ASBU ELEMENTS

ASUR COMI COMS CSEP

☑ Functional Description   ☑ Enablers   ☑ Deployment Applicability   ☑ Performance Impact Assessment

——— ASUR ———

ASUR-B0/1	Automatic Dependent Surveillance – Broadcast (ADS-B)	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To support the provision of Air Traffic Services and operational applications at reduced cost and increased surveillance coverage.

New Capabilities ❓   ADS-B provides precise position/velocity information in all airspace (accuracy not range-dependent as with radar). It also provides aircraft call sign and precise position/velocity information to nearby aircraft with ADS-B-In receivers.

ADS-B can also support State aircraft airspace access, however it should, when possible, leverage benefits from dual-use of State aircraft capabilities to reduce cost and technical impact.

Description ❓   ADS-B provides an aircraft's identification, position, altitude, velocity, and other information to any receiver (airborne or ground) within range. The broadcasted aircraft position/velocity is normally based on the global navigation satellite system (GNSS) and transmitted at least once per second.

Maturity Level ❓   Ready for implementation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out Departure En-route Arrival Taxi-in

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-operational need	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)
Relation-benefit	NAVS-B0/2 - Satellite Based Augmentation Systems (SBAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Ground system infrastructure	Surveillance	ADS-B ground stations	ADS-B ground stations receive information from aircraft and transmit it to one or more Service Delivery Points Reference material: Technical standards and guidance material: ICAO Annex 10 Volume IV Chapter 2,3 and 5 ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter RTCA/EUROCAE MOPS: DO-260/ED-102, DO-260A, or DO-260B/ED-102A EUROCAE ED-129, ED-129A or ED-129B ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2008
Ground system infrastructure	Surveillance	*Service Delivery Point(s) for ADS-B information	Service Delivery Point(s) receive ADS-B information provides it to ATC automation for processing and display to controller Reference material: Guidance material: ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2008
Ground system infrastructure	Technical systems	HMI that supports controller awareness	Human Machine Interface (HMI) of the Air Traffic Controller Working Position (ATCo CWP) Reference: Guidance material: ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2008
Airborne system capability	Surveillance	SSR Mode S transponder with extended squitter version 0, version 1 and version 2	Reference: Technical standards and guidance material: ICAO Annex 10 Volume IV Chapter 2,3 and 5 ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter RTCA/EUROCAE MOPS: DO-260/ED-102, DO-260A, or DO-260B/ED-102A ICAO Doc. 9924 Aeronautical Surveillance Manual	Aircraft manufacturer Aircraft operator	2008
Training	-	Training requirements ADS-B implementation	Depending on the ANSP implementation, some controller training on new symbology may be required. If phraseology is changed by an ANSP, then controller and pilot training on the new phraseology is required. If new ANSP equipment is installed, then training for maintenance personnel may be required (see ICAO Doc 8071).	ANSP	2008

| Airborne system capability | Navigation | Basic Aviation GNSS receiver with RAIM | Position source. Basic Aviation GNSS receiver with RAIM. Such a receiver must comply with the technical performance requirements of either [E]TSO-C129, or [E]TSO-C196, or [E]TSO-C145/-C146. (Note that the US/Europe and equivalent ADS-B mandates require more – see FAA AC 20-165 or EASA CS-ACNS). | Aircraft manufacturer / Aircraft operator | 2008 |

ASUR-B0/2 — Multilateration cooperative surveillance systems (MLAT) — Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓
To provide an alternative to radar surveillance by using available aircraft transponders.

New Capabilities ❓
MLAT allows cooperative surveillance in rough terrain such as in mountainous regions or on airport surfaces where surveillance systems requiring a rotating radar dish had performance difficulties. It may also be integrated with ADS-B ground stations to provide a surveillance capability that is more resilient to GNSS function failure.

Description ❓
MLAT is a new technique providing independent cooperative surveillance. The MLAT system interrogates an aircraft and the transponder reply is received by multiple receivers located in different places. The reply's times of arrival difference at the receivers allows the position of the source of signals to be determined, with an accuracy that is dependent on the number of receivers and their location relative to the aircraft. MLAT systems do not require a rotating radar dish and were initially deployed on airports to provide surface surveillance of aircraft. The technique is now used to provide surveillance over wide area (wide area MLAT system - WAM), sometimes in conjunction with ADS-B. MLAT requires more ground stations than ADS-B, but has the early implementation advantage of using existing aircraft transponders.

Maturity Level ❓
Ready for implementation

Human Factor Considerations

PLANNING LAYERS ❓
Tactical-During ops

OPERATIONS ❓
Taxi-out | Departure | En-route | Arrival | Taxi-in

DEPENDENCIES AND RELATIONS ❓
There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Ground system infrastructure	Surveillance	MLAT ground stations	MLAT ground stations interrogate aircraft transponders and receive/process transponder replies to determine aircraft position; this information is then transmitted to Service Delivery Point(s) Reference material: Technical standards and guidance material: ICAO Annex 10 Volume IV Chapters 2,3,5 and 6. ICAO Doc 9871 Technical Provisions for Mode S Services and Extended Squitter RTCA/EUROCAE MOPS: DO-181D/ED-73C or subsequent versions ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2008
Airborne system capability	Surveillance	SSR Mode A, C and S transponders	References: Technical standards and guidance material: ICAO Annex 10 Volume IV Chapter 2,3 and 5 ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter RTCA/EUROCAE MOPS: DO-181D/ED-73C or subsequent versions ICAO Doc. 9924 Aeronautical Surveillance Manual	Aircraft manufacturer / Aircraft operator	2008
Ground system infrastructure	Surveillance	Service Delivery Point (s) for MLAT information	Service Delivery Points(s) receive MLAT information and provide it to ATC automation for display to controller Reference: Guidance material: ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2008
Training	-	Training requirements MLAT implementation	If new ANSP equipment is installed, then training for maintenance personnel may be required (see Doc 8071).	ANSP	2008

ASUR-B0/3	Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ To obtain additional information from an aircraft transponder in support of the provision of Air Traffic Services.

New Capabilities ❓ SSR-DAPS enables ATM systems to obtain additional information from an aircraft transponder, via interrogation by a cooperative surveillance system (Mode S radar or MLAT). This additional information can be used to increase controller awareness and reduce the volume of air-ground voice communications, and/or to improve the performance of tracking systems or safety net systems such as STCA and MSAW.

Description ❓ Downlink of Aircraft Parameters (DAPS) includes both Controller Access Parameters (CAPs) and System Access Parameters (SAPs). Possible CAPs include Magnetic Heading, Indicated Airspeed / Mach Number, Barometric rate of climb/descent, and Selected Altitude (which can also be consider a SAP). SAPs include Roll Angle, Track Angle Rate, True Track Angle, and Barometric Pressure Setting.

Maturity Level ❓ Ready for implementation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Airborne system capability	Surveillance	SSR Mode A, C and S transponders	References: Technical standards and guidance material: ICAO Annex 10 Volume IV Chapter 2,3 and 5 ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter RTCA/EUROCAE MOPS: DO-181D/ED-73C or subsequent versions ICAO Doc. 9924 Aeronautical Surveillance Manual	Aircraft manufacturer Aircraft operator	2008
Ground system infrastructure	Surveillance	Mode S cooperative surveillance system	Mode S cooperative surveillance system with DAPS capability interrogates aircraft transponders to retrieve data; this information is then provided to the ATC automation system. Reference material: Technical standards and guidance material: ICAO Annex 10 Volume IV Chapter 2,3 and 5 ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter: RTCA/EUROCAE MOPS: DO-181D/ED-73C or subsequent versions ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2008

Ground system infrastructure	Technical systems	*HMI that supports controller awareness for CAPs and automation processing for SAPs	Reference: Guidance material: ICAO Doc 9924 Aeronautical Surveillance Manual	ANSP	2008
Training	-	Training requirements SSR-DAPS implementation	Depending on the ANSP implementation, some controller training on new symbology or alerts may be required. If phraseology is changed, or new phraseology is introduced by an ANSP, then controller and pilot training on the new phraseology is required. If new ANSP equipment is installed, then training for maintenance personnel may be required (see Doc 8071).	ANSP	2008

ASUR-B1/1 — Reception of aircraft ADS-B signals from space (SB ADS-B) — Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To provide surveillance coverage in locations where ground stations siting is not possible or not currently provided.

New Capabilities ❓   SB ADS-B provides precise position/velocity information in airspace where it is not cost-effective or even feasible to place ground surveillance infrastructure.

Description ❓   ADS-B provides an aircraft's identification, position, altitude, velocity, and other information to a receiver on an orbiting satellite. The broadcasted aircraft position/velocity is normally based on the global navigation satellite system (GNSS) and transmitted at least once per second. Aircraft ADS-B signals are received on one or more orbiting satellites, and this information is passed through a data network to a Service Delivery Point at an Air Traffic Service facility (or facilities).

Maturity Level ❓   Ready for implementation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

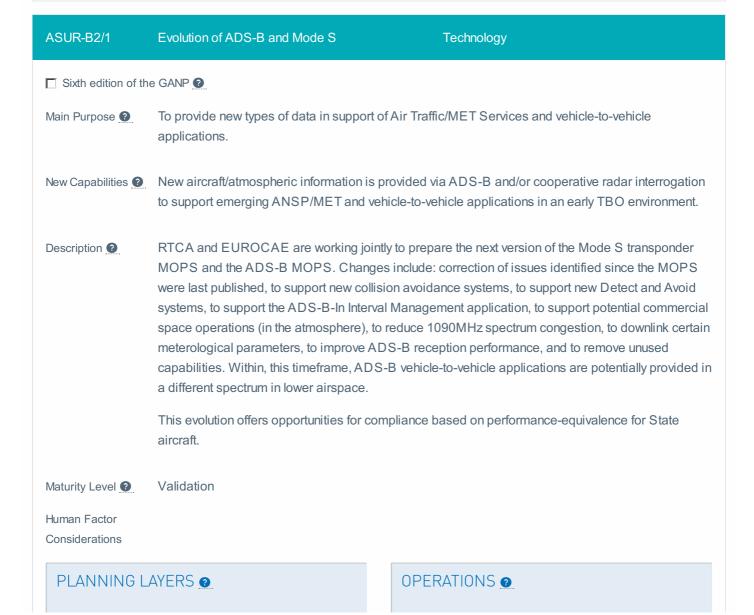### DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Evolution	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)

Relation-operational need	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)
Relation-benefit	NAVS-B0/2 - Satellite Based Augmentation Systems (SBAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Ground system infrastructure	Technical systems	HMI that supports controller awareness	Human Machine Interface (HMI) of the Air Traffic Controller Working Position (ATCo CWP) Reference: Guidance material: ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2008
Airborne system capability	Surveillance	SSR Mode S transponder with extended squitter version 0, version 1 and version 2	Reference: Technical standards and guidance material: ICAO Annex 10 Volume IV Chapter 2,3 and 5 ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter RTCA/EUROCAE MOPS: DO-260/ED-102, DO-260A, or DO-260B/ED-102A ICAO Doc. 9924 Aeronautical Surveillance Manual	Aircraft manufacturer Aircraft operator	2008
Ground system infrastructure	Surveillance	*ADS-B receivers on orbiting satellites	ADS-B receivers on orbiting satellites receive information from aircraft and transfer this information to ground Service Delivery Point(s). Reference: Technical standards and guidance material: ICAO Annex 10 Volume IV Chapter 2,3 and 5 ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter: RTCA/EUROCAE MOPS: DO-260/ED-102, DO-260A, or DO-260B/ED-102A EUROCAE ED-129A or ED-129B ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2015
Ground system infrastructure	Surveillance	Service Delivery Point(s) for satellite ADS-B	Service Delivery Point(s) receive information and transfer it to ATC automation for processing and display to controller. Reference: Guidance material: ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2015

Training	-	Training requirements SB ADS-B	If this capability is used to apply new separation minima per PANS-ATM, controller training is required. Depending on the ANSP implementation, some controller training on new symbology may be required. If phraseology is changed by an ANSP, then controller and pilot training on the new phraseology is required. If new ANSP equipment is installed, then training for maintenance personnel may be required (see ICAO Doc 8071).	ANSP	2018
Airborne system capability	Navigation	Basic Aviation GNSS receiver with RAIM	Position source. Basic Aviation GNSS receiver with RAIM. Such a receiver must comply with the technical performance requirements of either [E]TSO-C129, or [E]TSO-C196, or [E]TSO-C145/-C146. (Note that the US/Europe and equivalent ADS-B mandates require more – see FAA AC 20-165 or EASA CS-ACNS).	Aircraft manufacturer / Aircraft operator	2008

ASUR-B2/1	Evolution of ADS-B and Mode S	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To provide new types of data in support of Air Traffic/MET Services and vehicle-to-vehicle applications.

New Capabilities ❓   New aircraft/atmospheric information is provided via ADS-B and/or cooperative radar interrogation to support emerging ANSP/MET and vehicle-to-vehicle applications in an early TBO environment.

Description ❓   RTCA and EUROCAE are working jointly to prepare the next version of the Mode S transponder MOPS and the ADS-B MOPS. Changes include: correction of issues identified since the MOPS were last published, to support new collision avoidance systems, to support new Detect and Avoid systems, to support the ADS-B-In Interval Management application, to support potential commercial space operations (in the atmosphere), to reduce 1090MHz spectrum congestion, to downlink certain meterological parameters, to improve ADS-B reception performance, and to remove unused capabilities. Within, this timeframe, ADS-B vehicle-to-vehicle applications are potentially provided in a different spectrum in lower airspace.

This evolution offers opportunities for compliance based on performance-equivalence for State aircraft.

Maturity Level ❓   Validation

Human Factor Considerations

PLANNING LAYERS ❓

OPERATIONS ❓

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Evolution	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Evolution	ASUR-B0/2 - Multilateration cooperative surveillance systems (MLAT)
Evolution	ASUR-B0/3 - Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)
Evolution	ASUR-B1/1 - Reception of aircraft ADS-B signals from space (SB ADS-B)
Relation-operational need	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)
Relation-benefit	NAVS-B0/2 - Satellite Based Augmentation Systems (SBAS)
Relation-benefit	NAVS-B2/2 - Dual Frequency Multi Constellation (DF MC) SBAS
Relation-benefit	NAVS-B2/3 - Dual Frequency Multi Constellation (DF MC) ABAS

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Ground system infrastructure	Technical systems	HMI that supports controller awareness	Human Machine Interface (HMI) of the Air Traffic Controller Working Position (ATCo CWP) Reference: Guidance material: ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2008
Airborne system capability	Surveillance	SSR Mode S transponder with extended squitter version 3	Reference: Technical standards and guidance material: Future revision ICAO Annex 10 Volume IV Chapter 2,3 and 5 Future revision ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter: RTCA/EUROCAE MOPS: DO-260C/ED-102C, DO-181F/ED-73F (TBC) Future revision ICAO Doc. 9924 Aeronautical Surveillance Manual	Aircraft manufacturer Aircraft operator	2022

Ground system infrastructure	Surveillance	ADS-B receivers and/or cooperative radars	ADS-B receivers and/or cooperative radars receive information from aircraft and transfer this information to Service Delivery Point(s). Reference material: Technical standards and guidance material: Future revision ICAO Annex 10 Volume IV Chapter 2,3 and 5 Future revision ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter RTCA/EUROCAE MOPS: DO-260C/ED-102C, DO-181F/ED-73F, ED-129B (or subsequent revision) Future revision ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2022
Ground system infrastructure	Surveillance	Service Delivery Point(s) for ADS-B v3	Service Delivery Point(s) receive information and transfers it to ATC automation for processing and display to controller. Reference: Guidance material: Future revision of ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2022
Airborne system capability	Navigation	Basic Aviation GNSS receiver with RAIM	Position source. Basic Aviation GNSS receiver with RAIM. Such a receiver must comply with the technical performance requirements of either [E]TSO-C129, or [E]TSO-C196, or [E]TSO-C145/-C146. (Note that the US/Europe and equivalent ADS-B mandates require more – see FAA AC 20-165 or EASA CS-ACNS).	Aircraft manufacturer Aircraft operator	2008

| ASUR-B2/2 | New community based surveillance system for airborne aircraft (low and higher airspace) | Technology |

☐ Sixth edition of the GANP ❓

Main Purpose ❓ — To support the provision of separation services by operators for aircraft operating at very low altitudes (<500 ft) and higher airspace.

New Capabilities ❓ — A community based network solution for surveillance at a lower lifecycle cost is provided using operator reported positions into that network to support conflict detection and resolution. It substitutes shared information for visual recognition of other aircraft.

Description ❓ — Within this timeframe, vehicle identities/positions/velocities may be shared using an aviation network. Information is provided to the ANSP on aircraft location to detect airspace infringement (low altitudes) and support operator to operator (even if provided by third party acting on the operators behalf) conflict management. It extends to higher airspace to support new entrants.

Maturity Level ❓ — Concept

Human Factor
Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-operational need	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)
Relation-benefit	NAVS-B0/2 - Satellite Based Augmentation Systems (SBAS)
Relation-benefit	NAVS-B2/2 - Dual Frequency Multi Constellation (DF MC) SBAS
Relation-benefit	NAVS-B2/3 - Dual Frequency Multi Constellation (DF MC) ABAS

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Ground system infrastructure	Surveillance	"Public" network-based cooperative surveillance	"Public" network-based cooperative surveillance system collects, processes and shares "target" information; this information is then provided as needed to ANSP personnel.	ANSP	2024

ASUR-B3/1	New non-cooperative surveillance system for airborne aircraft (medium altitudes)	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To provide non-cooperative and independent surveillance system at a lower cost.

New Capabilities ❓   Non-cooperative surveillance is provided at a lower lifecycle cost using multiple, networked receivers to detect aircraft-reflected RF signals originated from continuously transmitting non-aviation transmitters such as digital TV stations, FM radio stations, or cellphone towers.

Description ❓   Information is provided to the ANSP on aircraft location to detect airspace infringement or to safely manage aircraft with surveillance equipment failure. A performance-based surveillance framework allows ANSPs to determine the most effective means of obtaining needed surveillance information. Within this timeframe, all aircraft identities/positions/velocities can be provided/shared by operators using an aviation network. Operators not receiving safety-of-life services can be surveilled using non-aviation spectrum.

Maturity Level ❓   Concept

Human Factor
Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Ground system infrastructure	Surveillance	*Non-cooperative surveillance system	Non-cooperative surveillance system observes RF reflections large enough to be declared as "targets"; this information is then provided to the ATC display (sometimes merged with data from cooperative surveillance systems). Reference material: Future revision of ICAO Doc 9924 – Aeronautical Surveillance Manual	ANSP	2031

ASUR-B4/1	Further evolution of ADS-B and MLAT	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ To support the provision of Air Traffic/MET Services and vehicle-to-vehicle applications in a full TBO environment and within a performance-based surveillance framework.

New Capabilities ❓ Additional aircraft/atmospheric information is provided in a performance-based surveillance context to resiliently support ANSP/MET and vehicle-to-vehicle applications in a full TBO environment.

Description ❓ This evolution will address TBO needs for surveillance information discovered in Block 2. A performance-based surveillance framework allows ANSPs to determine the most effective means of obtaining needed surveillance information.

Cooperative surveillance is expected to be the principal means of surveillance and is typically provided by ADS-B and MLAT systems; rotating radars will be replaced at end-of-life where appropriate. Within this timeframe, all aircraft identities/positions/velocities can be provided/shared by operators using internet. Operators not receiving safety-of-life services can be surveilled using non-aviation spectrum.

Maturity Level ❓ Concept

Human Factor
Considerations

PLANNING LAYERS ❷

Tactical-During ops

OPERATIONS ❷

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❷

Type of Dependencies	ASBU Element
Evolution	ASUR-B2/1 - Evolution of ADS-B and Mode S
Relation-operational need	NAVS-B2/2 - Dual Frequency Multi Constellation (DF MC) SBAS
Relation-operational need	NAVS-B2/3 - Dual Frequency Multi Constellation (DF MC) ABAS

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Ground system infrastructure	Technical systems	HMI that supports controller awareness	Human Machine Interface (HMI) of the Air Traffic Controller Working Position (ATCo CWP) Reference: Guidance material: ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2008
Airborne system capability	Surveillance	SSR Mode S transponder with extended squitter version 4 (TBC)	Reference: Technical standards and guidance material: ICAO Annex 10 Volume IV Chapter 2,3 and 5 ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter: RTCA/EUROCAE MOPS: DO-260D/ED-102D (TBC) ICAO Doc. 9924 Aeronautical Surveillance Manual	Aircraft manufacturer Aircraft operator	2032
Ground system infrastructure	Surveillance	ADS-B receivers and/or MLAT	ADS-B receivers and/or MLAT receive information from aircraft and transfer this information to Service Delivery Point(s) Reference material: Technical standards and guidance material: Future revision ICAO Annex 10 Volume IV Chapter 2,3 and 5 Future revision ICAO Doc. 9871 Technical Provisions for Mode S Services and Extended Squitter RTCA/EUROCAE MOPS: DO-260D/ED-102D (TBC); ED-129B (or subsequent revision) Future revision ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2032
Ground system infrastructure	Surveillance	Service Delivery Point(s) for ADS-B v4	Service Delivery Point(s) receive information and transfers it to ATC automation for processing and display to controller. Reference: Guidance material: Future revision of ICAO Doc. 9924 Aeronautical Surveillance Manual	ANSP	2032

| Airborne system capability | Navigation | Basic Aviation GNSS receiver with RAIM | Position source. Basic Aviation GNSS receiver with RAIM. Such a receiver must comply with the technical performance requirements of either [E]TSO-C129, or [E]TSO-C196, or [E]TSO-C145/-C146. (Note that the US/Europe and equivalent ADS-B mandates require more – see FAA AC 20-165 or EASA CS-ACNS). | Aircraft manufacturer | 2008 |
| | | | | Aircraft operator | |

COMI

COMI-B0/1	Aircraft Communication Addressing and Reporting System (ACARS)	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ The Aircraft Communications Addressing and Reporting System (ACARS) is a digital datalink system for transmission of messages between aircraft and ground stations via VHF or satellites.

New Capabilities ❓ ACARS provides the network for the controller and pilot with the ability to exchange datalink messages and thus provides a backup to voice communications. It also provides for airline operational control messaging.

Description ❓ ACARS is a digital datalink network system which transmits and routes messages between aircraft and ground stations via VDL Mode 0/Mode2 radios or satellites.

Maturity Level ❓ Ready for implementation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out Departure En-route Arrival Taxi-in

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology option	COMI-B0/3 - VHF Data Link (VDL) Mode 0/A
Relation-technology option	COMI-B0/4 - VHF Data Link (VDL) Mode 2 Basic
Relation-technology option	COMI-B0/5 - Satellite communications (SATCOM) Class C Data
Relation-technology option	COMI-B0/6 - High Frequency Data Link (HFDL)
Relation-technology benefit	COMI-B1/2 - VHF Data Link (VDL) Mode 2 Multi-Frequency

Relation-technology benefit	COMI-B1/3 - SATCOM Class B Voice and Data

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Protocols	Communication infrastructure	ACARS Protocols	AEEC 618- Air Ground Character-Oriented Protocol. (AEEC 620 Datalink Ground System Standard and Interface Specification) ARINC 622- ATS Datalink Applications over ACARS Air-Ground Network. AEEC 623- Character-Oriented Air Traffic Services. ARINC 633 is the air-ground definition for sending XML over ACARS	ANSP Aircraft manufacturer	2013
Airborne system capability	Communication infrastructure	ACARS Airborne Radio Transceiver	ACARS is a digital datalink system for transmission of short messages between aircraft and ground stations via airband radio or satellite. AEEC 618- Air Ground Character-Oriented Protocol. AEEC 620 Datalink Ground System Standard and Interface Specification ARINC 624 is a standard for aircraft onboard maintenance system	Aircraft manufacturer Aircraft operator	2013
Ground system infrastructure	Communication infrastructure	ACARS Ground Radio Transceiver	ACARS is a digital datalink system for transmission of short messages between aircraft and ground stations via airband radio or satellite. AEEC 618- Air Ground Character-Oriented Protocol. AEEC 620 Datalink Ground System Standard and Interface Specification	ANSP Ground systems supplier	2013
Space system infrastructure	Communication infrastructure	ACARS Space Radio Transceiver	Inmarsat Classic Aero Standard and Iridium Standard (includes a satellite data unit, a high power amplifier and an antenna with a steerable beam).	Satellite provider	2013

COMI-B0/2	Aeronautical Telecommunication Network/Open System Interconnection (ATN/OSI)	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   ATN/OSI provides a bit-oriented multi-layer protocol for exchanging ATS messages between the aircraft and ground system.

New Capabilities ❓	The ATN/OSI provides an alternative, dedicated ATS protocol for exchanging flight safety messages.
Description ❓	The ATN/OSI provides a dedicated ATS commuications protocol for the usage of B1 data link applications (e.g. CPDLC and CM).
Maturity Level ❓	Ready for implementation
Human Factor Considerations	

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out Departure En-route Arrival Taxi-in

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology benefit	COMI-B1/2 - VHF Data Link (VDL) Mode 2 Multi-Frequency
Relation-technology benefit	COMI-B1/3 - SATCOM Class B Voice and Data
Relation-technology benefit	COMI-B3/1 - VHF Data Link (VDL) Mode-2 Connectionless
Relation-technology need	COMI-B0/4 - VHF Data Link (VDL) Mode 2 Basic

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Protocols	Communication infrastructure	ATN/OSI protocol	ICAO Doc. 9880- Manual on Detailed Technical Specifications for the ATN/OSI.	ANSP	2013
Airborne system capability	Communication infrastructure	ATN/OSI Airborne Router	ICAO Doc. 9880- - Manual on Detailed Technical Specifications for the ATN/OSI. Connectivity is to be accomplished over multiple subnetwork types. The ATN currently recognizes a limited set of subnetworks: SSR Mode Select (Mode S), Very High Frequency (VHF) Digital Link (VDL), Aeronautical Mobile Satellite Service (AMSS), Gatelink, and High Frequency (HF).	ANSP Aircraft manufacturer	2013
Ground system infrastructure	Communication infrastructure	ATN/OSI Ground Router	ICAO Doc. 9880- Manual on Detailed Technical Specifications for the ATN/OSI.	ANSP	2013

COMI-B0/3	VHF Data Link (VDL) Mode 0/A	Technology

Main Purpose ❓ VDL Mode 0/A is a data communications subnetwork that supports transmission of data link messages.

New Capabilities ❓
- Introduction of a datalink to support domestic data communications operations.
- a supplement to voice communications
- Exchanges aviation data (AOC, CPDLC and ADS)

Description ❓ VDL Mode 0/A is a narrow-band transceiver operating in the VHF aviation protected spectrum band which will transmit data to and from the aircraft to support data communications. The VHF digital radio system is based on the double side band AM multi-shift keying modulation to transfer 2400 bps.

Maturity Level ❓ Ready for implementation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out   Departure   En-route   Arrival   Taxi-in

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Protocols	Communication infrastructure	"Plain Old" ACARS (POA) protocol	AEEC 758 - Communications Management Unit ARINC 771 - Low-earth orbiting aviation satellite communication systems	ANSP Aircraft manufacturer	2013
Airborne system capability	Communication infrastructure	VDL Mode 0/A airborne Analog Radio	AEEC 618 - Air/ground character-oriented protocol specification	ANSP Aircraft manufacturer	2013
Ground system infrastructure	Communication infrastructure	VDL Mode 0/A Ground Analog transceiver	Datalink Ground System Standards and Interface Specification (ARINC 620). Defines the interfaces to the ACARS Ground System Operated by a Datalink Service Provider.	ANSP Ground systems supplier	2013

COMI-B0/4 ❓	VHF Data Link (VDL) Mode 2 Basic	Technology

Main Purpose ❓	VDL Mode 2 Basic is a data communications subnetwork that supports transmission of data link messages. It provides higher performance than VDLM0/A.

New Capabilities ❓

- Provides an Increase in data capacity over VDL Mode O/A
- Exchanges aviation data (AOC, CPDLC and ADS)
- More efficient use of spectrum

Description ❓ VDL Mode 2 is narrow-band transceiver operating in the VHF aviation protected spectrum band, which will transmit data to support data communications between the aircraft and ground. It consists of a set of air-ground protocols that increase the data rate to 31.5 kbits.

Maturity Level ❓ Ready for implementation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out Departure En-route Arrival Taxi-in

DEPENDENCIES AND RELATIONS ❓
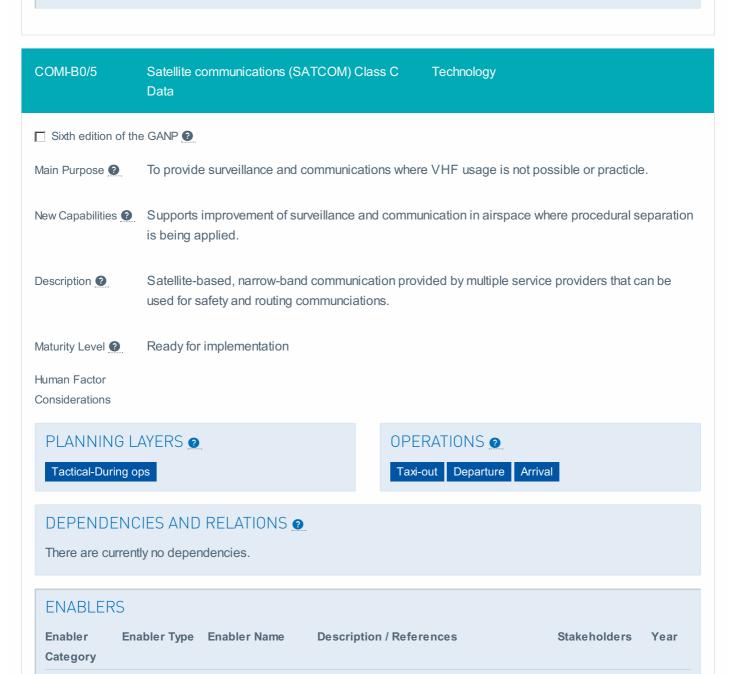
Type of Dependencies	ASBU Element
Evolution	COMI-B0/3 - VHF Data Link (VDL) Mode 0/A

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Protocols	Communication infrastructure	VDL-M2 operational Usage & Protocol	VDL-M2 is the primary VDL mode being implemented operationally to support Controller Pilot Data Link Communications. • ICAO Doc 9776 VDL2 Technical Manual • VHF air-ground Digital Link (VDL) Mode 2; Technical characteristics and methods of measurement for ground-based equipment ETSI EN 301 841-1 • RTCA DO 224 Minimum Aviation System Performance Standard) • ARINC 631 VHF Digital Link (VDL) Mode 2 implementation provisions	ANSP	2013
Airborne system capability	Communication infrastructure	VDL-M2 Digital Airborne Radio Transceiver	Aircraft must be fitted with a digital connection to a VHF Digital Radio (VDR) transceiver. • AEEC 631-B • DO-281B (RTCA Minimum Aviation System Performance) • ED-92B (EUROCAE MOPS)	ANSP	2013

| Ground system infrastructure | Communication infrastructure | VDL-M2 Digital Ground Radio Transceiver | VHF Digital Link Mode 2 system uses digital radios to improve the performance of VHF analog data link. VDL Mode 2 provides a data rate of 31.5 kbit/second using a radio channel that is the same width as the channel used by the VHF analog data link system, providing a data rate of only 2.4 kbit/second. • DO-224C (RTCA Minimum Aviation System Performance Standard) | ANSP | 2013 |

COMI-B0/5 Satellite communications (SATCOM) Class C Data Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To provide surveillance and communications where VHF usage is not possible or practicle.

New Capabilities ❓   Supports improvement of surveillance and communication in airspace where procedural separation is being applied.

Description ❓   Satellite-based, narrow-band communication provided by multiple service providers that can be used for safety and routing communciations.

Maturity Level ❓   Ready for implementation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out   Departure   Arrival

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Protocols	Communication infrastructure	SATCOM Class C Usage and Data Protocol	SATCOM Performance Class C covers the performance requirements included in the current AMS(R)S SARPs and is applicable to systems already standardized in ICAO (such as Inmarsat Classic Aero, MTSAT and Iridium SBD) as well as the Inmarsat SBB system which was recently included in the AMS(R)S Manual. Class C is effectively covering remote and oceanic operations (Performance specification DO-306/ED-122). NGSS DO-210/DO-262	ANSP / Satellite provider	2013
Airborne system capability	Communication infrastructure	SATCOM Class C Management Unit (Airborne Radio Transceiver)	AMSRS Satellite SARPS with Section for INMARSAT and Iridium AEEC 741, 761, 781-7 SATCOM Class C Form, Fit and Function	Aircraft manufacturer / Satellite provider	2013
Ground system infrastructure	Communication infrastructure	SATCOM Class C Ground Radio Transceiver	Minimum Aviation System Performance Standards (MASPS) for the aeronautical mobile-satellite (R) service (AMS(R)S) as used in aeronautical data links.	ANSP	2013
Space system infrastructure	Communication infrastructure	SATCOM Class C Space Radio Transceiver	Aeronautical Mobile Satellite (Route) Service Manual (Doc 9925) with a section that addresses Satcom Performance Class C	Satellite provider	2013
Space system infrastructure	Communication infrastructure	Communication satellites for class C	Inmarsat I4, MTSAT and Iridium.	Satellite provider	2013

COMI-B0/6	High Frequency Data Link (HFDL)	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ To communicate in areas where SATCOM and VHF are not available.

New Capabilities ❓ HFDL is a communications media used to exchange data messages between aircraft end-systems and corresponding ground-based HFDL ground stations.

Supports improvement of surveillance in airspace where procedural separation is being applied.

Description ❓ The HFDL includes the HFDL network and avionics. Specifically this means the introduction of an airborne communications router (e.g. Communications Management Unit) and an HFDL radio.

Maturity Level ❓ Ready for implementation

Human Factor
Considerations

OPERATIONS ?

En-route

DEPENDENCIES AND RELATIONS ?

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Protocols	Communication infrastructure	HF Datalink operational Usage & Protocol	HFDL is an ACARS communications media that is used to exchange data between aircraft end-systems and ground based stations. • ARINC Specification 635-4: HF Data Link Protocols • ARINC Characteristic 753-2: HF Data Link System • ARINC Report 634: HF Data Link System Design Guidance Material • ICAO Doc. 9741 HFDL	ANSP Aircraft manufacturer	2013
Airborne system capability	Communication infrastructure	HFDL data radio transmission	To use High Frequency Data Links an aircraft needs to be equipped with a Communications Management Function or equivalent. This allow for airborne communications to interface with many aircraft communications systems. • DO-265 HFDL MOPS	ANSP Aircraft manufacturer	2013
Ground system infrastructure	Communication infrastructure	HFDL ground radio transmission	• DO-277 MASPS	ANSP Aircraft manufacturer	2013

COMI-B0/7	ATS Message Handling System (AMHS)	Technology

☐ Sixth edition of the GANP ?

Main Purpose ?
- Supports improved communication over AFTN
- Provide flight information coordination between ANSPs at adjacent FIRs, and with relevant military units, support separation assurance, potentially providing, when used in conjunction with other enablers (e.g. navigation capabilities), reduced separation.

New Capabilities ❓
- AMHS makes use of higher speed communication than AFTN. It also allows the use of bit-oriented communications allowing greater flexibility in message types. Attachments to messages can also be supported thus allowing the exchange of graphics. Provides direct communication between adjacent FIRs using data communication to minimize the use of voice communication.
- Increase performance to handle large files
- Implement AFTN/AMHS gateway
- Initiate the standardization of IP interface and addressing scheme

Description ❓

The AMHS is served as ICAO mandated communication for data exchange between ANSPs (ICAO Doc. 9880 and Annex X). AMHS is served as enabler for

1. Flight Plan/Clearance
2. AIDC: Flight transfer
3. MET data

ATS voice service is used for emergency coordination and/or normal coordination when data communication service is not available.

AMHS is expected to be utilized to carry traffic for AIDC/Flight Plan/MET until SWIM is ready in Block 2. This is due to ANSPs need time to upgrade/implement adaptors to support SWIM interface. In the meantime, AMHS will accommodate SWIM compliance data message (IWXXM) as required. It is noted that AMHS would not be able to support FF-ICE and FIXM data.

The interface is based on IP over legacy dedicated point-to-point circuits.

Maturity Level ❓   Ready for implementation

Human Factor
Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology benefit	COMI-B1/1 - Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Protocols	Communication infrastructure	AMHS operational Usage & Protocol	ATS Message Handling Systems (AMHS) is a standard for aeronautical ground-to-ground communication. AMHS was first implemented by Avitech GmbH in 1996 and the first European AMHS connection was operational in 2005. The AMHS is a set of end systems that work together to allow cooperation between human and automated users. • ICAO Doc 4444, Procedures for Air Navigation Services Air Traffic Management • ICAO Doc 7030, Regional Supplementary Procedures • ICAO Doc 10037 Edition 1 • Global Operational Datalink Manual (GOLD) • ICAO Doc 9869 Second Edition • Performance-Based Communication and Surveillance (PBCS) Manual	ANSP	2013
Ground system infrastructure	Communication infrastructure	Aviation Authority to Aircraft pilot data transmission	ICAO Doc 9880 Part II defines two fundamental levels of service within AMHS: basic and extended. The basic AMHS performs an operational role similar to the Aeronautical Fixed Telecommunication Network with some enhancements. • ED122/DO306, including Change 1 & 2, Oceanic Remote Safety and Performance Requirements • ED100A/DO258A, FANS 1/A Interoperability Requirements	ANSP	2013

COMI-B1/1	Ground-Ground Aeronautical Telecommunication Network/Internet Protocol Suite (ATN/IPS)	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓　To provide for a more modern, more efficient, cost-effective, and robust data communications network infrastructure.

New Capabilities ❓　It enables the efficient integration of technologies with improved integrity to support future air to ground aeronautical safety services and regularity of flight communications.

Description ❓　The ATN/IPS internetwork consists of IPS nodes and networks operating in a multinational environment in support of Air Traffic Service Communication (ATSC) as well as Aeronautical Industry Service Communication (AINSC), such as Aeronautical Administrative Communications (AAC) and Aeronautical Operational Communications.

This evolution will support enhanced civil-military cooperation and coordination functions, if interoperability and military information security aspects are considered.

Maturity Level ❓　Standardization

Human Factor
Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

En-route

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology benefit	COMI-B1/4 - Aeronautical Mobile Airport Communication System (AeroMACS) Ground-Ground

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Protocols	Communication infrastructure	IPS Protocol	The Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocols Doc 9896	ANSP	2019

COMI-B1/2	VHF Data Link (VDL) Mode 2 Multi-Frequency	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓
- Supports transmission of data link message sets to supplement current voice operations, thus reducing voice channel congestion; while increasing productivity and capacity.
- Supports increased subnetwork capacity and reduces interference over the standard VDL Mode 2 system.

New Capabilities ❓
- Provides an increase in data capacity over VDL Mode 2
- Exchanges aviation data (AOC, CPDLC and ADS)
- Provides a supplement to voice communications
- More efficient use of spectrum

Description ❓
VDL Mode 2 Multi-Frequency consists of a set of air-ground protocols that increase the data rate to 31.5 kbits. It allows transmission from a character oriented protocols to digital or bit based protocols while using VHF air and ground narrow-band transceiver operating in the VHF aviation protected spectrum band, which will transmit textual data to and from the cockpit to support data communications between the pilot and the air traffic controller.

Maturity Level ❓   Ready for implementation

Human Factor
Considerations

PLANNING LAYERS ❓

OPERATIONS ❓

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Evolution	COMI-B0/4 - VHF Data Link (VDL) Mode 2 Basic

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Protocols	Communication infrastructure	VDL-M2 MF operational Usage & Protocol	• ICAO Doc 9776 VDL2 Technical Manual • ED-92B (EUROCAE MOPS) • DO-281B (RTCA Minimum Operational Performance Standard) • AEEC 631-B • RTCA DO 224	ANSP Aircraft manufacturer	2019
Airborne system capability	Aircraft system	Airborne VDL M-2 MF autotune functionality	VDL Mode 2 frequency management capability allow for auto-tune of an aircraft, from the VDL common signaling channel to an alternate VDL frequency, and back to the common signaling channel. The auto-tune command is the primary building block to instruct aircraft to tune to VDL frequencies, which enables service providers to actively manage traffic load among VDL frequencies. • DO-281B (RTCA Minimum Operational Performance Standard) • AEEC 631-6 • ED-92B (EUROCAE MOPS)	ANSP Aircraft manufacturer	2019
Ground system infrastructure	Communication infrastructure	Ground VDL M-2 MF autotune functionality	VDL Mode 2 frequency management capability allow for auto-tune of an aircraft, from the VDL common signaling channel to an alternate VDL frequency, and back to the common signaling channel. The auto-tune command is the primary building block to instruct aircraft to tune to VDL frequencies, which enables service providers to actively manage traffic load among VDL frequencies. • DO-224C (RTCA Minimum Aviation System Performance Standard) • DO-343A Minimum Aviation System Performance Standards (MASPS) for the Aeronautical Mobile-Satellite (R) Service (AMS(R)S) for FANS1/A+ • RTCA DO-262 MOPS	ANSP Aircraft manufacturer	2019

COMI-B1/3	SATCOM Class B Voice and Data	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓
- Supports introduction of SATVOICE and SATDATA as a complement to HF voice communications.
- Provides for oceanic and domestic broadband IPS based safety critical data link operations.
- Supports safety critical, safety and regularity of flight operations.

New Capabilities ❓
- Use of SATCOM voice for all types of ATS communications (routine and emergency/urgency communications).
- Provide high-speed IP based broadband networks.
- Improved security
- Lower cost than the traditional circuit switched services (Classic Aero).

Description ❓

SATCOM System is a broadband, IP based communication system that provides voice and high-speed data communications between the aircraft and the air-traffic controller.

Two constellations are expected to provide this service (INMARSAT and Iridium).

SATCOM Class B (SB-S): SwiftBroadband is available over the Inmarsat 4 satellite constellation, providing near global coverage. SwiftBroadband includes SB-S avionics, the satellite modem that accesses the service, and the aircraft antenna capable of receiving SwiftBroadband and related equipment such as diplexer, LNA, HPA and cabling.

SATCOM Class B (Certus)The Iridium NEXT (Certus) Satellite Network, with its constellation of 66 Low Earth Orbit (LEO) satellites, is a global mobile satellite communication network, with coverage of the entire Earth, including polar regions, offering ATC voice and data service.

This evolution will support enhanced civil-military cooperation and coordination functions, if interoperability and military information security aspects are considered.

Maturity Level ❓   Ready for implementation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

| Protocols | Communication infrastructure | SATCOM Class B usage and protocols | SB-S is the INMARSAT Satellite System (2019). SATCOM Performance Class B covers more stringent (compared to Class C) performance requirements and will be applicable to commercial SATCOM systems, (i.e. the Iridium Next and the Inmarsat SB-S supporting safety services. SATCOM Performance Class B covers the performance requirements of initial 4D operations and the Baseline 2 (B2) requirements defined by RTCA and EUROCAE. Performance Class B requirements will cover remote, oceanic as well as continental/domestic operations. Global Operational Data Link Document (GOLD) Manual (Doc 10037), the PBCS Manual (DOC 9869) and the Satellite Voice Guidance Material (SVOM, Doc 10038) Performance specification DO-306/ED-122; DO-290/ED-120 Interoperability Specification DO-258A/ED-100A DO-280B/ED-112B Certus is the Iridium Next Satellite System (2025). SATCOM Performance Class B covers more stringent (compared to Class C) performance requirements and will be applicable to commercial SATCOM systems, (i.e. the Iridium Next and the Inmarsat SB-S supporting safety services. SATCOM Performance Class B covers the performance requirements of initial 4D operations and the Baseline 2 (B2) requirements defined by RTCA and EUROCAE. Performance Class B requirements will cover remote, oceanic as well as continental/domestic operations. Performance specification DO-306/ED-122 DO-350A/ED-228A Interoperability Specification DO-258A/ED-100A DO-351A/ED-229A RTCA DO 262 MOPS Certus Technical Manual The AMS(R)S manual (Doc 9255), separate chapter for the IridiumNext (Certus) system Global Operational Data Link Document (GOLD) Manual (Doc 10037), the PBCS Manual (DOC 9869) and the Satellite Voice Guidance Material (SVOM, Doc 10038) | ANSP Aircraft manufacturer | 2019 |

Airborne system capability	Communication infrastructure	SATCOM Class B Management Unit (Airborne Radio Transceiver)	AEEC Characteristic, 771 / 781 (INMARSAT; 2019) RTCA DO 262 MOPS Certus Technical Manual (Iridium;2025) AEEC 771-2 SATCOM Class B Form, Fit and Function (Iridium;2025)	Aircraft manufacturer	2019
Ground system infrastructure	Communication infrastructure	SATCOM Class B Ground Radio Transceiver	RTCA DO-343 MASPS (INMARSAT;2019) DO-343B Minimum Aviation System Performance Standards (MASPS) for the Aeronautical Mobile-Satellite (R) Service (AMS(R)S) For FANS1/A+ and ATN/IPS (Iridium;2025)	ANSP Aircraft manufacturer	2019
Space system infrastructure	Communication infrastructure	Communication satellites for class B	Swift Broadband Safety Satellite (2019): The AMS(R)S manual (Doc 9925), separate chapter for the Inmarsat SB-Safety systems Certus Satellite (2025): Performance specification DO-306/ED-122 DO-350A/ED-228A Interoperability Specification DO-258A/ED-100A DO-351A/ED-229A	Satellite provider	2019

COMI-B1/4	Aeronautical Mobile Airport Communication System (AeroMACS) Ground-Ground	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓
- Reduced Separation
- Improved situational awareness
- Reduced Cost
- Improved Efficiency

New Capabilities ❓
- Broadband Communications
- Supports Safety communications
- IPS Based System
- Improved Security

Description ❓   AeroMACS is a broadband wireless communications system. It can provide network connectivity on the airport surface for fixed wireless communications and can be used only for the safety critical and regularity of flight. The fixed assests supported by AeroMACS include multilateration sensors, weather sensors, surface radar and fixed navigation aids.

Maturity Level ❓   Ready for implementation

Human Factor Considerations

PLANNING LAYERS ❓	OPERATIONS ❓

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	AeroMACS operational description	• ED222 / Do345: Aeronautical Mobile Airport Communications System (AeroMACS) Profile Doc. • Doc 10044: AeroMACS Technical Manual	ANSP	2017
Ground system infrastructure	Airport systems	AeroMACS Mobile Station (Ground Radio Unit)	•ED223 / Do346: Minimum Operational Performance Standards (MOPS) for the AeroMACS. •ICAO ANNEX-10, Volume III, Chapter 7: AeroMACS SARPs	Airport operator	2017
Ground system infrastructure	Communication infrastructure	AeroMACS Base Station	EUROCAE ED-227: AeroMACS MASPS	ANSP	2017

COMI-B2/1	Air-Ground ATN/IPS	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To improve integrity of the information.

New Capabilities ❓   This element:

- provides more efficient data communications;
- improves information integrity.

Description ❓   A new network infrastructure based on Internet Protocol (IP) that promises to use Commercial-Off-The-Shelf (COTS) products to support air to ground aeronautical safety services and regularity of flight communications.

Maturity Level ❓   Validation

Human Factor Considerations

PLANNING LAYERS ❓

OPERATIONS ❓

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology option	COMI-B1/2 - VHF Data Link (VDL) Mode 2 Multi-Frequency
Relation-technology option	COMI-B1/3 - SATCOM Class B Voice and Data
Relation-technology benefit	COMI-B3/1 - VHF Data Link (VDL) Mode-2 Connectionless
Relation-technology benefit	COMI-B3/2 - SATCOM Class A voice and data
Relation-technology benefit	COMI-B3/4 - Links meeting requirements for safety critical communication
Relation-technology benefit	COMI-B3/3 - L-band Digital Aeronautical Communication System (LDACS)
Relation-technology benefit	COMI-B2/2 - Aeronautical Mobile Airport Communication System (AeroMACS) aircraft mobile connection

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Protocols	Communication infrastructure	IPS Protocol	The Manual on the Aeronautical Telecommunication Network (ATN) using Internet Protocol Suite (IPS) Standards and Protocols Doc 9896	ANSP	2019
Airborne system capability	Communication infrastructure	IPS Airborne Router	Aviation Profiles for Internet Protocol Suite (IPS) ICAO ANNEX-10, Volume III, IPS SARPs ARINC Project Paper 858 IPS technical requirements	Aircraft manufacturer / Aircraft operator	2025
Ground system infrastructure	Communication infrastructure	IPS Ground Router	IPS MASPS	ANSP	2025

COMI-B2/2	Aeronautical Mobile Airport Communication System (AeroMACS) aircraft mobile connection	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ To reduce separation and improve situational awareness.

New Capabilities ❓
- Broadband communications.
- Supports safety communications.
- IPS based system.
- Improved security.

Description ❓	AeroMACS is a broadband wireless communications system. It can provide network connectivity on the airport surface for communications to mobile assets (e.g. Aircraft, emergency vehicles, baggage trucks). It is used to transmit safety critical and regularity of flight information.

Maturity Level ❓   Validation

Human Factor
Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out   Taxi-in

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	-	AeroMACS mobile connection operational description	• ED222 / Do345: Aeronautical Mobile Airport Communications System (AeroMACS) Profile Doc. • Doc 10044: AeroMACS Technical Manual	ANSP	2031
Airborne system capability	Communication infrastructure	AeroMACS Mobile Station (Avionics Radio Unit)	• ED223 / Do346: Minimum Operational Performance Standards (MOPS) for the AeroMACS. • ICAO ANNEX-10, Volume III, Chapter 7: AeroMACS SARPs • ARINC 766: Aeronautical Mobile Airport Communication System (AeroMACS) Transceiver and Aircraft Installation Standards	Aircraft manufacturer Aircraft operator	2031
Ground system infrastructure	Communication infrastructure	AeroMACS Base Station for mobile connection	EUROCAE ED-227: AeroMACS MASPS	ANSP	2031

COMI-B2/3	Links meeting requirements for non-safety critical communication	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ To:

- reduce operational cost;
- improve performance;
- take advantage of new technologies sooner;
- enable the global exchange of non-safety information.

New Capabilities ❓

- Improved resiliency
- Reduced operational costs
- Improved capacity
- Broadband communications
- Enable a single IP-based global operating network

Description ❓ Broadband satellite and cellular services are used to support non-safety critical communications. By adopting the use of available infrastructure and possibly the use of a multi-sensor concept these systems meet performance requirements, in effect leading to reduced system cost, while improving the overall performance of the network and the system resiliency.

Maturity Level ❓ Validation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out Departure En-route Arrival Taxi-in

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Airborne system capability	Communication infrastructure	Commercial airborne data transfer	In the future commercial provider (Ex. AWS, Azure, Google) may increase their range and service offerings to allow implementation of radio systems that can be used to transfer data from airborne systems to ground systems.	ANSP Communication service provider	2025
Ground system infrastructure	Communication infrastructure	Commercial ground data transfer	To reduce congestion on current air traffic control towers, commercial cellular infrastructure and systems already in place can be used to relay data.	ANSP Communication service provider	2025

Space system infrastructure	Communication infrastructure	Commercial satellite data transfer	To relay messages via satellites while saving the cost on implementation, commercial broadband satellites and constellation systems (Ex. Amazon, Google, SpaceX) can be used to relay data.	ANSP Satellite provider	2025

COMI-B3/1   VHF Data Link (VDL) Mode-2 Connectionless   Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To make a more efficient use of the bandwith.

New Capabilities ❓   Connection-less mode 2 uses a previously dormant feature (unnumbered information frames) instead of information frames.

Description ❓   Connection-less VDL 2 is capable of transporting AOA messages, ATN messages and IPS messages. It reduces connection orientated complexity; while being efficient in its use, and extending the lifetime of the finite number of VDL 2 channels available. It is determined to be less complicated overall and a larger percentage of the complexity is in the ground system where it's easier to maintain and less expensive.

Additionally, connection-less will provide better performance (fewer Provider Aborts and lower propagation times).

This evolution offers opportunities for compliance based on performance-equivalence for State aircraft.

Maturity Level ❓   Concept

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out   Departure   En-route   Arrival   Taxi-in

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Evolution	COMI-B0/4 - VHF Data Link (VDL) Mode 2 Basic

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

				ANSP	2030
Protocols	Communication infrastructure	Connectionless VDL-M2 operational usage & protocols	• ICAO Doc 9776 VDL2 Technical Manual • AEEC 631-6 • DO-281B (RTCA Minimum Operational Performance Standard) • ED-92B (EUROCAE MOPS) • DO-224C (RTCA Minimum Aviation System Performance Standard)	Aircraft manufacturer	
Airborne system capability	Communication infrastructure	Connectionless VDL-M2 Digital Airborne Radio Transceiver	Existing VDL Mode 2 requires airplanes and ground stations to establish an explicit connection. This is less efficient than connectionless VDL Mode 2 because of resulting overhead message traffic for link establishment, ground station handoff, etc. Existing VDL Mode 2 is also less robust because airplanes will accept an uplink only from a connected ground station and ground stations will accept a downlink only from a connected airplane. • AEEC 631-6 • DO-281B (RTCA Minimum Operational Performance Standard) • ED-92B (EUROCAE MOPS)	ANSP Aircraft manufacturer	2025
Ground system infrastructure	Communication infrastructure	Connectionless VDL-M2 Digital Ground Radio Transceiver	Existing VDL Mode 2 requires airplanes and ground stations to establish an explicit connection. This is less efficient than connectionless VDL Mode 2 because of resulting overhead message traffic for link establishment, ground station handoff, etc. Existing VDL Mode 2 is also less robust because airplanes will accept an uplink only from a connected ground station and ground stations will accept a downlink only from a connected airplane. • DO-224C (RTCA Minimum Aviation System Performance Standard)	ANSP Aircraft manufacturer	2025

COMI-B3/2	SATCOM Class A voice and data	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ To improve efficiency and cost-effectiveness of SATCOM globally. SATCOM Performance Class A defines more stringent (compared to Class B) performance requirements necessary to support future concepts of SESAR/NextGen/CARATS.

New Capabilities ❓
- Improved resiliency
- Reduced operational costs
- Improved capacity
- Support B3 Message Sets

Description ❓ SATCOM Class A will make use of existing and future commercially available constellations to provide multilink operations and thus improved capacity, availability and resiliency.

This evolution offers opportunities for compliance based on performance-equivalence for State aircraft.

Maturity Level ❓ Concept

Human Factor
Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out   Departure   Arrival

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Protocols	Communication infrastructure	SATCOM Class A operational usage and protocols	SATCOM Performance Class A covers more stringent (compared to Class B) performance requirements and will be applicable to future SATCOM systems SATCOM Performance Class A covers the performance requirements of full 4D operations and operations required to support the SESAR/NextGEN/CARATS future concepts. SATCOM Performance Class A requirements correspond to the Baseline 3 (B3) requirements. Class A will cover remote, oceanic as well as continental operations/domestic. Class A performance requirements are expected to serve in particular as design guidelines for the definition and specification of future SATCOM systems to support the future aviation requirements.	ANSP	2031

COMI-B3/3	L-band Digital Aeronautical Communication System (LDACS)	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To:

- support improved Message Sets (B2) including accurate aircraft trajectory for improved 4D flight path;
- provide for more efficient data communications;
- increase security.

New Capabilities ❓
- Broadband communications.
- Supports safety communications.
- IPS based system.
- Improved security.

Description ❓   LDACS (L-band Digital Aeronautical Communications System) is the future terrestrial air-ground data link. It is a frequency division duplex (FDD) configuration utilizing Orthogonal Frequency Division Multiplexing (OFDM), reservation based access control and advance network protocols (i.e. IPS).

Maturity Level ❓   Validation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out Departure En-route Arrival Taxi-in

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

There are currently no enablers.

COMI-B3/4	Links meeting requirements for safety critical communication	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To:

- provide more efficient data communications;
- increase security;
- reduce cost;
- improve performance;
- take advantage of newer technologies sooner;
- enable the global exchange of safety critical information.

New Capabilities ❓
- Broadband Communications
- Supports Safety communications
- IPS Based System
- Improved Security
- Enable a single IP-based global operating network for all information

Description ❓
Broadband satellite and cellular services are used for safety-critical communications. Through the use of a multi-sensor concept, a combination of these systems can be used together to meet the safety critical and regularity of flight performance, interoperability and certification requirements, reducing the system cost while improving the overall performance of the network and the resiliency of the system. LDACS and AeroMACS are other candidate solutions for use in the en-route/terminal area and airport surface respectively.

Maturity Level ❓   Concept

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Taxi-out   Departure   En-route   Arrival   Taxi-in

DEPENDENCIES AND RELATIONS ❓

There are currently no dependencies.

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Ground system infrastructure	Communication infrastructure	Commercial ground system use	Future improvements to ground based commercial systems will allow safety critical information to be transferred on existing commercial systems.	Communication service provider	2031
Space system infrastructure	Communication infrastructure	Commercial space system use	Future improvements to satellite-based data transfer services as well as the addition of new satellites will allow safety critical communication to utilize commercial satellites. Likely require exploration of hybrid satellite constellation services	Communication service provider	2031

COMS

| COMS-B0/1 | CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace | Technology |

Sixth edition of the GANP ❓

Main Purpose ❓   Supports :

- reduction of voice channel congestion and increase of capacity in domestic airspace,
- improvement of communication and surveillance in airspace where procedural separation is being applied.

New Capabilities ❓   As a complement to voice communications, controller–pilot data link communications (CPDLC) provides the controller and the pilot with the ability to communicate through exchange of data link messages.

Description ❓   Depending on the specific implementations, other advantages associated with CPDLC include:

1. in certain airspace, direct controller-pilot communications (DCPC) where it was not previously available;
2. allowing the flight crew to print messages;
3. allowing messages to be stored and reviewed as needed;
4. reducing flight crew-input errors by allowing the loading of information from specific uplink messages, such as route clearances or frequency change instructions, into other aircraft systems, such as the FMS or radios;
5. allowing the flight crew to request complex route clearances, which the controller can respond to without having to manually enter a long string of coordinates;
6. reducing flight crew workload by supporting automatically transmitted reports when a specific event occurs, such as crossing a waypoint and the loading of clearance information directly into the flight management system; and
7. reducing controller workload by providing automatic flight plan updates when specific downlink messages (and responses to some uplink messages) are received.

For domestic airspaces, **ATN B1 CPDLC services** provide management of the ATC data link and voice communications, check of ATC microphone stuck and exchange of a limited set of ATC clearances and requests. The vast majority of ATN B1 aircraft do not support any automatic integration of CPDLC instructions into the aircraft Flight Management System.

For procedural airspaces, **FANS 1/A CPDLC services** provide management of the ATC data link and voice communications, exchange of an extensive set of ATC clearance and requests, reporting of aircraft derived information (including Position Reporting). The vast majority of FANS 1/A aircraft support automatic integration of CPDLC instructions into the aircraft Flight Management System (even though implementations are not harmonized across the fleet due to lack of standardization).

Maturity Level ❓   Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

| PLANNING LAYERS ❓ | OPERATIONS ❓ |

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology option	COMI-B0/1 - Aircraft Communication Addressing and Reporting System (ACARS)
Relation-technology option	COMI-B0/2 - Aeronautical Telecommunication Network/Open System Interconnection (ATN/OSI)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Communication service	CPDLC procedures and monitoring	Requirements and guidance to support deployment of CPDLC operations, such as : Annex 10 Vol II ICAO Doc 4444, Procedures for Air Navigation Services Air Traffic Management ICAO Doc 10037 Edition 1 Global Operational Datalink Manual (GOLD)	ANSP; Aircraft manufacturer; Aircraft operator	2013
Airborne system capability	Communication service	FANS 1/A CPDLC aircraft system	Technical standards to ensure operational and technical interoperability, such as : Annex 10 Vol II ED100/DO258, FANS 1/A Interoperability Requirements	Aircraft manufacturer; Aircraft operator	2002
Airborne system capability	Communication service	ATN B1 CPDLC aircraft system	Technical standards to ensure operational and technical interoperability, such as : Annex 10 Vol II ED110B/DO280B, ATN B1 Interoperability Requirements ED120/DO290, Domestic SPR	Aircraft manufacturer; Aircraft operator	2007
Ground system infrastructure	Communication service	FANS 1/A CPDLC Ground System	Technical standards to ensure operational and technical interoperability, such as : Annex 10 Vol II ED100/DO258, FANS 1/A Interoperability Requirements	ANSP; Ground systems supplier	2002
Ground system infrastructure	Communication service	ATN B1 CPDLC Ground System	Technical standards to ensure operational and technical interoperability, such as : Annex 10 Vol II ED110B & ED120 ED100/DO258, FANS 1/A Interoperability Requirements	ANSP; Ground systems supplier	2007
Training	Communication service	Training requirements for CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace	Flight Crew Training, Maintenance and Flight Operations Training, controllers training ICAO Doc 10037 Edition 1 Global Operational Data link Manual (GOLD)	ANSP; Aircraft manufacturer; Aircraft operator	2013

| Regulatory provisions | Equipage requirements or/and mandates | CPDLC Requirements and/or mandates | Airspace requirements and separation standards, with associated means of compliance. References: Amendment of Regional Supplementary Procedures – Doc 7030 (PAC, NAT and EUR) | ANSP CAA Aircraft operator | 2013 |
| Regulatory provisions | SMS | CPDLC Safety Management System | Requirements to support local safety cases. References: Annex 19 Annex 11 PANS ATM 4444 | ANSP | 2013 |

COMS-B0/2 ADS-C (FANS 1/A) for procedural airspace Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ Supports improvement of surveillance in airspace where procedural separation is being applied.

New Capabilities ❓ ADS-C (FANS 1/A) provides aircraft position and projected route information (i.e. next two waypoints ahead of aircraft).

Description ❓ The ADS-C capability provides automatically, without pilot intervention, an ATS unit with information concerning the aircraft position and projected profile for the flight at time intervals, events or on demand dictated by the ground needs.

Maturity Level ❓ Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

En-route

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology need	COMI-B0/1 - Aircraft Communication Addressing and Reporting System (ACARS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Operational procedures	Communication service	ADS-C procedures and monitoring	Requirements and guidance to support deployment of CPDLC operations, such as : Annex 10 Vol II ICAO Doc 4444, Procedures for Air Navigation Services Air Traffic Management ICAO Doc 10037 Edition 1 Global Operational Datalink Manual (GOLD)	ANSP; Aircraft manufacturer; Aircraft operator	2013
Airborne system capability	Communication service	FANS 1/A ADS-C aircraft system	Technical standards to ensure operational and technical interoperability, such as : Annex 10 Vol II ED100/DO258, FANS 1/A Interoperability Requirements	Aircraft manufacturer; Aircraft operator	2002
Ground system infrastructure	Communication service	FANS 1/A ADS-C Ground System	Technical standards to ensure operational and technical interoperability, such as : Annex 10 Vol II ED100/DO258, FANS 1/A Interoperability Requirements	ANSP; Ground systems supplier	2002
Training	Communication service	Training requirements for ADS-C (FANS 1/A) for procedural airspace	Flight Crew Training, Maintenance and Flight Operations Training and air traffic controllers ICAO Doc 10037 Edition 1 Global Operational Datalink Manual (GOLD)	ANSP; Aircraft manufacturer; Aircraft operator	2013
Regulatory provisions	Equipage requirements or/and mandates	ADS-C Requirements and/or mandates	Airspace requirements and separation standards, with associated means of compliance. References: Amendment of Regional Supplementary Procedures – Doc 7030 (PAC and NAT)	ANSP; CAA; Aircraft operator	2013
Regulatory provisions	SMS	ADS-C Safety Management System	Requirements to support local safety cases. References: Annex 19 Annex 11 PANS ATM 4444	ANSP	2013

COMS-B1/1	PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   Supports:

- reduction of voice channel congestion and increase of capacity in domestic airspace,
- introduction of performance-based reduced separation minima in procedural airspace.

New Capabilities ❓   FANS 1/A+ CPDLC systems (along with associated air-ground network and physical layers) are demonstrated compliant with RCP240 (procedural) and RCP130 (domestic).

Description ❓ In procedural airspace, RCP240 authorized CPDLC (FANS 1/A+) provides the controller with intervention capability, allowing when used in conjunction with other enablers (e.g. ADS-C and navigation capabilities), reduced separation minima and thus capacity increase.

In domestic airspace, RCP 130 compliant CPDLC (FANS 1/A+) provides a complementary means of communications for en-route routine communications and the extension of CPDLC for ground operations (e.g. departure clearance).

PBCS will also enhance airspace access for State aircraft as it would offer opportunities for application of performance-equivalence.

Maturity Level ❓ Ready for implementation

Human Factor Considerations
1. Does it imply a change in task by a user or affected others? Yes

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

`Tactical-Pre ops` `Tactical-During ops`

OPERATIONS ❓

`Departure` `En-route`

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Evolution	COMS-B0/1 - CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace

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ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Communication service	CPDLC procedures and monitoring	Requirements and guidance to support deployment of CPDLC operations, such as : Annex 10 Vol II ICAO Doc 4444, Procedures for Air Navigation Services Air Traffic Management ICAO Doc 10037 Edition 1 Global Operational Datalink Manual (GOLD)	ANSP / Aircraft manufacturer / Aircraft operator	2013
Operational procedures	Communication service	Datalink performance requirements and monitoring	Guidance to support deployment of Performance Based operations, such as: ICAO Doc 9869 Third Edition Performance-Based Communication and Surveillance (PBCS) Manual	ANSP / Aircraft manufacturer / Aircraft operator / Communication service provider	2019

Airborne system capability	Communication service	FANS 1/A+ CPDLC aircraft system	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED122/DO306, including Change 1 & 2, Oceanic Remote Safety and Performance Requirements ED100A/DO258A, FANS 1/A+ Interoperability Requirements	Aircraft manufacturer / Aircraft operator	2007
Ground system infrastructure	Communication service	FANS 1/A+ CPDLC Ground System	Technical standards to ensure operational and technical interoperability, such as : Annex 10 Vol II ED122/DO306, including Change 1 & 2, Oceanic Remote Safety and Performance Requirements ED100A/DO258A, FANS 1/A+ Interoperability Requirements	ANSP / Ground systems supplier	2007
Training	Communication service	Training requirements for PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace	Controllers training, Flight Crew Training, Maintenance and Flight Operations Training. ICAO Doc 10037 Edition 2 Global Operational Datalink Manual (GOLD)	ANSP / Aircraft manufacturer / Aircraft operator	2019
Regulatory provisions	Equipage requirements or/and mandates	CPDLC PBCS Requirements and/or mandates	Airspace requirements and separation standards, with associated means of compliance. References: Amendment of Regional Supplementary Procedures – Doc 7030 (PAC and NAT) Annex 6 Annex 11 Annex 15 ICAO Doc 9869 Second Edition Performance-Based Communication and Surveillance (PBCS) Manual	ANSP CAA / Aircraft operator	2016
Regulatory provisions	SMS	CPDLC PBCS Safety Management System	Requirements to support local safety cases. References: Annex 19 Annex 11 PANS ATM 4444	ANSP	2013
Regulatory provisions	Operational Approval	PBCS Approval	Requirements and guidance for PBCS operational authorization in Annex 6 and Doc 9869, 3rd Edition	CAA / Aircraft operator	2019

COMS-B1/2	PBCS approved ADS-C (FANS 1/A+) for procedural airspace	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ Supports introduction of performance-based reduced separation minima in procedural airspace.

New Capabilities ❓	FANS 1/A+ ADS-C systems (along with associated air-ground network and physical layers) are demonstrated compliant with RSP180.	
Description ❓	ADS-C (FANS 1/A) RSP180 authorized provides separation assurance, allowing when used in conjunction with other enablers (e.g. CPDLC and navigation capabilities), reduced separation minima and thus capacity increase.	
	PBCS will also enhance airspace access for State aircraft as it would offer opportunities for application of performance-equivalence.	
Maturity Level ❓	Ready for implementation	
Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes	
	2. Does it imply processing of new information by the user? Yes	
	3. Does it imply the use of new equipment? Yes	
	4. Does it imply a change to levels of automation? Yes	

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

En-route

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Evolution	COMS-B0/2 - ADS-C (FANS 1/A) for procedural airspace

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Communication service	ADS-C procedures and monitoring	Requirements and guidance to support deployment of CPDLC operations, such as : Annex 10 Vol II ICAO Doc 4444, Procedures for Air Navigation Services Air Traffic Management ICAO Doc 10037 Edition 1 Global Operational Datalink Manual (GOLD)	ANSP, Aircraft manufacturer, Aircraft operator	2013
Airborne system capability	Communication service	FANS 1/A+ ADS-C aircraft system	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED122/DO306, including Change 1 & 2, Oceanic Remote Safety and Performance Requirements ED100A/DO258A, FANS 1/A+ Interoperability Requirements	Aircraft manufacturer, Aircraft operator	2007

Ground system infrastructure	Communication service	FANS 1/A+ ADS-C Ground System	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED122/DO306, including Change 1 & 2, Oceanic Remote Safety and Performance Requirements ED100A/DO258A, FANS 1/A+ Interoperability Requirements	ANSP Ground systems supplier	2007
Training	Communication service	Training requirements for PBCS approved ADS-C (FANS 1/A+) for procedural airspace	Controllers training, Flight Crew Training, Maintenance and Flight Operations Training. ICAO Doc 10037 Edition 1 Global Operational Datalink Manual (GOLD)	ANSP Aircraft manufacturer Aircraft operator	2016
Regulatory provisions	SMS	ADS-C Safety Management System	Requirements to support local safety cases. References: Annex 19 Annex 11 PANS ATM 4444	ANSP	2013
Regulatory provisions	Equipage requirements or/and mandates	ADS-C PBCS Requirements and/or mandates	Airspace requirements and separation standards, with associated means of compliance. References: Amendment of Regional Supplementary Procedures – Doc 7030 (PAC and NAT) Annex 6 Annex 11 Annex 15 ICAO Doc 9869 Second Edition Performance-Based Communication and Surveillance (PBCS) Manual	ANSP CAA Aircraft operator	2016
Operational procedures	Communication service	Datalink performance requirements and monitoring (ADS-C)	Guidance to support deployment of Performance Based operations, such as: ICAO Doc 9869 Second Edition Performance-Based Communication and Surveillance (PBCS) Manual	ANSP Aircraft manufacturer Aircraft operator Communication service provider	2016
Regulatory provisions	Operational Approval	PBCS Approval (RSP 180)	Requirements and guidance for PBCS operational authorization in Annex 6 and Doc 9869, 2nd Edition	CAA Aircraft operator	2016

COMS-B1/3   SATVOICE (incl. routine communications) for procedural airspace   Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   Increase quality of voice communications in procedural airspace without VHF coverage.

New Capabilities ❓   Use of SATVOICE for all types of ATS communications (routine and emergency/urgency communications).

Description ❓	A priority level is used by dedicated networks and the aircraft system to pre-empt calls of lower priority, if necessary, and establish precedence for incoming calls of higher priority (usually routine ATS communication will be Priority 2 out of 4, Priority 1 being dedicated to distress/urgent calls). PBCS will also enhance airspace access for State aircraft as it would offer opportunities for application of performance-equivalence.
Maturity Level ❓	Ready for implementation
Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes 2. Does it imply processing of new information by the user? Yes 3. Does it imply the use of new equipment? Yes 4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

En-route

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology need	COMI-B0/5 - Satellite communications (SATCOM) Class C Data

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Equipage requirements or/and mandates	Requirements for the use of SATVOICE	Annex 10 , Volume III Annex 4 PANS-ATM (Doc 4444) PANS-AIM (Doc 10066)	ANSP CAA Aircraft manufacturer Aircraft operator Communication service provider Satellite provider	2016
Regulatory provisions	SMS	SATVOICE Safety Management System	Requirements to support local safety cases. References: Annex 19 Annex 11 PANS ATM 4444	ANSP	2013
Operational procedures	-	SATVOICE procedures	Doc 10038, Satellite Voice Operations Manual (SVOM)	ANSP Aircraft manufacturer Aircraft operator	2019

Operational procedures	-	SATVOICE performance monitoring	Reference: Performance-Based Communication and Surveillance (PBCS) Manual, Second Edition.	ANSP Aircraft manufacturer Aircraft operator Communication service provider	2016
Airborne system capability	Aircraft system	SATVOICE airborne system	References: Annex 10, Volume III Manual on the Aeronautical Mobile Satellite (Route) Service. (Doc 9925)	Aircraft manufacturer Aircraft operator	2016
Ground system infrastructure	-	SATVOICE ground system	References: Annex 10, Volume III Manual on the Aeronautical Mobile Satellite (Route) Service. (Doc 9925)	ANSP Ground systems supplier	2016
Training	-	Training requirements for SATVOICE	SATVOICE training for flight crew, radio operator and air traffic controller References: Doc 10038, Satellite Voice Operations Manual (SVOM), Edition 1	ANSP Airspace user	2019

COMS-B2/1	PBCS approved CPDLC (B2) for domestic and procedural airspace	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ Provision of Air Traffic Services (ATS), with the extension of data link communications use in support of various ATM enhancements among which:

- Trajectory-based operations, with new CPDLC messages to uplink route amendments (with standardized automation rules to ensure consistent Flight Management System implementation among the aircraft fleet),
- Surface operations, with new CPDLC TAXI (D-TAXI) messages.

New Capabilities ❓ New generation of CPDLC application, named Baseline 2, designed to:

- perpetuate legacy data link operations in procedural and domestic airspace,
- introduce new data link services (e.g. 4D trajectory exchange, D-TAXI).

Description ❓ Baseline 2 data link capabilities (CPDLC and ADS-C) support provision of data communications in all operational environments e.g., continental, oceanic, and surface in support of provision of air traffic control services.

Baseline 2 CPDLC has been designed to be independent of the underlying technologies.

PBCS will also enhance airspace access for State aircraft as it would offer opportunities for application of performance-equivalence.

Maturity Level ❓ Validation

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes
	2. Does it imply processing of new information by the user? Yes
	3. Does it imply the use of new equipment? Yes
	4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ?

Tactical-Pre ops   Tactical-During ops

OPERATIONS ?

Taxi-out   Departure   En-route   Arrival   Taxi-in

DEPENDENCIES AND RELATIONS ?

Type of Dependencies	ASBU Element
Evolution	COMS-B0/1 - CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace
Evolution	COMS-B1/1 - PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace
Relation-technology need	COMI-B0/2 - Aeronautical Telecommunication Network/Open System Interconnection (ATN/OSI)
Relation-benefit	COMI-B2/1 - Air-Ground ATN/IPS

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Communication service	Datalink performance requirements and monitoring	Guidance to support deployment of Performance Based operations, such as: ICAO Doc 9869 Third Edition Performance-Based Communication and Surveillance (PBCS) Manual	ANSP Aircraft manufacturer Aircraft operator Communication service provider	2019
Operational procedures	Communication service	CPDLC (B2) procedures and monitoring	Requirements and guidance to support deployment of CPDLC operations, such as: Annex 10 Vol II ICAO Doc 4444, Procedures for Air Navigation Services Air Traffic Management ICAO Doc 10037 Edition 2 Global Operational Datalink Manual (GOLD)	ANSP Aircraft manufacturer Aircraft operator	2024

Airborne system capability	Communication service	Baseline 2 CPDLC aircraft system	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED228A/DO350A, Baseline 2 Safety and Performance Requirements ED229A/DO351A, Baseline 2 Interoperability Requirements ED230A/DO352A, Baseline 2 FANS 1/A Accommodation Interoperability Requirements ED232A/DO353A, Baseline 2 ATN B1 Accommodation Interoperability Requirements	Aircraft manufacturer Aircraft operator	2016
Ground system infrastructure	Communication service	Baseline 2 CPDLC Ground System	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED228A/DO350A, Baseline 2 Safety and Performance Requirements ED229A/DO351A, Baseline 2 Interoperability Requirements ED230A/DO352A, Baseline 2 FANS 1/A Accommodation Interoperability Requirements ED232A/DO353A, Baseline 2 ATN B1 Accommodation Interoperability Requirements	ANSP Ground systems supplier	2016
Training	Communication service	Training requirements for PBCS approved CPDLC (B2) for domestic and procedural airspace	Controllers training, Flight Crew Training, Maintenance and Flight Operations Training. ICAO Doc 10037 Edition 2 Global Operational Data link Manual (GOLD)	ANSP Aircraft manufacturer Aircraft operator	2019
Regulatory provisions	Operational Approval	PBCS Approval	Requirements and guidance for PBCS operational authorization in Annex 6 and Doc 9869, 3rd Edition	CAA Aircraft operator	2019
Regulatory provisions	SMS	CPDLC PBCS (B2) Safety Management System	Requirements to support local safety cases. References: Annex 19 Annex 11 PANS ATM 4444	ANSP	2013

COMS-B2/2	PBCS Approved ADS-C (B2) for domestic and procedural airspace	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ Provision of Air Traffic Services (ATS), with the extension of data link communications use in support of various ATM enhancements among which:

- Trajectory-based operations, in particular with ADS-C Extended Project Profile (i.e. predicted route ahead of the aircraft, up to 128 waypoints with their predicted level, speed and time).

New Capabilities ❓ New generation of ADS-C applications, named Baseline 2, designed to:

- perpetuate legacy data link operations in procedural airspace
- new data link services (e.g.4D trajectory exchange)

Description ❓ Baseline 2 data link capabilities (CPDLC and ADS-C) support provision of data communications in all operational environments e.g., continental, oceanic, and surface in support of provision of air traffic control services.

Baseline 2 ADS-C has been designed to be independent of the underlying technologies.

PBCS will also enhance airspace access for State aircraft as it would offer opportunities for application of performance-equivalence.

Maturity Level ❓ Validation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

Tactical-Pre ops   Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Evolution	COMS-B1/2 - PBCS approved ADS-C (FANS 1/A+) for procedural airspace
Relation-technology need	COMI-B0/2 - Aeronautical Telecommunication Network/Open System Interconnection (ATN/OSI)
Relation-benefit	COMI-B2/1 - Air-Ground ATN/IPS

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Communication service	Datalink performance requirements and monitoring (B2 ADS-C)	Guidance to support deployment of Performance Based operations, such as: ICAO Doc 9869 Fourth Edition Performance-Based Communication and Surveillance (PBCS) Manual	ANSP Aircraft manufacturer Aircraft operator Communication service provider	2024

Operational procedures	Communication service	ADS-C (B2) procedures and monitoring	Requirements and guidance to support deployment of CPDLC operations, such as: Annex 10 Vol II ICAO Doc 4444, Procedures for Air Navigation Services Air Traffic Management ICAO Doc 10037 Edition 2 Global Operational Datalink Manual (GOLD)	ANSP Aircraft manufacturer Aircraft operator	2024
Airborne system capability	Communication service	Baseline 2 ADS-C aircraft system	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED228A/DO350A, Baseline 2 Safety and Performance Requirements ED229A/DO351A, Baseline 2 Interoperability Requirements ED230A/DO352A, Baseline 2 FANS 1/A Accommodation Interoperability Requirements ED232A/DO353A, Baseline 2 ATN B1 Accommodation Interoperability Requirements	Aircraft manufacturer Aircraft operator	2016
Ground system infrastructure	Communication service	Baseline 2 ADS-C Ground System	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED228A/DO350A, Baseline 2 Safety and Performance Requirements ED229A/DO351A, Baseline 2 Interoperability Requirements ED230A/DO352A, Baseline 2 FANS 1/A Accommodation Interoperability Requirements ED232A/DO353A, Baseline 2 ATN B1 Accommodation Interoperability Requirements	ANSP Ground systems supplier	2016
Training	Communication service	Training requirements for PBCS approved ADS-C (B2) for domestic and procedural airspace	Controllers training, Flight Crew Training, Maintenance and Flight Operations Training. ICAO Doc 10037 Edition 2 Global Operational Data link Manual (GOLD)	ANSP Aircraft manufacturer Aircraft operator	2019
Regulatory provisions	SMS	ADS-C PBCS (B2) Safety Management System	Requirements to support local safety cases. References: Annex 19 Annex 11 PANS ATM 4444	ANSP	2013
Regulatory provisions	Operational Approval	PBCS Approval (RSP 160)	Requirements and guidance for PBCS operational authorization in Annex 6 and Doc 9869, 4th Edition	CAA Aircraft operator	2024

COMS-B2/3	PBCS approved SATVOICE (incl. routine communications) for procedural airspace	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   Supports introduction of reduced separation minima in procedural airspace.

New Capabilities ❓   SATVOICE systems are demonstrated compliant with a new RCP specification (to be developed).

Description ❓   In procedural airspace, PBCS approved SATVOICE systems provides the controller with intervention capability, allowing when used in conjunction with other enablers (e.g. ADS-C or space-based ADS-B and navigation capabilities), reduced separation minima and thus capacity increase.

PBCS will also enhance airspace access for State aircraft as it would offer opportunities for application of performance-equivalence.

Maturity Level ❓   Validation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

En-route

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Evolution	COMS-B1/3 - SATVOICE (incl. routine communications) for procedural airspace
Relation-technology need	COMI-B0/5 - Satellite communications (SATCOM) Class C Data

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	SMS	SATVOICE PBCS SMS for procedural airspace	Requirements to support local safety cases. References: Annex 19 Annex 11 PANS ATM 4444	ANSP	2013
Operational procedures	-	SATVOICE PBCS operational procedures for procedural airspace	PANS-ATM (Doc 4444), Procedures for Air Navigation Services — Air Traffic Management Doc 10038, Satellite Voice Operations Manual (SVOM), Edition 2	ANSP Aircraft manufacturer Aircraft operator	2024

Operational procedures	-	SATVOICE PBCS performance monitoring for procedural airspace	Performance-Based Communication and Surveillance (PBCS) Manual, Edition 4	ANSP Aircraft manufacturer Aircraft operator Communication service provider	2024
Airborne system capability	Aircraft system	SATVOICE PBCS airborne system for procedural airspace	Annex 10, Volume III Manual on the Aeronautical Mobile Satellite (Route) Service. (Doc 9925)	Aircraft manufacturer Aircraft operator	2024
Ground system infrastructure	-	SATVOICE PBCS ground system for procedural airspace	Annex 10, Volume III Manual on the Aeronautical Mobile Satellite (Route) Service. (Doc 9925)	ANSP Ground systems supplier	2024
Regulatory provisions	Operational Approval	SATVOICE PBCS operational approval for procedural airspace	Requirements and guidance for PBCS operational authorization in Annex 6 and Doc 9869, 4th Edition.	CAA Aircraft operator	2024
Training	-	Training for SATVOICE PBCS for procedural airspace	Doc 10038, Satellite Voice Operations Manual (SVOM), Edition 2	ANSP Aircraft operator	2024

COMS-B3/1 — Extended CPDLC (B2 incl. Adv-IM and dynamic RNP) for dense and complex airspace — Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓ Supports dynamic PBN rerouting and advanced interval management operations.

New Capabilities ❓ Extension of B2 CPDLC services to introduce instructions for dynamic RNP and advanced interval management.

Description ❓

Maturity Level ❓ Concept

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes
	2. Does it imply processing of new information by the user? Yes
	3. Does it imply the use of new equipment? Yes
	4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

`Tactical-Pre ops` `Tactical-During ops`

OPERATIONS ❓

`Departure` `En-route` `Arrival`

DEPENDENCIES AND RELATIONS ❓

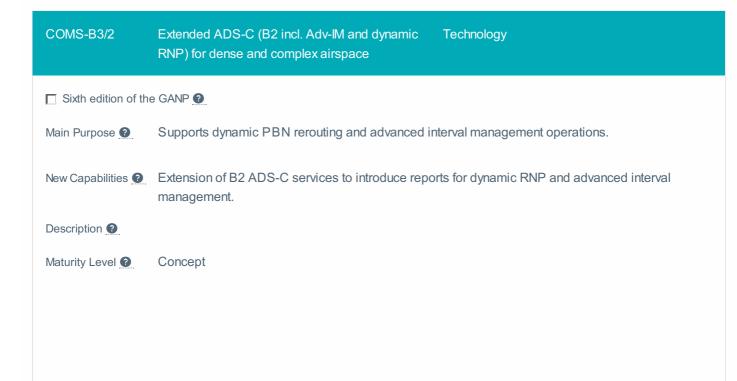| Type of Dependencies	ASBU Element
Evolution	COMS-B2/1 - PBCS approved CPDLC (B2) for domestic and procedural airspace

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Communication service	CPDLC (B2 incl. Adv-IM and DRNP) procedures and monitoring	Requirements and guidance to support deployment of CPDLC operations, such as: Annex 10 Vol II ICAO Doc 4444, Procedures for Air Navigation Services Air Traffic Management ICAO Doc 10037 Edition x Global Operational Data link Manual (GOLD)	ANSP, Aircraft manufacturer, Aircraft operator	2028
Operational procedures	Communication service	Datalink performance requirements and monitoring (B2 incl. Adv-IM and DRNP)	Guidance to support deployment of Performance Based operations, such as: ICAO Doc 9869 Edition x Performance-Based Communication and Surveillance (PBCS) Manual	Airport operator, ANSP, Aircraft manufacturer, Communication service provider	2028
Airborne system capability	Communication service	Baseline 2 CPDLC (B2 incl. Adv-IM and DRNP) aircraft system	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED228B/DO350B, Baseline 2 Safety and Performance Requirements ED229B/DO351B, Baseline 2 Interoperability Requirements ED230B/DO352B, Baseline 2 FANS 1/A Accommodation Interoperability Requirements ED232B/DO353B, Baseline 2 ATN B1 Accommodation Interoperability Requirements	Aircraft manufacturer, Aircraft operator	2023

Ground system infrastructure	Communication service	Baseline 2 CPDLC (B2 incl. Adv-IM and DRNP) Ground System	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED228B/DO350B, Baseline 2 Safety and Performance Requirements ED229B/DO351B, Baseline 2 Interoperability Requirements ED230B/DO352B, Baseline 2 FANS 1/A Accommodation Interoperability Requirements ED232B/DO353B, Baseline 2 ATN B1 Accommodation Interoperability Requirements	ANSP Ground systems supplier	2023
Training	Communication service	Training requirements for extended CPDLC (B2 incl. Adv-IM and DRNP) for domestic airspace	Controllers Training, Flight Crew Training, Maintenance and Flight Operations Training. ICAO Doc 10037 Edition x Global Operational Data link Manual (GOLD)	ANSP Aircraft manufacturer Aircraft operator	2025
Regulatory provisions	SMS	CDPLC PBCS (B2 incl. Adv-IM and DRNP) Safety Management System	Requirements to support local safety cases. References: Annex 19 Annex 11 PANS ATM 4444	ANSP	2013
Regulatory provisions	Operational Approval	PBCS Approval CPDLC (B2 incl. Adv-IM and DRNP)	Requirements and guidance for PBCS operational authorization in Annex 6 and Doc 9869, X Edition	CAA Aircraft operator	2028

COMS-B3/2	Extended ADS-C (B2 incl. Adv-IM and dynamic RNP) for dense and complex airspace	Technology

☐ Sixth edition of the GANP ❓

Main Purpose ❓   Supports dynamic PBN rerouting and advanced interval management operations.

New Capabilities ❓   Extension of B2 ADS-C services to introduce reports for dynamic RNP and advanced interval management.

Description ❓

Maturity Level ❓   Concept

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes
	2. Does it imply processing of new information by the user? Yes
	3. Does it imply the use of new equipment? Yes
	4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❷

Tactical-Pre ops   Tactical-During ops

OPERATIONS ❷

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❷

Type of Dependencies	ASBU Element
Evolution	COMS-B2/2 - PBCS Approved ADS-C (B2) for domestic and procedural airspace

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Communication service	Datalink performance requirements and monitoring (B2 incl. Adv-IM and DRNP)	Guidance to support deployment of Performance Based operations, such as: ICAO Doc 9869 Edition x Performance-Based Communication and Surveillance (PBCS) Manual	Airport operator, ANSP, Aircraft manufacturer, Communication service provider	2028
Operational procedures	Communication service	ADS-C (B2 incl. Adv-IM and DRNP) procedures and monitoring	Requirements and guidance to support deployment of CPDLC operations, such as: Annex 10 Vol II ICAO Doc 4444, Procedures for Air Navigation Services Air Traffic Management ICAO Doc 10037 Edition x Global Operational Data link Manual (GOLD)	ANSP, Aircraft manufacturer, Aircraft operator	2028
Airborne system capability	Communication service	Baseline 2 ADS-C (B2 incl. Adv-IM and DRNP) aircraft system	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED228B/DO350B, Baseline 2 Safety and Performance Requirements ED229B/DO351B, Baseline 2 Interoperability Requirements ED230B/DO352B, Baseline 2 FANS 1/A Accommodation Interoperability Requirements ED232B/DO353B, Baseline 2 ATN B1 Accommodation Interoperability Requirements	Aircraft manufacturer, Aircraft operator	2023

Ground system infrastructure	Communication service	Baseline 2 ADS-C (B2 incl. Adv-IM and DRNP) Ground System	Technical standards to ensure operational and technical interoperability, such as: Annex 10 Vol II ED228B/DO350B, Baseline 2 Safety and Performance Requirements ED229B/DO351B, Baseline 2 Interoperability Requirements ED230B/DO352B, Baseline 2 FANS 1/A Accommodation Interoperability Requirements ED232B/DO353B, Baseline 2 ATN B1 Accommodation Interoperability Requirements	ANSP Ground systems supplier	2023
Training	Communication service	Training requirements for extended ADS-C (B2 incl. Adv-IM and DRNP) for domestic airspace	Controllers Training, Flight Crew Training, Maintenance and Flight Operations Training. ICAO Doc 10037 Edition x Global Operational Data link Manual (GOLD)	ANSP Aircraft manufacturer Aircraft operator	2025
Regulatory provisions	SMS	ADS-C PBCS (B2 incl. Adv-IM and DRNP) Safety Management System	Requirements to support local safety cases. References: Annex 19 Annex 11 PANS ATM 4444	ANSP	2013
Regulatory provisions	Operational Approval	PBCS Approval ADS-C (B2 incl. Adv-IM and DRNP)	Requirements and guidance for PBCS operational authorization in Annex 6 and Doc 9869, X Edition	CAA Aircraft operator	2028

CSEP

CSEP-B1/1	Basic airborne situational awareness during flight operations (AIRB)	Operational

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To improve traffic situational awareness in all phases of flight.

New Capabilities ❓
- AIRB facilitates out-the-window visual acquisition of airborne traffic within visual range and traffic situational awareness for traffic beyond visual range.
- It enhances traffic situational awareness and quicker visual acquisition of targets through basic airborne situational awareness during flight operations enabled by the use of a cockpit display traffic information (CDTI).
- It supplements the flight crew's out the window scan and radio communications listening.
- It supports the flight crew in integrating information from these sources into a comprehensive and accurate traffic picture including long traffic detection range.
- It also enables communication with surrounding aircraft on common/local frequency (e.g. turbulence reports, uncontrolled airfield operations).

Description ❓

The use of cockpit displays to provide the flight crew with a graphical depiction of traffic using relative range and bearing, supplemented by altitude, flight ID and other information. This element represents the use of the cockpit display traffic information (CDTI) with appropriate ADS-B data filtered for traffic situational awareness. The CDTI is capable of merging data with TCAS. It is recommended to use the display where ACAS information is already provided (if ACAS-equipped)

Maturity Level ❓

Ready for implementation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? No

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? No

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure En-route Arrival

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology need	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology benefit	ACAS-B1/1 - ACAS Improvements

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	Certification of CDTI for airborne situational awareness	References: ICAO Annex 10 Volume IV basic technical requirements ICAO Doc 9994 ADS-B IN equipment/function compliant with DO-317B/ED194A (2015)	CAA, Aircraft manufacturer, Aircraft operator	2015
Operational procedures	Operations	SOPs for the use of CDTI for AIRB	References: PANS-OPS (Doc 8168) operation of ADS-B IN traffic display (2016) Standard Operating Procedures	Aircraft operator	2013

Airborne system capability	Surveillance	ADS-B IN equipment/function	ADS-B IN equipment/function compliant with DO-317B/ED194A (2015)	Airspace user Aircraft manufacturer	2015
Airborne system capability	Aircraft system	CDTI	Cockpit Display of Traffic Information (CDTI). The CDTI may be shared with ACAS information traffic display but we should not assume this capability is only for ACAS-equipped aircraft. References:	Aircraft manufacturer Aircraft operator	2013
Training	-	Training requirements for AIRB	The appropriate use of the traffic display could be evaluated during recurrent training on ACAS. The equipage of AIRB capability is unknown to ATC. The use of AIRB must remain transparent to ATC. References:	Aircraft operator	2013

DEPLOYMENT APPLICABILITY

Operational conditions:

AIRB may be introduced in a partial equipage of ADS-B OUT, in which only some aircraft are equipped with ADS-B OUT.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Safety and efficiency: Improving the flight crew's decision-making process and the resulting actions for the safe and efficient operation of the flight with earlier detection of developing unsafe situations and better flight trajectory execution. Note: NOTE: Benefits vary depending on the airspace and operational flight rules.	Airspace user
	Safety and efficiency: Identification of the traffic ahead, enabling direct pilot-to-pilot communications, in oceanic airspace, to request turbulence information. Note: NOTE: Benefits vary depending on the airspace and operational flight rules.	Airspace user
	Vertical flight efficiency: Saving up to 15 000 Kg fuel per aircraft annually in North Atlantic airspace (5 min separation, about 40 NM). Substantially higher benefits in larger separation environments	Aircraft operator
	Safety: Reduced weather turbulence encounters through direct pilot-to-pilot communications Enhanced traffic situation awareness	Airspace user

Type	Operational description	Benefitting stakeholder(s)
	Improve situational awareness of the flight crew	Airspace user
Indirect benefits	Improved efficiency, reduced exchanges of R/T.	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve mid-air collision avoidance (safety net)	++	KPI20: Number of aircraft accidents KPI23: Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)
Safety		Improve separation provision (at a planning horizon > 2 minutes)	++	KPI20: Number of aircraft accidents KPI23: Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)

CSEP-B1/2	Visual Separation on Approach (VSA)	Operational

☐ Sixth edition of the GANP ❓

Main Purpose ❓   To assist pilots in maintaining own separation during successive visual approach procedures. VSA is defined to support aircraft performing successive visual approach and landing operations.

New Capabilities ❓   VSA is a situational awareness capability that offers a support tool for pilots to conduct existing procedures described in PANS-ATM (6.5.3.4 and 6.5.3.5). It assist the flight crew in maintaining own separation and quicker visual acquisition of preceding aircraft during successive visual approach procedures enabled by the use of a CDTI. It supplements the flight crew's out the window scan and radio communications listening.

Description ❓	This element is used to support existing procedures, i.e., the pilot can use the traffic display to support his visual scan of the preceding aircraft during the approach procedure if the preceding aircraft is transmitting ADS-B OUT surveillance data.
Maturity Level ❓	Ready for implementation
Human Factor Considerations	1. Does it imply a change in task by a user or affected others? No
	2. Does it imply processing of new information by the user? Yes
	3. Does it imply the use of new equipment? Yes
	4. Does it imply a change to levels of automation? No

PLANNING LAYERS ❓

`Tactical-During ops`

OPERATIONS ❓

`Arrival`

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology need	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology benefit	ACAS-B1/1 - ACAS Improvements

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	Certification of CDTI for airborne situational awareness	References: ICAO Annex 10 Volume IV basic technical requirements ICAO Doc 9994 ADS-B IN equipment/function compliant with DO-317B/ED194A (2015)	CAA, Aircraft manufacturer, Aircraft operator	2015
Airborne system capability	Surveillance	ADS-B IN equipment/function	ADS-B IN equipment/function compliant with DO-317B/ED194A (2015)	Airspace user, Aircraft manufacturer	2015
Airborne system capability	Aircraft system	CDTI	Cockpit Display of Traffic Information (CDTI). The CDTI may be shared with ACAS information traffic display but we should not assume this capability is only for ACAS-equipped aircraft. References:	Aircraft manufacturer, Aircraft operator	2013
Training	-	Training requirements for VSA	Training should be developed and given for the system functions, indications and interactions for each application/capability. The equipage of ADS-B IN is unknown to ATC. The use of ADS-B IN must remain transparent to ATC.	Aircraft operator	2013

Operational procedures	Operations	SOPs for the use of CDTI for VSA	References: ICAO Doc 8168 - PANS-OPS; operation of ADS-B IN traffic display (2016)	Aircraft operator	2016
Airborne system capability	Surveillance	ADS-B OUT equipment/functi on	ADS-B OUT capability required for the reference aircraft	Aircraft operator	2015

DEPLOYMENT APPLICABILITY

Operational conditions:

The application can be used by all suitably equipped aircraft during approach to any airports where own separation is used. VSA may be introduced in a partial equipage of ADS-B OUT environment, in which only some aircraft are equipped with ADS-B OUT. VSA is applicable for all types of runway configurations where successive visual approaches are in use (PANS-ATM 6.5.3).

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	VSA improve the efficiency and safety of arrival traffic at airports.	Airport operator ANSP
	The safety of the operation will be improved through the provision of accurate data to the pilots (e.g. preceding traffic ground speed) allowing them to better predict the evolution of the traffic.	Airport operator
	Improve situational awareness of the flight crew	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve separation provision (at a planning horizon > 2 minutes)	++	KPI20: Number of aircraft accidents KPI23: Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)

CSEP-B1/3   Performance Based Longitudinal Separation   Operational
Minima

☐ Sixth edition of the GANP ❓

Main Purpose ❓   Reduced separation allowing more flights to operate in their optimum flight levels.

New Capabilities ❓   The ability of aircraft to accurately navigate along a specified path and the ability to provide via data communication the position, intent and current navigation performance of the aircraft allow flights to be cleared to fly at reduced longitudinal separations.

Description ❓   50 NM, 30 NM and 5 minutes longitudinal separation have been made conditional on Required Communication Performance 240 (RCP 240) and Required Surveillance Performance 180 (RSP 180). Application of the separation may also require an RNP approval.

(Table to be inserted)

Maturity Level ❓   Standardization

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

En-route

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology option	COMI-B0/3 - VHF Data Link (VDL) Mode 0/A
Relation-technology option	COMI-B0/4 - VHF Data Link (VDL) Mode 2 Basic
Relation-technology option	COMS-B0/1 - CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace
Relation-technology option	COMS-B1/1 - PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace
Relation-technology option	COMS-B0/2 - ADS-C (FANS 1/A) for procedural airspace
Relation-technology option	COMS-B1/2 - PBCS approved ADS-C (FANS 1/A+) for procedural airspace
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year

Regulatory provisions	Operational Approval	Operational Approval for performance-based longitudinal separation	PBN, PBCS (when required)	CAA	2019
Operational procedures	Design and operations	Procedures for PBLoSM	Design and use of operational procedures shall be designed and used for the application of reduced longitudinal separation minima Reference : ICAO PBN, PBCS and GOLD manual	ANSP	2019
Ground system infrastructure	Surveillance	Surveillance systems for PBLoSM	To support RSP 180	ANSP	2019
Ground system infrastructure	Navigation	Navigation systems for PBLoSM	To support RNP 2, 4 or 10	ANSP	2019
Ground system infrastructure	Communications	Communication systems for PBLoSM	To support RCP 240	ANSP	2019
Training	-	Training requirements for PBLoSM	ATCO Training and Flight Crew Training Train for PBN Reduced Longitudinal Separation Minima Provide training to staff prior to implementation	ANSP Aircraft operator	2019
Airborne system capability	Communication service	Communication capabilities for PBLoSM	Aircraft and crew approvals for appropriate RNP specifications Reference: Aircraft and crew approvals for RCP 240 and ADS-C/CPDLC	Aircraft manufacturer Aircraft operator	2019
Airborne system capability	Navigation	Navigation capabilities for PBLoSM	Aircraft and crew approvals for appropriate RNP specifications	Aircraft manufacturer Aircraft operator	2019
Airborne system capability	Surveillance	Surveillance capabilities for PBLoSM	Aircraft and crew approvals for appropriate RNP specifications Reference: Aircraft and crew approvals for RSP 180	Aircraft manufacturer Aircraft operator	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Applicable to oceanic airspace and/or remote areas.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Improve what's needed to reduce longitudinal separation minima	++	KPI06: En-route airspace capacity
Capacity	Capacity, throughput & utilization	Take advantage of increased navigation precision (airspace with PBN operations) to implement route networks and airspace structures with smaller lateral and vertical safety buffers	++	KPI06: En-route airspace capacity

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CSEP-B1/4	Performance Based Lateral Separation Minima	Operational

☐ Sixth edition of the GANP ❓

Main Purpose ❓ To increase airspace capacity and allow optimum utilization of available airspace.

New Capabilities ❓ The ability of aircraft to accurately navigate along a specified path and the ability to provide via data communication the position, intent and current navigation performance of the aircraft allow flights to be cleared to fly at reduced lateral separations.

Description ❓ This element describes the application of lateral separation of 23 NM between any combination of RNP 4 and RNP 2 approved aircraft operating on parallel or non-intersecting tracks.

Maturity Level ❓ Standardization

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

En-route

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology option	COMI-B0/3 - VHF Data Link (VDL) Mode 0/A

Relation-technology option	COMI-B0/4 - VHF Data Link (VDL) Mode 2 Basic
Relation-technology option	COMS-B0/1 - CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace
Relation-technology option	COMS-B1/1 - PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace
Relation-technology option	COMS-B0/2 - ADS-C (FANS 1/A) for procedural airspace
Relation-technology option	COMS-B1/2 - PBCS approved ADS-C (FANS 1/A+) for procedural airspace
Relation-technology option	NAVS-B0/3 - Aircraft Based Augmentation Systems (ABAS)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Operational Approval	Operational Approval for performance-based lateral separation	Approval of PBN, PBCS	CAA	2019
Operational procedures	Design and operations	Procedures for PBLaSM	Design and use of operational procedures for the application of reduced lateral separation minima Reference : ICAO PBN, PBCS and GOLD manual	ANSP	2019
Training	-	Training requirements for PBLaSM	ATCO training ATCO and Flight Crew training Performance Based Lateral Separation Minima Provide training to staff prior to implementation	ANSP / Aircraft operator	2019
Airborne system capability	Communication service	Communication capabilities for PBLaSM	Aircraft and crew approvals for RCP 240	Aircraft manufacturer / Aircraft operator	2019
Airborne system capability	Navigation	Navigation capabilities for PBLaSM	Aircraft and crew approvals for appropriate RNP specifications	Aircraft manufacturer / Aircraft operator	2019
Airborne system capability	Surveillance	Surveillance capabilities for PBLaSM	Aircraft and crew approvals for RSP 180	Aircraft manufacturer / Aircraft operator	2019
Ground system infrastructure	Communications	Communication systems for PBLaSM	To support the specified RCP	ANSP	2019

Ground system infrastructure	Navigation	Navigation systems for PBLaSM	To support the specified RNP	ANSP	2019
Ground system infrastructure	Surveillance	Surveillance systems for PBLaSM	To support the specified RSP	ANSP	2019

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

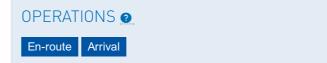| KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Improve what's needed to reduce lateral separation minima	++	KPI06: En-route airspace capacity

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CSEP-B2/1	Interval Management (IM) Procedure	Operational

☐ Sixth edition of the GANP ❓

Main Purpose ❓ The objective of the IM application is to achieve and/or maintain an assigned spacing between one aircraft and the designated aircraft (referred as the reference aircraft), using the guidance on the flight deck that enables the pilot to actively manage the spacing relative to the reference aircraft.

New Capabilities ❓ This element allows management by the pilot of the assigned spacing from a reference aircraft using airborne tools.

Description ❓ The air traffic controller chooses to use IM operations to manage the interval between aircraft when the aircraft need to be spaced closely together in an orderly manner or their timing synchronized. This is accomplished by the air traffic controller providing a clearance to the IM aircraft which includes the assigned interval. The assigned interval can be defined in time or distance. The pilot is responsible for identifying the reference aircraft (designated by the air traffic controller) and to implement the IM clearance. While some IM clearances will keep the IM aircraft on its current route and result only in speed management, other clearances may include a controller-defined path lengthening or shortening.

Maturity Level ❓ Standardization

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes
	2. Does it imply processing of new information by the user? Yes
	3. Does it imply the use of new equipment? Yes
	4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology need	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology benefit	ACAS-B1/1 - ACAS Improvements
Relation-benefit	ASUR-B2/1 - Evolution of ADS-B and Mode S

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Operational procedures	Operations	Procedures for the use of IM	PANS-ATM/PANS-OPS Interval Management Procedure (To be developed)	ANSP, Aircraft operator	2025
Airborne system capability	Surveillance	Surveillance system capabilities for IM	ADS-B IN equipment/function compliant with DO-317B/ED194A (and subsequent versions) (2014) + ADS-B OUT capability required for the reference aircraft	Aircraft manufacturer, Aircraft operator	2014
Airborne system capability	Navigation	Navigation system capabilities for IM	FIM equipment /spacing functions with advisories	Aircraft operator	2019
Airborne system capability	Aircraft system	Traffic display for IM	Cockpit display of traffic information	Aircraft manufacturer, Aircraft operator	2019
Training	-	Training requirements for IM	Air traffic controllers, Pilots	ANSP, Aircraft operator	2019
Ground system infrastructure	ATC systems	ATC tool for IM	Ground tools/capabilities that assist the air traffic controller in issuing ATC clearances to merge and space aircraft safely and efficiently by allowing ATC to use IM clearances	ANSP	2019

| Regulatory provisions | Certification | IM Certification | ICAO Annex 10 Technical requirements (to be developed) ICAO DOC9994 | CAA
Aircraft manufacturer
Aircraft operator | 2025 |

DEPLOYMENT APPLICABILITY

Operational conditions:

The air traffic controller chooses to use IM operations to manage the interval between aircraft when the aircraft need to be spaced closely together in an orderly manner or their timing synchronized. This is accomplished by the air traffic controller providing a clearance to the IM aircraft which includes the assigned interval. The assigned interval can be defined in time or distance. The pilot is responsible for identifying the reference aircraft (designated by the air traffic controller) and to implement the IM clearance. While some IM clearances will keep the IM aircraft on its current route and result only in speed management, other clearances may include a controller-defined path lengthening or shortening Note.— IM may not work in all conditions. A combination of air traffic controller judgment and ATC automation will be needed to determine the conditions of which IM can be completed successfully. The assigned interval can be defined in time or distance.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	The precise management of intervals between aircraft with common or merging trajectories, maximizes airspace throughput while reducing ATC workload along with more efficient aircraft fuel burn reducing environmental impact.	Airport operator ANSP
	Punctuality: IM will improve consistent spacing precision by making more frequent trajectory adjustments than is possible with a ground system alone.	ANSP Aircraft operator
	Reduction flight time variability	ANSP Aircraft operator
	Potential benefits of IM operations include: a) Timely speed advisories removing later requirement for path-lengthening; b) Consistent and low variance spacing between paired aircraft (e.g. at the entry to an arrival procedure and on final approach). More precise spacing can allow for higher throughput and more efficient aircraft operations; c) Optimized descent profile in high density environments; d) Reduced ATC instructions due to the reduced number of speed instructions; and e) More efficient aircraft operations for FIM-equipped aircraft, when aircraft are pre-sequenced, e.g. with the use of an arrival manager (AMAN).	ANSP Aircraft operator

Type	Operational description	Benefitting stakeholder(s)
	Improve situational awareness of the flight crew	Aircraft operator
Indirect benefits	Reduction of radar vectoring (and of R/T exchanges between ATCO and FC).	ANSP

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce ATCO workload (en-route)	++	KPI06: En-route airspace capacity
Capacity	Capacity, throughput & utilization	Resolve ATC staffing, workload, frequency congestion problems	++	KPI10: Airport peak throughput
Safety		Improve separation provision (at a planning horizon > 2 minutes)	++	KPI20: Number of aircraft accidents KPI23: Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)
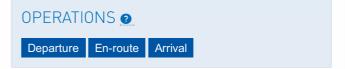
CSEP-B2/2	Cooperative separation at low altitudes	Operational

☐ Sixth edition of the GANP ❓

Main Purpose ❓ To maintain own separation with respect to manned aviation and other UAS in the UTM airspace.

New Capabilities ❓ A dedicated function to support separation assurance is provided to the UAS, which is supported by detection capability as well as a guidance to remain well clear of any other UAS. Note: in the UTM, this function may be automated and not operated by a remote pilot.

Description ❓ The UAS is capable of building a traffic picture associated to a separation assurance functionality enabling to establish and maintain the required separation from any other vehicle aka "remain well clear" using ADS-B IN for manned aviation and broadcast technologies to be determined for UAS to UAS.

Maturity Level ❓ Validation

Human Factor Considerations	1. Does it imply a change in task by a user or affected others? Yes
	2. Does it imply processing of new information by the user? Yes
	3. Does it imply the use of new equipment? Yes
	4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ⊘

Tactical-During ops

OPERATIONS ⊘

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ⊘

Type of Dependencies	ASBU Element
Relation-technology need	CSEP-B1/1 - Basic airborne situational awareness during flight operations (AIRB)
Relation-technology need	ASUR-B2/2 - New community based surveillance system for airborne aircraft (low and higher airspace)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	Low-altitude UAS separation certification	TBD	CAA UAS operator	2025
Regulatory provisions	Operational Approval	Low-altitude UAS separation operational approval	TBD	UAS operator	2025
Operational procedures	-	UTM rules for separation	TBC: in UTM, rules need to be established such as "remain well clear" definition, performance requirements…	UAS operator	2025
Airborne system capability	Surveillance	UAS airborne surveillance	ADS-B IN 1090ES (to be clear of manned aviation) and UAT	UAS operator UAS manufacturer	2025
Ground system infrastructure	-	Display for UTM	N/A for UAS UTM service provider and/or Remote Pilot Ground station	UAS operator UTM operator	2025
Ground system infrastructure	Surveillance	UAT for UAS	No new requirements (maybe UAT for UAS will trigger the need for ADS-R or TIS-R ground infrastructure?	UAS operator	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

At low altitudes.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Maintain or improve safety of very low-level operations	++	

CSEP-B2/3	Cooperative separation at higher airspace	Operational

☐ Sixth edition of the GANP ❓

Main Purpose ❓ To maintain own separation with respect to manned aviation and other UAS in the upper airspace.

New Capabilities ❓ A dedicated function to support separation assurance is provided to the UAS, which is supported by detection capability as well as a guidance to remain well clear of any other UAS. Note: in the UTM, this function may be automated and not operated by a remote pilot.

Description ❓ The UAS is capable of building a traffic picture associated to a separation assurance functionality enabling to establish and maintain the required separation from any other vehicle aka "remain well clear" using ADS-B IN for manned aviation and broadcast technologies to be determined for UAS to UAS.

Maturity Level ❓ Validation

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology need	CSEP-B1/1 - Basic airborne situational awareness during flight operations (AIRB)

Relation-technology need	ASUR-B2/2 - New community based surveillance system for airborne aircraft (low and higher airspace)

ENABLERS

Enabler Category	Enabler Type	Enabler Name	Description / References	Stakeholders	Year
Regulatory provisions	Certification	Higher airspace UAS separation certification	TBD	CAA UAS operator	2025
Regulatory provisions	Operational Approval	Higher airspace UAS separation operational approval	TBD	UAS operator	2025
Operational procedures	-	Higher airspace rules for separation	In higher airspace, rules need to be established such as "remain well clear" definition, performance requirements…	UAS operator	2025
Airborne system capability	Surveillance	Higher UAS airborne surveillance	ADS-B IN 1090ES (to be clear of manned aviation) and UAT	UAS operator UAS manufacturer	2025
Ground system infrastructure	-	Display for higher UTM	N/A for UAS UTM service provider and/or Remote Pilot Ground station	UAS operator UTM operator	2025
Ground system infrastructure	Surveillance	UAT for higher UAS	No new requirements (maybe UAT for UAS will trigger the need for ADS-R or TIS-R ground infrastructure?	UAS operator	2025
Other	-	MEL, performance compliance for higher UAS	Before reaching the higher airspace, the UAS will cross ATM airspace and may have to comply with the airspace requirements in terms of MEL, performance,… It is possible that in transition period, such operations will be conducted in temporarily segregated airspace to ensure safe and limited impact on ATM operations.	UAS operator	2025

DEPLOYMENT APPLICABILITY

Operational conditions:

At higher airspace.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Maintain or improve safety of higher airspace operations	++	

CSEP-B3/1 — Interval Management (IM) Procedure with complex Operational geometries

☐ Sixth edition of the GANP ❓

Main Purpose ❓
The objective of the IM application is to achieve and/or maintain an assigned spacing between one aircraft and the designated aircraft (referred as the reference aircraft), using the guidance on the flight deck that enables the pilot to actively manage the spacing relative to the reference aircraft supported by data link to facilitate exchange of complex clearances in a diversity of operational environments.

New Capabilities ❓
This element allows management by the pilot of the assigned spacing from a reference aircraft using airborne tools and data link in a diversity of operational environments.

Description ❓
The air traffic controller chooses to use IM operations to manage the interval between aircraft when the aircraft need to be spaced closely together in an orderly manner or their timing synchronized. This is accomplished by the air traffic controller providing a clearance to the IM aircraft which includes the assigned interval. The assigned interval can be defined in time or distance.

The pilot is responsible for identifying the reference aircraft (designated by the air traffic controller) and to implement the IM clearance. While some IM clearances will keep the IM aircraft on its current route and result only in speed management, other clearances may include a controller-defined path lengthening or shortening.

Maturity Level ❓
Concept

Human Factor Considerations

1. Does it imply a change in task by a user or affected others? Yes

2. Does it imply processing of new information by the user? Yes

3. Does it imply the use of new equipment? Yes

4. Does it imply a change to levels of automation? Yes

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element

Relation-technology need	ASUR-B2/1 - Evolution of ADS-B and Mode S
Relation-technology need	COMS-B3/1 - Extended CPDLC (B2 incl. Adv-IM and dynamic RNP) for dense and complex airspace
Evolution	CSEP-B2/1 - Interval Management (IM) Procedure

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Same as in Block 2 but, this element is also applicable in environments with complex geometries.

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce ATCO workload (en-route)	++	KPI06: En-route airspace capacity
Capacity	Capacity, throughput & utilization	Resolve ATC staffing, workload, frequency congestion problems	++	KPI10: Airport peak throughput
Safety		Improve separation provision (at a planning horizon > 2 minutes)	++	KPI20: Number of aircraft accidents KPI23: Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)

CSEP-B3/2	Remain Well Clear (RWC) functionality for UAS/RPAS	Operational

☐ Sixth edition of the GANP ❓

Main Purpose ❓   Aims at maintaining own separation with respect to any manned and/or unmanned aircraft in all phases of flight.

New Capabilities ❓ "Remain well clear" is a dedicated function to support separation assurance is provided to the aircraft, which must remain independent of the collision avoidance logic (ACAS).

While the detection capability can be the same, the objective of the function is different and must be supported by a specific logic based on separation minima developed to suit the new operations.

Description ❓ The remote pilot ensures separation from suitably equipped aircraft (manned and/or unmanned) thanks to a traffic picture (CDTI) associated to a separation assurance functionality enabling to establish and maintain the required separation (remain well clear) in all phases of flight.

Maturity Level ❓ Validation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-technology need	ASUR-B2/1 - Evolution of ADS-B and Mode S
Relation-operational need	ACAS-B2/2 - New collision avoidance capability as part of an overall detect and avoid system for RPAS

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce ATCO workload (en-route)	++	KPI06: En-route airspace capacity
Capacity	Capacity, throughput & utilization	Resolve ATC staffing, workload, frequency congestion problems	++	KPI10: Airport peak throughput

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Safety		Improve separation provision (at a planning horizon > 2 minutes)	++	KPI20: Number of aircraft accidents KPI23: Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)

CSEP-B4/1   Airborne separation   Operational

☐ Sixth edition of the GANP ❓

Main Purpose ❓   Aims at maintaining own separation with respect to one aircraft via a delegation of responsibility from the ATCO to the flight crew in all phases of flight.

New Capabilities ❓   A dedicated function to support separation assurance is provided to the aircraft, which must remain independent of the collision avoidance logic (ACAS-Bx). While the detection capability can be the same, the objective of the function is different and must be supported by a specific logic based on airborne separation minima developed to suit the new operations.

Description ❓   Airborne Separation = temporary delegation of responsibility to the flight deck for separation provision with suitably equipped designated aircraft.

The flight crew ensures separation from suitably equipped designated aircraft as communicated in new clearances, which relieve the controller from the responsibility for separation between these aircraft. However, the controller retains responsibility for separation from aircraft that are not part of these clearances. The flight crew/remote pilot is provided with a traffic picture (CDTI) associated to a separation assurance functionality enabling to establish and maintain the required separation (remain well clear for RPAS).

Maturity Level ❓   Validation

Human Factor Considerations

PLANNING LAYERS ❓

Tactical-During ops

OPERATIONS ❓

Departure   En-route   Arrival

DEPENDENCIES AND RELATIONS ❓

Type of Dependencies	ASBU Element
Relation-operational need	ASUR-B0/1 - Automatic Dependent Surveillance – Broadcast (ADS-B)
Relation-technology need	ASUR-B2/1 - Evolution of ADS-B and Mode S

Relation-operational need	ACAS-B2/1 - New collision avoidance system

ENABLERS

There are currently no enablers.

DEPLOYMENT APPLICABILITY

Operational conditions:

Main intended benefits:

Type	Operational description	Benefitting stakeholder(s)
Direct benefits	Improve situational awareness of the flight crew	Aircraft operator

INTENDED PERFORMANCE IMPACT ON SPECIFIC KPAS AND KPIS

KPA	Focus Areas	Most specific performance objective(s) supported	KPI Impact	KPI
Capacity	Capacity, throughput & utilization	Reduce ATCO workload (en-route)	++	KPI06: En-route airspace capacity
Capacity	Capacity, throughput & utilization	Resolve ATC staffing, workload, frequency congestion problems	++	KPI10: Airport peak throughput
Safety		Improve separation provision (at a planning horizon > 2 minutes)	++	KPI20: Number of aircraft accidents KPI23: Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)