**THE FORTY-FIRST MEETING OF THE**

**INFORMAL PACIFIC ATC CO-ORDINATING GROUP**

**(IPACG/41)**

(Kyoto, Japan 16 – 17 September 2015)

Agenda Item 5: Communications/Navigation/Surveillance (CNS) Issues

**PARC CWG FANS 1/A over SwiftBroadband (SBB) Project**

(Presented by Federal Aviation Administration (FAA) and Japan Civil Aviation Authority (JCAB))

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| --- |
| SUMMARY This paper provides an update on the FANS 1/A over SwiftBroadband (SBB) project activities by the FAA-sponsored Performance-based Operations Aviation Rulemaking Committee’s Communications Working Group (PARC CWG). It includes the outcome of the Fifteenth Meeting of the Informal Pacific ATC Co-Ordinating Group Providers Meeting (IPACG PM/15), in Anchorage, AK, held 2-4 June 2015. The FAA and JCAB are cooperating with other stakeholders and air navigation service providers (ANSPs) to evaluate FANS 1/A over SBB. |

# Introduction

## At IPACG/40 FIT/27, the U.S. provided an update on activities by the FAA-sponsored PARC CWG (Refer to IPACG/40 FIT/27 IP/04).

## The PARC CWG addresses issues, primarily concerning implementation, and policies, regulations and interpretative material for aircraft certification, operational authorizations and safety oversight of air navigation services. It provides recommendations to the FAA, taking into account global harmonization and standardization.

## PARC CWG initiated a project to investigate the performance of FANS 1/A controller-pilot data link communications (CPDLC) and automatic dependent surveillance – contract (ADS‑C) over SBB. This investigation includes an operational evaluation within the performance-based communication and surveillance (PBCS) framework and against required communication performance (RCP) 240 and required surveillance performance (RSP) 180 specifications. The operational evaluation involves revenue flights using certified aircraft with installed SBB equipment for use by FANS 1/A CPDLC and ADS‑C.

## The operational evaluation began in June with one Hawaiian Airlines (HAL) aircraft operating in the Oakland Oceanic, Fukuoka and Auckland flight information regions (FIRs). HAL and other operators are expected to participate that will operate throughout the Pacific and in other regions. To date, the operational evaluation indicates good performance of FANS 1/A over SBB. Some issues are under investigation.

## This paper provides IPACG with an update on the PARC CWG FANS 1/A over SBB project.

# Discussion

Overview of FANS 1/A over SBB project

## In August 2012, the PARC CWG completed its work on evaluating FANS 1/A over the I-4 Classic Aero Services and began work on a FANS 1/A over SBB project. One of the issues that caused delay in this project was recruiting operators to participate because the FAA’s data link recording rule had added significant costs to retrofit installations of the SBB equipment for FANS 1/A. This issue has since been resolved after the FAA provided notice of a policy change in March 2015 (refer to <http://www.regulations.gov>, Docket No. FAA-2015-0289).

## The goal of the FANS 1/A over SBB project is to show that CPDLC and ADS‑C meet the criteria of RCP 240 and RSP 180, respectively. PARC CWG is planning to complete its report to the FAA on the use of FANS 1/A over SBB with substantiating data by the middle of 2016.

## Inmarsat expects SBB to perform similar to VHF and envisions that ICAO will be developing more stringent RCP/RSP specifications for new ATM operations, which could include domestic and oceanic/remote applications, where Classic Aero may not comply, but SBB could comply. An evaluation against more stringent RCP/RSP specifications would be considered at a later time after ICAO develops new RCP/RSP specifications for the relevant ATM operations.

## The Inmarsat I-4 Satellite Coverage for SBB and Classic Aero is provided in Figure 1. Fucino will provide SBB backup to Burum for Alphasat satellite coverage; Auckland is planned to provide SBB backup for Paumalu for Americas and Asia-Pacific satellite coverage.



Auckland (SBB)

Figure 1. Inmarsat I-4 Satellite Coverage – SwiftBroadband & Classic

## To support FANS1/A over SBB operations, SITA and Rockwell Collins Information Management Systems (previously ARINC) have provided new SBB ACARS identifiers for the new gateways. Similarly to Classic Aero, the actual communication technical performance (ACTP) and actual surveillance performance (ASP) can be estimated specifically for CPDLC transactions and ADS-C reports, respectively, using FANS1/A over SBB, and compared with the time criteria provided by RCP 240 and RSP 180. These identifiers are provided in Table 1.

Table 1. SBB Station/Gateway Identifiers

|  |  |  |  |
| --- | --- | --- | --- |
| **PRIMARY SAS LOCATION(S)** | **SATELLITE/ REGION** | **SITA** | **ARINC** |
| Burum, Holland | Inmarsat I‑4  EMEA SBB | EME9 | XXB |
| Paumalu, Hawaii, US | Inmarsat I‑4  Americas SBB | AMR9 | XXU |
| Inmarsat I‑4  Asia-Pacific SBB | PAC9 | XXS |

Evaluation of AOC ACARS over SBB

## In addition to evaluating FANS 1/A over SBB performance from PBCS monitoring programs, PARC CWG is collecting and analyzing SBB data from aeronautical operational control (AOC) applications hosted by the aircraft communications addressing and reporting system (ACARS). PARC CWG believes the evaluation period may be shortened by comparing a large sample of AOC ACARS over SBB performance data with limited FANS 1/A over SBB performance data while maintaining a high level of confidence in the expected performance of CPDLC and ADS‑C. The AOC ACARS over SBB performance data will demonstrate stability of SBB performance over time. PARC CWG used a similar approach on PARC CWG FANS 1/A over Iridium evaluation.

## Inmarsat has already been conducting an evaluation of SBB AOC ACARS for over a year, and the results are provided in Figure 2 and Figure 3. PARC CWG will continue to collect this type of data.



Figure 2. AOC ACARS over SBB preliminary area of operation (courtesy of Inmarsat)

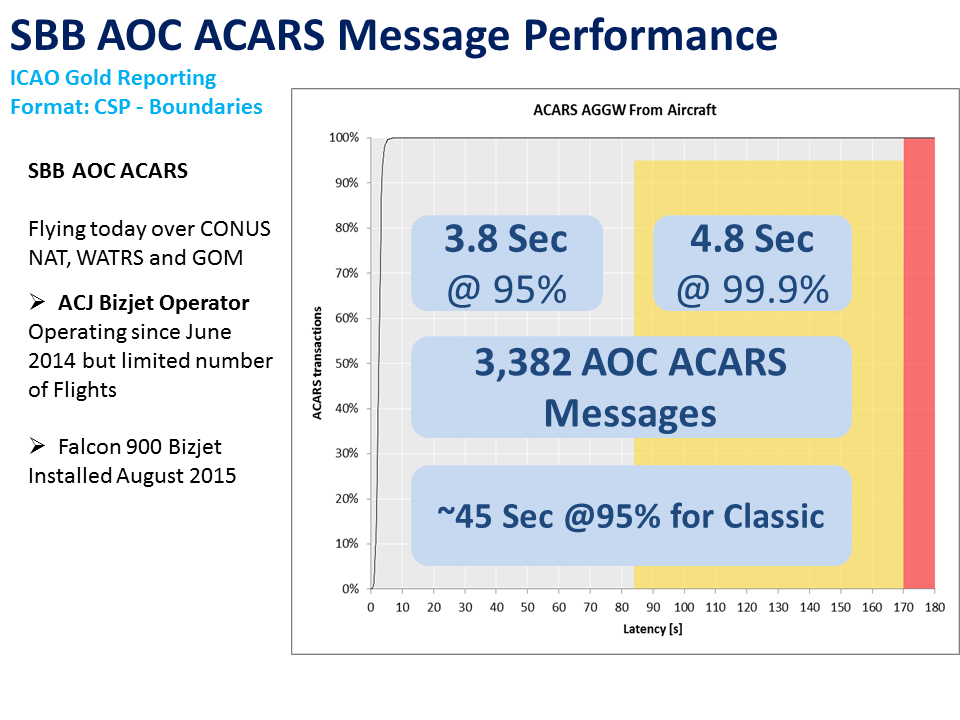


Figure 3. Preliminary AOC ACARS over SBB Message Performance (courtesy of Inmarsat)

Certification of FANS 1/A over SBB aircraft

## In May 2015, L2 Consulting Services completed the certification for the installation of FANS 1/A over SBB using a Cobham SBB radio on a Hawaiian Airlines (HAL) Boeing B767 aircraft. For this certification, the FAA recognized Advisory Circular (AC) 20-140B with the following additional conditions (provided by an issue paper) as a means of compliance for the design approval of FANS 1/A over SBB installations:

1. Table 5-1 of AC 20-140B includes sub-network designators for both FANS 1/A and FANS 1/A+. The FAA recognizes that the viable sub-network designators (e.g. SBB) identified for FANS 1/A+ are equally applicable to FANS 1/A.
2. Currently, there is no sub-network indicator and relevant criteria specified for SBB as a viable sub-network for FANS 1/A(+). Therefore, for FANS 1/A(+) over SBB installations and consistent with the planned update to AC 20-140B, the FAA is using FAA Technical Standard Order (TSO)-C159b, which refers to RTCA DO 262B, Appendix E, Section 2.4, which is applicable to the SBB equipment. This equipment includes the SBB transceiver, Diplexer/Low Noise Amplifier (DLNA) and the antenna.

Note.— The FAA does not require a Technical Standard Order Authorization (TSOA) and, therefore the Marking requirements of Section 4 of TSO C159b are not applicable. However, for any non-compliance to criteria provided by the TSO, the applicant must show that the equipment maintains an equivalent level of safety as part of the design approval data submittal.

1. For interoperability, the FAA also identified ARINC 618‑7, Air/Ground Character-Oriented Protocol Specification, which is common between Classic Aero and SBB, and ARINC 781‑5, Mark 3 Aviation Satellite Communication Systems, which includes SBB and other services that operates in L‑Band.

## In addition, to the above, the SBB equipment underwent testing with the Boeing Aircraft Equipment Interoperability Test (AEIT), ARINC Avionics Qualification Program (AQP) test and the SITA Validation Assessment and Qualification (VAQ) test.

Coordination with ANSPs on use of FANS 1/A over SBB

## After coordination and obtaining approval from participating ANSPs, the operational evaluation with HAL’s B767 aircraft has been conducted as follows:

1. HAL obtained approval for use of aircraft that are certified with FANS 1/A over SBB on revenue flights (using normal approval process);
2. HAL includes J5—CPDLC FANS 1/A SATCOM (INMARSAT)—in Item 10 of the flight plan (as normal) with no distinction between Classic Aero and SBB; and
3. Since these aircraft also file L1 (RNP4) in Item 18 of the flight plan, the ATS units will determine if HAL’s B767 FANS 1/A over SBB aircraft is eligible for application of performance-based separation minima (e.g. 30/50 NM or 5-minute or longitudinal), the same as any other FANS 1/A aircraft (as normal).

## There are no special operating conditions or restrictions on the basis that:

1. PBCS monitoring is in place and active;
2. FANS 1/A over SBB aircraft will be introduced in small numbers over a period of time; and
3. PARC CWG will coordinate with relevant ANSPs the specifics the operational flights for evaluation.

## The participating ANSPs, the associated FIRs/control areas (CTAs), logon address, coordinating groups and ICAO regions are listed in Table 2.

Table 2. Participating ANSPs/FIRs/CTAs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **FIR/CTA** | **Logon** | **ANSP** | **Coord** | **Region** |
| Nadi | NFFF | Airports Fiji Ltd | ISPACG | APAC |
| Brisbane | YBBB | Airservices Australia |
| Honiara | YBBB |
| Nauru | YBBB |
| Melbourne | YMMM |
| Auckland Oceanic | NZZO | Airways NZ |
| Tahiti | NTTT | SEAC PF |
| Oakland Oceanic | KZAK | FAA |
| Oakland Oceanic | KZAK | FAA | IPACG |
| Anchorage Oceanic | PAZN |
| Fukuoka | RJJJ | JCAB |
| New York Oceanic | KZWY | FAA | NAT CNSG & NAT IMG | NAT |
| Reykjavik | BIRD | Isavia |
| Gander Oceanic | CZQX | Nav Canada |
| Santa Maria Oceanic | LPPO | Nav Portugal |
| Shanwick Oceanic | EGGX | UK NATS |
| New York Oceanic (S of 27° N) | KZWY | FAA | FAA | CAR |
| Anchorage Arctic | PAZA | FAA | FAA | NAM |

Evaluation of FANS 1/A over SBB

## Since 3 June 2015, HAL has been operating in the Pacific Region with one Boeing B767 aircraft with FANS 1/A using a Cobham SBB radio. HAL has scheduled seven (7) more B767 aircraft to be equipped with FANS 1/A over SBB capability before the end of 2015—one (1) in September, one (1) in October, one (1) in November and four (4) in December.

## Figure 4 shows a geographical presentation of the data that was collected from HAL aircraft N588HA by Oakland (shown in green), Fukuoka (shown in orange), Auckland (shown in pink) and the Boeing ADS‑C Collection and Analysis Tool (ACAT) (shown in blue). In addition to using ADS event contracts, Oakland and Auckland are using an ADS periodic contract at a 14-minute interval, Fukuoka is using an ADS periodic contract at a 10-minute interval. The Boeing ACAT is using an ADS periodic contract at a 2-minute interval to collect a significant amount of actual surveillance performance from HAL aircraft over a short period of time.

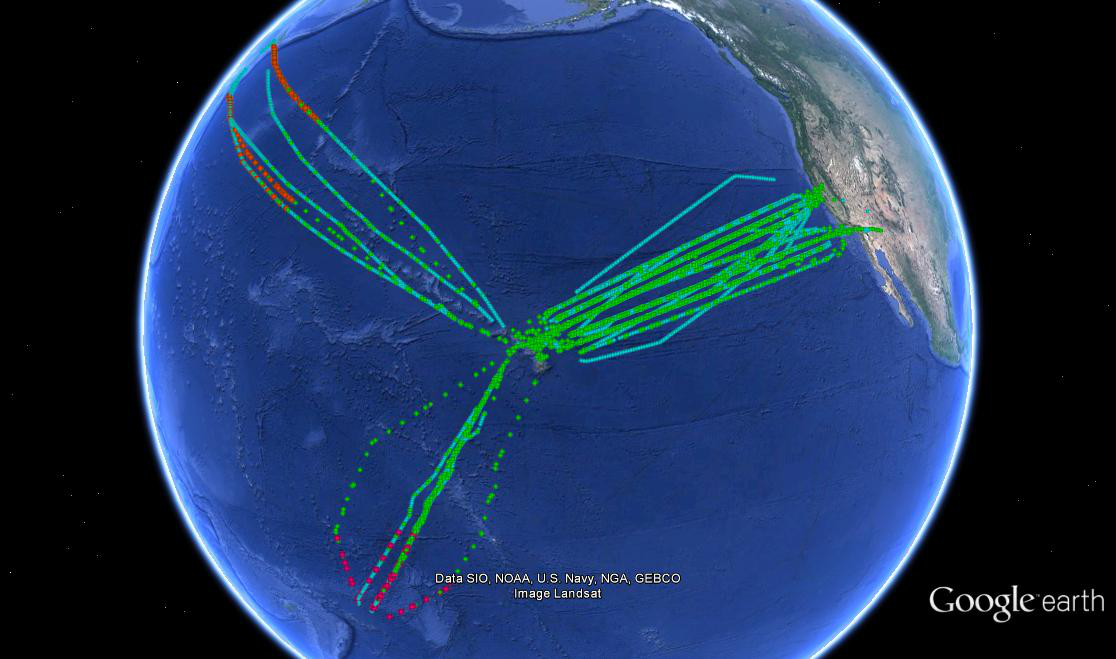


Figure 4. HAL FANS 1/A over SBB data points – N588HA

## Table 3 and Figure 5 show the results of the data collected with ACAT and at Oakland, Fukuoka, and Auckland centers.

## Table 4 provides a comparison of the results by month for Oakland to highlight the differences observed during the three-month analysis period.

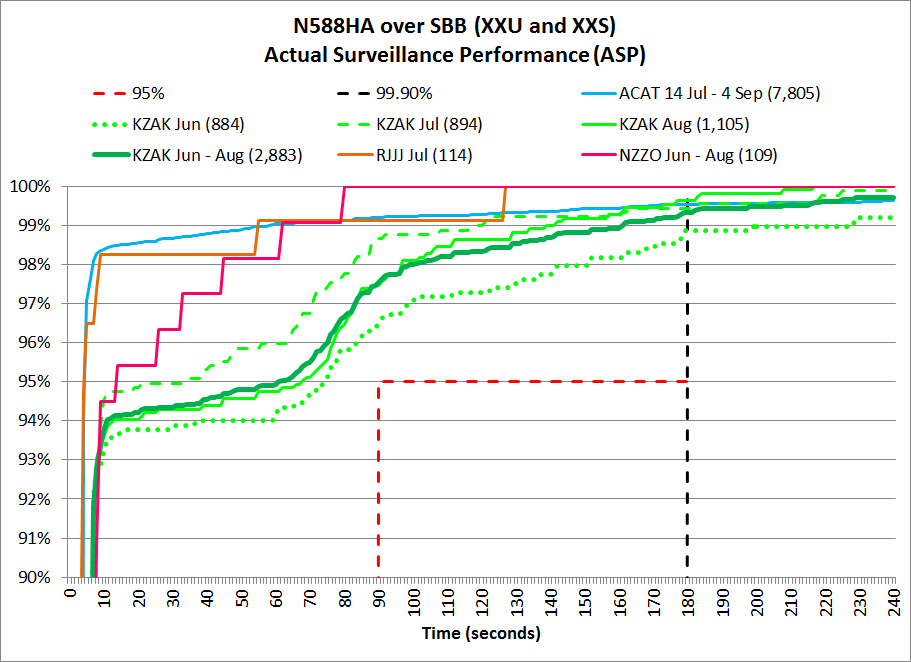
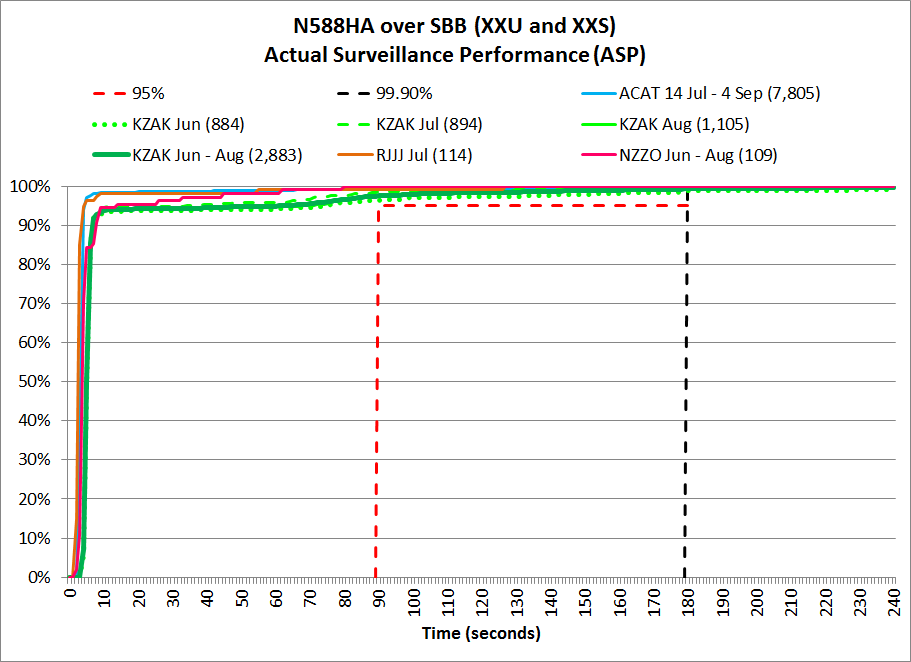
Table 3. Summary of N588HA FANS 1/A ADS‑C over SBB Performance – XXU/XXS Only

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| FIR/System | Boeing ACAT | Oakland Oceanic | Fukuoka | Auckland |
| Station IDs for SBB paths used | XXU/XXS | XXU/XXS | XXS | XXU |
| Time period of data collection | 14 Jul to  4 Sep | 1 Jun to  31 Aug | July | 1 Jun to  31 Aug |
| ADS‑C count – total | 7,805 | 2,883 | 114 | 109 |
| Count > 90 sec | 62 | 71 | 1 | 0 |
| % < 90 sec (95% RSP180) | 99.2% | 97.5% | 99.1% | 100% |
| 95% value | 5 | 61 | Insufficient data | Insufficient data |
| 99% value | 59 | 162 |
| 99.9% value | 379 | 265 |
| AVG delay (sec) | 5.9 | 11.4 | 5.6 | 6.6 |
| MAX delay (sec) | 403 | 393 | 128 | 80 |
| MIN delay (sec) | 2 | 3 | 3 | 2 |

Table 4. Summary of N588HA FANS 1/A ADS‑C over SBB Performance – Oakland by month

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| FIR/System | Oakland Oceanic | Oakland Oceanic | Oakland Oceanic | Oakland Oceanic |
| Station IDs for SBB paths used | XXU/XXS | XXU/XXS | XXU/XXS | XXU/XXS |
| Time period of data collection | June | July | August | 1 Jun to  31 Aug |
| ADS‑C count – total | 884 | 894 | 1,105 | 2,883 |
| Count > 90 sec | 31 | 12 | 28 | 71 |
| % < 90 sec (95% RSP180) | 96.5% | 98.7% | 97.5% | 97.5% |
| 95% value | 74 | 34 | 68 | 61 |
| 99% value | 229 | 121 | 139 | 162 |
| 99.9% value | 367 | 393 | 208 | 265 |
| AVG delay (sec) | 13.3 | 10.1 | 11.0 | 11.4 |
| MAX delay (sec) | 367 | 393 | 217 | 393 |
| MIN delay (sec) | 4 | 3 | 3 | 3 |

Figure 5. N588HA – ASP – ACAT, Oakland and Fukuoka Centers



## From data analysis overall, performance is generally very good. However, the data suggests that VHF/SATCOM transitions, which are not specific to SBB, continue to introduce long delays in ADS‑C report delivery in fringe areas of VHF coverage. In addition, some ADS-C reports exhibited long delivery delays well outside VHF coverage. A core team of experts are investigating the cause of these delayed ADS‑C reports. One topic being considered is the on-aircraft handling of Media Advisories.

## Since the first flights in June 2015, one unplanned 4-hour outage of the safety components of the system was observed on the 6-7 August. Inmarsat worked with suppliers to determine the cause and implement short term mitigation measures, with plans to implement a long term solution.

Next Steps for the FANS 1/A over SBB project

## The PARC CWG will continue FANS 1/A over SBB evaluation with HAL aircraft, including the seven other B767 aircraft when they are equipped and ready for operations. FedEx announced that it will equip three MD-11 aircraft with FANS 1/A over SBB using Cobham Aviator 700D system tentatively scheduled to be in service by early in 2016. In addition, a Falcon 900, supported by SITA and Satcom Direct, has joined in the evaluation of AOC ACARS over SBB (non-FANS1/A) with the other bizjet currently participating.

## Inmarsat and Cobham are continuing discussions with other air transport and air cargo candidates for the FANS 1/A over SBB evaluation. Any operators interested in participating should contact Mr. Gary Colledge ([gary.colledge@inmarsat.com](mailto:gary.colledge@inmarsat.com)).

## PARC CWG is planning to complete the FANS 1/A over SBB project report for the FAA by the middle of 2016.

## While the FAA is supporting PARC CWG FANS 1/A over SBB evaluation, ICAO will need to recognize SBB as Aeronautical Mobile Satellite (Route) Service (AMS(R)S) as a viable sub-network for FANS 1/A. A new Chapter to the ICAO *Manual on the Aeronautical Mobile Satellite (Route) Service* (Doc 9925), more commonly known as the SBB Technical Manual, has been drafted and is in the final stages of review by working groups of the Communications Panel (formerly Aeronautical Communications Panel). ICAO expects to begin the process for updating Doc 9925 by the end of 2015.

# Action by the meeting

## The meeting is requested to:

1. note the content of this information paper.

# – END –