



# Building Block Strategy

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thinking without limits

# Building Block Strategy

***A way to answer to industrial concern***

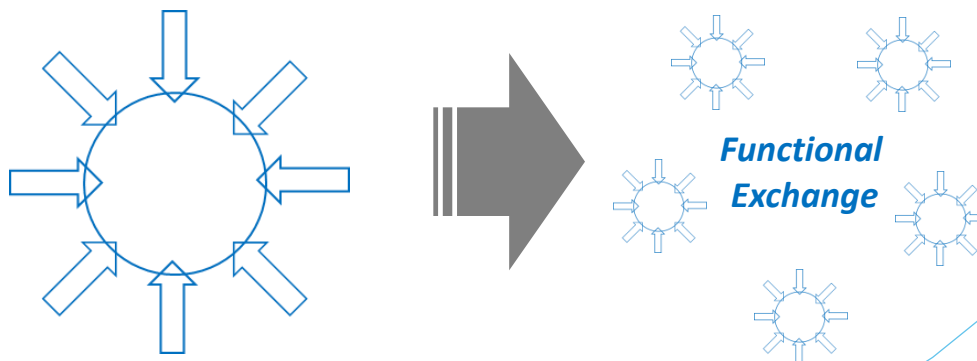
*To deploy Step by Step Family Concept*

*To Reduce Risk in introducing Innovation*

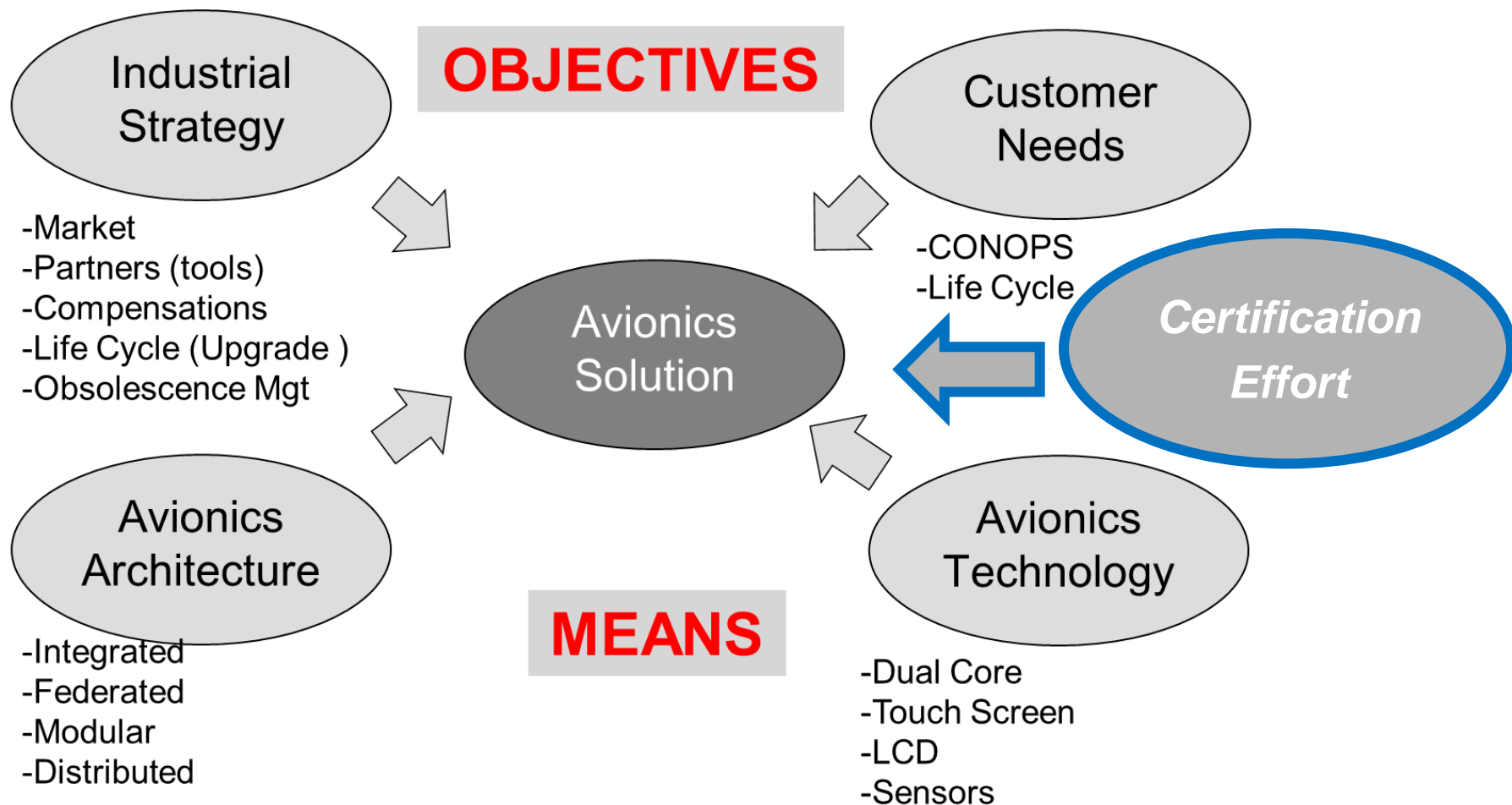
*To put in force Extended Enterprise agreement*

*To address IMA complexity for Certification Approach*

***By Transforming a Complex System into Multiple Simpler Subsystems***



# The Industrial Design Process



# The Objectives / Ambitions and Challenges

## To Manage in Parallel Risk Reduction and Innovation Capacity

- *To secure with a well known basis, for hurry up a first flight*
- *To secure for each enhancement an existing fall back solution*
- *To be scalable to process with progressive enhancements*
- *To include all potential innovation by local modification not affecting global system*
- *To be aware of existing supplier solutions to orient architecture and provision accordingly*
- *To reduce complexity by minimizing sub-systems dependency*

## To deploy a family concept covering all Helicopter fleet

- *With adapted level of reuse and commonality with existing development*
- *Taking care of Legacy fleet with potential upgrade or obsolescence treatment*

## To be compatible of third party subsystem introduction

- *To be capable to deploy Extended Enterprise Concept*
- *To maintain active competition*
- *To comply with potential compensation needs*

# *State of the Art in reuse process*

# Legacy Avionics

*Definition of Elements that can be reused (SW and HW)  
is dependent of the selected architecture .  
The Name of “LEGO” was used in previous developments*

**Operational Function Level :** *Equipment Host all resources to support a full function*

*“AVIONIQUE NOUVELLE” that equips all the Eurocopter commercial fleet today*

- *Central Panel Function (gathered in a single duplex equipment : I/O + CPU + Display)*
- *Automatic Pilot (hosted in HW /SW Module : I/O + CPU )*
- *Flight Monitoring (Independent Subsystem gathering CPU and Displays)*
- *Usage Function (Data concentration , processing and recording)*

**Or**

**HW Resources Level :** *Definition of a set of HW resources as elementary bricks*

*“MODULAR AVIONICS” defined by*

- *Display*
- *Data Concentration*
- *Processing*

***Avionics Architecture can take benefit of both approaches***



# Current IMA combining Functional and Modular Approaches

## SW Modules

### ● A653 Partitions

- Vehicle Monitoring Function (**VMS**)
- Usage Monitoring functions (**UMS**)
- Helicopter Flight Data Monitoring (**HFDM**)
- Flight data recorder (**FDR**)
- Digital Map (**DMAP**)
- Terrain Avoidance Warning System (**TAWS**)
- Synthetic vision (**SVS**)
- Electronic Flight Bag (**EFB**)
- Automatic Flight Control System (**AFCS**)
- Service functions (Loader/Monitoring..)

**Common Configurable Modules**

## HW Modules

### ● IMA Platforms

### ● + Sensors



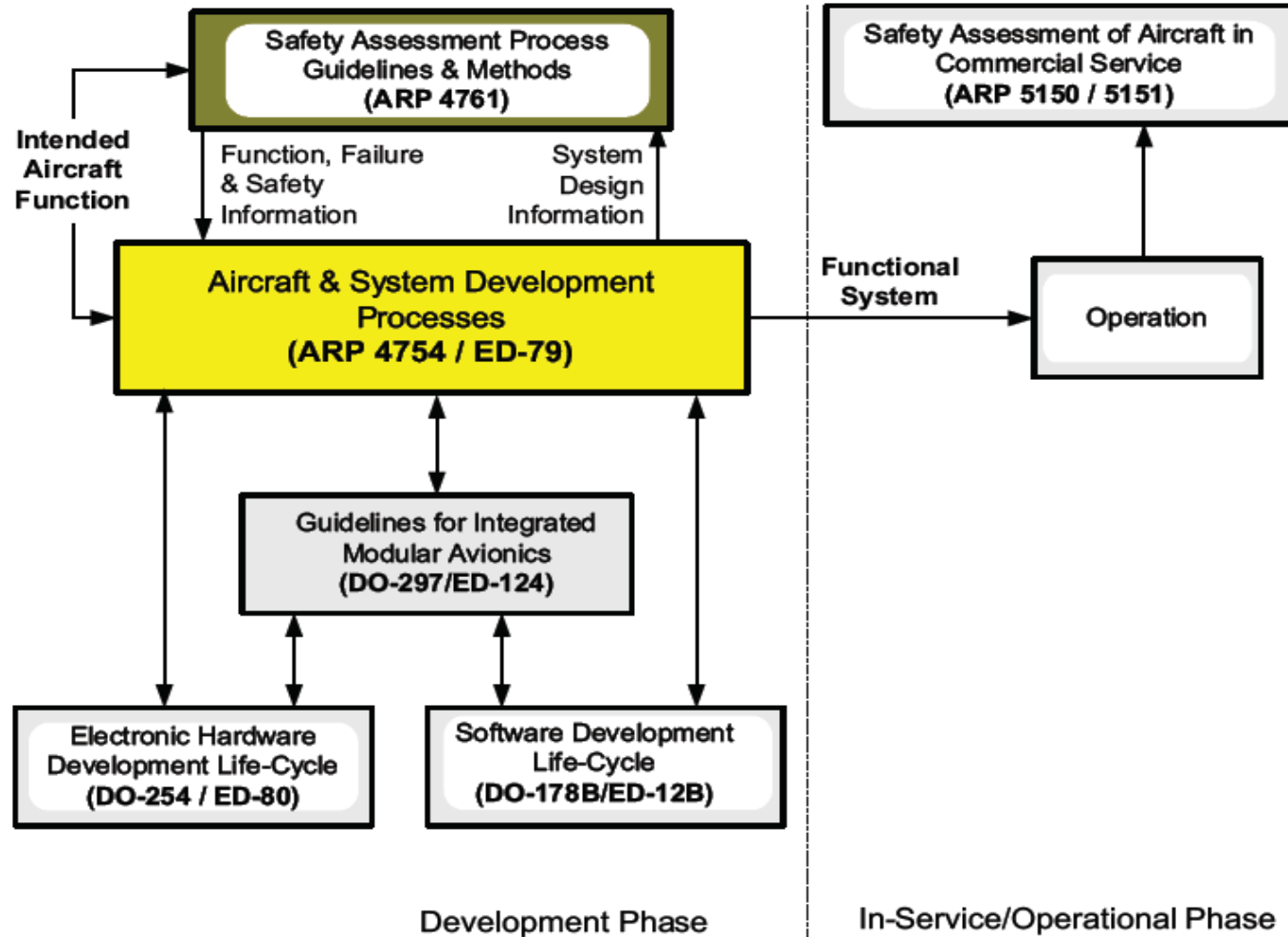
**40% LRU Type less**  
**MTBF X2**  
**30% Weight Less**

**Supporting The IMA Incremental Certification Process**

# System Engineering Development Methodology

## Applied for the recent developments

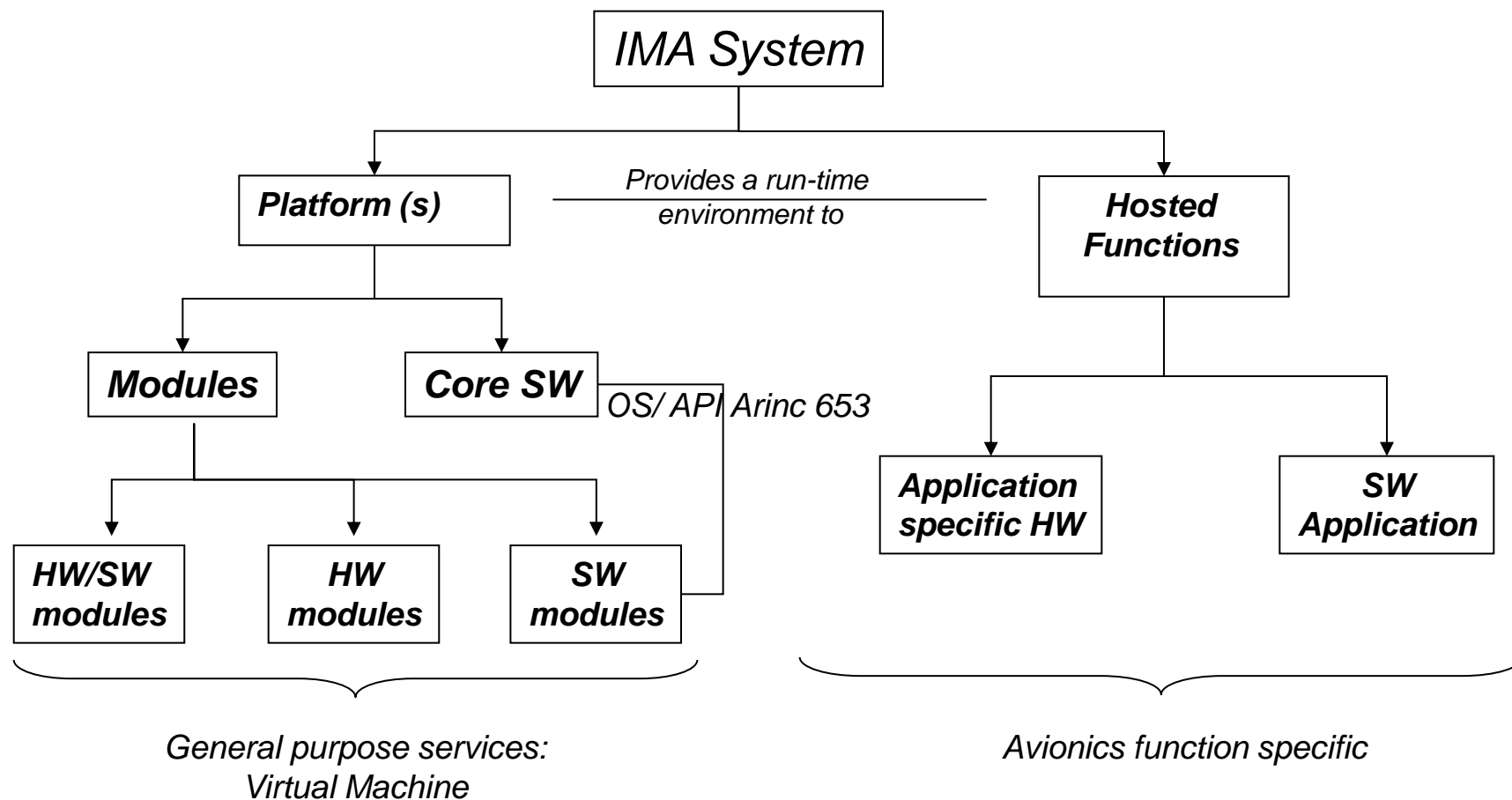
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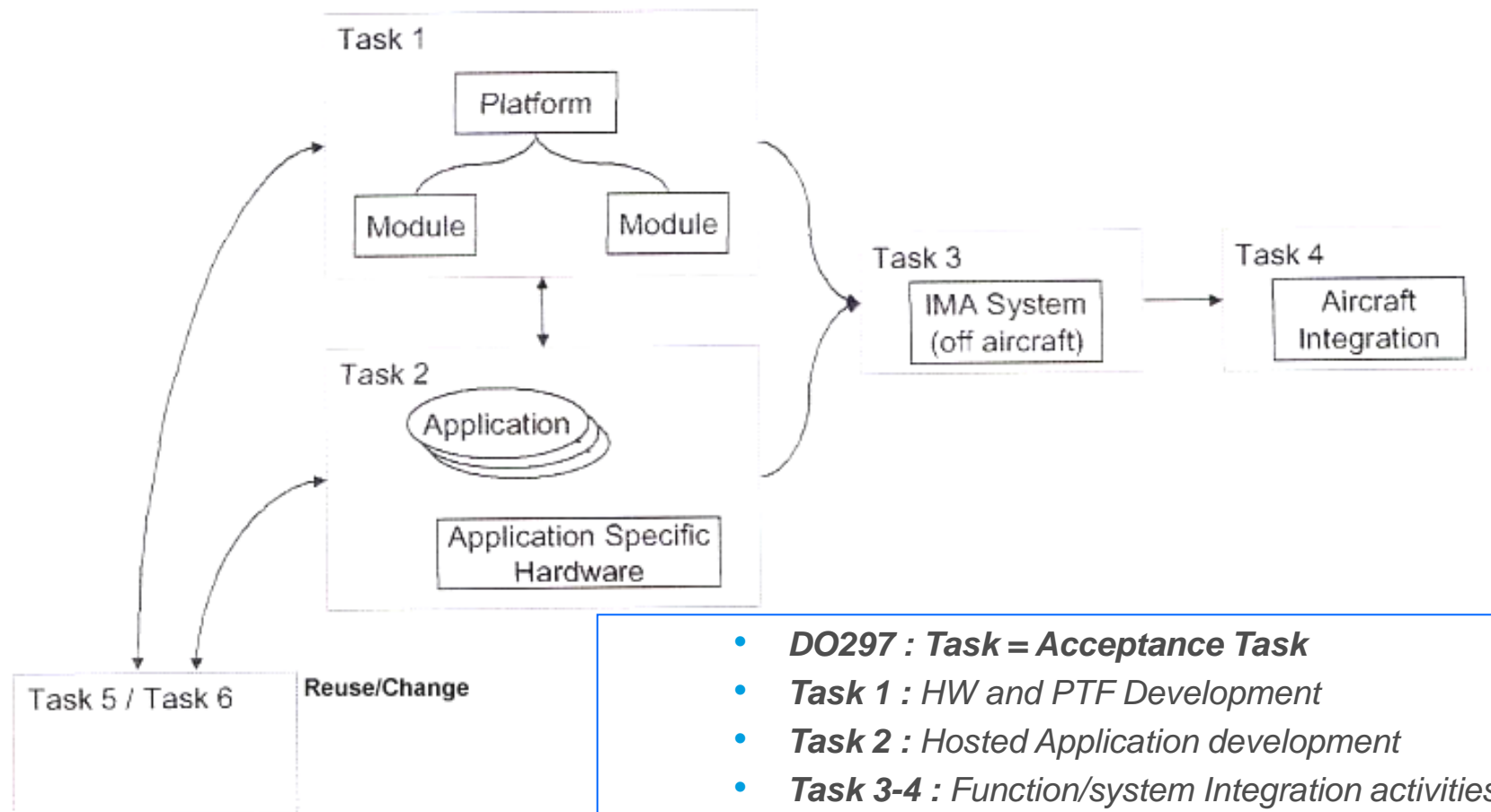




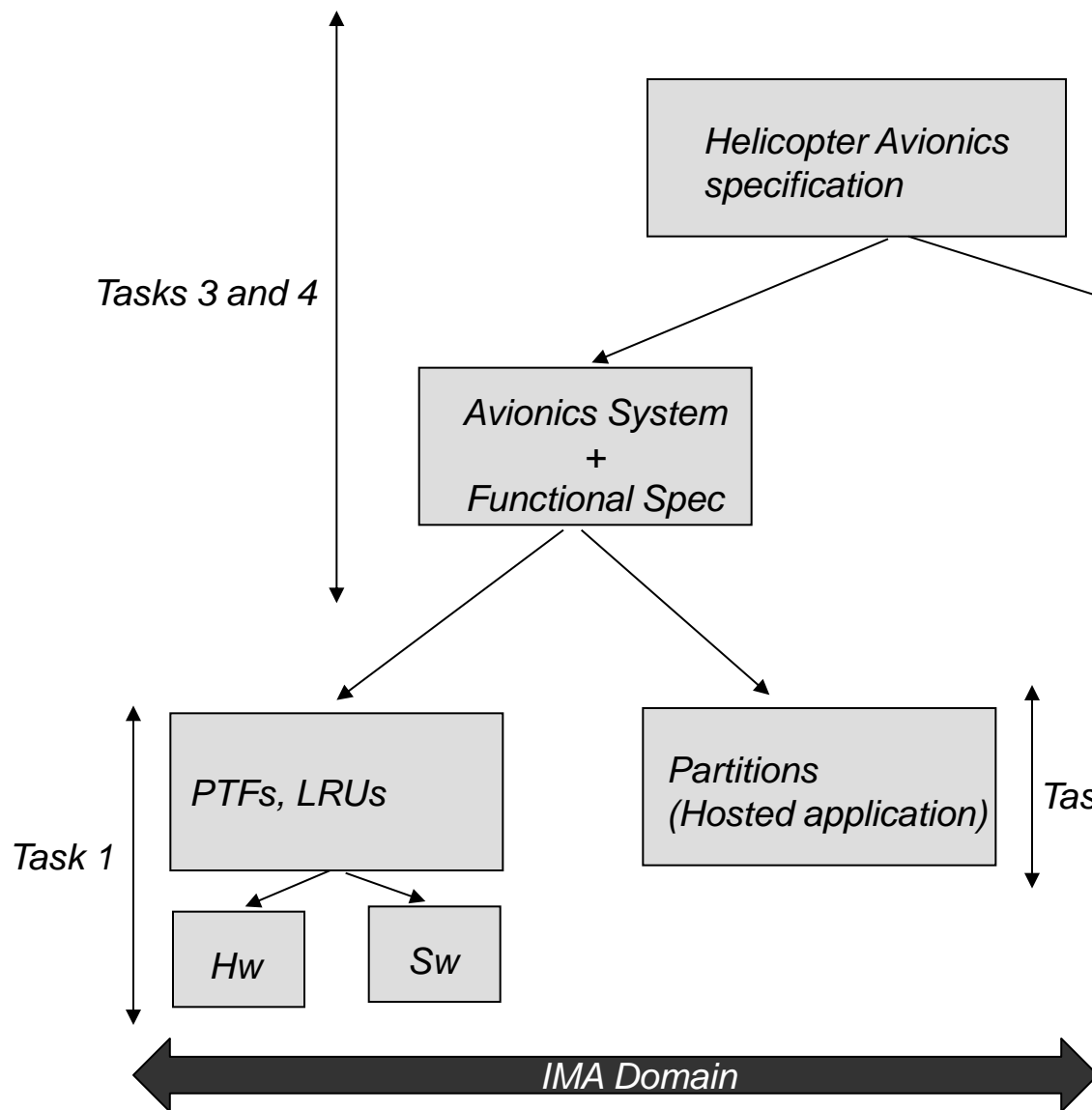
# Integrated Modular Avionics and Reuse Concern

## DO297 IMA Key Concept Incremental Certification



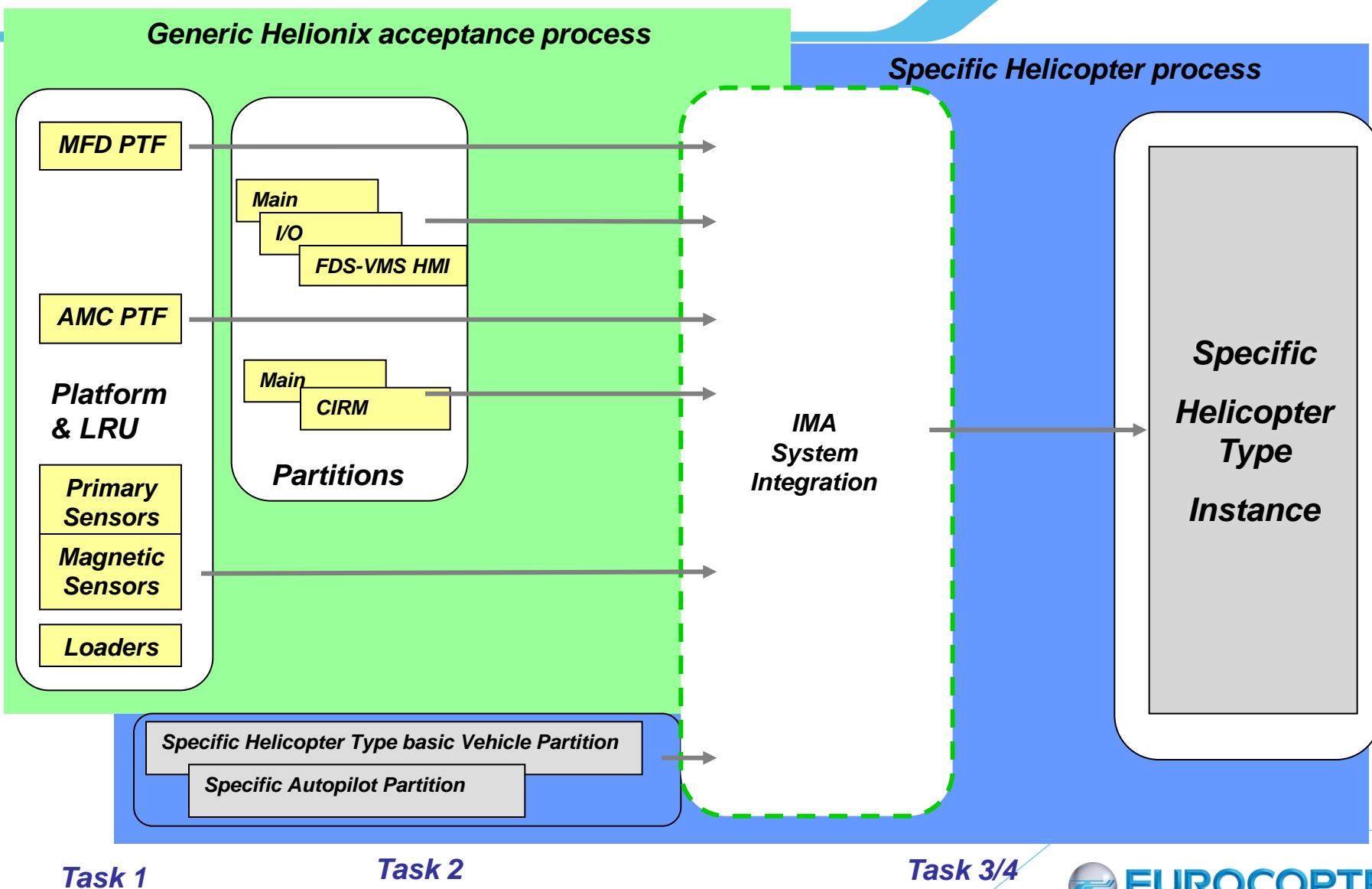


# D0297 task structure in avionics system and IMA « Bricks »



- IMA platform must be independent of hosted application / partitions (usage domain / user guide)
- IMA platform could be defined independently (prior) of the system (Consistency is ensured at architecture definition level)

# Typical Integration Tasks on avionics function



Task 1

Task 2

Task 3/4



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# Present situation for IMA reuse in DO297 (ED 124) context

-“Incremental qualification and acceptance is restricted to a particular certification project. For Re-use of qualification and acceptance data for other certification project, the applicant should submit its request of qualification credit (including the necessary justifications and supporting data) coming from previous installations”

→ *This is a major difference with TSO /ETSO approval*

-“No specific letter or stamped data sheet is provided as part of the EASA type certification process except for the final type certificate”

→ *This is an other important difference with STC which approve a “local” enhancement*

*Past Experience: DGAC “QAC” process allowed to overcome these limitations*

*Definition of Building Blocks covering Hw and SW resources Qualification*

*Identifying functional and environmental requirements in a self contained packages reusable as a TSO or ETSO*

*This approach do not prevent to develop these “subsystems “ using IMA techniques*

*But their System Integration is done in federated way*



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# Lessons Learned

## Industrial Benefits

- Structuration of activities and related deliverables through certification tasks
- Spec tree
- Traceability
- Impact Analysis in a frame of “change” process

## Weaknesses

- No real credit
- Important effort for reuse because elementary Bricks are at low level
- **The reuse is mainly Specification / Platform qualification**
- **System Integration tasks take few benefits of this approach**

## Consequences

- To get more credit and reduce reuse effort more global “Bricks” than HW platform or SW modules should be targeted
- The system must be more segregated into
  - Helicopter type specific (Engine /Vehicle basic functions highly subject to change)
  - Helicopter Industry or Aeronautic Function (FMS / DMAP / SVS are more generic)
- The Make or Buy Strategy should be associated to these choices

Reuse of  
Specification

Reuse of H/C  
Integration

Reuse  
Validation

Reuse of  
Sub-systems  
qualification

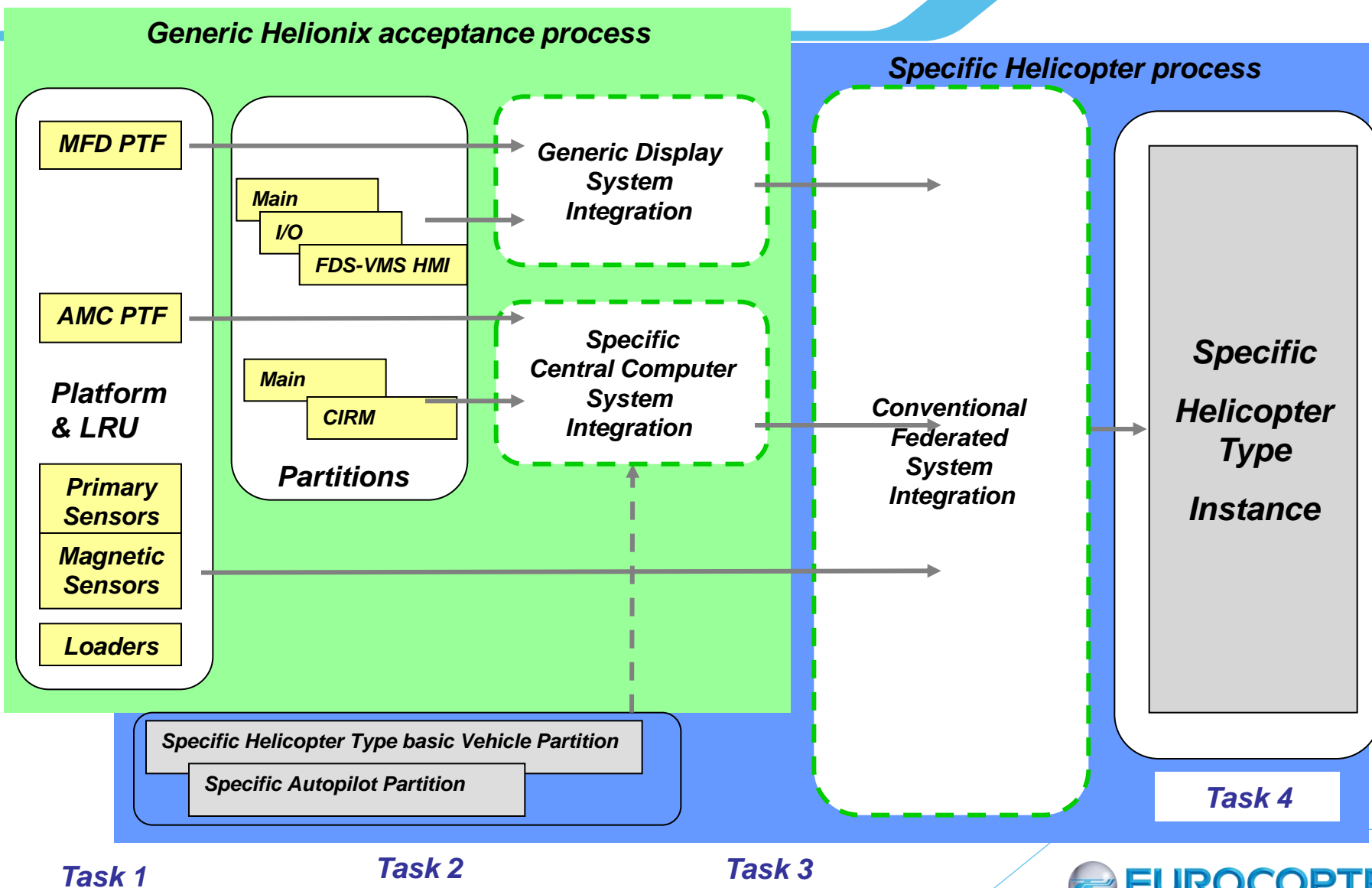
Reuse of  
tests set

Reuse of  
Platform / SW  
module



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# Enhancement for Reuse on existing avionics architecture



# *Move Forward to Sub-System Building Blocks*

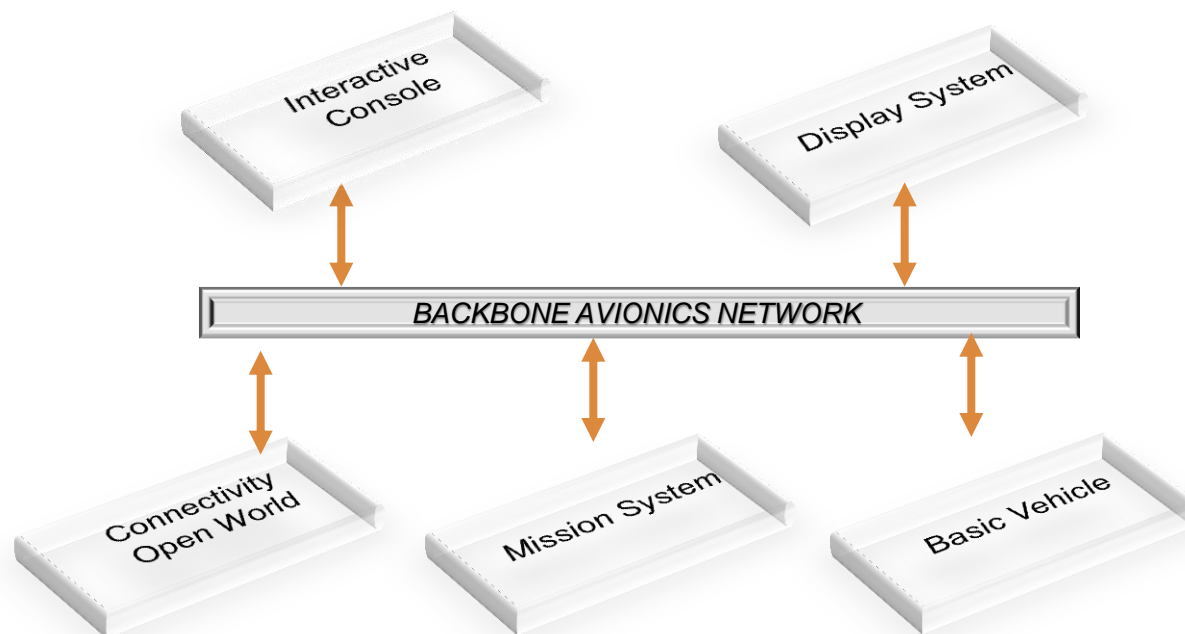




# The Building Blocks Architecture

Global architecture choice is key before entering in Building Block process

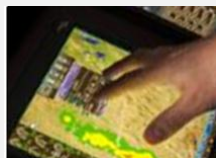
- Allocation of functions ( Where and Which functional link with other BB )
- Definition of resources ( Processing /Symbol generation for future needs ..)
- Definition of Interfaces ( now; growth; future) and break through identification



*Each building block shall be as far as possible independent of the other and specified /qualified as a separate element*

# Functional Allocation to Building Blocks

## Interactive Console :



Mission Management  
DMAP with Terrain Awareness  
FMS(ACARS) , Radio Com Management  
Interface with ICS  
Virtual Control Panels

## Display System:



Primary Piloting and Navigation data  
Synthetic and Combined Vision Systems  
Enhance Flight Vision Systems

Backbone Enhanced Avionics Network Video / Extended Data / Audio  
Backbone Network → Field Bus / SW Loading / Avionics Data

## Aircraft Connectivity



-Mission & Maintenance Data  
Interface with Ground Sat/Radio  
-Open World Mission preparation & on board Maintenance Diagnosis  
IP Satcom /Wi-Fi /GSM  
-Ground Support and Services

## Military Systems:



Tactical Mission System  
Armament  
Electronic Warfare  
HMSD Compatible  
Military Data Link  
MUMT / OPV capability

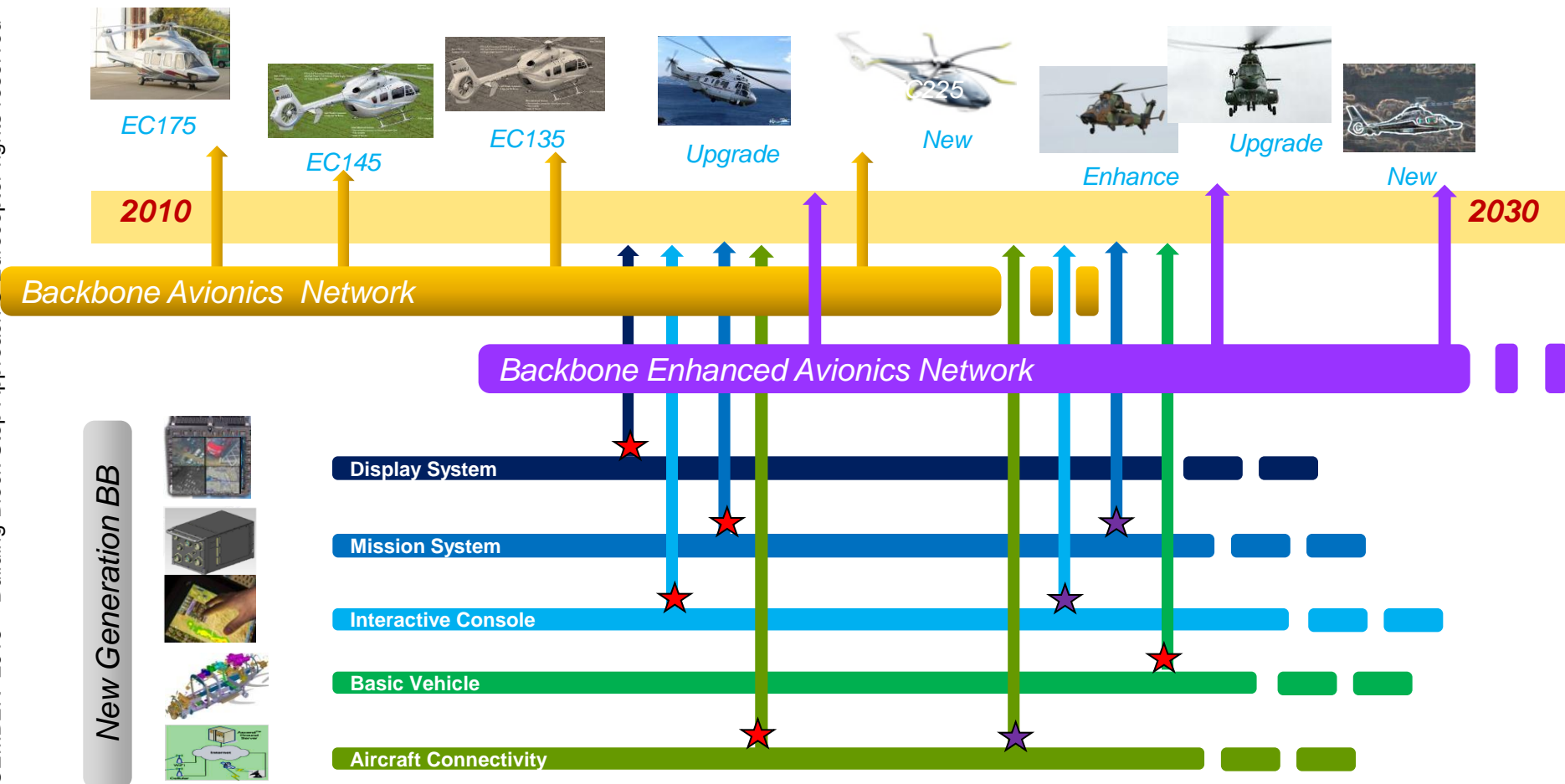
## Basic Vehicle



Vehicle and Engine Monitoring, EICAS, CVFDR  
Health and Usage Monitoring ,  
Helicopter Operational Monitoring Program  
Automatic Flight Control system ,Fly by Wire, ADAHRS

# Associated deployment as a family concept by building blocks

ETX - S G - DECEMBER 2013 - Building Block Step Approach © Eurocopter rights reserved



- Pragmatic deployment, re-use and consistency between BB roadmaps
- Eurocopter to establish to get EASA feedback to apply the "RE-USE" at subsystem s level closer to ETSO process than IMA DO297

# Building block as a “qualified” subsystem



*A Qualification Package TSO / ETSO subsystem equivalent (but on specific spec)*  
*Specification of the product (HW and SW)*  
*Set of qualification evidences ( DO254 /DO178/DO160 )*

# Each BB should be associated to a dedicated Roadmap

## — Present Situation

*identifying Strength and Weaknesses of the “existing solution”*

*define actual interfaces of the existing product ensuring the today solution*

## — Mid Term

*progressive insertion of innovation maintaining major interfaces*

## — Long Term

*Is a breakthrough identified that prevent evolving independently on the building block without affecting the others ?*

*The key driver for step by step approach is to maintain stable interfaces between building blocks*

# Conclusion :

## Back to Certification Process and Tasks

- *To review position on existing credit of DO297 methodology based on integration of Subsystem Building Blocks at a higher level than platform and partition integration:*
  - Based on Subsystem Building Blocks Individual Specification / Qualification
  - Integration between building blocks as “federated subsystems”
  - Each building block developed or not in IMA and associated to a subsystem
- *To ease the reuse of subsystems:*
  - Defining rules for Building Blocks qualification as independent elements
  - Getting approval on subsystems (ETSO for equipment / STC for Helicopter)
  - Defining context and process for reusing these subsystems building blocks