ICAO

Federal Aviation Administration

International Civil Aviation Organization

Tenth Meeting of the FANS Interoperability Team – Asia (FIT-Asia/10)

Video Teleconference, 03 – 06 August 2020

Agenda Item 3: PBCS Developments and Implementation

Performance-based Communication and Surveillance (PBCS) Non-compliance Reporting Updates

(Presented by the United States)

Overview

- PBCS monitoring requirements
- PBCS aircraft performance monitoring programs
  - Combined regional reporting
  - Monthly reporting
- Top cause for non-compliance

ICAO PBCS monitoring requirements

Annex 11, Air Traffic Services

3.3.5.2 Where RCP/RSP specifications are applied, programmes shall be instituted for monitoring the performance of the infrastructure and the participating aircraft against the appropriate RCP and/or RSP specifications, to ensure that operations in the applicable airspace continue to meet safety objectives. The scope of monitoring programmes shall be adequate to evaluate communication and/or surveillance performance, as applicable.

Annex 6, Operation of Aircraft, Part I

7.1.5 The State of the Operator shall ensure that, in respect of those aeroplanes mentioned in 7.1.3, adequate provisions exist for:

a) receiving the reports of observed communication performance issued by monitoring programmes established in accordance with Annex 11, Chapter 3, 3.3.5.2; and

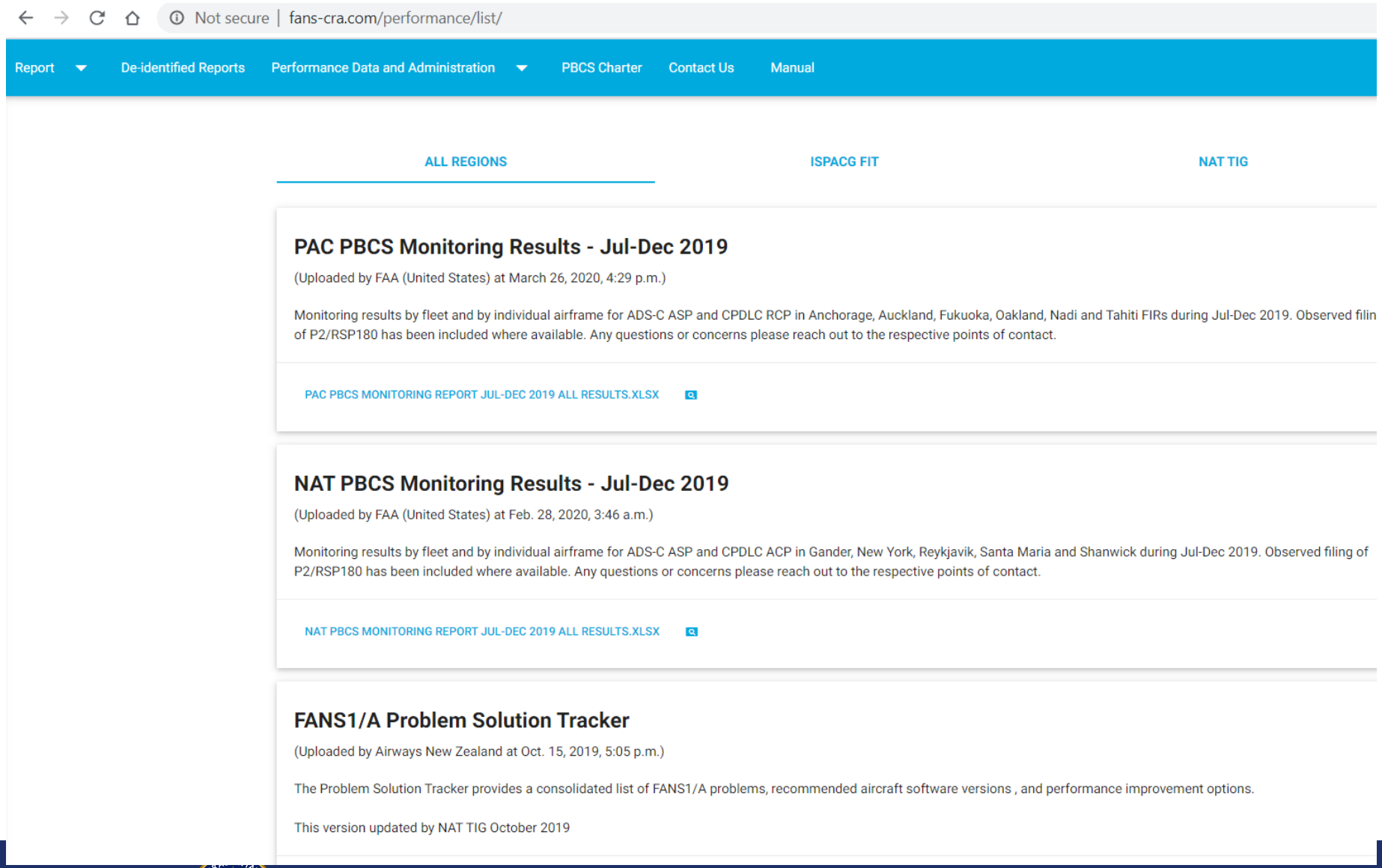
b) taking immediate corrective action for individual aircraft, aircraft types or operators, identified in such reports as not complying with the RCP specification(s).

Note: corresponding requirements in Part I, paragraph 7.3.4, and Part II, paragraphs 2.5.1.9 and 2.5.3.5

PBCS Aircraft Performance Monitoring Programs Combined regional reporting

- **Semi-annual reports posted on www.FANS-CRA.com for:**
  - **North Atlantic** - Gander, New York, Santa Maria, Shanwick, Reykjavik
  - **Pacific** - Anchorage, Auckland, Fukuoka, Nadi, Oakland, Tahiti
- When "red" performance is observed, corrective action may be needed
  - Operators should contact relevant monitoring PoC(s) for more details and consult applicable regulatory document, e.g. AC 90-117

PBCS Monitoring Results – Fleet/Airframe



PBCS Aircraft Performance Monitoring Programs Combined regional reporting

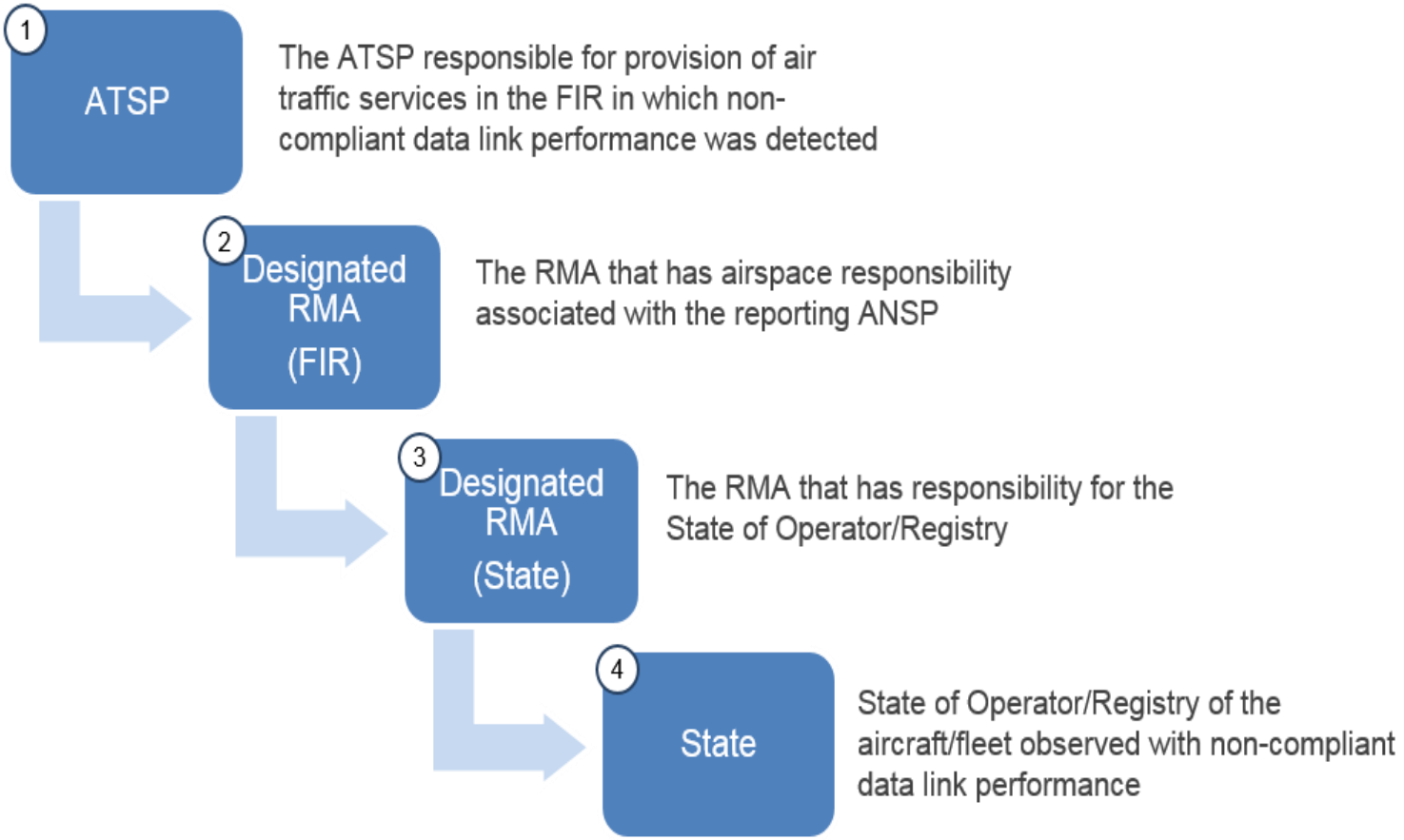
- **Annual reports for Asia-Pacific**
  - Data compiled through and reported to the FANS Interoperability Team – Asia (FIT-Asia) group

Reporting FIRS		
Code	**FIR**	**State**
KZAK	Oakland Oceanic	United States
NFFF	Nadi	Fiji
NTTT	Tahiti	French Polynesia
NZZO	Auckland Oceanic	New Zealand
PAZA	Anchorage Oceanic	United States
RJJJ	Fukuoka	Japan
RPHI	Manila	Philippines
VCCF*	Colombo	Sri Lanka
VOMM	Chennai	India
VVTS	Ho-Chi-Minh	Viet Nam
VYYF	Yangon	Myanmar
WAAF	Ujung Pandang	Indonesia
WMFC	Kuala Lumpur	Indonesia
WSJC	Singapore	Singapore
YBBB	Brisbane	Australia
YMMM	Melbourne	
ZLLL	Lanzhou	China
ZWWW	Urumqi	

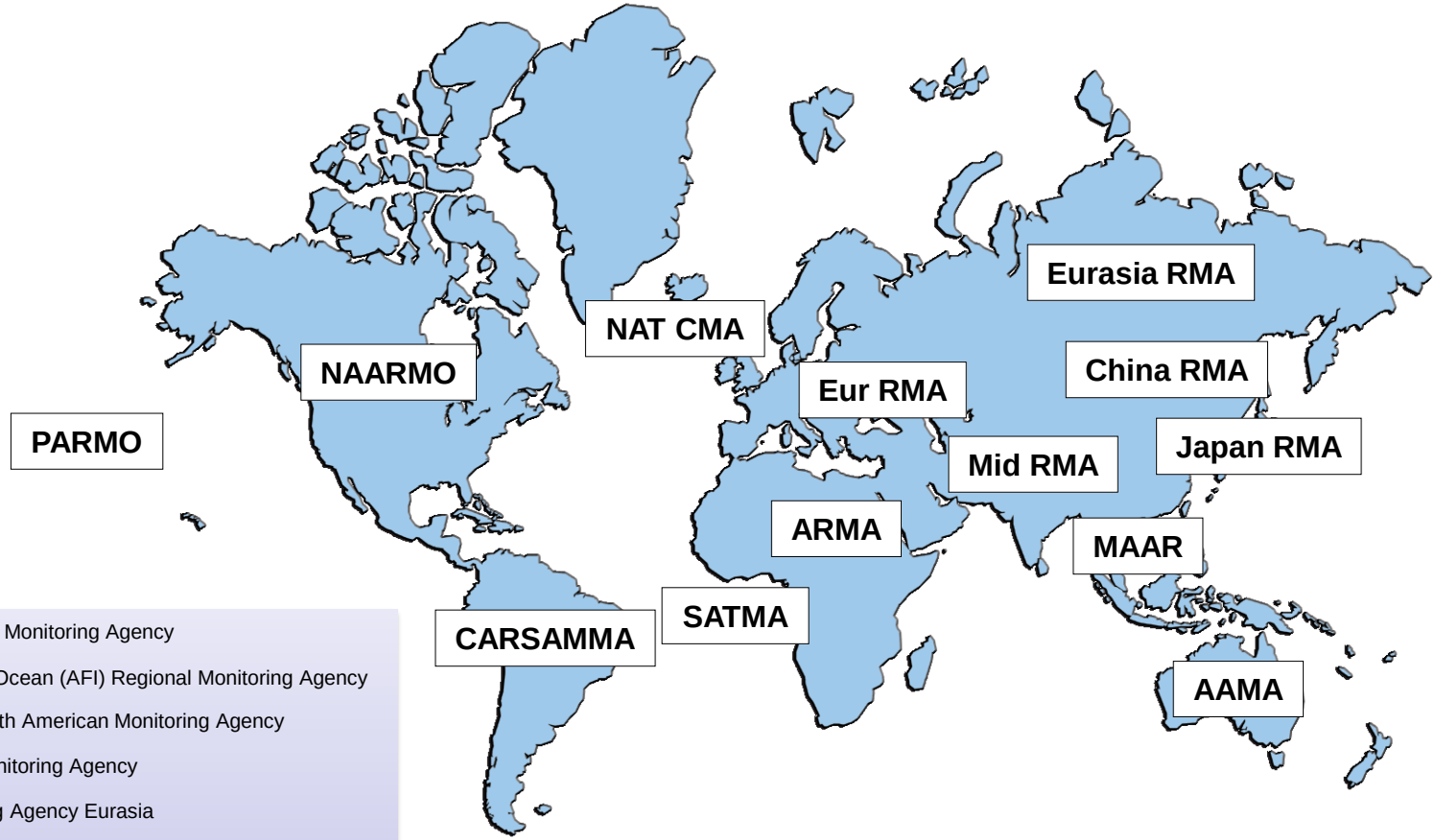
PBCS Aircraft Performance Monitoring Programs Monthly reporting

- Monthly monitoring processes being coordinated for ATSPs to compile and send reports for cases of airframe non-compliance to the relevant Regional Monitoring Agencies (RMAs)
- Focuses more on timely identification and investigation of non-compliant airframes
- To be effective, will rely on well defined processes and clear coordination between ATSPs, RMAs, State regulators, Operators

Non-compliance reporting

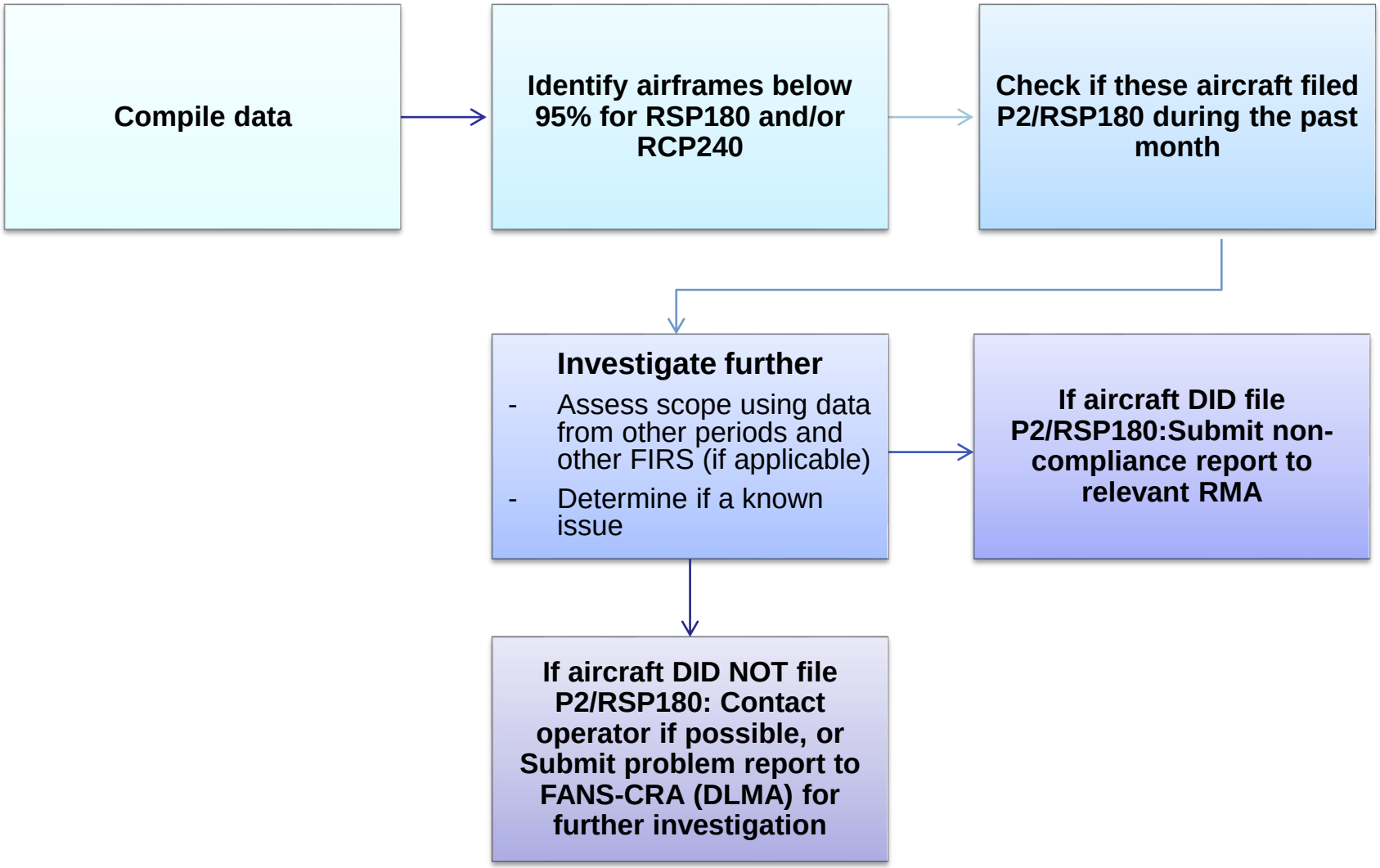


ICAO Endorsed Regional Monitoring Agencies (RMAs)



AAMA	Australian Airspace Monitoring Agency
ARMA	African and Indian Ocean (AFI) Regional Monitoring Agency
CARSAMMA	Caribbean and South American Monitoring Agency
China RMA	China Regional Monitoring Agency
EurAsia RMA	Regional Monitoring Agency Eurasia
Eur RMA	European Regional Monitoring Agency
Japan RMA	Japan Regional Monitoring Agency
MAAR	Monitoring Agency for Asia Region
Mid RMA	Middle East Regional Monitoring Agency
NAARMO	North American Approvals Registry and Monitoring Org
NAT CMA	North Atlantic Central Monitoring Agency
PARMO	Pacific Approvals Registry and Monitoring Organization
SATMA	South Atlantic Monitoring Agency

ATSP monthly monitoring process



Monthly non-compliance monitoring

Monitoring period: Jan-Mar 2020	
Airspace:	Oakland
Total aircraft observed using data link	2418
Have 100 or more ADS-C downlink reports and/or CPDLC transactions	1955
Observed below 95% for RSP180 and/or RCP240	46
Filed P2/RSP180	25

ATSP Investigation…

- **Check if performance issue occurred on one leg during monitoring period and was subsequently resolved**
- **Check media types of reports > 90 seconds (and reports before and after)**
  - Helps identify or confirm HF data link problems, media transition problems, specific media/path problem
- **Plot position reports and check locations of reports > 90 seconds**
  - Helps identify if delays occur in VHF/SAT or SAT/SAT transition areas, FIR boundaries
- **Check performance in 2 previous months**
  - Helps identify ongoing vs. new problems, scope of problem
- **Check estimated PORT if ACP < 95%**
  - *May* help identify abnormal pilot response behavior

FAA PBCS Analysis Tool

- **Platforms used**
  - Front end: Tableau
  - Data processing: Python
    - Input data: PBCS-formatted ACP and ASP files
- **Used to support investigations of non-compliant aircraft to determine cause, when possible, and whether a report should be generated**

Select Menu: ADS-C airframe report under 95%

Select a View 2: ADS-C Performance Und... / Filed ADS-C Performance

FIR Boundaries: (Multiple values)

Select a View 1: CPDLC performance by oper/actype / ADS-C by Path ID / Data

Select a (Map) View: Density Map / Lat/Long Points

DATE: 2/1/2020 – 3/31/2020

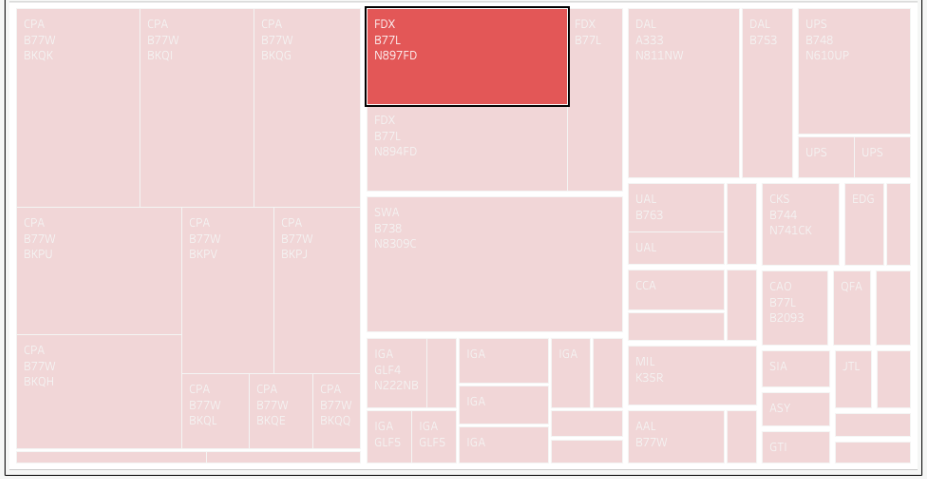
All airframes by media type

COMTYPE	ADS-C message downlink counts	95% RSP 180 benchmark ASP < 90 secs	99.9% RSP 180 benchmark ASP <= 180 sec
Aggregate	1,063	94.45%	96.14%
SAT	907	96.36%	97.91%
VHF	119	99.16%	100.00%
HF	37	32.43%	40.54%

COMTYPE	CPDLC Transaction counts	95% RCP 240 benchmark ACP <= 180 sec	99.9% RCP 240 benchmark ACP <= 210 sec
Aggregate	1,604	98.69%	98.94%
SAT	1,457	99.25%	99.38%
VHF	66	100.00%	100.00%
HF	13	53.85%	53.85%
HF-SAT	57	92.98%	96.49%
SAT-VHF	6	100.00%	100.00%
VHF-SAT	5	100.00%	100.00%

All Airframes Map

ADS-C airframe report under 95% by operator/aircraft type



Data of airframe report under 95% by operator/aircraft type

DATE	STIME	DEL (bin)	ACID	LAT	LONG	RGS	TYP	COMTYPE	ITV
2/7/2020	8:11:11 AM	3	FDX802	21.9717	-153.6817	ITOV	PER	VHF	9999
	8:19:20 AM	3	FDX802	22.2369	-152.4139	ITOV	PER	VHF	9999
	8:20:47 AM	283	FDX802	22.2831	-152.1878	H05	PER	HF	9999
	8:22:45 AM	392	FDX802	22.3503	-151.8828	AME1	WCE	SAT	9999
	8:24:00 AM	317	FDX802	22.4314	-151.7067	AME1	PER	SAT	9999
	8:27:44 AM	111	FDX802	22.6839	-151.1883	AME1	PER	SAT	9999
	8:30:23 AM	8	FDX802	22.8633	-150.8167	AME1	PER	SAT	9999
	8:40:00 AM	705	FDX802	23.5	-149.4739	H05	PER	HF	9999
	8:44:11 AM	582	FDX802	23.7742	-148.8833	H05	PER	HF	9999
	8:59:12 AM	771	FDX802	24.7261	-146.7756	H02	PER	HF	9999
	9:07:45 AM	463	FDX802	25.2447	-145.5842	H02	PER	HF	9999
	9:08:18 AM	430	FDX802	25.2772	-145.5078	H02	WCE	HF	9999
	9:08:48 AM	507	FDX802	25.3069	-145.4386	AME1	PER	SAT	9999
	9:18:24 AM	63	FDX802	25.865	-144.115	AME1	PER	SAT	9999
	9:28:00 AM	375	FDX802	26.4061	-142.7903	H02	PER	HF	9999
	9:32:23 AM	134	FDX802	26.6458	-142.1894	H02	PER	HF	9999
	9:37:37 AM	12	FDX802	26.9244	-141.4794	H02	PER	HF	9999
	9:47:13 AM	7	FDX802	27.4217	-140.1814	AME1	PER	SAT	9999
	9:56:49 AM	517	FDX802	27.8969	-138.8972	H02	PER	HF	9999
	9:57:09 AM	780	FDX802	27.9128	-138.8531	H02	WCE	HF	9999
	10:01:36 AM	513	FDX802	28.1247	-138.2658	H02	PER	HF	9999
	10:06:25 AM	719	FDX802	28.3472	-137.6392	H02	PER	HF	9999
	10:16:01 AM	608	FDX802	28.7811	-136.3839	H02	PER	HF	9999
	10:25:37 AM	847	FDX802	29.1994	-135.1294	H02	PER	HF	9999

PBCS ATSP Non-compliance Report Form	
Report Date:	7/27/2020
Period of observed non-compliance:	Jan-Mar 2020
Reporting Air Traffic Service Provider (ATSP):	FAA - Oakland
Contact email address(es) at Reporting ATSP:	FAAPBCSmonitoring@faa.gov
Reporting to Regional Monitoring Agency (RMA):	PARMO
ICAO CODE:	XXX
Airline Operator:	XXX Inc.
State of Operator/Registry:	United States

PBCS Data

FIR	4-letter ICAO Aircraft Type	Registration	ADS-C downlink Message Counts	95% RSP 180 Benchmark ASP <=90 sec	CPDLC Transaction Counts	95% RCP 240 benchmark ACP <=180 sec	Issue code
KZAK	B772	Reg 1	410	93.41%	25	96.00%	(*1)(*3)
KZAK	B772	Reg 2	290	94.48%	21	95.24%	(*1)

Issue code	Explanation	Recommendation(s)
(*1) Delayed reports around VHF/SAT transitions.	This note is used when ADS-C or CPDLC reports are observed with delays when there is mixed media usage in the sequence of reports before, at or after the delayed reports (ex.: VHF/VHF/SAT/VHF/SAT).	- Review "NAT OPS Bulletin 2019_003: Data Link Performance Improvement Options" and recommended solutions/actions (Problem/Issue #2).
(*2) Delayed reports via HF media.	This note is used when delayed ADS-C or CPDLC reports are observed to be delivered via HF data link (HFDL) or near reports delivered via HFDL. Check whether this appears to be a SATCOM failure with one flight or a period during the flight, or more continuous, intermittent use of HFDL. Potential issue with aircraft media priority settings.	- Review "NAT OPS Bulletin 2019_003: Data Link Performance Improvement Options" and recommended solutions/actions (Problem/Issue #1, #4, #9). - Review all Service Information Letters (SILs) and Software Bulletins (SBs) released from Satcom avionics manufacturers, particularly advice on Operator Requirement Table (ORT) set-up. - Operator should be aware that HFDL DOES NOT meet the RCP/RSP criterias for PBCS operations.
(*3) Delayed reports due to Inmarsat satellite to satellite transition (aircraft) or satellite problems (network).	This note is used when ADS-C or CPDLC reports are observed with delays and its noticed that there is a switch sequence between different or same Inmarsat satellite paths (Ex.: XXF/XXH/XXF/XXH). One known area where this occurs in the NAT is at 30W longitude. If multiple aircraft observed with same issue around same time, may be a network-related issue and ATSP may want to report to FANS-CRA/DLMA.	- Review all Service Information Letters (SILs) and Software Bulletins (SBs) released from Satcom avionics manufacturers, particularly advice on Operator Requirement Table (ORT) set-up. - Check with contracted Data Link Service Provider and Satellite Service Provider for possible coverage problems.
(*4) Delayed reports due to Iridium avionics (aircraft) or satellite problems (network).	This note is used when ADS-C or CPDLC reports are observed with delays via Iridium satellite paths (IG1, IGW1). If multiple aircraft observed with same issue around same time, may be a network-related issue and ATSP may want to report to FANS-CRA/DLMA.	- Check for SATCOM radio/unit problems.
(*5) Reported only on VHF and/or HF.	This note is used when delayed ADS-C reports or CPDLC messages are observed via VHF and/or HF only (no SATCOM). This might indicate that SATCOM unit is defective or became unavailable during flight. Check if this issue is observed during one flight or part of one flight only, or whether it is an ongoing problem. If not observed on subsequent flights, the issue may have been addressed.	- Operator should not declare PBCS if SATCOM not available. - Check for SATCOM radio/unit problems. - Flight crew should inform ATC if SATCOM becomes unavailable during flight.
(*6) Poor ACP due to high PORT.	This note is used when its found that the delayed CPDLC transactions are caused by high pilot operational response time (PORT).	- Review "NAT OPS Bulletin 2019_003: Data Link Performance Improvement Options" and recommended solutions/actions (Problem/Issue #6). - Review procedures to reduce pilot operational response time (PORT) to CPDLC messages.
(*7) Aircraft data link connection problems detected.	This note is used when we can identify that delays happened on periods that disconnections and reconnections have been performed. Check whether this appears to be a problem with one flight or a period during one flight, or whether it is an ongoing problem. If problem is not observed on later flights, the issue may have been addressed.	- Review "NAT OPS Bulletin 2019_003: Data Link Performance Improvement Options" and recommended solutions/actions (Problem/Issue #8 unknown cause).
(*8) Delays related to specific VHF station.	This note is used when the delayed ADS-C reports and CPDLC messages are observed via a specific VHF ground station. If multiple aircraft observed with same issue, ATSP may want to report to FANS-CRA/DLMA as a VHF station issue.	- Review "NAT OPS Bulletin 2019_003: Data Link Performance Improvement Options" and recommended solutions/actions (Problem/Issue #2).
(*9) FMS time before ATC uplink time. Clock setting not syncronized with GPS.	This note is used when its found that the FMS response time is earlier than the ATC uplink time. According to aircraft manufacturers this happens when clock is set manually and not being set by synchronization with GPS source.	- Review procedures for clock settings to be set to GPS clock instead of manual set of clock.

Top cause for non-compliance: VHF/SAT transition areas

- **Aircraft flying on routes with higher concentrations of VHF/SAT transition areas typically observed with lower performance**
- **Mitigations have been provided by OEMS – important to consult for solutions available for specific aircraft types**
  - Some aircraft have software updates available that have implemented changes to timer values that improve media transition performance

Questions for consideration

- **Do the areas where higher concentrations of delays greater than 90 sec correlate to areas where:**
  - Route systems/oceanic entry points are located?
  - Performance-based separations are applied?
- **Can these parts of airspace be considered compliant with RCP240/RSP180?**
- **Do controllers commonly experience issues connecting to or getting timely surveillance and com responses from aircraft in those areas?**
  - How do we assess and mitigate the impacts of VHF/SAT transition areas on controller workload/aircraft performance?
- **Do we have to change how we factor these areas into PBCS monitoring analysis?**

Summary

- **Semi-annual regional reporting in ongoing**
  - Provide operators/regulators periodic snapshots of overall performance
  - Operators can reach out to ATSP monitoring contacts for more details and further investigation when “red” or “yellow” performance is observed
- **Monthly reporting processes are in progress**
  - Focuses on identifying non-compliance in a more timely manner and involves additional level of investigation by ATSPs
  - Some RMAs/EMAs have started to send out reports
- **VHF/SAT transitions observed to be top cause for poor performance**
  - Different mitigations available depending on aircraft type – important to consult OEM for guidance
  - Further discussion by all stakeholders needed to address this ongoing challenge

Questions