Study on the ‘Triple One’ Concept

Preliminary results and outlook

13.12.2023

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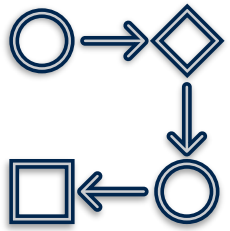
Study on the ‘Triple One’ Concept

…first of all – The Objective

Feedback and overview of the current status of the study



Preliminary results – no final conclusions yet

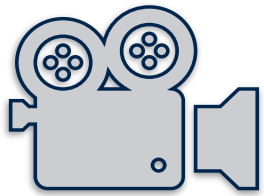
Exchange additional ideas and feedback

Discussion during Q&A session after the presentation

Get in touch with project teams afterwards – tripleone@airsight.de

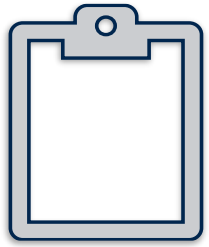
EASA participates via the webinar

Study on the ‘Triple One’ Concept
Some Housekeeping

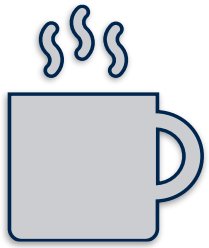


The webinar is recorded and will be made accessible with slide decks afterwards.

Questions may be asked in the chat and will be answered at the end.



There will be polls during the presentation.



There will be a break.

Study on the ‘Triple One’ Concept
Agenda

- Introduction
- Occurrence Analysis
- Current situation at European airports
- Case study: Implementation of Triple One at BRU/EBBR
- Considerations regarding Benefit and Risk Analysis
- Discussion and Q&A

Study on the ‘Triple One’ Concept

Here are some theses

Triple One can act as a preventive barrier or a corrective barrier, however, for certain runway incursions it does not have a perceived safety benefit.

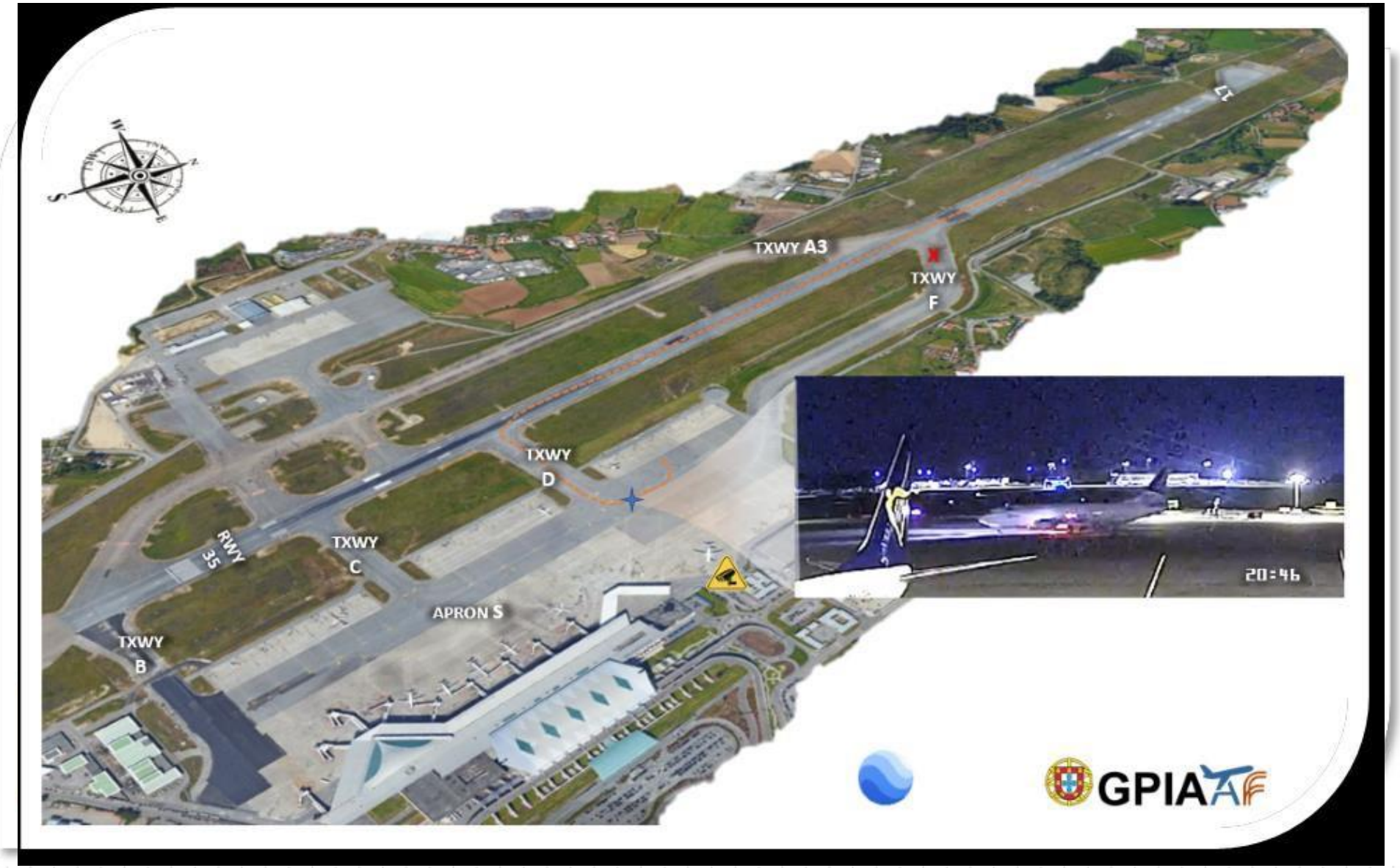
The discussion on the suitability of Triple One is negatively affected by the current language proficiency requirements.

The European aerodrome community needs a “How to ECCAIRS”.

Out of all runway incursions with known origin listed in ECCAIRS from 2005 to 2019, 26.5% are caused by vehicle or equipment.

Other safety nets might have a more significant impact on runway incursions.

Introduction
Runway Incursion Incident



Introduction
Runway Incursion Incident

airsight

No alerting system

ATCO human factor

Lack of situational awareness (separate frequencies)

Team management

Lack of training

Oversight

SMS

Compliance Monitoring

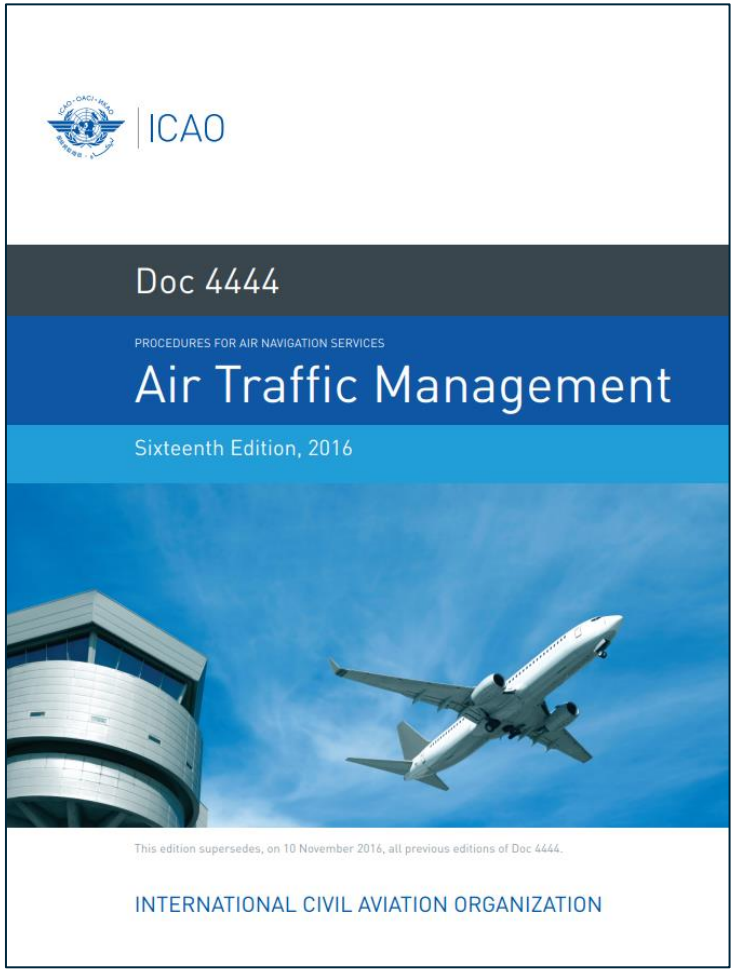
Introduction
International and European Efforts

- International

- European

Introduction
Definition of a Runway Incursion

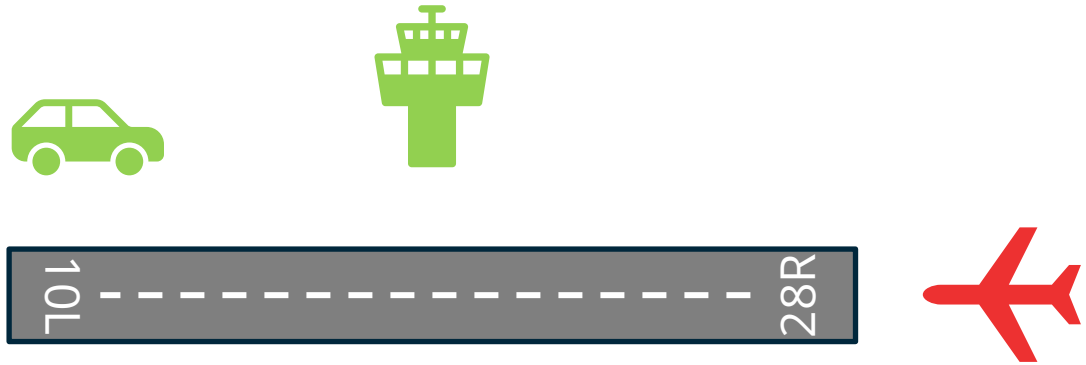
- **ICAO**



- **Doc 4444 – PANS-ATM**
  - Runway incursion
    - "Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take off of aircraft."
    - What is an "incorrect presence"?

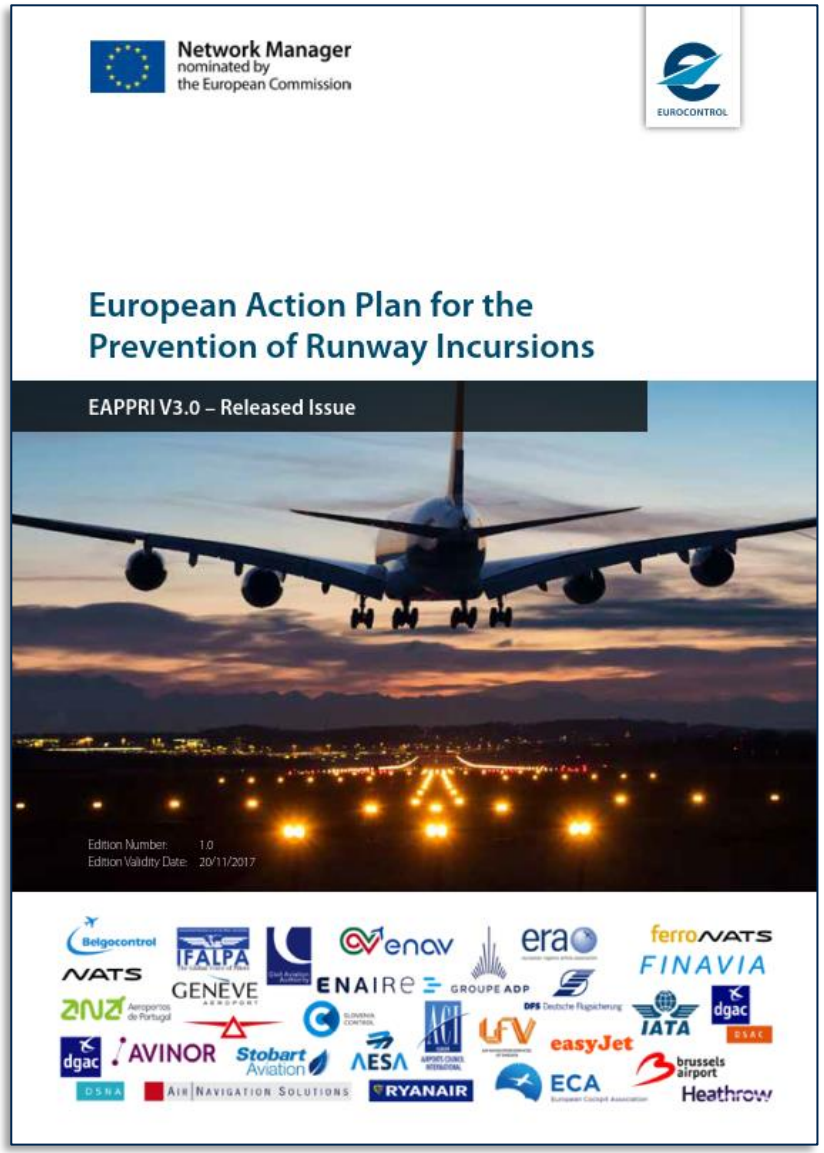
- **Incorrect presence means**
  - The failure of a pilot or vehicle driver to comply with a valid ATC clearance or compliance of a pilot or vehicle driver with an incorrect ATC clearance.

- **Potential scenarios:**
  - Landing without ATC clearance
  - Take-off without ATC clearance
  - Incorrect entry of an aircraft or vehicle onto the runway protected area
  - Incorrect runway crossing by an aircraft or vehicle
  - Incorrect spacing between successive arriving or arriving and departing or departing and arriving aircraft



➢ **Communication is key to reduce the risks of runway incursion**

Introduction
What is Triple One?



It is about:

communication on the runway and situational awareness of pilots, ATCOs, and vehicle drivers

1.3.3 Implement, monitor and ensure the use of the readback procedure (also applicable to manoeuvring area drivers and other personnel who operate on the manoeuvring area).
1.3.4 Where practicable, improve situational awareness by conducting all communications associated with runway operations using aviation English.
1.3.5 When practicable, improve situational awareness, by implementing procedures whereby all communications associated with runway operations are on a common or cross-coupled frequency.

Triple One Concept:

1. One Runway
2. One Frequency
3. One Language

Introduction
What is Triple One?

Triple One Concept:

1. One Runway
2. One Frequency
3. One Language

- Is Triple One a safety barrier that would have prevented the runway incursion from occurring?
- Or would Triple One have reduced the severity of the runway incursion outcome?

Triple One Concept:

1. One Runway
2. One Frequency
3. One Language

1. Preventive Safety Barrier

2. Corrective Safety Barrier

	A	B	C	D
Operational Incident An incident caused by the Air Traffic Controller.	A serious incident in which a collision is narrowly avoided.	An incident in which separation decreases and there is significant Potential for collision, which may result in a time-critical evasive response to avoid a collision.	An Incident characterised by ample time and/ or distance to avoid a collision.	An incident that meets the definition of runway incursion with no immediate safety consequences, because of the incorrect presence of a single object on the runway area
Pilot deviation An incident caused by the pilot				
Vehicle/ pedestrian deviation An incident caused by a vehicle or pedestrian.				

Introduction
What is Triple One?

Triple One Concept:

1. One Runway
2. One Frequency
3. One Language

- Vehicle Driver would have heard the clearance to the pilot
  - → Prevent the occurrence → Preventive Barrier
- If pilots had already accessed the runway and been cleared to t/o
  - → Reaction of Vehicle Driver → Corrective Barrier

- **Driver missed to stop before RWY:**
  - The driver of a snow removal vehicle received clearance on taxiways and should stop before the RWY.
  - The driver drove the cleared way but did not stop before the RWY, crossed it and stopped before the next RWY.
  - No traffic on the RWY

Triple One Concept:

1. One Runway
2. One Frequency
3. One Language

Triple One can act as a preventive barrier or a corrective barrier, however, for certain runway incursions it does not have a perceived safety benefit.

Introduction
The “Triple One”-Study

1. **Regulatory Assessment**
   - Regulatory Gap Analysis
   - Current Forms / State of Application
2. **Occurrence Analysis**
   - Collection of relevant Occurrences
   - Identification of Contributing Factors
3. **Stakeholder Workshops and Detailed Analysis**
   - Safety Benefits
   - Safety Risks
4. **Conclusion**
   - Policy Options
   - Regulatory Recommendations

EASA
European Union Aviation Safety Agency

Project Lead

airsight

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Technical Lead

brussels airport
the heart of Europe

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Kevin Cleynhens
Yves Brouwers

Additional experts and support

- ACI Europe
- Pilots
- ATCOs
- Lux-airport
- ANA (LUX ANSP)

Stakeholders

- Aerodrome Operators
- ANSPs
- Vehicle Operators
- Pilots
- Authorities

Study on the ‘Triple One’ Concept
Agenda

- Introduction
- **Occurrence Analysis**
- Current situation at European airports
- Case study: Implementation of Triple One at BRU/EBBR
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Goals

- Identification of runway incursion origin
- Identification of contributing (human) factors

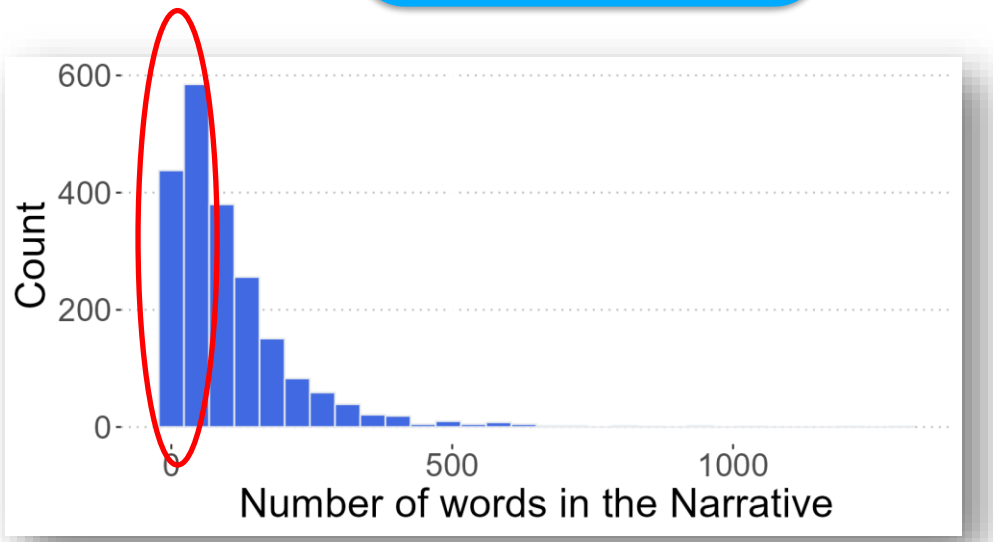
→ How big is the problem?

Sources

- ECCAIRS (European Co-ordination centre for Accident and Incident Reporting Systems)
  - European occurrence reporting platform, should include all RI
- EVAIR (EUROCONTROL voluntary ATM incident reporting)
  - Include voluntary RI
- Investigation authorities / official investigation reports
  - Only for accidents and serious incidents

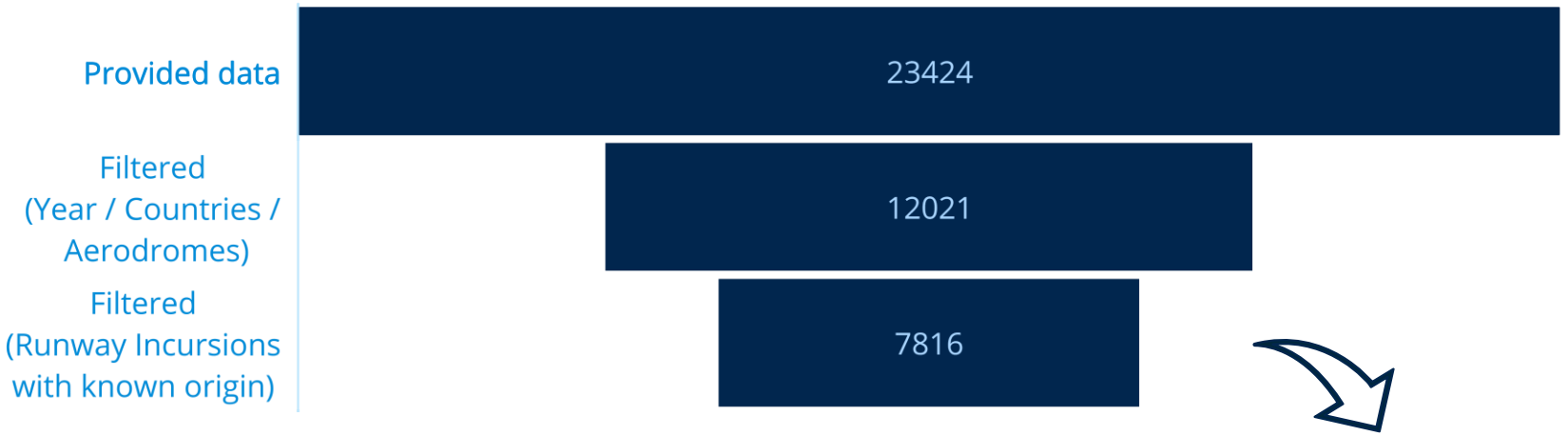
- **Issues with ECCAIRS data**
  - **Coding** of RI not as recommended by the ECCAIRS Coding Guide
    - Occurrence category for high level grouping
      - (“RI: Runway incursion - vehicle, aircraft or person”)
    - Event Types to code details
      - (“Runway Incursion by a Vehicle/Equipment”)
  - Many occurrences with only a **short description** (e.g. “Runway incursion by vehicle”)
  - Only a few occurrences contain investigation results in the corresponding narrative
  - Multiple entries of the same occurrence do not have the same “File number”

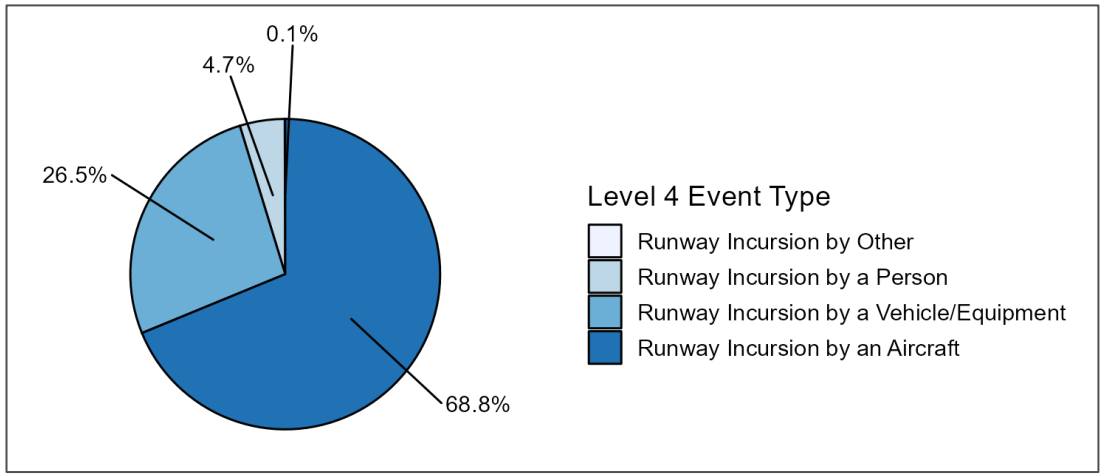
The European aerodrome community needs a “How to ECCAIRS”.



Occurrence Analysis
ECCAIRS – Runway Incursion Origin

Number of unique occurrences* depending on filtering level

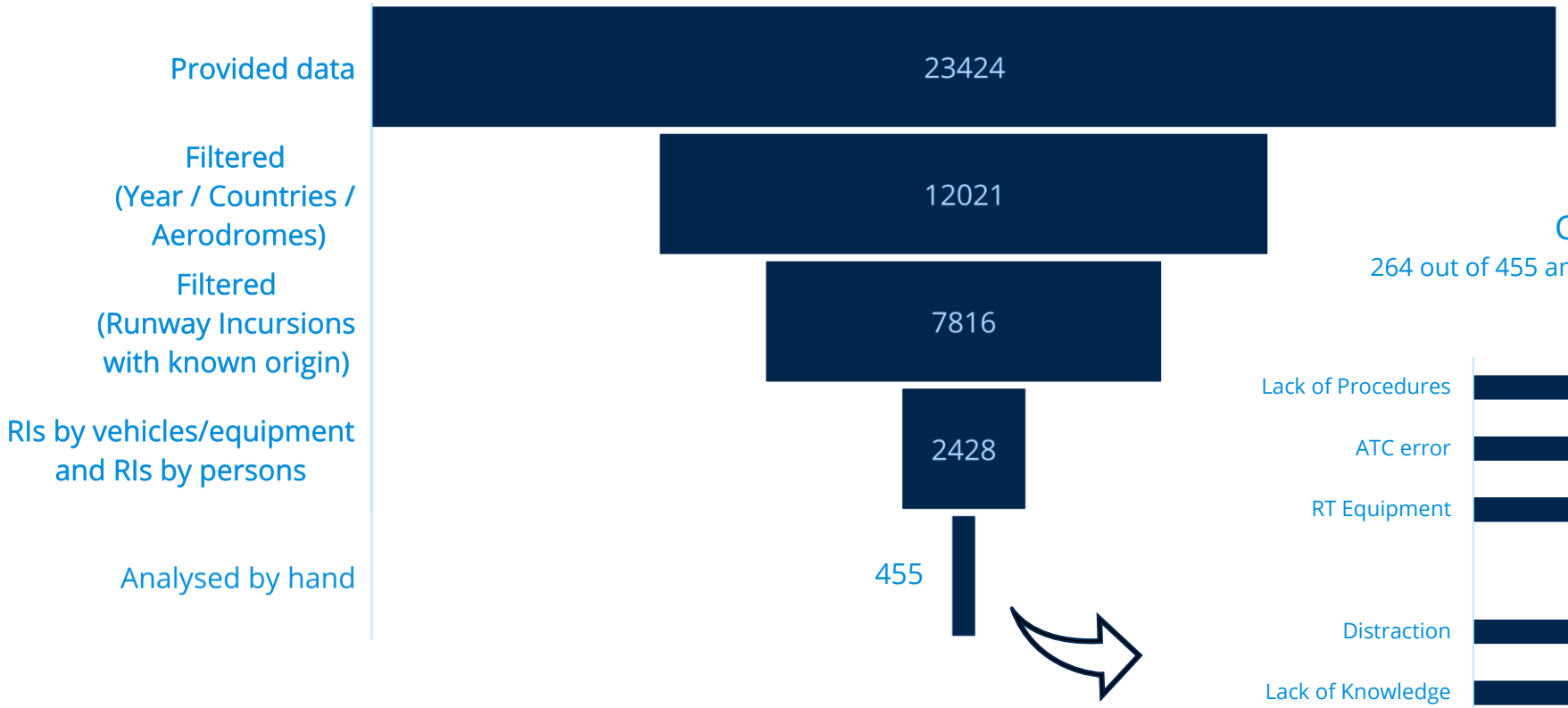




* unique: every file number contained in the (filtered) dataset was counted once

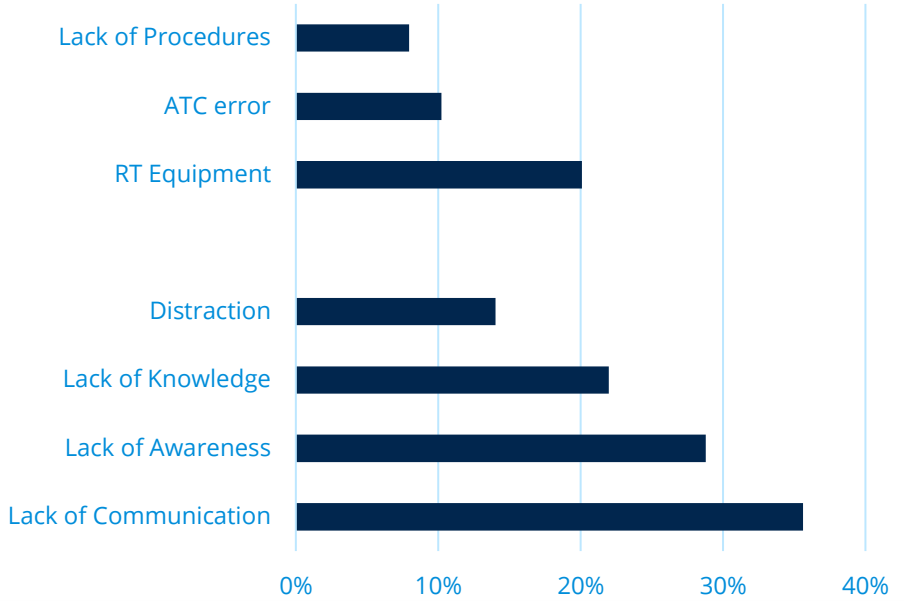
Occurrence Analysis
ECCAIRS – Contributing Factors

Number of unique occurrences* depending on filtering level



Contributing factors

264 out of 455 analysed events contained a corresponding indication



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Study on the ‘Triple One’ Concept
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Current situation at European airports
Objectives

Determination of **current situation at aerodromes** in Europe regarding the **implementation or non-implementation of the "Triple One"** concept

1st step → Identification of:

"Triple One" or variations ⟸ Established concepts ⟹ Correlation between airport characteristics and established concepts

2nd step → Determination of:

Constraints ⟺ Rationale ⟺ Challenges

Benefits and Hazards/Risks

Current situation at European airports
Stakeholder consultation

Survey

- Capture existing concepts and relevant aerodrome characteristics
- Distributed via ACI, IDRF, ERAC and aerodrome focal points

Interview

- Detailed discussion with aerodrome focal point(s) of survey responses and local specific concept
- Selection of interviewees:
  - ✓Coverage of wide range of aerodrome characteristics
  - ✓Availability and willingness

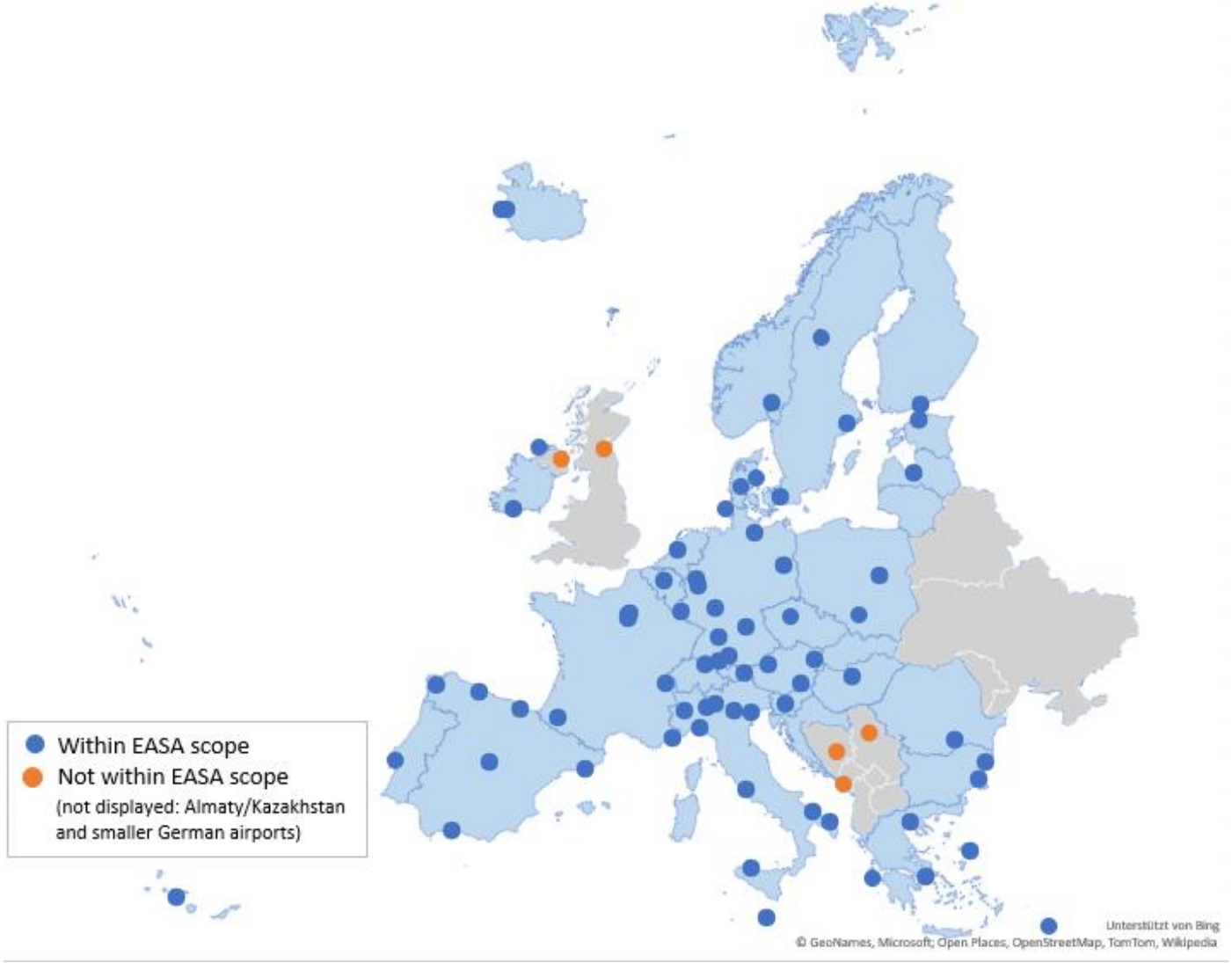
Workshop

- Involvement of all relevant stakeholders, e.g., Local Runway Safety Team, training department, ATC and airline representatives, ground handling, RFFS etc.
  - ✓Better understanding of local concept, rationale, constraints and challenges
  - ✓Identification of hazards and benefits associated with the local implementation of „Triple One“
- Dedicated workshops with ATCOs and pilot representatives

Current situation at European airports
Stakeholder involvement at a glance

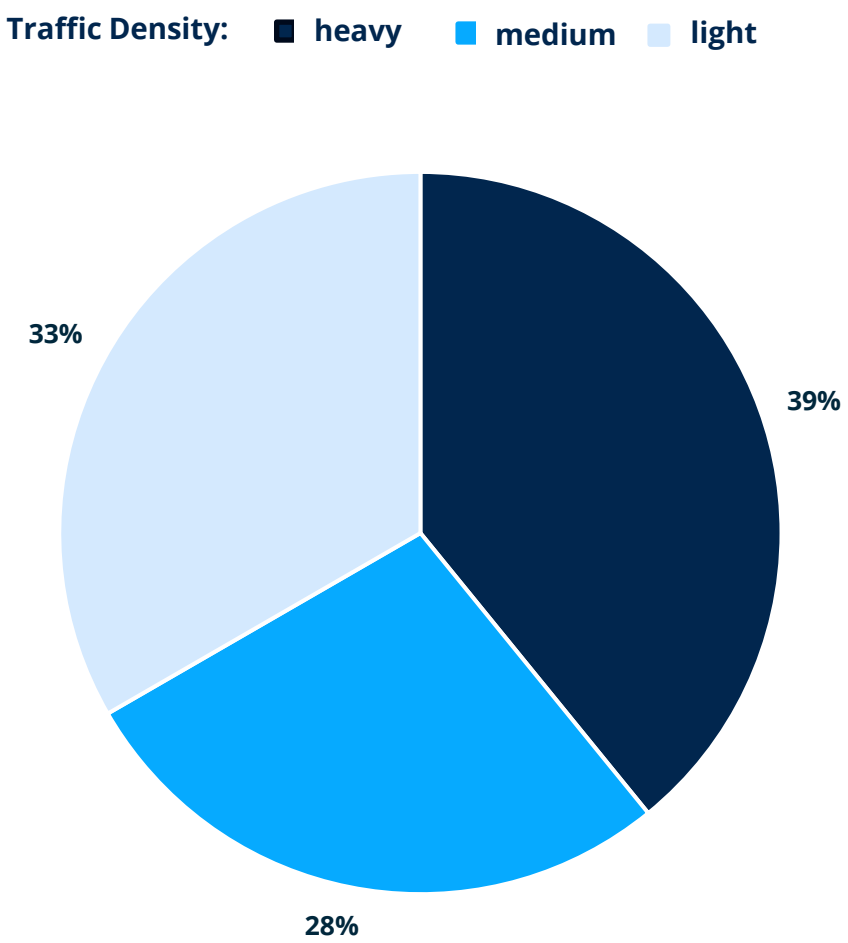
Online Survey

- **69** aerodromes / airport operators / organisations **within EASA scope**
- Additional participations from airports not within EASA scope or with exemption status
  - Bosnia and Herzegovina, Kazakhstan, Montenegro, Serbia, several regional airports in Germany, UK



Current situation at European airports

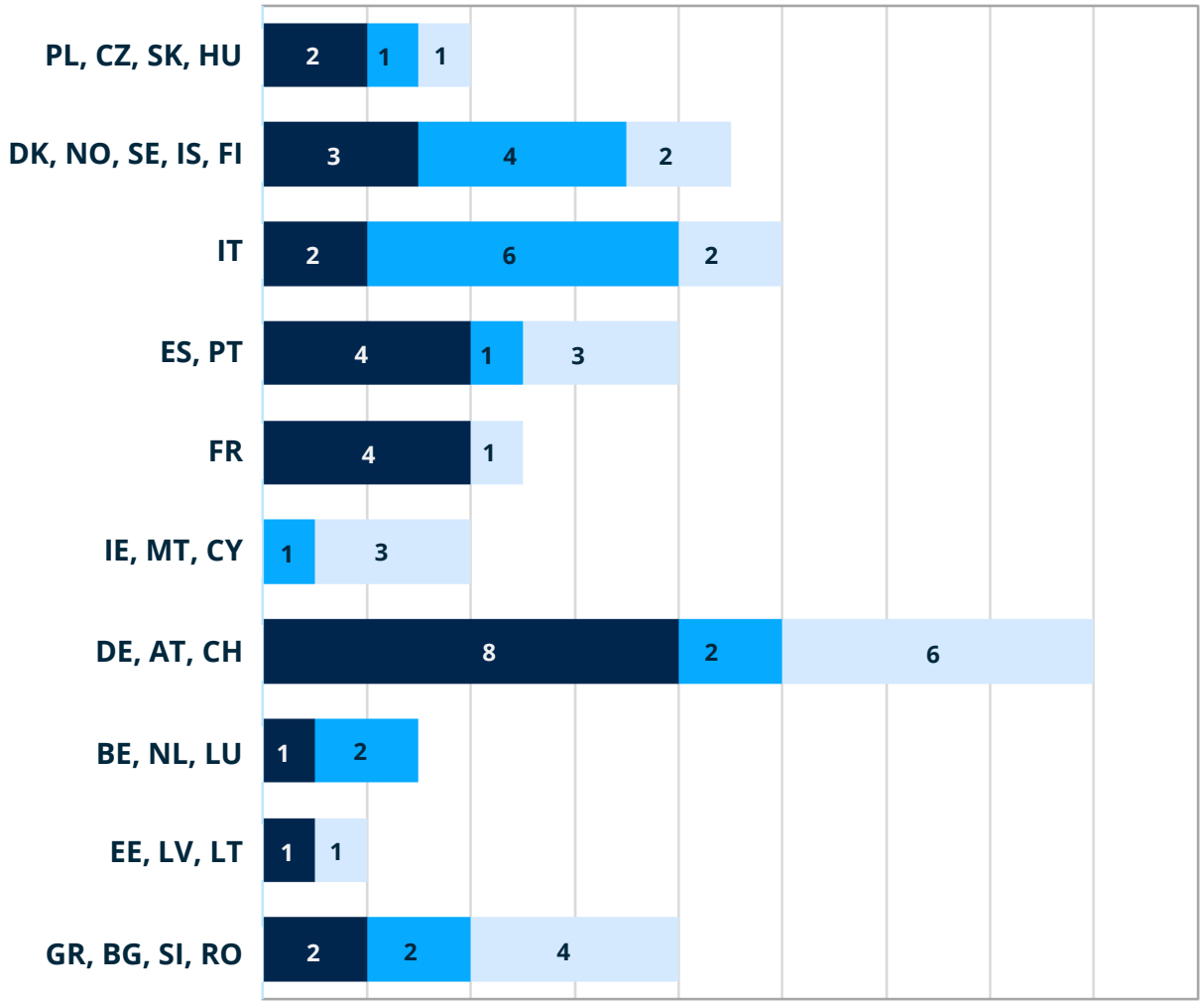
Aerodrome traffic density



Overall in Europe

Distribution in Europe

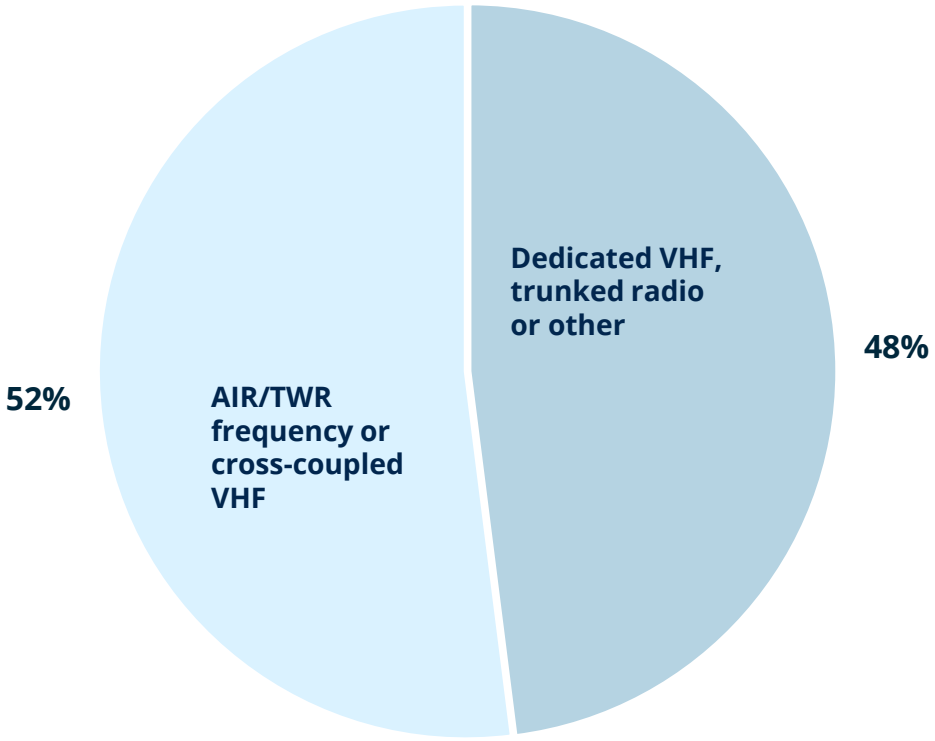
Among survey participants



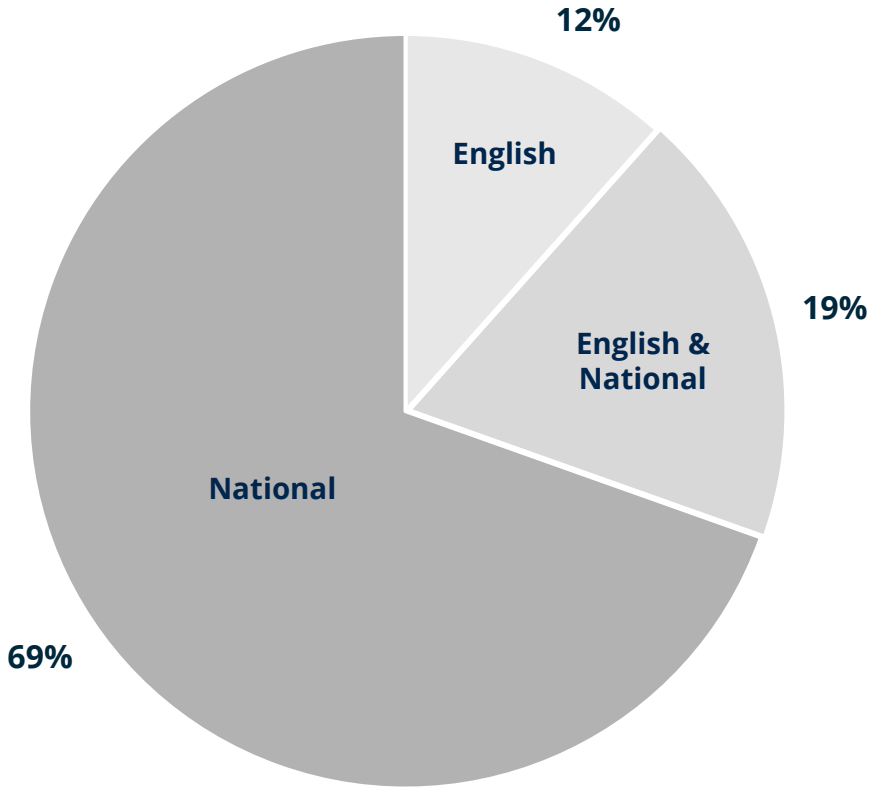
Number of ADR

Current situation at European airports
Vehicle Frequency & Driver Language

Distribution in Europe
Among survey participants



Vehicle Communication Frequency



Drivers' Communication Language

Current situation at European airports
Conclusions

ADR characteristics	Vehicle communication frequency TWR or cross coupled – 52% Dedicated VHF/Trunk Radio/Other – 48%	Vehicle communication language National – 69% English + National – 19% English – 12%
Aerodrome traffic density		
Commercial traffic share	Traffic share > 75%  TWR or cross coupled frecuency	
IFR traffic share		
Runway complexity		
Runway dependency	Dependent RWYs  TWR or cross coupled frecuency	

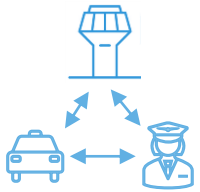
Aerodromes implement communication concepts based on other underlying factors, e.g.,
- ✓ **Local layout**
- ✓ **Local constraints**

Current situation at European airports

Current implementation of "Triple One"

69 Aerodromes within EASA Scope **participated in survey**

33 Aerodromes have a **common AIR/TWR frequency for pilots and vehicle drivers** (AIP-published) **or cross-coupled** TWR frequency



8 Aerodromes' drivers are (partially) **required to use English for communication** on active runway

Current situation at European airports
Current implementation of "Triple One"

ADR	Traffic density	IFR / commercial traffic share	RWY complexity	RWY dependency
1	Heavy	100%	Single RWY	
2	Heavy	75 – 95%	Parallel	Independent
3	Heavy	100%	Complex	Dependent
4	Medium	75 – 95%	Complex	Dependent
5	Medium	50 – 75%	Crossing	Dependent
6	Medium	75 – 95%	Crossing	Dependent
7	Light	75 – 95%	Single RWY	

No apparent set of characteristics that influence the implementation of „Triple One"

Current situation at European airports
Stakeholder involvement at a glance

Interviews and Workshops

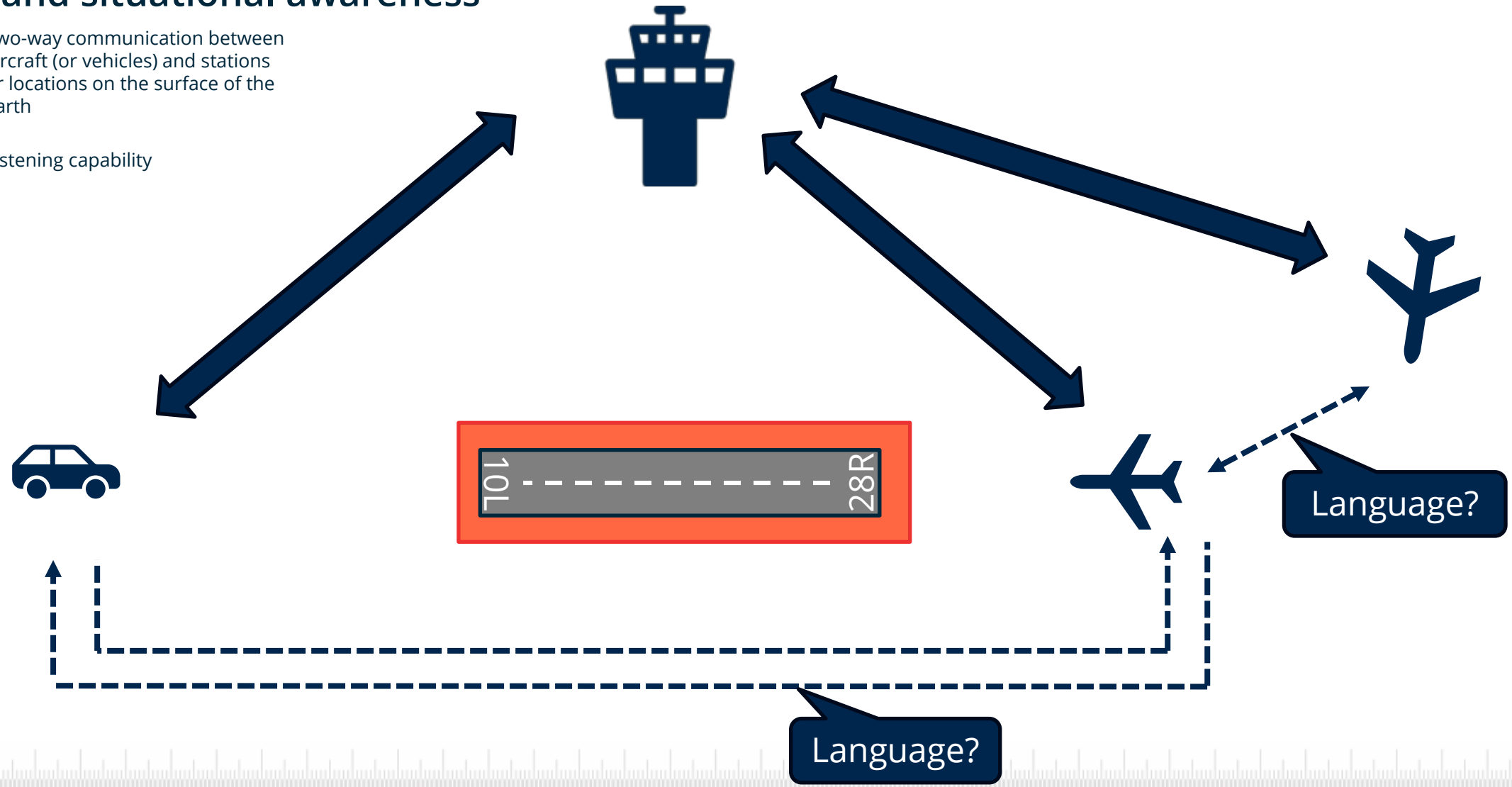
- **Interviews** with 19 aerodromes
- **Workshops** with 13 aerodromes
- Additional ATCO and pilot workshop

Current situation at European airports
Communication runway operations

- **Control and situational awareness**

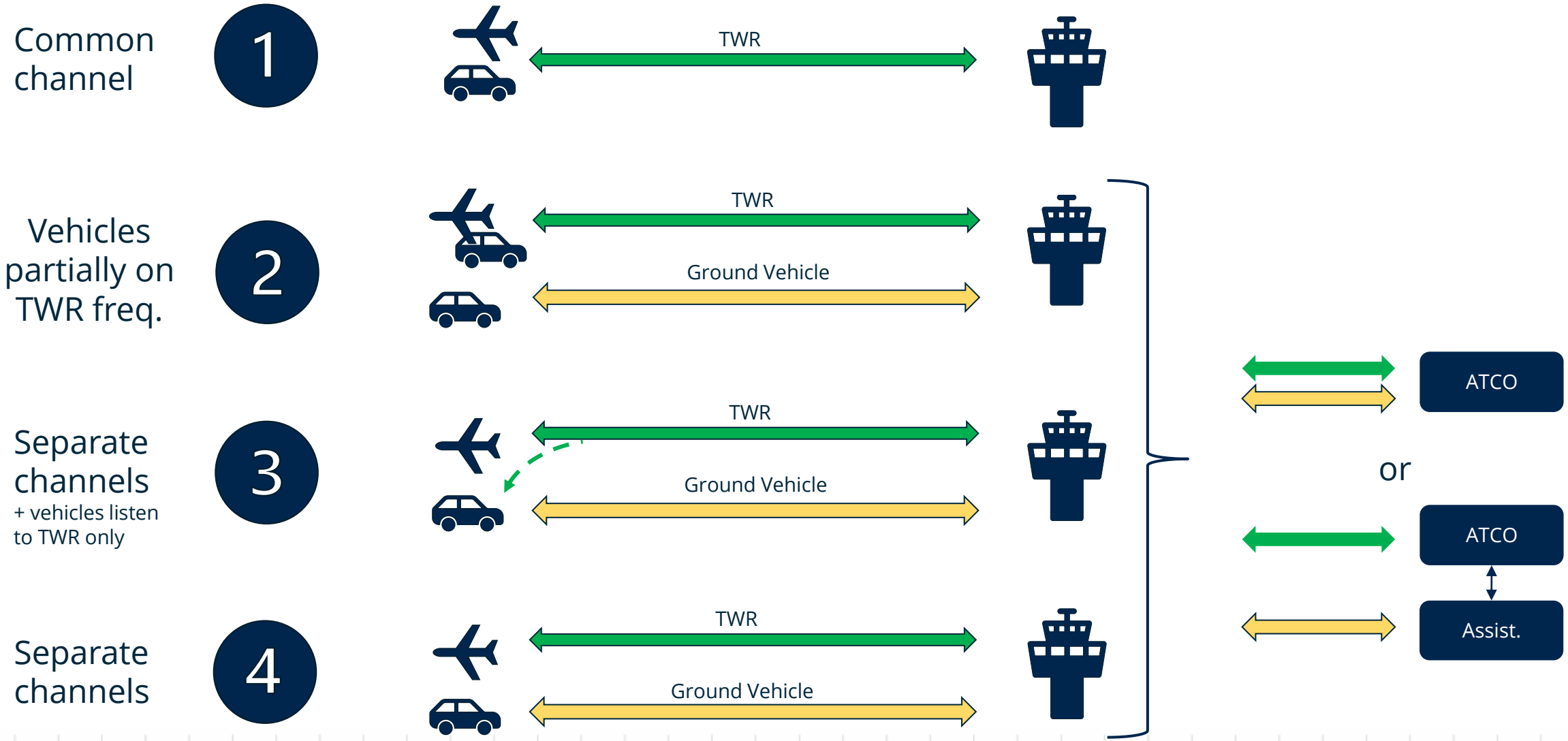
Two-way communication between aircraft (or vehicles) and stations or locations on the surface of the earth

Listening capability



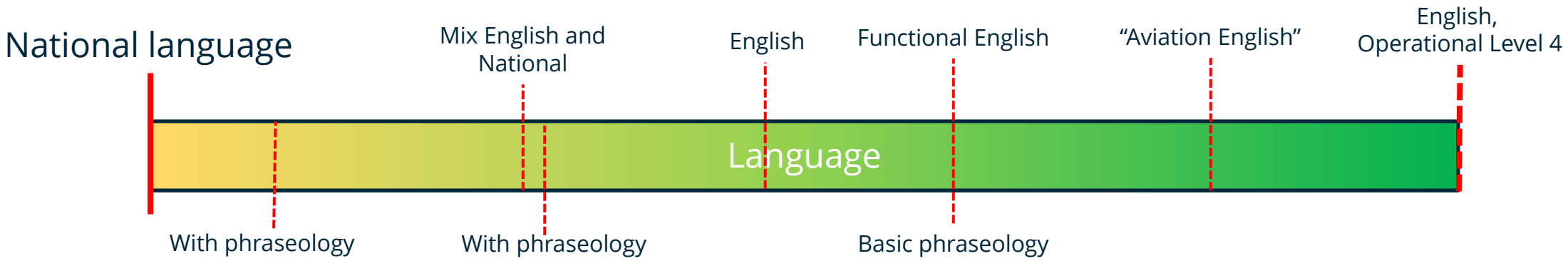
Current situation at European airports

Frequency between TWR and aircraft / TWR and ground vehicle



Current situation at European airports
Language and phraseology

- **Between TWR and ground vehicle operators on the runway**

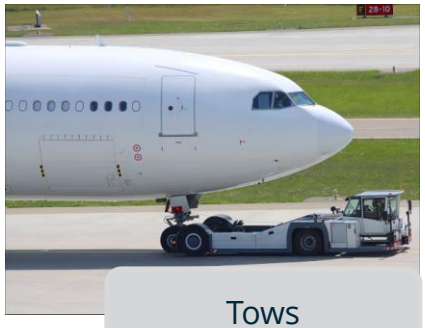


Current situation at European airports

Relevant ground operators and activities

RWY inspections (Airport OPS)

RFFS



Tows

Wildlife control

Winter service

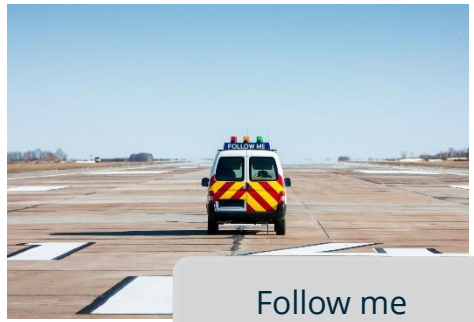
CAA

ADR Maintenance

ANSP Maintenance

MET Maintenance

Grass mowers



Follow me

Active RWY

Non-Active RWY
(unavailable)

Current situation at European airports

Relevant ground operators and activities

On the runway

- Primarily safety related tasks
- Can be planned to some extent
- Most frequent: inspections

RWY safety areas

- Safety related and maintenance activities
- Can be planned to some extent
- Challenge: identification of boundary

Crossing the RWY

- Only if unavoidable
- Usually not planned
- Short process time


RWY inspections (Airport OPS)


RFFS


Tows


Wildlife control


Winter service


CAA

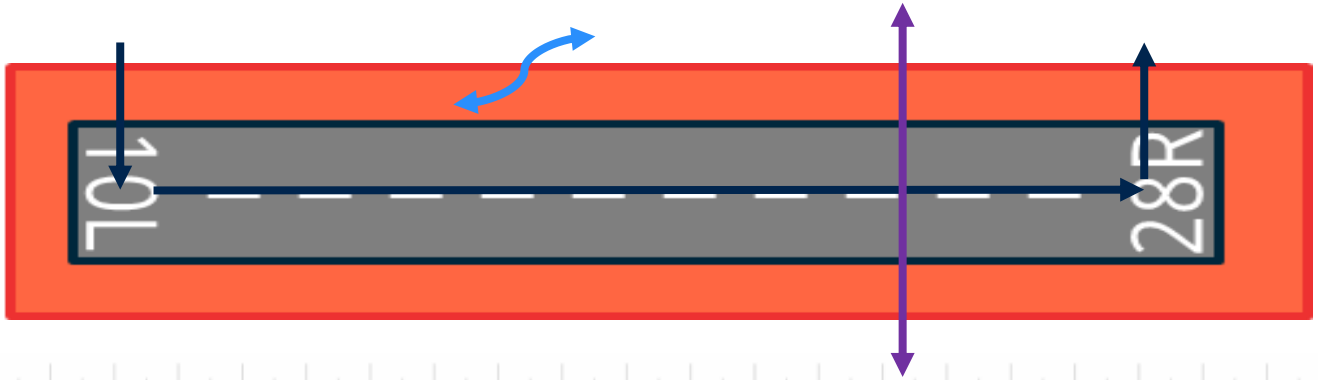

ADR Maintenance

ANSP Maintenance

MET Maintenance


Grass mowers


Follow me



Current situation at European airports
Common rationales

"From a safety management perspective, we have no reason to consider local language a hazard as no investigations conclude that any safety occurrences involved the use of local language. Furthermore, we consider it a risk to introduce foreign language requirements as a standard as the majority of our personnel is currently not experienced / have low English language skills. Hence, we consider introduction of English requirements a risk to flight safety."

Current situation at European airports

Safety barriers for prevention and recovery of runway incursions

Training

Phraseology
National and English
ICAO / SERA

Infrastructure
Visual aids, controllable stopbars
H24
TWY design perimeters

Procedures
Pre-coordination
Active/non-active runways

Technical applications to enhance situational awareness
Moving map

Surveillance systems
SMR, MLAT, transponder

ATCO memory aids
Vehicle strip, EFS, status indication

Advanced guidance and control systems
Follow the green

Automatic alerting and warning systems
RIMCAS / RIAS, geofencing

RWY status lights

Other safety nets might have a more significant impact on runway incursions.

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- Introduction
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- **Case study: Implementation of Triple One at BRU/EBBR**
- Considerations regarding Benefit and Risk Analysis
- Discussion and Q&A

brussels airport
the heart of Europe

Implementation of Triple One in BRU

1. History
2. Training
3. Airside Driving Simulator
4. Challenges

History

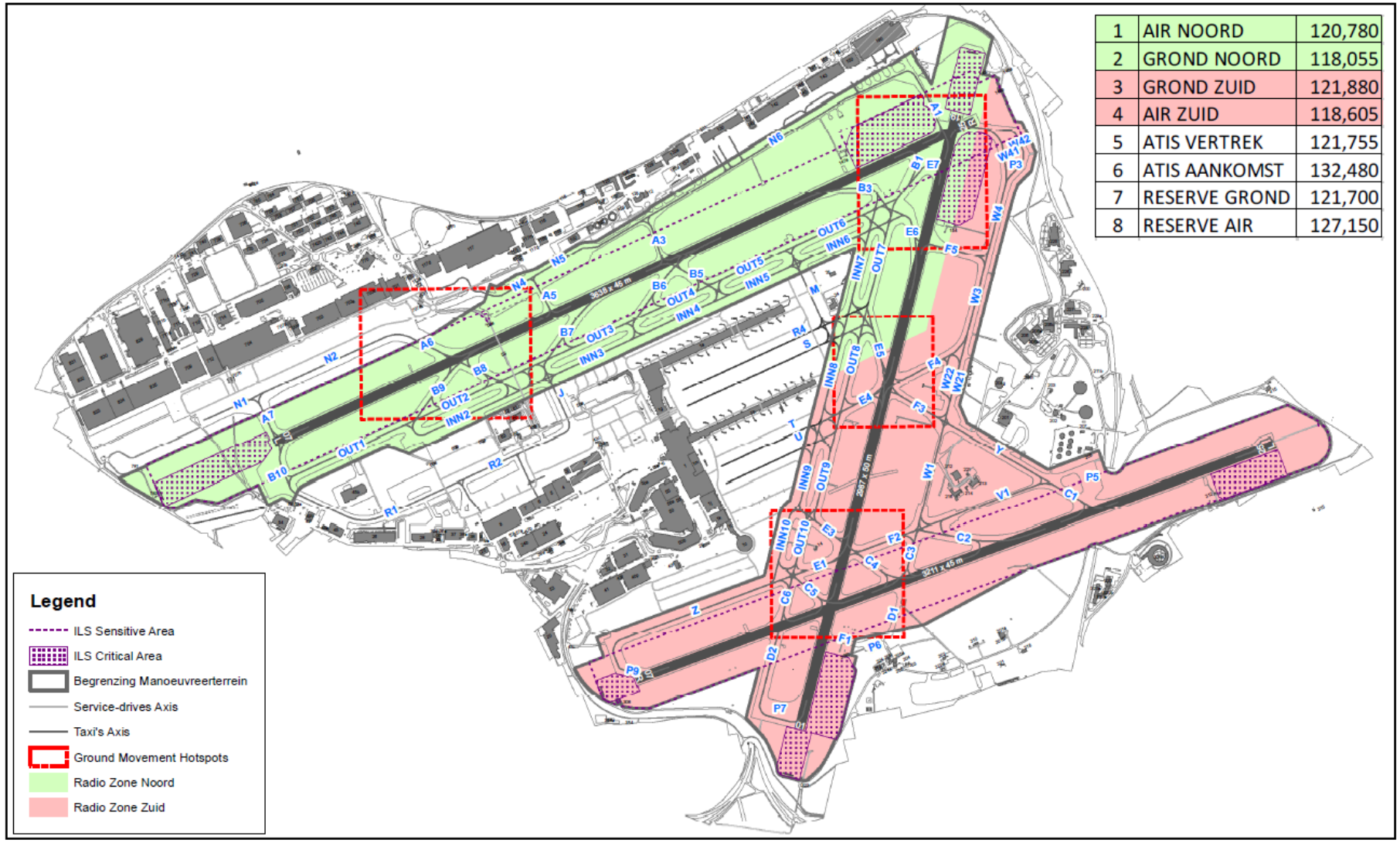
- Triple 1 is implemented in BRU as from 2004. This was done in different steps:
  - First step was to convince all involved parties
  - We looked for a trainer to have the ICAO standard phraseology trained
  - In coordination with the ANSP
  - Next step followed a year later: every vehicle driver needs to communicate in ICAO standard phraseology
  - Implementation of 1 frequency on 1 runway

- Step by step the implementation of ICAO standard phraseology was done
  - Training of the vehicle drivers
  - Implementation of the ICAO standard phraseology for all vehicle drivers. In the beginning, if the communication was not sufficient, ATC responded in native language in order to make sure the message was well understood

History

- Implemented both on Runway & Taxiway
- Changes for ANSP:
  - Vehicle drivers no longer on VHF radio
  - Ground frequency was integrated in the runway frequency (see map)
  - no oppossition from ATC: value was high
- Need was high due to different languages in Belgium, and some fatal accidents (rail) due to misunderstanding.
- Maps in vehicles
- Radio frequency zones in vehicles

Frequencies Brussels Airport



1	AIR NOORD	120,780
2	GROND NOORD	118,055
3	GROND ZUID	121,880
4	AIR ZUID	118,605
5	ATIS VERTREK	121,755
6	ATIS AANKOMST	132,480
7	RESERVE GROND	121,700
8	RESERVE AIR	127,150

Training

- The purpose of a standardized training program (driver license B) is to prevent the occurrence of runway incursions at Brussels Airport by enabling optimal driving & communication skills as well as an excellent comprehension of situational awareness on airside.
- The need for a uniform training program was identified after the investigation of runway incursions at EBBR and repeated lessons learned were formulated:
  - Lack of situational awareness of vehicle drivers;
  - Lack of situational awareness ATC;
  - Lack of knowledge 'standard phraseology' vehicle drivers;
  - Lack of knowledge procedures on the manoeuvring area.

Training

- Who needs to drive on the manoeuvring area;
  - Towing
    - Handling partners
    - 15W (MIL)
  - Operational services
    - Aerodrome operations (bird control, follow me, airside inspection,…)
    - Fire & Rescue services
    - Green keeping operators
    - Winter operators
    - 15W (MIL)
  - Infrastructural services
    - Sustainable development
    - Asset management
    - ATS provider technicians
    - Aircraft maintenance companies

Training

- In the context of the “Runway Incursion Prevention Program”, the number of airport driving license B holders is strictly limited to personnel who needs this driving license for the execution of their **daily** duties.
- There are approximately 300 vehicle drivers who receive recurrent training every 2 years.
- 50 of them are external workers responsible for the winter operations. They are trained every year.

Number of trained staff

2022	2023
265	328

Training

Airport driving license B INITIAL			
Duration		**Type**	
Day 1	8h	Theoretical training	Classroom training
Day 2	1h	Theoretical test	Computer based test (under supervision)
Day 2	1,5h	Practical training	Airside Driver Simulator
Day 2	0,5h	Practical test	Airside Driver Simulator

Training

Airport driving license B RECURRENT			
Duration		**Type**	
Day 1	2h	Theoretical training	E-Learning (autonomously)
Day 2	3h	Theoretical test	Computer based test (under supervision)
Day 2		Practical training	Airside Driver Simulator
Day 2		Practical test	Airside Driver Simulator

Training topics - communication

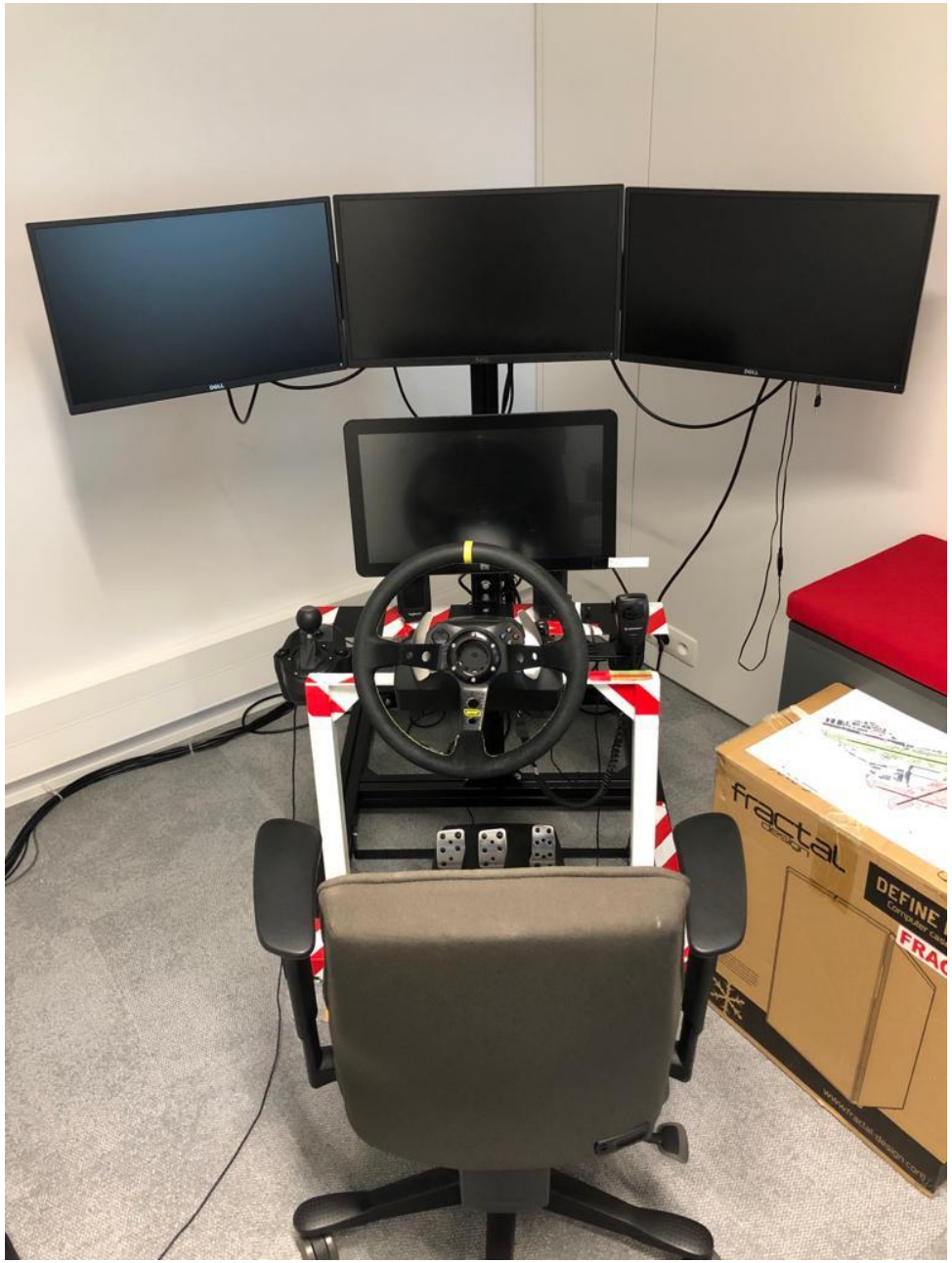
- Ground vehicle communications
  - Radio frequencies
  - Procedural words and phrases
- Aviation phonetic alphabet
- Aviation terminology
- Procedures for contacting the ATC/TWR

Training topics - communication

- Communication techniques
- Communication in convoy
- Radio check and failure
- Driver lost
- Emergency communications
- Vehicle breakdown
- Use of transponder

Airside Driver Simulator

- Training
- Testing
- Simulation of specific situations
- Aerodrome familiarisation



Challenges – now and in the future

- New simulator

Study on the ‘Triple One’ Concept
Agenda

- Introduction
- Occurrence Analysis
- Current situation at European airports
- Case study: Implementation of Triple One at BRU/EBBR
- **Considerations regarding Benefit and Risk Analysis**
- Discussion and Q&A

Considerations regarding Benefit and Risk Analysis

Benefits

Shared communication of safety relevant information:

- RWY crossings
- RWY inspections
- Take-off/Landing clearances
- Maintenance
- Wildlife
- ...

Pilots & Vehicle Drivers

1. Enhanced safety through **strengthened cross-checks** between stakeholders on:
   - **Presence and location of vehicles & A/C** in the maneuvering area, especially on active RWY
   - Communication of **current RWY status** and findings (e.g., FOD)
   - **Clearances** (e.g., A/C take-off, RWY crossing)
   - Anticipation of traffic on maneuvering area
2. Faster **problem identification** and more efficient **decision making** especially in dynamic situations, e.g.:
   - Approaching an active RWY
   - Prior to take-off or landing
   - (Near) RWY incursion
3. Enhanced **safety culture** among stakeholders

ATCO

Additional corrective measures:

- Increased awareness **of pilots**
- More detailed **traffic information**

LVC

Improvement of situational awareness

Considerations regarding Benefit and Risk Analysis

Benefits

Standardization of:

- Procedures
- Communication
- Hardware

Communication through **common language (patterns)**

1. **Vehicle drivers**
   - Effective communication and predictable procedures through standardized language patterns
   - Prompt response to instructions (by third party) contributing to more efficient ground operations and minimizing delays
2. **Pilots**
   - Knowledge and anticipation of ground traffic enhancing their situational awareness
3. **ATCOs**
   - Communication of consistent instructions reducing the risk of miscommunication and ambiguities
   - Unified communication reducing the need to switch between languages or frequencies.

Standard hardware

- Higher **equipment reliability** due to standardized and certified communication equipment
- Increased **transmission quality** (VHF)

Harmonization

Considerations for Benefit and Risk Analysis

Hazard Overview

	HZ.001	HZ.002	HZ.003	HZ.004	HZ.005	HZ.006
Hazard	More transmissions on TWR frequency	More stakeholders on TWR frequency	Insufficient English language skills	Higher training/ qualification requirements	Inability to follow communication regarding traffic on dependent RWYs	Higher number of used frequencies/ areas of responsibility
Undesirable Event	Frequency overload	Too much information and/or information overload	Miscommunication	Lack of aerodrome personnel operating on RWY	Loss of situational awareness (concerning dependent RWYs)	Ineffective and inefficient coordination and use of frequencies
Description	When more communication related to operations on an active RWY is conducted on one frequency, frequency overload may be the result.	Too much information on the TWR frequency leads to stress, neglection of important tasks, increased need for clarifications and/or fading out of conversations.	Insufficient English language skills may lead to misunderstandings and miscommunication	Higher training requirements and durations, notably due to English level 4 and phraseology requirements, may lead to understaffing. Understaffing of aerodrome personnel can result in operational safety issues.	By splitting up the frequency of dependent RWYs, situational awareness of pilots and vehicle drivers regarding operations on (other) dependent RWYs might not be given any more.	By assigning each runway a separate frequency a higher coordination effort is required between ATCOs. In addition, higher effort for pilots and vehicle drivers to manage even more frequencies and frequency changes.

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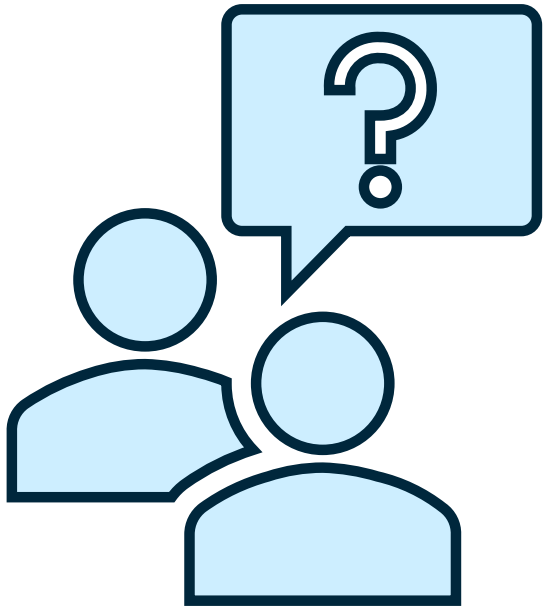

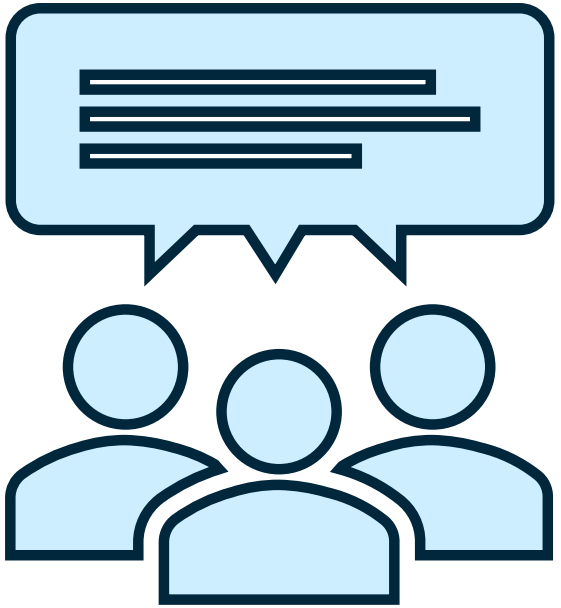

Thank you for your attention!

Do you have any questions?

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