Avionics Systems Hosted on a distributed modular electronics Large scale Demonstrator for multiple Type of aircraft

IMA2G Issues and challenges

ASHLEY-WP73-THA-DISM-PRES-0428 Issue 1
General Introduction

- Thanks to the European Community (EC) and their Framework Programs like H2020 to progress in the mastering of aeronautic technologies becoming more and more complex.

- Collaborative work is virtuous, and we have a good example within ASHLEY which is managed by the European IMA Domain Leader.

- We (European Industrial) are completely in line with the ambitious objectives required by ACARE in term of SWaP (Size, Weight, volume and Power Consumption).

- To access to a full IM2G we need to mature the requirements to be fulfilled and we need to have access to significant investment on the subject in the next coming years.

- ASHLEY is one of the European Study than can help to promote real visible progress done on the IMA2G roadmap.
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Name of the project:
Avionics Systems Hosted on a distributed modular electronics Large scale dEmonstrator for multiple tYpe of aircraft

Acronym: ASHLEY

Starting Date: October 1st, 2013
Ending Date: March 31st, 2017
Duration: 42 months
Total Cost: 39,8 M€
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ASHLEY consortium: 13 countries

United Kingdom

Netherlands

Norway

Sweden

Russia

France

Germany

Ashley consortium:
13 countries

Portugal

Spain

Switzerland

Italy

Greece

Czech Republic
## ASHLEY consortium: 36 beneficiaries

<table>
<thead>
<tr>
<th>Category</th>
<th>ASHLEY partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airframers</td>
<td>AIRBUS, DASSAULT AVIATION, Alenia Aermacchi, SAAB</td>
</tr>
<tr>
<td>Large Industrial Companies</td>
<td>THALES, gmv, Selex ES, Safran, Messier-Bugatti-Dowty, GE Aviation</td>
</tr>
<tr>
<td>National Research Centers</td>
<td>SINTEF, Fraunhofer</td>
</tr>
<tr>
<td>Research Centers inside large Industrial Groups</td>
<td>EADS</td>
</tr>
<tr>
<td>Universities</td>
<td>Università della Svizzera Italiana, TUHH, Technische Universität Braunschweig, Hochschule Luzern</td>
</tr>
<tr>
<td>Small and Medium Enterprises</td>
<td>ARTTIC, SMARTFIBRES, SYSGO, Embedding Innovations, OxSensis, qtd</td>
</tr>
</tbody>
</table>

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ASHLEY Project Summary

The Integrated Modular Avionics (IMA) concept proposes an integrated architecture with application software portable across an assembly of common hardware modules.

ASHLEY will consolidate and integrate the results of SCARLETT and several national collaborative research projects to achieve demonstration of the most advanced building blocks available today in a whole aircraft-level platform.
From the Federated Architecture Concept to the IMA1G concept

**Federated Architecture Concept**

- **F1**
- **F2**
- **F3**

One system designer

LRU Proprietary Solution

**Integrated Modular Concept (IMA1G)**

- **F1**
- **F2**
- **F3**

Many system designers

OS

CPU

IO

Switch

A664

Relies on **Line Replaceable Unit (LRU) Solution**

- The system designer is the module and function supplier
- One single system per LRU

Relies on **Line Replaceable Module (LRM) Solution**

- Clear separation between LRM suppliers and system designers
- LRM resources are shared between LRM hosted Functions

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IMA1G – An example

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IMA1,5G – An example

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Innovation beyond IMA 1G

From IMA 1G...

... to IMA 2G

Distributed Modular Avionics
Innovation beyond IMA 1G

Separate I/O from computing modules

Increase operational reliability
Avoid unscheduled maintenance
Reduce development cycle
Scalability to various aircraft types
Reduce cost of spare parts
Save weight, volume, power consumption

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Increased computing module performance

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Innovation beyond IMA 1G

Middleware providing platform level services (e.g. DB service)

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IMA1G - local File stack

one filesystem used locally

- Applications and mass storage colocated on the same module
  ➔ OS-centric services
  ➔ no simple way to access to remote mass storage
IMA1G - local File stack

one filesystem used locally

- Applications and mass storage colocated on the same module
  ➔ OS-centric services
  ➔ no simple way to access to remote mass storage

IMA2G - distributed File stack

many filesystem used by many functions

- Applications and mass storage hosted on different modules
  ➔ new platform-wide middleware services
Innovation beyond IMA 1G

Reconfiguration mechanisms

Platform level services

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Innovation beyond IMA 1G

Integrated processes and toolset

Integrated Platform Toolset

Platform level services

RDC RPC REU CPM OS CPM OS CPM OS CPM OS

A664

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Innovation beyond IMA 1G

SCALABILITY

= Capability of the architecture to be adapted to…

Set of Families
(Regional / Large+small transport, bizjet)

Family of A/C

Single A/C

Needs of various A/C types
- weight / volume
- power consumption
- environmental conditions (thermal, vibration, etc)
- Specific functions
- Specific Input / Outputs requirements

Large number and many types of applications
- high performance applications
- time critical applications
- avionics server functions
Innovation beyond IMA 1G

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IMA 1G

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Innovation beyond IMA 1G

SCALABILITY
= Capability of the architecture to be adapted to…

Set of Families
(Regional / Large+small transport, bizjet)

Family of A/C

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IMA 1G

DME

Needs of various A/C types
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Large number and many types of applications
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ASHLEY makes the step from single building blocks towards the integrative IMA platform solution.

Key challenges are:
- Industrialization
- Modularization
- Integration
- Services
- Certification

Application of IMA in aircraft
ASHLEY makes the step from single building blocks towards the integrative IMA platform solution.

Key challenges are:
- Industrialization
- Modularization
- Integration
- Services
- Certification

ASHLEY is on the path of future IMA2G-based aircraft programs.

Application of IMA in aircraft.
IMA 2G studies: Overview

Platform or Function Architecture
Applicative middleware
Tools and Framework
Support and training
Configuration Process

Platform Services

SCARLETT
NELA
GEODESIE
PRIMAE
SYSTAVIO
IDEE5

IMA 2G

Core Resources

Network Resources

Remote Resources

Installation and packaging

IMA 1G
A350
ATR
B787
A400M
SSJ
A380

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ASHLEY has the main objective of consolidating and extending the efforts of several independent projects by improving the current IMA2G Distributed Platform Solution.

* DME Distributed Modular Electronics

To extend the DME* concept and set of components over the Open World and Cabin aircraft domains for large aircraft, regional aircraft and business jets.

To evaluate the benefits of photonics and smart interfaces to sensors and actuators to increase performances of some avionics systems.

To propose DME* remote resources solutions for Secondary Power Distribution and Time Critical aircraft systems.

To decrease avionics (multi-domains) function overall design time thanks to a more system designer oriented tool chain.

To promote DME* concepts and innovations to any IMA key stakeholders (industrial, academics, certification and standardization bodies) that will influence existing academia and market and create new ones.

To validate the ASHLEY advanced state of the art by implementing a large scale demonstrator consisting of a set of representative aircraft systems onto the DME* extended set of components.

To provide Database Services covering both the avionics world and open world to allow for a higher flexibility in avionics systems design.
Ashley selected functions: Mission Management

- Terrain Avoidance Warning
- Flight Warning
- Maintenance
Demonstration of Platform solution: Remote architecture

Ashley selected functions: Cabin Utilities / High Lift

- Ventilation Control
- High Lift
- Sec. Power Distribution
- Cabin

DME Remote Solutions
Validating IMA2G platform solution: Photonics/ Smart & Remote

Ashley selected functions: Fuel / Landing Gear

- Braking Control system
- Fuel Gauging & Management Systems
- DME Remote Solutions
- Landing Gear System

Photonics & smart Sensors Solutions
ASHLEY Welcome You @

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