**THE FORTIETH MEETING OF THE**

**INFORMAL PACIFIC ATC CO-ORDINATING GROUP (IPACG/40)**

**THE TWENTY-SEVENTH MEETING OF THE**

**FANS INTEROPERABILITY TEAM (FIT/27)**

**Washington, DC 11 September 2014**

**Agenda Item x:** xxx

**Central Reporting Agency (CRA) Problem Report (PR) Briefing**

(Presented by the CRA)

**SUMMARY**

This working paper and its attachment describe the investigation and disposition of Future Air Navigation System (FANS) PRs that are of interest to the IPACG FIT.

1. Introduction
   1. FANS stakeholders submit PRs via the <http://www.ispacg-cra.com/> website.
      1. The website is graciously hosted and maintained by Airways Corporation of New Zealand (ACNZ).
      2. The website is used for multiple regions, namely the North and Central Pacific region (IPACG FIT), except for the Fukuoka Flight Information Region (FIR); the South Pacific region (ISPACG FIT); the Asia region (FIT-Asia); and the North Atlantic and Canada region (NAT CNSG).
   2. Between preparation of the IPACG/39 FIT/26 PR briefing and preparation of this PR briefing, FANS stakeholders submitted 288 PRs via the website, of which 22 PRs occurred in the North and Central Pacific region.
   3. The large and increasing number of PRs should not be unexpected, considering that FANS is a complex and evolving system-of-systems and that an increasing number of Air Traffic Services (ATS) units and aircraft operators are using FANS.
   4. Figure 1 illustrates the growth in the number of PRs per calendar year starting in 2006.
      1. The total number of PRs for 2014 is projected based on the number of PRs submitted through 22 August 2014 and matches the overall growth trend.

**Figure 1 PR Growth**

* 1. PR status definitions are the following:
     1. **RAISED**: The originator has submitted the PR but the CRA has not yet processed the PR.
     2. **ACTIVE**: The CRA has processed the PR and assigned it for investigation.
     3. **OPEN**: The CRA had completed its investigation but some form of correction is required before the PR can be closed.
     4. **CLOSED AS DUPLICATE**: The CRA closed the PR because it is already tracking the problem with another PR.
     5. **CLOSED**: The CRA closed the PR because corrective action has been implemented.
  2. PR type definitions are the following:
     1. **TBA**: To be assigned (or non-problem)
     2. **AIR**: Avionics or flight crew issue
     3. **NETWORK**: ARINC, SITA, Inmarsat, or Iridium issue
     4. **GROUND**: ATS unit system or controller issue

1. Discussion
   1. Eight updated or new PRs that occurred outside the North and Central Pacific region are of interest to the IPACG FIT:
      1. PR 1112-GS (also duplicate PRs 1126-SN, 1142-SN, 1150-SN, 1190-SN, 1211-RP, 1231-GS, 1246-SN, 1314-SN, 1340-GS, etc.), *SATCOM downlinks are delivered but SATCOM uplinks are not*. Status: CLOSED / Type: NETWORK. SITA implemented improved SATCOM uplink routing logic in August 2013 as well as improved VHF uplink routing logic in January 2014.
      2. PRs 1344-MM (also duplicate PRs 1511-MM, 1523-MM, 1669-MM, etc.), *Failed uplink delivery during Inmarsat satellite/GES switch*. Status: CLOSED / Type: TBA. When an aircraft is outside of VHF coverage, the DSP cannot deliver uplinks during the brief (usually about one minute) period that the aircraft is logged off SATCOM to switch from one Inmarsat satellite/GES to the next. This PR is closed because the network performed as designed. Nevertheless, should ATS units have the capability (whether automated and/or manual) to resend failed uplinks? Flight crews are made aware of failed AFN and CPDLC downlinks and may resend them, and International Civil Aviation Organization (ICAO) Doc 4444 section 14.3.8 states that “[w]hen a controller… is alerted that a single CPDLC message has failed, the controller… shall take one of the following actions as appropriate: a) via voice, confirm the actions that will be undertaken with respect to the related dialogue… b) **via CPDLC, reissue the CPDLC message that failed**.”
      3. PR 1405-GS (also duplicate PRs 1439-GS, 1483-GS, 1512-GS, etc.), *787 SATCOM issues*. Status: OPEN / Type: AIR. Issues have occurred with multiple operators. At least two causes have been identified, one of which (loss of Cat B VHF link may prevent determination of VHF NO COMM and resulting transition to SATCOM) has been duplicated in the 787 avionics lab and will be fixed in BP2.5 software scheduled for release in early 2015. The other cause is apparently SATCOM operational issues (e.g., improper registration of new aircraft with Inmarsat).
      4. PR 1406-SN, *A330 makes multiple partial ADS-C reports*. Status: OPEN / Type: AIR. Multiple ADS-C reports received with partial data from A330. Airbus unable to determine cause. Please submit PRs for any recurrences of this issue.
      5. PR 1444-GS (also duplicate PRs PRs 1458-GS, 1467-MM, 1468-GS, 1477-MM, 1550-MM, 1592-SN, 1599-SN, 1607-MM, 1636-SN, etc.), *CPDLC transfer failures with 757/767 aircraft*. Status: OPEN / Type: AIR. When 757/767 avionics receive an abnormal CPDLC uplink message containing concatenated uM161 END SERVICE and uM159 ERROR message elements, they correctly disconnect from the CDA and NDA (if one exists), but until power is cycled to the avionics they incorrectly disconnect from subsequent NDAs when subsequent CDAs attempt to transfer authority to them normally by sending uM161 END SERVICE without uM159 ERROR. Here is the generic sequence of events:
         * 1. ATSU1 connects as CDA
           2. ATSU2 connects as NDA
           3. ATSU1 sends abnormal END SERVICE + ERROR
           4. 757/767 correctly disconnects from both ATSU1 (CDA) and ATSU2 (NDA)
           5. ATSU3 connects as CDA
           6. ATSU4 connects as NDA
           7. ATSU3 sends normal END SERVICE
           8. 757/767 correctly disconnects from ATSU3 (CDA) but incorrectly also disconnects from ATSU4 (NDA)
           9. [repeat events e) through h) for subsequent CDAs and NDAs until power is cycled to the avionics]

The ICAO Global Operational Data Link Document (GOLD) 2nd Edition contains contradictory guidance concerning that CPDLC uplink message element combination. On page 2-18, it states that an ATS unit may send a “CPDLC message containing UM 161 END SERVICE and UM 159 ERROR (commanded termination)” as an ‘abort request’, but in section F.22 regarding “a FANS uplink containing a concatenated end-service (um161) and ERROR (um159)… this construct is recommended in DO-258/ED-100… [but] it was not included in DO-219, which is the basis of FANS designs. **ATC should therefore avoid using this… concatenated message**.” The ICAO Operational Data Link Panel (OPLINKP) is drafting changes to the GOLD to resolve the inconsistency and a fix is a candidate for the potential next 757/767 flight management computer (FMC) software release (the 757/767 FMC design is based on DO-219). In the meantime, ATS units should ensure that they follow the bolded guidance (which the FAA and JCAB have informally confirmed to the CRA that they already do).

* + 1. PR 1516-GS (also duplicate PRs 1516-GS, 1600-GS, 1642-GS, 1664-GS, etc.), *Old CPDLC message displayed to flight crew*. Status: OPEN / Type: AIR. All cases involve 767 aircraft, a uM117 CONTACT + uM161 END SERVICE message received by the aircraft during the previous flight, and the CONTACT instruction (re)displayed to the flight crew during the subsequent flight. Boeing and Honeywell are investigating.
    2. PR 1645-RP, *No CPDLC downlinks from 747-8*. Status: ACTIVE / Type: TBA. An ATS unit established a CPDLC connection with a 747-8. The flight crew reported that they were receiving CPDLC uplink messages but that they could not send any CPDLC downlink messages. The CRA is investigating this PR. Please submit PRs for any recurrences of this issue.
    3. PR 1685-SN, *Incorrect aircraft addresses included in 777 AFN contact messages*. Status: OPEN / Type: AIR. An ATS unit reported that 777 aircraft include incorrect ICAO 24-bit aircraft addresses (which generally have not been used for flight plan correlation) in AFN contact messages, specifically by reversing the encoding of the addresses. This problem has been fixed for in-production 777s which have current AIMS-2 avionics with forward-fit BP17 software and will be fixed for newer in-service 777s which have current AIMS-2 avionics with retrofit BP17.1 software that is expected to become available in 4Q 2014. This problem will likely not be fixed for older in-service 777s which have original AIMS-1 avionics, however.
  1. Three old PRs that occurred in the North and Central Pacific region have been updated recently:
     1. PR 1160-GS, *Ocean21 treats optional latitude/longitude as separate waypoint*. Status: CLOSED / Type: GROUND. A DARP route clearance request included a named waypoint (MORAY) with its optional latitude/longitude, but the route clearance response from Ocean21 included MORAY with its latitude/longitude as a separate waypoint. KZAK reported that updated software (T20) with the fix for this problem was released in July 2014.
     2. PR 1224-SN, *ADS-C report from A330 contained incorrect data*. Status: CLOSED / Type: AIR. An ADS-C report received by PAZA from an A330 contained incorrect data for the next and next+1 waypoints. The analysis from Airbus stated that the next and next+1 waypoints were approach fixes for one of the ILS Runway 04 approaches at JFK and that the flight crew had either selected the approach or revised the flight plan to proceed direct to the first approach fix.
     3. PR 1336-GS, *Intermittent log-on problems with A330*. Status: CLOSED AS DUPLICATE (of PR 1112-GS) / Type: NETWORK. SITA’s routing logic depended on media advisory downlinks indicating SATCOM establishment, but multiple aircraft types and avionics suites do not send those downlinks under certain conditions. SITA implemented improved SATCOM uplink routing logic in August 2013 as well as improved VHF uplink routing logic in January 2014.
  2. The CRA investigated 22 new PRs that occurred in the North and Central Pacific region:
     1. PR 1437-SN, *A380 AFN messages out of order*. Status: CLOSED / Type: TBA. CPDLC transfer of authority from PAZN to RJJJ failed because AFN messages from an A380 were received out of order. The analysis from Airbus indicated that the messages were received out of order because the aircraft was at the limit of VHF coverage and was transitioning from VHF to SATCOM. This PR is similar to other PRs discussed in IPACG/39 FIT/26 WP03, *Suggested VHF Region Definition Changes to Improve ACARS Performance*, and in NAT CNSG/10 IP14, *Impact of VHF Transitions on Data Link Performance* (which is also expected to be presented at IPACG/40 FIT/27).
     2. PR 1439-GS, *Failed CPDLC transfer to PAZN*. Status: CLOSED AS DUPLICATE / Type: AIR. RJJJ established a CPDLC connection with a 787, but the CPDLC transfer of authority to PAZN failed. Message log analysis indicated that this PR is a duplicate of PR 1405-GS, in which the loss of a Cat B VHF link prevented the determination of VHF NO COMM and the resulting transition to SATCOM. This issue has been duplicated in the 787 avionics lab and will be fixed in BP2.5 software scheduled for release in early 2015.
     3. PR 1490-SN, *Numerous downlinks received from 777*. Status: ACTIVE / Type: AIR. KZAK reported that it received 53 REQUEST CLIMB TO FL370 CPDLC downlinks and 937 AFN FN\_COMP downlinks from a 777. This PR is under investigation by Honeywell and KZAK; message log analysis indicated that aircraft was transferred between KZAK and PAZA 24 times (reference PR 1495-SN) and that the avionics may have a problem handling the largest CPDLC message identification number (MIN) of 63.
     4. PR 1495-SN, *KZAK and PAZA “ping pong” transfers*. Status: OPEN / Type: GROUND. While investigating PR 1490-SN, the CRA noted that KZAK and PAZA transferred the aircraft between them 24 times in approximately 90 minutes. KZAK indicated that the aircraft’s route violated UPR guidelines by repeatedly entering and exiting KZAK and PAZA airspace and that it has “a proposed system design enhancement that would allow Ocean21 to handle this situation more gracefully, however it is not currently scheduled for implementation.”
     5. PR 1498-SN, *Extra characters in CPDLC downlink request from 767*. Status: CLOSED AS DUPLICATE (of PR 1155-GS) / Type: AIR. This is a known issue with the 757/767 FMC.
     6. PR 1531-SN, *CPDLC dM62 ERROR [invalidData] downlink messages*. Status: OPEN / Type: GROUND. Four aircraft in a two-hour period responded to CPDLC route clearance uplink messages with CPDLC dm62 ERROR [invalidData] downlink messages. KZAK identified a problem with how their automation encodes arrival procedures in CPDLC route clearance uplink messages and indicated that the problem is planned to be fixed in T23 Ocean 21 software.
     7. PR 1534-GS,  *787 SATCOM data link problems*. Status: OPEN / Type: AIR. 787 flight crew reported problems using SATCOM data link, including a failed transfer of CPDLC authority from RJJJ to KZAK. Message log analysis indicated that the SATCOM problems portion of this PR is a duplicate of PR 1405-GS, in which the loss of a Cat B VHF link prevented the determination of VHF NO COMM and the resulting transition to SATCOM. This issue has been duplicated in the 787 avionics lab and will be fixed in BP2.5 software scheduled for release in early 2015. The other portion of the PR, the failed transfer of CPDLC authority from RJJJ to KZAK, was caused by the avionics not responding to an AFN contact message after a master communications management function (CMF) switch. This issue has also been duplicated in the 787 avionics lab and will also be fixed in BP2.5 software scheduled for release in early 2015.
     8. PR 1542-MM, *CPDLC over SATCOM failure*. Status: CLOSED / Type: AIR. 747-8 operator reported that although SATCOM functioned during the previous flight, it did not function for this flight – after departure, the aircraft used only VHF and (poor-performing) HF data link. The CRA recommended to the aircraft operator that it work with Boeing and the SATCOM avionics supplier because it appears that the problem occurred in the SATCOM avionics (not in the SATCOM network) and obtained the aircraft operator’s concurrence to close the PR.
     9. PR 1559-GS, 787 *DATALINK LOST indication*. STATUS: CLOSED / Type: AIR. Flight crew reported a DATA LINK LOST indication. Message log analysis revealed that SATCOM was not functional during much of flight, which explains that indication. Boeing and Honeywell are investigating the SATCOM problem separately.
     10. PR 1562-GS, *FMC position reports not transmitted*. Status: CLOSED / Type: TBA. The CRA closed this PR because FMC (i.e., AOC) position reports are not used for ATS purposes and the PR is therefore outside of the scope of the CRA. (Boeing did, however, work with the aircraft operator to resolve the issue.)
     11. PR 1563-GS, *FMC position reports not transmitted*. Status: CLOSED / Type: TBA. The CRA closed this PR because FMC (i.e., AOC) position reports are not used for ATS purposes and the PR is therefore outside of the scope of the CRA. (Boeing did, however, work with the aircraft operator to resolve the issue.)
     12. PR 1564-GS, *CPDLC transfer failure from PAZA to PAZN*. Status: CLOSED / Type: GROUND. The transfer of CPDLC authority from PAZA to PAZN failed. Message log analysis indicated that KZAK designated PAZA as the NDA and PAZA established a CPDLC connection as the NDA, but PAZA could not designate PAZN as the subsequent NDA because KZAK did not terminate its CPDLC connection until the aircraft was well inside PAZN airspace. The CRA closed the PR on the basis that KZAK would likely not be able to determine the cause for the late termination due to the length of time between the PR occurrence and the PR analysis.
     13. PR 1568-RP, *HF data link lost*. Status: ACTIVE / Type: TBA. The CRA is investigating this PR.
     14. PR 1571-SN, *MD-11 old CPDLC message.* Status: CLOSED / Type: AIR. PAZA reported that an MD-11 flight crew indicated receipt of a CPDLC climb clearance that PAZA did not send. Message log analysis confirmed that no CPDLC climb clearance was sent to the aircraft, so the CRA initially believed the PR was a result of the aircraft operator’s failure to follow MD-11 Interim Operating Procedure (IOP) 2-228A. (The IOP clears the CPDLC message log in the avionics to prevent the avionics from redisplaying old CPDLC uplink messages to the flight crew.) Further investigation, however, revealed that the flight crew likely misinterpreted a CPDLC downlink message contained in the CPDLC message log, specifically a dM48 POSITION REPORT [positionreport] to which the avionics had automatically appended dM29 CLIMBING TO [altitude] because the aircraft was climbing at the time that the flight crew sent the position report. In other words, the flight crew apparently misread dM29 CLIMBING TO [altitude] as uM20 CLIMB TO AND MAINTAIN [altitude].
     15. PR 1590-MM,  *CPDLC transfer failure from PAZA to PAZN*. Status: ACTIVE / Type: GROUND. Message log analysis indicates that PAZA transferred CPDLC authority to PAZN approximately 11 minutes late – the aircraft crossed W165 at approximately 0140Z, but PAZA did not send the END SERVICE until 0151Z. This PR is assigned to the FAA to investigate further.
     16. PR 1601-MM, *CPDLC transfer failure from KZAK to RJJJ*. Status: OPEN / Type: GROUND. KZAK indicated that it did not automatically send the END SERVICE uplink to transfer authority to RJJJ due to a pending CONTACT uplink that was permanently pending because KZAK had sent the END SERVICE uplink to transfer authority to PGZU immediately before. KZAK stated that it will submit a local change request to inhibit pending uplinks from preventing an automatic END SERVICE uplink.
     17. PR 1611-GS, *Unable to log on to KZAK*. Status: CLOSED / Type: AIR. The flight crew reported that they were unable to log on to KZAK. Message log analysis revealed that the flight crew sent seven AFN contact messages with an incorrect flight identifier and that KZAK properly responded with negative (reason code 4) AFN acknowledgement messages. The flight crew eventually corrected their mistake and successfully logged on to KZAK.
     18. PR 1654-SN, *Clearance to 777 not received by flight crew*. Status: CLOSED / Type: AIR. PAZA reported that it sent a concatenated RESUME NORMAL SPEED and MAINTAIN FL360 clearance to a 777 and that it received a WILCO response from the flight crew. When the aircraft later sent an ADS-C report indicating that it was at FL380, PAZA queried the flight crew, who stated that they had not received the MAINTAIN FL360 part of the clearance and were operating per the previous FL340 to FL380 block altitude clearance. Based on many precedents, the CRA believes that the flight crew did not read the MAINTAIN FL360 part of the clearance. PAZA concurred with the CRA assessment.
     19. PR 1672-GS, *Unable to establish CPDLC connection with RJJJ*. Status: OPEN / Type: TBA. A 787 flight crew reported that they were unable to establish a CPDLC connection with RJJJ. Message log analysis by the CRA contradicts the flight crew report by showing that the avionics sent CPDLC connect confirm (CC1) messages in response to the CPDLC connect request (CR1) messages from RJJJ. The CRA has requested more detail from the aircraft operator concerning the PR.
     20. PR 1676-DK, *Failure to establish CPDLC connections with RJJJ and KZAK*. Status: ACTIVE / Type: TBA. A 777 flight crew reported that they were unable to establish CPDLC connections with RJJJ and KZAK. The CRA is investigating this PR.
     21. PR 1677-RP*, 747-8 ADS-C Failure*. Status: ACTIVE / Type: TBA. A 747-8 operator reported an apparent ADS-C failure. The CRA is investigating this PR.
     22. PR 1684-MM, *747-400 FANS issues*. Status: CLOSED / Type: AIR. PAZN reported CPDLC connection management problems with a 747-400. Message log analysis revealed that the aircraft acknowledged receipt of to five consecutive FANS (both CPDLC and ADS-C) uplink messages from PAZN as well as from RJJJ but did not otherwise respond to them. For example, the aircraft sent an ACARS acknowledgement to a CPDLC connect request (CR1) from PAZN but did not send the expected CPDLC connect confirm (CC1). Boeing believes that the problem was a transient avionics issue that has not previously been encountered. The CRA obtained concurrence from PAZN to close the PR on the condition that the CRA will re-open it if any further occurences of this issue are documented. Please submit PRs for any recurrences of this issue.

1. Action
   1. The CRA invites the IPACG FIT to:
      1. note the content of this paper and its attachment; and
      2. promote expeditious resolution of ACTIVE and OPEN PRs.