



Building Block Strategy

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thinking without limits

Building Block Strategy

A way to answer to industrial concern

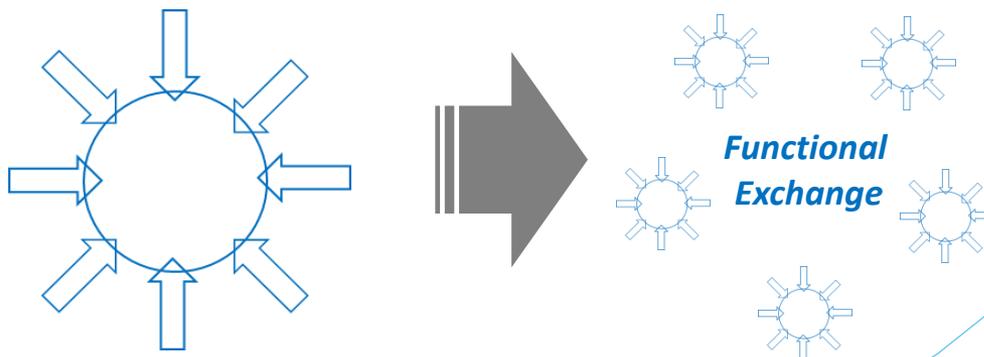
To deploy Step by Step Family Concept

To Reduce Risk in introducing Innovation

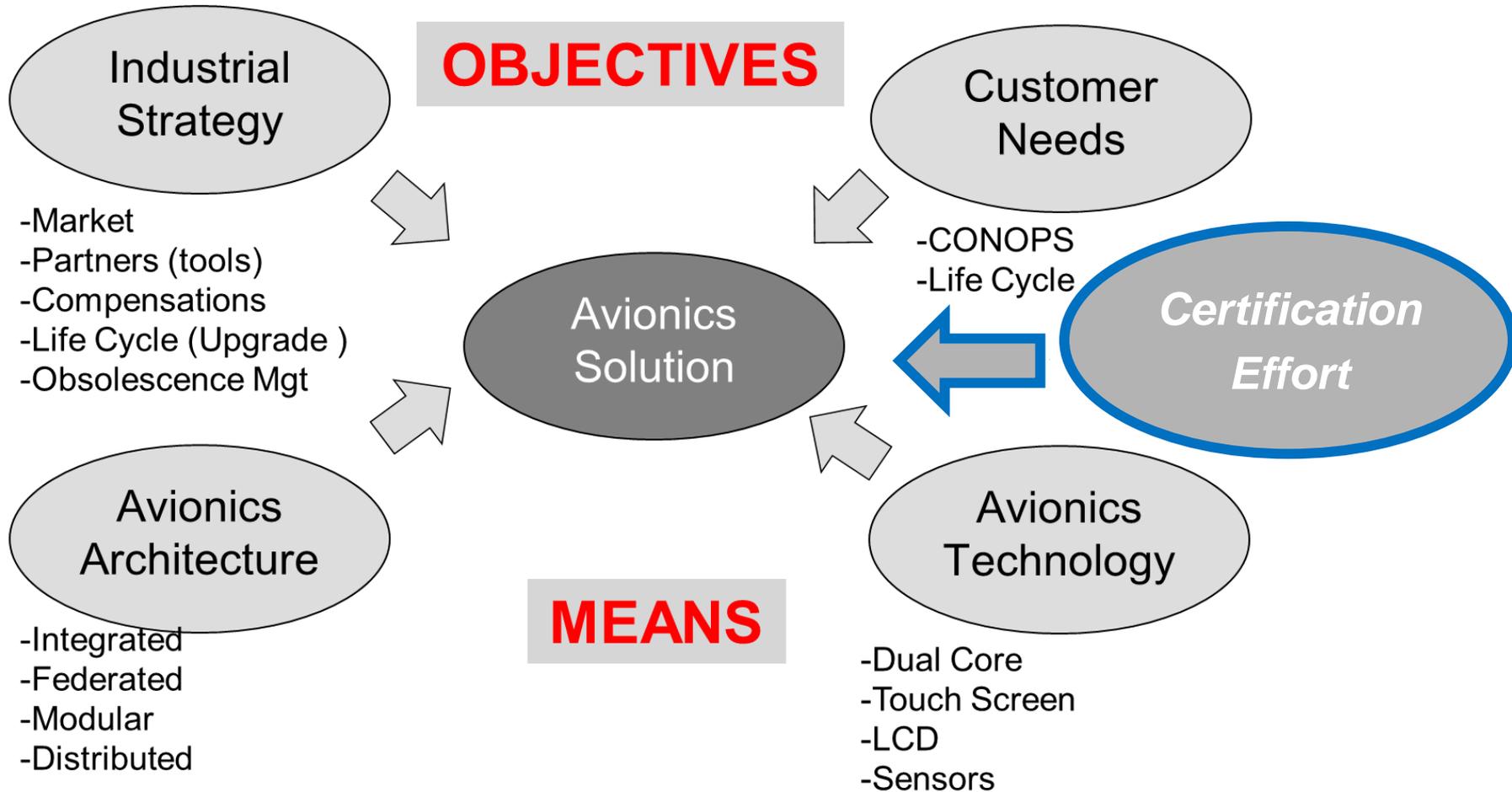
To put in force Extended Enterprise agreement

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*



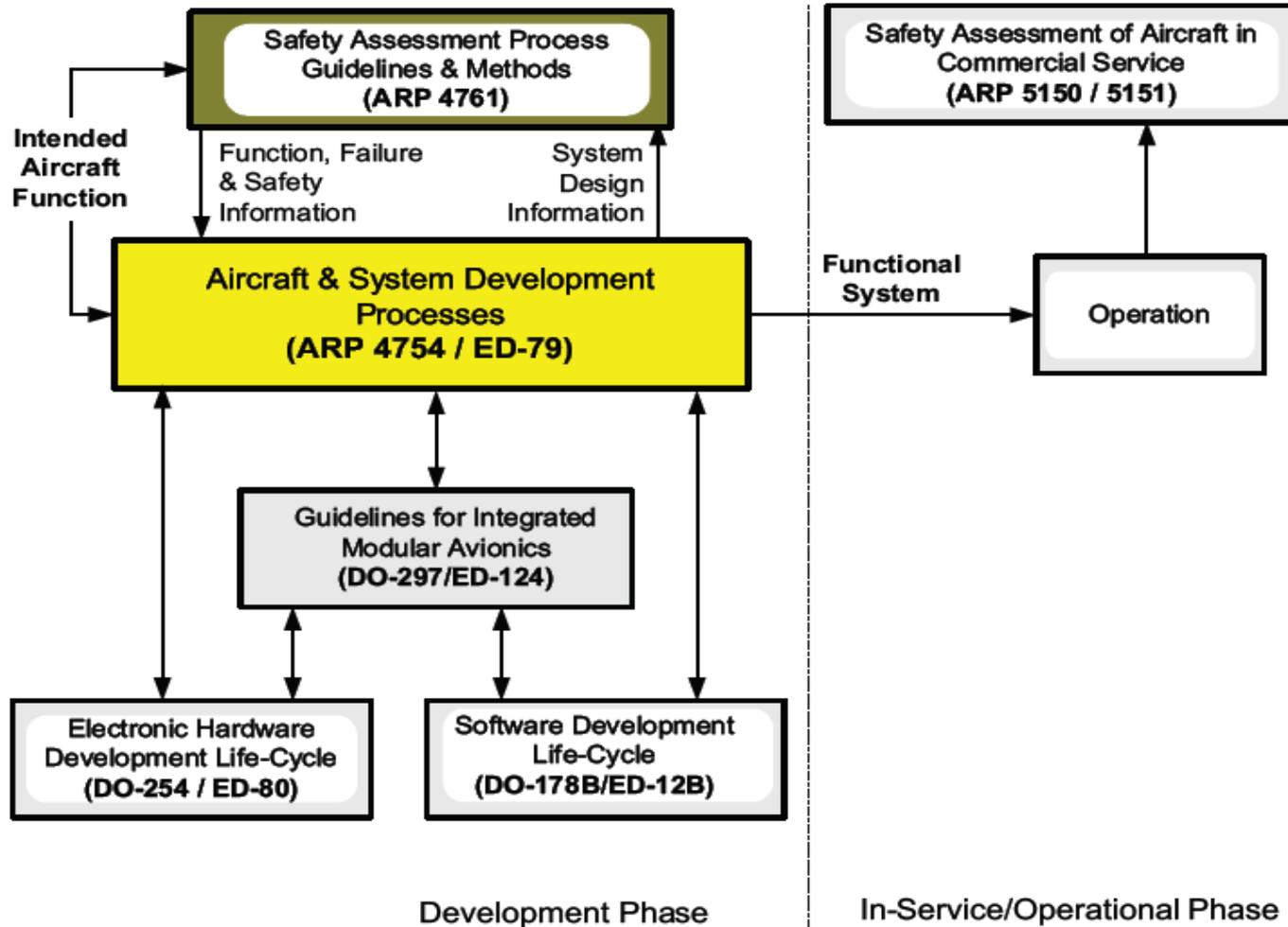
40% LRU Type less
MTBF X2
30% Weight Less

Supporting The IMA Incremental Certification Process

System Engineering Development Methodology

Applied for the recent developments

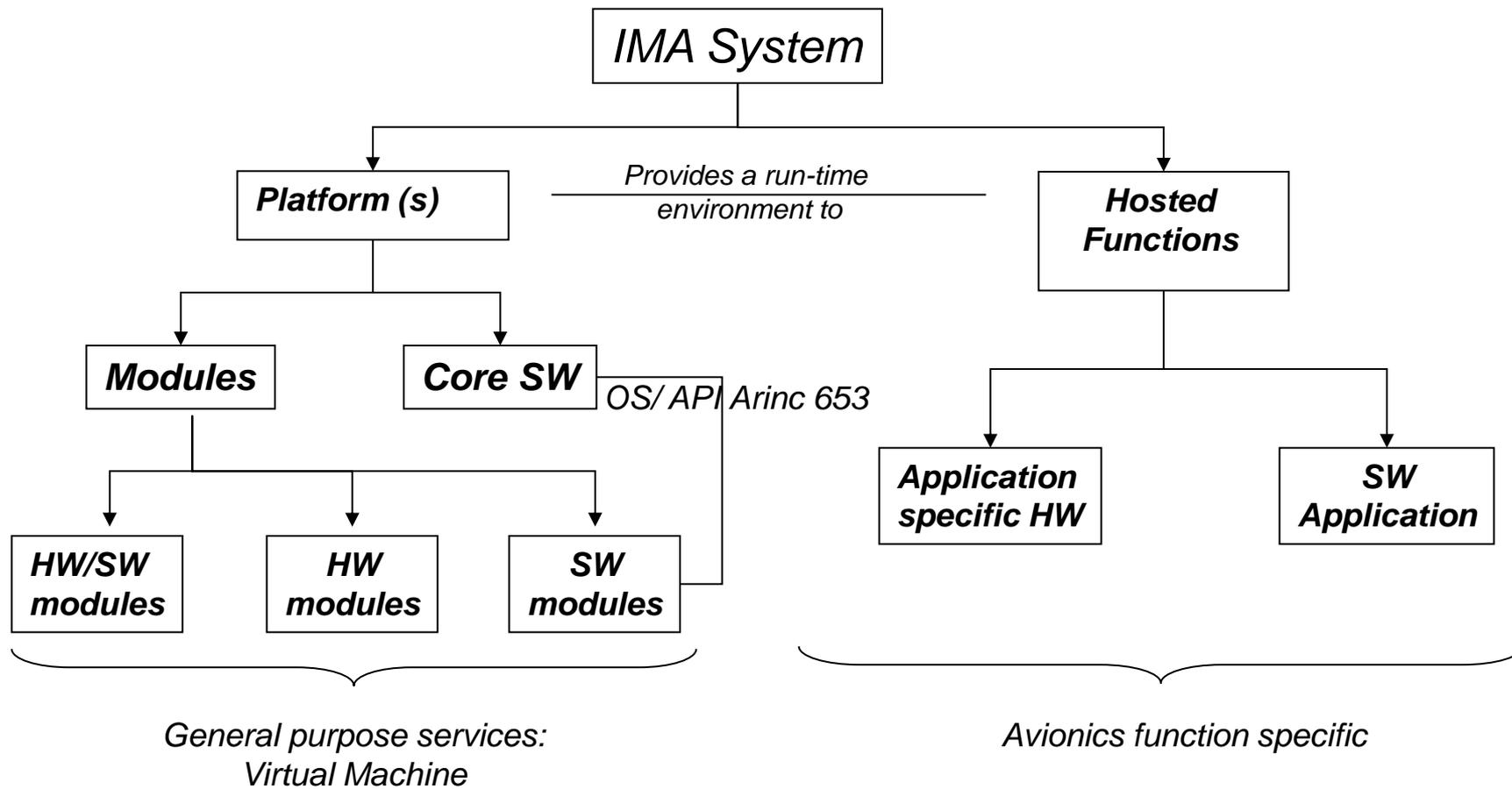
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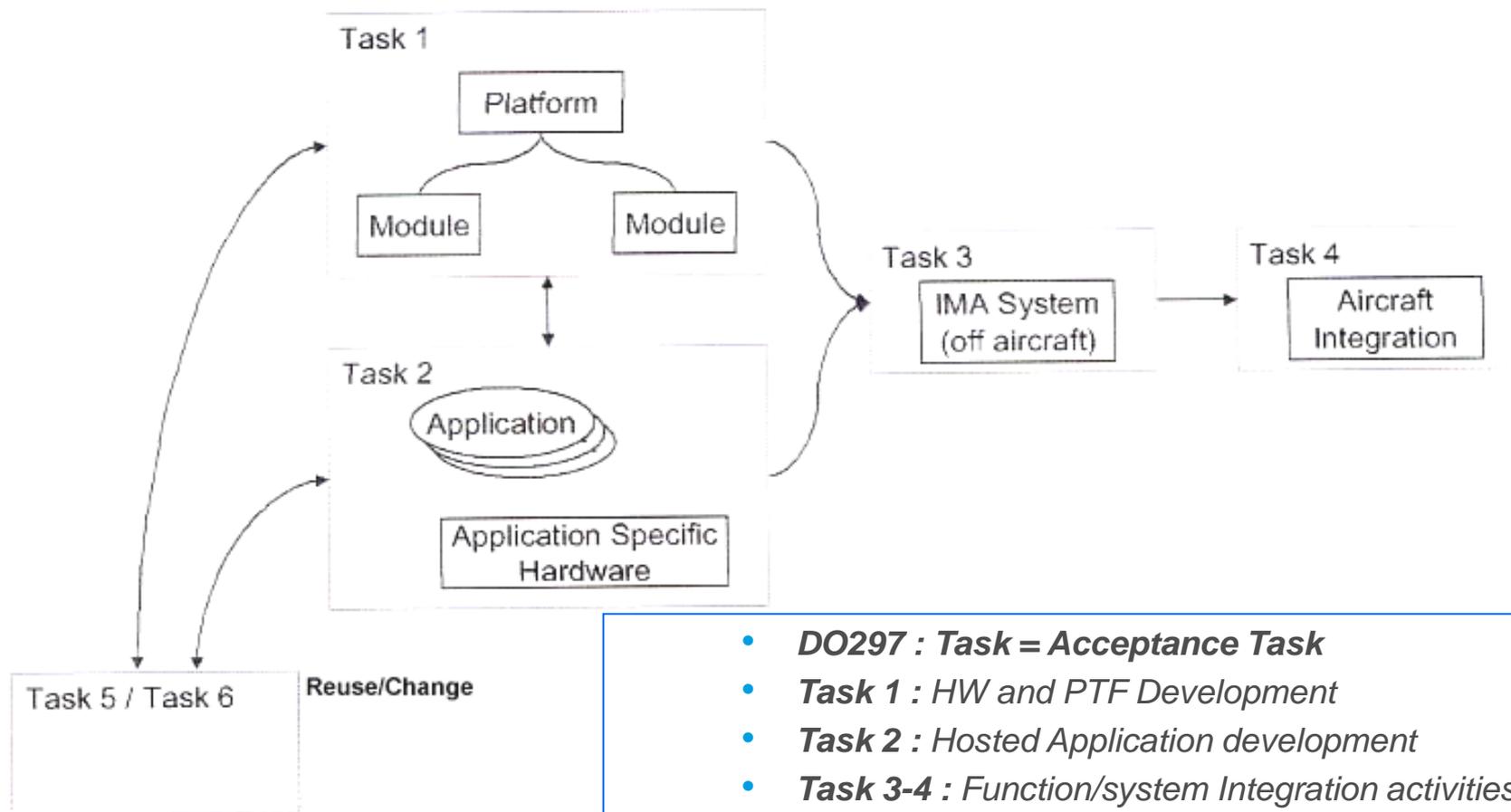
Integrated Modular Avionics and Reuse Concern

DO297 IMA Key Concept Incremental Certification



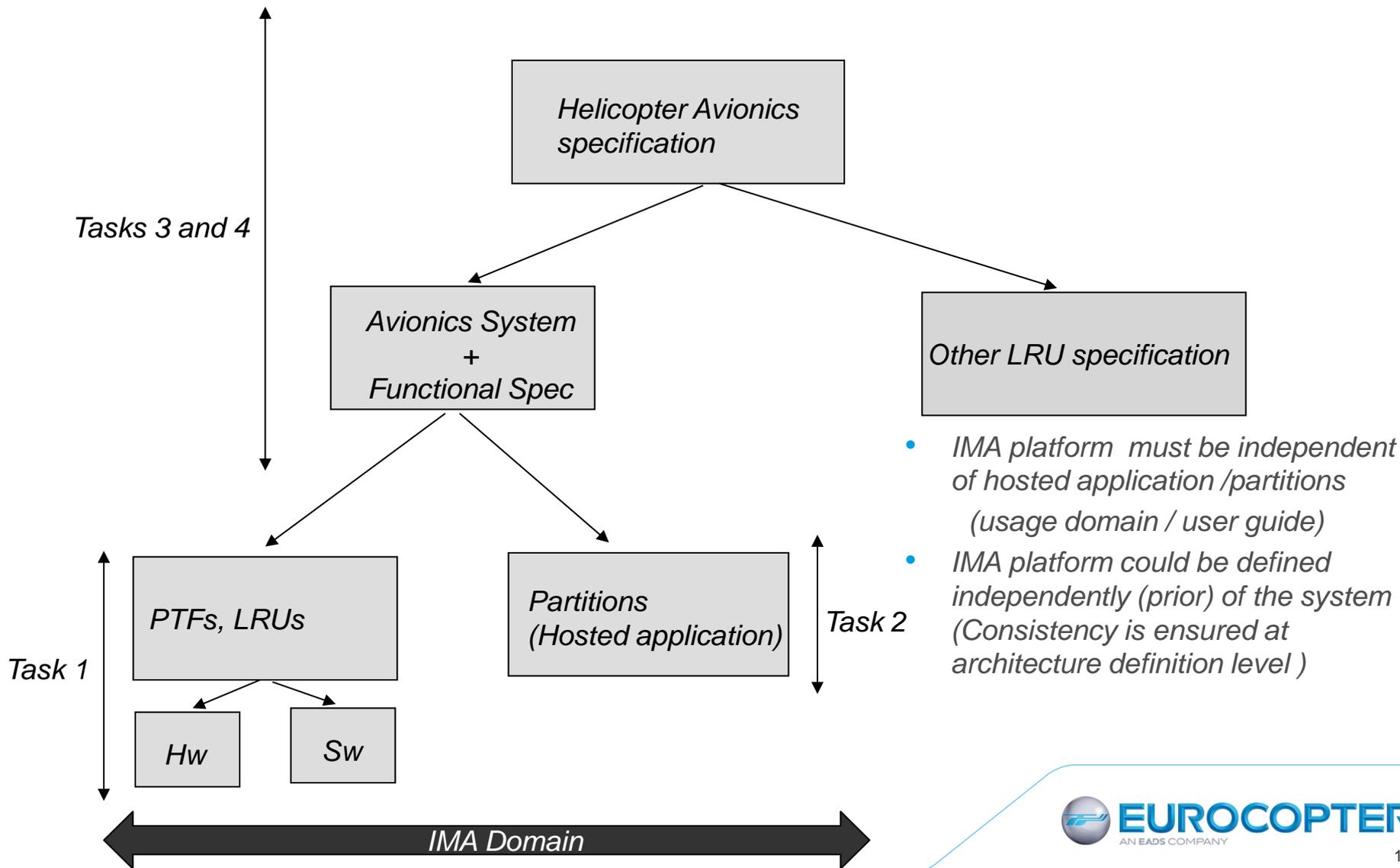
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Integrated Modular Avionics *Tasks Definition*

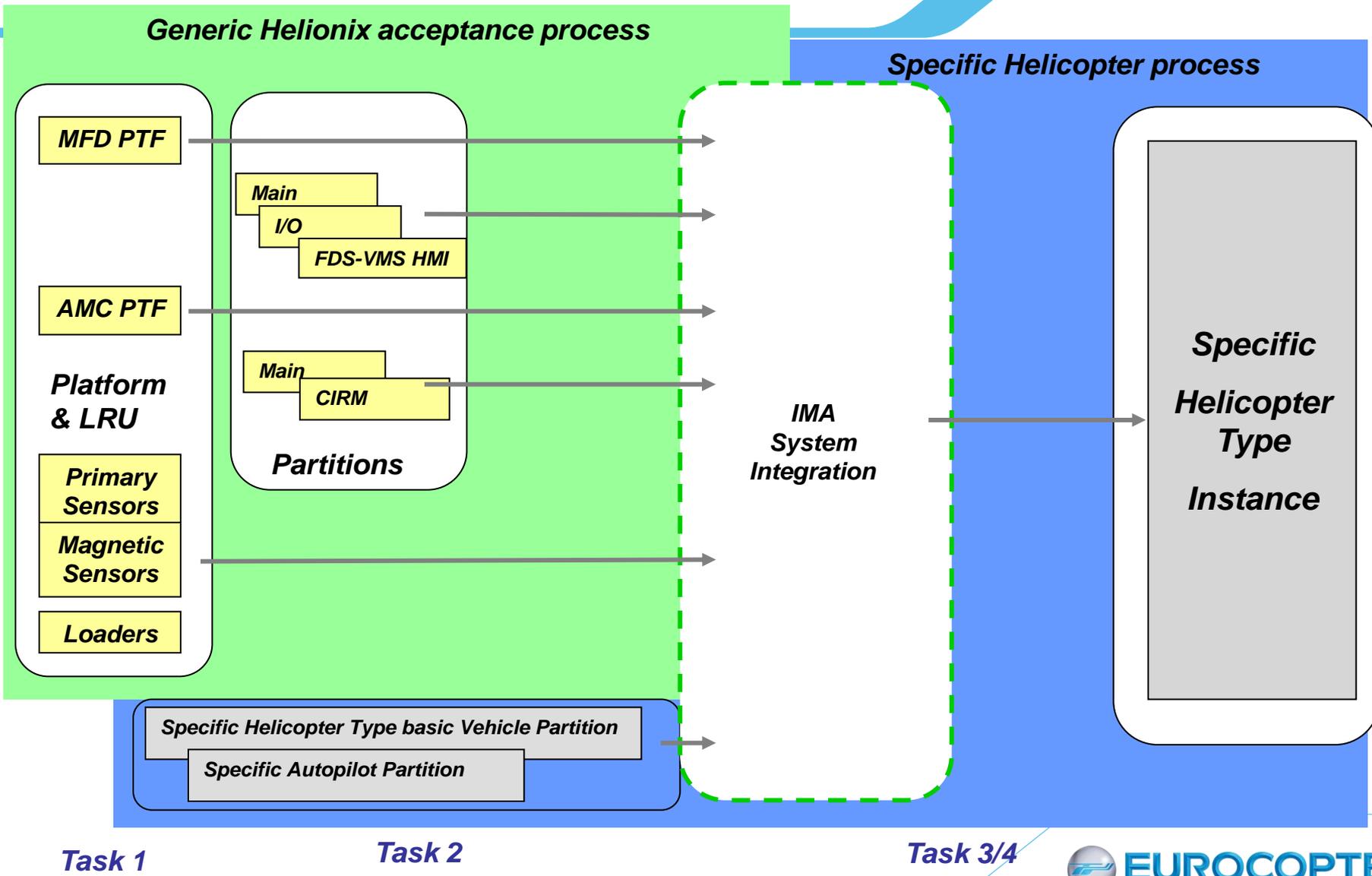


- **DO297 : Task = Acceptance Task**
- **Task 1 : HW and PTF Development**
- **Task 2 : Hosted Application development**
- **Task 3-4 : Function/system Integration activities**

D0297 task structure in avionics system and IMA « Bricks »



Typical Integration Tasks on avionics function



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Task 1

Task 2

Task 3/4

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

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
Validation

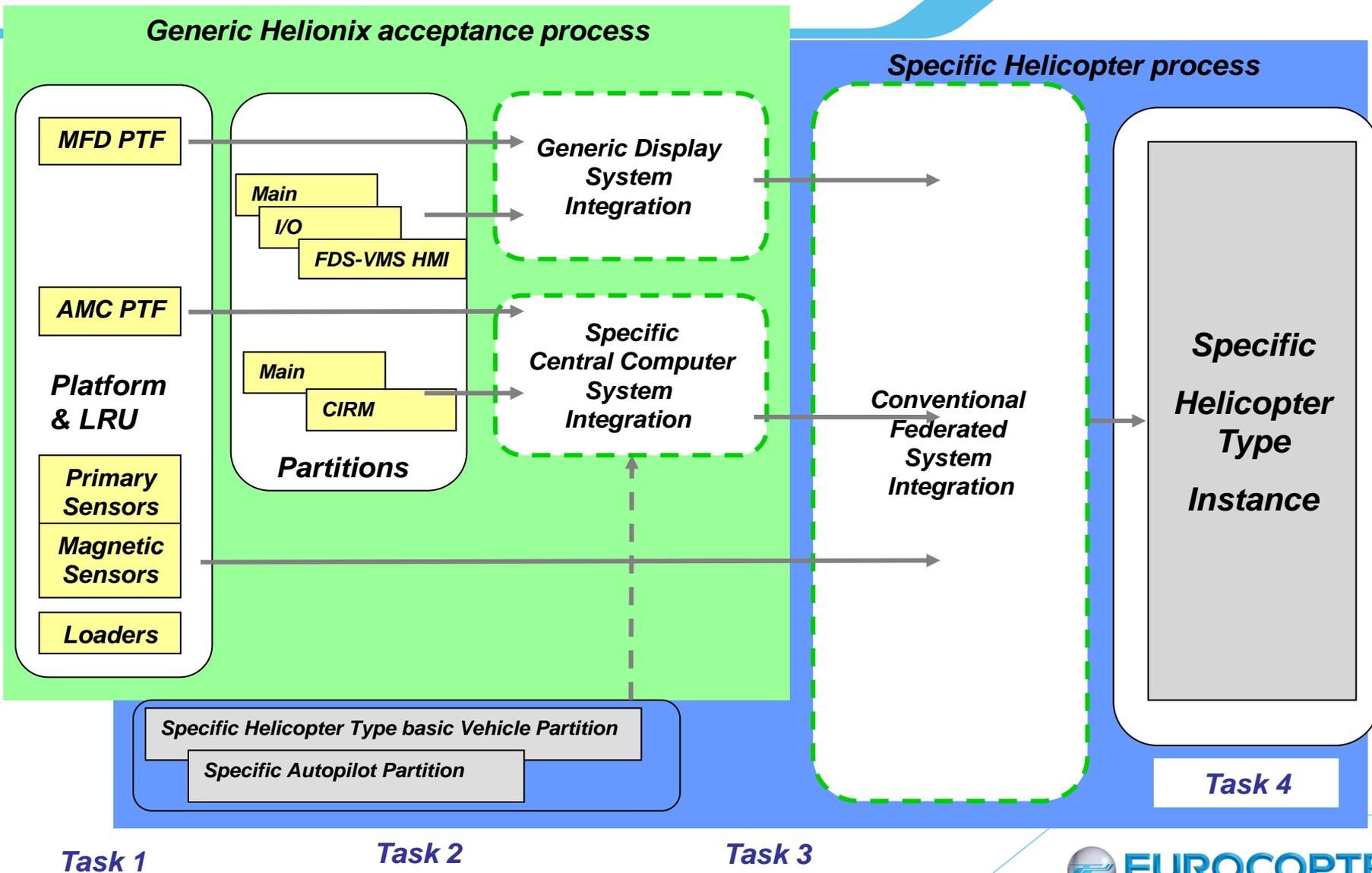
Reuse of
tests set

Reuse of
Platform / SW
module

Reuse of H/C
Integration

Reuse of
Sub-systems
qualification

Enhancement for Reuse on existing avionics architecture



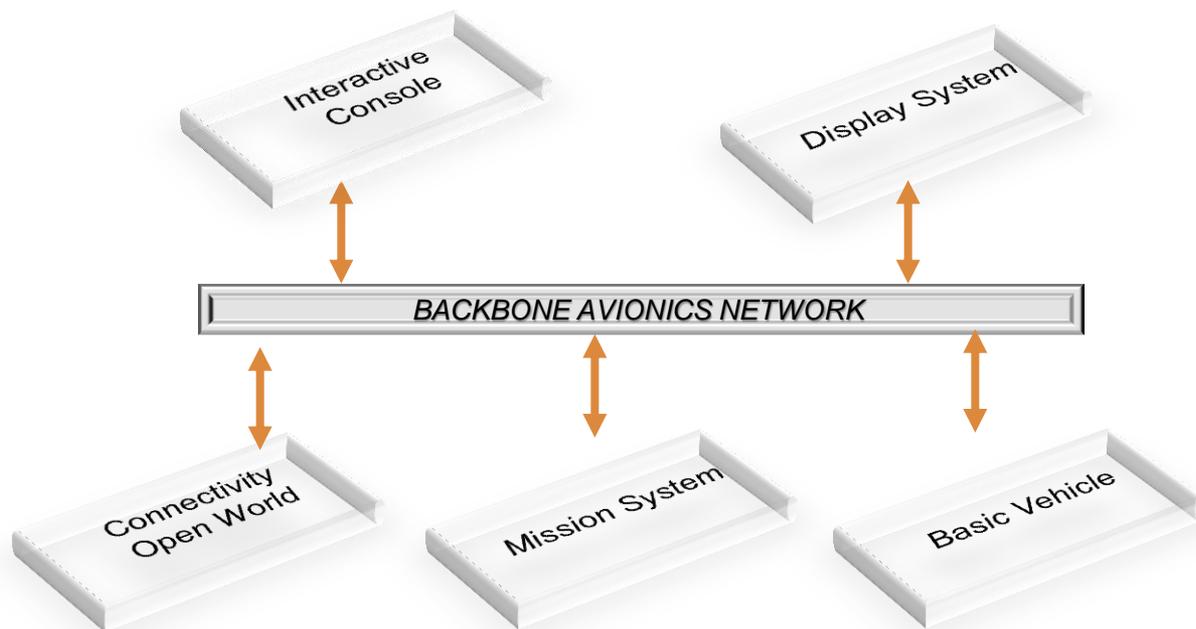
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Move Forward to Sub-System Building Blocks

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

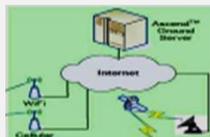
Display System:



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



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

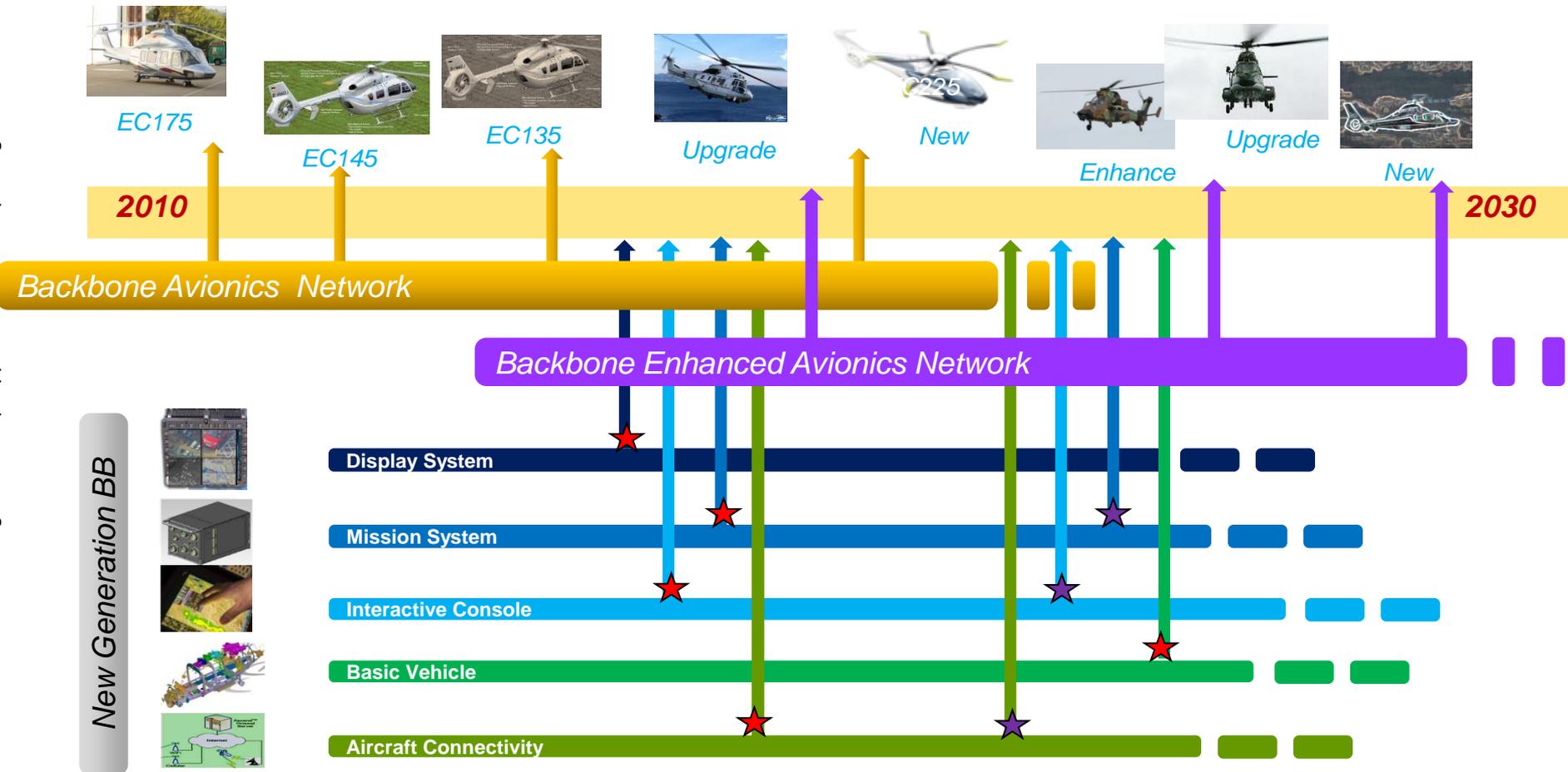
Basic Vehicle



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

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- 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 Ready
 ☆ Building Block 2nd Gen

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