APPENDIX

IMPLEMENTATION HAZARD LOG

This section lists some hazards that were considered by the SASP when developing the PBN longitudinal separation minima. The pertinent ATS authority must, in its implementation safety assessment, review these hazards and reflect how they may affect its local implementation and additionally identify if there are other regional, state or local hazards that need to be considered (refer to 3.2 and 3.9of the main text).

Definitions:

Hazard:

A hazard is defined as a condition or an object with the potential to cause injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function.

Subject 1 — Filing of incorrect FPL information
Hazard Loss of separation.
Unsafe event (cause) An ineligible aircraft receives a clearance for one of the performance based separation minimum because equipment and/or capability were incorrectly filed in the FPL or incorrect flight information transmitted from an adjacent ATC unit.

Analysis

The safety analysis used for determining the longitudinal separation standards was based on the assumption that the concerned aircraft and crew had and was operating the required on-board ADS-C and CPDLC equipment. If the equipment is filed in the FPL but not available or not used by the flight crew then the controller could apply inappropriate separation.

Aircraft operators are required to correctly file the on-board navigation equipment that is serviceable and usable by the crew. It is important that aircrew also use the equipment that is filed. It may, for example, lead to loss of separation if CPDLC capability is filed in the flight plan but then subsequently not used by the pilot.

ATC reads the navigation and equipment designators from the FPL and then plans for and applies separation accordingly. ATC normally does not question the data in the FPL and trusts that the filed data is correct. It is important that aircraft operators and aircrew understand the importance of filing correct data in the FPL and the adverse impact that incorrectly filing this information can have on airspace risk.

It is also the responsibility of ATC to correct flight plan data that is found to be incorrect and subsequently pass corrected data in coordination messages to the next facility. For example if CPDLC is found to be inoperative in an aircraft that has filed CPDLC capability then that information must be passed to the next ATC unit.

SASP global controls and/or mitigations

a) Establishment of ongoing system performance monitoring as defined in the *Manual on Monitoring the Application of Performance-Based Horizontal Separation Minima* (Doc 10063).

b) PANS-ATM providing guidance for completing the FPL form.

c) *Performance-based Communication and Surveillance Manual* (Doc 9869), *Global Operational Data Link Manual* (Doc 10037) providing guidance to aircraft operators.

Regional and local controls and/or mitigators required

Monitoring of airspace in accordance with *Manual on Monitoring the Application of Performance-based Horizontal Separation Minima* (Doc 10063) guidelines.

Subject 2 — Failure of ADS-C and/or CPDLC transfer
Hazard
Loss of separation.
Unsafe event (cause)
The receiving ANSP is unable to establish an ADS-C or CPDLC connection with one or both aircraft.

Analysis

ADS-C and CPDLC services are intended to be seamless as connected aircraft move across flight information region (FIR) boundaries. However, experience has shown that, due to any one of a number of ground or airborne system problems or errors, the transfer of ADS-C and/or CPDLC connections may not occur.

Examples of transfer failure include cases in which:

a)   the transferring ANSP fails to nominate the receiving ANSP as the Next Data Authority (NDA) for CPDLC;

b)   failure in the forwarding of the CPDLC connection to the receiving ANSP;

c)   inappropriate termination of the ADS-C connection by the flight crew when crossing the FIR boundary; and

d)   unintentional ADS-C disconnects due to or the ground system is unable to re-establish a lost ADS-C connection.

When this occurs, ATC is expected to request the flight crew to follow procedures for re-establishment of the AFN Logon or CPDLC connection.

If attempts to restore connectivity are unsuccessful, ATC is expected to apply an alternate form of separation between the aircraft pairs involved.

SASP global controls and/or mitigations

Establishment of recommended data link procedures as defined in the *Global Operational Data Link (GOLD) Manual* (Doc 10037).

Regional and local controls and/or mitigations required

A. Apply an alternate form of separation. B. Comply with guidelines provided in the *Global Operational Data Link (GOLD) Manual* (Doc 10037).

Subject 3 — Surveillance and/or Communication failure
Hazard Loss of Separation.
Unsafe event (cause) Failure within the data link system and/or supporting subnetworks.

Analysis

Performance-based longitudinal separations rely upon end to end connectivity of data link systems and subnetworks to ensure that required messages and information are sent, received and processed between the airborne equipment, communication service provider (CSP) networks and air traffic service unit (ATSU) ground system. Failure of individual components of the overall data link system can result in a necessary condition for separation application to not be available.

Examples of communication and surveillance system components that can fail individually include:

    a)   air navigation service provider (ANSP) gateway failure;

    b)   CSP network failure; and

    c)   ground-earth station (GES) failure.

SASP global controls and/or mitigations

Establishment of recommended data link procedures as defined in the *Global Operational Data Link (GOLD) Manual* (Doc 10037) and the *Performance-based Communication and Surveillance (PBCS) Manual* (Doc 9869).

Regional and local controls and/or mitigations required

    a)   Apply an alternate form of separation.

    b)   Ensure redundancy of equipment, lines, power supply, etc.

    c)   Comply with guidelines provided in the *Global Operational Data Link Document (GOLD) Manual* (Doc 10037), the *Performance-based Communication and Surveillance (PBCS) Manual* (Doc 9869) and the *Satellite Voice Operations Manual* (Doc 10038).

Subject 4 — Ground system failure

Hazard

Loss of Separation.

Unsafe event (cause)

Failure of the (ANSP) flight data processing system (FDPS).

Analysis

Performance-based longitudinal separations rely on ground system automation to process ADS-C reports to both calculate the distance between aircraft pairs and provide ATC alerts when the distance is in danger of falling below the minimum. Failure of FDPS hardware/software components or unavailability of power supply would negate this function and compromise the conditions for application of the separation.

SASP global controls and/or mitigations

None.

Regional and local controls and/or mitigations required

 a) Where able, transition remaining pairs to other form of separation that is not data link dependent.

 b) Ensure redundancy of equipment, lines, power supply, etc.

 c) Suspend further use of the performance-based separation minima.

Subject 5 — GNSS system failure

Hazard

Loss of separation.

Unsafe event (cause)

GNSS failure affecting multiple aircraft or a failure of individual GNSS receivers.

Analysis

Performance-based longitudinal separation rely on data link communications which have a requirement to be accurate to within one second of UTC. On most aircraft equipped with ADS-C and CPDLC, this accuracy is provided via the GNSS time source.

GNSS outages are detected by RAIM equipment. For individual GNSS receivers, the pilot shall advise ATC of failure.

SASP global controls and/or mitigations

PANS-ATM (Doc 4444), 5.2.2 Degraded Aircraft Performance

Regional and local controls and/or mitigations required

a) Make RAIM prediction a standard operation and suspend application of the performance-based separation minima in case of predicted RAIM outage.

b) Where able, transition remaining pairs to separation that is not reliant on GNSS.

c) Suspend further use of the performance-based separation minima.

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