List the bands of the radio frequency spectrum for electromagnetic waves" instead of "List the bands of the spectrum for frequency electromagnetic waves";*

	- the obsolete system Ground D / F is kept but it continues to be ignored the new eLORAN, which should be included, given that: *1. It is the secondary source of time synchronization and positioning in the USA, where there is global coverage in the mainland which led to the inclusion of its 29 stations in the WAAS system.* *2. eLORAN is the only system that could serve as a backup to GNSS in moments of signal blackout due to sun flare and jamming actions (eg. South Korea, in March 2016, and where the eLoran will be operating by the end 2019).* *3. The North West Europe has completed the process of modernization of the obsolete LORAN-C, converting it into eLORAN and ensuring coverage of this region* *4. There are already shipping hybrid systems that include eLORAN, and these are certified by IMO for SAR operations.* *5. There is eLORAN coverage between the EUR and the USA.* *- Keeping the D / F, Air D / F system continues to be ignored, and it is essential for SAR operations, in what concerns tracking and homing signals from the ELT* *- The reference to NDB N0N A1A is maintained, despite its obsolescence.* *- No reference is made to the accuracy and the importance of DME-precision which has assumed preponderance in PBN cases (eg. in the European P-RNAV), as a crucial element of validation of accuracy by the FMS) and concomitant move to the background of the VOR already in slow phase out (the USA will complete until 01JAN2020, the phase out of 400 VOR).* *- MLS is withdrawn; we question why the same argument "n practical application, GNSS approaches are developed" is not applied to the NDB / ADF. There are two dozen of MLS installed in Europe! The theme should have been maintained, with possible downgrade in their LOs* *- The operation and interpretation of AWR should not have passed to 050; Meteorology discipline deals with phenomena / events, and not instrumentation / Avionics* *- It is not rational to have moved the FMS and EFIS (ND) to 022. This mistake had been made with the Inertial Navigation (only now "returned" to 061). The course 022 should be devoted to describing the functioning and operation principles not the operation itself, since they involve specific navigation functions outside the "Instrumentation" context.* *Kind regards,* *APTTA*
response	Thank you for your extensive feedback, which has been greatly appreciated. EASA has carefully assessed all the comments received. Regarding your comments referring to Subject 061. EASA would like to refer to its responses regarding Subject 061 in the CRD part for 061 (CRD to NPA 2016-03(D)). To answer your comments in more detail: First comment: EASA would like to highlight that the theory of terrestrial magnetism and the direct-reading compass are instrument-related and therefore belong in Subject 022. Explanation and application of variation and deviation of course remain in Subject 061 01 03 01. Second comment: EASA agrees that there should be some knowledge of grid navigation. Syllabus references 061 01 04 05 (01) to (04) will be reinstated. See accepted comment 91-D. Third comment: EASA agrees that ‘speed factor’ should be maintained and these Syllabus references will be reinstated. See accepted comments 96-D and 251-D. Old LO 061 04 04 01 (03) regarding ‘speed factor’ is moved to new 061 01 07 01 (03).

Fourth comment: EASA has aligned Subject 050 and Subject 061 regarding attitude calculations into 30 ft/hPA. See also accepted comments 71-D, 76-D and 345-D.

Fifth comment: EASA agrees and these Syllabus references will be reinstated. See responses to this Subject in CRD for Subject 033 and CRD for Subject 061.

Regarding your comments referring to Subject 062.

EASA would like to refer to its responses regarding Subject 061 in the CRD part for 061 (CRD to NPA 2016-03(D)).

First comment: Instead of deleting VLF and EHF, EASA will retain VLF. See partially accepted comments 54-D and 65-D.

Second comment: EASA cannot find any reference to eLORAN in the NPA.

Third comment: EASA would like to state that some LOs on D/F have been kept.

Fourth comment: EASA does accept that NDB N0N A1A is obsolete.

Fifth comment: EASA would like to state that reference to the accuracy and the importance of DME precision is covered in PBN.

Sixth comment: EASA does not agree with your general comment on LO 062 06 00 00 (MLS).

Seventh comment: EASA does not agree with your general comment on LO 062 03 03 06.

Eight comment: EASA considers this to be part of Subject 022.

Regarding your comment referring to LO 050 09 07 00: Noted.

EASA is of the opinion that the ISA is defined up to FL 650 and that relevant condition and flight hazards in the lower stratosphere should be known by pilots.

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comment *296-D* comment by: *DGAC FRANCE*

General comment

First DGAC France would like to thank EASA for the update of the learning objectives, the theoretical knowledge syllabi and ground school exams. We congratulate the Agency on the comprehensive overhaul of the learning objectives which will lead to more simplicity. We notice in particular that the subject 022 in particular is well done, the learning objectives are clearer and the curriculum is both more precise and less redundant.

Secondly DGAC France supports the introduction of the TEM concept and application in the training programs. Nevertheless, without entering too much into details DGAC France wants to develop only two points among those that caught our attention and arose questions.

§ One of the goals of the area 100 KSA is to teach the future pilots the need for developing these core competencies so that they could manage the threats and errors in the TEM model.

We would like to emphasize that there is no need to assess future pilots on that knowledge, the only need is that the trainees understand the use of competencies in a TEM model, and the way they can rely on them.

The ICAO-defined competencies should be all introduced (and not only a selection of them) with their ICAO definitions, in order to prepare students to use them during practical training and need not to be assessed during the theoretical part of the training.

We suggest ensuring an identical level of use within the ATOs, that the observable indicators for these learning objectives should be in compliance with the ICAO principles.

DGAC France also considers that it is necessary to ensure consistency between the different

	EASA working groups on the EBT core competencies before implementing them. § We are surprised by the important focus on mental maths developed in this NPA. Mental maths should only be exercised to develop the situation awareness competency. Therefore, the assessment should be as less pervasive as possible since we do not see a significant safety or competency concern nowadays with the evolution of the cockpits.
response	Noted. Thank you for providing this general comment regarding this NPA.

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comment	*29-D* comment by: *Bristol Groundschool* The deletion of so many LO's that are deemed "irrelevant" or "of no practical use to pilots" is long overdue and highly commendable.. The new section on Performance-Based Navigation is also welcome and very relevant, but it moves into areas of rapid development in which many Theoretical Knowledge instructors will have little or no practical experience. They will be relieved to see that the LOs in the early part of this section are spelt out fully and precisely, but this clarity fades as we move further into the technical details of the topic.
response	Noted. Thank you for providing this general comment referring to Subject 050 'Meteorology'.

comment	*30-D* comment by: *UK CAA* **Page No:** 2 and 135 **Paragraph No:** n/a **Comment:** Several Learning Objectives (LO) have been categorised in all subject tables as Basic Knowledge (BK). The intention is that these LOs will be taught by the Approved Training Organisation (ATO) and tested in progress test, but not examined by the National Aviation Authority (NAA) using the European Central Question Bank (ECQB). The LOs that have been identified as BK are the principles on which all topic areas are developed and higher levels of understanding are achieved, therefore it should be a requirement that these principles are examined. If BK is being taught and tested by the ATO, there is no reason why the ECQB is not used to verify this knowledge and that these principles have been embedded and understood by the student. **Justification:** If BK is removed from the ECQB along with the existing questions, new more complex questions to a higher level will have to be developed to make the examination generate with an adequate coverage of all topic areas in individual subjects. This could have a detrimental effect on some students who are naturally nervous when taking examinations, as there will be no BK questions in the test to allow them to build their confidence and they will be seriously disadvantaged by this proposal. The EASA Exams Team require each topic area to be 5 deep with the number of questions

available in the ECQB, this will not be achievable in some subjects as it will not be possible to write additional question one topic area.

With additional questions examining to a higher level, the table at AMC1 ARA.FCL.300(b), detailing the time allowed for an examination and the number of questions for each topic area, will need to be reviewed to establish if an examination is achievable. We are not aware of any evidence that the RMG have confirmation of this or have carried out any sort of analysis or testing.

Proposed Text: n/a

response

Noted.
Thank you for providing this general comment referring to the BK of several LOs.
EASA would like to refer to the several responses regarding BK in the different CRD parts.

comment

283-D comment by: *Aero-Club of Switzerland*

Page 2/233
Subject 050 Meteorology
Your question addressed to the stakeholders on
050 09 07 00 Stratospheric conditions
In our view maintaining this topic is not justified, it of course remains a topic for military flight crew.

To add 050 09 01 04 on Ice crystal icing is well justified considering accidents and incidents of the past years involving not only airliners but also business jets.

response

Thank you for providing these comments.

Regarding your comment referring to Subject 050 09 07 00: Not accepted.

EASA is of the opinion that the ISA is defined up to FL 650 and that relevant condition and flight hazards in the lower stratosphere should be known by pilots.

Regarding your comment referring to Subject 050 09 01 04: Noted.

Thank you for the positive feedback on ice crystal icing.

SUBJECT 050 — METEOROLOGY p. 3-71

comment

19-D comment by: *Bristol Groundschool*

Page 5, LOs 050 01 01 03 (02 and (04).

The text is not scored out, but the crosses allocating the LOs to ATPL, CPL etc. are ALL scored out. It's not clear whether the LOs are supposed to be in, or out.

response

Accepted.

EASA agrees that the text of LOs 050 01 01 03 (02) and (04) has to be deleted. EASA acknowledges that that ozone can occur at jet cruise altitudes and can constitute a hazard. Therefore, EASA added a new LO.

The text will be amended as follows:

	(02) ~~Describe the main differences of the composition of the air in the stratosphere compared to the troposphere.~~ […] Describe that ozone can occur at jet cruise altitudes and that it constitutes a hazard. In comment 71-D, the same issue was raised regarding these LOs.
comment	*20-D* comment by: *Bristol Groundschool* Page 38 LO's 050 06 02 07 (01) and (02). The term "quasi-stationary front" is deleted from (01), because it is "not defined", but then it is used in section (02)
response	Accepted. Thank you for providing this comment referring to LOs 050 06 02 07 (01) and (02). EASA agrees that 'or quasi-stationary' in LO 050 06 02 07 (02) has to be deleted as well. The text will be amended as follows: Describe the cloud, weather, ground visibility and aviation hazards in a stationary ~~or quasi-stationary~~ front.
comment	*21-D* comment by: *Bristol Groundschool* Page 23, LO 050 03 02 01 (01). Here, the term "deposition" (gas changing directly to solid) is added, correctly, and this term is used in items (10) and (11), BUT later, on page 48/9, LO 050 09 01 01 (01) uses the term "sublimation" when it should be "deposition".
response	Partially accepted. Thank you for providing this comment referring to LO 050 03 02 01 (01). EASA agrees that the word 'deposition' is not in the International Meteorological Vocabulary (WMO) and should not be in this LO as proposed in the NPA. 'Sublimation' has to be used for both processes (gas changing directly to solid and vice versa). The text will remain the same.
comment	*22-D* comment by: *Bristol Groundschool* Page 57, LO 050 09 05 01 (3). I would suggest that knowledge of the Fujita scale for tornadoes is also "non-essential knowledge", especially as the classification of the different strengths of hurricanes is not included in the section on tropical revolving storms.
response	Accepted. Thank you for providing this comment referring to LO 050 09 05 01 (03). EASA agrees as every tornado has to be avoided. In LO 050 09 05 01 (03), '(including the Fujita Scale)' has to be deleted.

	In comments 38-D and 272-D, the same issue was raised regarding this LO. The text will be amended as follows: Describe the typical features of a tornado such as appearance, season, time of day, stage of development, speed of movement and wind speed ~~(including Fujita scale)~~.
comment	*35-D* comment by: *KLM Flight Academy* 050 01 03 02 03 Do not delete, isohypses have to be known as those lines are shown in high level charts
response	Accepted. Thank you for providing this comment referring to LO 050 01 03 02 (03). EASA agrees and the headline will read again: 'Pressure variation with height, contours (isohypses)'. In comment 35-D, the same issue was raised regarding this LO.
comment	*36-D* comment by: *KLM Flight Academy* 050 02 02 01 05 Do not delete isohypses, as those lines are shown in high level charts
response	Accepted. Thank you for providing this comment referring to LO 050 02 02 01 (05). As a consequence of the response to comments 35-D and 272-D, the word 'isohypse' will not be deleted in 050 02 02 01 (05). The text will remain the same. In comments 71-D and 302-D, the same issue was raised regarding this LO.
comment	*37-D* comment by: *KLM Flight Academy* 050 04 01 02 04 Delete fractus, humullis, mediocris, congestus, calvus and capillatus as those have no importance for pilots.
response	Accepted. Thank you for providing this comment referring to LO 050 04 01 02 (04). EASA agrees that fractus, humilis and mediocris have no importance for pilots, and they will be deleted from LO (04); congestus, calvus and capillatus are indicators for an unstable atmosphere with the possibility of Cbs and corresponding flight hazards and therefore will be part of the LO. The text will be amended as follows: Describe and identify by shape the following species and supplementary features: *castellanus, lenticularis, ~~fractus, humilis, mediocris,~~ congestus, calvus, capillatus* and *virga*. In comment 272-D, the same issue was raised regarding this LO.
comment	*38-D* comment by: *KLM Flight Academy* 050 09 05 01 03 Delete Fiujita scale. Not relevant for pilots as every tormado has to be

	avoided
response	Accepted. Thank you for providing this comment referring to LO 050 09 05 01 (03). EASA agrees as every tornado has to be avoided. In LO 050 09 05 01 (03), '(including the Fujita Scale)' has to be deleted. In comments 22-D and 272-D, the same issue was raised regarding this LO. The text will be amended as follows: (03) Describe the typical features of a tornado such as appearance, season, time of day, stage of development, speed of movement and wind speed ~~(including Fujita scale)~~.

comment	*39-D* comment by: *KLM Flight Academy* 050 09 08 03 01/02 Do not delete, necessary to understand formation of valley inversions in relation to the next LO 050 050 09 08 03 03
response	Accepted. Thank you for providing this comment referring to LOs 050 09 08 03 (01) and (02). EASA agrees that both LOs are necessary to understand formation of valley inversions in order to describe the effects of valley inversions on an aircraft in flight. Both LOs will be retained. In comment 272-D, the same issue was raised regarding this LO.

comment	*40-D* comment by: *KLM Flight Academy* 050 10 02 03 01/02/03/04 Do not delete, upper air charts are important for aviation
response	Accepted. Thank you for providing this comment referring to LOs 050 10 02 03 (01) to (04). EASA agrees that 'upper-air charts' are very essential for understanding flying in the upper air, wind speed and direction as well as flying on flight level and changing constantly the true altitude of the aircraft. LOs 050 10 02 03 (01) to (04) will be retained. In comments 71-D and 272-D, the same issue was raised regarding this LO.

comment	*41-D* comment by: *KLM Flight Academy* 050 10 04 01 … Rewrite the LO's in this item as the repetition of the '- ' make the LO's unclear.
response	Accepted. Thank you for providing this comment referring to Subject 050 10 04 01. EASA agrees that the LOs of Subject 050 10 04 01 have to be rewritten in order to avoid confusion. The text will be amended as follows: ~~— Name the main objectives of the world area forecast system:~~ ~~— world area forecast centres (upper-air forecasts).~~

Name the world area forecast centres (WAFCs) as the provider for the upper-air forecasts: WAFCs prepare upper-air gridded forecasts of upper winds; upper-air temperature and humidity; direction, speed and flight level of maximum wind; flight level and temperature of tropopause, areas of cumulonimbus clouds, icing, clear-air and in-cloud turbulence, and geopotential altitude of flight levels.

(02)

~~— Name the main objectives of the world area forecast system:~~

~~— meteorological offices (aerodrome forecasts, briefing documents).~~

— Name the meteorological (MET) offices as the provider for aerodrome forecasts and briefing documents.

(03)

~~— Name the main objectives of the world area forecast system:~~

~~— meteorological watch offices (SIGMET, AIRMET).~~

Name the meteorological watch offices (MWOs) as the provider for SIGMET and AIRMET.

(04)

~~— Name the main objectives of the world area forecast system:~~

~~— aeronautical meteorological stations (METAR, MET reports).~~

Name the aeronautical meteorological stations as the provider for METAR and MET reports.

(05)

~~— Name the main objectives of the world area forecast system:~~

~~— volcanic ash advisory centres~~

Name the volcanic ash advisory centres (VAACs) as the provider for forecasts of volcanic ash clouds.

(06)

~~— Name the main objectives of the world area forecast system:~~

~~— tropical cyclone advisory centres~~

Name the tropical cyclone advisory centres (TCACs) as the provider for forecasts of tropical cyclones.

In comment 272-D, the same issue was raised regarding this LO.

comment *67-D* comment by: *roger henshaw*

<u>These comments are all with reference to the CBIR & EIR syllabus in subject 050.</u>

050 01 03 03 (02) remove for EIR/CBIR- comparison of QNH with QFF is not considered to be of any relevance as the difference is likely to be insignificant and QFF is not used in aviation.

050 01 05 01 (02) remove for CBIR/EIR - the stratosphere above 36,090ft is of no relevance to the CBIR/EIR candidate.

050 02 02 01 (03) retain for CBIR/EIR - understanding of relationship between coriolis and wind direction is relevant.

	050 02 03 02 (01) if this topic is valid for IR it must be equally valid for CBIR/EIR. **050 02 06 03 (01, 02) if this topic is relevant to IR it must be equally relevant to CBIR/EIR especially as it is shown on Sig Weather Charts.** **050 03 02 01 (01, 09) retain for CBIR/EIR - a CBIR candidate should understand the definitions in these LOs.** **050 03 03 01 (02, 03, 08, 14, 19, 20) - retain for CBIR/EIR all of these processes have relevance to understanding cloud formation and flying conditions.** **050 05 01 01 (01) - this has a comment 'not necessary to know' but has not been deleted for CBIR/EIR.** **050 09 04 05 (01) - removal of reference to stormscope is considered premature as it is still in use.** **050 09 06 01 (01) - retain for IR and CBIR/EIR as there is no subject 032 for these ratings.** **050 10 01 01 (04, 05,26) - retain for CBIR/EIR - this is useful knowledge. Also an error in (026) as according to ICAO Annex 3 vertical visibility can also be given in metres.** **050 10 01 03 (01) - retain for CBIR - a basic understanding of satellite imagery is useful knowledge as these images are readily available.** **050 10 03 10 (05) - as far as I am aware GAFOR is still used in Europe and is therefore relevant.**
response	Thank you for your extensive feedback, which has been greatly appreciated. EASA has carefully assessed all the comments received. Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number. Regarding your comment referring to LO 05 01 03 03 (02): Not accepted. EASA does not agree to remove QFF for EIR/CB-IR. Although QFF is not used in aviation, EASA concludes that pilots should have (basic) knowledge of reduction to QFF after having defined it in LO 05 01 03 03 (01) and applying it in surface weather charts. Regarding your comment referring to LO 050 01 05 01 (02): Not accepted. EASA does not agree to remove it for CB-IR/EIR as the LO states to 'list the main values of ISA MSL pressure, MSL temperature, vertical temperature lapse rate up to FL 650, height and temperature of the tropopause'. All these terms are relevant except the vertical temperature lapse rate between tropopause and FL 650. Regarding your comment referring to LO 050 02 02 01 (03): Accepted. EASA agrees that understanding of the relationship between Coriolis and wind direction is relevant for CB-IR/EIR as well, and will put an 'X' under the column CB-IR(A) and EIR. Regarding your comment referring to LO 050 02 03 02 (01): Not Accepted. EASA was not able to find this LO you are referring to.

Regarding your comment referring to LOs 050 02 06 03 (01) and (02): Accepted.

EASA agrees that CAT is relevant to CB-IR/EIR especially as it is shown on Sig Weather Charts, and will put an 'X' under the column CB-IR(A) and EIR.

Regarding your comment referring to LOs 050 03 02 01 (01) and (09): Accepted.

EASA agrees that a CB-IR candidate should understand the definitions in LOs 050 03 02 01 (01, 09), and will put an 'X' under the column CB-IR(A) and EIR.

Regarding your comment referring to LOs 050 03 03 01 (02, 03, 08, 14, 19 and 20): Accepted.

EASA agrees that LOs 050 03 03 01 (02, 03, 08, 14, 19, 20) should be applicable for CB-IR/EIR as all of these processes have relevance to understanding cloud formation and flying conditions, and will put an 'X' under the column CB-IR(A) and EIR.

Regarding your comment referring to LO 050 05 01 01 (01): Not accepted.

The wording 'not necessary to know' in the last column was referring to this deleted LO. Because of the comment of 272-D, EASA has retained the LO.

Regarding your comment referring to LO 050 09 04 05: Accepted.

EASA agrees that the deleted text in 050 09 04 05 ('use of stormscope (lightning detector)' has to be retained.

In comment 71-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 09 06 01: Not accepted.

EASA cannot accept to leave it in as IR/CB-IR/EIR is additional to other licences as PPL/CPL, which do cover performance.

Regarding your comment referring to LO 050 10 01 01: Accepted.

EASA agrees that LOs (04) ad (05) are useful knowledge for the CB-IR candidate and will put an 'X' under the column CB-IR(A) and EIR for LOs (04) and (05).

EASA will also correct the error in LO (26).

The text will be amended as follows:

Name the units used for vertical visibility (ft, m).

Regarding your comment referring to LO 050 10 01 03: Accepted.

EASA agrees to retain 050 10 01 03 (01) for CB-IR because a basic understanding of satellite imagery is useful knowledge as these images are readily available.

Regarding your comment referring to LO 050 10 03 10: Not accepted.

EASA does not agree to this comment as GAFOR is for use in general aviation/PPL only.

comment *70-D* comment by: *European Cockpit Association*

Attachment #1

PAGE 3

Explanatory note	**3**	On the point: "— understand the physical processes in the atmosphere", we suggest to leave out ´the".
Explanatory note	**3**	On the point: "— collect all the weather information which may affect a given flight" - we suggest modification to " - collect all weather information prescribed by regulation"

response

Thank you for providing your two comments.

Regarding your first comment: Accepted.

EASA agrees to take out the 'the' in 'SUBJECT 050 — METEOROLOGY', p. 3.

The text will be amended as follows:

(1) Training aims

(i) Knowledge. After completion of the training, the pilot ~~must~~ should be able to:

— understand ~~the~~ physical processes in the atmosphere;

— […]

Regarding your second comment: Not accepted.

EASA is of the opinion that the text can stay like it is.

comment *71-D* comment by: *European Cockpit Association*

Attachment #2

NPA 2016_03 (D)		
Subject 050 — Meteorology	**Page nb**	
Explanatory note	**3**	On the point: "— understand the physical processes in the atmosphere", we suggest to leave out ´the".
Explanatory note	**3**	On the point: "— collect all the weather information which may affect a given flight" - we suggest modification to " - collect all weather information prescribed by regulation"
050 01 01 03 (04) Stratosphere; ozone layer temp.	**5**	Delete the LO. Instead, we suggest rewording of 050 01 01 03 (04) to: "describe that ozone can occur at jet cruise altitudes and constitute a hazard. Also, LO 050 01 01 03 has no practical use for helicopters.
050 01 02 03 (07) Greenhouse gases	**6**	Delete the LO; it presents "nice to know" value only.
050 01 03 01 (5) Barometric pressure, isobars	**9**	Re-instate 050 01 03 01 (5). This knowledge is useful.
050 01 03 03 (2) Reduction of pressure to QFF (MSL)	**10**	Delete the LO; it presents "nice to know" value only.
050 01 04 01 (3)	**11**	Re-instate 050 01 04 01 (3). This knowledge is useful.

Relationship between pressure, temperature and density		
050 01 05 01 (2) International Standard Atmosphere (ISA)	**11**	The learning objective 050 01 05 01 (2) is unclear: if students are to memorize a comprehensive table, this has no practical use. State which values have to be known.
050 01 06 03 (1) Calculations	**12**	It is unclear which readings are meant (e.g. the indicated altitude values?). Re-formulate the learning objective 050 01 06 03 (1).
050 01 06 03 (8)	**13**	Extend range of application of 30 ft/hpa approximation to 1060 hPa, as this is the practical use of it.
050 02 01 01 (2) Definition and measurement	**15**	Correction: km/h is not a unit for wind speed (delete). Wind direction in degrees true and magnetic should be specified. Annex 3, 4.6.1.1
050 02 01 01 (3)	**15**	QUOTE: *Describe how wind is measured (in meteorology).* The meaning is unclear, Meaning unclear. Is knowledge of specific devices required?
050 02 01 01 (4) *(New)*	**15**	Add new Learning Objective: Describe that the reported wind is an average wind, derived from measurements, over 2 min. for local routine and special reports and ATS units, and over 10 minutes for Metar and Speci. Annex 3, Appendix 3, 4.1.3 refers.
050 02 02 01 (5)	**15**	Isohypses were wrongly deleted. Pilots need to know that these exist. Re-introduce isohypses.
050 02 02 02 (3) Variation of wind in the friction layer	**16**	Factors that are to be named by the student need to be stated in the Learning Objective, e.g. terrain, wind-speed....
050 02 04 01 (5) *(New)* - General circulation around the globe	**18**	Add new Learning Objective: **Describe that local, low-level jet-streams can develop in the evening.** This knowledge is required also for helicopter pilots. Effect occurs over the Gulf countries (Sharja, Dubai and elsewhere)
050 02 05 01 (5) *(New)* Mountain waves (standing waves, lee waves); Origin and characteristics	**18**	Add new Learning Objective: **Describe that mountain wave effects can exceed the performance or structural capability of aircraft**
050 02 05 01 (6) *(New)*	**18**	Add new Learning Objective: **Describe that mountain wave effects can propagate from low to high level, e.g. over Greenland and elsewhere.**
050 02 06 03 (4) *(New)* Clear air	**19**	Add new Learning Objective: **State that remote sensing of CAT from satellites is not possible and that forecasting skill is**

turbulence (CAT) — description, cause and location		**limited.**
050 02 06 03 (5) *(New)*	**19**	Add new Learning Objective: **State that pilot reports of turbulence are very valuable as remote measurements are not available.**
050 02 07 03 (2) Location of jet streams and associated CAT areas	**20**	Learning Objective 050 02 07 03 (2) should be reinstated.
050 02 07 03 - all points	**20**	This knowledge should be required for CPL
050 03 01 03 (6) Temperature/dew point, relative humidity	**22**	Learning Objective 050 03 01 03 (6) should be re-instated as this is a fundamental relationship (relative humidity, the amount of water vapour and the temperature).
050 04 01 01 (3) Cloud formation	**27**	Learning Objective 050 04 01 01 (3) should be reinstated.
050 04 01 01 (4)	**27**	Learning Objective 050 04 01 01 (4) should be reinstated.
050 04 01 03 (4) Influence of inversions on cloud development	**29**	Delete the LO; it presents "nice to know" value only.
050 04 01 03 (05) - Influence of inversions on cloud development	**29**	This LO is relevant for CPL H, so it should be included.
050 04 02 04 Steam fog	**31**	Define Steam fog by a different name, more prevalent in use. See *glossary.ametsoc.org/wiki/Steam_fog*. Suggest **Sea mist or Sea smoke**
050 05 02 01 (03) - Types of precipitation, relationship with cloud types	**33**	Amend the wording: "…*damage to aeroplanes*" for "…damage to **aircraft**. This LO is also relevant for helicopters
050 05 01 01 (1) Process of development of precipitation		Learning Objective 050 05 01 01 (1) was deleted, but a basic knowledge of how precipitation forms is required. Re-formulate as ´describe the two basic processes...
050 05 02 01 (8) (New)	**33**	Add new Learning Objective: **Explain the relationship between moisture content and visibility during different types of winter precipitation (e.g. large vs. small snowflakes)** This LO is

		important for de-icing decisionmaking
050 06 02 01 (3) Fronts, General aspects	**35**	Modify: approx. position should be known; otherwise, the whole subject does not make sense.
050 06 02 02 (06) *(New)* Warm front, associated clouds and weather	**36**	Add new Learning Objective: **Describe the development of lines of CB along fronts.** Reasoning: Great hazard, can make turnarounds or 100nm + deviations to avoid CB necessary. Requires special treatment.
050 06 02 06 (04) Occlusions, associated clouds and weather	**37**	Re-instate 050 06 02 06 (04). Is necessary to know. If occlusions had no relevance for aviation, learning about them would be superfluos. Re-instate syllabus details.
050 06 02 09 (02) *(New)* Changes of meteorological elements at a frontal wave	**39**	Add new Learning Objective: **State that development of strong circulation systems is possible in connection with a frontal wave.** Note: only by exception do pilots get charts that show fronts, and it is even rarer that relatively small scale features like frontal waves are depicted on charts.
050 07 01 01 Location of the principal pressure areas	**39**	Delete this sub-part. No practical value.
050 07 04 00 Tropical revolving storms	**41**	Knowledge of the whole chapter 050 07 04 00 Tropical revolving storms should be required for CPL.
050 07 04 01 (02) Characteristics of tropical revolving storms	**41**	The proposed: *Explain how a tropical revolving storm moves during its life cycle* - implies certain predictability, which is not the case over the lifecycle of a tropical revolving storm. **This LO should be deleted.**
050 07 04 01 (6) *(New)*	**42**	Add new Learning Objective: **State that the movement of a TC can only rarely be forecast exactly, and that utmost care is necessary near Tcs**. Note: Tcs are unpredictable. Check the movement of Nadine, the Atlantic´s forth-longest running TC, for reference.
050 08 00 00 - CLIMATOLOGY	**42**	This chapter should be applicable also to CPL level syllabus.
050 08 01 02 (5) Climatic classification	**43**	The knowledge of 050 08 01 02 (5) is useful, re-instate. Climatic zones have geographic positions.
050 08 02 00 Tropical climatology	**43**	Knowledge of the whole chapter 050 08 02 00 should be required for CPL. Additionally, re-instate all items marked ´Not necessary to know´ in this chapter. Reason: CPL is not restricted to Europe.
050 08 02 00 (5) *(New)*	**43**	Add new Learning Objective: **Describe and explain the phenomenon of the ´tropical wave´ .** Comment: This is the principle moisture transport mechanism from Africa towards

		the west. Its observance can lead to choice of CB-free flight track.
050 08 03 03 Flat-pressure pattern	**47**	No major practical value. Delete chapter.
050 08 03 04 (3) Cold-air drop (cold-air pool)	**47**	Re-instate LO 050 08 03 04 (3). Is necessary to know for flights south of the Alps, for instance.
050 09 01 01 (7) Conditions for ice accretion	**48**	To the existing text of 050 09 01 01 (07) add: fuel temperature, radiative cooling of the aircraft surface, temperature of the aircraft surface, e.g. from previous flight.
050 09 01 04 Ice crystal icing	**52**	HIWC are a phenomenon **under research**. The given statement gives the impression of too much knowledge. Change to: **Explain how a pilot may possibly avoid...**
050 09 02 01 (5) *(New)* Turbulence; Effects on flight, avoidance	**52**	Add new Learning Objective: **Describe that forecasts of turbulence are not very reliable and state that pilot reports of turbulence are very valuable as they help others to prepare for or avoid turbulence.**
050 09 02 02 Clear Air Turbulence (CAT): effects on flight, avoidance	**53**	Knowledge of the whole chapter 050 09 02 02 should be required for CPL.
050 09 04 05 (1) Thunderstorm avoidance	**56**	Comment: The remark that stormscope is outdated is not correct; the stormscope is installed in smaller aircraft that do not have a weather radar. Re-instate the deleted text.
050 09 05 00 Tornadoes	**57**	Knowledge of the whole chapter 050 09 05 00 should be required for CPL.
050 09 07 00 Stratospheric conditions	**58**	Re-instate the whole chapter. Lower stratosphere is characterized by high-speed jet-streams, low density (decompression risk) and possibly, extremely low temperatures at times (-70 C or less). This knowledge is also required for CPL.
050 09 09 02 (2)&(3) Reduction of visibility caused by other phenomena	**60**	Knowledge of 050 09 09 02 (2)&(3) should be required for CPL, and for helicopters.
050 09 10 00 (New!!!)	**60**	**Insert new chapter on volcanic ash in preparation for upcoming amendments to ICAO Annex 3.** Formulate LOs based on the appropriate EASA SIB. *http://ad.easa.europa.eu/ad/2010-17R7*
Syllabus Ref. -1	**X**	Describe properties volcanic ash (fine to very fine powder, with relatively low melting point)
Syllabus Ref. -2	**X**	Describe that movement of ash clouds can be forecast by modelling performed at Volcanic Ash Advisory Centres (VAAC)

Syllabus Ref. -3	**X**	State that some VAAC provide information on the forecast amount of ash in the air, for example in the form of Contamination Charts.
Syllabus Ref. -4	**X**	Describe the Contamination Forecast Charts in use in the European Region
Syllabus Ref. -5	**X**	Describe that specific rules and regulations apply to each operator, as described in it´s Volcanic Ash Safety Risk Assessment
Syllabus Ref. -6	**X**	Describe that satellite detection of volcanic ash is possible and pictures are available to discern the presence of ash clouds even at night.
Syllabus Ref. -7	**X**	Describe that Sigmets on volcanic ash are issued based on the advisories produced by the VAACs
Syllabus Ref. -8	**X**	State that actual operation in visible volcanic ash or, where visibility of the ash is impaired (IMC,night), in discernible volcanic ash should be avoided.
050 09 11 00 (New!!!)	**X**	**Insert new chapter on space-weather in preparation for upcoming amendments to ICAO Annex 3** Formulate learning objectives based on the appropriate EASA SIB. *http://ad.easa.europa.eu/ad/2012-09*
Syllabus Ref. -1	**X**	Explain that Space weather is a generic term which refers to the environmental conditions in the space around the Earth extended up to the Sun.
Syllabus Ref. -2	**X**	Explain that the major drivers for the space weather are flows of energetic charged particles and electromagnetic radiation which can penetrate and interact with the Earth's ionosphere/atmosphere and magnetic field.
Syllabus Ref. -3	**X**	Describe that geomagnetic storms and solar radiation storms can lead to strong degradation of shortwave radio (radio blackout)
Syllabus Ref. -4	**X**	Describe that Ionospheric and solar radiation storms can lead to irregularities in the ionosphere which can disturb satellite navigation systems
Syllabus Ref. -5	**X**	Describe that the cosmic background radiation combined with solar radiation / solar radiation storms cause a radiation dose to electronics and humans which increases with flight altitude.
Syllabus Ref. -6	**X**	State radiation protection laws are in effect for Europe that require accounting for dose encountered by flight crew and may limit the allowable dose.
050 09 12 00 (New!!!)	**X**	**Insert new chapter on avoidance of nuclear contaminated clouds / nuclear releases in preparation for upcoming amendments to ICAO Annex 3** Formulate learning objectives based on the appropriate EASA SIB. http://ad.easa.europa.eu/ad/2011-04#download
Syllabus Ref. -1	**X**	Explain that nuclear material may be released into the

		atmosphere following industrial accidents, for example from nuclear reactors.
Syllabus Ref. -2	**X**	Explain that the radioactive debris comprises numerous radionuclides from the reactor which can accumulate in the human body and have been implicated in causing cancer.
Syllabus Ref. -3	**X**	State that the air conditioning filters on board aircraft are too coarse to filter out radionuclide particles in a radioactive cloud.
Syllabus Ref. -4	**X**	Explain that the transport of the radioactive debris in the atmosphere is controlled by atmospheric winds including wind shear and instability (frontal and convective clouds), and that deposition of articles occurs mostly due to gravity and rainfall.
Syllabus Ref. -5	**X**	State that the radioactive symbol may be found in SigWx-Charts and that Radioactive Cloud sigmets may be issued.
050 10 01 02 (02) Radiosonde observations	**63**	Re-instate 050 10 01 02 (02), knowledge required.
050 10 01 03 (7) *(New)* Satellite observations	**64**	Add new Learning Objective: **Describe and explain the importance of a date and time reference on satellite pictures** Comment: Safety-critical as outdated satellite pictures will be misleading. Knowledge required.
050 10 01 03 (8) (New)	**64**	Add new Learning Objective: **Describe and explain the need for accurately considering the flight track on satellite pictures**. Comment: Safety-critical as many different geographic projections and scales are in use for satellite and nav charts.
050 10 01 03 (6)	**64**	QUOTE 050 10 01 03 (6): *Interpret qualitatively the satellite pictures in order to get useful information for the flights:* *— location of jet streams.* Comment: This is rarely possible, except when atmospheric motion vector images are used. Change wording accordingly: **..for the flights using atmospheric motion vector images: ...** Furthermore, LO 050 10 01 03 (6) should be required for CPL
050 10 02 01 (3) *(New)*Significant weather charts	**66**	Add new Learning Objective: **Describe that the SigWx-charts are valid for specific times and may not represent meteorological conditions at other times accurately.**
050 10 02 02 Surface charts	**66**	Knowledge required, do not delete LO.
050 10 02 03 Upper-air charts	**66**	**Re-instate all deleted items from Chapter 050 10 02 03.** Material may not be used by pilots regularly, nor be part of regular briefing material, but it´s knowledge has value as these items are in wide use in aviation meteorology.
050 10 02 04 (New!!!)	**X**	**Insert new chapter on gridded forecast products (CB-tops, extension, turbulence, wind-speed etc.) according ICAO Annex 3**
Syllabus Ref. -1		State that numerical weather prediction uses a 3-d grid of

		weather data, consisting of horizontal data (latitude-longitude) and vertical data (height or pressure)
Syllabus Ref. -2		Explain that world area forecast centres prepare global sets of gridded forecasts for flight planning purposes (upper wind, temperature, humidity)
Syllabus Ref. -3		State that the WAFCs also produce gridded datasets for Flight Level and temperature of the tropopause, direction and speed of maximum wind, cumulonimbus clouds, icing and turbulence.
Syllabus Ref. -4		Explain that the data on CB and turbulence can be used in the visualization of flight hazards
Syllabus Ref. -5		Explain that the gridded forecasts can be merged in information processing systems with data relayed from aircraft or pilot reports, e.g. of turbulence, to provide improved situation awareness.
050 10 03 01 (2) Aviation weather messages	**67**	Knowledge of 050 10 03 01 (2) should be required for CPL.
050 10 03 02 (2) Meteorological broadcasts for aviation	**68**	Knowledge of 050 10 03 02 (2) should be required for CPL.
050 10 04 01 (1) World area forecast system and meteorological offices	**70**	Comment: The system has evolved since the 1950ies. **Please note present scope from ICAO Annex 3, appendix 2., and amend Learning Objectives**. WAFC prepare upper air gridded forecasts of temp+wind, Flight Level + temp of tropopause, direction + speed + Flight Level of max wind, humidity data, horizontal extent and Flight Level of base + top of cumulonimbus clouds, icing for several Flight Level, CAT for several layers.
050 10 04 01 (2) & (6)	**70**	Comment: References in (2) to (6) should not be to the WAFS but to the offices concerned.
Additional comments (helicopters)		Following LOs have no practical use for helicopters: 050 08 02 02 (04); 050 08 02 03; 050 08 03 01 (01); 050 10 01 03 (06); 050 10 02 03

response

Thank you for your extensive feedback, which has been greatly appreciated.

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your first two comments, please refer to your same two comments above under #70-D.

Regarding your comment referring to LO 050 01 01 03 (04): Accepted.

EASA agrees that the original version of 050 01 01 03 (04) should be deleted. EASA acknowledges that that ozone can occur at jet cruise altitudes and can constitute a hazard. Therefore, EASA rewrites the LO (04) to read:

(04) Describe that ozone can occur at jet cruise altitudes and can constitute a hazard.

Regarding your comment referring to LO 050 01 01 03: Accepted.

EASA acknowledges that 050 01 01 03 has no practical use for helicopters. The 'X' in the helicopter column of this headline will be deleted.

Regarding your comment referring to LO 050 01 02 03 (07): Accepted.

EASA agrees that this LO presents 'nice to know' value only, and that LO 050 01 02 03 (07) will be deleted.

Regarding your comment referring to LO 050 01 03 01 (05): Noted.

EASA agrees that the knowledge of this LO is useful. It was not intended to delete this LO but only 'wedges'. The comment was probably misleading.

Regarding your comment referring to LO 050 01 03 03 (02): Not accepted.

EASA concludes that pilots should have (basic) knowledge of reduction to QFF after having defined it in LO (01) and applying it in surface weather charts.

Regarding your comment referring to LO 050 01 04 01 (03): Not accepted.

EASA agrees that this knowledge is useful. EASA does not agree to retain this LO as the effect of humidity changes on the density of air is described in LO 050 03 01 01 (01).

Regarding your comment referring to 050 01 05 01 (02): Not accepted.

EASA does not agree with this comment. EASA is of the opinion that students have to know the mean values at MSL and the rate of change as described.

Regarding your comment referring to LO 050 01 06 03 (01): Accepted.

EASA agrees that this LO should be reformulated.

The text will be amended as follows:

Calculate the different readings on the altimeter when the pilot ~~changes the altimeter setting~~ uses different settings (QNH, 1013.25, QFE).

Regarding your comment referring to LO 050 01 06 03 (08): Accepted.

EASA agrees to extend the range of application of 30 ft/hPa.

The text will be amended as follows:

[…]

Remark: The following rules should be considered for altimetry calculations:

a) All calculations are based on rounded pressure values to the nearest lower hPa;

b) ~~The value for the barometric lapse rate near mean sea level is is 27 ft (8 m)30 ft (9m)per 1 hPa;~~

The value for the barometric lapse rate between MSL and 700 hPa to be used is 30 ft/hPa as an acceptable approximation of the barometric lapse rate.

[…]

In comments 76-D and 345-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 02 01 01 (02): Accepted.

EASA agrees that km/h is not a unit for wind speed and will rewrite this LO.

The text will be amended as follows:

State the units of wind directions (degrees true in reports; degrees magnetic from tower) and speed

(kt, m/s~~, km/h~~).

~~*(Refer to 050 10 01 01)*~~

Regarding your comment referring to LO 050 02 01 01 (03): Accepted.

EASA agrees that the meaning of this LO is unclear.

The text will be amended as follows:

~~Explain~~ Describe that the reported wind is an average wind derived from measurements with an anemometer at a height of 10 m over 2 min for local routine and special reports and ATS units, and over 10 min for aerodrome routine meteorological reports (METARs) and aerodrome special meteorological reports (SPECIs).~~how wind is measured~~ ~~in meteorology~~.

Regarding your comment referring to a new LO for 050 02 01 01 (04): Accepted.

EASA agrees with the new LO and has replaced the old (03) to this new test (see our response above to 050 02 01 01 (03)).

Regarding your comment referring to LO 050 02 02 01 (05): Accepted.

EASA agrees that pilots have to know isohypses and will not delete this from this LO as proposed in the NPA. The text remain the same

In comments 36-D and 302-D, the same issue was raised regarding this LO.

Regarding your comment referring to 050 02 02 02 (03): Partially accepted.

EASA agrees that the main factors that influence the vertical extent of the friction layer have to be stated in this LO.

The text will be amended as follows:

Name terrain, wind speed and stability as the main factors that influence the vertical extent of the friction layer.

Regarding your comment referring to LO 050 02 04 01 (05) new: Accepted.

EASA agrees that knowledge of local, low-level jet streams is important for pilots (for helicopter pilots as well).

The text for the new LO will be inserted as follows:

Describe that local, low-level jet streams can develop in the evening.

Regarding your comment referring to LO 050 02 05 01 (05) new: Accepted.

EASA agrees that pilots need to know about the flight hazards of mountain waves.

The text for the new LO will be inserted as follows:

Describe that mountain wave effects can exceed the performance or structural capability of aircraft.

Regarding your comment referring to LO 050 02 05 01 (06) new: Accepted.

EASA agrees that pilots need to know about the propagation of mountain waves.

The text for the new LO will be inserted as follows:

Describe that mountain wave effects can propagate from low to high level, e.g. over Greenland and elsewhere.

Regarding your comment referring to LO 050 02 06 03 (04) new: Accepted.

EASA agrees that pilots should be aware of the limited possibilities of remote sensing of CAT from satellites and of limited forecasting skills of CAT.

The text for the new LO will be inserted as follows:

State that remote sensing of CAT from satellites is not possible and that forecasting skill is limited.

Regarding your comment referring to 050 02 06 03 (05) new: Accepted.

EASA agrees that pilots should know about the possibilities to receive information on occurrence and strength of turbulence.

The text for the new LO will be inserted as follows:

State that pilot reports of turbulence are a very valuable source of information as remote measurements are not available.

Regarding your comment referring to LO 050 02 07 03 (02): Not accepted.

EASA does not agree with this comment as the content of this LO is too detailed for theoretical instruction of pilots.

Regarding your comment referring to LO 050 02 07 03: Accepted.

EASA agrees that all (remaining) LOs of this chapter should be required for CPL. An 'X' will be added for this LO under the CPL column for aeroplanes.

Regarding your comment referring to LO 050 03 01 03 (6): Not accepted.

EASA does not agree with this comment as this LO is a duplication of 050 03 01 03 (3).

Regarding your comment referring to LO 050 04 01 01 (03): Not accepted.

EASA does not agree with this comment as pilots will not compute cloud bases.

Regarding your comment referring to LO 050 04 01 01 (04): Not accepted.

EASA does not agree with this comment as pilots will not determine the height of a cloud base as a function of relative humidity.

Regarding your comment referring to LO 050 04 01 03 (04): Accepted.

EASA concludes that this LO presents 'nice to know' value only and therefore can be deleted.

The text will be deleted as follows:

~~(04) Determine on a simplified diagram the top of a cumulus cloud caused by an inversion.~~

Regarding your comment referring to LO 050 04 01 03 (05): Accepted.

Thank you for providing this comment. EASA agrees that this LO is relevant for CPL(H). An 'X' will be added in the CPL column for helicopters.

Regarding your comment referring to LO 050 04 02 04: Accepted.

EASA agrees and proposes to replace 'steam fog' with 'sea smoke' in the headline of LO 050 04 02 04 and in LOs (01), (02) and (04).

The text will be amended as follows:

~~***Steam fog***~~ ***Sea smoke***

Explain the formation of ~~steam fog~~ sea smoke.

Explain the conditions for the development of ~~steam fog~~ sea smoke.

Summarise the conditions for the dissipation of ~~steam fog~~ sea smoke.

Regarding your comment referring to LO 050 05 02 01 (03): Accepted.

EASA agrees that the wording 'aeroplanes' should be replaced by 'aircraft', because this LO is also relevant for helicopters. The relevance for helicopters is already stated by 'X' in all helicopter categories.

The text will be amended as follows:

~~State the approximate weights and diameters for hailstones.~~ State that, because of their size, hail stones can cause significant damage to aircraft.

Regarding your comment referring to LO 050 05 01 01 (01): Accepted.

EASA agrees that pilots should have basic knowledge of how precipitation forms.

In comments 253-D, 272-D and 311-D, the same issue was raised regarding retaining LO (01) to LO (03).

The text of the retained LO (01) will be amended as follows:

~~Distinguish between the two following processes by which precipitation is formed.~~ Describe the two basic processes of forming precipitation (The Wegener–Bergeron–Findeisen process, Coalescence).

Regarding your comment referring to LO 050 05 02 01 (08) new: Accepted.

EASA agrees that the new LO seems to be relevant and important for de-icing decision-making and that pilots should be able to explain the relationship between moisture content and visibility during different types of winter precipitation.

The text will be inserted as follows:

Explain the relationship between moisture content and visibility during different types of winter precipitation (e.g. large versus small snowflakes).

Regarding your comment referring to LO 050 06 02 01 (03): Accepted.

EASA agrees not to delete the approximate seasonal latitudes of the polar front. LO (03) will be retained as 050 06 02 01 (04).

In comment 272-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 06 02 02 (06) new: Not accepted.

EASA does not agree as the proposed new LO is already included in 050 06 02 03 (02).

Regarding your comment referring to LOs 050 06 02 06 (04) to (06): Accepted.

EASA agrees to retain LOs (04) to (06) as this content is necessary for the pilots to know.

Regarding your comment referring to LO 050 06 02 09 (02) new: Not accepted.

EASA does not agree as the LO is already in the preceding LO 050 06 02 09 (01).

Regarding your comment referring to Subject 050 07 01 01: Not accepted.

EASA would like to state that pilots should know about the location of principal pressure area and therefore these LOs should not be deleted or made BK.

Regarding your comment referring to Subject 050 07 04 00: Accepted.

EASA agrees that knowledge of the whole chapter 050 07 04 00 should be required for CPL. Therefore, all LOs of 050 07 04 00 shall be marked with 'X' in the 'CPL' columns (both helicopter and aeroplane).

Regarding your comment referring to LO 050 07 04 01 (02): Partially accepted.

EASA agrees on the non-predictability of actual tropical revolving storms but concludes that is possible to describe the general movement by means of statistics.

The text will be amended as follows:

~~Explain~~ State how a tropical revolving storm generally moves ~~during its life cycle~~ in its area of occurrence.

Regarding your comment referring to LO 050 07 04 01 (06) new: Accepted.

EASA agrees to increase the awareness of student pilots concerning the flight hazards of a tropical revolving storm especially in the light of the already mentioned non-predictability of the future track of a tropical revolving storm.

The text for the new LO will be inserted as follows:

State that the movement of a tropical revolving storm can only rarely be forecasted exactly, and that

utmost care is necessary near a tropical revolving storm.

Regarding your comment referring to LO 050 08 00 00: Accepted.

EASA agrees that knowledge of the whole chapter 050 08 00 00 should be required for CPL. Chapter 050 08 00 00 should be applicable also to CPL level. Therefore, all LOs of 050 08 00 00 shall be marked with 'X' in the 'CPL' columns (both helicopter and aeroplane).

Regarding your comment referring to LO 050 08 01 02 (05): Accepted.

EASA agrees that the knowledge of geographical positions of climate zones is important for pilots. This LO will be retained.

Regarding your comment referring to Subject 050 08 02 00: Partially accepted.

EASA agrees that this chapter as a whole should be required for CPL. Therefore, all LOs of 050 08 02 00 shall be marked with 'X' in the 'CPL' columns (both helicopter and aeroplane).

EASA agrees to retain the deleted LOs of this chapter with the comment 'not necessary to know' (LOs 050 08 02 04 (02), (05), (06), (07), (08), (09) and (10)), except in LO 050 08 02 05 as LOs (01) and (02) are covered in LO (03) and therefore remain deleted.

Regarding your comment referring to LO 050 08 02 00 (05) new: Not accepted.

EASA states that the new LO describes an easterly wave which is covered in 050 08 02 05. EASA does not see the necessity for an additional LO. The headline of LO 050 08 02 05 will be retained.

In comment 259-D, the same issue was raised regarding the heading.

Regarding your comment referring to LO 050 08 03 03: Accepted.

EASA agrees that the chapter 'Flat-pressure pattern' has no major practical value. The entire chapter will be deleted.

The text will be deleted as follows:

~~***050 08 03 03 Flat-pressure pattern***~~

~~(01) Identify on a surface weather chart the typical flat-pressure pattern.~~

~~(02) Describe the weather associated with a flat-pressure pattern.~~

Regarding your comment referring to LO 050 08 03 04 (03): Not accepted.

EASA is of the opinion that the existing LOs (01), (02), (04) and (05) fully describe the cold-air drop and that associated hazardous weather has to be recognised on significant weather charts.

Regarding your comment referring to LO 050 09 01 01 (07): Accepted.

EASA agrees to describe ice accretion in more detail and will add a new LO to describe this:

Explain the influence of fuel temperature, radiative cooling of the aircraft surface and temperature of the aircraft surface (e.g. from previous flight) on ice formation.

Regarding your comment referring to LO 050 09 01 04 (05): Accepted.

EASA agrees to avoid the impression of too much knowledge as HIWC is a phenomenon under research.

The text will be amended as follows:

Explain how a pilot may possibly avoid areas with a high concentration of ice crystals.

Regarding your comment referring to LO 050 09 02 01 (05) new: Accepted.

EASA agrees that pilots should not rely on forecasts of turbulence but to make use of pilot reports.

The text for the new LO will be inserted as follows:

Describe that forecasts of turbulence are not very reliable and state that pilot reports of turbulence are very valuable as they help others to prepare for or avoid turbulence.

Regarding your comment referring to LO 050 09 02 02: Accepted.

EASA agrees that knowledge of the whole Chapter 050 09 02 02 should be required for CPL. Therefore, all LOs of 050 09 02 02 shall be marked with 'X' in the 'CPL' columns (both helicopter and aeroplane).

Regarding your comment referring to LO 050 09 04 05 (01): Accepted.

EASA agrees that stormscope is still in use especially in smaller aircraft. As a consequence, the comment of this LO has to be deleted and '~~use of stormscope (lightning detector)~~' will be retained.

In comment 67-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 09 05 00: Accepted.

EASA agrees that knowledge of the whole Chapter 050 09 05 00 should be required for CPL. Therefore, all LOs of 050 09 05 00 shall be marked with 'X' in the 'CPL' columns (both helicopter and aeroplane).

Regarding your comment referring to LO 050 09 07 00: Accepted.

EASA is of the opinion that the ISA is defined up to FL 650 and that relevant condition and flight hazards in the lower stratosphere should be known by pilots. The whole chapter will be retained. EASA also agrees that all LOs of 050 09 07 00 shall be marked with 'X' in the 'CPL' columns (both helicopter and aeroplane).

Regarding your comment referring to LOs 050 09 09 02 (02) and (03): Accepted.

EASA agrees that knowledge of the whole Chapter 050 09 09 02 should be required for CPL. For LO (02) and (03), the 'X' was missing. Therefore, an 'X' should be inserted in the 'CPL' columns of these LOs (both helicopter and aeroplane).

Regarding your comment referring to LO 050 09 10 00 new: Not accepted.

EASA will take the new LO in account as soon as upcoming amendments of ICAO Annex 3 are finalised.

Regarding your comment referring to LO 050 09 11 00 new: Not accepted.

EASA will take the new LO in account as soon as upcoming amendments of ICAO Annex 3 are finalised.

Regarding your comment referring to LO 050 09 12 00 new: Not accepted.

EASA will take the new LO in account as soon as upcoming amendments of ICAO Annex 3 are finalised.

Regarding your comment referring to LO 050 10 01 02 (02): Accepted.

EASA agrees that knowledge of radiosonde observations is necessary for pilots. This LO will be retained.

Regarding your comment referring to LO 050 10 01 03 (07) new: Not accepted.

EASA is of the opinion that this new LO is not necessary as for the items mentioned (the importance of a date and time reference) there is no LO for weather maps and other documents.

Regarding your comment referring to LO 050 10 01 03 (08) new: Not accepted.

EASA is of the opinion that this new LO is not necessary as for the item mentioned (explain the need for accurately considering the flight track) there is no LO for weather maps and other documents.

Regarding your comment referring to LO 050 10 01 03 (06): Accepted.

EASA agrees to the additional wording for the sake of completeness.

The text will be amended as follows:

Interpret qualitatively the satellite pictures in order to get useful information for the flights using atmospheric motion vector images to locate jet streams.~~:~~

~~location of jet streams.~~

Regarding your comment referring to LO 050 10 02 01 (03) new: Not accepted.

EASA does not agree as the new LO is part of 050 10 02 01 (01).

Regarding your comment referring to Subject 050 10 02 02: Not accepted.

EASA does not agree as no LO has been deleted at all.

Regarding your comment referring to LO 050 10 02 03 (01): Accepted.

EASA agrees as the items mentioned within the LOs are widely used in aviation meteorology. This LO will be retained.

In comments 40-D and 272-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 10 02 04 new chapter: Accepted.

EASA agrees to introduce a new chapter due to relevance of gridded forecast products.

The text for the new chapter 050 10 02 04 will be inserted as follows:

050 10 02 04 Gridded forecast products

(01) State that numerical weather prediction uses a 3D grid of weather data, consisting of horizontal data (latitude, longitude) and vertical data (height or pressure).

(02) Explain that world area forecast centres prepare global sets of gridded forecasts for flight planning purposes (upper wind, temperature, humidity).

(03) State that the WAFCs also produce gridded datasets for flight level and temperature of the tropopause, direction and speed of maximum wind, cumulonimbus clouds, icing and turbulence.

(04) Explain that the data on CB and turbulence can be used in the visualisation of flight hazards.

(05) Explain that the gridded forecasts can be merged in information processing systems with data relayed from aircraft or pilot reports, e.g. of turbulence, to provide improved situation awareness.

Regarding your comment referring to LO 050 10 03 01 (02): Accepted.

EASA agrees to this comment. The 'CPL' column of LO 050 10 03 01 (2) should be marked with 'X' (both helicopter and aeroplane).

Regarding your comment referring to LO 050 10 03 02 (02): Accepted.

EASA agrees to this comment. The 'CPL' column of LO 050 10 03 02 (2) should be marked with 'X' (both helicopter and aeroplane).

Regarding your comment referring to LO 050 10 04 01 (01): Accepted.

EASA agrees to this comment.

The text will be amended as follows:

~~— Name the main objectives of the world area forecast system:~~

~~— world area forecast centres (upper-air forecasts).~~

Name the world area forecast centres (WAFCs) as the provider for the upper-air forecasts: WAFCs prepare upper-air gridded forecasts of upper winds; upper-air temperature and humidity; direction, speed and flight level of maximum wind; flight level and temperature of tropopause, areas of cumulonimbus clouds, icing, clear-air and in-cloud turbulence, and geopotential altitude of flight levels.

In comments 40-D, 41-D and 272-D, the same issue was raised regarding this LO.

Regarding your comment referring to LOs 050 10 04 01 (02) and (06): Accepted.

EASA agrees to this comment.

The text will be amended as follows:

Name the meteorological offices (MET) as the provider for aerodrome forecasts and briefing documents.

[…]

(06) Name the tropical cyclone advisory centres (TCACs) as the provider for forecasts of tropical

cyclones.

Regarding your last comment referring to certain LOs for helicopters: Accepted.

The 'X' in the columns of the following LOs for helicopter should be deleted as there is no practical use for them:

050 08 02 02 (04)

050 08 02 03

050 08 03 01 (01)

050 10 01 03 (06)

050 10 02 03

Comment	*75-D* comment by: *LFT* 050 01 02 06 (05): correction: (...) (hPa, inches of mercury)
Response	Partially accepted. Thank you for providing this comment referring to LO 050 01 02 06 (05). EASA agrees to this comment as it refers to another LO (050 01 03 01 (02)) and is valid. The text will be amended as follows: List the units of measurements of the atmospheric pressure used in aviation (hPa, inches of ~~,~~ mercury).

Comment	*76-D* comment by: *LFT* 050 01 06 03 (08) (...) b): Please keep the original version of the LO: "The value for the barometric lapse rate..." as only the value near MSL is needed.
Response	Partially accepted. Thank you for providing this comment referring to LO 050 01 06 03 (08) new. In comments 71-D and 345-D, the same issue was raised regarding this LO. The text will be amended as follows: (08) […] *Remark: The following rules should be considered for altimetry calculations:* *a) All calculations are based on rounded pressure values to the nearest lower hPa;* *b) ~~The value for the barometric lapse rate near mean sea level is is 27 ft (8 m)30 ft (9m)per 1 hPa;~~* The value for the barometric lapse rate between MSL and 700 hPa to be used is 30 ft/hPa as an acceptable approximation of the barometric lapse rate. […]

Comment	*77-D* comment by: *LFT* 050 03 03 01 (14): Please replace the nouns "stability", "conditional instability" and "instability" by the adjectives: "stable", "conditionally unstable", "unstable"
Response	Accepted. Thank you for providing this comment referring to LO 050 03 03 01 (14). The text will be amended as follows: Define qualitatively and quantitatively the terms ~~'stability', 'conditional instability', 'instability' and 'indifferent (neutral)'~~ 'stable', 'conditionally unstable', 'unstable' and 'indifferent'.

comment	*78-D* comment by: *LFT* 050 06 02 02 (03): Do not delete. It is of practical relevance (e.g. warm fronts in summer are possible with CB and in winter freezing rain.)
response	Accepted. Thank you for providing this comment referring to LO 050 06 02 02 (03). EASA agrees to this comment and accepts the necessity of the content of this LO due to its practical relevance concerning the flight hazards mentioned. This LO will be retained.

comment	*79-D* comment by: *LFT* 050 06 02 03 (03): Do not delete. LO is of practical importance.
response	Accepted. Thank you for providing this comment referring to 050 06 02 03 (03). EASA agrees that cold fronts are more relevant in aviation than warm fronts, because cold fronts can develop heavy thunderstorms and squall-lines in summertime. The LO (03) will be retained. In comment 272-D, the same issue was raised regarding this LO.

comment	*80-D* comment by: *LFT* 050 06 02 04 (03): Do not delete. LO is of practical importance.
response	Accepted. Thank you for providing this comment referring to LO 050 06 02 04 (03). LO (03) will be retained. In comment 315-D, the same issue was raised regarding this LO.

comment	*81-D* comment by: *LFT*

	050 06 02 05 (02): Do not delete. LO is of practical importance.
response	Accepted. Thank you for providing this comment referring to LO 050 06 02 05 (02). LO (02) will be retained. In comment 316-D, the same issue was raised regarding this LO.

comment	*82-D* comment by: *LFT* 050 06 02 06 (01): Please add: "Define the term "occlusion" and occluded front." (Explanation: Principally, occlusion is a process which results in an occluded front.")
response	Accepted. Thank you for providing this comment referring to LO 050 06 02 06 (01). EASA agrees to this comment and accepts the necessity to define both terms. The text will remain as it was: Define the term 'occlusion' and 'occluded front'.

comment	*83-D* comment by: *LFT* 050 08 02 04 (08): Do not delete.
response	Accepted. Thank you for providing this comment referring to LO 050 08 02 04 (08). EASA agrees to this comment and accepts the necessity of the content of this LO as pilots need to have knowledge of the formation and properties of sandstorms. It will not be deleted. This LO will be retained. In comment 71-D, the same issue was raised regarding this LO.

comment	*84-D* comment by: *LFT* 050 08 02 04 (09): Do not delete.
response	Accepted. Thank you for providing this comment to LO 050 08 02 04 (09). EASA agrees to this comment and accepts the necessity of the content of this LO as pilots need to have knowledge of cold-air outbreaks entering subtropical weather systems. This LO will be retained. In comment 71-D, the same issue was raised regarding this LO.

comment	*85-D* comment by: *LFT* 050 08 02 04 (10): Do not delete.

response	Accepted. Thank you for providing this comment referring to LO 050 08 02 04 (10). EASA agrees to this comment and accepts the necessity of the content of this LO. This LO will be retained. In comment 71-D, the same issue was raised regarding this LO.

comment	*86-D* comment by: *LFT* 050 08 04 01 (01): New: "Describe the mechanisms for the development of Foehn winds (including Chinook). (Explanation: The old "classical" mechanism alone is wrong.)
response	Accepted. Thank you for providing this comment referring to 050 08 04 01 (01). The text will be amended as follows: Describe the ~~classical~~ mechanism for the development of Foehn winds (including Chinook).

comment	*249-D* comment by: *FTEJerez* **Comment on 050 03 01 02** An appreciation of mixing ratio, to explain amounts of rainfall and risk of icing at different temperatures and latitudes seems essential basic knowledge. (01) (02) (03) should be reinstated but can be BK (04) (05) can be deleted as proposed (06) Essential for learning (07) can be deleted as proposed
response	Not accepted. Thank you for providing this comment referring to LOs 050 03 01 02 (01) to (07). EASA is of the opinion that mixing ratio knowledge is not relevant for pilots. Relative humidity is relevant and sufficient.

comment	*250-D* comment by: *FTEJerez* **Comment on 050 03 03 01** (15) (16) (17) Essential to understanding of the development of different weather phenomena e.g. between early morning and afternoon in the UK, however, can be BK
response	Not accepted. Thank you for providing this comment referring to LOs 050 03 03 01 (15), (16) and (17). EASA is of the opinion that knowledge of these LOs is not relevant for pilots and therefore not necessary to know.

comment	*252-D* comment by: *FTEJerez* **Comment on 050 04 01 01** (04) (05) Reinstate but as BK. Essential to understand that cloud base may rise during the day, and lower at night.
response	Not accepted. Thank you for providing this comment referring to LOs 050 04 01 01 (04) and (05). EASA is of the opinion that these LOs are not necessary as a pilot will get the cloud base in the METAR and in practice there will be no information about the ELR.

comment	*253-D* comment by: *FTEJerez* **Comment on 050 05 01 01** (01) (02) (03) These LO's give the student an appreciation of the relative risk of icing at different levels in cloud, and are important to help with AWR explanations.
response	Accepted. Thank you for providing this comment referring to LOs 050 05 01 01 (01), (02) and (03). EASA agrees that pilots should have basic knowledge of how precipitation forms. In comments 71-D, 272-D and 311-D, the same issue was raised regarding retaining LOs (01) to (03). The text of the retained LO will be amended as follows: ~~Distinguish between the two following processes by which precipitation is formed.~~ Describe the two basic processes of forming precipitation (The Wegener–Bergeron–Findeisen process, Coalescence).

comment	*254-D* comment by: *FTEJerez* **Comment on 050 06 02 01** (03) Useful to introduce climatic variation, and to understand transitional climate zones where many European flights take place.
response	Not accepted. Thank you for providing this comment referring to LO 050 06 02 01 (03). EASA does not agree to this comment as pilots will see the fronts on surface weather charts. (Remark: Old LO (03) is the 4th LO in this chapter).

comment	*255-D* comment by: *FTEJerez* **Comment on 050 06 02 08** (03) Contradictory. Why is this BK when the other LO's in this section are not.

response	Accepted. Thank you for providing this comment referring to LO 050 06 02 08 (03). EASA agrees to this comment; the 'X' in the BK column has to be deleted for 050 06 02 08 (03).

comment	*256-D* comment by: *FTEJerez* **Comment on 050 07 02 01** (04) Important to develop the concepts behind the world circulation. Can be BK
response	Partially accepted. Thank you for providing this comment. EASA agrees to retain LO 050 07 02 01 (04), but will not mark it as BK.

comment	*257-D* comment by: *FTEJerez* **Comment on 050 08 02 04** (05) (06) (07) Leave one of these LO's as an example to explain monsoon conditions more fully? Perhaps (06) the best?
response	Accepted. Thank you for providing this comment referring to LOs 050 08 02 04 (05), (06) and (07). EASA is aware that an example helps to explain monsoon conditions more fully — this is integrated in the new LO.

comment	*259-D* comment by: *FTEJerez* **Comment on 050 08 02 05** Heading should not be deleted? (04) Useful as a practical example of use of charts?
response	Thank you for providing these two comments. Regarding your comment referring to the heading: Accepted. EASA agrees that the heading should not be deleted as there is still an LO in this chapter. The heading will be retained. In comment 71-D, the same issue was raised regarding the heading. Regarding your comment referring to LO 050 08 02 05 (04): Not accepted. Thank you for providing this comment. EASA supports the idea of practical examples of use of charts but does not agree to specify this as an LO.

comment	*260-D* comment by: *FTEJerez* **Comment on 050 09 04 03**

	(03) Spelling mistake assess instead of asses
response	Accepted. Thank you for providing this comment referring to LO 050 09 04 03 (03). The text will be amended as follows: Describe and assess the 'St. Elmo's fire' weather phenomenon.

comment	*261-D* comment by: *FTEJerez* **Comment on 050 09 04 04** New LO ? Explain the difference between wet and dry downbursts.
response	Not accepted. Thank you for providing this comment referring to Subject 050 09 04 04. EASA does not agree to this comment as general knowledge of downburst is assumed to be sufficient.

comment	*262-D* comment by: *FTEJerez* **Comment on 050 09 08 01** (01) Grammar mistake: Describe the influence of mountainous …
response	Accepted. Thank you for providing this comment referring to LO 050 09 08 01 (01). EASA will delete the first LO as it is similar to the last one.

comment	*264-D* comment by: *FTEJerez* **Comment on 050 09 09 02** Don't understand what the "-"s in the BK column mean
response	Accepted. Thank you for providing this comment referring to Subject 050 09 09 02. EASA agrees to this comment, the '—'s are not necessary (not in column BK, not in the text of the LO, and will be deleted.

comment	*265-D* comment by: *FTEJerez* **Comment on 050 10 01 03** (04) (05) (06) Grammar "for flights" not "for the flights"
response	Accepted. Thank you for providing this comment referring to LOs 050 10 01 03 (04) to (06). The text will be amended as follows: Interpret qualitatively the satellite pictures in order to get useful information for ~~the~~ flights concerning location of clouds (distinguish between strati form and cumuliform clouds). Interpret qualitatively the satellite pictures in order to get useful information for ~~the~~ flights

	concerning location of fronts. Interpret qualitatively the satellite pictures in order to get useful information for ~~the~~ flights concerning location of jet streams.
comment	*266-D* comment by: *FTEJerez* **Comment on 050 10 02 02** Would it hurt to include the col, as it is mentioned in 01 03 01 (05). Not difficult for students to understand.
response	Accepted. Thank you for providing this comment referring to Subject 050 10 02 02. EASA agrees that 'cols' (a principal surface pressure pattern between two highs and two lows) often exists, and has special surface weather properties in winter (e.g. fog) and in summer. 'Col' will be retained within LO 050 10 02 02 (01). In comment 272-D, the same issue was raised regarding this LO.
comment	*284-D* comment by: *Aero-Club of Switzerland* Page 10/233 Comment on 050 01 03 03 Several pilots (living in Alpine areas) questioned the necessity of the para "Reduction of pressure to QFF (MSL), this is for your information only.
response	Noted. Thank you for providing this note on Subject 050 01 03 03. EASA would like to state that neither the chapter as a whole nor the LOs are to be deleted.
comment	*285-D* comment by: *Aero-Club of Switzerland* Page 12/233 050 01 06 02 Altimeter settings Question: Should we not add these two elements to the CB-IR/EIR syllabus? Rationale: It would fit with 050 01 06 03 just below, we think.
response	Accepted. Thank you for providing this comment referring to Subject 050 01 06 02. EASA agrees to this comment. LOs (01) and (02) of this chapter will be marked with 'X' in the CB-IR/EIR column.
comment	*286-D* comment by: *Aero-Club of Switzerland* Page 67/233 Comment on 050 10 03 01 (05) The deletion of GAFOR is proposed. We think this should not be done.

Rationale:
Knowing what GAFOR indicates might be helpful to CB-IR and EIR flight crew, especially in mountainous areas.

response

Not accepted.

Thank you for providing this comment referring to LO 050 10 03 01 (05).

EASA does not agree to this comment as GAFOR belongs to PPL.

comment

295-D comment by: *FAA*

Thunderstorm Avoidance, Page 56. This section should also mention the use of real and near real-time weather information transmitted to the cockpit and displayed using a multi-function display.

response

Noted.

Thank you for providing this comment referring to thunderstorm avoidance.

EASA would like to state that LO (01) of this chapter is sufficient.

comment

297-D comment by: *DGAC FRANCE*

Doc D
Page 5/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 01 02 01
Definition and Unit
LO (01) Define “air temperature” by kinetic gas theory.

Content of comment:
The reference to “Kinetic gas theory” seems to be superfluous.

Alternative draft for proposed amendment

Delete “by kinetic gas theory”

LO (01) Define “air temperature” ~~by kinetic gas theory.~~

response

Accepted.

Thank you for providing this comment referring to LO 050 01 02 01 (01).

The text will be kept as it was:

Define ‘air temperature’.

comment

298-D comment by: *DGAC FRANCE*

Doc D

Page 8/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 01 02 06
Temperature near the Earth's surface, insolation, surface effects, ~~diurnal and seasonal variation,~~ effect of clouds, effect of wind
LO (01) ~~Describe how the temperature near the Earth's surface is influenced by seasonal variation.~~ Explain the cooling/warning of the surface of the Earth by radiation.

Content of comment:
Radiation is of course the primary cause, but we cannot be unaware of seasonal variations.

Alternative draft for proposed amendment
Maintain the notion of seasonal variation.

response

Not accepted.

Thank you for providing this comment referring to LO 050 01 02 06 (01).

EASA does not agree to this comment; radiation differs (among other things) due to seasonal variation, and seasonal variation is implicitly included in LO (01).

comment *299-D* comment by: *DGAC FRANCE*

Doc D
Page 8/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 01 02 06
Temperature near the Earth's surface, insolation, surface effects, ~~diurnal and seasonal variation,~~ effect of clouds, effect of wind
LO (02) Explain the cooling/~~and~~ warming of the air by molecular or turbulent heat transfer to/from ~~on~~ the earth or sea surfaces

Content of comment:
Too precise!

Alternative draft for proposed amendment
Modify "Explain the cooling/and warming of the air ~~by molecular or turbulent heat transfer to/from~~ on the earth or sea surfaces. "

response

Not accepted.

Thank you for providing this comment referring to LO 050 01 02 06 (02).

EASA is of the opinion that this LO is not too precise as it describes exactly cooling and warming. The original version of the LO has to be kept.

comment *300-D* comment by: *DGAC FRANCE*

Doc D

Page 9/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 01 03 01
~~LO (03) Describe the principle of the barometers (mercury barometer, aneroid barometer)~~

Content of comment:
It's linked to the definition of pressure.

Alternative draft for proposed amendment
Keep "Describe the principle of the barometers (mercury barometer, aneroid barometer)."

response

Not accepted.

Thank you for providing this comment referring to LO 050 01 03 01 (03).

EASA does not agree to this comment as the principal function of barometers is covered in 022.

comment

301-D comment by: *DGAC FRANCE*

Doc D
Page 10/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 01 03 02 (03)
~~LO (O3) Describe and interpret contour lines (isohypses) on a constant pressure chart.~~
Content of comment:

Necessary to define altitude pressure field and geostrophic wind

Alternative draft for proposed amendment
Keep "Describe and interpret contour lines (isohypses) on a constant pressure chart ».

response

Accepted.

Thank you for providing this comment referring to LO 050 01 03 02 (03).

EASA agrees and this LO will be retained.

comment

302-D comment by: *DGAC FRANCE*

Doc D
Page 15/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 02 02 01 (05)
Indicate how the geostrophic wind flows in relation to the isobars/~~isohypses~~ in the northern and in the southern hemisphere

Content of comment:
Used to define geostrophic wind that blows above the planetary boundary layer

Alternative draft for proposed amendment
Keep isohypses (or contour lines) in "Indicate how the geostrophic wind flows in relation to the isobars/isohypses in the northern and in the southern hemisphere."

response

Accepted.

Thank you for providing this comment referring to LO 050 02 02 01 (05).

EASA agrees that pilots have to know isohypses and will not delete this from this LO, as proposed in the NPA. The text remains the same.

In comments 36-D and 302-D, the same issue was raised regarding this LO.

comment *303-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 03 01 02
~~Mixing ratio~~ Intentionally left blank

Alternative draft for proposed amendment
Keep " Mixing ratio"

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 03 01 02
~~LO (01) Define 'mixing ratio' and 'saturation mixing ratio'~~.

Alternative draft for proposed amendment
keep (01) "Define 'mixing ratio' and 'saturation mixing ratio'

response

Not accepted.

Thank you for providing this comment referring to 050 03 01 02 (01).

EASA does not agree as mixing ratio is not that important (it is not present in MET reports), whereas relative humidity is important knowledge.

comment *304-D* comment by: *DGAC FRANCE*

Doc D
Page 21/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 03 01 02
~~LO (02) Name the unit used in meteorology to express the mixing ratio (g/kg~~

Content of comment:

Necessary to define and estimate relative humidity

Alternative draft for proposed amendment
Keep and modify (02) "**State that** the unit used in meteorology to express the mixing ratio **is** (g/kg)."

response

Not accepted.

Thank you for providing this comment referring to LO 050 03 01 02 (02).

EASA does not agree to this comment as the definition in LO (01) is sufficient, no MET information for pilots speaks about mixing ratio.

comment *305-D* comment by: *DGAC FRANCE*

Doc D
Page 22/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 03 01 03
(03) Define 'relative humidity'.

Content of comment :
Need the definition of r and rw to define relative humidity

Alternative draft for proposed amendment
Define 'relative humidity **using mixing ratio'**

response

Not accepted.

Thank you for providing this comment referring to LO 050 03 01 03 (03).

EASA does not agree to this comment: mixing ratio not necessarily needs to be taught for definition of RH.

comment *306-D* comment by: *DGAC FRANCE*

Doc D
Page 23/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 0302 00
Change of state of aggregation

Content of comment :

By definition (WMO): aggregation = The process in which solid precipitation particles combine in the atmosphere to produce larger particles, e.g. hailstones**.**

Alternative draft for proposed amendment
Modify "Change of state of ~~aggregation~~ **water**"

response

Accepted.

Thank you for providing this comment referring to Subject 050 03 02 00.

The heading of this Subject will be amended as follows:

050 03 02 00 Change of state of ~~aggregation~~ water.

comment *307-D* comment by: *DGAC FRANCE*

Doc D
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Page 24/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 03 02 01
Condensation, evaporation, sublimation, freezing and melting, latent heat
LO (01) Define "condensation", "evaporation", sublimation", "deposition", "freezing and melting" and "latent heat".
LO (10) List the conditions for sublimation / deposition.
LO (11) Explain the sublimation / deposition process.

Content of comment:
The word "deposition" is not in the International Meteorological Vocabulary (WMO)

Alternative draft for proposed amendment
The word "deposition" should be deleted.

response

Accepted.

Thank you for providing this comment referring to LOs 050 03 02 01 (01), (10) and (11).

EASA agrees that the word 'deposition' is not in the International Meteorological Vocabulary (WMO) and should not be in this LO as proposed in the NPA. 'Sublimation' has to be used for both processes (gas changing directly to solid and vice versa).

The text will remain the same.

comment *308-D* comment by: *DGAC FRANCE*

Doc D
Page 24/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 03 02 01
(15) Illustrate all the changes of state of aggregation with practical examples.

Alternative draft for proposed amendment
Modify "Illustrate all the changes of state of ~~aggregation~~ **water** with practical examples."

	See above
response	Partially accepted. Thank you for providing this comment referring to LO 050 03 02 01 (15). EASA agrees to delete 'aggregation' in the subject title and here in LO 050 03 02 01 (15). The text will be amended as follows: **050 03 02 00 Change of state of ~~aggregation~~ water** Illustrate all the changes of state ~~of aggregation~~ of water with practical examples.

comment	*309-D* comment by: *DGAC FRANCE* **Doc D** **Page 29/233** **Subject:** **SUBJECT 050 - METEOROLOGY** *syllabus reference 050 04 01 03* (05) Describe the role of the tropopause inversion with regard to the formation of clouds **Content of comment:** More precise **Alternative draft for proposed amendment** Modify "Describe the role of the tropopause inversion with regard to the ~~formation~~ **vertical development** of clouds."
response	Accepted. Thank you for providing this comment referring to LO 050 04 01 03 (05). The text will be amended as follows: Describe the role of the tropopause inversion with regard to the ~~formation~~ vertical development of clouds.

comment	*310-D* comment by: *DGAC FRANCE* **Doc D** **Page 29/233** **Subject:** **SUBJECT 050 - METEOROLOGY** *syllabus reference 050 04 02 01* *General aspects* LO (01) Define "fog", "~~mist" and "haze~~" with reference to the WMO standards of visibility range. LO (02) New Define "mist" and "haze". **Content of comment:** The words "Mist" and "Haze" are very well defined and described in the International

Meteorological Vocabulary (WMO).

Alternative draft for proposed amendment

Delete the LO (02) and complete the LO (01)
LO (01) Define "fog", "mist" and "haze" with reference to the WMO standards of visibility range.
~~LO (02) New Define "mist" and "haze".~~

response

Accepted.

Thank you for providing this comment referring to LOs 050 04 02 01 (01) and (02).

EASA agrees to this comment but sees no need for separate LOs and will retain the wording 'mist' and 'haze' back in LO (01) and will delete LO (02).

The text will be amended as follows:

Define 'fog', 'mist' and 'haze' with reference to the WMO standards of visibility range.

~~(02) New Define 'mist' and 'haze'.~~

comment

311-D comment by: *DGAC FRANCE*

Doc D
Page 32/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 05 01 01
Process of development of precipitation
LO (01) ~~Distinguish between the two following professed by which precipitation is formed~~.
LO (02) ~~Summarise the outlines of the ice crystal process (Wegener Bergeron Findeisen).~~
LO (03) ~~Summarise the outlines of the coalescence process.~~
LO (04) ~~Describe the atmospheric conditions that favour either process.~~

Content of comment:
We cannot agree with the explanation "Not necessary to know". The processes of formation of precipitations have to be known by pilots at least on ATPL (Airplane and Helicopter) level !

Alternative draft for proposed amendment
Add this LOs in theoretical knowledge.

response

Accepted.

Thank you for providing this comment to Subject 050 05 01 01.

EASA agrees that pilots should have basic knowledge of how precipitation forms.

In comments 71-D, 253-D and 272-D, the same issue was raised regarding retaining LOs (01) to (03).

The text of the retained LO (01) will be amended as follows:

~~Distinguish between the two following processes by which precipitation is formed.~~ Describe the two basic processes of forming precipitation (The Wegener–Bergeron–Findeisen process, Coalescence).

comment	*312-D* comment by: *DGAC FRANCE* **Doc D** **Page 33/233** **Subject:** **SUBJECT 050 - METEOROLOGY** *syllabus reference 050 05 02 01* *Process of development of precipitation* LO (03) ~~State the approximate weights and diameters for hailstones.~~ State that, because of their size, hail stones can cause significant damage to aeroplanes. **Content of comment:** We have to be careful about diameters (difference between Ice Pellets and Hail stones). So we can perhaps add "Ice Pellets" somewhere in this LO (03). **Alternative draft for proposed amendment** Add "Ice Pellets" in the LO (03).
response	Not accepted. Thank you for providing this comment. EASA does not agree to this comment as ice pellets do not do damage (as raindrops won't either).

comment	*313-D* comment by: *DGAC FRANCE* **Doc D** **Page 36/233** **Subject:** **SUBJECT 050 - METEOROLOGY** *syllabus reference 050 06 02 02* *Warm front, associated clouds and weather* LO (03) ~~Explain the seasonal differences in the weather at warm fronts.~~ **Content of comment:** We do not agree with this deletion of "Seasonal differences" regarding the warm front, and the comment "Not necessary to know". **Alternative draft for proposed amendment** Add the LO (03) in topic 050 06 02 02
response	Accepted. Thank you for providing this comment to LO 050 06 02 02 (03). The LO (03) will be retained. In comment 78-D, the same issue was raised regarding this LO.

comment	*314-D* comment by: *DGAC FRANCE*

Doc D
Page 36/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 06 02 03
Cold front, associated clouds and weather
LO (03) ~~Explain the seasonal differences in the weather at cold fronts.~~

Content of comment:
We do not agree with this deletion of "Seasonal differences" regarding the cold front, and the comment "Not necessary to know".

Alternative draft for proposed amendment
Add the LO (03) in topic 050 06 02 03

response

Accepted.

Thank you for providing this comment to LO 050 06 02 03 (03).

LO (03) will be retained.

In comments 79-D and 272-D, the same issue was raised regarding this LO.

comment *315-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 06 02 04
Warm sector, associated clouds and weather
LO (03) ~~Explain the seasonal differences in the weather in the warm sector.~~

Content of comment:
We do not agree with this deletion of "Seasonal differences" regarding the warm sector, and the comment "Not necessary to know".

Alternative draft for proposed amendment
Add the LO (03) in topic 050 06 02 04

response

Accepted.

Thank you for providing this comment to LO 050 06 02 04 (03).

LO (03) will be retained.

In comment 80-D, the same issue was raised regarding this LO.

comment *316-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 06 02 05
Weather behind the cold front
LO (02) ~~Explain the seasonal differences in the weather behind the cold front.~~

Content of comment:
We do not agree with this deletion of "Seasonal differences" and the comment "Not necessary to know".

Alternative draft for proposed amendment
Add the LO (02) in topic 050 06 02 05

response

Accepted.

Thank you for providing this comment to LO 050 06 02 05 (02).

LO (02) will be retained.

In comment 81-D, the same issue was raised regarding this LO.

comment *317-D* comment by: *DGAC FRANCE*

Doc D
Page 38/233
Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 06 02 06
(02) Define a 'cold occlusion
(03) Define a 'warm occlusion
Content of comment:
Remove these 2 items, not useful for aviation to know the differences between cold and warm occlusion

response

Accepted.

Thank you for providing this comment to LOs 050 06 02 06 (02) and (03).

EASA agrees to this comment as both LOs are not useful for aviation to know the differences. Both LOs will be deleted as follows:

~~(02) Define a 'cold occlusion~~

~~(03) Define a 'warm occlusion~~

comment *318-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 06 02 06
(07) Sketch a cross section of cold and warm occlusions showing weather, cloud and aviation hazards

Alternative draft for proposed amendment

Modify "Sketch a cross section of ~~cold and warm~~ occlusions showing weather, cloud and aviation hazards. "
See above

response

Accepted.

Thank you for providing this comment to LO 050 06 02 06 (07).

The text will be amended as follows:

Sketch a cross section of ~~cold and warm~~ occlusions showing weather, cloud and aviation hazards.

comment *319-D* comment by: *DGAC FRANCE*

Doc D
Page 40/233

Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 07 02 01
Anticyclones, types, general properties, cold and warm anticyclones, ridges and ~~wedges~~, subsidence.
LO (01) ~~List the different types of anticyclones.~~

Content of comment:
We do not agree with the comment "Not necessary to know".
The types of anticyclones are to be known event basically and particularly at ATPL (Airplane and Helicopter) level ; but the line "Formation" (04) can effectively be deleted.

Alternative draft for proposed amendment
Add the LO (01) in the topic 050 07 02 01

response

Accepted.

Thank you for providing this comment to LO 050 07 02 01 (01).

LOs (01) and (04) will be retained.

In comment 256-D, the same issue was raised regarding this LO.

comment *320-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 08 03 04
~~Cold air pool (cold air drop)~~ Cold-air drop (cold-air pool).

Content of comment:
We agree with the proposed amendments "Cold air drop" is the correct word. We suggest

	deleting “Cold air pool”, because a cold air pool or a pool of cold air is totally different (Mass of cold air formed by the spreading out into hollows and valleys of air cooled by nocturnal radiation on neighboring slopes). **Alternative draft for proposed amendment** Delete the term “Cold-air pool” 050 08 03 04 Cold-air drop ~~(cold-air pool)~~
response	Accepted. Thank you for providing this comment to the heading ‘050 08 03 04 Cold-air drop’. The text of the heading will be amended as follows: ***050 08 03 04 ~~Cold-air pool (cold-air drop)~~ Cold-air drop***

comment	*321-D* comment by: *DGAC FRANCE* **Doc D** **Page 52/233** **Subject:** **SUBJECT 050 - METEOROLOGY** *syllabus reference 050 09 01 04 (New)* *Ice crystal icing* **Content of comment:** We agree for the introduction of the new chapter “Ice crystal icing”, but we have to keep in mind that this notion is not for the time being detailed in the different manuals dealing with aviation meteorology.
response	Noted. Thank you for providing this comment regarding Subject 050 09 07 00. EASA acknowledges your comment.

comment	*322-D* comment by: *DGAC FRANCE* **Doc D** **Page 55/233** **Subject:** **SUBJECT 050 - METEOROLOGY** *syllabus reference ~~050 09 07 00 Stratospheric conditions~~* **Content of comment:** It is not useful to focus on this subject because all information is already given in the previous chapters and no MET information focuses on it.
response	Noted. Thank you for providing this comment regarding Subject 050 09 07 00. EASA is of the opinion that the ISA is defined up to FL 650 and that relevant condition and flight hazards in the lower stratosphere should be known by pilots.

comment	*323-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 10 01 01
Surface observations
LO (10) List of the units for visibility (m, km, stat.mi.)

Content of comment:
What is the signification of stat.mi ? Is it Statute Mile ?

Alternative draft for proposed amendment
Delete abbreviations to avoid any confusion
LO (10) List of the units for visibility (meter, kilometre, statute mile).

response

Accepted.
Thank you for providing this comment to LO 050 10 01 01 (10).
EASA agrees to this comment to avoid confusion on the meaning of abbreviations.
The text will be amended as follows:
List the units used for visibility (m, km, statute mile).

comment *324-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 10 01 01
(16) Compare ground visibility and runway visual range

Content of comment:
More precise.

Alternative draft for proposed amendment
Modify “Compare ground visibility, **prevailing visibility** and runway visual range. “

response

Accepted.
Thank you for providing this comment to LO 050 10 01 01 (16).
EASA agrees to this comment since prevailing visibility is mentioned on METAR and ATIS.
The text will be amended as follows:
Compare ground visibility, prevailing visibility and runway visual range.

comment *325-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 10 01 01
Surface observations
LO (19) ~~List the clouds considered in meteorological reports, and how they are indicated in METARs, TAFs and SIGMETs (TCU, CB).~~ State the clouds which are indicated in METAR and TAF.

Content of comment:
We suggest adding SIGMET after METAR and TAF.

Alternative draft for proposed amendment
Add SIGMET after METAR and TAF.
LO (19) ~~List the clouds considered in meteorological reports, and how they are indicated in METARs, TAFs and SIGMETs (TCU, CB).~~ State the clouds which are indicated in METAR, ~~and~~ TAF and SIGMET.

response

Accepted.

Thank you for providing this comment to LO 050 10 01 01 (19).

EASA agrees to this comment as the amended LO is more precise and clearer.

The text will be amended as follows:

~~List the clouds considered in meteorological reports, and how they are indicated in METARs, TAFs and SIGMETs~~ (~~TCU, CB~~). State the clouds which are indicated in METAR, TAF and SIGMET.

comment

326-D comment by: *DGAC FRANCE*

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Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 10 01 01
Surface observations
LO (28) ~~List the units used for air temperature (Celsius, Fahrenheit, Kelvin). (Refer to 050 01 02 01)~~

Content of comment:
There is an error in the column “comments”. Instead of “Duplication of 050 02 02 01 (2), read 050 01 02 01 (02)

Alternative draft for proposed amendment
In the column “comments”, instead of : ~~Duplication of 050 02 02 01 (2)~~ read
Duplication of 050 **01** 02 01 (02)

response

Accepted.

Thank you for providing this comment referring to LO 050 10 01 01 (28).

EASA agrees with your comment but would like to state that the column ‘Comments’ will be

changed into 'Remarks', and will be empty in all the Subjects. The text under the column 'Comments' was there only to help to read the NPA.

comment *327-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 050 - METEOROLOGY
syllabus reference 050 10 01 04
Weather-radar observations (refer to 050 09 04 05)
LO (05) Name, for areas of differing reflection intensity, the colour gradations (green, yellow, red, magenta) indicating the increasing intensity of precipitations. *Remark : Airborne weather radar devices may use magenta for turbulence (not CAT).*
LO (06) Interpret typical airborne weather radar images.
LO (07) Describe the use of the weather radar to avoid a thunderstorm.
LO (08) Explain how turbulence (not CAT) can be detected by modern weather radar.
LO (09) Explain how wind shear can be detected by a modern weather radar.

Content of comment:
We cannot agree to move those lines from 062 (radio navigation). In meteorology, we have only **weather radars** and not airborne weather radars. Those topics have to be kept in 062.

Alternative draft for proposed amendment

Put back these LOs in topic 062 – Radionavigation.

~~LO (05) Name, for areas of differing reflection intensity, the colour gradations (green, yellow, red, magenta) indicating the increasing intensity of precipitations. *Remark : Airborne weather radar devices may use magenta for turbulence (not CAT).*~~
~~LO (06) Interpret typical airborne weather radar images.~~
~~LO (07) Describe the use of the weather radar to avoid a thunderstorm.~~
~~LO (08) Explain how turbulence (not CAT) can be detected by modern weather radar.~~
~~LO (09) Explain how wind shear can be detected by a modern weather radar.~~

response Accepted.

Thank you for providing this comment referring to LOs 050 10 01 04 (05), (07), (08) and (09).

EASA agrees to move back these LOs to Subject 062 where they were covered under LOs 062 03 03 02 (02) and 062 03 03 06 (02) to (04).

See also EASA's response on comments 57-D and 357-D in CRD for Subject 062.

comment *328-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 050 - METEOROLOGY

syllabus reference 050 10 02 03
~~LO (01) Define 'constant-pressure chart'~~

Content of comment:
Because WINTEM are constant pressure charts
Alternative draft for proposed amendment
Keep "Define 'constant-pressure chart'".

response

Accepted.

Thank you for providing this comment referring to LO 050 10 02 03 (01).

EASA agrees that 'upper-air charts' are very essential for understanding flying in the upper air, wind speed and direction as well as flying on flight level and changing constantly the true altitude of the aircraft. LOs (01) to (04) will be retained.

In comments 40-D, 71-D and 328-D, the same issue was raised regarding this LO.

comment

345-D comment by: *Karl Hunkeler*

050 01 06 03 (08)
what value should be used for the barometric lapse rate above 1013.25 hPa?
The relevant elevation for the calculation is not the elevation of the airport, but the elevation of the station, where the QNH was measured. Thud the temperature correction has to be considered for the layer between the altitude of the aircraft and the altitude of the station measuring the QNH.

response

Accepted.

Thank you for providing this comment referring to LO 050 01 06 03 (08).

EASA agrees to extend the range of application of 30 ft/hPa.

The text will be amended as follows:

(08) New
[…]
Remark: The following rules should be considered for altimetry calculations:

a) All calculations are based on rounded pressure values to the nearest lower hPa;

b) ~~The value for the barometric lapse rate near mean sea level is is 27 ft (8 m)30 ft (9m)per 1 hPa;~~

The value for the barometric lapse rate between MSL and 700 hPa to be used is 30 ft/hPa as an acceptable approximation of the barometric lapse rate.

[…]

In comments 76-D and 345-D, the same issue was raised regarding this LO.

comment

347-D comment by: *Karl Hunkeler*

Most of the subjects considered necessary for IR are also necessary for CBIR/EIR, since also these pilots are allowed to fly in clouds.

response	Noted. Thank you for providing this comment referring to the CB-IR(A) and EIR column. The applicable LOs will be marked with 'X' in the CB-IR(A) and EIR column.

Additional comments received by email:

comment	*Per email* comment by: SAT: Blatter Patrick General Overview: "The current syllabus for meteorology comprises too many LO's with elementary knowledge on which the practical knowledge was built" Is this not the normal way: elementary knowledge and then built on that the practical knowledge??? 050 02 02 01 (07) This LO is very important to understand the development for low pressure systems 050 02 03 01 (01) Describe is not sufficient. You have to be able to explain to understand the thermal dynamic low pressure 050 02 07 03 (02) Absolutely necessary for the "imagination" of polar jet stream 050 02 07 04 (01) Jet streams and their meteorological phenomena are very important themes of civil aviation (we do not really understand how this LO can't be of practical use ???) 050 03 03 01 (04) (06) (09-12) and (15-18) How you would one understand thermodynamic when the mixing ration will not be explained? How should one explain the „the need for condensation nuclei "without explaining the definition of „water vapour". The „hand-on"-training on the simplified emagramm helps a lot to understand convection, building up of hail etc. also stability, instability and the importance of humidity in unstable processes. 050 05 01 01 (01-04) It is important to know the two types of precipitation (why freezing rain can be build up in a NS but not in a CB). 050 06 02 02 (03) The embedded CB in a summerly warm front is one of the most dangerous hazards and absolutely necessary for practical use 050 06 02 04 (03) The warm sector can be very different from one season to another. For the weather assessment this fact has to be known. 050 06 02 05 (02) The weather behind the front is different from one season to another. For the weather assessment this fact has to be known. 050 06 02 06 (04-06) The knowledge of these LO's is of upmost importance for a pilot. 050 08 01 02 (05) Each pilot on ATPL – level should known a least 5 examples of each climate zone. 050 08 02 04 (05-10) A pilot with ATP-level have to know monsoons, also on the southern hemisphere. 050 10 03 01 (LO) The interpretation of GAFOR is necessary and of upmost practical use. As long as GAFOR exists it must be maintained in the LO's. By the way a CPL – pilot flies not always in IMC-conditions and has to understand the GAFOR.
response	Thank you for your extensive feedback, which has been greatly appreciated. EASA has carefully assessed all the comments received. Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number. Regarding your comment referring to LO 050 02 02 01: Accepted.

EASA agrees that mainly all flying above the friction layer happens with the gradient wind. There is a great practical use and so it is basic knowledge for pilots.

The heading of 50 02 02 01 will be retained: 'Primary cause of wind, pressure gradient, Coriolis force, gradient wind'. As a consequence, LO (07) will not be deleted and will be marked as BK.

In comment 272-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 02 03 01: Not accepted.

EASA does not agree to this comment; if the description is good, then knowledge for practical use should be sufficient.

Regarding your comment referring to LO 050 02 07 03: Not accepted.

EASA does not agree with this comment as the content of this LO is too detailed for theoretical instruction of pilots.

Regarding your comment referring to LO 050 02 07 04: Not accepted.

EASA does not agree with this comment as jet streams are depicted quite accurately on significant weather charts and when flying in/through indicated wind/turbulence clearly indicate their presence.

Regarding your comment referring to LO 050 03 03 01: Not accepted.

EASA is of the opinion that knowledge of these LOs is not relevant for pilots and therefore not necessary to know.

Regarding your comment referring to LO 050 05 01 01: Accepted.

EASA agrees that it would be impossible to understand the principles of 'warm' and 'cold' clouds which will have a great effect on understanding icing and several kinds of precipitation. LOs (01) to (03) will be retained.

Text of LO (01) will be amended as follows:

~~Distinguish between the two following processes by which precipitation is formed.~~ Describe the two basic processes of forming precipitation (The Wegener–Bergeron–Findeisen process, Coalescence).

In comments 71-D, 272-D and 311-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 06 02 02 (03): Accepted.

EASA accepts the necessity of the content of this LO due to its practical relevance concerning the flight hazards mentioned and will be retained.

In comments 78-D and 313-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 06 02 04 (03): Accepted.

EASA accepts the necessity of the content of this LO due to its practical relevance concerning the flight hazards mentioned and will be retained.

In comments 80-D and 315-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 06 02 05 (02): Accepted.

EASA accepts the necessity of the content of this LO and will be retained.

In comment 81-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 06 02 06 (04-06): Accepted.

EASA will retain LOs (04) to (06) as this content is necessary for the pilots to know.

In comment 71-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 050 08 01 02 (05): Accepted.

EASA agrees that the knowledge of geographical positions of climate zones is important for pilots and will retain it.

	In comment 71-D, the same issue was raised regarding this LO. Regarding your comment referring to LO 050 08 02 04: Not accepted. EASA would like to state that general knowledge about monsoon is required, but not in detail. EASA is aware that an example helps to explain monsoon conditions more fully — this is integrated in new LO (04). An overview of regions of occurrence of monsoons is given in LO (01) of this chapter. Regarding your comment referring to LO 050 10 03 01: Not accepted. EASA does not agree to this comment as GAFOR is for use in general aviation/PPL only.

comment	*177-RMT.0581* comment by: *European Transport Workers Federation - ETF* DDOU email: Subject to the content of the detailed version of the syllabus, the ETF proposes to the Agency to amend the "SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE ATPL, CPL AND IR" in the "AMC1 FCL.310; FCL.515 (b); FCL.615 (b)" by adding two lines in the "050 METEOROLOGY" section: - "weather at high altitude" in order to emphasize the theoretical knowledge specially on ice crystals - "Volcanic activity" in order to emphasize the theoretical knowledge on Volcanic ashes and the effects on planes (visibility, pitot probe and engines)
response	Not accepted. Thank you for providing this comment referring to crystal icing. EASA does not agree as crystal icing is a new chapter in Subject 050. EASA will take into account new LO for volcanic ash as soon as upcoming amendments of ICAO Annex 3 are finalised.
comment	*RMT.0581* comment by: *DDOU* DDOU email: "- more emphasis on severe weather at high altitude theoretical knowledge in the initial CPL and ATPL training (volcanic ashes, ice crystal)" - "detection of hazardous situation at high altitude (Pitot probe freezing)
response	Not accepted. Thank you for providing this comment referring to crystal icing. EASA does not agree as crystal icing is a new chapter in 050. EASA will take into account the new LO for volcanic ash as soon as upcoming amendments of ICAO Annex 3 are finalised.

Appendix
to ED Decision 2018/001/R
Subject 061 — NAVIGATION — GENERAL NAVIGATION

RELATED NPA: 2016-03(D) — RMT.0595 — 6.2.2018

Table of contents

3. Summary of the outcome of the consultation

Please refer to the Explanatory Note to Decision 2018/001/R.

4. Individual comments and responses

In responding to comments, a standard terminology has been applied to attest EASA's position. This terminology is as follows:

(a) **Accepted** — EASA agrees with the comment and any proposed amendment is wholly transferred to the revised text.

(b) **Partially accepted** — EASA either agrees partially with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.

(c) **Noted** — EASA acknowledges the comment but no change to the existing text is considered necessary.

(d) **Not accepted** — The comment or proposed amendment is not shared by EASA.

Overview of the proposed amendments to Subject 061 'General navigation' p. 72-73

comment	*42-D* comment by: *KLM Flight Academy* - 061 01 04 02 01/04/05/06/07 and 06 061 01 04 03 01/02/04, 061 02 01 00 Terrestrial Magnetism and its limitations as variation, inclination and deviation for use by navigators. It is part of the basic navigation principles and belonged to General Navigation for long. These LO's should not be transferred to 022.
response	Not accepted. Thank you for providing this comment referring to LOs 061 01 04 02 (01), (04) to (07), LOs 06 061 01 04 03 (01), (02) and (04), and Subject 061 02 01 00. EASA would like to highlight that the theory of terrestrial magnetism and the direct-reading compass are instrument-related and therefore belong in Subject 022. Explanation and application of variation and deviation of course remain in Syllabus area 061 01 03 01.

comment	*43-D* comment by: *KLM Flight Academy* 061 06 01 00 should not be in Gen Nav and the proposed transfer from 022 is not appropriate. In a former revision of the LO's in the twentieth century Inertial Navigation was transferred from 061 to 022.
response	Accepted. Thank you for providing this comment referring to Subject 061 06 01 00. EASA agrees that the proposed transfer from inertial navigation in Subject 022 to Subject 061 06 00 00 was not appropriate. The text of Subject 061 06 00 00, including the minor amendments based on accepted comments on specific LOs, will be transferred back in Subject 022 under Subject 022 05 00 00.

comment	*44-D* comment by: *KLM Flight Academy* - 061 04 02 04/05,

	- 061 05 02 00. It has to be realised that the technique of navigation is part of the Subject General Navigation. The application of the technique is done in other subjects as 033. So most of the proposed transfers to 033 should not be done.
response	Partially accepted. Thank you for providing this comment referring to Subjects 061 04 02 04, 061 04 02 05, and 061 05 02 00. EASA disagrees with your comment regarding the transfer to Subject 033 of Subject 061 04 02 04 and 061 04 02 05 as this should go to Subject 033 as suggested. EASA is of the opinion that these calculations/conversions should be in Subject 033. EASA agrees with your comment on Subject 061 05 02 00 regarding navigation in climb and descent, and these LOs should remain in Subject 061. Those LOs will be placed under new Subject 061 01 09 00.

comment	*45-D* comment by: *KLM Flight Academy* Th061 The part with mental calculations state that ECQB exam questions should be answered with rules that approximate the correct answers. For example it is assumed that the EWC is equal to the wind component along the track, which is not correct. It is even stated that answers, which are c calculated in a correct with trigonometrics and a calculator would be marked as not correct. This is unacceptable. In the theory instruction it is realistic to teach the candidates how to get the correct values. In subject 100 KSA it is possible to deal with rules of thumb to get the approximations as used by mental calculation.
response	Noted. Thank you for providing this comment referring to mental calculations. EASA acknowledges this problem and agrees that mental calculations should form part of Subject KSA 100.

comment	*46-D* comment by: *KLM Flight Academy* 061 The parts with text, stating what to do when one is unsure of the position and lost position, do not belong to LO's.
response	Not accepted. Thank you for providing this comment referring to parts with text, stating what to do when one is unsure of the position and lost position. EASA would like to highlight that this is part of the VFR navigation technique.

comment	*48-D* comment by: *KLM Flight Academy* 061 The many transfers are not logical and will give a lot of unnecessary extra costs for all stakeholders. Every ATO is free to determine the order of subjects and items in their lesson plans as those have to made up and written in their own training manuals. Propose to cancel the transfers to other subjects.
response	Partially accepted.

	Thank you for providing this comment referring to the many transfers of LOs. EASA acknowledges this problem and has agreed not to transfer all recommendations to/from other subjects. Please check the other responses of this CRD for Subject 061 regarding the transfer of certain subjects.

comment	*263-D* comment by: *University of Tromsø School of Aviation* Consider splitting the newly purposed 061 01 into subsection 061 01 and 061 02. The remaining five subsections will naturally follow as 061 03 through 061 07. 061 01 as purposed feels big, maybe too big.
response	Noted. Thank you for your comment referring to the newly purposed Subject 061 01. EASA considers that Syllabus reference 061 01 contains all the basic elements of general navigation and as such fit nicely under one heading.

comment	*329-D* comment by: *DGAC FRANCE* **Doc D** **Subject:** **SUBJECT 061 – GENERAL NAVIGATION** **Content of comment:** No comment
response	Noted. Thank you for general comment referring to Subject 061.

SUBJECT 061 — GENERAL NAVIGATION p. 74-113

comment	*49-D* comment by: *KLM Flight Academy* 061 03 03 05 01 Do not delete Radio bearings are as important as VOR radials in the next LO. Plotting is relevant for understanding and can be used for preparation of a flight plan.
response	Accepted. Thank you for providing this comment referring to old LO 061 03 03 05 (01). Whilst non-directional radio beacons (NDBs) are used less and less, EASA agrees to reinstate this LO 061 03 03 05 01 in the 'old 061 document' and move this LO to the 'new 061 document' to the new LO 061 04 03 02 (03). See also EASA's response to comment 248-D.

comment	*50-D* comment by: *KLM Flight Academy* 061 04 01 03 01 Due to cross out of wind velocity the LO is not complete.

response

Partially accepted.

Thank you for providing this comment to old LO 061 04 01 03 (01).

EASA agrees that 'wind velocity' should be part of this LO. The text of this LO in the 'old 061 document' is reworded and moved to the 'new 061 document' to the new 061 01 06 02 (01). Wind velocity is indicated there as 'WV'.

comment

51-D comment by: *KLM Flight Academy*

061 04 04 01 03 Do not delete as this is important for mental calculations.

response

Accepted.

Thank you for providing this comment to old LO 061 04 04 01 (03).

EASA agrees that it is important for mental calculations and will reinstate this LO 061 04 04 01 03 (01) in the 'old 061 document' and move this LO to the 'new 061 document' to the new LO 061 01 07 01 (03).

comment

52-D comment by: *kg*

061 01 01 01
(01)
State that the geoid is an irregular shape based on the surface of the oceans influenced only by ~~gravity~~ and centrifugal force.

...gravitation...

(03)
State that the ~~circumference~~ of the Earth is approximately ~~40 000~~ km.

...radius...
...6370 km.

061 01 03 02
(02)
~~Explain and apply the concepts of~~ drift and WCA.

Define...

(03)
Calculate the ~~track made good (TMG)~~ with appropriate data of heading and drift.

...actual track...

(04)

Calculate the track angle error (TKE) with appropriate data of ~~WCA and drift~~.

...desired track and actual track.

061 01 04 04
(01)
Evaluate the effect of wind and altitude on ~~ground~~ distance.

...air...

(02)
Convert between ~~ground distance (NM)~~ and ~~air distance~~ ~~(NAM)~~ using the formula ~~NAM = NM × TAS/GS.~~

...ground distance/still air distance (SAD)...
...air distance (AD)...
SAD/GS=AD/TAS

061 02 01 01
(01)
Recognise which elements would make a ground feature suitable for use for VFR navigation.

Belongs to 033 and already included in 033.01.01.02.01

061 02 01 02
(01)
Describe the problems of VFR navigation at lower levels and the causes of reduced visibility.

Belongs to 033 and already included in 033.01.01.02.01

061 02 02 01
(01)
Apply the techniques of DR, map reading, orientation, timing and revision of ETAs and headings.

Belongs to 033 and already included in 033.01.01.02.05

(02)
Describe the problems of VFR navigation at night.

Belongs to 033 and already included in 033.01.01.02.01

061 02 02 01
(02)

Explain what needs to be considered in case of diversion, when unsure of position and when lost.

Belongs to 033

061 03 01 01
(01)
Describe the geometric properties of a great circle (including the vertex) ~~and a small circle~~.

No practical use

061 03 01 02
(02)
State the formula used to approximate the value of Earth convergence as change of longitude × sine mean latitude.

only valid up to 30° difference of longitude

(03)
Calculate the approximate value of Earth convergence between any two positions.

Which formular and up to what distance?

061 03 02 01
(03)
Explain that the true track direction of a rhumb line route does not change.

Included in 061 03 02 01 (01)

061 03 03 01
(01)
Explain that the variation in distance of the great circle route and rhumb line route between any two positions increases with increasing latitude and/or change in longitude.

No practical use

061 03 03 02
(01)
Calculate and apply the conversion angle.

No practical use

061 04 02 04
(01)

State ~~and apply~~ the properties of a Lambert projection.

061 05 01 02
(01)
Perform LMT and ~~GMT~~ calculations.

...UTC...

061 05 02 02
(01)
State the changes when crossing the International Date Line.

No practical use

061 06 01 00
(03)
State that earlier gyro mechanical stabilised platforms are (technically incorrectly but conventionally) referred to as inertial navigation systems (INSs) and more modern fixed (strap down) platforms are conventionally referred to as inertial reference systems (IRSs).

Stand alone systems used to be named INS, while FMS integrated systems are called IRS.

(04)
Explain the basic principles of inertial navigation (including double integration of measured acceleration and the necessity for north-south, east-west and vertical components to be measured/extracted).

Measured acceleration needs to be corrected (Coriolis, gravity)

(05)
Explain the necessity of applying correction for transport precession and Earth rate precession.

Background Knowledge

(06)
State that in modern aircraft fitted with inertial reference system (IRS) and flight management system (FMS), the flight management computer (FMC) position is normally derived from a mathematical analysis of IRS, global positioning system (GPS) and distance measuring equipment (DME) data.

& VOR, LOC
(LO should belong to FMS LOs)

(07)

List all navigational data that can be determined by a stand-alone ~~inertial system~~.

...INS

(08)

State that a strap-down system is fixed to the structure of the aircraft and normally consists of three laser ring gyros and three accelerometers.

& computation unit.
Display and operation mainly via MCDU of FMS.

(09)

~~Explain~~ the ~~fundamental~~ differences between a laser ring gyro and a conventional mechanical gyro.

State...

061 06 02 00
(01)

State that during the alignment process ~~the inertial platform is levelled and the aircraft heading determined~~.

...the local vertical and the true north direction are determined.

(04)

Explain that the inertial navigation system (INS) platform is maintained level and north-aligned after alignment is complete and the aircraft is in motion.

This is not true for free azimuth and strap down systems.

(10)

~~Identify where~~ the majority of the IRS data can be accessed through the FMS control and display unit (CDU)/flight management and guidance system (FMGS) multifunctional control and display unit (MCDU).

State that...

(11)

~~Describe~~ the procedure available to the pilot for assessing the performance of individual IRUs after a flight:
— reviewing the residual indicated ground speed when the aircraft has parked;
— reviewing the ~~drift given as NM/h~~.

State...
...total drift for a particular flight.

Additionally a complete set of INS LOs:

061 06 01 00 Basic principles

(01)
State that inertial navigation/reference systems are the main source of attitude and one of the main sources of navigational data in commercial air transport aeroplanes.

(02)
State that inertial systems require no external input to determine aircraft attitude and navigational data.

(03)
Inertial navigation systems (INS) used to be stand alone systems, while in modern FMS equiped aircraft they are called inertial reference systems (IRS). IRS are connected to the FMC.

State that the sensors of an inertial system are 3 accelerometers and 3 gyros whereby each sensor group is arranged rectangular to get 3 dimensional measurements

State that earlier systems worked with mechanical stabilized platforms (platform system) and more modern systems with platforms fixed to the aircraft's body (strap down systems)

State that the platform systems where stabilized to keep the sensors aligned to the horizontal plane of the earth

(05)
Explain the necessity of applying correction for transport precession and Earth rate precession.

State that strap down systems are virtually stabilizing the sensors with the help of a co ordinate transformation

(08)
State that a strap-down system is fixed to the structure of the aircraft and normally consists of three laser ring gyros, three accelerometers and a computation unit.

State that an inertial system that is able to perform waypoint navigation is referred to as inertial navigation system (INS) and that an inertial system that only provides navigational data to a flight management system is referred to as inertial reference system (IRS)

(04)
Explain the basic principles of inertial navigation (including double integration of aircraft acceleration and the necessity for north-south, east-west and vertical components to be

measured/extracted).

(06)
State that in modern aircraft fitted with inertial reference system (IRS) and flight management system (FMS), the flight management computer (FMC) position is normally derived from a mathematical analysis of IRS, global positioning system (GPS) and other data from radio navigation sensors.

(07)
List typical navigational data that can be determined by a stand-alone inertial navigation system. (TK,GS, TH, DA, XTK, TKE, Pos, WPT, Distance and time to next waypoint, Wind, TC)
(09)
State the differences between a laser ring gyro and a conventional mechanical gyro.

061 06 02 00 Alignment and operation
(01)
State that during the alignment process the inertial platform is levelled, the aircraft heading determined (mechanical for platform systems, mathematical for strap down systens) and the errors of the sensors are assessed.

(02)
Explain that the aircraft must be stationary during alignment and the aircraft position is entered during the alignment phase.

Explain why the duration of the alignment process depends on the geographical latitude and why it is limited up to latitudes of 80°.

State that in mid latitudes the alignment process takes around 15 minutes and list factors that may influence the duration of the alignment.

(03)
State that in-flight realignment is not possible and loss of alignment leads to loss of navigational data although attitude information may still be available.

(04)
Explain how the inertial navigation system (INS) platform is maintained level and north-aligned after alignment is complete and the aircraft is in motion.

(05)
State that an incorrect entry of latitude may cause an incorrect assessment of the sensor errors during the alignment phase

(06)
State that the positional error of inertial navigation varies (a typical value can be quoted as 1–2 NM/h) and is dependent on the gyro drift rate, accelerometer bias, misalignment of the platform, and computational errors.

Explain how the schuler oscillation affects the development of the velocity and position error of inertial navigation

(07)
Explain that, on a modern aircraft, there is likely to be an air data inertial reference unit (ADIRU), which is an inertial reference unit (IRU) integrated with an air data computer (ADC).

(08)
Identify examples of IRS control panels.

(09)
Explain the following selections on the IRU mode selector:
— NAV (normal operation);
— ATT (attitude only).
(10)
Identify where the majority of the IRS data can be accessed through the FMS control and display unit (CDU)/flight management and guidance system (FMGS) multifunctional control and display unit (MCDU).

(11)
Describe the procedure available to the pilot for assessing the performance of individual IRUs after a flight:
— reviewing the residual indicated ground speed when the aircraft has parked;
— reviewing the total drift for a particular flight.

response

Thank you for all your comments regarding the new 061 document.

EASA has carefully assessed all the comments received. These are listed as follows:

Regarding your comment referring to new LO 061 01 01 01 (01): Not accepted.

EASA considers that ‘gravity’ is a clearer term in this context rather than ‘gravitation’.

Regarding your comment referring to new LO 061 01 01 01 (03): Partially accepted.

EASA considers that circumference is correct, but would add ‘or approximately 21 600 NM’.

The text will be amended as follows:

State that the circumference of the Earth is approximately 40 000 km or approximately 21 600 NM.

Regarding your comment referring to new LO 061 01 03 02 (02): Not accepted.

EASA considers that by changing the wording ‘explain and apply’ to ‘define’ would stop calculation questions.

Regarding your comment referring to LO 061 01 03 02 03: Accepted.

EASA agrees with your proposed amendment.

The text will be amended as follows:

Calculate the actual track with appropriate data of heading and drift.

Regarding your comment referring to new LO 061 01 03 02 (04): Not accepted.

EASA considers that ‘WCA and drift’ is correct.

Regarding your comment referring to new LO 061 01 04 04 (01): Accepted.

EASA agrees to change the wording ‘ground distance’ into ‘air distance’.

The text will be amended as follows:

Evaluate the effect of wind and altitude on air distance.

Regarding your comment referring to new LO 061 01 04 04 (02): Not accepted.

EASA considers that the formula should be the same as used in Subject 033.

Regarding your comment referring to new LO 061 02 01 01 (01): Not accepted.

EASA considers that this is more suitable for Subject 061.

Regarding your comment referring to new LO 061 02 01 02 (01): Not accepted.

EASA considers that this is more suitable for Subject 061.

Regarding your comment referring to new LO 061 02 02 01 (01): Not accepted.

EASA considers that this is more suitable for Subject 061.

Regarding your comment referring to new LO 061 02 02 01 (02): Not accepted.

EASA considers that this is more suitable for Subject 061.

Regarding your comment referring to new LO 061 02 02 02 (01): Not accepted.

EASA considers that this is more suitable for Subject 061.

Regarding your comment referring to new LO 061 03 01 01 (01): Not accepted.

EASA considers that this Syllabus reference is relevant to great circles. It gives a better understanding of convergency and the reason for flying at high latitudes on eastbound and westbound routes.

Regarding your comment referring to new LO 061 03 01 02 (02): Accepted.

EASA agrees to amend this LO (02) to include ‘up to 30° difference of longitude’.

The text will be amended as follows:

Describe the geometric properties of a great circle and a small circle, up to 30° difference of longitude.

Regarding your comment referring to new LO 061 03 01 02 (03): Noted.

The formula is given in LO 061 03 01 02 (02).

Regarding your comment referring to new LO 061 03 02 01 (03): Accepted.

EASA agrees that this LO 061 03 02 01 (03) is already covered in LO 061 03 02 01 (01) and will delete LO 061 03 02 01 (03).

Regarding your comment referring to new LO 061 03 03 01 01: Not accepted.

EASA considers this to be essential for understanding the relationship between GC and RL distances.

Regarding your comment referring to new LO 061 03 03 02 01: Not accepted.

EASA considers this to be essential for understanding the relationship between GC and RL tracks.

Regarding your comment referring to new LO 061 04 02 04 01: Accepted.

EASA agrees to delete ‘and apply’.

The text will be amended as follows:

State the properties of a Lambert projection.

Regarding your comment referring to new LO 061 05 01 02 (01): Accepted.

EASA agrees to change 'GMT' to 'UTC', and will also amend the heading.

The text will be amended as follows:

Local Mean Time (LMT) and Universal Time Coordinated (UTC)

Perform LMT and UTC calculations.

Regarding your comment referring to new LO 061 05 02 02 01: Not accepted.

EASA considers that a pilot should be aware of what happens to the date when the date line is crossed.

EASA has agreed that new Subject 061 06 should be 01 in Subject 022.

Regarding your comment referring to new LO 061 06 01 00 (03): Partially accepted.

The text of the LO states the protocol in naming, but should be reworded: '…inertial reference systems (IRSs). INSs can be considered to be stand-alone, whereas IRSs are integrated with the FMS'.

The text will be amended as follows:

State that earlier gyro mechanically stabilised platforms are (technically incorrectly but conventionally) referred to as inertial navigation systems (INSs) and more modern fixed (strap-down) platforms are conventionally referred to as inertial reference systems (IRSs). INSs can be considered to be stand-alone, whereas IRSs are integrated with the FMS.

This LO is now in Subject 022 under Subject **022 05 01 01 Systems**.

Regarding your comment referring to new LO 061 06 01 00 (04): Partially accepted.

This has been included in 061 06 01 00 (05).

The text will be amended as follows:

Explain the necessity of applying correction for transport precession, and Earth rate precession, coriolis and gravity.

This LO is now in Subject 022 under Subject **022 05 01 01 Systems**.

Regarding your comment referring to new LO 061 06 01 00 (05): Not accepted.

The concept should be examinable.

Regarding your comment referring to new LO 061 06 01 00 (06): Accepted.

This LO will be amended accordingly and is also covered in Subject 062 05 04.

The text will be amended as follows:

State that in modern aircraft fitted with inertial reference system (IRS) and flight management system (FMS), the flight management computer (FMC) position is normally derived from a mathematical analysis of IRS, global positioning system (GPS), and distance measuring equipment (DME) data, VOR and LOC.

This LO is now in Subject 022 under Subject **022 05 01 01 Systems**.

Regarding your comment referring to new LO 061 06 01 00 (07): Accepted.

This LO will be amended accordingly and the word 'navigation' will be deleted.

The text will be amended as follows:

List all navigational data that can be determined by a stand-alone inertial navigation system.

This LO is now in Subject 022 under Subject **022 05 01 01 Systems**.

Regarding your comment referring to new LO 061 06 01 00 (08): Not accepted.

The LO is not asking about components, it's asking about the mounting system.

Regarding your comment referring to LO 061 06 01 00 (09): Accepted.

This LO will be amended accordingly and the word 'fundamental' will be deleted and the word 'Explain' replaced by 'State'.

The text will be amended as follows:

State the differences between a laser ring gyro and a conventional mechanical gyro.

This LO is now in Subject 022 under Subject **022 06 01 01 Systems**.

Regarding your comment referring to new LO 061 06 02 00 (01): Partially accepted.

This LO will be reworded.

The text will be amended as follows:

State that during the alignment process, the inertial platform is levelled (INS) or the local vertical is determined (IRS) and true north/aircraft heading established.

This LO is now in Subject 022 under Subject **022 06 02 01 Alignment process, incorrect date entry, and control panels**.

Regarding your comment referring to new LO 061 06 02 00 (14): Not accepted.

LO (03) determines that the naming protocol refers to an INS as having a gyro stabilised platform.

Regarding your comment referring to new LO 061 06 02 00 (10): Accepted.

This LO will be amended accordingly and the words 'Identify with' will be replaced by 'State that'.

The text will be amended as follows:

State that the majority of the IRS data can be accessed through the FMS control and display unit (CDU)/flight management and guidance system (FMGS) multifunctional control and display unit (MCDU).

This LO is now in Subject 022 under Subject **022 05 02 01 Alignment process, incorrect date entry, and control panels**.

Regarding your comment referring to new LO 061 06 02 00 (11): Not accepted.

EASA is of the opinion that the text should remain as is.

Regarding your comment referring to new Subject 061 06 01 00 basic principles: Not accepted.

Whilst EASA can see that the wording of theses LOs may be an improvement on the RMT recommendations, there is always room for improvement in wording and layout. To incorporate all these changes at this stage would be time-prohibitive. To be considered for a subsequent update.

comment	*53-D*	comment by: *kg*

response

Noted.

No comment was made.

comment

72-D comment by: *European Cockpit Association*

Attachment #3

Subject 061 — General navigation	Page nb	
061 04 01 04 - Airspeed	**101**	Conversions to mach number are not of practical use for helicopters, delete LO for H
061 04 05 04 - Determination of Mach number	**107**	No practical use for helicopters, delete LO for H. Justification is made when in LO 061 01 05 02 is not set for helicopters

response

Partially accepted.

Thank you for providing this comment referring to old Subjects 061 04 01 04 and 061 04 05 04.

In the new 061 document there are no references any more to helicopters.

comment

87-D comment by: *Bristol Groundschool*

061 01 02 03 (08). Recommend leaving this in, as it is crucial for convergency calculation, and students like confirmation of the approved method, which is indeed basic arithmetic.

response

Not accepted.

Thank you for providing this comment referring to old LO 061 01 02 03 (06).

EASA considers this to be simple mathematics and is not required to be a separate Syllabus reference.

comment

88-D comment by: *Bristol Groundschool*

061 01 02 04 (07) and (08). Disagree with the removal of these two LOs – a lot of basic knowledge is not taught in schools, and non-native English speakers appreciate the examples.

response

Partially accepted.

Thank you for providing this comment referring to old LOs 061 01 02 04 (07) and (08).

EASA agrees to reinstate LO 061 01 02 04 07 in the 'old 061 document' and move this LO to the 'new 061 document' to the new LO 061 03 01 01 (04).

EASA sees no need to reinstate old LO 061 01 02 04 08.

comment	*89-D* comment by: *Bristol Groundschool* **061 01 02 05** (03). Leave it in - the term is used in another LO in this subject.
response	Not accepted. Thank you for providing this comment referring to old LO 061 01 02 05 (03). EASA would like to highlight that the term is not used in the new 061 Syllabus references.

comment	*90-D* comment by: *Bristol Groundschool* **061 01 03 01** (01). Leave in. Why would an airline pilot not want to know about time zones? The others (03), (13), (14) and (15) could go but it's amazing how many students know nothing about leap years- but then again they probably don't need to.
response	Not accepted. Thank you for providing this comment referring to old LO 061 01 03 01 (01). EASA would like to highlight that zone time is not used and standard time remains in the Syllabus references.

comment	*91-D* comment by: *Bristol Groundschool* **061 01 04 05.** Suggest a basic knowledge of the principles of Grid Nav would be useful so that pilots have an idea of what their FMS is doing at high latitudes. No need to examine specific problems. I would keep (1), (2) and (3).
response	Partially accepted. Thank you for providing this comment referring to old Subject 061 01 04 05. EASA agrees that there should be some knowledge of grid navigation and reinstates 061 01 04 05 (01 to 04) in the 'old 061 document' and moves this LO to the 'new 061 document' to the new LOs 061 01 03 01 (08) to (11).

comment	*92-D* comment by: *Bristol Groundschool* **061 03 01 01** (04), (05) and (06). Leave them in. One could say that 90% of Gen Nav is "no practical use". A basic knowledge of projections should remain in my opinion.
response	Not accepted. Thank you for providing this comment referring to old LOs 061 03 01 01 (04), (05) and (06). EASA would like to highlight that the basic knowledge of the projection is in the new 061 04 02 03 (01). EASA sees no practical use for scale calculations.

comment	*93-D* comment by: *Bristol Groundschool* **061 03 01 02** (05), (08), (09), (10) and (11). Leave them in. One could say that 90% of Gen Nav is "no practical use". A basic knowledge of projections should remain in my opinion.
response	Accepted. Thank you for providing this comment referring to old LOs 061 03 01 02 (05), (08), (09), (10)

	and (11). EASA agrees to reinstate the LOs 061 03 01 02 (05), (08), (09), (10) and (11) in the 'old 061 document' and move these LOs to the 'new 061 document' to the new LOs 061 04 02 04 (03) to (07).

comment	*94-D* comment by: *Bristol Groundschool* **061 03 01 03** (04) and (04). Agreed- very badly worded LOs anyway.
response	Noted. Thank you for providing this comment referring to old LO 061 03 01 03 (04).

comment	*95-D* comment by: *Bristol Groundschool* **061 03 02 01** (05) and (06). I think the comment that a GC is not plotted on a Mercator chart misses the point. These LOs are targeted at knowing that conversion angle must be applied to get a GCT as a straight line on the Mercator is a rhumb line.
response	Accepted. Thank you for providing this comment referring to the old LOs 061 03 02 01 (05) and (06). EASA agrees to reinstate the LOs 061 03 02 01 (05) and (06) in the 'old 061 document' and move these LOs to the 'new 061 document' to the new LOs 061 04 02 03 (02) and (03).

comment	*96-D* comment by: *Bristol Groundschool* **061 04 04 01** (03). Disagree- The new proposed section on MDR uses approximations to work out crosswinds etc. If the calculated crosswind is divided by the speed factor (or NM/min) the result is the WCA from which the heading required to maintain desired track can be calculated.
response	Accepted. Thank you for providing this comment referring to old LO 061 04 04 01 (03). EASA agrees to reinstate LO 061 04 04 01 (03) in the 'old 061 document' and move this LO to the 'new 061 document' to the new LO 061 01 07 01 (03). See also EASA's response to comment 251-D.

comment	*242-D* comment by: *University of Tromsø School of Aviation* Too many LO's seemingly off "no practical use". We make the argument that several of these LO's marked as *"no practical use"* is an important part of the greater understanding the subject has to offer. If one is to combine the introduction of KSA 100 and at the same time increase the understanding and ability to apply knowledge higher up on Blooms Taxonomy, certain parts of the aviation history as well as items that may not be "used in every day aviation" is still an essential part in developing every students total understanding of the subject. We feel that while working to stream line the subject, some important parts have been put

	aside due to “no straight forward and current applications”. This reduction should be reconsidered. Example: Grid navigation is not currently used widely (or almost at all) in every day navigation. The history behind it however is important, and most certainly interesting. The same goes for Transverse (Gauss) Mercator projection. This way of navigating however is still used among other places in Norway, Sweden and Chile. The student should develop an understanding for the fact that there is a wide variety of ways to project maps, and know of more than just the ways used “most places”. Further comments on the specific LO's.
response	Noted. EASA thanks you for your general comment on Subject 061.

comment	*243-D* comment by: *University of Tromsø School of Aviation* The speed of which daylight is reduced/increased varies greatly across the globe. Especially in northern countries, planning a flight around march and/or September can add/remove a whole hour of daylight if the flight is flown a few days later. Certainly a thing to be vary of. Should not be removed. Alternatively, expand LO 061 01 01 01 (08) moved to 061 01 01 02 (01) and (02) to include "which time of the year duration of daylight changes at the highest rate".
response	Accepted. Thank you for providing this comment referring to old LO 061 01 01 01 (08). EASA agrees to reinstate LO 061 01 01 01 (08) in the ‘old 061 document’ and move this LO to the ‘new 061 document’ to the new LO 061 05 03 01 (03).

comment	*244-D* comment by: *University of Tromsø School of Aviation* LO (05) no practical use: We argue that calculating the approximate Earth diameter and radius is basic knowledge. As part of understanding that the earth is a slightly flattened sphere, each and every student should know the basic math required to calculate the diameter and radius. Also: a deeper understanding of the earth as a sphere, and the relationship cosinus and sinus have - and why - should be specified as an LO.
response	Not Accepted. Thank you for providing this comment referring to old LO 061 01 01 01 (05). EASA considers that the flattening of the sphere is covered in the revised LO 061 01 01 01 (02) and that there is no requirement to calculate the diameter of the Earth.

comment	*245-D* comment by: *University of Tromsø School of Aviation*

	Scale expansion Mercator Charts: Knowledge of scale expansion and the rate at this happens is key to understanding map distortions. While precise calculations can be of little use, the general expansion/contraction from equator/poles/std. parallels should still be taught.
response	Accepted. Thank you for providing this comment referring to 'Scale expansion Mercator Charts'. EASA agrees and a basic knowledge of the projections remains in the 'new 061 document' under LO 061 04 02 03 (01).

comment	*246-D* comment by: *University of Tromsø School of Aviation* Scale expansion Lambert conformal conic: Knowledge of scale expansion and the rate at this happens is key to understanding map distortions. While precise calculations can be of little use, the general expansion/contraction from equator/poles/std. parallels should still be taught.
response	Accepted. Thank you for providing this comment referring to scale expansion Lambert conformal conic. EASA agrees and the basic knowledge of the projections remains in the 'new 061 document' under LO 061 04 02 03 (01).

comment	*247-D* comment by: *University of Tromsø School of Aviation* Understanding convergency is a big part of greater understanding of map distortion. Knowledge regarding how a Great Circle, Rhumb Line and Small Circle appear on each and every chart projection should stay as a LO.
response	Accepted. Thank you for providing this comment referring to convergency. EASA agrees and the basic knowledge of the projections remains in the 'new 061 document' under Subjects 061 04 02 02, 03 and 04.

comment	*248-D* comment by: *University of Tromsø School of Aviation* Cannot speak for the whole world, but in Norway a vast majority of the smaller short-field airports still employ NDBs. Most also have NDB approaches. Until NDBs are removed all-together, being able to plot bearings is most certainly of practical use.
response	Noted. Thank you for providing this comment referring to old LO 061 03 03 05 (01). Whilst NDBs are used less and less, EASA agrees to reinstate this LO 061 03 03 05 (01) in the 'old 061 document' and move this LO to the 'new 061 document' to the new LO 061 04 03 02

	(03). See also EASA's response to comment 49-D.

comment	*251-D* comment by: *University of Tromsø School of Aviation* Using speed factor (SF) for Mental Dead Reckoning is both efficient and a fairly accurate method. We argue that it most certainly is of practical use, and use it daily while flying. Should remain as a LO.
response	Accepted. Thank you for providing this comment referring to old LO 061 04 04 01 (03). EASA agrees to reinstate LO 061 04 04 01 (03) in the 'old 061 document' and move this LO to the 'new 061 document' to the new LO 061 01 07 01 (03). See also EASA's response to comment 96-D.

comment	*287-D* comment by: *Aero-Club of Switzerland* Page 121ff/233 General remark to Subject 061 We take note that no items are addressing CB-IR and EIR training requirements.
response	Noted Thank you for providing this general comment referring to Subject 061. Subject 061 is not part of the CB-IR and EIR Syllabus.

New 061 document: SUBJECT 061 — GENERAL AND INERTIAL NAVIGATION p. 114-134

comment

47-D comment by: *KLM Flight Academy*

061 The title of this subject should not be changed, delete 'and inertial' as these LO's belong to 022.

response

Accepted.

Thank you for providing this comment referring to new Subject 061 00 00 00.

EASA has agreed that Subject 061 06 regarding inertial navigation should be in Subject 022.

The text will be amended as follows:

061 00 00 00 GENERAL AND INERTIAL NAVIGATION

Also in the introduction text of this new 061 document, reference to 'and inertial' will be deleted.

comment

73-D comment by: *European Cockpit Association*

Attachment #4

- Great circles - New 061 doc	**127**	Great Circles are of no practical use for helicopters, delete LO for H
061 06 00 00 - Inertial navigation	**131**	Inertial navigation systems are also fit in bigger helicopters and should be included in ATPL level. Review the content for H of this LO

response

Thank you for providing these comments.

Regarding your first comment referring to new Subject 061 03 01 00: Not accepted.

EASA considers that new Subject 061 03 01 00 is required for helicopters, especially for long-distance flights such as North Sea operations.

Regarding your second comment referring to new Subject 061 03 01 00: Accepted.

EASA accepts that new Subject 061 06 00 00 should be included for ATPL(H).

In addition, the LOs have been moved back to Subject 022, in section 022 05 00 00, in response to comments 30-B, 51-B, 260-B and 68-F.

comment

258-D comment by: *University of Tromsø School of Aviation*

For Mental Dead Reckoning, the XWC table intended seems to complicated.
We recommend replacing it with the "clock rule".

Each 15° of wind angle is represented by 1/4 of an hour - meaning 1/4 the wind strenght.
Ex:

Wind angle: 15° / 30° / 45° / 60°
% of wind speed: 25% / 50% / 75% / 100%

"Clock rule" since it is based upon an analog clock.

Values in between can be figured out by mental interpolation. Even though 60° wind angle is off by a bit, it will for the sake of mental calculations only add a safety margin, and learning that the XWIND-component is based on trigonometry together with this rule of thumb should give students the sufficient knowledge to apply it quickly and efficiently.

The purpose of MDR should be to make it relatively easy to perform fairly accurate calculations. This little adjustment may be a better approach than remembering 6 angles and corresponding percentages.

response

Accepted.

Thank you for providing this comment referring to MDR techniques.

EASA agrees with your comment regarding the MDR techniques. The 'new 061 document' with the new Syllabus area accommodates your comments.

The text of the introduction text of this new 061 paragraph 'MDR crosswind component (XWC)' will be amended accordingly.

comment

267-D comment by: *University of Tromsø School of Aviation*

INS/IRS:

A big part of the 061 syllabi have been moved from 061 to 022, 033 and 050 (AGK, FPM, MET). The general "scope of the subject" have certainly been narrowed.
Meanwhile, INS/IRS have been transferred from 022 to 061.

The addition of INS/IRS to 061 GNAV seems fair when looked on from a navigational point of view. From a "how does this work"-point of view however, it seems somewhat misplaced. Especially considering IRS and gyros. How in depth should one be regarding gyroscopes, gyroscopic precession and how gyroscopes work? This part of 022 AGK is already "pretty hard to grasp" according to numerous students.

We recommend emphasizing the wording of LO's so that the operational principles of gyros used in IRS will be explained in depth in 022 AGK. The operational usage of IRS/INS can still be transferred to 061 GNAV.

response

Noted.

Thank you for your comments referring to the transfer from Subject 61 to Subject 022.

EASA has agreed that Syllabus reference 061 06 should be in Subject 022.

Additional comments received by email:

comment

Per email comment by: SAT: Blatter Patrick

061 01 01 01 (010-05) These are the basics to understand e.g. "061 05 01 01 (01) Mean and

	apparent sun" and that sunrise and sunset are not related to mean sun but to apparent sun 061 01 01 01 (18) It is not obvious to understand why twilight times changes over a year if the basic understand for the movement of the sun is not understood 061 01 02 03 (02) The qualitative knowledge is desirable since the flattening shall be taught. 061 01 02 05 (03) Why deleted when "061 01 02 05 (04)" refers to departure? 061 01 03 01 (01) No practical use for the time zones? Each traveller has to know it.. 061 01 03 01 (03) "Transit" should be not deleted as in the next LO also as (08, 09 and 12) you refer to "transit". 061 01 04 02 (04-07) Basic explanation of magnetic field should remain in 061¨ 061 04 03 01 (02) Rather leave in 061 as it has more common with General Navigation than with Instrumentation. 061 03 01 02 (08-11) These topics have no practicable use other than to assess the understanding of chart projection. 061 03 01 03 (04) This topic has no practicable use other than to assess the understanding of chart projection. 061 03 03 05 (01) Necessary to understand how bearings are plotted. 061 04 01 02 (01) Is grid still in practical use? 061 04 02 08 Rather move to 033 (especially for terrain clearance) 061 04 04 01 (01-02, 04) Moved or deleted? Prefer moved… 061 04 04 01 (05) Definition of speed factor was deleted in 061 04 04 01 (03) and here it is used? 061 01 05 04 (02) Where should this LO be learnt (ATP, CPL ?) 061 02 02 01 (01) What does it mean in the end and what should be tested? 061 03 01 02 (03) Up to which LAT/ LONG the equation is assumed be acceptable? 061 03 03 02 All the information of convergence and conversion angle is gone!!! 061 04 02 02/ 061 04 02 03/ 061 04 02 04: A too much wide area. What is really needed? 061 05 01 01 (01) A too much wide area. What is really needed? 061 05 02 01 (01) Calculations but no explanation needed. Why? 061 06 01 00 (02) The IRS/ INS needs an input!
response	Thank you for all your comments referring to the old 061. EASA has carefully assessed all the comments received. These are listed as follows: Regarding your comment referring to old LO 061 01 01 01 (01) to (05): Not accepted. These elements are in the new Subject 061 05 01 01 and there is no need for separate Syllabus areas for each part of the description. Regarding your comment referring to old LO 061 01 01 01 (18): Noted. These elements are in the new LO 061 05 03 01 (02) and there is no need for separate Syllabus areas for each part of the description. Regarding your comment referring to old LO 061 01 02 03 (02): Not accepted. These elements are in the new LO 061 01 01 01 (02). Regarding your comment referring to old LO 061 01 02 05 (03): Not accepted. EASA would like to highlight that the term is not used in the new 061 Syllabus references. Regarding your comment referring to old LO 061 01 03 01 (01): Noted. EASA would like to highlight that zone time is not used and standard time remains in the new Syllabus references. Regarding your comment referring to old LO 061 01 03 01 (03): Noted. All LOs of the old Subject 061 01 03 01 have become new LO 061 05 01 01 01, so instead of 18 LOs there is 1 covering all.

Regarding your comment referring to old Subject 061 01 04 02: Not accepted.

EASA would like to highlight that the theory of terrestrial magnetism and the direct-reading compass are instrument-related and therefore belong in Subject 022. Explanation and application of variation and deviation of course remain in Syllabus area 061 01 03 01.

Regarding your comment referring to old LO 061 04 03 01 (02): Not accepted.

EASA could not find the referenced LO.

Regarding your comment referring to old LOs 061 03 01 02 (08) to (11): Accepted.

EASA agrees to reinstate LO 061 03 01 02 (08) to (11) in the 'old 061 document' and move these LOs to the 'new 061 document' to the new 061 04 02 04 (04) to (07).

See also EASA's response to comment 93-D.

Regarding your comment referring to old LO 061 03 01 03 (04): Accepted.

EASA agrees and this LO has been removed.

Regarding your comment referring to old LO 061 03 03 05 (01): Accepted.

Whilst NDBs are used less and less, EASA agrees to reinstate this LO 061 03 03 05 (01) in the 'old 061 document' and move this LO to the 'new 061 document' to the new LO 061 04 03 02 (03).

See also EASA's response to comments 49-D and 248-D.

Regarding your comment referring to old LO 061 04 01 02 (01): Accepted.

EASA agrees that there should be some knowledge of grid navigation. Syllabus references 061 01 04 05 (01) to (04) will be reinstated in the 'old 061 document' and move this LO to the 'new 061 document' to the new LO 061 01 03 01 (08) to (11).

See also EASA's response to comment 91-D.

Regarding your comment referring to old Subject 061 04 02 08: Not accepted.

Subject 061 04 02 08 has been moved to Subject 050.

Regarding your comment referring to old LO 061 04 04 01 (01), (02) and (04): Noted.

These LO areas have been moved.

Regarding your comment referring to old LO 061 04 04 01 (05): Noted.

EASA has reinstated old LO 061 04 04 01 (05) and moved it to new LO 061 01 07 01 (03).

Regarding your comment referring to new LO 061 01 05 04 (02): Accepted.

EASA agrees that all categories except IR should be applied to this LO.

Regarding your comment referring to new LO 061 02 02 01 (01): Accepted.

EASA agrees that new Subject 061 02 02 01 needs to be expanded to incorporate the 13 LOs that were moved here from the 'old 61 document' to the 'new 061 document'.

Regarding your comment referring to new LO 061 03 01 02 (03): Accepted.

EASA agrees that this new LO (03) should include 'up to 30° difference of longitude'.

The text will be amended as follows:

(03) Describe the geometric properties of a great circle and a small circle, up to 30° difference of longitude.

Regarding your comment referring to new LO 061 03 03 02: Not accepted.

EASA considers this is covered in new Subjects 061 03 01 02 and 061 03 03 02.

Regarding your comment referring to new Subjects 061 04 02 02/03 04: Not accepted.

EASA considers the new Subject 061 04 to be sufficient knowledge.

Regarding your comment referring to new LO 061 05 01 01 (01): Not accepted.

EASA considers the new Subject 061 05 to be sufficient knowledge.

Regarding your comment referring to new LO 061 05 02 01 (01): Accepted.

EASA agrees to expand the new Syllabus reference 061 05 02 01 01 to read 'Explain and apply…'.

The text will be amended as follows:

(01) Explain and apply the concept of standard time and daylight saving time and perform standard time and daylight saving time calculations.

Regarding your comment referring to LO 061 06 01 00 (02): Accepted.

EASA agrees the Syllabus reference needs to be amended to incorporate the input of TAS to the system.

The text will be amended as follows:

(02) State that inertial systems require no external input, except TAS, to determine aircraft attitude and navigational data.

This Syllabus reference has been referred to in Subject 022.

Appendix
to ED Decision 2018/001/R
Subject 062 — NAVIGATION — RADIO NAVIGATION

RELATED NPA: 2016-03(D) — RMT.0595 — 6.2.2018

Table of contents

5. Summary of the outcome of the consultation

Please refer to the Explanatory Note to Decision 2018/001/R.

6. Individual comments and responses

In responding to comments, a standard terminology has been applied to attest EASA's position. This terminology is as follows:

(a) **Accepted** — EASA agrees with the comment and any proposed amendment is wholly transferred to the revised text.

(b) **Partially accepted** — EASA either agrees partially with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.

(c) **Noted** — EASA acknowledges the comment but no change to the existing text is considered necessary.

(d) **Not accepted** — The comment or proposed amendment is not shared by EASA.

Overview of the proposed amendments to Subject 062 'Radio navigation' p. 135

comment *165-D* comment by: *KLM Flight Academy*

General comment about accuracies. In some items Annex 10 is mentioned. There is another source Doc 8168 chapter 2, see below. This knowledge is essential for the PBN LO's. It can be discussed if this belongs to 071 Operational Procedures. Proposal is make LO's for the info below.

2.4 FIX TOLERANCE FOR OTHER TYPES OF NAVIGATION SYSTEMS
2.4.1 Surveillance radar
Radar fix tolerances are based on radar mapping accuracies, azimuth resolution, flight technical tolerance, controller
technical tolerances, and the speed of aircraft in the terminal area. The fix tolerances are listed below:
a) terminal area surveillance radar (TAR) within 37 km (20 NM): fix tolerance is ±1.5 km (0.8 NM); and
b) en-route surveillance radar (RSR) within 74 km (40 NM): fix tolerance is ±3.1 km (l.7 NM).

2.4.2 Distance measuring equipment (DME)
Fix tolerance is ±0.46 km (0.25 NM) + 1.25 per cent of distance to the antenna.
2.4.3 75 MHz marker beacon
Use Figure I-2-2-2 to determine the fix tolerance for instrument landing system (ILS) and "z" markers for use with
instrument approach procedures.
2.4.4 Fix tolerance overheading a station
2.4.4.1 *Very high frequency omnidirectional radio range (VOR)*
Fix tolerance overheading a VOR is based upon a circular cone of ambiguity generated by a straight line passing
through the facility and making an angle of 50° from the vertical, or a lesser angle as determined by flight test. Entry
into the cone is assumed to be achieved within such an accuracy from the prescribed track as to keep the lateral

deviation abeam the VOR:
d = 0.2 h (d and h in km); or
d = 0.033 h (d in NM, h in thousands of feet).
For a cone angle of 50°, the accuracy of entry is ±5°. Tracking through the cone is assumed to be within an accuracy of
±5°. Station passage is assumed to be within the limits of the cone of ambiguity. See Figure I-2-2-3 for an illustration
of fix tolerance area.
2.4.4.2 *Non-directional beacon (NDB)*
Fix tolerance overheading an NDB is based upon an inverted cone of ambiguity extending at an angle of 40° either side
of the facility. Entry into the cone is assumed to be achieved within an accuracy of ±15° from the prescribed track.
Tracking through the cone is assumed to be within an accuracy of ±5°. See Figure I-2-2-4 for an illustration of fix
tolerance area.

response

Noted.

Thank you for providing this general comment to Subject 062.

EASA agrees that in some areas the accuracies need to be stated.

SUBJECT 062 — RADIO NAVIGATION p. 136-233

comment *3-D* comment by: *ENAIRE*

NPA file – Item reference – Page: (D) - 062 06 01 02 - Page 204
Comment: Reference (04) is identical to the deleted LO (05) due to “no practical use”. Seems an editorial mistake.

response

Accepted.

Thank you for providing this comment referring to LO 062 06 01 02 (04).

EASA agrees that the text of LOs 062 06 01 02 (04) and (05) is identical and the text of LO (04) will be deleted as well.

The text will be deleted as follows:

~~(04)~~

~~State that the space segment consists of a notional constellation of 24 operational satellites.~~

In comments 25-D and 66-D, the same issue was raised regarding this LO.

comment *4-D* comment by: *ENAIRE*

NPA file – Item reference – Page: (D)- 062 06 01 02 - Page 204
Comment: Reference (10) deletes the GPS L1 and L2 frequencies; however, these have been maintained in the case of ILS (e.g. in **062 02 05 01**).
Proposed action: not to delete the GPS L1 and L2 frequencies.

response | Not accepted.
Thank you for providing this comment referring to LO 062 06 01 02 (10).
EASA is of the opinion that the GPS L1 and L2 frequencies remain deleted.

comment | *5-D* comment by: *ENAIRE*

NPA file – Item reference – Page: (D) - 062 06 01 02- Page 205
Comment: Reference (15) details the contents of the GPS navigation message. The development of these contents has been deleted (references 18, 19, etc) due to a lack of practical use . However, reference (27) about the GPS satellites' atomic clocks is retained. The practical value of knowing that the time reference is provided by atomic clocks is challenged.
Proposed action: Either maintain a high-level explanation for each component of the GPS navigation message, or alternatively, delete the mention to atomic clocks in LO (27); for instance: "State that the GPS system is able to keep very accurate time reference".

response | Not accepted.
Thank you for providing this comment referring to LOs 062 06 01 02 (15) and (27).
EASA considers LO 062 06 01 02 (27) to be relevant for accurate time-keeping.

comment | *6-D* comment by: *ENAIRE*

NPA file – Item reference – Page: (D) - 062 06 01 02 - Page 206
Comment: Reference (24) addresses the GPS signal C/A and Precision codes; however, the difference between the Standard and the Precise Positioning Services has been deleted (in references (01), (11) and (12)). The relevance of the C/A and Precision codes seems linked to the existence of the SPS and PPS services.
Proposed action: not to delete references (01), (11) and (12) concerning the GPS SPS and PPS services.

response | Accepted.
Thank you for providing this comment referring to LO 062 06 01 02 (24).
EASA agrees that LO (24) is linked with the deleted LOs (01), (11) and (12), and that these deleted LOs are necessary.
LOs 062 06 01 02 (01), (11) and (12) will be retained.
In comments 66-D and 203-D, a similar issue was raised regarding this LO.

comment | *7-D* comment by: *ENAIRE*

NPA file – Item reference – Page: (D) - 062 06 01 02 - Page 208
Comment: Reference (42) seems to imply that the satellite exclusion function is always present. However, it is only available if the airborne GPS receiver features the FDE functionality. The flight crew should be aware of the fact that not all GPS aviation receivers are able to exclude satellites.
Proposed action: Rephrase (42) so as to make clear that the sixth satellite can only

	be used by certain aircraft.
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 02 (42). EASA is of the opinion that LO (42) is clear like it is and will not be rephrased. Based on accepted comment 66-D, EASA agrees to move LOs (40), (41) and (42) to Chapter 062 06 02 04 Airborne-based augmentation systems (ABAS).

comment	*8-D* comment by: *ENAIRE* **NPA file – Item reference – Page:** (D) - 062 06 01 02 - Page 209 **Comment:** Reference (43) has been deleted. As in (42), baro-aiding to RAIM is not a mandatory feature, and it is considered useful that the pilots do not take ir for granted. Furthermore, it can be considered as a particular case of AAIM, which is explained in 062 06 02 04. **Proposed action:** not to delete LO (43) Even if it is eventually deleted, the pilot licences related to this LO have not been stricken through. **Proposed action:** If (43) is deleted [see a)], to delete the pilot licence marks as well.
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 02 (43). The content of this deleted LO 062 06 01 02 (43) is covered in LO 062 06 02 04 (04). LO (43) remains deleted. There was an omission in the NPA text regarding the 'X' which was not struck through. This will be amended.

comment	*9-D* comment by: *ENAIRE* **NPA file – Item reference – Page:** (D) - 062 06 01 02 - Page 212 **Comment:** References from (46) to (58) address other GNSS core constellations other than GPS. GLONASS is a global, Annex 10-compliant constellation. However, the depth of the GLONASS-related contents seems much shallower than that of GPS. For instance, LO (49) specifying the use of the PZ-90 datum is deleted (but the GPS part still mentions WGS-84 in (23)); LO (50) completely deletes GLONASS frequencies, when GPS frequencies were still mentioned by name in (10), etc. Furthermore, reference (46) about the GLONASS control segment has been left, but LO (44) listing all the GLONASS components has been deleted, leaving LO (46) out of context. **Proposed action:** to keep enough GLONASS LOs so that the level of detail is more or less comparable to that of GPS.
response	Not accepted. Thank you for providing this comment referring to LOs 062 06 01 02 (46) to (58). EASA considers that the depth of knowledge for GLONASS is sufficient.

comment	*10-D* comment by: *ENAIRE*

NPA file – Item reference – Page: (D)- 062 06 01 03 - Page 215
Comment: Reference (02) mentions the use of two frequencies to eliminate IPD; however, not all users can profit from (military) dual-frequency PPS receivers; the explanation of GPS SPS and PPS has been deleted in ***062 06 01 02.*** This seems contradictory.
Proposed action: either to delete reference (02), or not to delete the SPS and PPS description in 062 06 01 02.

response

Partially accepted.

Thank you for providing this comment referring to LO 062 06 01 03 (02).

EASA agrees that the text of this LO is not clear.

The text will be amended as follows:

State that the error from ~~i~~ionospheric p~~P~~ropagation d~~D~~elay (IPD) can be reduced by modelling using a model of the ionosphere or almost be eliminated by using two frequencies.

In comment 66-D, the same issue was raised regarding this LO.

comment

11-D comment by: *ENAIRE*

NPA file – Item reference: (D) - 062 06 02 01 and 062 06 02 02
Comment: General GBAS comment: the GBAS content depth seems significantly less than the SBAS one. In fact, several of the SBAS LOs would also be true for GBAS with minor or no changes. For instance:

- ***062 06 02 02 (01)*** most of this definition is equally applicable to GBAS; in fact, GBAS transmits integrity messages exactly like SBAS. This fact should be mentioned;
- ***062 06 02 02 (05)*** would be equally valid, just mentioning the ground infrastructure and the GBAS airborne receivers;
- ***062 06 02 02 (06)*** would be valid just changing "SBAS" by "GBAS" and deleting "network";
- ***062 06 02 02 (10)*** is valid for GBAS if "regionally" is replaced by "locally"; in fact, GBAS is able to support precision approach operations.

Proposed action: to enhance the contents of GBAS (***062 06 02 01)*** by adding new LOs derived from the equivalent ones in the SBAS section (***062 06 02 02***).

response

Thank you for your extensive feedback, which has been greatly appreciated.

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your comment referring to LO 062 06 02 02 (01): Not accepted.

EASA does not agree with this statement.

Regarding your comment referring to LO 062 06 02 02 (05): Not accepted.

Not required for GBAS.

	Regarding your comment referring to LO 062 06 02 02 (06): Accepted. Based on the accepted comment 66-D, EASA agrees that this LO is too detailed and is a duplication of 062 06 02 02 LO (01) and will be deleted. The text will be deleted as follows: ~~(06) Explain that the SBAS station network measures the pseudo-range between the ranging source and an SBAS receiver at the known locations and provides separate corrections for ranging source ephemeris errors, clock errors and ionospheric errors. The user applies corrections for tropospheric delay.~~ Regarding your comment referring to LO 062 06 02 02 (10): Accepted. Based on the accepted comment 66-D, EASA agrees that this LO is irrelevant and will be deleted. The text will be deleted as follows: ~~(10) Explain that SBAS systems regionally augment GPS and GLONASS by making them suitable for safety-critical applications such as landing aircraft.~~
comment	*12-D* comment by: *ENAIRE* **NPA file – Item reference:** (D) – all 062 07 00 00 sections **Comment:** The relationship between the PBN learning objectives in NPA 2016-03 and the PBN pilot knowledge specified in the forthcoming PBN AMC/GM to EASA AIR-OPS (965/2012) should be clarified. Indeed, NPA 2016-03 does not fully cover, for example, the RNP APCH training syllabus contained in EASA AMC 20-27A or 20-28.
response	Noted. Thank you for providing this comment referring to all 062 07 00 00 sections. EASA has read your statement and no further action is required.
comment	*13-D* comment by: *ENAIRE* **NPA file – Item reference – Page:** (D) - 062 07 01 01 - Page 221 **Comment:** Reference (01) exposes the PBN aircraft performance requirements (accuracy, integrity, continuity and functionality). The following LOs develop each one of these requirements except functionality. **Proposed action:** to explain the meaning of “functionality” in some LO.
response	Partially accepted. Thank you for providing this comment referring to LO 062 07 01 01 (01). EASA does not see the need to explain the meaning of ‘functionality’. This LO will be changed in a way that ‘functionality’ will be skipped — ICAO separates performance and functionality. Functionality describes the software-based guidance possibilities of the airborne system (e.g. RF legs). The text will be amended as follows: List the factors used to define RNAV or required navigation performance (RNP) system performance requirements (accuracy, integrity and continuity ~~and~~

	~~functionality~~).

comment	*14-D* comment by: *ENAIRE* **NPA file – Item reference – Page:** (D) - 062 07 01 01 - Page 222 **Comment:** Reference (08) containing the difference between raw and calculated data is deleted due to a lack of practical use. However, part (B), section 022 11 03 00 reference (10), which is new, contains "the difference between following the FMS data compared to following raw data from radio-navigation receivers". This seems contradictory. **Proposed action:** either delete both references, or keep both of them.
	Not accepted. Thank you for providing this comment referring to LO 062 07 01 01 (08). EASA is of the opinion that this LO (08) remain deleted here. The content belongs to FMS which is part of Subject 022.

comment	*15-D* comment by: *ENAIRE* **NPA file – Item reference – Page:** (D) - 062 07 02 03 - Page 224 **Comment:** Reference (05) mentions both RNAV 2 and RNP 2, but however only the latter one is explained (in reference 06). **Proposed action:** to explain what is RNAV 2 used for.
response	Accepted. Thank you for providing this comment referring to LO 062 07 02 03 (05). EASA agrees that also RNAV 2 has to be explained, and a new LO will be added. The text will be amended as follows: State that RNAV 2 might be used in the en-route continental, arrival and departure.

comment	*16-D* comment by: *ENAIRE* **NPA file – Item reference:** (D) - 062 07 03 01 // 062 06 01 02 **Comment:** Reference (02) in 062 07 01 01 explains that the RNAV and RNP systems "are necessary to optimise the utilisation of available airspace"; however, LO (01) in 062 07 03 01, stating that "navigation performance is one factor used to determine minimum route spacing" is deleted due to a lack of practical use. These two items seem of similar practical value. **Proposed action:** either delete both 062 07 01 01 (02) and 062 07 03 01 (01), or keep both of them.
response	Not accepted. Thank you for providing this comment referring to LO 062 07 01 01 (02) and LO 062 07 03 01 (01). EASA is of the opinion that this LO 062 07 03 01 (01) remain deleted here. The content is already covered in 062 07 01 01 (02).

comment	*17-D* comment by: *ENAIRE* **NPA file – Item reference – Page:** (D)- 062 07 03 02 - Page 225 **Comment:** This section could help the pilot to correctly fulfil PBN fields (10 and/or 18) in the Flight Plan. Indeed, the Flight Plan is supposed to inform about aircraft operational capacities, not just airworthiness certification. For instance, an RNP AR-capable aircraft belonging to a non-operationally approved airline should not display RNP AR Flight Plan codes. **Proposed action:** not to delete section **062 07 03 02.**
response	Not accepted. Thank you for providing this comment referring to Subject 062 07 03 02. EASA is of the opinion that the LOs 062 07 03 02 (01) and (02) remain deleted here. Filling out the ATC flight plan is subject of 010. Operational approval is not specific for PBN.

comment	*18-D* comment by: *ENAIRE* **NPA file – Item reference – Page:** (D) - 062 07 03 03 - Page 226 **Comment:** Reference (05) is supposed to apply to RNAV holding patterns only. **Proposed action:** not to delete reference (05), but rewording it to address RNAV holdings only.
response	Not accepted. Thank you for providing this comment referring to LO 062 07 03 03 (05). EASA is of the opinion that this LO 062 07 03 03 (05) remain deleted here. The content is not specific to PBN.

comment	*23-D* comment by: *Bristol Groundschool* **Page 143 LO 062 01 03 06** (2). If minimum skip distance is considered relevant, the phenomenon of "dead space" is sometimes experienced by pilots and is therefore worth retaining.
response	Accepted. Thank you for providing this comment referring to LO 062 01 03 06 (02). EASA agrees that the phenomenon of 'dead space' is relevant in LO 062 01 03 06 (02) and will be retained. In comments 65-D and 109-D, the same issue was raised regarding this LO.

comment	*24-D* comment by: *Bristol Groundschool* **Page 163 LO 062 02 05 02** (13). Should some mention be made of the "back course" switch that retains normal sensing on some aircraft types**?**

response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 02 (13). EASA is of the opinion that mentioning the 'back course' switch is not relevant.

comment	*25-D* comment by: *Bristol Groundschool* **Page 204 LO 062 06 01 02** (04). Typo error? This LO is repeated word for word in the next LO (05), but, there, it is scored through and described as of no practical use.
response	Accepted. Thank you for providing this comment referring to LO 062 06 01 02 (04). EASA agrees that the text of LOs 062 06 01 02 (04) and (05) is identical and the text of LO (04) will be deleted as well. The text will be deleted as follows: ~~(04) State that the space segment consists of a notional constellation of 24 operational satellites.~~ In comments 3-D and 66-D, the same issue was raised regarding this LO.

comment	*26-D* comment by: *Bristol Groundschool* **Page 206 LO 062 06 01 02** (21)**.** Typo error? The wording of the LO is not scored through, but the allocation crosses are all scored out which seems to make this LO irrelevant.
response	Accepted. Thank you for providing this comment referring to LO 062 06 01 02 (21)**.** EASA agrees that there is an omission. The deleted allocation crosses will be retained.

comment	*27-D* comment by: *Bristol Groundschool* **Page 226 LO 062 07 04 01 PBN Principles.** Subsection (05) is relevant, but there is an argument that subsections (01) to (04) inclusive fall into the category of "excessive technical detail of no practical value to pilots", (especially subsection (01))
response	Not accepted. Thank you for providing this comment referring to Subject 062 07 04 01 'PBN principles'. EASA is of the opinion that the definition of the subcategories of TSE is necessary. LOs (01) to (05) will be kept.

comment *28-D* comment by: *Bristol Groundschool*

Page 230 LO 062 07 05 04 (01) Lines 4 to 8.

The wording of these statements seems more appropriate for airspace designers. The pilot will use whatever form of communication he is advised to use. If the purpose is to make the student aware of DCPC, CPDLC and ADS-C, this should be done in a separate LO, and probably in a different subject.

response Not accepted.

Thank you for providing this comment referring to LO 062 07 05 04 (01).

EASA is of the opinion that these statements should not be done in a separate LO.

comment *33-D* comment by: *KLM Flight Academy*

062 02 01 04 (01)
The range of signals with a frequency of 30 MHz and higher is now only stated in the VDF LO's. For VOR. DME and RADAR no LO about the range is left. It should be stated also for those nav aids and 062 02 03 03 02 should not be deleted. For DME it can be stated in 062 02 04 03 and for RADAR in 062 03 01 00.

response Not accepted.

Thank you for providing this comment referring to LO 062 02 01 04 (01).

The comment is not relevant to this LO.

comment *34-D* comment by: *KLM Flight Academy*

062 07 04 01 .. PBN

In this item no LO is stated about systematic errors, random errors, drms, R95 and the graph of Gauss. Pilots have to understand what it means to have a 95% accuracy. At least the relevant NSE's have to mentioned fort he different navaids as stated in ICAO Annex 10, NDB and VOR 5°, DME 0.2 NM, GNSS depending of the aids to improve the accuracy.

response Noted.

Thank you for providing this comment referring to Subject 062 07 04 01.

The accuracies belong to the subsections of the mentioned navaids, but are not specific to PBN. EASA agrees with the importance of describing errors, but this is also not specific to PBN.

comment *54-D* comment by: *FTEJerez*

Basic principles	136	062 01 01 01 (01)	162000 NM/s should remain
	137	062 01 01 03 (01)	If VLF removed then EHF should be removed.

	138	062 01 01 03 (04)	Need to know emmission designators and meaning for NDB/ADF LOs page 147

response

Thank you for your multiple comments.

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your comment referring to LO 062 01 01 01 (01): Not accepted.

EASA does not consider this is relevant.

Regarding your comment referring to LO 062 01 01 03 (01): Partially accepted.

Instead of deleting VLF and EHF, EASA will retain VLF.

In comment 65-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 01 01 03 (04): Accepted.

EASA agrees that in order to understand the explanations within the AIP, OM-B and the BFO function of an ADF receiver, this LO should be retained, but with different wording.

The text of the new LO will be as follows:

~~State that a radio signal may be classified by three symbols in accordance with the ITU Radio Regulation, Volume 1: e.g. A1A.~~

~~— The first symbol indicates the type of modulation of the main carrier;~~

~~— The second symbol indicates the nature of the signal modulating the main carrier;~~

~~— The third symbol indicates the nature of the information to be transmitted.~~

State that the following abbreviations (classifications according to International Telecommunication Union (ITU) regulations) are used for aviation applications:

— N0N: carrier without modulation as used by NDBs;
— A1A: carrier with keyed Morse code modulation as used by NDBs;
— A2A: carrier with amplitude modulated Morse code as used by NDBs;
— A3E: carrier with amplitude modulated speech used for communication (VHF-COM).

In comment 65-D, the same issue was raised regarding this LO.

comment

55-D comment by: *FTEJerez*

Antennas	140	062 01 02 01 (07)	It is relevant and should be combined with LO 062 01 02 02 (01)
	141	062 01 02 02 (02)	Only mention of circular polarisation so should remain
	141	062 01 02 02	Need to add circular polarisation as used in GPS

		(03)	
	143	062 01 02 03 (02)	Should remain as good for explaining with ADF

response

Thank you for your multiple comments.

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your comment referring to LO 062 01 02 01 (07): Not accepted.

EASA considers this LO is not relevant and will remain deleted.

Regarding your comment referring to LO 062 01 02 02 (02): Not accepted.

EASA considers this LO is not relevant and will remain deleted.

Regarding your comment referring to LO 062 01 02 02 (03): Not accepted.

EASA agrees with comment 66-D regarding this LO (03) that the content of this LO is already included in (01).

Regarding your comment referring to LO 062 01 02 03 (02): Not accepted.

This LO (02) cannot be found.

comment

56-D comment by: *FTEJerez*

RADIO AIDS			
Ground Direction Finding	145	062 02 01 02 (05)	Should keep as it is relevant, used in General Nav for lost procedure
NDB ADF	147	062 02 02 01 (18)	Is of practical use and is true
	148	062 02 02 02 (04)	Remove as irrelevant as no longer use QUJ and QTE.
	149	062 02 02 04 (02)	Why does this remain if removing LO 062 02 02 05 (01)
	150	062 02 02	Keep unless remove LO 062 02 02 04 (02)

		05 (01)	
	151	062 02 02 05 (06)	Should add additional LO to cover failure od compass when using ADF and VOR and what can be relied upon. Practical.
DME	155	062 02 04 01 (03)	Should keep the frequency division between Tx and Rx. 63Mhz is not required.
	157	062 02 04 03 (01) (02)	Keep Lo but change to STATE. Good for explaining and of practical use.
ILS	158	062 02 05 01 (02)	Distances for LOC have been removed so 300m for GP should be removed. According to Annex 10, horisontal distance from threshold and glide path antenna depends on height of the ILS datum over threshold, vertical height between threshold and antenna, glide path angle and angle between horizontal and a line passing through the trheshold the antenna
	159	062 02 05 01 (05)	An additional statement should be added to say that the ILS freq band 108-111.975MHZ is the LOC freq.
	163	062 02 05 03 (01)	Horizontal and vertical coverage areas for both LOC and GP should be stated iaw Annex 10.
	165	062 02 05 04 (07)	Needs to be re-worded.'More than half dot' is ambiguous as to whether 2 dot, 5 dot display. 8168 always reference to half scale deflection.

response

Thank you for your multiple comments.

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your comment referring to LO 062 02 01 02 (05): Accepted.

EASA agrees that this LO is relevant and will be retained.

In comments 113-D and 332-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 02 02 01 (18): Not accepted.

EASA does not agree that this LO is of practical use and will remain deleted.

Regarding your comment referring to LO 062 02 02 02 (04): Not accepted.

EASA does not agree that this LO is irrelevant and will not delete it.

Regarding your comment referring to LO 062 02 02 04 (02): Noted.

This LO is kept and 062 02 02 05 (01) is deleted.

Regarding your comment referring to LO 062 02 02 05 (01): Not accepted

This LO will remain here and will not be moved to 062 02 02 04 (02).

Regarding your comment referring to LO 062 02 02 05 (06): Noted.

EASA is of the opinion that no new LO is required.

Regarding your comment referring to LO 062 02 04 01 (03): Partially accepted.

EASA will add the wording ‘on different frequencies’ at the end of the LO.

The text will be amended as follows:

Describe the principle of distance measurement using DME in terms of a timed transmission from the interrogator and reply from the transponder on different frequencies.~~:~~

~~— pulse pairs~~

~~— fixed frequency division of 63 MHz;~~

~~— propagation delay;~~

~~— 50-microsecond delay time;~~

~~— irregular transmission sequence;~~

~~— search mode;~~

~~— tracking mode;~~

~~— memory mode.~~

Regarding your comment referring to LOs 062 02 04 03 (01) and (02): Accepted.

EASA agrees that these LOs are relevant and will be retained.

In comment 143-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 02 05 01 (02): Accepted.

EASA agrees to delete the reference to ‘300 m’.

The text will be amended as follows:

State the site locations of the ILS components:

— the ~~localiser~~LOC antenna should be located on the extension of the runway centre line at the stop-end;

— the ~~glide-path~~GP antenna should be located ~~300 m~~ beyond the runway threshold, laterally displaced ~~approximately 120 m~~ to the side of the runway centre line.

In comment 146-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 02 05 01 (05): Accepted.

EASA agrees to add 'LOC' after 'ILS' as follows:

State that in the ILS LOC frequency assigned band 108.0–111.975 MHz, only frequencies which have an odd number in the first decimal are ILS LOC frequencies.

In comment 147-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 02 05 03 (01): Noted.

Horizontal and vertical coverage areas are stated for both LOC and GP.

Regarding your comment referring to LO 062 02 05 04 (07): Partially accepted.

EASA agrees that this LO should be reworded, but differently from your proposal.

The text will be amended as follows:

State that if a pilot deviates by more than ~~half-scale~~ half-course deflection on the ~~LLZ~~LOC or by more than half-dot ~~course~~ ~~fly-up~~ deflection on the GP, an immediate go-around should be executed because obstacle clearance may no longer be guaranteed.

In comment 61-D, the same issue was raised regarding this LO.

comment *57-D* comment by: *FTEJerez*

GROUND Radar	170	062 03 02 01 (02)	LO is ambiguous, reference should eb made to primary radar being more accurate than secondary.
	170	062 03 02 02 (01)	LO should remain but reworded to state modern Atc systems use various inputs from…….to generate display
AWR	172	062 03 03 03 (01)	Remove mapping as 062 03 03 06 (01) removes any ref to mapping.
	172	062 03 03 06	More sense to keep this LO in Radio nav rather than meteorology
SSR	174	062 03	Figures not important but of use to know interogation and

		04 02 (03)	reply are different freqs.
	175	062 03 04 02 (08)	Do not remove LO, as practical importance to know Mode A made up of 4 digits which can be manually selected. The number of codes is irrelevant but of more practical use would be to know the 4 digits are from 0-7
		062 03 04 02 (16)	Keep

response

Thank you for your multiple comments.

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your comment referring to LO 062 03 02 01 (02): Not accepted.

EASA does not agree that this LO is ambiguous and will retain the LO as it is.

Regarding your comment referring to LO 062 03 02 02 (01): Partially accepted.

EASA agrees to retain this LO and reword it, but slightly different than your proposal. Also the heading will be retained.

The text will be amended as follows:

062 03 02 02 Presentation and interpretation

~~(01) State that modern ATC systems use computer-generated display.~~

State that modern ATC systems use inputs from various sensors to generate the display.

Regarding your comment referring to LO 062 03 03 03 (01): Not accepted.

EASA is not in favour of deleting this LO as ground mapping should at least be mentioned.

Regarding your comment referring to LO 062 03 03 06: Accepted.

These four LOs of 062 03 03 06 'Application for navigation' will be retained; see also comment 357-D on Subject 050: Weather-radar observations (refer to 050 09 04 05).

Regarding your comment referring to LO 062 03 04 02 (08): Accepted.

This LO will be retained.

Regarding your comment referring to LO 062 03 04 02 (16): Partially accepted.

EASA agrees to retain this LO but will reword it.

The text will be amended as follows:

~~Explain that this (24-bit) address is included in all Mode-S transmissions, so that every interrogation can be directed to a specific aircraft, preventing multiple replies.~~

Explain that a 24-bit address is used in all Mode S transmissions, so that every interrogation can be directed to a specific aircraft.

comment	*58-D* comment by: *st* **062 02 01 00 Ground D/F** ***062 02 01 01 Principles*** **(03)** Explain the limitation of range because of the path of the VHF signal If the line of sight (LOS) propagation was shifted to "062 01 03 03 Space waves", then delete! Otherwise: "…because of the line of sight propagation." ***062 02 01 03 Coverage and range*** **(01)** Use the formula '1.23 x sqrt transmitter height in feet + 1.23 x sqrt receiver height in feet' to calculate the range in NM If the line of sight (LOS) propagation was shifted to "062 01 03 03 Space waves", then delete! Otherwise: For easier use, use factor 1.2 or use the formula: R[NM] = 2*  ; H = flight altitude in metres ***062 02 01 04 Errors and accuracy*** **(01)** Explain why synchronous transmissions will cause errors. Delete! No practical use! **(02)** Describe the effect of multipath signals If multipath was shifted to "062 01 03 06 Factors affecting propagation", then delete! Otherwise too high level: "State that can affect the signals of a DF – station!" **(03)** Explain that VDF information is divided into the following classes according to ICAO Annex 10: - Class A: Accurate to within ± 2° - Class B: Accurate to within ± 5° - Class C: Accurate to within ± 10° - Class D: Accurate to less than class C Delete! No practical use! The controller doesn't tell the pilot the actual accuracy class!
response	Thank you for your multiple comments. EASA has carefully assessed all the comments received. Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number. Regarding your comment referring to LO 062 02 01 01 (03): Not accepted. EASA does not see the need to make a new didactical order. Regarding your comment referring to 062 02 01 03 (01): Not accepted. EASA is of the opinion that the formula is correct. Regarding your comment referring to 062 02 01 04 (01): Not accepted. EASA considers that this LO is required and will not be deleted. Regarding your comment referring to 062 02 01 04 (02): Not accepted. EASA does not see the need to make a new didactical order. Regarding your comment referring to 062 02 01 04 (03): Not accepted. EASA is of the opinion that pilots need to know the accuracy.

comment	*59-D* comment by: *st* **062 02 02 00 NDB/ADF** ***062 02 02 01 Principles*** **(07)** Define a locator beacon. An LF/MF NDB used as an aid to final approach usually with a range, according to ICAO annex 10, of 10-25 NM Delete "**final**"! à Helpful in all phases of approach! **(11)** Explain why it is necessary to use a directionally sensitive receiver antenna system in order to obtain the direction of the incoming radio wave This LO is trivial and self-explaining! Too high level: "State that it is necessary…" (or delete!) **(NEW)** State that according to ICAO annex 10, an NDB station has an automatic ground monitoring system. ***062 02 02 02 Presentation and interpretation*** **(01)** Name the types of indicator commonly in use: - Electronic navigation display - Radio Magnetic Indicator RMI - Fixed card ADF (radio compass) - Moving card ADF Fixed card ADF (radio compass) - Moving card ADF à delete, outdated (if deleted here, then delete in LO (02) too) **(02)** Interpret the indications given on RMI, fixed card and moving card ADF displays. Delete "fixed card and moving card ADF displays" if deleted in LO (01) **(04)** Calculate the true bearing from the compass heading and relative bearing **(05)** Convert the compass bearing into magnetic bearing and true bearing Delete LO (04) and LO (05): True bearing has no practical use! **(06)** Describe how to fly the following in-flight ADF procedures according to DOC 8168 Vol.1: - Homing and tracking and explain the influence of wind - Interceptions - Procedural turns - Holding patterns These are no ADF – procedures! Summarize procedures in a special chapter!!! ***062 02 02 03 Coverage and range*** **(05)** Explain that interference between sky and ground waves at night leads to "fading" Duplication to wave propagation: 062 01 03 06 LO (03)! **(06)** Define the accuracy the pilot has to fly the required bearing in order to be considered established during approach according to ICAO DOC 8168 as within ± 5° Summarize all procedures in a special chapter!!! ***062 02 02 04 Errors and accuracy*** ***062 02 02 05 Factors affecting range and accuracy***
response	Thank you for your multiple comments. EASA has carefully assessed all the comments received. Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number. Regarding your comment referring to LO 062 02 02 01 (07): Not accepted. EASA is of the opinion that this LO is correct. Regarding your comment referring to LO 062 02 02 01 (11): Accepted.

EASA agrees that this LO should be reworded.

The text will be amended as follows:

~~Explain why it is necessary to use a directionally sensitive receiver antenna system in order to obtain the direction of the incoming radio wave.~~ State that according to ICAO Annex 10, an NDB station has an automatic ground monitoring system.

Regarding your comment referring to LOs 062 02 02 02 (01), (02), (04), (05) and (06): Not accepted.

EASA is of the opinion that these LOs are correct.

Regarding your comment referring to LOs 062 02 02 03 (05) and (06): Not accepted.

EASA is of the opinion that these LOs are correct.

Regarding your comment referring to Subject 062 02 02 04: Noted.

No comment is made here.

Regarding your comment referring to Subject 062 02 02 05: Noted.

No comment is made here.

comment

60-D comment by: *st*

Attachment #5

062 02 04 00 DME
062 02 04 01 Principles
(04) State that the distance measured by DME is slant range
Add: "…and state that near the DME station there is a difference to the horizontal range."
062 02 04 02 Presentation and interpretation
(02) Calculate ground distance given slant range and altitude
Delete! Calculation has no practical use!
(03) Describe the use of DME to fly a DME arc in accordance with DOC 8168 Vol. 1
Summarize all procedures in a special chapter!!!
062 02 04 04 Errors and accuracy
(01) ~~State that the error of the DME 'N' according to Annex 10 should not exceed + 0.25 NM + 1.25% of the distance measured. For installations installed after 1. Jan 1989, the total system error should not exceed 0.2 NM DME 'P'~~
Your comment: ICAO annex 10 does not state the total system error!
My comment: This LO shall continue to exist!
In the **attachment** you can see the total system error (copy from ICAO Annex 10)

response

Thank you for your multiple comments.

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your comment referring to LO 062 02 04 01 (04): Partially accepted.

EASA agrees that this LO should be reworded, but not according to your proposal.

The text will be amended as follows:

~~State~~ Explain that the distance measured by DME is slant range.

In comment 138-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 02 04 02 (02): Not accepted.

EASA is of the opinion that calculation is required and will not delete this LO.

Regarding your comment referring to LO 062 02 04 02 (03): Not accepted.

EASA does not see the need to make a new didactical order.

Regarding your comment referring to LO 062 02 04 04 (01): Not accepted.

ICAO Annex 10 no longer gives a clear definition of total system error, and therefore the LO remains deleted.

In comment 144-D, the same issue was raised regarding this LO.

comment *61-D* comment by: *st*

062 02 05 00 ILS
062 02 05 01 Principles
(05) State that in the ILS frequency assigned band 108.0 - 111.975 MHz, only frequencies with the first decimal odd are ILS frequencies
112.0 MHz for practical use

(08) Describe the use of the 90 Hz and the 150 Hz signals in the LLZ and GP transmitters/receivers, stating how the signals at the receivers vary with angular deviation
Too high level of LO; replace "…stating how the signal…" by "…stating that the signal…"
062 02 05 02 Presentation and interpretation
(10) Describe the circumstances in which warning flags will appear for both the ~~LLZ~~ LOC and the GP: - Absence of the carrier frequency -Absence of the ~~90 and 150 Hz~~ modulation simultaneously - The percentage modulation of ~~either~~ the ~~90 or 150 Hz~~ signal reduced to zero
Very complicated formulated! Too detailed!
Suggestion: State that warning flags will appear for both the LOC and the GP if the received signal strength is below a threshold value.
(13) Explain the setting of the course pointer of an HSI and the course selector of an omnibearing indicator (OBI) for front-beam and back-beam approaches
Replace „omnibearing indicator (OBI)" by CDI

062 02 05 04 Errors and accuracy
(01) Explain that ILS approaches are divided into facility performance categories defined in ICAO annex 10
Too high level! "State that…"
(02) Define the following ILS operation categories: - Category I - Category II - Category IIIA - Category IIIB - Category IIIC
Why in "errors and accuracy"?
These are no ILS Categories, contains also A/C-, runway categories. Includes also RWY - lightning
(06) Explain the following in accordance with ICAO DOC 8168: - The accuracy the pilot has to fly the ILS localizer to be considered established on an ILS track is within half full scale deflection of the required track - The aircraft has to be established

	within half scale deflection of the LLZ before starting descent on the GP - The pilot has to fly the ILS GP to a maximum of half scale fly-up deflection of the GP in order to stay in protected airspace Summarize all procedures in a special chapter!!! **(07)** State that if a pilot deviates by more than half scale deflection on the LLZ or by more than half-dot ~~course~~ ~~fly-up~~ deflection on the GP, an immediate missed approach should be executed, because obstacle clearance may no longer be guaranteed Summarize all procedures in a special chapter!!! Replace "…half – dot deflection" by "**half – scale deflection**" and replace "immediate missed approach" by "immediate **go – around**"
response	Thank you for your multiple comments. EASA has carefully assessed all the comments received. Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number. Regarding your comment referring to LO 062 02 05 01 (05): Not accepted. EASA is of the opinion that 111.975 MHz is correct. Regarding your comment referring to LO 062 02 05 01 (08): Not accepted. EASA is of the opinion that this LO is correct. Regarding your comment referring to LO 062 02 05 02 (10): Accepted. EASA agrees that this LO should be reworded. The text will be amended as follows: ~~State that a failure of either the LLZ or the GP to stay within the predetermined limits will cause:~~ ~~— removal of identification and navigation components from the carrier;~~ ~~— radiation to cease;~~ ~~— a warning to be displayed at the designated control point.~~ State that warning flags will appear for both the LOC and the GP if the received signal strength is below a threshold value. Regarding your comment referring to LO 062 02 05 02 (13): Not accepted. EASA considers this is not required and will not replace 'omnibearing indicator (OBI)' with 'CDI'. Regarding your comment referring to LO 062 02 05 04 (01): Not accepted. EASA is of the opinion that this LO is correct. Regarding your comment referring to LO 062 02 05 04 (02): Not accepted. EASA is of the opinion that pilots need to know the different categories as shown on the approach charts. Regarding your comment referring to LO 062 02 05 04 (06): Not accepted. EASA does not see the need to make a new didactical order. Regarding your comment referring to LO 062 02 05 04 (07): Partially accepted. The text will be amended as follows: State that if a pilot deviates by more than ~~half-scale~~ half-course deflection on the

~~LLZ~~LOC or by more than half-dot ~~course~~ ~~fly-up~~ deflection on the GP, an immediate go-around should be executed because obstacle clearance may no longer be guaranteed.

In comment 56-D, the same issue was raised regarding this LO.

comment

62-D comment by: *st*

062 03 01 00 Pulse techniques and associated terms
(08) Describe, in general terms, the effects of the following factors with respect to the quality of the target depiction on the radar display: - Atmospheric conditions; super refraction and sub refraction - Attenuation with distance - Condition and size of the reflecting surface
Delete! No practical use!

response

Accepted.

Thank you for providing this comment referring to LO 062 03 01 00 (08).

EASA agrees that this depends on the processor used and will delete this LO as it is of no practical use.

The text will be deleted as follows:

~~(08) Describe, in general terms, the effects of the following factors with respect to the quality of the target depiction on the radar display:~~

~~— super refraction and sub refraction;~~

~~— attenuation with distance;~~

~~— condition and size of the reflecting surface.~~

comment

63-D comment by: *st*

62 03 03 00 Airborne Weather Radar
062 03 03 02 Presentation and interpretation
(03) Illustrate the use of azimuth marker lines and range lines in respect of the relative bearing and the distance to a thunderstorm or to a landmark on the screen
Too high level: „State the use…“,
Delete „…or to a landmark…“ àLOs for the mapping mode are deleted too (LO 062 03 03 06 (01))!

response

Accepted.

Thank you for providing this comment referring to LO 62 03 03 00 (03).

EASA agrees to reword this LO.

The text will be amended as follows:

~~Illustrate~~ State the use of azimuth-marker lines and range lines in respect of the relative bearing and the distance to a thunderstorm ~~or to a landmark~~ on the screen.

comment

64-D comment by: *st*

062 03 04 00 Secondary Surveillance Radar and transponder

062 03 04 02 Modes and codes
(19) State that Mode S interrogation contains either: - Aircraft address - All-call address - Broadcast address
Delete! Duplication with 062 03 04 02 (13) and (18)
(25) Explain that Mode S can provide enhanced vertical tracking, using a 25 feet altitude increment
Too high level: „State that …"

062 03 04 03 Presentation and interpretation
(01) Explain how an aircraft can be identified by a unique code
Delete: Duplication with 062 03 04 02 Modes and codes, LO (14) "~~Explain~~ State that every aircraft will have been allocated an ICAO Aircraft Address which is hard coded into the ~~airframe~~ Mode S transponder(Mode S address)"

ELEMENTARY SURVEILLANCE
LO (06) – (09): elementary surveillance is outdated
See ICAO Annex 10, SARPS, Amendment 77: "Enhanced surveillance is mandatory from 31.March 2005")

ENHANCED SURVEILLANCE
All LO too detailed
New formulated LO 13, suggestion:
(13) State that the enhanced surveillance consists of the extraction of additional aircraft parameters known as Downlink Aircraft Parameters (DAP) consisting of A/C parameters which describe the 3 dimensional movement.
(14) Explain that the controller's information is improved by providing actual aircraft derived data such as Magnetic Heading, Indicated Airspeed, Vertical Rate and Selected Altitude
Is included in LO (13), delete
(15) Explain that the automatic extraction of an aircraft's parameters, and their presentation to the controller, will reduce ~~their R/T workload and will free them to concentrate on ensuring the safe and efficient passage of air traffic~~ the likelihood of pilots mis-selecting speed, heading and/or altitude.
Delete

response

Thank you for your multiple comments.

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your comment referring to LO 062 03 04 02 (19): Partially accepted.

EASA agrees that these three LOs (13), (18) and (19) can be combined into one LO. EASA will delete LOs (18) and (19) and will formulate a new LO (13).

The text will be amended as follows:

State that Mode S interrogation contains either the aircraft address, selective call or all call address ~~surveillance protocols implicitly use the principle of selective addressing.~~

[…]

~~(18) Interpret the following Mode S terms:~~

~~— selective addressing;~~

~~— mode 'all call';~~

~~selective call.~~

~~(19) State that Mode S interrogation contains either:~~

~~— aircraft address;~~

~~— all call address;~~

~~broadcast address.~~

In comment 184-D, the same issue was raised regarding these LOs.

Regarding your comment referring to LO 062 03 04 02 (25): Accepted.

EASA agrees to replace the wording 'Explain' with 'State'.

The text will be amended as follows:

~~Explain~~ State that Mode S can provide enhanced vertical tracking, using a 25-feet altitude increment.

In comment 186-D, the same issue was raised regarding this LO.

Regarding your comment referring to LOs 062 03 04 03 (13), (14) and (15): Accepted.

EASA agrees to delete LOs (13), (14) and (15) and formulate a new LO (13).

The text will be amended as follows:

~~State that enhanced surveillance consists of the extraction of additional aircraft parameters known as Downlink Aircraft Parameters (DAP) consisting of:~~

~~— magnetic heading;~~

~~— indicated airspeed;~~

~~— Mach number;~~

~~— vertical rate;~~

~~— roll angle;~~

~~— track angle rate;~~

~~— true track angle;~~

~~— ground speed;~~

~~— selected altitude.~~

State that every aircraft is allocated an ICAO aircraft address which is hard-coded into the airframe Mode S transponder (Mode S address).

~~(14) Explain that the controller's information is improved by providing actual aircraft-derived data such as magnetic heading, indicated airspeed, vertical rate and selected altitude.~~

~~(15) Explain that the automatic extraction of an aircraft's parameters, and their presentation to the controller, will reduce their R/T workload and will free them to concentrate on ensuring the safe and efficient passage of air traffic.~~

In comment 193-D, a similar issue was raised regarding deletion of LO (14).

Regarding your comment referring to LOs 062 03 04 03 (06) to (09): Accepted.

EASA agrees that elementary surveillance is outdated and will delete those four LOs and the heading.

In comments 191-D and 191-D, the same issue was raised regarding LO (08) and (09).

Regarding your comment referring to 062 03 04 03 (15): Accepted.

EASA agrees that this LO is already covered in other LOs of this item and will be deleted. See also EASA's response above in this box.

comment *65-D* comment by: *st*

Attachments #6 #7

062 01 00 00 BASIC RADIO PROPAGATION THEORY

The content of 062 01 is missing a good didactical order and meaningful headlines. At the end of these comments a summary is given to give an impression on the result (easier to read)

Suggested new order and headlines:
062 01 01 00 Definitions
062 01 02 00 Modulation
062 01 03 00 Antenna
062 01 04 00 Wave propagation

062 01 01 01 Electromagnetic waves
(01) State that radio waves travel at the speed of light, being approximately 300 000 km/s ~~or 162 000 NM/s~~.
(02) Define a 'cycle'. A complete series of values of a periodical process.
Sort under "062 01 01 00 Definitions".
(03) Define 'Hertz' (Hz)'. 1 Hertz is 1 cycle per second.
Delete, included in 062 01 01 02 (01).

062 01 01 02 Frequency, wavelength, amplitude, phase angle
(01) Define 'frequency': ~~T~~the number of cycles occurring in 1 second in a radio wave expressed in Hertz (Hz).
Sort under "062 01 01 00 Definitions".
(02) Define 'wavelength': the physical distance travelled by a radio wave during one cycle of transmission.
Sort under "062 01 01 00 Definitions"
(03) Define 'amplitude': the maximum deflection in an oscillation or wave.
Sort under "062 01 01 00 Definitions".
(04) State that the relationship between wavelength and frequency is:
— wavelength (λ) = speed of light (c) / frequency (f);.
— ~~or λ (meters) = 300 000 / kHz.~~
Sort under "062 01 01 00 Definitions"
(05) Define 'phase': the fraction of one wavelength expressed in degrees from 000° to 360°.
Sort under "062 01 01 00 Definitions".

(06) Define 'phase difference/shift': the angular difference between the corresponding points of two cycles of equal wavelength, which is measurable in degrees.
Sort under "062 01 01 00 Definitions".

062 01 01 03 Frequency bands, sidebands, single sideband
(01) List the bands of the frequency spectrum for electromagnetic waves:
~~— Very Low Frequency (VLF): –30 kHz;~~
— Low Frequency (LF): 30–300 kHz;
— Medium Frequency (MF): 300–3 000 kHz;
— High Frequency (HF): 3–30 MHz;
— Very High Frequency (VHF): 30–300 MHz;
— Ultra High Frequency (UHF): 300–3 000 MHz;
— Super High Frequency (SHF): 3–30 GHz;
— Extremely High Frequency (EHF): 30–300 GHz.
Either complete or delete both, VLF and EHF. Sort under "062 01 01 00 Definitions".
(02) ~~State that when a carrier wave is modulated, the resultant radiation consists of the carrier frequency plus additional upper and lower sidebands~~.
Shall continue to exist
Without this LO it is not possible to understand channel spacing, interference, working principles of VOR/DVOR and further more. Sort under "062 01 02 00 Modulation".
(03) ~~State that HF VOLMET and HF two-way communication use a single sideband~~.

Shall continue to exist
Without this LO it is not possible to understand the labeling of switches and explanations within the OM-B.
Sort under "062 01 02 00 Modulation".
In the **attachments** you can find excerpts from the AIP USA and from the OM-B A340. In these texts you will find the wording from the LO (03)

(04) ~~State that a radio signal may be classified by three symbols in accordance with the ITU Radio Regulation, Volume 1: e.g. A1A.~~
~~— The first symbol indicates the type of modulation of the main carrier;~~
~~— The second symbol indicates the nature of the signal modulating the main carrier;~~
~~— The third symbol indicates the nature of the information to be transmitted~~.
Without this LO it is not possible to understand explanations within the AIP, OM-B and the BFO function of an ADF receiver.
But modulated formulation:
State that the following abbreviations (classifications according ITU regulations) are used for aviation applications.
— N0N: Carrier without modulation as used by NDBs
— A1A: Carrier with keyed Morse code modulation as used by NDBs
— A2A: Carrier with amplitude modulated Morse code as used by NDBs
— A3E: Carrier with amplitude modulated speech used for communication (VHF-COM)
Sort under "062 01 02 00 Modulation"

062 01 01 04 Pulse characteristics
(01) ~~Define the following terms as associated with a pulse string:~~
~~— pulse length,~~
~~— pulse power,~~
~~— continuous power~~.
Shall continue to exist; delete only continuous power
Without this LO it is not possible to understand explanations around weather radar, surveillance radar, etc.; Sort under "062 01 02 00 Modulation"

062 01 01 05 Carrier, modulation
(01) Define 'carrier wave': the radio wave acting as the carrier or transporter.
Sort under "062 01 02 00 Modulation"
(02) Define 'keying': interrupting the carrier wave ~~to break it into dots and dashes~~.
Delete complete, included in 062 01 01 06.
(03) Define 'modulation': the technical term for the process of impressing and transporting information by radio waves.
Sort under "062 01 02 00 Modulation"

062 01 01 06 Kinds of modulation (amplitude, frequency, pulse, phase)
(01) Define 'amplitude modulation': the information that is impressed onto the carrier wave by altering the amplitude of the carrier.
Sort under "062 01 02 00 Modulation"
NEW LO: Define 'single-sideband modulation': a modulations form used for HF communication which transmits only one sideband (upper sideband).
If this LO is implemented, delete LO 062 01 01 03 (03).
(02) Define 'frequency modulation': the information that is impressed onto the carrier wave by altering the frequency of the carrier.
Sort under "062 01 02 00 Modulation"
(03) Describe pulse modulation. A modulation form used in radar, by transmitting short pulses followed by larger interruptions.
Technical not correct!
Suggestion: Describe pulse modulation. A modulation form used in radar application (mode S) and various AC applications (variable speed constant frequency generator, motor control, etc.).
Sort under "062 01 02 00 Modulation". Synchronize with "021 09 03 02 to 021 09 03 04 and 021 09 05 00"
(04) Describe 'phase modulation': a modulation form used in GPS where the phase of the carrier wave is reversed.
Sort under "062 01 02 00 Modulation"

062 01 02 00 Antennas
062 01 02 01 Characteristics
(05) State that an electromagnetic wave always consists of an oscillating electric (E) and an oscillating magnetic (H) field which propagates at the speed of light.
Sort under "062 01 01 00 Definitions"
(06) State that the (E) and (H) fields are perpendicular to each other. The oscillations are perpendicular to the propagation direction and are in-phase.

Sort under “062 01 01 00 Definitions”

062 01 02 02 Polarisation
Delete headline “polarisation”
(01) State that the polarisation of an electromagnetic wave describes the orientation of the plane of oscillation of the electrical component of the wave with regard to its direction of propagation.
Sort under “062 01 01 00 Definitions”
(03) Explain the difference between horizontal and vertical polarisation in the dependence of the alignment of the dipole antenna.
Delete, is already content of LO (01)
NEW LO: List the following technical data of an antenna:
- Gain
- Radiation pattern

062 01 02 03 Types of antennas
delete headline “types of antennas”
(01) ~~List and describe~~ Name the common different kinds of directional antennas:
— loop antenna used in old automatic direction-finding (ADF) receivers;
— parabolic antenna used in weather radars;
Replace with NEW LO or delete LO (outdated) or “...used in **old** weather radars”
— slotted planar array used in more modern weather radars;
Replace with NEW LO or delete “more modern”
— helical antenna used in GPS transmitters.
Replace with NEW LO
NEW LO: Identify the following antennas used for aviation:
— VHF COM antenna
— SAT COM antenna
— HF COM antenna
— VHF NAV antenna
— GPS antenna
— ADF antenna (loop and sense)
— AWR antenna (slotted planar array)
— Marker antenna
— GP antenna
— GPS antenna

062 01 03 00 Wave propagation
062 01 03 01 Structure of the ionosphere
Rename headline to “Ionosphere and its effect on radio waves”
(01) State that the ionosphere is the ionised component of the Earth’s upper atmosphere from 60 km to 400 km above the surface, which is vertically structured in three regions or layers.
Add the word: “… about 60 km…”

062 01 03 02 Ground waves

062 01 03 03 Space waves
(01) Define ‘space waves’: the electromagnetic waves travelling through the air

directly from the transmitter to the receiver
Add "…to the receiver (line of sight propagation)": shift the following LOs into this chapter!
062 02 01 01 LO (03): Explain the limitation of range because of the path of the ~~VHF signal~~. "space waves and name this as line of sight propagation."
062 02 01 03 LO(01): Use the formula '1.23 x sqrt transmitter height in feet + 1,23 x sqrt receiver height in feet' to calculate the range in NM
è For easier use, use factor 1.2 or use the formula: R[NM] = 2* ; H = flight altitude

062 01 03 04 Propagation with the frequency bands

062 01 03 05 Doppler principle
Rename headline to "Physical phenomena"

062 01 03 06 Factors affecting propagation
delete headline
(01) Define 'skip distance': the distance between the transmitter and the point on the surface of the Earth where the first sky return arrives.
Sort under 062 01 03 01
(02) ~~State that skip zone/dead space is the distance between the limit of the surface wave and the sky wave.~~
Shall continue to exist, need for HF - communication
Sort under 062 01 03 01
(03) Describe 'fading': when a receiver picks up the sky signal and the surface signal, the signals will interfere with each other causing the signals to be cancelled out.
Sort under 062 01 03 05
Fading happens also between 2 ground waves
Technical correct formulation: Describe 'fading': when a receiver picks up two signals with same frequency, the signals will interfere with each other causing changes in resultant signal strength and polarisation.
(04) State that radio waves in the VHF band and above are limited in range as they are not reflected by the ionosphere and do not have a surface wave.
Sort under 062 01 03 04
(05) Describe the physical phenomena reflection, refraction, diffraction, absorption and interference.
Sort under 062 01 03 05

From 062 06 01 03 LO (07): State that Multipath is when the signal arrives at the receiver via more than one path (the signal being reflected from surfaces near the receiver).
Multipath is a general problem; this background is needed in the complete subject 062!

Summary of the comments

062 01 00 00 BASIC RADIO PROPAGATION THEORY
062 01 01 00 Definitions
062 01 01 01 Frequency, amplitude, phase angle
(01) Define a 'cycle'. A complete series of values of a periodical process.

(02) Define 'frequency': the number of cycles occurring in 1 second in a radio wave expressed in Hertz (Hz).
(03) Define 'amplitude': the maximum deflection in an oscillation or wave.
(04) Define 'phase': the fraction of one wavelength expressed in degrees from 000° to 360°.
(05) Define 'phase difference/shift': the angular difference between the corresponding points of two cycles of equal wavelength, which is measurable in degrees.

062 01 01 02 Electromagnetic waves
(01) State that an electromagnetic wave always consists of an oscillating electric (E) and an oscillating magnetic (H) field which propagates at the speed of light being approximately 300 000 km/s
(02) State that the (E) and (H) fields are perpendicular to each other. The oscillations are perpendicular to the propagation direction and are in-phase.
(03) State that the polarisation of an electromagnetic wave describes the orientation of the plane of oscillation of the electrical component of the wave with regard to its direction of propagation
(04) Define 'wavelength': the physical distance travelled by a radio wave during one cycle of transmission.
(05) State that the relationship between wavelength and frequency is:
— wavelength (λ) = speed of light (c) / frequency (f)

062 01 01 03 Frequency bands, sidebands, single sideband
(01) List the bands of the frequency spectrum for electromagnetic waves:
— Very Low Frequency (VLF): –30 kHz;
— Low Frequency (LF): 30–300 kHz;
— Medium Frequency (MF): 300–3 000 kHz;
— High Frequency (HF): 3–30 MHz;
— Very High Frequency (VHF): 30–300 MHz;
— Ultra High Frequency (UHF): 300–3 000 MHz;
— Super High Frequency (SHF): 3–30 GHz;
— Extremely High Frequency (EHF): 30–300 GHz.

062 01 02 00 Modulation
062 01 02 01 Commonalities and classification
(01) Define 'modulation': the technical term for the process of impressing and transporting information by radio waves.
(02) Define 'carrier wave': the radio wave acting as the carrier or transporter
(03) State that when a carrier wave is modulated, the resultant radiation consists of the carrier frequency plus additional upper and lower sidebands.
(04) State that the following abbreviations (classifications according ITU regulations) are used for aviation applications.
— N0N: Carrier without modulation as used by NDBs
— A1A: Carrier with keyed Morse code modulation as used by NDBs
— A2A: Carrier with amplitude modulated Morse code as used by NDBs
— A3E: Carrier with amplitude modulated speech used for communication (VHF-COM)

062 01 02 02 Kinds of modulation (amplitude, frequency, pulse, phase)
(01) Define 'amplitude modulation': the information that is impressed onto the carrier wave by altering the amplitude of the carrier.
(02) Define 'single-sideband modulation': a modulations form used for HF communication which transmits only one sideband (upper sideband)
(03) Define 'frequency modulation': the information that is impressed onto the carrier wave by altering the frequency of the carrier.
(04) Describe 'pulse modulation': a modulation form used in radar application (mode S) and various AC applications (variable speed constant frequency generator, motor control, etc.)
(05) Describe 'phase modulation': a modulation form used in GPS where the phase of the carrier wave is reversed
(06) Define the following terms as associated with a pulse string:
— pulse length,
— pulse power,

062 01 03 00 Antenna
062 01 03 01 Characteristics
(01) Define 'antenna': a wave-type transducer for the process of converting a line AC into a free electromagnetic wave.
(02) State that the simplest type of antenna is a dipole which is a wire of length equal to one half of the wavelength.
(03) List the following technical data of an antenna:
- Gain
- Radiation pattern

062 01 03 02 Types of antenna
(01) Identify the following antennas used for aviation:
— VHF COM antenna
— SAT COM antenna
— HF COM antenna
— VHF NAV antenna
— GPS antenna
— ADF antenna (loop and sense)
— AWR antenna (slotted planar array)
— Marker antenna
— GP antenna
— GPS antenna

062 01 04 00 Wave propagation
062 01 04 01 Physical phenomena
(01) Describe the physical phenomena reflection, refraction, diffraction, absorption and interference.
(02) Describe 'fading': when a receiver picks up two signals with same frequency, the signals will interfere with each other causing changes in resultant signal strength and polarisation.
(03) State that the Doppler effect is the phenomenon that where the frequency of an electromagnetic wave will increase or decrease if there is relative motion between the transmitter and the receiver.

(04) State that Multipath is when the signal arrives at the receiver via more than one path (the signal being reflected from surfaces near the receiver).

062 01 04 02 Ionosphere and its effect on radio waves
(01) State that the ionosphere is the ionised component of the Earth's upper atmosphere from about 60 km to 400 km above the surface, which is vertically structured in three regions or layers.
(02) State that the layers in the ionosphere are named D, E and F layers, and their depth varies with time.
(03) State that electromagnetic waves refracted from the E and F layers of the ionosphere are called sky waves
(04) Define 'skip distance': the distance between the transmitter and the point on the surface of the Earth where the first sky return arrives.
(05) State that skip zone/dead space is the distance between the limit of the surface wave and the sky wave.

062 01 04 03 Ground waves
(01) Define 'ground or surface waves': the electromagnetic waves travelling along the surface of the Earth.

062 01 04 04 Space waves
(01) Define 'space waves': the electromagnetic waves travelling through the air directly from the transmitter to the receiver (line of sight propagation).
(02) Explain the limitation of range because of the path of the space waves and name this as line of sight propagation.
(03) Use the formula '1.2 x sqrt transmitter height in feet + 1.2 x sqrt receiver height in feet' to calculate the range in NM

062 01 04 05 Propagation with the frequency bands
(01) State that radio waves in VHF, UHF, SHF and EHF propagate as space waves.
(02) State that radio waves in the VHF band and above are limited in range as they are not reflected by the ionosphere and do not have a surface wave.
(03) State that radio waves in LF, MF and HF propagate as surface/ground waves and sky waves.

response

Thank you for your extensive feedback, which has been greatly appreciated.

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your comment referring to Subject 062 01 00 00: Not accepted.

EASA does not agree that the content of 062 01 lacks a good didactical order and meaningful headings. EASA is of the opinion that this LO is correct.

Regarding your comment referring to LO 062 01 01 01 (01): Accepted.

The NM reference was already deleted in the NPA text.

Regarding your comment referring to LO 062 01 01 01 (02): Not accepted.

EASA does not see the need to make a new didactical order. EASA is of the opinion that this LO is correct.

Regarding your comment referring to LO 062 01 01 01 (03): Accepted.

EASA agrees that the content of this LO is already included in 062 01 01 02 (01) and will delete this LO.

The text will be amended as follows:

~~(03) Define 'Hertz' (Hz)'. 1 Hertz is 1 cycle per second.~~

Regarding your comment referring to LOs 062 01 01 02 (01), (02), (03), (04), (05) and (06): Not accepted.

EASA does not see the need to make a new didactical order. EASA is of the opinion that these LOs are correct.

Regarding your comment referring to LO 062 01 01 03 (01): Partially accepted.

Instead of deleting VLF and EHF, EASA will retain VLF.

In comment 54-D, the same issue was raised regarding this LO.

EASA does not see the need to make a new didactical order.

Regarding your comment referring to LO 062 01 01 03 (02): Accepted.

EASA agrees that in order to understand channel spacing, interference, working principles of VOR/DVOR, etc., this LO is relevant and will be retained.

In comments 99-D and 330-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 01 01 03 (03): Accepted.

EASA agrees that in order to understand the labelling of switches and explanations within the OM-B, this LO is relevant and will be retained.

In comment 330-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 01 01 03 (04): Accepted.

EASA agrees that in order to understand the explanations within the AIP, OM-B and the BFO function of an ADF receiver, this LO should be retained, but with different wording.

The text of the new LO will be as follows:

~~State that a radio signal may be classified by three symbols in accordance with the ITU Radio Regulation, Volume 1: e.g. A1A.~~

~~— The first symbol indicates the type of modulation of the main carrier;~~

~~— The second symbol indicates the nature of the signal modulating the main carrier;~~

~~— The third symbol indicates the nature of the information to be transmitted.~~

State that the following abbreviations (classifications according to International Telecommunication Union (ITU) regulations) are used for aviation applications:

— N0N: carrier without modulation as used by NDBs;
— A1A: carrier with keyed Morse code modulation as used by NDBs;
— A2A: carrier with amplitude modulated Morse code as used by NDBs;
— A3E: carrier with amplitude modulated speech used for communication (VHF-COM).

In comment 54-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 01 01 04 (01): Accepted.

EASA agrees that in order to understand the explanations around weather radar, surveillance radar, etc., this LO is relevant and will be retained.

In comment 331-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 01 01 05 (01): Not accepted.

EASA does not see the need to make a new didactical order.

Regarding your comment referring to LO 062 01 01 05 (02): Accepted.

EASA agrees that the content of this LO is already included in 062 01 01 02 (01) and will delete this LO.

The text will be deleted as follows:

~~(05) Define 'keying': interrupting the carrier wave to break it into dots and dashes.~~

Regarding your comment referring to LO 062 01 01 05 (03): Not accepted.

EASA does not see the need to make a new didactical order.

Regarding your comment referring to LOs 062 01 01 06 (01), (02), (03) and (04): Not accepted.

EASA does not see the need to make a new didactical order.

Regarding your comment referring to LOs 062 01 02 01 (05) and (06): Not accepted.

EASA does not see the need to make a new didactical order.

Regarding your comment referring to LO 062 01 02 02 (01): Not accepted.

EASA does not see the need to make a new didactical order.

Regarding your comment referring to LO 062 01 02 02 (03): Partially accepted.

EASA agrees that the content of this LO (03) is already included in (01).

The text will be deleted as follows:

~~(3) Explain the difference between horizontal and vertical polarisation in the dependence of the alignment of the dipole.~~

Regarding your comment referring to LO 062 01 02 03 (01): Partially accepted.

EASA agrees with the proposal and will amend LO (01) and add (02) and (03).

The text will be amended as follows:

~~List and describe~~Name the common different kinds of directional antennas:

— loop antenna used in old automatic direction-finding (ADF) receivers;

— parabolic antenna used in weather radars;

— slotted planar array used in more modern weather radars;

— ~~helical antenna used in GPS transmitters.~~

Explain antenna shadowing.

Explain importance of antenna placement on aircraft.

In comments 104-D and 354-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 01 03 01 (01): Accepted.

EASA agrees to rename the heading and to amend LO (01).

The text will be amended as follows:

Structure of the ionosphere and its effect on radio waves

State that the ionosphere is the ionised component of the Earth's upper atmosphere

from approximately 60 ~~km~~ to 400 km above the surface, which is vertically structured in three regions or layers.

Regarding your comment referring to Subject 062 01 03 02: Noted.

No comment is made here.

Regarding your comment referring to LO 062 01 03 03 (01): Not accepted.

EASA does not see the need to make a new didactical order.

Regarding your comment referring to Subject 062 01 03 04: Noted.

No comment is made here.

Regarding your comment referring to Subject 062 01 03 05: Not accepted.

EASA considers the heading to be correct.

Regarding your comment referring to LO 062 01 03 06 (01): Not accepted.

EASA does not see the need to make a new didactical order.

Regarding your comment referring to LO 062 01 03 06 (02): Accepted.

EASA agrees that the phenomenon of 'dead space' is relevant in LO 062 01 03 06 (02) and will be retained.

In comments 23-D and 109-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 01 03 06 (03): Accepted.

EASA agrees that this LO has to be reworded.

The text will be amended as follows:

Describe 'fading': when a receiver picks up two signals with the same frequency, ~~the sky signal and the surface signal,~~ the signals will interfere with each other causing ~~the signals to be cancelled out.~~ changes in the resultant signal strength and polarisation.

In comments 110-D and 352-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 01 03 06 (04): Not accepted.

EASA does not see the need to make a new didactical order.

Regarding your comment referring to LO 062 01 03 06 (05): Not accepted.

EASA does not see the need to make a new didactical order.

comment *66-D* comment by: *st*

062 06 00 00 Global Navigation Satellite Systems (GNSSs)
The chapter GNSS needs a bigger makeover. In the beginning of the comment you will find all our comments in detail, at the end there will be a summary of all existing, new and changed LOs.
062 06 01 01 Principles
Chapter contains general statements, no principles
New Headline: **062 06 01 01 General**

(01) State that there are ~~two~~ four main ~~Global Navigation Satellite Systems (~~GNSS~~). currently in existence with a third which is planned to be fully operational by 2011.~~ These are: - USA NAVigation System with Timing And Ranging Global Positioning System (NAVSTAR GPS) - Russian GLObal NAvigation Satellite System (GLONASS)- European GALILEO (under construction), Chinese BeiDou (under construction)

~~GALILEO~~ à Galileo

(02) State that all ~~3~~ four systems (will) consist of a constellation of satellites which can be used by a suitably equipped receiver to determine position.
Belongs to BK

062 06 01 02 Operation
Global Navigation Satellite System (GNSS)
(01) ~~State that there are currently two modes of operation, SPS (Standard Positioning Service) for civilian users, and PPS (Precise Positioning Service) for authorised users~~
Shall continue to exist: other LOs are based on this! (see LO (24))

(03) Name the three segments as: - Space segment - Control segment - User segment

Space segment
(04) State that the space segment consists of a notional constellation of 24 operational satellites
Delete! LO (05) (same text) was deleted "no practical use"
24 satellites are specific for GPS and GLONASS, not in general (see headline: GNSS)

(10) State that each satellite broadcasts ranging signals on two UHF frequencies. L1 ~~1575.42 MHz~~ and L2 ~~1227.6 MHz~~
(11) State that SPS is a positioning and timing service provided on frequency L1
(12) State that PPS uses both frequencies L1 and L2
LOs (11) and (12): Both shall continue to exist
Instead of these 2 LOs delete LO (24)

(14) State that the ranging signal contains a (Coarse Acquisition) C/A code and a navigational data message
C/A is GPS specific, new formulation
Suggestion: State that the satellites transmit a coded signal used for ranging, identification, timing and navigation.

(15) State that the navigation message contains: - Almanac data - Ephemeris - Satellite clock correction parameters - UTC parameters - Ionospheric model - Satellite health data
Replace "Almanac data –and Ephemeris" by "orbital data"

(17) State that the almanac contains the orbital data about all the satellites in the GPS constellation
Delete! No practical use, after replacing the almanac data by orbital data à duplication to LO (15)

(21) State that an ionospheric model is currently used to calculate the time delay of the signal travelling through the ionosphere.
Delete! Duplication to 062 06 01 03 LO (01)

(23) State that GPS uses the WGS 84 model
Delete! Headline is: Global Navigation Satellite System (GNSS)! WGS 84 is GPS specific!

(24) State that two codes are transmitted on the L1 frequency, namely a C/A code and a P (precision) code. The P code is not used for SPS
Delete! Instead of this LO keep the LOs (11) and (12)
(27) State that satellites are equipped with atomic clocks, which allow the system to keep very accurate time reference

Control Segment
(28) State that the control segment comprises: - A master control station - Ground antenna - Monitoring stations
Delete! Instead of LO (28) keep LO (46): State that the control segment provides: - Monitoring of the constellation status - Correction to the orbital parameters - Navigation data uploading
LO(46) should be shifted here!

User Segment
(31) State that GPS supplies three-dimensional position fixes and speed data, plus a precise time reference.
Replace here and in the following LOs GPS by GNSS (Headline is: Global Navigation Satellite System (GNSS)!)

(32) State that a GPS receiver is able to determine the distance to a satellite, by determining the difference between the time of transmission by satellite and the time of reception

(33) State that the initial distance calculated to the satellites is called pseudo range because the difference between the GPS receiver and the satellite time references initially creates an erroneous range

(38) State that the GPS receiver is able to synchronise to the correct time base when receiving four satellites

(39) State that the receiver is able to calculate aircraft groundspeed using the SV Doppler frequency shift and /or the change in receiver position over time
Delete: "… using the SV Doppler frequency shift and /or the change in receiver position over time."

NAVigation System with Timing And Ranging Global Positioning System (NAVSTAR GPS) Integrity
(40) Define RAIM (Receiver Autonomous Integrity Monitoring). A technique whereby a receiver processor determines the integrity of the navigation signals
Wording is misleading!
Suggestion: Define RAIM as a technique that ensures the integrity of the provided data by redundant measurements.
(41) State that RAIM is achieved by consistency check among ~~pseudo~~ range measurements.

(42) State that basic RAIM requires 5 satellites. A 6th is for isolating a faulty satellite from the navigation solution
Shift LOs (40) – (42) to chapter 062 06 02 04 Airborne Based Augmentation Systems (ABAS) and delete headline

Global Navigation Satellite System (GLONASS)
(46) State that the control segment provides: - Monitoring of the constellation status - Correction to the orbital parameters - Navigation data uploading.
This LO shall replace LO (28); shift to this position!
After shifting the LO à delete the headline GLONASS

(57) State that agreements have been made between the appropriate agencies for the interoperability by any one approved user of NAVSTAR and GLONASS systems
Add compatibility: "…for the compatibility and interoperability …"

NEW (58) State that the different GNSSs use different data with respect to reference systems, orbital data, and navigation services.
Your Comment: General statement about differences in GNSS instead of deleted details in this item 062 06 01 02 (46)
Delete new LO, item 062 06 01 02 (46) is not deleted

062 06 01 03 Errors and Factors affecting accuracy
(01) List the most significant factors affecting accuracy: - Ionospheric propagation delay - Dilution of position - Satellite clock error - Satellite orbital variations - Multipath
NEW: State that a user equivalent range error can be computed from all these factors.

(02) State that ionospheric propagation delay (IPD) can almost be eliminated, by using two frequencies
Delete acronym IPD (not necessary),
Add the phrase: "…ionospheric propagation delay ~~(IPD)~~ can be modelled or almost…"

(04) State that ionospheric delay is the most significant error
Delete, duplication to LO (01)

(05) State that dilution of position arises from the geometry and number of satellites in view. It is called Position Dilution of precision (PDOP)
Replace Position Dilution of precision (PDOP) by geometric dilution of precision (GDOP)

NEW: State that the user equivalent range error (UERE) in combination with the dilution of precision (GDOP) allows for an estimation of position accuracy.

(06) State that errors in the satellite orbits are due to: - Solar wind - Gravitation of the sun, moon and planets
Delete LO (06): there is no explanation about the satellite orbits, why these details about the disturbances of satellite orbits à no practical use

Minimum to delete: "planets" à too small influences

(07) State that Multipath is when the signal arrives at the receiver via more than one path (the signal being reflected from surfaces near the receiver).
Shift to 062 01 03 06 Factors affecting propagation; Multipath is no special problem of GNSS, also other navigation systems have the phenomenon of multipath, should be known at this point!

062 06 02 01 Ground based augmentation systems (GBASs)
(03) State that for a GBAS station the coverage is about 30 km
Replace 30 km by 20 NM

(04) ~~Explain~~ State that ICAO standards provide the possibility to interconnect GBAS stations to form a network broadcasting large-scale differential corrections. Such a system is identified as GRAS , (Ground Regional Augmentation System)
Delete! No practical use!

(05) Explain that GBAS ground subsystems provide two services: the precision approach service and the GBAS positioning service. The precision approach service provides deviation guidance for Final Approach Segments, while the GBAS positioning service provides horizontal position information to support RNAV operations in terminal areas.
Is the GBAS positioning service really in use?

(06) ~~Explain that one ground station can support all the aircraft subsystems within its coverage providing the aircraft with approach data, corrections and integrity information for GNSS satellites in view via a VHF data broadcast (VDB).~~
Shall continue to exist: it's the central idea of GBAS!
Too high level of LO: State that…

(07) ~~State that the minimum GBAS plan coverage is 15 NM from the landing threshold point within 35° apart the final approach path and 10° apart between 15 and 20 NM~~
State that the minimum coverage area is 10° on either side of the final approach path to a distance between 15 and 20 NM, and 35° on either side of the final approach path to a distance of 15 NM.
Add: "… the minimum software designed coverage area…"

New LO: State that outside this area the data of GBAS are not used.

(08) State that GBAS based on GPS is sometimes called Local Area Augmentation System (LAAS).
Where and when is sometimes? Only in the USA? Really in use today? Delete!

(09) ~~Describe the characteristics of Local Area Augmentation System (LAAS) with respect to: differential corrections applied to a satellite signal by a ground based reference station regional service providers to compute the integrity of the satellite signals over their region extra accuracy for extended coverage around airports, railways, seaports and urban areas as required by the user~~

Add New LO: State that a GBAS based approach is called GNSS landing system – GLS!

062 06 02 02 Satellite Based Augmentation Systems (SBASs)
(06) Explain that SBAS station network measures the pseudo-range between the ranging source and an SBAS receiver at the known locations and provides separate corrections for ranging source ephemeris errors, clock errors and ionospheric errors. The user applies corrections for tropospheric delay.
Delete! Too detailed! Duplication to 062 06 02 02 LO (01)

(10) Explain that SBAS systems regionally augment GPS and GLONASS by making them suitable for safety critical applications such as landing aircraft
Delete! Irrelevant

062 06 02 03 European geostationary navigation overlay service
Why especially about EGNOS? Delete this headline and number consecutively!

(01) State that (EGNOS) European Geostationary Navigation Overlay Service consists of 3 geostationary Inmarsat satellites which broadcast GPS look-alike signals
Delete! Irrelevant!

(02) State that EGNOS is designed to improve accuracy to 1 - 2 m horizontally and 3 - 5 m vertically.
Formulate general for all SBAS: replace EGNOS by SBAS; source for these values?

(03) Explain that integrity and safety are improved by alerting users within 6 seconds if a GPS malfunction occurs (up to 3 hrs GPS alone)
General characteristic of SBAS! Add: "…by alerting the SBAS users…"

062 06 02 04 Airborne Based Augmentation Systems (ABAS)
(02) State that the type of ABAS using only GNSS information is RAIM (Receiver Autonomous Integrity Monitoring)
Add behind LO (02) the RAIM – LO from chapter 062 06 01 02 NAVSTAR – GPS integrity (LO (40) – (42)) à LOs (40) – (42) are not GPS – specific!

(40) Define RAIM (Receiver Autonomous Integrity Monitoring). A technique whereby a receiver processor determines the integrity of the navigation signals
Wording is misleading! **Suggestion**: Define RAIM as a technique that ensures the integrity of the provided data by redundant measurements.

(41) State that RAIM is achieved by consistency check among ~~pseudo~~ range measurements.
(42) State that basic RAIM requires 5 satellites. A 6th is for isolating a faulty satellite from the navigation solution

(04) Explain that the typical sensors used are barometric altimeter and inertial navigation system (INS).
Delete some words: Explain that the typical sensors used are barometric and inertial.

Summary of LO

062 06 00 00 Global Navigation Satellite Systems (GNSSs)

062 06 01 01 General

(01) State that there are four main GNSS. These are:
- USA NAVigation System with Timing And Ranging Global Positioning System (NAVSTAR GPS)
- Russian GLObal NAvigation Satellite System (GLONASS)
- European Galileo (under construction)
- Chinese BeiDou (under construction)

BK (02) State that all four systems (will) consist of a constellation of satellites which can be used by a suitably equipped receiver to determine position.

062 06 01 02 Operation

Global Navigation Satellite System (GNSS)

(01) State that there are currently two modes of operation, **SPS** (Standard Positioning Service) for civilian users, and **PPS** (Precise Positioning Service for authorised users

(03) Name the three segments as: - Space segment - Control segment - User segment

Space segment

(10) State that each satellite broadcasts ranging signals on two UHF frequencies.

(11) State that SPS is a positioning and timing service provided on frequency L1

(12) State that PPS uses both frequencies L1 and L2.

(14) State that the satellites transmit a coded signal used for ranging, identification, timing and navigation.

(15) State that the navigation message contains:
- Orbital data
- Satellite clock correction parameters
- UTC parameters
- Ionospheric model
- Satellite health data

(27) State that satellites are equipped with atomic clocks, which allow the system to keep very accurate time reference

Control Segment

(46) State that the control segment provides:
- Monitoring of the constellation status
- Correction to the orbital parameters
- Navigation data uploading.

User Segment

(31) State that GNSS supplies three-dimensional position fixes and speed data, plus a precise time reference.

(32) State that a GPS receiver is able to determine the distance to a satellite, by determining the difference between the time of transmission by satellite and the time of reception

(33) State that the initial distance calculated to the satellites is called pseudo range because the difference between the GPS receiver and the satellite time references initially creates an erroneous range

(34) State that each range defines a sphere with its centre at the satellite

(37) State that four spheres are needed to calculate a three dimensional position, hence four satellites are required
(38) State that the GPS receiver is able to synchronise to the correct time base when receiving four satellites
(39) State that the receiver is able to calculate aircraft groundspeed.
(57) State that agreements have been made between the appropriate agencies for the compatibility and interoperability by any one approved user of NAVSTAR and GLONASS systems.

062 06 01 03 Errors and Factors affecting accuracy
(01) List the most significant factors affecting accuracy:
- Ionospheric propagation delay
- Dilution of position
- Satellite clock error
- Satellite orbital variations
- Multipath

(02) State that ionospheric propagation delay can be modelled or almost eliminated, by using two frequencies.
(05) State that dilution of position arises from the geometry and number of satellites in view. It is called Geometric Dilution of precision (GDOP).
062 06 02 01 Ground based augmentation systems (GBASs)
(01) Explain the principle of a GBAS: to measure on ground the signal errors transmitted by GNSS satellites and relay the measured errors to the user for correction
(02) State that the ICAO GBAS standard is based on this technique through the use of a data link in the VHF band of ILS -VOR systems (108 - 118 MHz)
(03) State that for a GBAS station the coverage is about 20NM.
(05) State that the precision approach service provides deviation guidance for Final Approach Segments.
(06) State that one ground station can support all the aircraft subsystems within its coverage providing the aircraft with approach data, corrections and integrity information for GNSS satellites in view via a VHF data broadcast.
(07) State that the minimum software designed coverage area is 10° on either side of the final approach path to a distance between 15 and 20 NM, and 35° on either side of the final approach path to a distance of 15 NM.
(NEW) State that outside this area the data of GBAS are not used.
(NEW) State that a GBAS based approach is called GNSS landing system – GLS.

062 06 02 02 Satellite Based Augmentation Systems (SBASs)
(01) Explain the principle of a SBAS: to measure on the ground the signal errors transmitted by GNSS satellites and transmit differential corrections and integrity messages for navigation satellites
(02) State that the frequency band of the data link is identical to that of the GPS signals.
(03) Explain that the use of geostationary satellites enables messages to be broadcast over very wide areas
(04) Explain that pseudo-range measurements to these geostationary satellites can also be made, as if they were GPS satellites
(05) State that SBAS consists of 3 elements:

	- The ground infrastructure (monitoring and processing stations), - The SBAS satellites - The SBAS airborne receivers **(07)** Explain that SBAS can provide approach procedure with Vertical guidance (APV). **(09)** State that SBASs include: - European geostationary navigation overlay service (EGNOS) in western Europe and the Mediterranean – wide area augmentation service (WAAS) in USA – multi-functional transport satellite (MTSAT) satellite-based augmentation system (MSAS) in Japan – GPS and geostationary Earth orbit augmented navigation (GAGAN) in India **(Former 062 06 02 03 LO (02))** State that SBASs are designed to improve accuracy to 1 - 2 m horizontally and 3 - 5 m vertically. **(Former 062 06 02 03 LO (03))** Explain that integrity and safety are improved by alerting users within 6 seconds if a GPS malfunction occurs (up to 3 hrs GPS alone). **062 06 02 04 Airborne Based Augmentation Systems (ABAS)** **(01)** Explain the principle of ABAS: to use redundant elements within the GPS constellation (e g. multiplicity of distance measurements to various satellites) or the combination of GNSS measurements with those of other navigation sensors (such as inertial systems), to develop integrity control **(02)** State that the type of ABAS using only GNSS information is RAIM (Receiver Autonomous Integrity Monitoring) **Former 062 06 01 02 (40)** Define RAIM as a technique that ensures the integrity of the provided data by redundant measurements. **Former 062 06 01 02 (41)** State that RAIM is achieved by consistency check among range measurements. **Former 062 06 01 02 (42)** State that basic RAIM requires 5 satellites. A 6th is for isolating a faulty satellite from the navigation solution **(03)** State that a system using information from additional on-board sensors is named AAIM (Aircraft Autonomous Integrity Monitoring) **(04)** Explain that the typical sensors used are barometric and inertial.
response	Thank you for your extensive feedback, which has been greatly appreciated. EASA has carefully assessed all the comments received. Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number. Regarding your comment referring to the heading 062 06 01 01 ‘Principles’: Accepted. EASA agrees that this Chapter contains general statements, no principles. The text will be amended as follows: **062 06 01 00** ~~**Global positioning system (GPS), GLONASS, GALILEO**~~ **GNSS** **062 06 01 01** ~~**Principles**~~ ***General*** In comment 195-D, the same issue was raised regarding this LO. Regarding your comment referring to LO 062 06 01 01 (01): Accepted. EASA agrees that ‘GALILEO’ should read ‘Galileo’. The text will be amended as follows:

[…]

— European ~~GALILEO~~ Galileo (under construction);~~.~~

Regarding your comment referring to LO 062 06 01 01 (02): Accepted.

EASA agrees that this LO belongs to 'BK' and will add an 'X' in the 'BK' column.

Regarding your comment referring to LO 062 06 01 02 (01): Accepted.

EASA agrees that other LOs are based on this LO, therefore relevant and will be retained.

Regarding your comment referring to LO 062 06 01 02 (01): Accepted.

EASA agrees that LO (24) is linked with the deleted LOs (01), (11) and (12) and that these deleted LOs are necessary.

LOs 062 06 01 02 (01), (11) and (12) will be retained.

In comments 6-D and 203-D, a similar was raised regarding this LO.

Regarding your comment referring to LO 062 06 01 02 (04): Accepted.

EASA agrees that the text of LOs 062 06 01 02 (04) and (05) is identical and the text of LO (04) will be deleted as well.

The text will be amended as follows:

~~(04) State that the space segment consists of a notional constellation of 24 operational satellites.~~

In comments 3-D and 25-D, the same issue was raised regarding this LO.

Regarding your comment referring to LOs 062 06 01 02 (10) and (11): Partially accepted.

EASA agrees that LO (24) is linked with the deleted LOs (01), (11) and (12) and that these deleted LOs are necessary.

LOs 062 06 01 02 (01), (11) and (12) will be retained.

EASA will not delete LO (24) as you propose.

In comment 66-D, a similar issue was raised regarding this LO.

Regarding your comment referring to LO 062 06 01 02 (14): Accepted.

EASA agrees that this LO should be reworded.

The text will be amended as follows:

~~State that the ranging signal contains a Coarse Acquisition (C/A) code and a navigational data message.~~ State that the satellites transmit a coded signal used for ranging, identification (satellite individual PRN code), timing and navigation.

In comment 274-D, a similar issue was raised regarding this LO.

Regarding your comment referring to LO 062 06 01 02 (15): Accepted.

EASA agrees that this LO should be reworded.

The text will be amended as follows:

State that the navigation message contains:

— ~~almanac data;~~

— ~~ephemeris;~~

— satellite clock correction parameters;

— Universal Time Coordinated (UTC) parameters;

— an ionospheric model;

— satellite health data.

Regarding your comment referring to LO 062 06 01 02 (17): Accepted.

EASA agrees that this LO is now a duplicate of LO (15), and so LO (17) will be deleted.

The text will be deleted as follows:

~~(17) State that the almanac contains the orbital data about all the satellites in the GPS constellation.~~

Regarding your comment referring to LO 062 06 01 02 (21): Not accepted.

EASA does not agree that this LO is a duplication of LO 062 06 01 03 LO (01) and will not be deleted.

Regarding your comment referring to LO 062 06 01 02 (23): Accepted.

EASA agrees that this LO is no longer necessary as the heading reads 'global navigation satellite system (GNSS)'.

The text will be deleted as follows:

~~(23) State that GPS uses the WGS-84 model.~~

Regarding your comment referring to LO 062 06 01 02 (24): Not accepted.

Please refer to the response above regarding LOs (11) and (12).

Regarding your comment referring to LO 062 06 01 02 (28): Partially accepted.

EASA agrees to move LO (46) into LO (28), but will not delete LO (28).

The text will be amended as follows:

State that the control segment comprises:

— a master control station;

— ground antenna;

— monitoring stations.

State that the control segment provides:

— monitoring of the constellation status;

— correction to orbital parameters;

— navigation data uploading.

In comment 211-D, the same issue was raised regarding moving LO (46).

Regarding your comment referring to LOs 062 06 01 02 (31), (32), (33) and (38): Accepted.

EASA agrees to replace 'GPS' with 'GNSS' as the heading reads 'global navigation satellite system (GNSS)'.

The text will be amended as follows:

State that ~~GPS~~ GNSS supplies three-dimensional position fixes and speed data, plus a precise time reference.

State that a ~~GPS~~ GNSS receiver is able to determine the distance to a satellite by determining the difference between the time of transmission by the satellite and

the time of reception.

State that the initial distance calculated to the satellites is called pseudo-range because the difference between the ~~GPS~~ GNSS receiver and the satellite time references initially creates an erroneous range.

State that the ~~GPS~~ GNSS receiver is able to synchronise to the correct time base when receiving four satellites.

Regarding your comment referring to LO 062 06 01 02 (39): Not accepted.

EASA does not agree to delete this part of the LO and the text remains like it is.

Regarding your comment referring to LO 062 06 01 02 (40): Accepted.

EASA agrees that the wording of the current LO is misleading.

The text will be amended as follows:

Define 'r~~R~~eceiver a~~A~~utonomous i~~I~~ntegrity m~~M~~onitoring (RAIM)'~~:~~ as a technique that ensures the integrity of the provided data by redundant measurements. ~~whereby a receiver processor determines the integrity of the navigation signals.~~

Regarding your comment referring to LOs 062 06 01 02 (40), (41) and (42): Partially accepted.

EASA agrees to move LOs (40), (41) and (42) to Chapter 062 06 02 04 'Airborne-based augmentation systems (ABAS)', but will not delete the heading.

Regarding your comment referring to LO 062 06 01 02 (46): Partially accepted.

Please refer to EASA's response under LO (28).

Regarding your comment referring to LO 062 06 01 02 (57): Accepted.

EASA agrees to add the wording 'compatibility' in this LO.

The text will be amended as follows:

State that agreements have been concluded between the appropriate agencies for the compatibility and interoperability by any approved user of NAVSTAR and GLONASS systems.

In comment 212-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 06 01 02 (58) new: Not accepted.

EASA is of the opinion that your reference to LO 062 06 01 02 (46) is not correct and therefore this LO will not be deleted.

Regarding your comment referring to LO 062 06 01 03 (01): Accepted.

EASA agrees to insert this new proposed LO.

The text will be inserted as follows:

State that a user equivalent range error can be computed from all these factors.

Regarding your comment referring to LO 062 06 01 03 (02): Partially accepted.

EASA agrees to reword this LO, but slightly differently from your proposal.

The text will be amended as follows:

State that the error from i~~I~~onospheric p~~P~~ropagation d~~D~~elay (IPD) can be reduced by modelling using a model of the ionosphere or almost be eliminated by using two frequencies.

In comment 10-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 06 01 03 (04): Not accepted.

EASA does not agree that this LO is a duplication of LO (01). LO (01) is just a list of factors, whereas LO (04) states the most significant error.

Regarding your comment referring to LO 062 06 01 03 (05): Accepted.

EASA agrees to replace 'position dilution of precision (PDOP)' with 'geometric dilution of precision (GDOP)'.

The text will be amended as follows:

State that dilution of position arises from the geometry and number of satellites in view. It is called geometric ~~pPosition~~ d~~D~~ilution of p~~P~~recision (~~P~~GDOP).

Regarding your comment referring to LO 062 06 01 03 (05) new: Accepted.

EASA agrees to insert this new proposed LO.

The text will be inserted as follows:

State that the user equivalent range error (UERE) in combination with the geometric dilution of precision (GDOP) allows for an estimation of position accuracy.

Regarding your comment referring to LO 062 06 01 03 (06): Partially accepted.

EASA agrees that the reference to the planets is of no practical use.

The text will be amended as follows:

State that errors in the satellite orbits are due to:

— solar wind;

— gravitation of the Sun and the Moon ~~Sun, Moon and planets~~.

Regarding your comment referring to LO 062 06 01 03 (07): Accepted.

EASA agrees to move this LO (07) to 062 01 03 06 'Factors affecting propagation'. Multipath is no special problem of GNSS, also other navigation systems have the phenomenon of multipath; should be known at this point.

Regarding your comment referring to LO 062 06 02 01 (03): Accepted.

EASA agrees to reword this LO and replace '30 km' with '20 NM'.

The text will be amended as follows:

State that for a GBAS station the coverage is about 20 NM ~~30 km~~.

Regarding your comment referring to LO 062 06 02 01 (04): Accepted.

EASA agrees that this LO had no practical use and will delete this LO.

The text will be amended as follows:

~~(04) Explain that ICAO Standards provide the possibility to interconnect GBAS stations to form a network broadcasting large-scale differential corrections. Such a system is identified as Ground- Regional Augmentation System (GRAS).~~

Regarding your comment referring to LO 062 06 02 01 (05): Accepted.

EASA agrees that this LO is not clear and will be rephrased.

The text will be amended as follows:

~~Explain~~ State that GBAS ground systems provide information for guidance in the terminal area and for three-dimensional guidance in the final approach segment (FAS) by transmitting the FAS data block. ~~subsystems provide two services: precision approach service and GBAS positioning service.~~

~~The precision approach service provides deviation guidance for final approach Segments, while the GBAS positioning service provides horizontal position~~

~~information to support RNAV operations in terminal areas.~~

In comment 218-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 06 02 01 (06): Accepted.

EASA agrees to retain this LO and will replace 'Explain' with 'State'.

The text will be amended as follows:

~~Explain~~ State that one ground station can support all the aircraft subsystems within its coverage providing the aircraft with approach data, corrections and integrity information for GNSS satellites in view via a VHF ~~D~~data ~~B~~broadcast (VDB).

Regarding your comment referring to LO 062 06 02 01 (07): Accepted.

EASA agrees to reword this LO.

The text will be amended as follows:

~~State that the minimum GBAS plan coverage is 15 NM from the landing threshold point within 35° apart the final approach path and 10° apart between 15 and 20 NM.~~ State that the minimum software designed coverage area is 10° on either side of the final approach path to a distance between 15 and 20 NM, and 35° on either side of the final approach path to a distance of 15 NM.

Regarding your comment referring to LO 062 06 02 01 (07) new: Partially accepted.

EASA agrees to insert a new LO, but formulated slightly differently from the proposal.

The text will be inserted as follows:

State that outside this area the FAS data of GBAS is not used.

Regarding your comment referring to LO 062 06 02 01 (08): Not accepted.

EASA is of the opinion that students should know the term 'LAAS'.

Regarding your comment referring to LO 062 06 02 01 (09): Partially accepted.

EASA agrees to insert this new proposed LO, but with slightly different wording. This new LO will replace the deleted LO (09).

The text will be inserted as follows:

~~Describe the characteristics of a Local Area Augmentation System (LAAS) with respect to:~~

- ~~differential corrections applied to a satellite signal by a ground-based reference station;~~
- ~~regional service providers to compute the integrity of the satellite signals over their region;~~
- ~~extra accuracy for extended coverage around airports, railways, seaports and urban areas as required by the user.~~

State that a GBAS-based approach is called GLS approach (GLS GNSS landing system).

Regarding your comment referring to LO 062 06 02 02 (06): Accepted.

EASA agrees that this LO is too detailed and is a duplication to 062 06 02 02 LO (01) and will be deleted.

The text will be deleted as follows:

~~(06) Explain that the SBAS station network measures the pseudo-range between the ranging source and an SBAS receiver at the known locations and provides separate corrections for ranging source ephemeris errors, clock errors and ionospheric errors. The user applies corrections for tropospheric delay.~~

Regarding your comment referring to LO 062 06 02 02 (10): Accepted.

EASA agrees that this LO is irrelevant and will be deleted.

Regarding your comment referring to the heading 062 06 02 03 'European geostationary navigation overlay service': Accepted.

EASA agrees that a separate heading for EGNOS is not relevant and will delete this heading and number consecutively.

Regarding your comment referring to LO 062 06 02 03 (01): Accepted.

EASA agrees that this LO is irrelevant and will be deleted. The content is already stated in LOs 062 06 02 02 (03) to (05).

Regarding your comment referring to LO 062 06 02 03 (02): Partially accepted.

EASA agrees that this LO should be reworded, but slightly differently from your proposal.

The text will be amended as follows:

State that ~~EGNOS~~ SBAS is designed to improve accuracy ~~to 1–2 m horizontally and 3–5 m vertically~~ and integrity significantly.

In comment 226-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 06 02 03 (03): Accepted.

EASA agrees that this LO should be reworded and add wording regarding alerting the SBAS users.

The text will be amended as follows:

Explain that integrity and safety are improved by alerting SBAS users within 6 seconds if a GPS malfunction occurs ~~(up to 3 hours GPS alone).~~

In comment 227-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 06 02 04 (02): Accepted.

EASA agrees that before LO (02) the RAIM LO from Chapter 062 06 01 02 'NAVSTAR – GPS integrity' LOs (40) to (42) will be inserted and LO (40) will be reworded.

See EASA's response above to comment 66-D.

Regarding your comment referring to LO 062 06 02 04 (04): Accepted.

EASA agrees to delete the last wording of this LO and replace it with 'inertial reference system (IRS)'.

The text will be amended as follows:

Explain that the typical sensors used are barometric altimeter and inertial reference system (IRS) ~~inertial navigation system~~

In comments 228-D and 344-D, the same issue was raised regarding this LO.

comment

68-D comment by: *roger henshaw*

	<u>The comments that follow are with reference to CBIR & EIR in the subject 062.</u> **062 02 01 02 (01, 02) - retain for CBIR/EIR - a CBIR/EIR holder should know basic Q codes.** **062 02 03 01 (04, 06) - retain for CBIR/EIR - a CBIR/EIR holder should be aware of different types of VOR as many are still used inus in Europe and elsewhere.** **062 02 05 01 (08) - delete for CBIR/EIR - a knowledge of the specific ILS lobe modulation frequencies is not considered relevant knowledge for a CBIR/EIR holder - no practical use.** **062 02 05 01 (16, 17) retain for CBIR/EIR - an awareness of marker beacons is included in (03) and therefore a CBIR/EIR holder should also know the indications.** **062 02 05 02 (12, 13) - remove from CBIR/EIR - knowledge and use of back beam approach is not necessary as it has very little practical application.** **062 02 05 05 (01, 02) - retain for CBIR/EIR - an awareness of ILS critical and sensitive areas and the reasons must be of relevance to all pilots.** **062 06 01 02 (043,044) - syllabus detail is cancelled but crosses have not been struck through.** **End of comments**
response	Thank you for your multiple comments. EASA has carefully assessed all the comments received. Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number. Regarding your comment referring to LOs 062 02 01 02 (01) and (02): Accepted. EASA agrees that a CB-IR/EIR holder should know basic Q codes and will put an 'X' in the 'CB-IR/EIR' column. Regarding your comment referring to LOs 062 02 03 01 (04) and (06): Accepted. EASA agrees that a CB-IR/EIR holder should be aware of the different types of VOR as many are still used in Europe and elsewhere. EASA agrees that this LO (04) is relevant and will be retained. In comments 68-D and 335-D, the same issue was raised regarding this LO (04). Regarding your comment referring to LO 062 02 05 01 (08): Accepted. EASA agrees that knowledge of the specific ILS lobe modulation frequencies is not considered relevant knowledge for a CB-IR/EIR holder. The 'X' in the 'CB-IR/EIR' column will be deleted. Regarding your comment referring to LOs 062 02 05 01 (16) and (17): Accepted. EASA agrees that awareness of marker beacons is included in LO (03) and therefore a CB-IR/EIR holder should also know the indications and will put an 'X' in the 'CB-IR/EIR' column.

Regarding your comment referring to LOs 062 02 05 02 (12) and (13): Accepted.

EASA agrees that knowledge and use of back beam approach is not necessary as it has very little practical application and is not considered relevant knowledge for a CB-IR/EIR holder. The 'X' in the 'CB-IR/EIR' column will be deleted.

Regarding your comment referring to LOs 062 02 05 05 (01) and (02): Accepted.

EASA agrees that awareness of ILS critical and sensitive areas and the reasons must be of relevance to all pilots. This LO is indeed relevant for a CB-IR/EIR holder: they should also know the indications; EASA will put an 'X' in the 'CB-IR/EIR' column.

Regarding your comment referring to LOs 062 06 01 02 (43) and (44): Accepted.

EASA confirms that LOs (43) and (44) are deleted, but in the NPA text the crosses have not been struck through by mistake. This is an omission and will be corrected.

comment *69-D* comment by: *st*

062 07 00 00 Performance Based Navigation (PBN)
062 07 01 00 PBN concept (as described in ICAO ~~D~~doc 9613)
062 07 01 01 PBN principles
(02) New: State that these RNAV and RNP systems are necessary to optimise the utilisation of available airspace.
Delete, irrelevant, max.BK
(04) New: Define accuracy as the stated limits for the system error to be within for 95 % of the flight time.
Add: "…for the total system error…"
(06) Define integrity as a measure of the trust that can be placed in the correctness of the information supplied by the total system. Integrity includes the ability of a system to provide timely and valid warnings to the user (alerts).
Delete parts! New: Define integrity as a measure of the trust. Integrity includes the ability of a system to provide timely and valid warnings to the user (alerts).
062 07 02 00 Navigation s~~S~~pecifications
062 07 02 02 Navigation functional requirements
(01) List the basic functional requirements of RNAV and RNP specifications (continuous indication of lateral deviation, distance/bearing to active waypoint, g/s or time to active waypoint, navigation data storage and failure indication).
Trivial! Delete!
062 07 02 03 Designation of RNP and RNAV specifications
(10) State that RNP 0.3 navigation specification is used in all phases of flight except for oceanic/remote and final approach, primarily for helicopters.
(11) New: State that RNAV 1, RNP 1 and RNP 0.3 may also be used in en-route phases of low-level instrument flight rules (IFR) helicopter flights.
Both LO (10) and (11) are helicopters only! Delete the crosses in the columns: **Aeroplane ATPL** and **IR**
062 07 03 03 Specific RNAV and RNP system functions
(03) New: State the importance of respecting the flight director guidance and the speed constraints associated with an RF procedure.
Delete "respecting"!
062 07 04 02 On-board performance monitoring and alerting

(01) State that on-board performance monitoring and alerting of flight technical error is managed by on-board systems or crew procedures.
(02) State that on-board performance monitoring and alerting of navigation system error is a requirement of on-board equipment for RNP.
Delete LO (01) and (02)! Duplication to 062 07 02 01 Area navigation (RNAV) and required navigation performance (RNP) LO (01)
(04) New: Explain how a navigation system assesses the EPE.
Too high level! "State that a navigation system…"
062 07 04 04 Database management
(01) State that, unless otherwise specified in operations documentation or acceptable means of compliance (AMC), the navigational database must be valid for the current aeronautical information regulation and control (AIRAC) cycle
Delete! This LO describes parts of the FMS, is not special for PBN!
062 07 05 00 Requirements of specific RNAV and RNP specifications
062 07 05 01 RNAV 10
(01) State that RNAV 10 requires that aircraft operating in oceanic and remote areas be equipped with at least two independent and serviceable long-range navigation systems (LRNSs) comprising an INS, an inertial reference system (IRS)/flight management system ~~IRS~~ (FMS) or a GNSS.
(02) State that aircraft incorporating dual ~~inertial navigation systems~~ (INSs) or inertial reference units (IRUs) have a standard time limitation.
(03) State that operators may extend their RNAV 10 navigation capability time by updating.
Delete LO (01) – (03)! These LOs describe in detail the sensors. The concept of PBN is a turning away from sensors going to specifications!
062 07 05 03 ~~RNAV/RNP1~~/2 RNAV 1/RNAV 2/RNP 1/RNP 2
Delete all LOs ((01) – (03))!
062 07 05 04 RNP 4
Delete the LO (01)
062 07 05 05 RNP APCH
Because of the importance this headline should be one level higher!
062 07 05 07 Advanced required navigation performance (A-RNP)
(01) State that ~~Advanced~~ A-RNP incorporates the navigation specifications RNAV 5, RNAV 2, RNAV 1, RNP 2, RNP 1 and RNP APCH.
At the moment: no practical use! Delete!
062 07 05 08 PBN pPoint-in-sSpace (PinS) dDeparture
All LOs are helicopter operations. **Delete** all crosses in the column: "**IR**". For helicopters the instrument rating is already included in the ATPL (see the column: Helicopter ATPL / IR)!
062 07 05 09 PBN pPoint-in-sSpace (PinS) aApproach
All LOs are helicopter operations. **Delete** all crosses in the column: "**IR**". For helicopters the instrument rating is already included in the ATPL (see the column: Helicopter ATPL / IR)!

response

Thank you for your multiple comments.

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your comment referring to LO 062 07 01 01 (02): Partially accepted.

EASA is of the opinion that this LO is relevant and will remain, but marked with an 'X' in the 'BK' column.

Regarding your comment referring to LO 062 07 01 01 (04): Partially accepted.

EASA agrees that this LO should be reworded, but differently from your proposal.

The text will be amended as follows:

Define accuracy as the conformance of the true position and the required position.

In comments 230-D and 268-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 07 01 01 (06): Partially accepted.

EASA does not agree to delete certain parts of this LO, but will add some wording.

The text will be amended as follows:

~~Explain the concept of integrity.~~ Define integrity as a measure of the trust that can be placed in the correctness of the information supplied by the total system. Integrity includes the ability of a system to provide timely and valid alerts to the user.

In comment 231-D, the same issue was raised regarding this LO.

Regarding your comment referring to LO 062 07 02 02 (01): Not accepted.

EASA is of the opinion that this LO is relevant and will remain, but marked with an 'X' in the 'BK' column. The abbreviation 'g/s' will be replaced with 'GS'.

The text will be amended as follows:

List the basic functional requirements of RNAV and RNP specifications (continuous indication of lateral deviation, distance/bearing to active waypoint, ~~g/s~~ GS or time to active waypoint, navigation data storage and failure indication).

In comment 233-D, the same issue was raised regarding g/s in this LO.

Regarding your comment referring to LOs 062 07 02 03 (10) and (11): Accepted.

EASA agrees to delete the crosses in the 'ATPL(A)' and 'IR(A)' columns.

Regarding your comment referring to LO 062 07 03 03 (03): Accepted.

EASA agrees to reword this LO and replace 'of respecting' with 'to respect'.

The text will be amended as follows:

State the importance to respect the flight director guidance and the speed constraints associated with an RF procedure.

comment *74-D* comment by: *European Cockpit Association*

Attachment #8

Subject 062 — Radio navigation	**Page nb**	
		General statement: positive development that several Learning Objectives in Subject 062 that used to go deep into electrical/radio wave technical background have been simplified (by replacing

		"explain" by "state") or even removed. The practical use of it is limited. Anything learnt by a pilot should have a practical use in our daily operation. Finally, all topics discussed in 062 should apply to Aeroplane and Helicopter ATPL and CPL
062 06 00 00		Do not remove LO's with background knowledge on GNSS's (062 06 00 00). Satellite navigation is here to stay, and removing as many LO's as proposed because of "no practical use" undermines the pilot's knowledge and therefore recognition of possible errors of satellite navigation. Keep all LO's in this chapter.
062 02 02 02 (06)	**148**	Describe different interception methodes in relation to angle difference between actual and requested QDM and QDR. Describe wind correction concerning heading and timing during: interceptions; procedural turns; holding patterns; Describe influence of distance to or from station during interceptions; Describe passing station procedure to intercept requested QDR
062 02 03 02 (06)	**154**	Describe different interception methodes in relation to angle difference between actual and requested Track or Radial; Describe wind correction concerning heading and timing during: interceptions; procedural turns; holding patterns; Describe influence of distance to or from station during interceptions; Describe passing station procedure to intercept requested Radial
062 02 06 00		MLS (062 02 06 00) has been removed. We disagree with this removal. For example, MLS is still in use at London Heathrow, one of the world's major airports
062 03 03 06 (01) and (02) - Radar application for navigation	**172**	Helicopters in SAR uses radar for navigation, mainly in costal areas. This LO should remain for ATPL/IR H level
062 07 00 00		Chapter PBN (062 07 00 00) should be elaborated and focussed on more, as this is certainly the way aviation develops, as PBN will be implemented more and more often. ECA would like to ask for more clarification on this Chapter, especially regarding the (confusing) proliferation of RNP/RNAV/GNSS procedures, approaches and terminology in use

response

Thank you for your multiple comments

EASA has carefully assessed all the comments received.

Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number.

Regarding your comment referring to Subject 062 06 00 00: Not accepted.

EASA does not agree with your general comment.

Regarding your comment referring to LO 062 02 02 02 (06): Noted.

EASA sees no further amendments needed regarding this LO.

Regarding your comment referring to LO 062 02 03 02 (06): Noted.

EASA sees no further amendments needed regarding this LO.

Regarding your comment referring to LO 062 02 06 00: Accepted.

EASA agrees that MLS is still in used and this LO will be retained.

Regarding your comment referring to LOs 062 03 03 06 (01) and (02): Not accepted.

EASA decided, based on received comment 57-D, that the four LOs of 062 03 03 06 'Application for navigation' will be retained. See also comment 357-D on Subject 050: Weather-radar observations (refer to 050 09 04 05).

Regarding your comment referring Subject LO 062 07 00 00: Noted.

EASA would like to refer you to the responses to the different comments regarding this Subject 062 07 00 00 'PBN'.

comment

97-D comment by: *KLM Flight Academy*

01 01 02 (01) Delete radio wave as it is also true for AC current.

response

Accepted.

Thank you for providing your comment referring to LO 062 01 01 02 (01).

EASA agrees with your comment to delete the wording 'in a radio wave'.

The text will be amended as follows:

Define 'frequency'~~.~~: ~~T~~the number of cycles occurring in 1 second ~~in a radio wave~~ expressed in Hertz (Hz).

comment

98-D comment by: *KLM Flight Academy*

(05) and (06) phase or phase angle, see title of this LO.

response

Accepted.

Thank you for providing your comment referring to LOs 062 01 01 02 (05) and (06).

EASA agrees that the wording regarding 'phase' in the heading and in LOs (05) and (06) should be the same.

The text will be amended as follows:

	Define ‘phase angle’: the fraction of one wavelength expressed in degrees from 000° to 360°. Define ‘phase angle difference/shift’: the angular difference between the corresponding points of two cycles of equal wavelength, which is measurable in degrees.
comment	*99-D* comment by: *KLM Flight Academy* On HF-COM panels use is made of the terms DSB, SSB, USB and/or LSB. A professional pilot should know at least something on sidebands.
response	Accepted. Thank you for providing your comment referring to LO 062 01 01 03 (02). EASA agrees that in order to understand channel spacing, interference, working principles of VOR/DVOR, etc., this LO is relevant and will be retained. In comment 65-D, the same issue was raised regarding this LO.
comment	*100-D* comment by: *KLM Flight Academy* (02) Keying is not of practical use in the cockpit, pls delete this LO.
response	Accepted. Thank you for providing your comment referring to LO 062 01 01 05 (02). EASA agrees that keying is not of practical use in the flight crew compartment. Next to that, the content of this LO is already included in 062 01 01 02 (01) and therefore EASA will delete this LO. The text will be amended as follows: ~~(05) Define ‘keying’: interrupting the carrier wave to break it into dots and dashes.~~ In comment 65-D, the same issue was raised regarding this LO.
comment	*101-D* comment by: *KLM Flight Academy* (01) Strange definition: a 'wave-type' transducer? DOes everybody understand a 'line AC'? An antenna canalso be a 'line'. What are 'free electromagnetic waves'?
response	Partially accepted. Thank you for providing your comment referring to LO 062 01 02 01 (01). EASA agrees that the wording of this LO is not clear. The text will be amended as follows: Define ‘antenna’: ~~a wave-type transducer for the process of converting a line AC into a free electromagnetic wave.~~ an antenna, or aerial, is an electrical device which converts electric power into radio waves, and vice versa.
comment	*102-D* comment by: *KLM Flight Academy*

	(02) add at the end: ... and which has an electrical connection halfway its length.
response	Not accepted. Thank you for providing your comment referring to LO 062 01 02 01 (02). EASA considers the LO to be correct.

comment	*103-D* comment by: *KLM Flight Academy* (03) poor english. Please introduce in here also 'circular polarisation'.
response	Not accepted. Thank you for providing your comment referring to LO 062 01 02 01 (03). This LO was already deleted in the NPA text.

comment	*104-D* comment by: *KLM Flight Academy* 02 03 (01) Listing not complete without 'dipole' and '1/4 lambda'. Applications not relevant in here: what is for instance antenna for modern ADF? And for radio altimeter etc. Better to discuss type of antenna in relevant chapter.
response	Partially accepted. Thank you for providing your comment referring to LO 062 01 02 03 (01). EASA agrees that the wording of this LO is not clear. In comments 65-D and 354-D, the same issue was raised regarding this LO and there EASA agreed with their proposal to amend LO (01) and add a new LO (02) and LO (03). The text will be amended as follows: ~~List and describe~~Name the common different kinds of directional antennas: — loop antenna used in old automatic direction-finding (ADF) receivers; — parabolic antenna used in weather radars; — slotted planar array used in more modern weather radars; — ~~helical antenna used in GPS transmitters.~~ Explain ‘antenna shadowing’. Explain the importance of antenna placement on aircraft.

comment	*105-D* comment by: *KLM Flight Academy* (02) depth or height? No LO anymore about variation in layers between day/night, summer winter etc. despite practical use in HF-COM?
response	Not accepted.

	Thank you for providing your comment referring to LO 062 01 03 01 (02). EASA considers the LO to be correct.

comment	*106-D* comment by: *KLM Flight Academy* (01) Not more? Follow curvature of earth? Power loss with distance and frequency?
response	Not accepted. Thank you for providing your comment referring to LO 062 01 03 02 (01). EASA considers the LO to be correct.

comment	*107-D* comment by: *KLM Flight Academy* 03 (01) Missing: other name for space wave is 'direct wave'? Terms 'radio horizon' vs 'optical horizon'. The range formula?
response	Not accepted. Thank you for providing your comment referring to LO 062 01 03 03 (01). EASA considers the LO to be correct.

comment	*108-D* comment by: *KLM Flight Academy* 05 (01) Doppler is for all wave-types, not only for em-waves, so pls delete electromagnetic
response	Accepted. Thank you for providing your comment referring to LO 062 01 03 05 (01). EASA agrees that the wording ‘electromagnetic’ should be deleted. The text will be amended as follows: State that the Doppler effect is the phenomenon ~~that~~ where the frequency of a~~n electromagnetic~~ wave will increase or decrease if there is relative motion between the transmitter and the receiver.

comment	*109-D* comment by: *KLM Flight Academy* (02) For HF communication purposes the term 'dead space' is interesting to know as a/c may fly in the dead space where there is no reception unless the a/c climbs and/or increases or decreases the distance to the transmitter. Pls do not delete.
response	Accepted. Thank you for providing this comment referring to LO 062 01 03 06 (02). EASA agrees that the phenomenon of ‘dead space’ is relevant for LO 062 01 03 06 (02) and will be retained. In comments 23-D and 65-D, the same issue was raised regarding this LO.

comment	*110-D* comment by: *KLM Flight Academy* (03) Can't fading also occur when there is interference between a direct wave and a reflected wave? I think 'fading' is any variation in signal strength due to atmospheric and geographical influences.
response	Accepted. Thank you for providing this comment referring to LO 062 01 03 06 (02). EASA agrees that this LO has to be reworded. The text will be amended as follows: Describe 'fading': when a receiver picks up two signals with the same frequency, ~~the sky signal and the surface signal,~~ the signals will interfere with each other causing ~~the signals to be cancelled out.~~ changes in the resultant signal strength and polarisation. In comment 65-D, the same issue was raised regarding this LO.

comment	*111-D* comment by: *KLM Flight Academy* (01) Not clear what is meant. Please be more specific: VDF/UDF? reception of CW sufficient? lost procedure? (recognition of) ground based antenna?
response	Not accepted. Thank you for providing your comment referring to LO 062 01 01 (01). EASA considers the LO to be correct.

comment	*112-D* comment by: *KLM Flight Academy* (03) When in 062 01 an LO was added about the range (see remark) this LO would not be necessary here.
response	Not accepted. Thank you for providing your comment referring to LO 062 02 01 01 (03). EASA is of the opinion that the LO is correct and needs to remain.

comment	*113-D* comment by: *KLM Flight Academy* (05) In the Netherlands this service is still available. Pls do not delete
response	Accepted. Thank you for providing this comment referring to LO 062 02 01 02 (05). EASA agrees that this LO is relevant and will be retained. In comments 56-D and 332-D, the same issue was raised regarding this LO.

comment	*114-D* comment by: *KLM Flight Academy* (06) "State the frequency band assigned ... etc." space before and after the dashed line.
response	Accepted. Thank you for providing this comment referring to LO 062 02 02 01 (06). EASA agrees that this LO should be reworded. The text will be amended as follows: State that the ~~The~~ frequency band assigned to aeronautical NDBs according to ICAO Annex 10 is 190–1 750 kHz.

comment	*115-D* comment by: *KLM Flight Academy* (11) It is also important to know aviation NDB's transmit omni-directional (and with vertical polarised signals).
response	Noted. Thank you for providing this comment referring to LO 062 02 02 01 (11).

comment	*116-D* comment by: *KLM Flight Academy* (08) Difference between locator NDB and airway NDB not sufficiently clear in these LO's. Difference in ident (tone and Morse code) and in range for instance to be mentioned as well.
response	Noted. Thank you for providing this comment referring to LO 062 02 02 01 (08). EASA would like to refer you to the accepted comment 59-D where the text of this LO has been amended: ~~Explain why it is necessary to use a directionally sensitive receiver antenna system in order to obtain the direction of the incoming radio wave.~~ State that according to ICAO Annex 10, an NDB station has an automatic ground monitoring system.

comment	*117-D* comment by: *KLM Flight Academy* (12) Please give more detail.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 02 01 (12). EASA considers the LO to be correct and that this LO does not need more detail.

comment	*118-D* comment by: *KLM Flight Academy* (13) as described in ... Pls give more detail

response	Noted. Thank you for providing this comment referring to LO 062 02 02 01 (13). EASA considers the LO to be correct and that this LO does not need more detail.

comment	*119-D* comment by: *KLM Flight Academy* (15) N0N/A1/2 etc. is no longer an LO! Same applies for (17)
response	Not accepted. Thank you for providing this comment referring to LOs 062 02 02 01 (15) and (17). EASA considers these LOs (15) and (17) as relevant and will not delete them.

comment	*120-D* comment by: *KLM Flight Academy* (19) Explain or state? How does the BFO distinguish between A1 and A2 transmission.
response	Partially accepted. Thank you for providing this comment referring to LO 062 02 02 01 (19). The text will be amended as follows: ~~Explain~~ State that on modern aircraft the BFO is activated automatically.

comment	*121-D* comment by: *KLM Flight Academy* 02 02 (01) Use 'electronic display' instead of 'electronic navigation display'. The fixed card indicator is also known as the relative bearing indicator (RBI) but on the other hand it is outdated in modern transport aviation. The same applies for the moving card indicator. There is no LO (nor in 062 nor in 022) that asks to explain or describe the RMI. Also in here, one only has to name the RMI. It would be good to add a LO (in subject 022 for instance) about the RMI (and about the CDI, the OBI, the VOR/ILS indicator, the HSI etc.) This would perfectly fit in the 022 LO's where also the technical aspects EFIS are mentioned. Another reason for this proposed move is that there is still a lot of confusion about the exact names. See also comments in the VOR and ILS part.
response	Thank you for your multiple comments. Regarding your comment referring to LO 062 02 02 02 (01): Accepted. EASA agrees to delete the wording ‘navigation’. The text will be amended as follows: Name the types of indicators commonly in use ~~in common use~~: — electronic ~~navigation~~ display; — r~~R~~adio m~~M~~agnetic i~~I~~ndicator (RMI); — fixed card ADF (radio compass);

	— moving card ADF. Regarding your comment referring to Subject 22: Not accepted. EASA does not agree to add an LO in Subject 022 about RMI. The construction of RBI, RMI, OBI or HSI is not relevant or required knowledge for a pilot. The pilot only needs to know how to use/interpret, which is covered by Subject 062.
comment	*122-D* comment by: *KLM Flight Academy* (01) Be clear on what power: the power of the transmitter
response	Accepted. Thank you for providing this comment referring to LO 062 02 02 03 (01). EASA agrees to the wording 'of the transmitter' after 'power'. The text will be amended as follows: State that the power of the transmitter limits the range of an NDB.
comment	*123-D* comment by: *KLM Flight Academy* (02) Recommend this as an LO for 062-01 basics, do not delete.
response	Accepted. Thank you for providing this comment referring to LO 062 02 02 03 (02). EASA agrees that this LO is relevant and will be retained.
comment	*124-D* comment by: *KLM Flight Academy* (05) sky waves and ground waves
response	Accepted. Thank you for providing this comment referring to LO 062 02 02 03 (05). The text will be amended as follows: Explain that interference between sky waves and ground waves ~~at night~~ leads to 'fading'.
comment	*125-D* comment by: *KLM Flight Academy* (05) Static emission or em radiation?
response	Partially accepted. Thank you for providing this comment referring to LO 062 02 02 05 (05). EASA agrees to change the wording but differently from your proposal. The text will be amended as follows: State that static ~~emission~~ radiation energy from a cumulonimbus cloud may interfere with the radio wave and influence the ADF bearing indication.

comment	*126-D* comment by: *DMU/RFK* This amendment generally appears very helpful in that it considers the operational usefulness and rapid technological advances. Comment: 062 06 01 01 (01). The syllabus should not refer to a specific number of "main GNSSs". Rationale: Development of GNSS systems has been continuous, worldwide, and will be so in any foreseeable future. The number of systems in operation will change, and the number of systems under construction is hardly well established at any fixed time. Thus the "correct" statement about this will at some time be different from the syllabus statement, which is bound to limit the general confidence in the syllabus, as the syllabus cannot realistically be updated to account for this at any time. Also the concept of "main GNSSs" is not defined and not operationally useful.
response	Noted Thank you for providing this general comment regarding GNSSs. EASA would like to point out that those LOs are describing the general valid aspects of all GNSSs. System-specific information seems to be of no practical use for the pilot. Naming the currently used GNSSs is important to know for a pilot.

comment	*127-D* comment by: *KLM Flight Academy* 03 00 Amend title to more complete description: "VHF omnidirectional range (VOR): Conventional VOR (CVOR) and Doppler VOR (DVOR)"
response	Accepted. Thank you for providing this comment referring to the heading of Subject 062 02 03 00. EASA agrees to change the wording of the heading. The text will be amended as follows: **VHF omnidirectional radio range (VOR): conventional VOR (CVOR) and Doppler VOR (DVOR)**

comment	*128-D* comment by: *KLM Flight Academy* (01) What is meant with 'operation'? working principle is more clear. Is knowledge of the ground based transmitter irrelevant?
response	Accepted. Thank you for providing this comment referring to LO 062 02 03 01 (01). EASA agrees to change the wording 'operation' to 'working principle'. The text will be amended as follows: Explain the ~~operation~~ working principle of VOR using the following general terms: — reference phase;

	— variable phase; — phase difference.

comment	*129-D* comment by: *KLM Flight Academy* (02) delete: "according to ICAO Annex 10" as is non info.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 03 01 (02). EASA does not agree to delete the reference to ICAO Annex 10.

comment	*130-D* comment by: *KLM Flight Academy* Pilots have to know difference between CVOR, DVOR, TVOR and VOT as it is stated in documents like AIP.
response	Accepted. Thank you for providing this comment referring to LO 062 02 03 01 (04). EASA agrees that this LO is relevant and will be retained. In comments 68-D and 335-D, the same issue was raised regarding this LO.

comment	*131-D* comment by: *KLM Flight Academy* (05) 'is transmitted' or 'can be transmitted'? Can this still be recalled a TVOR?
response	Not accepted. Thank you for providing this comment referring to LO 062 02 03 01 (05). EASA does not agree to reword this LO.

comment	*132-D* comment by: *KLM Flight Academy* (07) If here, then do the same for ADF/NDB.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 03 01 (07). EASA does not agree to reword this LO.

comment	*133-D* comment by: *KLM Flight Academy* (08) Annex 10 is non info
response	Not accepted. Thank you for providing this comment referring to LO 062 02 03 01 (08). EASA does not agree to delete the reference to ICAO Annex 10.

comment	*134-D* comment by: *KLM Flight Academy* (02) Is the term 'CDI' standardised. A CDI is the needle halfway the coursepointer that can deflect sidewards along a dotted scale. The CDI can be found on an HSI but also on a (conventional) VOR indicator.
response	Noted. Thank you for providing this comment referring to LO 062 02 03 02 (02). EASA acknowledges your comment.

comment	*135-D* comment by: *KLM Flight Academy* (03) The deleted part of the LO stated "considering also....'. That is relevant. Pls do not delete this part as it is important for the positional awareness.
response	Accepted. Thank you for providing this comment referring to LO 062 02 03 02 (03). EASA agrees that the last deleted part of this LO is relevant and will be retained.

comment	*136-D* comment by: *KLM Flight Academy* When pilots do a walk-around inspection they must know something on which antenna is what. Same remark for the ADF antenna, the airborne VOR antenna and the different ILS antennas.
response	Noted. Thank you for providing this general comment. EASA agrees that a pilot should have knowledge of the antennae during a walk-around, this is part of the type rating or class rating preceding and during the practical flight training.

comment	*137-D* comment by: *KLM Flight Academy* (03) It would be good to distinguish between a 'normal' DME and an ILS DME as the ILS-DME has a different time delay in order to have the zero readout at both runway ends. I miss this info in the ILS LO's.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 04 01 (03). EASA considers the LO to be correct.

comment	*138-D* comment by: *KLM Flight Academy* (04) Better LO level is: "explain". Now a candidate can state 'slant range' without knowing what it means.

response	Accepted. Thank you for providing this comment referring to LO 062 02 04 01 (04). EASA agrees that this LO should be reworded. The text will be amended as follows: ~~State~~ Explain that the distance measured by DME is slant range. In comment 60-D, the same issue was raised regarding this LO.

comment	*139-D* comment by: *KLM Flight Academy* (07) More precise: ...co-location 'with VOR and ILS'...
response	Accepted. Thank you for providing this comment referring to LO 062 02 04 01 (07). EASA agrees that this LO should be more precise and reworded. The text will be amended as follows: Describe, in the case of co-location with VOR and ILS, the frequency pairing and identification procedure.

comment	*140-D* comment by: *KLM Flight Academy* (09) Better level: Explain how this can be done and that a fictive VHF freq is used.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 04 01 (09). EASA considers the LO to be correct.

comment	*141-D* comment by: *KLM Flight Academy* (02) altitude or height?
response	Not accepted. Thank you for providing this comment referring to LO 062 02 04 02 (02). EASA considers the LO to be correct.

comment	*142-D* comment by: *KLM Flight Academy* (04) Time to station also?
response	Accepted. Thank you for providing this comment referring to LO 062 02 04 02 (04). EASA agrees that this LO should be reworded. The text will be amended as follows: State that a DME system may have a ground speed and time to station read-out

	combined with the DME read-out.

comment	*143-D* comment by: *KLM Flight Academy* (02) In very busy airspace this may be the reason why the DME does not give a distance when within the range of the space waves. It is good pilots know the DME has normally sufficient but still limited capacity while VOR and NDB have unlimited capacity.
response	Accepted. Thank you for providing this comment referring to LOs 062 02 04 03 (01) and (02). EASA agrees that these LOs are relevant and will be retained. In comment 56-D, the same issue was raised regarding this LO.

comment	*144-D* comment by: *KLM Flight Academy* 04 (01) Somewhere something has to be stated about the accuracy of DME. Here or in a PBN LO. Pilots must have an idea about the accuracy of the presented ranges.
response	Accepted. Thank you for providing this comment referring to LO 062 02 04 04 (01). ICAO Annex 10 no longer gives a clear definition of total system error and therefore the LO remains deleted. In comment 60-D, the same issue was raised regarding this LO.

comment	*145-D* comment by: *KLM Flight Academy* Missing is an LO about information on the ILS-DME. For instance location halfway the runway with time correction to have a zero-readout at both rwy ends? Improved accuracy for ILS-DME? Maybe implement in the DME-LO's?
response	Not accepted. Thank you for providing this comment referring to Subject 062 02 05 00 ‘ILS’. EASA is of the opinion that there is no DME information missing in the LOs. The DME information at the threshold is stated in the chart. Whether the zero read-out is changed or not, this information is not relevant for flight operation.

comment	*146-D* comment by: *KLM Flight Academy* (02) How important are the exact numbers? Maybe: "The GP antenna is located alongside the touchdown zone."
response	Accepted. Thank you for providing this comment referring to LO 062 02 05 01 (02). EASA agrees to delete the reference to ‘300 m’. The text will be amended as follows:

State the site locations of the ILS components:

— the ~~localiser~~LOC antenna should be located on the extension of the runway centre line at the stop-end;

— the ~~glide-path~~GP antenna should be located ~~300 m~~ beyond the runway threshold, laterally displaced ~~approximately 120~~ m to the side of the runway centre line.

In comment 56-D, the same issue was raised regarding this LO.

comment *147-D* comment by: *KLM Flight Academy*

(05) From the LO's it is not clear that the assigned frequency band is for the LOC.

response Accepted.

Thank you for providing this comment referring to LO 062 02 05 01 (05).

EASA agrees to add 'LOC' after 'ILS frequency' in two instances.

The text will be amended as follows:

State that in the ILS LOC frequency assigned band 108.0–111.975 MHz, only frequencies which have an odd number in the first decimal are ILS LOC frequencies.

In comment 61-D, the same issue was raised regarding this LO.

comment *148-D* comment by: *KLM Flight Academy*

(09) Maybe change 'draw' in 'interpret' and then combine with (13)?

response Not accepted.

Thank you for providing this comment referring to LO 062 02 05 01 (09).

This LO was already deleted in the NPA text.

comment *149-D* comment by: *KLM Flight Academy*

(13) Would be good to mention the term "false glide path" in these LO's since the LO's will be used as a reference for text books and exam questions.

response Not accepted.

Thank you for providing this comment referring to LO 062 02 05 01 (13).

EASA considers the LO to be correct.

comment *150-D* comment by: *KLM Flight Academy*

(16) It is not clear that the MB receiver is always tuned to 75 MHz and therefore no extra control panel is necessary.
Maybe good to add extra LO about the ILS receiver (Rx) consisting of a LOC Rx, a GP Rx and a MB and/or DME Rx.
Are the IM and the MM still existing? Relevant? Many IM were transferred to

	remote areas to act as airway markers. Relevant or not?
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 01 (16). EASA considers the LO to be correct.

comment	*151-D* comment by: *KLM Flight Academy* It would be nice as to have this rule of thumb as an aid for the pilot to check if he/she is on a false glide path. The rule is principle that has to be in 060, the application is 033 so pls leave it here in 062.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 02 (02). EASA is of the opinion that this LO should remain deleted. This is covered in Subject 033.

comment	*152-D* comment by: *KLM Flight Academy* (08) last bullet: If relevant it should also be an LO for NDB's and VOR's.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 02 (08). EASA would like to point out that this LO refers to ILS and not to NDB and VOR.

comment	*153-D* comment by: *KLM Flight Academy* (10) The term 'modulation depth' is no longer an LO in 062 01, so % modulation can't be an LO either.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 02 (10). EASA is of the opinion that the percentage modulation should stay in this LO. The LO has already been modified and made simpler.

comment	*154-D* comment by: *KLM Flight Academy* (11) See previous remark on the CDI in the VOR LO's. CDI is the needle. CDI is the needle halfway the coursepointer that can deflect sidewards along a dotted scale. The CDI can be found on an HSI but also on a (conventional) VOR indicator.
response	Noted. Thank you for providing this comment referring to LO 062 02 05 02 (11).

comment	*155-D* comment by: *KLM Flight Academy*

	The term 'reversed sensing' should be mentioned in the LO's
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 02 (12). EASA considers the LO to be correct.

comment	*156-D* comment by: *KLM Flight Academy* (13) OBI is the right term, pls use this also in the VOR LO's
response	Accepted. Thank you for providing this comment referring to LO 062 02 05 02 (13). EASA will also use this term in 062 02 03 02 (02) instead of 'course deviation indicator (CDI)'. The text of 062 02 03 02 (02) will be amended as follows: Read off the angular displacement in relation to a preselected radial on a~~n~~ horizontal situation indicator (HSI) or omnibearing indicator (OBI).

comment	*157-D* comment by: *KLM Flight Academy* (01) Which centerline is meant at the GP? The GP centerline or the LOC centerline? See also LO 062 02 05 02 (11)
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 03 (01). EASA considers the LO to be correct.

comment	*158-D* comment by: *KLM Flight Academy* (02) Isn't this subject Operational Procedures? It would be good to define the three ILS performance (= facility) categories in here.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 04 (02). EASA considers the LO to be correct.

comment	*159-D* comment by: *KLM Flight Academy* (06) Is this OP 071?
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 04 (06). EASA considers the LO to be correct.

comment	*160-D* comment by: *KLM Flight Academy* (07) Looking at this comment one has to rephrase last part of this LO text as well. This LO can move to Operational Procedures.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 04 (07). EASA considers the LO to be correct.

comment	*161-D* comment by: *KLM Flight Academy* (08) 'Scalloping' and 'beam noise' no longer applicable? Knowledge is practical.
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 04 (08). EASA considers the LO to be correct.

comment	*162-D* comment by: *KLM Flight Academy* (01) about or around? "All" ILS operations or only under IMC?
response	Not accepted. Thank you for providing this comment referring to LO 062 02 05 05 (01). EASA considers the LO to be correct.

comment	*163-D* comment by: *KLM Flight Academy* (01) MET? better ..weather observations..
response	Accepted. Thank you for providing this comment referring to LO 062 03 01 00 (01). EASA agrees to change 'MET' to read 'weather observations'. The text will be amended as follows: Name the different applications of radar with respect to air traffic control (ATC), ~~MET~~ weather observations, and airborne weather radar (AWR).

comment	*164-D* comment by: *KLM Flight Academy* (03) Would be good to keep in text about pulse length in order to let candidate understand why pulses can't be too long (min distance). What is meant with power? pulse power or antenna power? What is meant with: "and radar antenna"? also the height of the radar antenna or just the type of radar antenna? Therefore propose the following change: "State that the range of radar depends on pulse repetition frequency (PRF), pulse length, pulse power, height of aircraft, height of antenna and frequency used."

response | Accepted.
Thank you for providing this comment referring to LO 062 03 01 00 (03).
EASA agrees to reword this LO.
The text will be amended as follows:
~~Explain the relationship between the maximum theoretical range and the Pulse Repetition Frequency (PRF)~~ State that the range of a radar depends on pulse repetition frequency (PRF), pulse length, pulse power, height of aircraft, height of antenna and frequency used.

comment | *166-D* comment by: *KLM Flight Academy*
Ground radar.
Add an LO about the ground based antenna system: rotating antenna (speed of rotation in relation to distance and the concentration of echoes received for instance). Pilots do see the rotating antennae at airports and should know what they are for.
For the same reason it would be good to have an LO about how these echoes are visualised on a screen (and indeed without going too deep).

response | Not accepted.
Thank you for providing this comment referring to Subject 062 03 02 00.
EASA does not agree to add a new LO under this subject as the proposed text is more important for a traffic controller than for pilots.

comment | *167-D* comment by: *KLM Flight Academy*
Missing: LO on the approximate max range of the AWR

response | Not accepted.
Thank you for providing this comment referring to Subject 062 03 03 00.
EASA does not agree to write a new LO under this subject on the range of the AWR as it depends on the type of radar.

comment | *168-D* comment by: *KLM Flight Academy*
01 (01) Please add these two tasks in this LO.

response | Not accepted.
Thank you for providing this comment referring to LO 062 03 03 01 (01).
EASA sees no reason to amend the LO as the two tasks are already mentioned in the LO.

comment | *169-D* comment by: *KLM Flight Academy*
(02) It is good to give pilots a general understanding about frequencies and wavelengths in relation to target recognition. Especially at Wx radars this enhances

	their understanding about which 'target' are better received. Dry snow, wet hailstones or land for instance. (There is an LO that asks for the use of Wx radar at navigation). Proposal: State modern weather radars employ frequencies that give wavelengths of about 3 cm that reflect best on a wet hailstones."
response	Accepted. Thank you for providing this comment referring to LO 062 03 03 01 (02). EASA agrees to retain this LO and will reword this LO. The text will be amended as follows: ~~State the wavelength (approx. 3 cm) and frequency of most AWRs (approx. 9 GHz).~~ State that modern weather radars employ frequencies that give wavelengths of about 3 cm that reflect best on wet hailstones.

comment	*170-D* comment by: *KLM Flight Academy* (03) 'State' instead of 'explain how'? Proposal (slight text change): "State the antenna is stabilised in the horizontal plane with signals from the aircraft's attitude reference system."
response	Accepted. Thank you for providing this comment referring to LO 062 03 03 01 (03). EASA agrees to reword this LO. The text will be amended as follows: ~~Explain how~~ State the antenna is ~~attitude-~~stabilised in~~ relation to~~ the horizontal plane with signals from ~~using~~ the aircraft's attitude reference system.

comment	*171-D* comment by: *KLM Flight Academy* (05) 'depiction' or 'detection'? What must be described?
response	Accepted. Thank you for providing this comment referring to LO 062 03 03 01 (05). EASA agrees to reword this LO and will replace 'depiction' with 'detection'. The text will be amended as follows: Describe the cone-shaped pencil beam of about 3 to 5° beam width used for weather detection ~~depiction~~.

comment	*172-D* comment by: *KLM Flight Academy* (01) The listed items are not 'modes' but 'controls' "... functions and use of the following different controls on..." A pilot should know 'how' turbulence is detected in WX+T mode (using Doppler shifts)
response	Partially accepted.

	Thank you for providing this comment referring to LO 062 03 03 02 (01). EASA agrees to replace 'modes' with 'controls', but the pilot does not need to know how turbulence is detected (Doppler). The text will be amended as follows: Explain the functions of the following different ~~modes~~ controls on the radar control panel: — off/on switch; — function switch with WX, WX+T and MAP modes; — gain control setting (auto/manual); — tilt/autotilt switch.
comment	*173-D* comment by: *KLM Flight Academy* 03 (01) Please make more precise how to interpret the display. It is too general now. The strange thing is the candidate does not need to have knowledge about the colour display (deleted LO) but he/she must know how to use the radar for weather detection...
response	Not accepted. Thank you for providing this comment referring to LO 062 03 03 03 (01). EASA retains the LO as it is. The details for interpretation of the radar screen are in Subject 050.
comment	*174-D* comment by: *KLM Flight Academy* (04) Each time an LO starts with 'state (dis)advantages', the LO should also tell exactly which (dis)advantages one must know. Otherwise it becomes very subjective.
response	Accepted. Thank you for providing this comment referring to LO 062 03 04 01 (04). EASA agrees to reword this LO. The text will be amended as follows: ~~Explain~~ State the advantages of secondary surveillance radar (SSR) over a primary radar regarding range and collected information due to transponder principal information and active participation of the aircraft.
comment	*175-D* comment by: *KLM Flight Academy* (01) series of pulses is not relevant for mode A/C interrogators, so delete 'series' or add 'or pulse pairs'.
response	Accepted.

Thank you for providing this comment referring to LO 062 03 04 02 (01).

EASA agrees to reword this LO.

The text will be amended as follows:

(01) ~~Explain~~ State that the interrogator transmits its interrogations in the form of a series of pulse pairs.

comment *176-D* comment by: *KLM Flight Academy*

Combine: "Mode A, C and S."
From the LO's (02) and (04) it is not clear that Mode-S is the successor of Mode-A and Mode-C. Mode-S supplies 'flight data' that includes 'pressure altitude' but Mode-S must also supply the Mode A 'squawk code'. PLs be more clear on that in the (02) and (04) LO's.

response Partially accepted.

Thank you for providing this comment referring to LOs 062 03 04 02 (02) and (04).

EASA agrees to reword LO (02).

The text will be amended as follows:

Name ~~and explain~~ the interrogation modes:

— Mode A and C; and successor;

— ~~Intermode:~~

- ~~Mode A/C/S all call,~~
- ~~Mode A/C only all call;~~

— Mode S~~:~~.

- ~~Mode S only all call,~~
- ~~broadcast (no reply elicited),~~
- ~~selective.~~

The text of LO (04) remains the same.

comment *177-D* comment by: *KLM Flight Academy*

(04) 'decoding of the time between the interrogation pulses' or 'time interval between the pulse pairs' (also see rephrased (01).
In lieu of this, maybe it is better to combine (02) with (04).
Don't understand what is meant with 'aircraft selection'? Probably one means the possibility to address a specific aircraft, a group of aircraft or all aircraft.
In Mode-C (ALT) the TPR responds to Mode-A and to Mode-C interrogations.

response Partially accepted.

Thank you for providing this comment referring to LO 062 03 04 02 (04).

EASA does not agree to combine LO (02) with (04).

EASA agrees to reword this LO.

The text will be amended as follows:

Explain that the decoding of the time interval between the ~~interrogation~~ pulse pairs determines the operating mode of the transponder:

— Mode A: transmission of aircraft transponder code;

— Mode C: transmission of aircraft pressure altitude;

— Mode S: aircraft's address selection and transmission of flight data for the ground surveillance.

comment *178-D* comment by: *KLM Flight Academy*

(03) knowledge about the frequencies used is in relation to DME freq band and ADS-B frequencies necessary, so pls do not delete this LO.

response Partially accepted.

Thank you for providing this comment referring to LO 062 03 04 02 (03).

EASA agrees to retain and reword this LO.

The text will be amended as follows:

State that the interrogation frequency ~~is 1 030 MHz~~ and the reply frequency are different. ~~is 1 090 MHz~~.

In comment 340-D, a similar issue was raised regarding this LO.

comment *179-D* comment by: *KLM Flight Academy*

'reply 'or 'replies'?
Maybe add: "... and regardless of the altimeter subscale setting"?

response Not accepted.

Thank you for providing this comment referring to LO 062 03 04 02 (09).

EASA would like to keep the current LO text as is and sees no reason to add more details.

comment *180-D* comment by: *KLM Flight Academy*

(10) Improvement for clarification: "State that in addition to the information provided, on request from ATC, a special position identification (SPI) pulse can be transmitted but only as a result of a manual selection by the pilot (IDENT button)"

response Accepted.

Thank you for providing this comment referring to LO 062 03 04 02 (10).

EASA agrees to reword this LO.

The text will be amended as follows:

~~Explain~~ State that in addition to the information ~~pulses~~ provided, on request from ATC, a s~~S~~pecial p~~P~~osition i~~I~~dentification (SPI) pulse can be transmitted but only as a result of a manual selection by the pilot (IDENT button).

comment	*181-D* comment by: *KLM Flight Academy* (12) Do 'other" Mode-S transponders interrogate? Only TCAS interrogates Mode-A/C and S transponders; not he transponders themselves. Maybe confused with ADS-B in/out technology via Mode-S?
response	Accepted. Thank you for providing this comment referring to LO 062 03 04 02 (12). EASA agrees to reword this LO. The text will be amended as follows: Explain that Mode S transponders receive interrogations from TCAS, other Mode S transponders, and SSR ground stations.

comment	*182-D* comment by: *KLM Flight Academy* (13) better LO level: Explain the principle of selective addressing...
response	Not accepted. Thank you for providing this comment referring to LO 062 03 04 02 (13). EASA does not agree to change the LO level as it is enough for the pilot to have the knowledge as is, and 'state' instead of 'explain'.

comment	*183-D* comment by: *KLM Flight Academy* (14) The LO makes not clear what happens in case the transponder is replaced.
response	Not accepted. Thank you for providing this comment referring to LO 062 03 04 02 (14). EASA does not agree that a pilot should have this knowledge as it is more relevant for the maintenance department.

comment	*184-D* comment by: *KLM Flight Academy* Propose to combine (13), (18) and (19) to one LO
response	Accepted. Thank you for providing this comment referring to LOs 062 03 04 02 (13), (18) and (19). EASA agrees that these three LOs (13), (18) and (19) can be combined into one LO. EASA will delete LOs (18) and (19), and will reword LO (13). The text will be amended as follows: State that Mode S interrogation contains either the aircraft address, selective call or all call address ~~surveillance protocols implicitly use the principle of selective addressing~~. […] ~~(18) Interpret the following Mode S terms:~~

~~— selective addressing;~~

~~— mode 'all call';~~

~~selective call.~~

~~(19) State that Mode S interrogation contains either:~~

~~— aircraft address;~~

~~— all-call address;~~

~~— broadcast address.~~

In comment 64-D, the same issue was raised regarding these LOs.

comment

185-D comment by: *KLM Flight Academy*

Broadcast address exists or is that a contamination with ADS-B? Does this differ from all-call address?

response

Noted.

Thank you for providing this comment referring to LO 062 03 04 02 (26).

EASA would like to refer you to its response to comment 184-D.

comment

186-D comment by: *KLM Flight Academy*

(25) better LO level is 'State'

response

Accepted.

Thank you for providing this comment referring to LO 062 03 04 02 (25).

EASA agrees to reword this LO.

The text will be amended as follows:

~~Explain~~ State that Mode S can provide enhanced vertical tracking, using a 25-feet altitude increment.

In comment 64-D, the same issue was raised regarding this LO.

comment

187-D comment by: *KLM Flight Academy*

(26) Pilots must know the ADS-B system transmits info on the SSR frequencies without having been elicited. Level is not too high.

response

Not accepted.

Thank you for providing this comment referring to LO 062 03 04 02 (26).

EASA does not consider it necessary to change the taxonomy indicator as for a pilot it is sufficient to use 'state'.

comment

188-D comment by: *KLM Flight Academy*

(02) 'ATS' or 'ATC'?

	Deletion of the summary is a pity. How does a candidate know what to learn if it is made so general?
response	Accepted. Thank you for providing this comment referring to LO 062 03 04 03 (02). EASA agrees to retain the examples in this LO and the wording 'ATS' will be replaced with 'ATC'. The text will be amended as follows: ~~Illustrate how~~ State which ~~the following~~ information ~~is~~ can be presented on the AT~~S~~C display system ~~radar screen:~~: — pressure altitude; — flight level; — flight number or aircraft registration; — ground speed.

comment	*189-D* comment by: *KLM Flight Academy* (04) 'Explain the use and function' instead of 'interpret'. The information on a screen can be interpreted. Pls add 'Mode-S' and the 'REPLY' lamp.
response	Accepted. Thank you for providing this comment referring to LO 062 03 04 03 (04). EASA agrees to reword this LO. The text will be amended as follows: ~~Interpret the~~ Explain the use and function of the selector modes: OFF, Standby, ON (Mode A), ALT (Mode A, C and S~~C~~), ~~and~~ TEST and of the reply lamp.

comment	*190-D* comment by: *KLM Flight Academy* The next LO's on elementary surveillance and enhanced surveillance are too detailed for subject 062. These LO's fit better in the subjects Communications and/or Air Law where the role of the air traffic controller is highlighted. Propose to stick here (062) to the difference between el. surv and enh. surv (number and type of parameters) and what the onboard requirements are.
response	Not accepted. Thank you for providing this comment referring to Subject 062 03 04 03. EASA would like to state that as most of the following LOs are deleted, they are not transferred to Communication/Air Law. There is no elementary surveillance any more.

comment	*191-D* comment by: *KLM Flight Academy*

	(08) not relevant for 062
response	Accepted. Thank you for providing this comment referring to LO 062 03 04 03 (08). EASA agrees that this LO is not relevant for a pilot and will be deleted. In comment 64-D, the same issue was raised regarding LOs (06), (07), (08) and (09). EASA agrees that elementary surveillance is outdated and will delete those four LOs and the heading. The text will be deleted as follows: ~~***ELEMENTARY SURVEILLANCE***~~ ~~(06) Explain that the elementary surveillance provides the ATC controller with the aircraft's position, altitude and identification.~~ ~~(07) State that the elementary surveillance needs Mode S transponders with Surveillance Identifier (SI) code capacity and the automatic reporting of aircraft identification, known as ICAO Level 2s.~~ ~~(08) State that the SI code must correspond to the aircraft identification specified in item 7 of the ICAO flight plan or to the registration marking.~~ ~~(09) State that only the ICAO identification format is compatible with the ATS ground system.~~

comment	*192-D* comment by: *KLM Flight Academy* (09) not relevant for 062
response	Accepted. Thank you for providing this comment referring to LO 062 03 04 03 (09). EASA agrees that this LO is not relevant for a pilot and will be deleted. See above EASA's response to your comment 191-D.

comment	*193-D* comment by: *KLM Flight Academy* (14) trivial, not to be examined. Delete this LO
response	Accepted. Thank you for providing this comment referring to LO 062 03 04 03 (14). EASA agrees that LO (14) is a repetition of LO (13). In comment 64-D, a similar issue was raised regarding this LO. EASA agreed there to delete LOs (13), (14) and (15), and to formulate a new LO. The text will be amended as follows: ~~State that enhanced surveillance consists of the extraction of additional aircraft parameters known as Downlink Aircraft Parameters (DAP) consisting of:~~ ~~— magnetic heading;~~ ~~— indicated airspeed;~~ ~~— Mach number;~~

~~— vertical rate;~~

~~— roll angle;~~

~~— track angle rate;~~

~~— true track angle;~~

~~— ground speed;~~

~~— selected altitude.~~

State that every aircraft will have been allocated an ICAO Aircraft Address which is hard coded into the airframe Mode S transponder (Mode S address).

~~(14) Explain that the controller's information is improved by providing actual aircraft-derived data such as magnetic heading, indicated airspeed, vertical rate and selected altitude.~~

~~(15) Explain that the automatic extraction of an aircraft's parameters, and their presentation to the controller, will reduce their R/T workload and will free them to concentrate on ensuring the safe and efficient passage of air traffic.~~

comment

194-D comment by: *KLM Flight Academy*

(15) trivial, delete this LO.

response

Accepted.

Thank you for providing this comment referring to LO 062 03 04 03 (15).

EASA agrees that this LO is not relevant for a pilot and will be deleted.

See above EASA's response to your comment 193-D.

comment

195-D comment by: *KLM Flight Academy*

Overall comment: GNSS LO's have quite a chaotic structure. Difficult to find your way through them and see the differences between the various systems.
E.g. Why is 062 06 01 00 called GPS and 062 06 01 02 again GNSS?

response

Partially accepted.

Thank you for providing this comment referring to Subject 062 06 00 00.

EASA agrees that this Chapter contains general statements, no principles.

The text will be amended as follows:

062 06 01 00 ~~**Global positioning system (GPS), GLONASS, GALILEO**~~ **GNSS**

062 06 01 01 ~~**Principles**~~ ***General***

In comment 66-D, the same issue was raised regarding this LO.

comment

196-D comment by: *KLM Flight Academy*

(05) For the understanding and general idea about GNSS it is necessary to know that satellites move in planes around the earth, so pls do not delete (05) and (06)

response	Not accepted. Thank you for providing this comment referring to LOs 062 06 00 00 (05) and (06). EASA will not retain those LOs because there is no practical use for a pilot.

comment	*197-D* comment by: *KLM Flight Academy* 01 02 The next LO's are about the NAVSTAR system and not about all satnav systems (GNSS).
response	Partially accepted. Thank you for providing this comment referring to the LOs under Subject 062 06 01 02. To make those LOs more clear, the heading 'Space segment' has been amended. The text will be amended as follows: ***Space segment (example: NAVSTAR GPS)*** In comment 273-D, the same issue was raised regarding this LO.

comment	*198-D* comment by: *KLM Flight Academy* (04) delete 'notional' as it is not relevant
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 02 (04). This LO was already deleted in the NPA text.

comment	*199-D* comment by: *KLM Flight Academy* (10) Make this BK as it is difficult to make an exam question about this LO and delete 'ranging'
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 02 (10). EASA considers the LO to be correct and that this not basic knowledge (BK).

comment	*200-D* comment by: *KLM Flight Academy* (17) Change ..about.. all into ..of all..
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 02 (17). This LO was already deleted in the NPA text.

comment	*201-D* comment by: *KLM Flight Academy* (21) Pls be more specific if this calculation takes place in the satellite or in the

	receiver. This (21) LO now falls under the space segment so it seems the calculation is done in the satellite... Take out "currently".
response	Partially accepted. Thank you for providing this comment referring to 062 06 01 02 (21). EASA agrees to delete the wording 'currently'; the rest of the LO is correct. The text will be amended as follows: State that an ionospheric model is ~~currently~~ used to calculate the time delay of the signal travelling through the ionosphere.

comment	*202-D* comment by: *KLM Flight Academy* (23) This (23) LO has nothing to do with the space segment. Move to the user segment.
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 02 (23). This LO was already deleted in the NPA text.

comment	*203-D* comment by: *KLM Flight Academy* (24) Confusing when comparing (10) and (14) with (24). This is the first time the SPS is mentioned. Currently there is no LO that refers to the meaning of SPS. Propose to make an LO about SPS and PPS
response	Accepted. Thank you for providing this comment referring to LO 062 06 01 02 (24). EASA agrees that LO (24) is linked with the deleted LOs (01), (11) and (12), and that these deleted LOs are necessary. LOs 062 06 01 02 (01), (11) and (12) will be retained. In comments 66-D and 203-a, similar issue was raised regarding this LO.

comment	*204-D* comment by: *KLM Flight Academy* (28) This is too little info. Flight crews must know the constellation is kept healthy by constant monitoring its performance and by updating satellites with fresh info. Monitoring stations near equator measure deviations twice a day and if necessary the master control station provides an update.
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 02 (28). EASA is of the opinion that your proposed information is too detailed. Next to that, EASA moved former LO (46) to this LO (28) based on comment 66-D.

comment	*205-D* comment by: *KLM Flight Academy* (31) GPS or GNSS? See previous remark. 'fix' or 'fixes'? One GPS gives one fix. Three-dimensional speed data means also direction and vertical speed.
response	Partially accepted. Thank you for providing this comment referring to LO 062 06 01 02 (31). EASA agrees to replace 'GPS' with 'GNSS' for LOs (31), (33), (34) and (38). In comment 66-D, a similar issue was raised regarding this replacement. The rest of the LO is correct and 'fixes' will remain.

comment	*206-D* comment by: *KLM Flight Academy* (35) 'satellite time references' or 'satellite's clock'? Simply refer to the receiver's clock error.
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 02 (35). EASA considers the LO to be correct.

comment	*207-D* comment by: *KLM Flight Academy* (37) Four spheres is nonsense. There are four unknown parameters, x, y, z and b (receiver clock error), which require measurement of ranges 4 different satellites in order to get the position. Pls amend the LO accordingly.
response	Accepted. Thank you for providing this comment referring to LO 062 06 01 02 (37). EASA agrees that this LO has to be reworded. The text will be amended as follows: State that ~~four spheres are needed to calculate a three-dimensional position, hence four satellites are required.~~ there are four unknown parameters, x, y, z and Δt (receiver clock error), which require the measurement of ranges to four different satellites in order to get the position.

comment	*208-D* comment by: *KLM Flight Academy* (38) better to remain using the same terms; Change time base into time reference
response	Accepted. Thank you for providing this comment referring to LO 062 06 01 02 (38). EASA agrees to replace 'base' with 'reference'. The text will be amended as follows: State that the ~~GPS~~ GNSS receiver is able to synchronise to the correct time ~~base~~ reference when receiving four satellites.

comment	*209-D* comment by: *KLM Flight Academy* (39) Don't understand this LO. Wording is not clear enough?. The SV itself does not has a Doppler shift, that only occurs at the reception. It seems that groundspeed can also be determined measuring the change in position over time?
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 02 (39). EASA considers the LO to be correct.

comment	*210-D* comment by: *KLM Flight Academy* Propose to combine (41) and (42)
response	Not accepted Thank you for providing this comment referring to LOs 062 06 01 02 (41) and (42). EASA is of the opinion that these LOs should be kept separate.

comment	*211-D* comment by: *KLM Flight Academy* (46) This info should also be an LO for GPS
response	Accepted. Thank you for providing this comment referring to LO 062 06 01 02 (46). EASA agrees to move LO (46) into LO (28). In comment 66-D, the same issue was raised regarding this LO.

comment	*212-D* comment by: *KLM Flight Academy* (57) Better for practical use: State that receivers can use both GPS and GLONASS satellite for positioning.
response	Partially accepted. Thank you for providing this comment referring to LO 062 06 01 02 (46). EASA agrees to add the wording ‘compatibility’ in this LO. The text will be amended as follows: State that agreements have been concluded between the appropriate agencies for the compatibility and interoperability by any approved user of NAVSTAR and GLONASS systems. In comment 66-D, the same issue was raised regarding this LO.

comment	*213-D* comment by: *KLM Flight Academy* 03 (01) Miss in next LO's how SV clock errors are corrected and/or if/how this affects GPS receiver. propose to add an LO about this.

response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 03 (01). EASA considers that an LO regarding how SV clock errors are corrected and/or if and how this affects GPS receiver, might be inserted at a future revision of the LOs.

comment	*214-D* comment by: *KLM Flight Academy* (02) What is the relevance of this LO as the civil GPS receiver only makes use of L1? See also previous remark on L1. Secondly, as stated before in the LO's already, use is made of an ionospheric model that also reduces these errors. so pls delete this one.
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 03 (02). EASA considers the LO to be correct. Future GNSS have two civil frequencies.

comment	*215-D* comment by: *KLM Flight Academy* Change dilution of position in dilution of precision
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 03 (05). EASA considers the LO to be correct.

comment	*216-D* comment by: *KLM Flight Academy* (05) Add an LO with info on good and poor DOPs
response	Not accepted. Thank you for providing this comment referring to LO 062 06 01 03 (05). EASA considers that an LO regarding information on good and poor DOPs might be inserted at a future revision of the LOs.

comment	*217-D* comment by: *KLM Flight Academy* (06) When listing these items, it is also important to know how to correct for orbital variations? Update of ephemeris data in nav message or use SV's engines
response	Noted. Thank you for providing this comment referring to LO 062 06 01 03 (06). Your comment is not clear to take action.

comment	*218-D* comment by: *KLM Flight Academy* (05) IN the light of PBN this LO has to be adjusted to three dimensional. Propose to amend the LO to:

	The precision approach service provides three dimensional deviation guidance to support PBN in terminal areas.
response	Partially accepted. Thank you for providing this comment referring to LO 062 06 02 01 (05). EASA agrees to reword this LO. The text will be amended as follows: ~~Explain~~ State that GBAS ~~ground~~ provides information for guidance in the terminal area, and for three-dimensional guidance in the final approach segment (FAS) by transmitting the FAS data block. ~~subsystems provide two services: precision approach service and GBAS positioning service.~~ ~~The precision approach service provides deviation guidance for final approach Segments, while the GBAS positioning service provides horizontal position information to support RNAV operations in terminal areas.~~ In comment 66-D, the same issue was raised regarding this LO.

comment	*219-D* comment by: *KLM Flight Academy* (01) Better change ..the signal errors transmitted by GNSS satellites ... in ..the errors in the signals received from the satellites... Satellites do not transmit ionospheric errors.
response	Accepted. Thank you for providing this comment referring to LO 062 06 02 02 (01). EASA agrees to replace the wording 'the signal errors transmitted by GNSS satellites' with 'the errors in the signals received from the satellites'. The text will be amended as follows: Explain the principle of an SBAS: to measure on the ground the ~~signal~~ errors in the signals received from the ~~transmitted by GNSS~~ satellites and transmit differential corrections and integrity messages for navigation satellites.

comment	*220-D* comment by: *KLM Flight Academy* (04) better LO level is 'state'.
response	Accepted. Thank you for providing this comment referring to LO 062 06 02 02 (04). EASA agrees to replace 'Explain' with 'State'. The text will be amended as follows: ~~Explain~~ State that pseudo-range measurements to these geostationary satellites can also be made, as if they were GPS satellites.

comment	*221-D* comment by: *KLM Flight Academy* (05) SBAS makes use of communication satellites and can not be called SBAS

	satellites. Is it necessary to have a separate SBAS receiver on board of the aircraft?
response	Accepted. Thank you for providing this comment referring to LO 062 06 02 02 (05). EASA agrees that the wording of this LO is not clear and will be reworded. The text will be amended as follows: State that SBAS consists of ~~three~~ two elements: — ~~the~~ ground infrastructure (monitoring and processing stations); — ~~the SBAS~~ communication satellites~~;~~. — ~~the SBAS airborne receivers.~~

comment	*222-D* comment by: *KLM Flight Academy* (06) Ranging source or 'satellite'. Pls be consistent in the use of same terms. I've seen 'satellite', 'space vehicle (SV) and 'ranging source'. Which clock errors? The applicable GNSS system takes care of correcting for their satellite clock errors. How does the user apply corrections for tropospheric delay? Term 'tropospheric delay' not stated elsewhere in LO's.
response	Noted. Thank you for providing this comment referring to LO 062 06 02 02 (06). This LO was already deleted in the NPA text.

comment	*223-D* comment by: *KLM Flight Academy* (07) propose to combine this with (06). APV is not described in the LO's.
response	Not accepted. Thank you for providing this comment referring to LO 062 06 02 02 (07). LO (06) is deleted, therefore cannot be combined with this LO (07).

comment	*224-D* comment by: *KLM Flight Academy* (09) I would not say 'include'. Each of the mentioned systems is SBAS. Proposal: "State the following examples of SBAS:"
response	Accepted. Thank you for providing this comment referring to LO 062 06 02 02 (09). EASA agrees that the wording of this LO is not clear and will be reworded. The text will be amended as follows: State the following examples of ~~that~~ ~~Satellite-Based Augmentation Systems~~SBASs ~~include~~:

	— European Geostationary Navigation Overlay Service (EGNOS) in western Europe and the Mediterranean; — wide area augmentation system (WAAS) in the USA; — multi-functional transport satellite (MTSAT)-based augmentation system (MSAS) in Japan; — GPS and geostationary earth orbit augmented navigation (GAGAN) in India. In comment 276-D, the same issue was raised regarding this LO.

comment	*225-D* comment by: *KLM Flight Academy* (01) pls be more clear about 'lookalike signals'
response	Noted. Thank you for providing this comment referring to LO 062 06 02 03 (01). This LO was already deleted in the NPA text.

comment	*226-D* comment by: *KLM Flight Academy* (02) it is tricky to express the accuracy in metres as no error theory about drms or R95 has been in an LO. Propose to amend to: ....to improve accuracy significantly.
response	Partially accepted. Thank you for providing this comment referring to LO 062 06 02 03 (02). EASA agrees that this LO should be reworded, but slightly differently from your proposal. The text will be amended as follows: State that ~~EGNOS~~ SBAS is designed to improve accuracy ~~to 1–2 m horizontally and 3–5 m vertically~~ and integrity significantly. In comment 66-D, the same issue was raised regarding this LO.

comment	*227-D* comment by: *KLM Flight Academy* (03) delete (up to 3 hours GPS alone) as this can vary and is not important to know.
response	Accepted. Thank you for providing this comment referring to LO 062 06 02 03 (03). EASA agrees that this LO should be reworded and add wording regarding alerting the SBAS users. The text will be amended as follows: Explain that integrity and safety are improved by alerting SBAS users within 6 seconds if a GPS malfunction occurs ~~(up to 3 hours GPS alone)~~. In comment 66-D, the same issue was raised regarding this LO.

comment	*228-D* comment by: *KLM Flight Academy* (04) replace IRS inertial reference system for INS. INS is outdated.
response	Accepted. Thank you for providing this comment referring to LO 062 06 02 03 (04). EASA agrees to delete the last wording of this LO and replace it with 'inertial reference system (IRS)'. The text will be amended as follows: Explain that the typical sensors used are barometric altimeter and inertial reference system (IRS) ~~inertial navigation system~~. In comments 66-D and 344-D, the same issue was raised regarding this LO.

comment	*229-D* comment by: *KLM Flight Academy* (01) It is not clear what is meant with 'redundant elements within the GPS constellation'. Measurement to more than 4 SV's of the same constellation or a combination of GPS NAVSTAR with GLONASS for instance? Pls change 'inertial systems' in 'inertial reference systems'. Better is to take out this text between brackets as it is perfectly stated in the (04) LO.
response	Not accepted. Thank you for providing this comment referring to LO 062 06 02 04 (01). EASA considers the LO to be correct.

comment	*230-D* comment by: *KLM Flight Academy* (04) 'system error' or 'total system error'? Also see 062 07 02 03 (01).
response	Partially accepted. Thank you for providing this comment referring to LO 062 07 01 01 (04). EASA agrees that this LO should be reworded, but differently from your proposal. The text will be amended as follows: Define accuracy as the conformance of the true position and the required position. In comments 69-D and 268-D, the same issue was raised regarding this LO.

comment	*231-D* comment by: *KLM Flight Academy* (06) A 'warning' is a special type of 'alert'. Alerts are classified in 'advisories, cautions and warnings'.
response	Accepted. Thank you for providing this comment referring to LO 062 07 01 01 (06). EASA agrees to rephrase the last wording of this LO.

	The text will be amended as follows: ~~Explain the concept of integrity.~~ Define integrity as a measure of the trust that can be placed in the correctness of the information supplied by the total system. Integrity includes the ability of a system to provide timely and valid alerts to the user. In comment 69-D, the same issue was raised regarding this LO.

comment	*232-D* comment by: *KLM Flight Academy* (01) 'phases of flight' or 'areas'?
response	Noted. Thank you for providing this comment referring to LO 062 07 01 03 (01). It is 'phases of flight'.

comment	*233-D* comment by: *KLM Flight Academy* 02 (01) g/s to be abbreviated as GS
response	Accepted. Thank you for providing this comment referring to LO 062 07 02 02 (01). EASA agrees to replace 'g/s' with 'GS'. The text will be amended as follows: List the basic functional requirements of RNAV and RNP specifications (continuous indication of lateral deviation, distance/bearing to active waypoint, ~~g/s~~ GS or time to active waypoint, navigation data storage and failure indication). In comment 69-D, the same issue was raised regarding 'g/s' in this LO.

comment	*234-D* comment by: *KLM Flight Academy* (03) LO (03) until (11) do not belong to subject 062 Radio Navigation but to subject Operational Procedures.
response	Not accepted. Thank you for providing this comment referring to LO 062 07 02 02 (03). For EASA, this is Subject 062 knowledge.

comment	*235-D* comment by: *KLM Flight Academy* 062 07 03 03 Move this chapter to 071 Operational Procedures
response	Not accepted. Thank you for providing this comment referring to Subject 062 07 03 03. For EASA, this is Subject 062 knowledge.

comment	*236-D* comment by: *KLM Flight Academy* (08) "Define'... instead of 'recognize the definition of'....
response	Accepted Thank you for providing this comment referring to LO 062 07 03 03 (08). EASA agrees to reword this LO. The text will be amended as follows: ~~Recognise the definition of an~~ Define the term 'offset flight path'.

comment	*237-D* comment by: *KLM Flight Academy* 07 04 01 This chapter fits better in 071 Operational Procedures
response	Not accepted. Thank you for providing this comment referring to Subject 062 07 04 01. For EASA, this is Subject 062 knowledge.

comment	*238-D* comment by: *KLM Flight Academy* 07 04 03 chapter fits better in 071
response	Not accepted. Thank you for providing this comment referring to Subject 062 07 04 03. For EASA, this is Subject 062 knowledge.

comment	*239-D* comment by: *KLM Flight Academy* 07 05 00 Complete chapter fits better in Operational Procedures. Subject Radio Navigation should cover more technical, architectural, conceptual aspects. Operational use is OP!
response	Not accepted. Thank you for providing this comment referring to Subject 062 07 05 00. For EASA, this is Subject 062 knowledge.

comment	*240-D* comment by: *KLM Flight Academy* (02) What is meant with a 'satnaderd time limitation'. Pls clarify.
response	Partially accepted. Thank you for providing this comment referring to LO 062 07 05 01 (02). EASA agrees that this LO (02) is not clear and will delete it.

comment	*268-D* comment by: *Julian Scarfe* I was the original author of the PBN LOs included in RMT.0256 on PBN. In general,

	the proposals in the NPA improve the LOs, both in terms of the editorial consistency and the consistent use of standard verbs. There are a few technical points that I would ask the review group to consider please. 062 07 01 01 (04) Define accuracy as the stated limits for the system error to be within for 95 % of the flight time. I don't agree with the definition as written. The accuracy is the degree of conformance of the measured/indicated position with the true position. It is not a limit. The accuracy **requirement** in a PBN specification is expressed as the accuracy expected to be achieved at least 95 per cent of the flight time by the population of aircraft operating within the airspace, route or procedure. But this is captured separately in 062 07 02 03 (01). While a definition in terms of TSE might be set out, it doesn't serve much purpose. I suggest you drop 062 07 01 01 (04).
response	Partially accepted. Thank you for providing this comment referring to LO 062 07 01 01 (04). EASA agrees that this LO (04) is not clear and will reword it. The text will be amended as follows: Define accuracy as the conformance of the true position and the required position. In comments 69-D and 230-D, the same issue was raised regarding this LO.

comment	*269-D* comment by: *Julian Scarfe* 062 07 04 01 (01) I don't agree that PDE is assumed to be zero in general. For some nav specs, it is assumed to be "negligible". For others, particularly where the route is not retrieved from a database, it needs consideration. There's a cultural aspect of this about not assuming that the magenta line is always a correct representation of the required path. For this reason, I propose reinstating 062 07 04 02 (06)
response	Thank you for your multiple comments. Regarding your comment referring to LO 062 07 04 01 (01): Accepted. EASA agrees that the last part of the sentence should be deleted. The text will be amended as follows: ~~Recognise the definition of path definition error.~~ Define 'path definition error (PDE)'. Regarding your comment referring to LO 062 07 04 02 (06): Accepted. EASA agrees that PDE is an important term that is used in the PBN documentation and therefore this LO (06) will be retained.

comment	*270-D* comment by: *Julian Scarfe* 062 07 02 03 (04) (07) (08) are appropriate for the CBIR/EIR. RNAV 5, RNAV/RNP 1/2 and RNP APCH will be encountered by a CBIR/EIR pilot RNAV 10, RNP 4 and RNP AR APCH are unlikely to be encountered in a non-HPA.

response	Accepted. Thank you for providing this comment referring to LOs 062 07 02 03 (04), (07) and (08). EASA agrees that LOs 062 07 02 03 (04), (07) and (08) are relevant for CB-IR(A)/EIR and an 'X' will be marked in the 'CB-IR(A)/EIR' column. In comment 289-D, the same issue was raised regarding this LO.

comment	*271-D* comment by: *Julian Scarfe* 062 07 05 02, 062 07 05 03 and 062 07 05 05 should be included for the CBIR/EIR RNAV 5, RNAV/RNP 1/2 and RNP APCH will be encountered by a CBIR/EIR pilot RNAV 10, RNP 4 and RNP AR APCH are unlikely to be encountered in a non-HPA.
response	Accepted. Thank you for providing this comment referring to the LOs under Subject 062 07 05 02, 062 07 05 03 and 062 07 05 05. EASA agrees these LOs are relevant for CB-IR(A)/EIR and an 'X' will be marked in the 'CB-IR(A)/EIR' column. In comment 292-D, the same issue was raised regarding this LO.

comment	*273-D* comment by: *ESSP-SAS* Page 203, 062 06 01 02 "NAVSTAR GPS" is replaced by "Global navigation satellite system (GNSS)", the more generic, but subsequent items refer to specific GPS characteristics: (04), (17), (23), (31), etc. It is recommended to either modify these specific items and make them more generic or to add equivalent references to other constellations.
response	Partially accepted. Thank you for providing this comment referring to the LOs under Subject 062 06 01 02 To make those LOs more clear, the heading 'Space segment' has been amended. The text will be amended as follows: ***Space segment (example: NAVSTAR GPS)*** In comment 197-D, the same issue was raised regarding this LO.

comment	*274-D* comment by: *ESSP-SAS* Page 206, 062 06 01 02 References to PRN (Pseudo-Random Noise) have been eliminated due to "No practical use". However, in many GNSS navigators the pilot may access to the "GPS status page" and see a skyplot with tracked and visible satellites on it. The satellites are identified with PRN codes. Thus it is recommended to at least make pilots know that PRN codes can be used to

identify individual satellites.

response

Accepted.

Thank you for providing this comment referring to LO 062 06 01 02 (14).

EASA agrees that this LO should be reworded.

The text will be amended as follows:

~~State that the ranging signal contains a Coarse Acquisition (C/A) code and a navigational data message.~~ State that the satellites transmit a coded signal used for ranging, identification (satellite individual PRN code), timing and navigation.

In comment 66-D, a similar issue was raised regarding this LO.

comment

275-D comment by: *ESSP-SAS*

Page 219, 062 06 02 02

(07) Wording is not exact enough, and from a certain viewpoint it is not applicable in accordance to latest ICAO Annex 6 and 14 standards. It is recommended to note the following remarks and amend the wording as appropriate:
- SBAS does not provide approaches. This sentence is too vague. SBAS is an enabler to implement instrument approach procedures compliant with ICAO Annex 10 APV and CAT-I performances. Such approach procedures are published with a LPV line of minima.
- With the latest wording, SBAS allows for the implementation of 3D Type A and B operations, it does not make sense anymore to talk about NPA or PA approaches.

response

Partially accepted.

Thank you for providing this comment referring to LO 062 06 02 02 (07).

EASA agrees that this LO should be reworded, but slightly differently from your proposal.

The text will be amended as follows:

~~Explain~~ State that SBAS allows the implementation of ~~3D~~ three-dimensional Type A and Type B approaches. ~~can provide approach and landing operations with vertical guidance (APV) and precision approach service.~~

comment

276-D comment by: *ESSP-SAS*

Page 219, 062 06 02 02
(09) EGNOS Service Area covers not only western Europe, but also central and parts of eastern Europe (Bulgaria, Romania, Western Ukraine, etc...). It is suggested to remove "western" from the sentence.

response

Accepted.

Thank you for providing this comment referring to LO 062 06 02 02 (09).

EASA agrees that the wording of this LO is not clear and will be reworded.

The text will be amended as follows:

State the following examples of ~~that~~ ~~Satellite-Based Augmentation Systems~~SBASs ~~include~~:

— European Geostationary Navigation Overlay Service (EGNOS) in western Europe and the Mediterranean;

— wide area augmentation system (WAAS) in the USA;

— multi-functional transport satellite (MTSAT)-based augmentation system (MSAS) in Japan;

— GPS and geostationary earth orbit augmented navigation (GAGAN) in India.

In comment 223-D, the same issue was raised regarding this LO.

comment

277-D comment by: *ESSP-SAS*

Page 219, 062 06 02 02

(10) As of August 2016, none of the operational SBAS is augmenting GLONASS. If GLONASS is to be maintained, the it is recommended to include Galileo as EGNOS will augment it in the future.

response

Noted.

Thank you for providing this comment referring to LO 062 06 02 02 (10).

This LO was already deleted in the NPA text.

comment

278-D comment by: *ESSP-SAS*

Page 219 062 06 02 03

Some EGNOS payloads in Immarsat satellites have been retired from EGNOS Space Segment and replaced by payloads in ASTRA satellites. Check https://egnos-user-support.essp-sas.eu/new_egnos_ops/?q=content/service-implementation-roadmaps for latest status.

response

Noted.

Thank you for providing this comment referring to Subject 062 06 02 03.

EASA is of the opinion that the names of the satellites are not interesting for pilots.

comment

279-D comment by: *ESSP-SAS*

Page 222, 062 07 01 01

(08) There are practical uses of this and an example makes the PBN concept more understandable. The most evident case is for RNAV 1 implementation, which in most cases is based on DME/DME or on GNSS, there are examples of both cases all around Europe.

response

Partially accepted.

Thank you for providing this comment referring to LO 062 07 01 01 (08).

	EASA retained LO (08) based on comment 340-D. EASA will not introduce your examples in the retained LO.

comment	*280-D* comment by: *ESSP-SAS* Page 225, 062 07 03 02 Some PBN specifications (RNP-AR for example) require, or will require, specific operational approvals. Maintaining this item, or including it in another syllabus reference, would make pilots aware of their privileges once in flight.
response	Not accepted. Thank you for providing this comment referring to Subject 062 07 03 02. EASA does not agree with your argumentation. The necessary authorisation, for example RNP AR APCH, is in 062 07 05 06.

comment	*281-D* comment by: *ESSP-SAS* Page 231, 062 07 05 05 (04) Prior tothis reference, it is suggested to include a new one with a requirement to explain the difference between "advisory" vertical guidance, as offered by some modern avionics, and "certified" vertical guidance.
response	Not accepted. Thank you for providing this comment referring to LO 062 07 05 05 (04). EASA does not see the need to include a new LO on this matter. The vertical guidance is defined by the published procedure.

comment	*282-D* comment by: *ESSP-SAS* Page 232, 062 07 05 05 (11) "State that the FAS data block is a standard data format to describe the final approach path." It is suggested to write "describe and identify".
response	Not accepted. Thank you for providing this comment referring to LO 062 07 05 05 (11). With this LO, EASA's intention is just to mention the FAS data block. FAS is a data block that describes only.

comment	*289-D* comment by: *Aero-Club of Switzerland* page 223ff/233 062 07 02 03 We propose to add to the CB.IR/EIR list the following topics to the one's already mentioned:

(04)
(07)
(08)
(09)
(10)
(11) New

Rationale:
In our view these items are appropriate to cover the needs of CB-IR and EIT rating holders, these items are not a burden, they enhance understanding what it is about.

response

Partially accepted.

Thank you for providing this comment referring to LOs 062 07 02 03 (04), (07), (08) and (09).

EASA agrees that LOs 062 07 02 03 (04), (07), (08) and (09) are relevant for CB-IR(A)/EIR and an 'X' will be marked in the 'CB-IR(A)/EIR' column.

In comment 270-D, the same issue was raised regarding these LOs.

comment

292-D comment by: *Aero-Club of Switzerland*

Page 228ff/233
Requirements of specific RNAV and RNP specifications
062 07 05 02
062 07 05 03
062 07 05 05
062 07 05 08
062 07 05 09
should be added to the CB-IR/EIR column.

Rationale:
Adding these items completes knowledge whose application will be operationally helpful for aeroplane and for rotary wing flight crews, we believe.

response

Partially accepted.

Thank you for providing this comment referring to the LOs under Subject 062 07 05 02, 062 07 05 03, 062 07 05 05, 062 07 05 08 and 062 07 05 09.

EASA agrees the LOs under Subject 062 07 05 02, 062 07 05 03 and 062 07 05 05 are relevant for CB-IR(A)/EIR and an 'X' will be marked in the 'CB-IR(A)/EIR' column.

In comment 271-D, the same issue was raised regarding these LOs.

The LOs under Subject 062 07 05 08 and 062 07 05 09 are for helicopters only.

comment

330-D comment by: *DGAC FRANCE*

Doc D
Page 138/233

Subject:

SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 01 01 03
Frequency bands, sidebands, single sideband
~~LO (02) State that when a carrier wave is modulated, the resultant radiation consists of the carrier frequency plus additional upper and lower sidebands..~~
~~LO (03) State that HF VOLMET and HF two way communication use a single sideband.~~

Content of comment:
We do not agree with the comment "No practical use".
EASA decided to delete the basic knowledge for applicants beginning the theoretical training in ATO, because they normally have the request level.
Which is the used way to know the level of trainees?

Alternative draft for proposed amendment

Add the following LOs in topic 062 01 01 03

LO (02) State that when a carrier wave is modulated, the resultant radiation consists of the carrier frequency plus additional upper and lower sidebands
LO (03) State that HF VOLMET and HF two way communication use a single sideband.

response

Accepted.

Thank you for providing this comment referring to LOs 062 01 01 03 (02) and (03).

EASA agrees that these LOs are relevant and will be retained.

In comment 65-D, a similar issue was raised regarding this LO.

comment *331-D* comment by: *DGAC FRANCE*

Doc D
Page 138/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 01 01 04
~~*Pulse characteristics*~~
~~LO (01) Define the following terms as associated with a pulse string :~~
~~- *Pulse length,*~~
~~*Pulse power,*~~
~~*Continuous power*~~

Content of comment:
We do not agree with the comment "No practical use".
EASA decided to delete the basic knowledge for applicants beginning the theoretical training in ATO, because they normally have the request level.
Which is the used way to know the level of trainees?

Alternative draft for proposed amendment

Add the following LO in topic 062 01 01 04

LO (01) Define the following terms as associated with a pulse string :
- *Pulse length,*
- *Pulse power,*
- *Continuous power*

response

Accepted.

Thank you for providing this comment referring to LO 062 01 01 04 (01).

EASA agrees that in order to understand the explanations of weather radar, surveillance radar, etc., this LO is relevant and will be retained.

In comment 65-D, the same issue was raised regarding this LO.

comment *332-D* comment by: *DGAC FRANCE*

Doc D
Page 145/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 02 01 02
Presentation and interpretation
~~LO (05) Explain that by using more than one ground station, the position of an aircraft can be determined and transmitted to the pilot.~~

Content of comment:
We do not agree with the comment “Irrelevant”.
EASA decided to delete the basic knowledge for applicants beginning the theoretical training in ATO, because they normally have the request level.
Which is the used way to know the level of trainees?

Alternative draft for proposed amendment

Add the following LO in topic 062 02 01 02

LO (05) Explain that by using more than one ground station, the position of an aircraft can be determined and transmitted to the pilot.

response

Accepted.

Thank you for providing this comment referring to LO 062 02 01 02 (05).

EASA agrees that this LO is relevant and will be retained.

In comments 56-D and 113-D, the same issue was raised regarding this LO.

comment *333-D* comment by: *DGAC FRANCE*

Doc D

Page 149/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 02 02 03
Coverage and range
~~LO (03) State that the range of an NDB over sea is better than over land due to better ground wave propagation over seawater than over land.~~

Content of comment:
We do not agree with the comment “No practical use”.
Has to be maintained in the program of the theoretical examination; use in initial training.

Alternative draft for proposed amendment

Add the following LO in topic 062 02 02 03

LO (03) State that the range of an NDB over sea is better than over land due to better ground wave propagation over seawater than over land.

response

Not accepted.

Thank you for providing this comment referring to LO 062 06 02 03 (05).

This LO was already deleted in the NPA text.

comment

334-D comment by: *DGAC FRANCE*

Doc D
Page 150/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 02 02 04
Errors and accuracy
~~LO (04) State that interference from other NDB stations on the same frequency may occur at night due to sky wave contamination.~~

Content of comment:
We do not agree with the comment “No practical use”.
Has to be maintained in the program of the theoretical examination; use in initial training.

Alternative draft for proposed amendment

Add the following LO in topic 062 02 02 04

LO (04) State that interference from other NDB stations on the same frequency may occur at night due to sky wave contamination.

response

Accepted.

Thank you for providing this comment referring to LO 062 02 02 04 (04).

EASA has read your statement and would like to state that because of comment 352-D, EASA agrees that this LO is relevant and will be retained.

comment

335-D comment by: *DGAC FRANCE*

Doc D
Page 151/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 02 03 01
Principles
~~LO (04) State that the following types of VOR are in operation :~~
~~- Conventional VOR (CVOR) : a first generation VOR station emitting signals by means of a rotating antenna,~~
~~- Doppler VOR (DVOR) : a second generation VOR station emitting signals by means of a combination of fixed antennas utilising the Doppler principle,~~
~~- En-route VOR for use by IFR traffic,~~
~~- Terminal VOR (TVOR) : a station with a shorter range used as part of the approach and departure structure at major airports,~~
~~Test VOR (VOT) : a VOR station emitting a signal to test VOR indicators in an aircraft.~~

Content of comment:
We do not agree with the comment “No practical use”.
Has to be maintained in the program of the theoretical examination; use on the aeronautical cards.

Alternative draft for proposed amendment

Add the following LO in topic 062 02 03 01

LO (04) State that the following types of VOR are in operation :
- Conventional VOR (CVOR) : a first generation VOR station emitting signals by means of a rotating antenna,
- Doppler VOR (DVOR) : a second generation VOR station emitting signals by means of a combination of fixed antennas utilising the Doppler principle,
- En-route VOR for use by IFR traffic,
- Terminal VOR (TVOR) : a station with a shorter range used as part of the approach and departure structure at major airports,
- Test VOR (VOT): a VOR station emitting a signal to test VOR indicators in an aircraft.

response

Accepted.

Thank you for providing this comment referring to LO 062 02 03 01 (04).

EASA agrees that this LO is relevant and will be retained.

In comments 68-D and 130-D, the same issue was raised regarding this LO.

comment	*336-D* comment by: *DGAC FRANCE*

Doc D
Page 153/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 02 03 02
Presentation and interpretation
LO (03) Explain the use of the TO/FROM indicator in order to determine aircraft position relative to the VOR ~~considering also the heading of the aircraft.~~

Content of comment:
We do not agree with the comment "TO/FROM indicator is irrelevant to the heading of the aircraft".
Has to be maintained to know if trainees understood the interpretation.

Alternative draft for proposed amendment

Add the following LO in topic 062 02 03 02

LO (03) Explain the use of the TO/FROM indicator in order to determine aircraft position relative to the VOR considering also the heading of the aircraft.

response	Not accepted. Thank you for providing this comment referring to LO 062 02 03 02 (03). EASA considers the LO to be correct.

comment	*337-D* comment by: *DGAC FRANCE*

Doc D
Page 166/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 02 06 01
Principles

Content of comment:
The MLS is rarely used but it's still used in airports, so the theory has to be known by trainees.

Alternative draft for proposed amendment

Add all of the following topic

062 02 06 01 - Principles

response

Accepted.

Thank you for providing this comment referring to Subject 062 02 06 01 ‘Principles’.

EASA agrees that these LOs are relevant and will be retained.

comment

338-D comment by: *DGAC FRANCE*

Doc D
Page 167/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 02 06 02
Presentation and interpretation

Content of comment:
The MLS is rarely used but it’s still used in airports, so the theory has to be known by trainees.

Alternative draft for proposed amendment

Add all of the following topic
062 02 06 02 – Presentation and interpretation

response

Accepted.

Thank you for providing this comment referring to the LOs under Subject 062 02 06 02 ‘Presentation and interpretation’.

EASA agrees that these LOs are relevant and will be retained.

comment

339-D comment by: *DGAC FRANCE*

Doc D
Page 168/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 02 06 03
Coverage and range

Content of comment:
The MLS is rarely used but it’s still used in airports, so the theory has to be known by trainees.

Alternative draft for proposed amendment

Add all of the following topic

062 02 06 03 – Coverage and range

response

Accepted.

Thank you for providing this comment referring to the LOs under Subject 062 02 06 03 'Coverage and range'.

EASA agrees that these LOs are relevant and will be retained.

comment

340-D comment by: *DGAC FRANCE*

Doc D
Page 174/233
Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 03 04 02
Modes and codes
~~LO (03) State that the interrogation frequency is 1030 MHz and the reply frequency is 1090 MHz.~~
Content of comment:
Just specify that frequencies are different.

response

Accepted.

Thank you for providing this comment referring to LO 062 03 04 02 (03).

EASA agrees to retain and reword this LO.

The text will be amended as follows:

State that the interrogation frequency ~~is 1 030 MHz~~ and the reply frequency are different ~~is 1 090 MHz~~.

In comment 178-D, a similar issue was raised regarding this LO.

comment

341-D comment by: *DGAC FRANCE*

Doc D
Page 178/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 03 04 03
Presentation and interpretation
~~LO (05) Explain the function of the emission of a Special Position Identification (SPI) pulse after pushing the IDENT button in the aircraft.~~

Content of comment:
Daily use ; has to be maintained.

Alternative draft for proposed amendment

Add this LO to topic 062 03 04 03
LO (05) Explain the function of the emission of a Special Position Identification (SPI) pulse after pushing the IDENT button in the aircraft.

response

Accepted.

Thank you for providing this comment referring to LO 062 03 04 03 (05).

EASA agrees to retain this LO.

comment *342-D* comment by: *DGAC FRANCE*

Doc D
Page 206/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 06 01 02
Operation
~~LO (22) State that the GPS health message is used to exclude unhealthy satellites from the position solution. Satellite health is determined by the validity of the navigation data.~~

Content of comment:
Daily use; has to be maintained.

Alternative draft for proposed amendment

Add this LO to topic 062 06 01 02

LO (22) State that the GPS health message is used to exclude unhealthy satellites from the position solution. Satellite health is determined by the validity of the navigation data.

response

Not accepted.

Thank you for providing this comment referring to LO 062 06 01 02 (22).

EASA considers the LO to be correct: unhealthy satellites are automatically deselected from the navigational solution.

comment *343-D* comment by: *DGAC FRANCE*

Doc D
Page 210/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 06 01 02
Operation
~~LO (49) State that the datum used is PZ 90 Earth centred Earth Fixed.~~

Content of comment:
Has to be maintained. This reference is used in aeronautical maps.

Alternative draft for proposed amendment

Add this LO to topic 062 06 01 02

LO (49) State that the datum used is PZ 90 Earth centred Earth Fixed.

response

Not accepted.

Thank you for providing this comment referring to LO 062 06 01 02 (49).

EASA is of the opinion that this LO remain deleted.

comment *344-D* comment by: *DGAC FRANCE*

Doc D
Page 220/233

Subject:
SUBJECT 062 - RADIONAVIGATION
syllabus reference 062 06 02 04
Airborne-based augmentation system (ABASs)
LO (04) Explain that the typical sensors used are barometric altimeter and inertial navigation system (INS).

Content of comment:
This LO has to be modified, old INS does not give altitude info.

Alternative draft for proposed amendment

Modify the following LO

LO (04) Explain that the typical sensors used are barometric altimeter and inertial reference system (IRS).

response

Accepted.

Thank you for providing this comment referring to LO 062 06 02 04 (04).

EASA agrees to delete the last wording of this LO and replace it with 'inertial reference system (IRS)'.

The text will be amended as follows:

Explain that the typical sensors used are barometric altimeter and inertial reference system (IRS) ~~inertial navigation system~~.

In comments 66-D and 228-D, the same issue was raised regarding this LO.

comment *346-D* comment by: *DGAC FRANCE*

Doc D
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Subject:
SUBJECT 062 - RADIONAVIGATION

syllabus reference 062 07 01 01
PBN principles
~~LO (08) Explain the difference between raw data and computed data~~.

Content of comment:
Has to be maintained, daily use.

Alternative draft for proposed amendment

Add this LO to the topic 062 07 01 01
LO (08) Explain the difference between raw data and computed data.

response

Accepted.

Thank you for providing this comment referring to LO 062 07 01 01 (08).

EASA agrees to retain this LO.

comment *348-D* comment by: *European GNSS Agency*

062 06 01 02 Operation - space segment

Other GNSS
We agree that many aspects of GNSS theoretical knowledge training are unusable in operation and that is right decision to remove them, but we also believe that there should be more information about operationally significant differences of GNSS.
Especially:
- Glonass FDMA principle and change to CDMA
- Beidou differences in space segment and orbits of satellite which directly effects operational usage
- Galileo interoperability of signals with other GNSS
- And information about multi-constellation usability

Information that Galileo is not operational now is not important because of time when this NPA will turn into AMC à information about Galileo should be incorporated.

response

Not accepted.

Thank you for providing this comment referring to Subject 062 06 01 02 'Operation — space segment'.

EASA is of the opinion that this information is too detailed for practical use. Interoperability is already stated in another LO.

comment *349-D* comment by: *European GNSS Agency*

062 06 02 03 European Geostationary Navigation Overlay Service (EGNOS)
State that EGNOS consists of three geostationary ~~Inmarsat~~ satellites which broadcast GPS lookalike signals.

response

Not accepted.

Thank you for providing this comment referring to Subject 062 06 02 03 'European

	Geostationary Navigation Overlay Service (EGNOS)'. EASA has deleted this LO based on comment 66-D.
comment	*350-D* comment by: *European GNSS Agency* **062 07 05 06 RNP AR APCH** **Add following LO:** LO State that information about approval for RNP AR APCH might be found in EASA rule SPA.PBN.105 and related AMCs.
response	Not accepted. Thank you for providing this comment referring to Subject 062 07 05 06. EASA will not add the proposed new LO: EASA does not consider it necessary to require pilots to state where information can be found.
comment	*351-D* comment by: *European GNSS Agency* **062 06 02 03 European Geostationary Navigation Overlay Service (EGNOS)** Proposing to add following LOs: LO State that EGNOS signal is compliant with Annex 10 Amendment 77 SARPS. LO Explain the information contained in EGNOS message. LO State that EGNOS message contains 500 bits transmitted with at a rate of 250 bits per second. LO Explain that EGNOS may transmit different types of messages and state what the purpose of the most important messages is.
response	Not accepted. Thank you for providing this comment referring to Subject 062 06 02 03 'European Geostationary Navigation Overlay Service (EGNOS)'. EASA is of the opinion that this information is too detailed for pilots.
comment	*352-D* comment by: *Karl Hunkeler* General: I am a licensed radio amateur for all bands (HB9CXF) with a lot of experience on all bands. Therefore I feel it necessary to correct some statements made in the LOs. 062 01 03 06 (03): Fading: the signals will interfere with each other causing the signals to be regularly cancelled out or doubled. 062 02 02 01 (18): I agree, that there is no practical use of this statement, but it is true, that the indication is erratic because during ident no signal is transmitted, the indicator will try to return to the home position (3 o'clock) 062 02 02 01 (19): the automatic activation of the BFO is not due to the age of the aircraft but the age of the equipment. 062 02 02 04 (01): according to my experience in small aircraft (approx 2'000 hours

	IFR) the quadrantal error is not corrected during installation. The indicator will always be some 10°to 15° fast in the direction of the turn. This has to be taken into account when intending to roll out an a certain course. 062 02 02 04 (04): during night it is easily possible to receive to NDB stations on the same frequency more than 100 nm apart which interact in a manner so as to cause completely wrong bearings. 062 02 03 01 (05): ATIS CAN be transmitted on VOR fequencies, the the function ID has to be disabled in order to monitor the ATIS. Also Radio communications can be transmitted on VOR frequencies. This is a common procedure in the US, where small airports use Unicom frequencies, and the FSS answers on a VOR frequency. 062 02 05 02 (06): also the VORs have an automatic ground monitoring system. 062 02 05 05 (01): critical area: an area AROUND (not about) LOC and GP antennas.
response	Thank you for your multiple comments. EASA has carefully assessed all the comments received. Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number. Regarding your comment referring to LO 062 01 03 06 (03): Accepted. EASA agrees that this LO has to be reworded. The text will be amended as follows: Describe 'fading': when a receiver picks up two signals with the same frequency, ~~the sky signal and the surface signal,~~ the signals will interfere with each other causing ~~the signals to be cancelled out.~~ changes in resultant signal strength and polarisation. In comments 110-D and 352-D, the same issue was raised regarding this LO. Regarding your comment referring to LO 062 02 02 01 (18): Noted. EASA has read your statement and no further action is required. Regarding your comment referring to LO 062 02 02 01 (19): Noted. EASA has read your statement and no further action is required. Regarding your comment referring to LO 062 02 02 04 (01): Noted. This LO was already deleted in the NPA text. Regarding your comment referring to LO 062 02 02 04 (04): Noted. EASA has read your statement and would like to state that because of comment 334-D, EASA agrees that this LO is relevant and will be retained. Regarding your comment referring to LO 062 02 03 01 (05): Noted. EASA has read your statement and no further action is required. Regarding your comment referring to LO 062 02 05 02 (06): Not accepted. EASA is of the opinion that this is covered in the LOs regarding VOR. Regarding your comment referring to LO 062 02 05 05 (01): Accepted. EASA agrees to change the wording 'about' into 'around'. The text will be amended as follows:

Define the 'ILS-critical area': an area of defined dimensions ~~about~~ around the ~~LLZ~~LOC and GP antennas where vehicles, including aircraft, are excluded during all ILS operations.

comment *354-D* comment by: *GNSS Centre of Excellence*

Many changes in subject 062 are in consensus with our findings. We agree with most removals and additions in this chapter. In removals part we even identified several more Los which may be removed - 062 01 01 06 and 07. These Los are connected with modulation and we suggest to remove them, or if they are found important to add to these Los several other modulations used in aviation. But it is matter of discussion if this knowledge has any practical use.
But our most important issue with whole NPA is connected with GNSS, part of 062. We found that there are completely missing information about all GNSS signals and services planned in nearest future. L5 E5 and LC will be probably in operation earlier that this NPA will turn in AMC.
Signal on L5 frequency is meant to be new standard for aviation. Glonas will introduce own SBAS system. Multi constellation of several GNSS system will solve problems with achievability and will change the flight planning process, etc. These information are essential and important and shall be incorporated in theoretical training. Specific proposed Los are in second part of this document.

Similarly in area of other GNSS we agree with removal of information of no practical value but we strongly urge to add information about differences of other GNSS systems.
For example information about SBAS usage of other GNSS. Information about types of signals and information incorporated in these signals of Galileo, Glonas and Beidou. I tis essential to know which information is GNSS providing to allow pilot to use them most properly.
Galileo systems is removed from LO completely even the fact that in multi constellation is already usable today.
We found these technical information usable for practical flying and we recommend that this chapter of LO shall be changed properly.
Information about antenna shadowing shall be more stressed.
Advanced RNP is covered vaguely, for system which shall be most important in future.
Other issue in 062 is inadequate explanation of several types of RNAV/RNP operation. We are not sure if this agenda is part of subject 010 or 062, but in this NPA we find information about PBN little underestimated. Number of Los of PBN in compare with classical navigation seems still inadequate, with fact that PBN will, and in many regions already is, the most used navigation way.
Whole chapter of 062 connected to GNSS is changed importantly and number of removals and changes made these LO break away from the concept.

062
Positive changes, we would recommend some additional removals of unnecessary parts, but information about GNSS are not satisfaction in several aspects which are operational important
062 01 01 01 Electromagnetic waves

~~LO State that radio waves travel at the speed of light, being approximately 300 000 km/s or 162 000 NM/s.~~
LO State that radio waves travel at the speed of light, being approximately 300 000 km/s or 162 000 NM/s in vacuum, and that this speed may be lowered when travelling in a material medium.

062 01 01 06 Kinds of modulation (amplitude, frequency, pulse, phase, phase quadrant)
LO Describe the quadrature amplitude modulation (QAM) used by L5 signal.

062 01 01 07 Kinds of digital modulation (PSK, FSK, ASK)
LO Define time multiplex.
LO Define the Frequency Division Multiple Access (FDMA).
LO Define phase-shift keying PSK.
LO Define frequency-shift keying FSK.
LO Define amplitude-shift keying ASK.
LO Define quadrature phase shift keying used by Beidou II signal.
LO State that there several different types of digital modulation.
(These two Los 062 01 01 05 and 062 01 01 06 **are in our point of view, out of practical use completely and we would recommend to remove information about modulation completely. But If we presume that knowledge of modulations is necessary it would be advisable to mention new types of modulations used in modern navigation systems.)**

062 01 02 03 Types of antennas
~~LO helical antenna used in GPS transmitters.~~
LO Explain antenna shadowing.
LO Explain importance of antenna placement on aircraft.

062 01 03 01 Structure of the ionosphere
LO Explain how different layers of ionosphere influence signal propagation.

062 01 03 07 Factors affecting propagation of GNSS signal
LO State all factors affecting propagation.
LO Explain ionospheric refraction.
LO Explain tropospheric refraction.
LO Explain signal multipath propagation.
LO Explain the impact of solar radiation on signal propagation.

062 06 01 02 Operation – space segment
LO explain that there are several types of satellites currently in orbit which may differ by the type of signals they broadcast.

LO State that the navigation message contains:
— almanac data;
— ephemeris;
~~— satellite clock correction parameters;~~
~~— UTC parameters;~~
— ionospheric model;

~~— satellite health data.~~
- time parameters and clock corrections
- service parameters

It is essential to mention new development in GNSS signals – L2C, L5, multiconstelation
LO State that there currently are three signals transmitted on L1 frequency, namely C/A code, p(Y) code, L2C and M-code.
LO State that there currently are three signals transmitted on L2 frequency, namely L2C, p(Y) code and M-code. When L2C and M code is only transmitted by several satellites.

LO State that there will be a new code transmitted on L5 frequency (1176.45 MHz) (change after new development).

LO Explain which codes are specified to be used in civil aviation.

LO explain advantages of new codes L2C and L5

LO explain PRN code

User segment
LO Define the time to first fix.

Other GNSS
We agree that many aspect of GNSS theoretical knowledge training are unusable in operation and that is right decision to remove them, but
We also believe that there should be more information about operational significant differences of GNSS
Especially: Glonas FDMA principle and change to CDMA
Beidou: differences in space segment and orbits of satellite which directly effects operational usage
Galileo: interoperability of signals with other GNSS
And information about multiconstelation usability
Information that Galileo is not operational now is not important because of time when his NPA will turn into AMC and information about Galileo should be incorporated

062 06 02 01 Ground-bBased aAugmentation sSystems (GBAS)
State that the minimum coverage area is 10° on either side of the final approach path to a distance between 15 and 20 NM, and 35° on either side of the final approach path to a distance of 15 NM and explain difference of coverage for area navigation GBAS

062 06 02 03 ***European Geostationary Navigation Overlay Service (EGNOS)***
State that EGNOS consists of three geostationary ~~Inmarsat~~ satellites which broadcast GPS lookalike signals.
LO State that EGNOS signal is compliant with Annex 10 Amendment 77 SARPS .

LO Explain the information contained in EGNOS message.

LO State that EGNOS message contains 500 bits transmitted with at a rate of 250 bits per second.

LO Explain that EGNOS may transmit different types of messages and state what the purpose of the most important messages is.

062 07 00 00 PBN
LO Explain the concept of availability.
(which is missing 062 07 01 01)

062 07 05 06 RNP AR APCH
LO State that information about approval for RNP AR APCH might be found in EASA rule SPA.PBN.105 and related AMCs.

062 07 05 07 A-RNP
LO State that A-RNP permits a range of scalable RNP lateral navigation accuracies.
LO List functional requirements for A-RNP.
LO Explain Engagement altitude.
LO State STAR Specific Requirements for A-RNP.
LO Explain Contingency Procedures for A-RNP.
LO State A-RNP turn principle

062 07 05 01 RNAV10
LO State that RNP 10 designation is inconsistent with PBN RNP and RNAV specifications. RNP 10 does not include requirements for on-board performance monitoring and alerting. For purposes of consistency with the PBN concept, RNP 10 is referred to as RNAV 10.
LO State that RNAV 10 retains designation of RNP 10 in implementation.
LO State that the flight manual must indicate that a particular GNSS installation meets the appropriate aviation authority's requirements according to the pertinent country of registry and its legislation.

062 07 05 02 RNAV5
LO State that RNAV operations determine the position in the horizontal plane (lateral navigation).
LO State that position may be determined based one or more of
a) VOR/DME;
b) DME/DME;
c) INS or IRS; and
d) GNSS.
LO State that a turn can start as early as 20 NM before the waypoint in the case of large track angle change with a "fly-by" turn; manually initiated turns may overshoot the following track.

062 07 05 03 RNAV/RNP1/2
LO State that Operator holding P-RNAV approval may must obtain additional

	approval for RNAV 1/2.
response	Thank you for your multiple comments. EASA has carefully assessed all the comments received. Each comment has been dealt with on a one-by-one basis. Comments on LOs as indicated by LO number. Regarding your comment referring to LO 062 01 01 01 (01): Not accepted. EASA is of the opinion that the text of this LO is correct. Regarding your comment referring to Subject 062 01 01 06: Not accepted. EASA is of the opinion that the text of this Subject is correct. Regarding your comment referring to Subject 062 01 01 07 (New): Not accepted. EASA does not agree to introduce these new proposed LOs in a new Subject 062 01 01 07 'Kinds of digital modulation (PSK, FSK, ASK)'. These proposed LOs are too detailed. The LOs under Subject 062 01 01 05 and 062 01 01 06 are sufficient for a pilot. Regarding your comment referring to LO 062 01 02 03 (01): Accepted. EASA agrees with your proposal and will amend LO (01) and add (02) and (03). The text will be amended as follows: ~~List and describe~~Name the common different kinds of directional antennas: — loop antenna used in old automatic direction-finding (ADF) receivers; — parabolic antenna used in weather radars; — slotted planar array used in more modern weather radars~~;~~. — ~~helical antenna used in GPS transmitters.~~ Explain antenna shadowing. Explain the importance of antenna placement on aircraft. In comments 65-D and 104-D, the same issue was raised regarding this LO. Regarding your comment referring to Subject 062 01 03 01: Accepted. EASA agrees with your proposal and will add a new LO (04). The new LO will be inserted as follows: Explain how different layers of the ionosphere influence wave propagation. Regarding your comment referring to LO 062 01 03 07 new: Not accepted. EASA is of the opinion that these new proposed LOs are not necessary. Regarding your comment referring to LO 062 06 01 02: Not accepted. EASA is of the opinion that this new proposed LO is not necessary. There is already LO 062 06 01 01 01 describing that there are different GNSSs. Regarding your comment referring to LO 062 06 01 02 (15): Partially accepted. EASA has amended this LO based on comment 66-D, differently from your proposal. The text has been amended as follows: State that the navigation message contains: — ~~almanac data;~~

~~— ephemeris;~~

— satellite clock correction parameters;

— Universal Time Coordinated (UTC) parameters;

— an ionospheric model;

— satellite health data.

Regarding your comment referring to the LOs 062 06 01 02 under 'Space segment' new proposals: Not accepted.

EASA is of the opinion that all those proposed LOs are too detailed for practical flying; additional LOs might be inserted at a later revision.

Regarding your comment referring to the LOs 062 06 01 02 under 'User segment' new proposal: Noted.

EASA is of the opinion that this additional LO might be inserted at a later revision.

Regarding your comment referring to LO 062 06 02 01 (07): Partially accepted.

EASA agrees to reword this LO, but differently from your proposal.

The text will be amended as follows:

~~State that the minimum GBAS plan coverage is 15 NM from the landing threshold point within 35° apart the final approach path and 10° apart between 15 and 20 NM.~~

State that the minimum software designed coverage area is 10° on either side of the final approach path to a distance between 15 and 20 NM, and 35° on either side of the final approach path to a distance of 15 NM.

Regarding your comment referring to LO 062 06 02 03 new proposal: Not accepted.

EASA is of the opinion that these new proposed LOs for EGNOS contain too detailed information for pilots.

Regarding your comment referring to LO 062 07 01 01: Partially accepted.

EASA will insert a new LO regarding 'the concept of availability' but with a different text from the one you proposed.

The text of the new inserted LO is as follows:

Define availability as the percentage of time (annually) during which the system is available for use.

Regarding your comment referring to LO 062 07 05 06: Not accepted.

EASA is of the opinion that your proposed new LO for RNP AIR APCH is not needed.

Regarding your comment referring to Subject 062 07 05 07: Not accepted.

EASA is of the opinion that your proposed six new LOs for A-RNP are not needed.

Regarding your comment referring to LO 062 07 05 01: Not accepted.

EASA is of the opinion that your proposed three new LOs for RNAV10 are not needed and it is not correct to write LOs about former errors in terminology.

Regarding your comment referring to LO 062 07 05 02: Not accepted.

EASA is of the opinion that your proposed two new LOs for RNAV10 do not belong to the RNAV5 concept. Next to that, the RNAV concept is performance-driven and not sensor-driven.

Regarding your comment referring to LO 062 07 05 03: Not accepted. EASA would like to state that P-RNAV approval is acceptable provided the guidance is not VOR/DME.

Appendix A — Attachments

3.5.4.5 *Accuracy*

3.5.4.5.1 *DME/N.* The transponder shall not contribute more than plus or minus 1 microsecond (150 m (500 ft)) to the overall system error.

3.5.4.5.1.1 *DME/N.* **Recommendation.**— *The contribution to the total system error due to the combination of the transponder errors, transponder location coordinate errors, propagation effects and random pulse interference effects should be not greater than plus or minus 340 m (0.183 NM) plus 1.25 per cent of distance measure.*

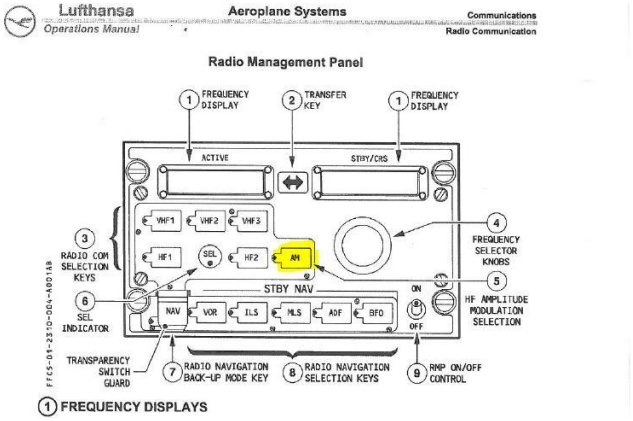
Note.— This error contribution limit includes errors from all causes except the airborne equipment, and assumes that the airborne equipment measures time delay based on the first constituent pulse of a pulse pair.

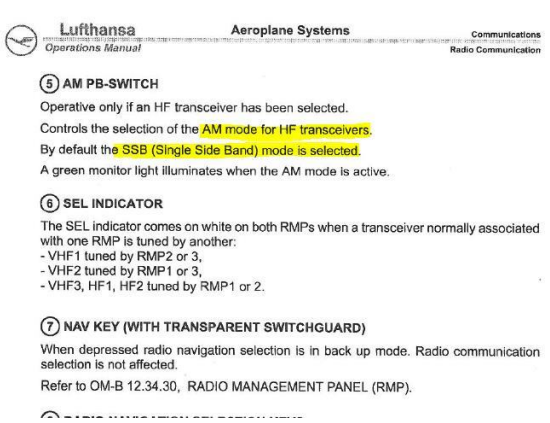
‡3.5.4.5.1.2 *DME/N.* The combination of the transponder errors, transponder location coordinate errors, propagation effects and random pulse interference effects shall not contribute more than plus or minus 185 m (0.1 NM) to the overall system error.

Note.— This error contribution limit includes errors from all causes except the airborne equipment, and assumes that the airborne equipment measures time delay based on the first constituent pulse of a pulse pair.

‡3.5.4.5.2 *DME/N.* A transponder associated with a landing aid shall not contribute more than plus or minus 0.5 microsecond (75 m (250 ft)) to the overall system error.

Attachment #5 to comment #60





Attachment #6 to comment #65

8.7 Aircraft operating in the Anchorage Arctic CTA/FIR beyond line of sight range of remote control VHF air/ground facilities operated from the Anchorage ACC, must maintain communications with Cambridge Bay radio and a listening or SELCAL watch on HF frequencies of the North Atlantic D (NAT D) network (2971 kHz, 4675 kHz, 8891 kHz and 11279 kHz). Additionally, and in view of reported marginal reception of the Honolulu Pacific Volmet broadcasts in that and adjacent Canadian airspace, Cambridge Bay radio can provide Anchorage and Fairbanks surface observations and terminal forecasts to flight crews on request.

Attachment #7 to comment #65