**Thirty-Seventh Meeting of the
Informal South Pacific ATS Co-ordinating Group
(ISPACG/37)**

**State Civil Aviation Service in French Polynesia
April 27, 2023**

Agenda Item 4: Information Papers

Proposed Space Based ADS-B with HF Communications Minima

Presented by FAA

SUMMARY
This paper provides an update on the FAA efforts to create a Space Based ADS-B with HF Communications (SBAHF) separation minima.

1. INTRODUCTION

1.1 With the introduction of Space Based ADS-B (SBA), ICAO developed the Separation minima using ATS surveillance systems where VHF voice communications are not available, more commonly known as “ASEPS”. While the ASEPS minima are most commonly thought of as a Space Based ADS-B minima, the minima is applicable to all surveillance sources that meet the requirements. For example in the South Pacific there are islands that have terrestrial based ADS-B or radar, those surveillance sources would also most likely also qualify. The PANS-ATM paragraph 8.7.4 “ASEPS” minima relies on CPDLC RCP 240 Communications. There was great effort put into developing the ASEPS Collision Risk Model (CRM). A key component of the ASEPS CRM is the A22 Timing and Intervention Model. (The name “A22” simply represents that it was the twenty-second revision before it was agreed to in SASP.) The A22 Timing and Intervention model represents the typical times it would take a controller to identify a conflict or problem with an aircraft and intervene with a clearance to reestablish separation and prevent a collision. The A22 model assumes CPDLC RCP 240 with HF Voice backup as the communication capability. There are percentage breakdowns within A22 of how long an intervention clearance takes to be delivered.

1.2 The FAA approach for developing a SurvHF minima was to take advantage of the already approved ASEPS CRM. By revising the A22 Timing and Intervention Model (TIM) to reflect HF communications and using the HF TIM in the ASEPS CRM, it will produce a SurvHF separation minima. Many IPACG and ISPACG ANSPs have helped the FAA develop the HF TIM for the SurvHF minima by providing HF Clearance performance data. The FAA has been sharing and discussing their efforts with the ICAO Separation and Airspace Safety Panel (SASP). The SASP Math Sub Group agreed on a HF Timing and Intervention Model for the SBAHF CRM which produced a 23 NM lateral and a 17 NM longitudinal possible minimum.

1.3 The SurvHF minima would be very useful from two perspectives. Most important is that the SurvHF minima would provide a backup separation minima for when RCP 240 data link outages occur. Reduced oceanic separation minima require RCP 240 communications capability, which has had a number of outages over the past few years. When these RCP 240 outages occur, controllers must revert to much larger separation minima. This can cause major traffic flow disruptions and high controller workloads. These RCP 240 outages are a prime reason why route and track systems have rarely been developed using the reduced lateral minima. A SurvHF lateral backup minimum would promote the development of more efficient route systems.

1.4 The other advantage of a reduced SurvHF minimum is overall airspace efficiency improvement. In order for a pair of aircraft to take advantage of reduced separation minima, both aircraft must have the required capabilities to apply the minima. For example an aircraft with the best oceanic capabilities, RNP2, ADS-B, RSP 180 and RCP240 can be held down to a lower inefficient flight level because the aircraft above it does not have RCP 240 approval. Many oceanic traffic flows have lower levels of RCP 240 capability filed in the flight plans. Often operators do not obtain RCP 240 capability for their aircraft because of costly FMS upgrades that are required.

1.5 The FAA would like to thank the many ISPACG and IPACG ANSPs that provided HF performance data to support the development of the SurvHF minima.

1.6 SASP submitted a Job Card to the Air Navigation Commission (ANC) for approval to develop the SurvHF minima. The ANC did not approve the Job Card. ICAO noted "that the FAA may/will use the work done as the basis for "contingency separations" in Oakland FIR. It was considered by those groups that there are enabling provisions in the PANS-ATM and Annex 11 which allow ANSPs, such as the FAA, to determine contingency procedures (which may include "separations"), as follows:

Annex 2

- **Note 2** to 3.6.5
  - Note 2.— The requirement for an aircraft to maintain an air-ground voice communication watch remains in effect after CPDLC has been established.

Annex 11,

- 2.29 Any significant safety-related change to the ATS system, including the implementation of a reduced separation minimum or a new procedure, shall only be effected after a safety risk assessment has demonstrated that an acceptable level of safety will be met and users have been consulted…
- 3.4.1 The selection of separation minima for application within a given portion of airspace shall be as follows:

a) the separation minima shall be selected from those prescribed by the provisions of the PANS-ATM (Doc 4444) and the Regional Supplementary Procedures as applicable under the prevailing circumstances except that, where types of aids are used or circumstances prevail which are not covered by current ICAO provisions, other separation minima shall be established as necessary by:

1) the appropriate ATS authority, following consultation with operators, for routes or portions of routes contained within the sovereign airspace of a State;
2) regional air navigation agreements for routes or portions of routes contained within airspace over the high seas or over areas of undetermined sovereignty.

PANS-ATM (Doc 4444)

- 2.2.6 A safety risk assessment shall be carried out in respect of proposals for significant airspace reorganizations, for significant changes in the provision of ATS procedures applicable to an airspace or an aerodrome, and for the introduction of new equipment, systems or facilities, such as:
  - a) a reduced separation minimum to be applied within an airspace or at an aerodrome; …
  - f) implementation of new communications, surveillance or other safety-significant systems and equipment, including those providing new functionality and/or capabilities.
- 2.6.2 Safety-significant factors

The safety risk assessment shall consider relevant all factors determined to be safety-significant, including:

- e) type of air-ground communications and time parameters for communication dialogues, including controller intervention capability;
- f) type and capabilities of surveillance system, and the availability of systems providing controller support and alert functions. Where ADS-B implementation envisages reliance upon a common source for surveillance and/or navigation, the safety risk assessment shall take account of adequate contingency measures to mitigate the risk of either degradation or loss of this common source (i.e. common mode failure); and

- 5.2.1.4 Where the type of separation or minimum used to separate two aircraft cannot be maintained, another type of separation or another minimum shall be established prior to the time when the current separation minimum would be infringed.
- 5.2.2 Degraded aircraft performance

Whenever, as a result of failure or degradation of navigation, communications, altimetry, flight control or other systems, aircraft performance is degraded below the level required for the airspace in which it is operating, the flight crew shall advise the ATC unit concerned without delay. Where the failure or degradation affects the separation minimum currently being employed, the controller shall take action to establish another appropriate type of separation or separation minimum.

- 5.4.1.1.3 When information is received indicating navigation equipment failure or deterioration below the navigation performance requirements, ATC shall then, as required, apply alternative separation methods or minima.
- 5.10.1.1 Essential traffic is that controlled traffic to which the provision of separation by ATC is applicable, but which, in relation to a particular controlled flight is not, or will not be, separated from other controlled traffic by the appropriate separation minimum.
- 5.11.1 Provided an appropriate safety risk assessment has shown that an acceptable level of safety will be maintained, and after prior consultation with users, the separation minima detailed in 5.4.1 and 5.4.2 may be reduced in the following circumstances:
- 5.11.1.1 As determined by the appropriate ATS authority as appropriate:
  - a) when special electronic or other aids enable the pilot-in-command of an aircraft to determine accurately the aircraft's position and when adequate communication facilities exist for that position to be transmitted without delay to the appropriate air traffic control unit; or
  - b) when, in association with rapid and reliable communication facilities, information of an aircraft's position, derived from an ATS surveillance system, is available to the appropriate air traffic control unit; or

c) when special electronic or other aids enable the air traffic controller to predict rapidly and accurately the flight paths of aircraft, and adequate facilities exist to verify frequently the actual aircraft positions with the predicted positions; or

d) when RNAV-equipped aircraft operate within the coverage of electronic aids that provide the necessary updates to maintain navigation accuracy.

- 5.11.1.2 In accordance with regional air navigation agreements when:

a) special electronic, area navigation or other aids enable the aircraft to closely adhere to their current flight plans; and

b) the air traffic situation is such that the conditions in 5.11.1.1 a) regarding communications between pilots and the appropriate ATC unit or units need not necessarily be met to the degree specified therein.

- 13.4.3.4.6.2.2 In the event of an unplanned ADS-C ground system shutdown, the relevant ATS provider shall:

a) inform all affected aircraft and advise them of the requirement for position reports via voice or CPDLC;

b) take necessary action to establish alternative separation, if required;

……

- 13.5.3.2 ATS authorities shall ensure that contingency procedures are available to be followed in the event of degradation of ADS-C information due to a loss of the required navigation performance accuracy.
- 15.7.1.1 If, during an emergency situation, it is not possible to ensure that the applicable horizontal separation can be maintained, emergency separation of half the applicable vertical separation minimum may be used, i.e. 150 m (500 ft) between aircraft in airspace where a vertical separation minimum of 300 m (1 000 ft) is applied, and 300 m (1 000 ft) between aircraft in airspace where a 600 m (2 000 ft) vertical separation minimum is applied.

1.7 The previously listed references add up to a justification and method for ANSPs to determine and use SB ADS-B/Surveillance with HF communications as a “back-up” separation for the 23 NM Lateral and 20 / 30 NM longitudinal PBCS separations.

2. DISCUSSION

2.1 The FAA has determined that after careful consideration, not to recommend moving forward with the currently available SBA implementation at this time due to:

- The high costs for the marginal benefits provided for use in U.S.-managed ICAO airspace.
- Current SBA capability limitations.

2.2 The FAA considers that SBA HF minima would be very useful as global safety/ separation tools that could serve as an efficient backup to the separation minima with RCP 240 requirements when occasional network outages occur. ICAO rejected the Job Card to develop a global SurvHF minima, but highlighted that ICAO guidance enables States to develop their own contingency separations.

2.3 The Surveillance with HF communications minima Collision Risk Modelling is very mature and ready to be progressed. Recognizing the rapid development of new business models and systems, the FAA intends to conduct industry engagement to identify future

potential options for cost-efficient and technologically acceptable SBA deployment in the future. Should a cost-effective source of SB ADS-B that meets our operational needs becomes available, the FAA would like to continue their work on these SBAHF contingency separation minima to develop regional procedures, which would allow the Surveillance with HF communications minima to be used across FIR boundaries utilizing the same procedural requirements.

3. CONCLUSION

3.1 The meeting is invited to note the information provided.

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