ARINC Project Initiation/Modification (APIM)

# Name of Proposed Project

1. ARINC Project Paper xxx: Hyperconnected ATM (HCATM) – HCATM System Technical Requirements (working title), Part 1 (Airborne) and Part 2 (Ground)
2. ARINC Project Paper xxx: Hyperconnected ATM (HCATM) – HCATM protocol (working title)

## Name of Originator and/or Organization

Airbus, Boeing

# Subcommittee Assignment and Project Support

## Suggested AEEC Group and Chairman

Group: TBD (New) Subcommittee

Co-Chairs: xxx (Airbus) and xxx (Boeing) TBC

## Support for the activity

Airlines: TBD

Airframe Manufacturers: Boeing, Airbus

Suppliers: Airtel ATN? Honeywell?, Collins?, Thales? Frequentis?

Others: Collins CAS?, EUROCONTROL?, FAA?, SITA?

## Commitment for Drafting and Meeting Participation

Airlines: TBD

Airframe Manufacturers: Boeing, Airbus

Suppliers: Airtel ATN?, Honeywell?, Collins?, Thales?

Others: Collins CAS?, EUROCONTROL?, FAA?, SITA?

## Recommended Coordination with other groups

DLUF, DLK, NIS, SAI, IPS

# Project Scope

## Description

The ongoing modernization of air traffic management requires efficient air-ground datalink with sufficient resources to accommodate the air traffic growth with current and future datalink services exchanges between air and ground ATM components and actors.

The capacity of current communication links used for safety communications is already reaching its limit particularly in some continental areas and is probably not sufficient to support this transformation in the medium/long term. Although new systems such as LDACS and AeroMacs are being standardized by ICAO, these may not be deployed globally on short term, or be installed on many aircraft in time to support the transition. Other solutions such as L-Band SATCOM also supply additional bandwidth, and indeed will help, although not all aircraft will be equipped and not all countries will support L-Band SATCOM

At the same time, aircraft are increasingly equipped with commercial cabin connectivity systems, providing broadband communications access that support both the passenger experience, and aircraft operations. The multiple, emerging, satellite mega constellations, combined with the latest geostationary earth orbit (GEO) very high throughput satellite (VHTS) technologies, and with 4G/5G terrestrial solutions available at airports (International Mobile Telecommunications solutions) and en-route (“air-to-ground” solutions) are bringing massive capacity.

“Hyperconnected ATM” (HCATM) concept has been defined, with the objective to allow using this commercial cabin connectivity in addition to safety protected spectrum links. Dedicated mechanisms allow using such commercial cabin connectivity systems and links, to convey safety communications:

- A secure channel established through the commercial connectivity systems from a trusted domain in the aircraft to a ground trusted organization involved in aeronautical safety communications (e.g., a Communication Service Provider).

Note: Additional security mechanisms (not in the scope of this standard) may be required.

- A performance and status monitoring function, called Virtual Overlay Radio, that continuously monitors the availability and performance of this secure channel and can detect its loss or performance degradations.

- A “switch with reversion” function that takes the decision to use (or not) the commercial connectivity for the transfer of each safety message, and can promptly retransmit over the safety links in case a message attempted to be sent over a commercial connectivity system is not successfully transmitted and acknowledged (this decision making is based on information gathered by the Virtual Overlay Radio mechanisms, and end-to-end transport mechanisms (e.g. messages acknowledgements).

These three mechanisms in particular require to be standardized as they are relying on air and ground components that need to be coordinated and interoperable.

## Planned usage of the envisioned specification

New aircraft developments planned to use this specification yes ⌧ no 

 Specify: TBD

Modification/retrofit requirement yes ⌧ no 

 Specify: If airlines want to take advantage of HCATM, then they must retrofit the capability via CMU (or equivalent) avionics

Needed for airframe manufacturer or airline project yes ⌧ no 

 Specify:

Mandate/regulatory requirement yes  no ⌧

 Program and date: No mandate yet planned, but possible

Is the activity defining/changing an infrastructure standard? yes ⌧ no 

 Specify: HCATM will complement existing or envisaged network infrastructures (ACARS, ATN/OSI and ATN/IPS)

When is the ARINC Standard required? 2027

What is driving this date? With the deployment of new ATS services (e.g.. ADS-C EPP in Europe mandated end 2027, and full B2 services also starting to be deployed in parallel), it becomes necessary to deploy additional capacity to VDL2. HCATM is a promising concept to extend this capacity. It is part of the European Datalink “multilink” roadmap, and identified in the EASA/FAA/Boeing/Airbus FCAV (Future Connectivity for Aviation) paper as a key technology to be deployed in the 2032 timeframe.

Are 18 months (min) available for standardization work? yes ⌧ no 

 If NO, please specify solution: Not applicable

Are Patent(s) involved? yes  no ⌧

 If YES please describe, identify patent holder: Not applicable

## Issues to be worked

Issues to be worked include the following:

* Description of the overall HCATM architecture and environment, including the ACARS, ATN/OSI and ATN/IPS networks
* Definition of possible / recommended architecture options (“interfaced” versus “integrated”), for both airborne and ground systems
* Description of the HCATM components and identification of the links with other A/C systems (“CMU”, “Cabin Connectivity system” …)
* HCATM Airborne and ground routing/switching mechanisms: It may be suitable to define some of the required mechanisms (routing/switching/multilink) that needs to be similar or as a minimum coordinated between HCATM airborne and ground components.
* Investigation of the need for HCATM standard interfaces: Airborne HCATM components will have to be interfaced with several airborne equipment, and in particular the datalink routers (e.g. CMU, ACR, CMF) and the Cabin connectivity systems. The standard should define these interfaces (protocol and data format) if appropriate.
* Specification of the Air-ground interoperability (between Air and ground HCATM components). This includes in particular a technical solution to ensure end-to-end security, and a Transport protocol to convey (and acknowledge) ATS messages between air and ground HCATM components.

The Subcommittee will organize and execute HCATM standards development efforts to address this work scope.

## Security Scope

 Is Cyber Security Impacted (if yes, check box(es) below) yes [x]  no [ ]

 Aircraft Control Domain yes [x]  no [ ]

 Airline Information Services Domain yes [ ]  no [x]

 PAX Information and Entertainment Systems yes [ ]  no [x]

 Other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ yes [x]  no [ ]

The HCATM concept relies on a comprehensive cyber security solution, which is required to interface air and ground HCATM components These components will be connected via a secure channel (e.g. VPN like), and additional mechanisms, like firewalls and deep packet inspection functionality, will be also necessary to protect the aircraft and the ground systems.

Both the HCATM technical requirements and the air-ground protocol shall fully endorse these security objectives.

# Benefits

## Basic benefits

Operational enhancements? yes ⌧ no 

For equipment standards:

a. Is this a hardware characteristic? yes  no ⌧

b. Is this a software characteristic? yes ⌧ no 

c. Interchangeable interface definition? yes ⌧ no 

d. Interchangeable function definition? yes ⌧ no 

 If not fully interchangeable, please explain: Not applicable

Is this a software interface and protocol standard? yes ⌧ no 

Specify: HCATM will require to interface with several airborne equipment and interoperate with dedicated ground components

Product offered by more than one supplier yes ⌧ no 

 Identify: TBD

## Specific project benefits (Describe overall project benefits.)

### Benefits for Airlines

The Hyperconnected ATM solution has the potential to provide additional capacity needed for future ATM needs, in complement to VDL2 and current SATCOM L-band. Because it is relying on physical link infrastructures already deployed, and aircraft and ground modifications are assumed relatively simple, it may be deployable before any new safety link technology.

This solution is likely to be the most cost effective (compared with the deployment cost of a new safety link). It relies on commercial links infrastructure that is already widely deployed and will continue to grow significantly (5G, LEO/MEO constellation, etc.). The communication costs for the Airlines could decrease significantly for ATM data exchange.

In the near term, on HCATM introduction, Airlines should benefit from the ability to utilize more cost-effective and higher performance non-safety links for AOC data exchanges,

### Benefits for Airframe Manufacturers

The Hyperconnected ATM solution has the potential to provide additional capacity needed for future ATM needs, in complement to VDL2 and current SATCOM L-band. Modernization of ATM in support of greener operations is key and requires the deployment of additional connectivity capacity to enable new ATS services (e.g. for 4D trajectory management / “B2”). Because it is relying on physical link infrastructures already deployed, and aircraft and ground modifications are assumed relatively simple, it may be deployable before any new safety link technology.

This solution is likely to be the most cost effective (compared with the deployment of a new safety link) in terms of airborne equipment development and certification (no need for new radios).

It should allow a large penetration on the aircraft fleet given the increasing adoption rate of broadband connectivity for the cabin domain, and thanks to the compatibility with legacy and future communication protocols.

It is considered future proof as the cabin connectivity will continuously evolve towards more efficient and cost-effective solutions delivering higher throughput and better performances, which are required to make the airplanes more digital and connected.

### Benefits for Avionics Equipment Suppliers

The cost-effectiveness, simplicity and efficiency of the concept have the potential to offer a powerful solution at limited development effort and cost.

# Documents to be Produced and Date of Expected Result

ARINC Project Paper xxx: Hyperconnected ATM (HCATM) – HCATM System Technical Requirements (working title), Part 1 (Airborne) and Part 2 (Ground), in 2026

ARINC Project Paper xxx: Hyperconnected ATM (HCATM) – HCATM protocol (working title), in 2026

## Meetings and Expected Document Completion

The following table identifies the number of meetings and proposed meeting days needed to produce the documents described above.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Activity** | **Mtgs\*** | **Mtg-Days****(Total)** | **Expected****Start Date** | **Expected Completion Date** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ARINC Project Paper XXX, HCATM Technical Requirements and ARINC Project Paper XXX, HCATM protocol | 6 | 18 | Jan 2025 | Dec 2026 |

# Comments

# Comments

Monthly check-in meetings online,

\*3-day in-person meetings 3 times per year. Additional meetings will be scheduled based on the volume of work.

## Expiration Date for the APIM

December 2026

Completed forms should be submitted to (aeec@sae-itc.org)