DATACOM INDUSTRY ASSOCIATION

# Aerospace

## Working Group Charter

# Executive Summary

This charter aims to capture the vertical technology work within the DIA with respect to the Aerospace sector. It establishes the foundational context and rationale for applying data communication technologies in this complex field. The aerospace sector encompasses the multifaceted design, manufacturing, and operation of vehicles navigating both aeronautical and astronautical domains, including commercial and military aircraft, spacecraft, and satellites.

The core of this charter details the technical themes and activities that will launch the work of the **Aerospace Working Group** (WG). These themes and activities have been collectively agreed upon by the participating aerospace community. It's important to note that these outlines are not exhaustive; they serve as a starting point. The WG's future endeavors can be expanded, refined, and broadened over time, with all updates documented in subsequent versions of this charter and on its accompanying webpages.

| Version | Authors | Changes | Date |
|---|---|---|---|
| 1.0 | Paulo Mendes | Based on provided template | 22.05.2025 |
| 2.0 | Dirk Trossen | Comments and layout changes | 26.05.2025 |
| 3.0 | Tomaso de Cola | | |
| 4.0 | Maria Guta | | |

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## 1. Background & Drivers

The **Aerospace industry** drives the design, manufacturing, and operation of vehicles that traverse both atmospheric and space realms, playing a vital role in global transportation, communication, defense, and the exploration of our universe. Data communication is the invisible network empowering every facet of modern aerospace operations.

There is a growing impetus to embed data communication systems used by the aerospace industry into a larger, more encompassing version of the Internet. This drive is fueled by the need for seamless, real-time data exchange across diverse platforms—from aircraft and satellites to ground control stations and remote users. Integrating these specialized communication networks into a broader Internet promises enhanced interoperability, increased efficiency through shared infrastructure, while raising the potential for innovative services leveraging the vast capabilities of a globally connected network. This evolution aims to create a more robust, resilient, and interconnected aerospace ecosystem capable of supporting future advancements in air travel, space exploration, and ubiquitous connectivity.

Key examples include:

- **Air Traffic Management**: Real-time data exchange is paramount for precise aircraft tracking and streamlined communication between pilots and controllers, minimizing errors and optimizing airspace utilization.
- **Aircraft Operations**: Within aircraft, data communications facilitate continuous monitoring, supporting predictive maintenance and enhanced safety.
- **Operational Efficiency**: Efficient data transfer enables optimized flight routes and fuel efficiency, thereby reducing operational costs and environmental impact**.**
- **Space Exploration**: Data communications are indispensable for transmitting vital telemetry and scientific data from distant spacecraft.
- **Space - Terrestrial Communications:** Data communications are essential for a seamless integration of the Internet, the mainstream usage of mobile services and the increasing number of space networks, including an heterogenous set of low and medium earth orbit constellations.

## 2. Aerospace WG Objectives

The **AEROSPACE WG** is dedicated to analyzing the role and impact of data communication within the aerospace industry, with the goal of driving safety, efficiency, and innovation. The aerospace industry faces significant technical challenges in data communications due to extreme environments, critical safety requirements, and the sheer volume of data involved. These include:

- **Cybersecurity**:
  - Protecting sensitive data and critical systems from malicious actors.
  - Maintaining data integrity within the aerospace ecosystem.
- **Reliability and Resilience**:
  - Ensuring reliable communication with low delays in extreme environments.
  - Developing efficient data compression and transmission techniques to address bandwidth limitations.
- **Data Management and Processing**:
  - Managing vast amounts of data generated by aerospace systems, requiring efficient storage, processing, and analysis.
  - Addressing the need for real-time data processing in critical applications such as air traffic control and spacecraft navigation.
- **Advancements in Networking Technologies**:
  - Developing new in-network computing concepts that intertwine communication, data processing, and storage.
  - Conducting research into extensible data communication frameworks to facilitate the deployment and management of value-added services.

Addressing these challenges requires ongoing research and development in areas such as cybersecurity, networking, data science, and communication technologies, while also ensuring compatibility of modern communication technologies with legacy systems.

For this, the Aerospace WG will establish, undertake but also revise relevant **themes** in collaboration with other suitable vertical WG activities. It will also interface with the relevant horizontal WGs, specifically the Systems and Enabling Technologies (SET) WG that explores a number of vertical-spanning technology enablers..

Each theme will define a set of **activities** and **outcomes**, which can be monitored to ensure progress of discussions over a given time. Themes will be led by an identified set of **champions** that provide support and/or drive the activities undertaken by the theme. Championship (within a theme) may be ephemeral, driven by interest in the specific activities undertaken, handed over to other champion(s) to ensure continuity of activities within the theme or, in agreement with the WG leaders, brought to conclusion (of the theme).

## 3. Themes & Activities

The Aerospace WG will undertake the following three themes, subject to revision, including addition of new themes and activities, in a future re-chartering of the WG.

### 3.1 Services & Ecosystem

This theme focuses on understanding problem statements and related use cases to define technical challenges for innovative services and business models within the aerospace ecosystem, driven by extreme conditions and critical safety requirements. Such new services and business models may impact various areas, including:

- **Improvement of Aerospace Operations**:
  - Decentralized Aerospace Traffic Management: Envisioning a future where aircraft make more autonomous decisions, coordinating with each other and ground systems dynamically to optimize flight paths, reduce delays, and decrease fuel consumption.
  - Emergency Coordination: Utilizing data communications for rapid and efficient coordination between air traffic control, pilots, and emergency services.
- **Aerospace as Datacom Infrastructure**:
  - Mobile Communications Services: Providing seamless global connectivity via flying platforms based on aircraft and spacecraft.
  - Global Secure Communications: Supporting government and military operations, even in hostile environments, through secure data transmission and encryption techniques.
  - Data Muling: Aerospace vehicles physically carrying stored data between remote locations and exchange points to create low-cost communication services.
  - Fediverse: Hosting exchange points in space to enable thousands of users to interact in social networks without traffic flowing on terrestrial networks.
- **Aerospace as Base for Value-Added Services**:
  - Sensing Services: Enabling remote monitoring of assets and environmental conditions (e.g., oil rigs, forests, agricultural fields) and supporting rapid deployment of IoT devices in disaster zones for real-time data collection.
  - Earth Observation Services: Providing high-resolution imagery for monitoring weather patterns, optimizing agricultural practices, and environmental monitoring (e.g., deforestation, pollution, climate change).
  - Cooperative Perception Services: Supporting autonomous vehicles with precise contextual awareness data through accurate object detection, especially in low sensorial environments.
  - Data Processing Services: Leveraging aircraft and spacecraft with enhanced onboard connectivity and next-generation digital services harnessing AI to enable new levels of service execution, facilitating operations and the creation of new digital services.

For this, the following activities are planned as a recurring effort:

| Activity | Outcome | Champion(s) |
|---|---|---|
| Brainstorming event to elaborate on challenges and opportunities for new Aerospace services. | Whitepaper | ? |
| Workshop on deployment and adoption of innovative technical solutions in the Aerospace ecosystem. | Whitepaper | ? |
| Workshop on the role of standardization to support innovative Aerospace Services. | Whitepaper | ? |

## 3.2 Design & Architecture

This theme involves a comprehensive and systematic approach to analyzing the technical requirements for novel aerospace services, given the sector's inherent complexity and safety-critical nature. Each service, from decentralized air traffic management to space-based social networks, presents unique challenges demanding rigorous technical definition. This process includes identifying core functionalities and addressing critical non-functional requirements such as safety, security, reliability, performance, and regulatory compliance.

For this, the following activities are planned as a recurring effort:

| Activity | Outcome | Champion(s) |
|---|---|---|
| Workshop on system architecture definition and decomposition, aiming to translate high-level service concepts into a preliminary system architecture, breaking down the overall system into smaller, manageable components. | Whitepaper & Webinar | ? |
| Workshop on risk assessment and technology readiness level focusing on identifying potential technical challenges, bottlenecks, and the maturity of underlying technologies (e.g., Time Varying Networks, AI, and Edge computing) required for each service. | SRA contributions | ? |
| Match-making for the elaboration of national and EU research projects. | Joint R&D | ? |

### 3.3 Policies and Governance

Integrating new datacom services into the aerospace sector involves a complex interplay between technological innovation and existing governmental and policy frameworks. Governments play a crucial role not only in regulating but also in enabling and fostering the development of these services, given aerospace's critical nature for safety, security, and national interests. Analyzing policies and governance requires a multifaceted approach, encompassing regulatory frameworks, international cooperation, and economic and ethical considerations.

For this, the following activities are planned as a recurring effort:

| Activity | Outcome | Champion(s) |
|---|---|---|
| Workshop on comprehensive regulatory mapping and gap analysis, meticulously reviewing current national and international aviation and space laws, regulations, and treaties to identify overlaps, inconsistencies, and critical gaps concerning novel services. | Whitepaper | ? |
| Public consultation on multi-stakeholder engagement and consensus building to gather diverse perspectives, understand potential impacts, and build consensus on regulatory approaches. | Webinar | ? |
| Workshop on proactive international harmonization and standardization efforts to understand the need for developing harmonized regulations, best practices, and technical standards. | Whitepaper | ? |

# 4. Organization

- WG chairs: **Paulo Mendes (Airbus), Tomaso di Cola (DLR) - proposal**
- Mailing list: aerospace@datacom-ia.org
- Subscribe: https://lists.hostpoint.ch/mailman3/lists/aerospace.datacom-ia.eu/
- Web page: https://datacom-ia.eu/wgs/aerospace

## 4.1 Potential Members

**Potential Industrial Members**

- Airbus (DE)
- European Space Agency (BE)
- German Aerospace Center (DE)
- Tesat (DE)
- Rivada Space Networks (DE)
- Eutelsat OneWeb (FR)
- Thales (FR)
- Leonardo (IT)
- BAE Systems (UK)
- OHB SE (DE)
- Isar Aerospace (DE)
- E-Space (FR)
- Sateliot (SP)
- Open Cosmos (UK)
- Astrocast (CH)

**Potential Academic Members (with Aerospace programs)**

- TUM (DE)
- ISAE-SUPAERO (FR)
- University of Cambridge (UK)
- Delft University (NE)
- Imperial College London (UK)
- ETH Zurich (CH)
- Politecnico di Milano (IT)
- Université de Toulouse (FR)
- KTH (SE)
- University of Oxford (UK)
- EPFL (CH)
- RWTH Aachen University (DE)