

Global Operational Data Link Document

Introduction to RCP and RSP

Presented to: Asia/Pac Data Link
Performance
Monitoring Seminar

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Date: 27-28 March 2013



Federal Aviation
Administration



GOLD

Overview

- **Global Operational Data Link Document**
- **ATS data link provision and operator readiness**
- **RCP – RSP concept assumptions and premises**
- **RCP – RSP specifications, parameters and values**
- **RCP – RSP compliance determination**
- **Summary**



GOLD introduction

- **In June 2010, the North Atlantic (NAT) and Asia-Pacific (APAC) Regions endorsed the use of the Global Operational Data Link Document (GOLD), First Edition**
- **The GOLD now supersedes both the**
 - NAT Data Link Guidance Material and
 - FANS 1/A Operations Manual (FOM)



GOLD contents

| | | |
|-----------------------|---|--------------------|
| Information | Background | Foreword |
| | Definitions of terms / acronyms | Chapter 1 |
| | Data link general familiarization | Chapter 2 |
| Guidelines | Data link service provision | Section 3.1 |
| | Operator – aircraft preparation | Section 3.2 |
| | Controller – flight crew procedures | Chapters 4-7 |
| Supporting Guidelines | CPDLC message sets / standardized free text | Appendix A |
| | RCP – RSP specifications | Appendices B and C |
| | Post-implementation monitoring | Appendix D |
| | Region/State & aircraft specifics | Appendices E and F |



GOLD availability

- **GOLD, 1st Edition, is available without need for user ID or password and free of charge on the following web sites:**
 - <http://www.ispacg-cra.com>
 - http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/data_link/
- **GOLD, v1.5 FINAL DRAFT, is available now on**
 - ICAO Portal Website – GOLD Working Group – GOLD Folder
 - Contact ICAO EUR-NAT Regional Office



GOLD application

- **GOLD is a very significant step towards the global harmonization of ADS-C and CPDLC procedures for pilots and air traffic controllers**
- **Amendment program will allow GOLD to be applicable to existing and new data link implementations throughout the world**
 - Nov 2010 – Program established to support EANPG
 - Apr 2013 – Issue GOLD, 2nd Edition



EUR Region plans to endorse GOLD

- **Amendments were needed to support EUR Region, which included implementing rule for data link services (LINK 2K+)**
 - Operational differences – airspace where ATS surveillance services are provided (domestic) versus airspace where procedural separations are applied (oceanic and remote)
 - Technical differences - ATN B1 versus FANS 1/A
- **Ensure amendments are globally acceptable**



Participating ICAO Regions

- **Bangkok – Asia / Pacific (A-PAC) Regions**
- **Paris (EUR-NAT) – European / North Atlantic Regions**
- **Lima (SAM) – South American Region**
- **Dakar (AFI) – African – Indian Ocean Region**
- **Mexico (CAR) – Caribbean Region**
- **And also North American (NAM) Region**



Other participation

- **ICAO Montreal - Headquarters (e.g. OPLINKP)**
- **IATA, IFALPA and operators / pilots**
- **CANSO, IFATCA, ANSPs and controllers**
- **IBAC, IGA and general aviation community**
- **ATS system suppliers**
- **Aircraft manufacturers and equipment suppliers**
- **CSPs and satellite service providers (SSPs)**
- **Others**



GOLD Working Group

- 120+ GOLD website subscribers
- 56 different organizations from 27 different countries

| | | |
|-----------|-------------------|----------------------|
| AUSTRALIA | MALAYSIA | RUSSIAN FEDERATION |
| BELGIUM | MEXICO | SENEGAL |
| CANADA | NETHERLANDS | SINGAPORE |
| FRANCE | NEW ZEALAND | SPAIN |
| GERMANY | OMAN | THAILAND |
| ICELAND | PERU | TUNISIA |
| ITALY | PORTUGAL | UNITED ARAB EMIRATES |
| JAPAN | REPUBLIC OF KOREA | UNITED KINGDOM |
| LIBYA | ROMANIA | UNITED STATES |

Activity since GOLD 1st Edition

- **10-14 Oct 2011 – GOLD/4 in Paris, France – 27**
 - 21 Oct 2011 – GOLD v1.1 Working Draft
- **9 May 2012 – GOLD Web 4.1 - 17**
 - 14 May 2012 – GOLD v1.2 Working Draft
- **10-15 Jun 2012 – GOLD/5 in Miami - 28**
 - 30 Jun 2012 – GOLD v1.3 Working Draft
- **17 Oct 2012 – GOLD Web 5.1 - 23**
 - 4 Nov 2012 – GOLD v1.4 Working Draft
 - 18 Jan 2013 – GOLD v1.4.1 Working Draft
- **28 Jan to 4 Feb 2013 – GOLD/6 in Phoenix – 38**
 - 4 Feb 2013 – GOLD v1.4.4 Working Draft
 - 16 Feb 2013 – GOLD v1.5 Final Draft

GOLD, 2nd Edition, trailer (1 of 2)

- **Applies to all airspace**
 - Where procedural separations are applied
 - Where ATS surveillance services are provided
- **Applies to FANS 1/A, ATN B1 and FANS 1/AATN B1 aircraft and ground systems**
 - Generalized Chapter 2 data link description
 - Common procedures (for most part) in Chapter 4-6
- **Addresses High Level Safety Conference (HLSC) recommendations**



GOLD, 2nd Edition, trailer (2 of 2)

- **Added advanced air traffic services supported by data link**
 - CPDLC for ATC-initiated re-route procedure
 - CPDLC for ADS-B in trail procedure (ITP)
- **Clarified position reporting requirements in ADS-C environments, e.g. reporting revised time estimates**
- **Updated Appendix E, Region / State specifics, with new look and includes European Region**
- **Includes guidance on RCP – RSP specifications and post-implementation monitoring**



What's left to do?

- **15 March 2013 – 30 day review and comment period on GOLD v1.5 ends**
- **15 March to 15 April 2013 – Resolve comments**
- **15 April 2013 – Issue GOLD, 2nd Edition**



GOLD, 2nd Edition, endorsement

- **North Atlantic – NAT SPG – Jun 2013**
- **Asia – Pacific – APANPIRG – Sep 2013**
- **European – EANPG - Nov 2013**
 - Propose to supersede LINk2000+ guidance docs
- **South American – SAM/IG – Oct 2013**
- **African – Indian Ocean – APIRG – Mar 2014**



Summary

- **GOLD continues to provide global basis for global harmonization of data link operations**
- **GOLD is proving to be a significant activity to converge data link implementations worldwide**
- **GOLD embraces performance based concept for communication and surveillance capabilities**
- **We all need to participate and contribute**



GOLD – Chapter 3

ATS data link provision and Operator readiness

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Introduction – GOLD, Chapter 3

- **ATS CPDLC and ADS-C data link service provision**
- **Operator readiness**
- **Flight Planning**
- **Additional – Flight management computer waypoint position reporting (FMC WPR)**



Validation of ATS provision

- **Managing safety – system safety**
- **Confirming active CPDLC connection – CDA**
- **Using free text**
- **Complying with interoperability, safety and performance standards (GOLD, Apx B, C & D)**
- **Establishing procedures (GOLD, Chapter 4)**
- **Establishing training/qualification programs**



ATC automated data link functions

- **Correlating logon request with flight plan**
- **Managing CPDLC connections/transfers**
- **Managing ADS contracts and reports**
- **Processing emergency messages**
- **Automating responses, including those for unsupported messages**
- **Processing abnormal behavior of system**



Contractual considerations for CSP

- **Performance of communication services**
 - GOLD, Appendices B and C
- **Data link message delivery, including messages from non-contracted operators**
- **Notification of communication service degradation, outages, maintenance and restoration**
- **Monitoring and data retention requirements**



Interfacility agreements

- **CPDLC connection transfers**
 - Additional considerations for aircraft transiting small data link area
- **ADS contract management with neighboring control areas**
- **Voice frequency assignment by CPDLC**



Aeronautical information (1 of 2)

- **Notification of air traffic data link services**
 - Area of applicability
 - Special considerations, limitations, restrictions
 - Prescription of RCP/RSP specifications
 - Operator requirements, including aircraft equipage
 - Flight crew position and revised time estimate reporting via CPDLC, HF voice or
 - ADS contracts (periodic interval and event)
 - Flight plan requirements



Aeronautical information (2 of 2)

- **Once ANSPs have notified operators of air traffic data link service, then ANSP should issue notification(s) of service status, including**
 - Degradation
 - Outages
 - Maintenance
 - Restoration



Monitoring and data recording

- **Post-implementation monitoring**
 - Annex 11, paragraph 2.27.5
 - GOLD, Appendix D
- **Data retention – 30 days**
- **CSP monitoring and data retention**
 - contractual consideration



Operator eligibility (1 of 2)

- **Operational authorization with the State of Registry or State of the Operator**
 - Procedures (GOLD, Chapter 5)
 - Flight crew training and qualification,
 - Aircraft maintenance,
 - Minimum Equipment List (MEL)
 - User modifiable software (e.g. ORT)
 - Service agreements with the CSP
 - Aircraft equipment approved for intended use



Operator eligibility (2 of 2)

- **Regional/State Data Link Monitoring Agencies**
 - Establish procedures for flight crew and operations staff to report problems
 - Provide contact information and participate in problem investigations

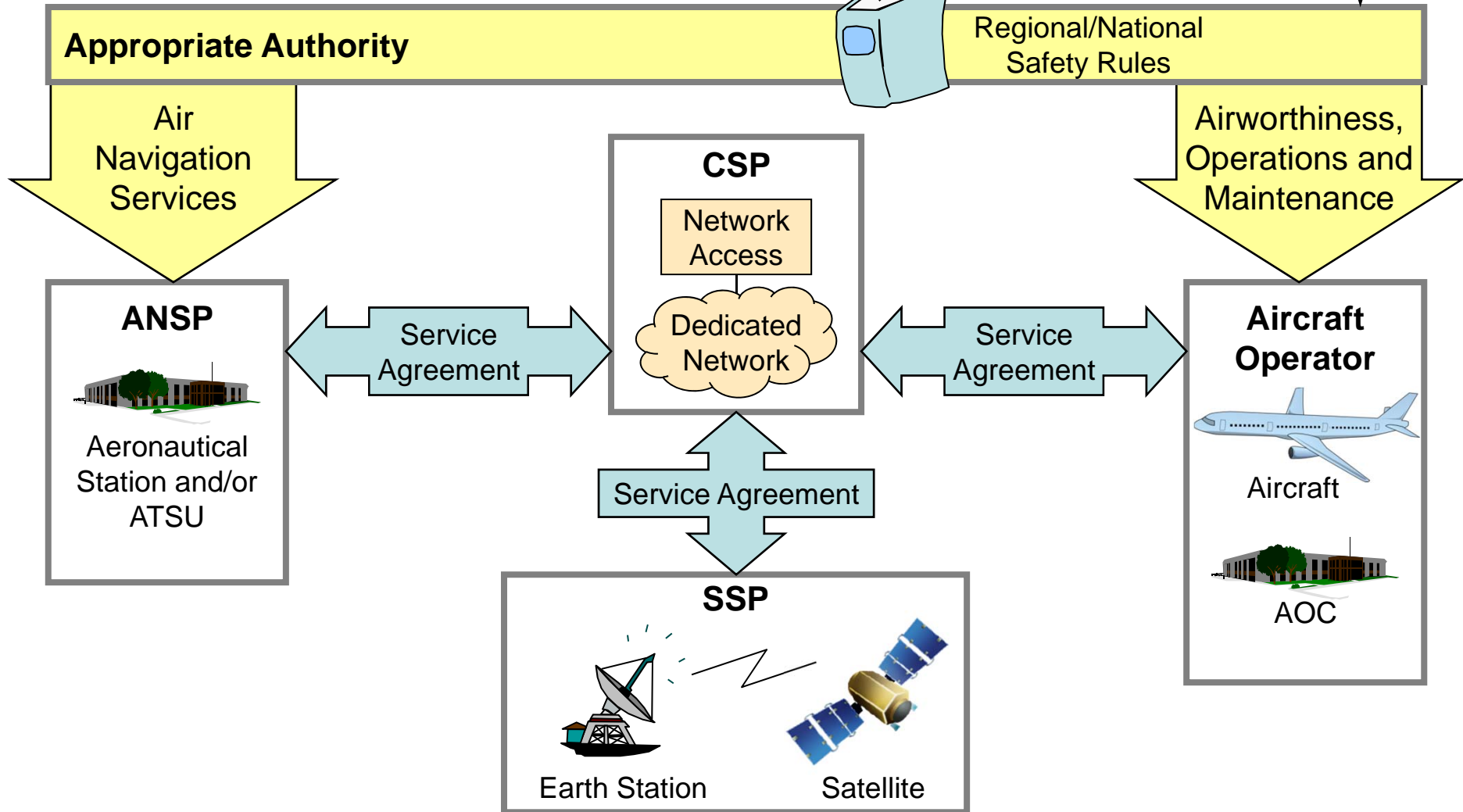
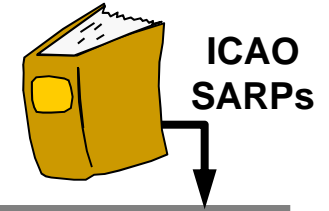


Flight plan

- **The ANSP needs to publish its policies, procedures or any special circumstances applicable in individual State and/or FIRs**
 - (e.g. Regional SUPPs, AIP and/or equivalent publication)
- **The operator needs to**
 - Ensure that the planned use of data link for the flight will be in accordance with appropriate aeronautical information publications
 - File the flight plan in accordance with ICAO Doc 4444, Appendix 2, and appropriate aeronautical information publications



Safety oversight framework



Summary

- **Good planning and ensuring controls are in place will aid successful implementation**
 - Validation of air traffic data link services
 - ATC automated data link functions
 - Service agreements for communication services
 - Interfacility agreements
 - Regional SUPPs and AIPs – Notifications
 - Monitoring and data recording
 - Operator eligibility



Performance based communication and surveillance

RCP – RSP concept assumptions and premises



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Application of RCP – RSP

Can mean different things

- **Air traffic services (ATS) provision and prescription**
- **Operator authorization**
- **Post-implementation monitoring, analysis, and corrective action, as appropriate**



Application of RCP – RSP

What it means in terms of ATM initiatives

- **Data link operations**
- **Reduced separation minima**
 - Air traffic services (ATS) provision and prescription
 - Operator authorization
 - Post-implementation monitoring
- **Other applications, where beneficial**



RCP basis (SARPs and PANS)

- **Annex 11 (SMS, RCP prescription and ATS system)**
- **Annex 6 (Operational authorization)**
- **Doc 4444 (Reduced separation minima and flight plan requirements)**
- **Doc 7030 and related AIPs (or equivalent publication)**

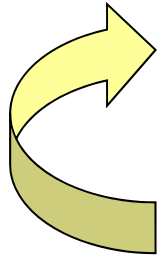
**RSP basis in work
by OPLINKP**



RCP – RSP guidance material

Where to find more information

Currently
“Manual
on RCP”



September 2013 – Performance Based Communication and Surveillance Manual (Doc 9869)

15 April 2013 – GOLD, 2nd Edition

- **Safety and Performance Standards**
 - Oceanic SPR Standard - RTCA DO-306/EUROCAE ED-122
 - Continental SPR Standard – RTCA DO-120/EUROCAE ED-120
- **Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications (RTCA DO-264/EUROCAE ED-78A)**

**RSP in work by
OPLINKP and
GOLD Working Group**



Interoperability Standards

- **Interoperability standards allow choices that can affect operational performance**
 - Different technologies
 - Different implementations



Performance based communication and surveillance

**RCP – RSP
specifications,
parameters and values**



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RCP 240 – RSP 180 specifications

- **Provided in GOLD (same as RTCA DO306 / EUROCAE ED122, but augmented)**
 - RCP 240 operational requirement (ICAO Doc 9869)
 - RCP 240 – RSP 180 time requirements based on standards for application of 30 and 50 NM longitudinal separation minima (ICAO Doc 4444)
 - RCP 240 – RSP 180 continuity, availability and integrity requirements based on operational safety assessment (RTCA DO-264 / EUROCAE ED-78A)



RCP 240 – RSP 180 time requirements

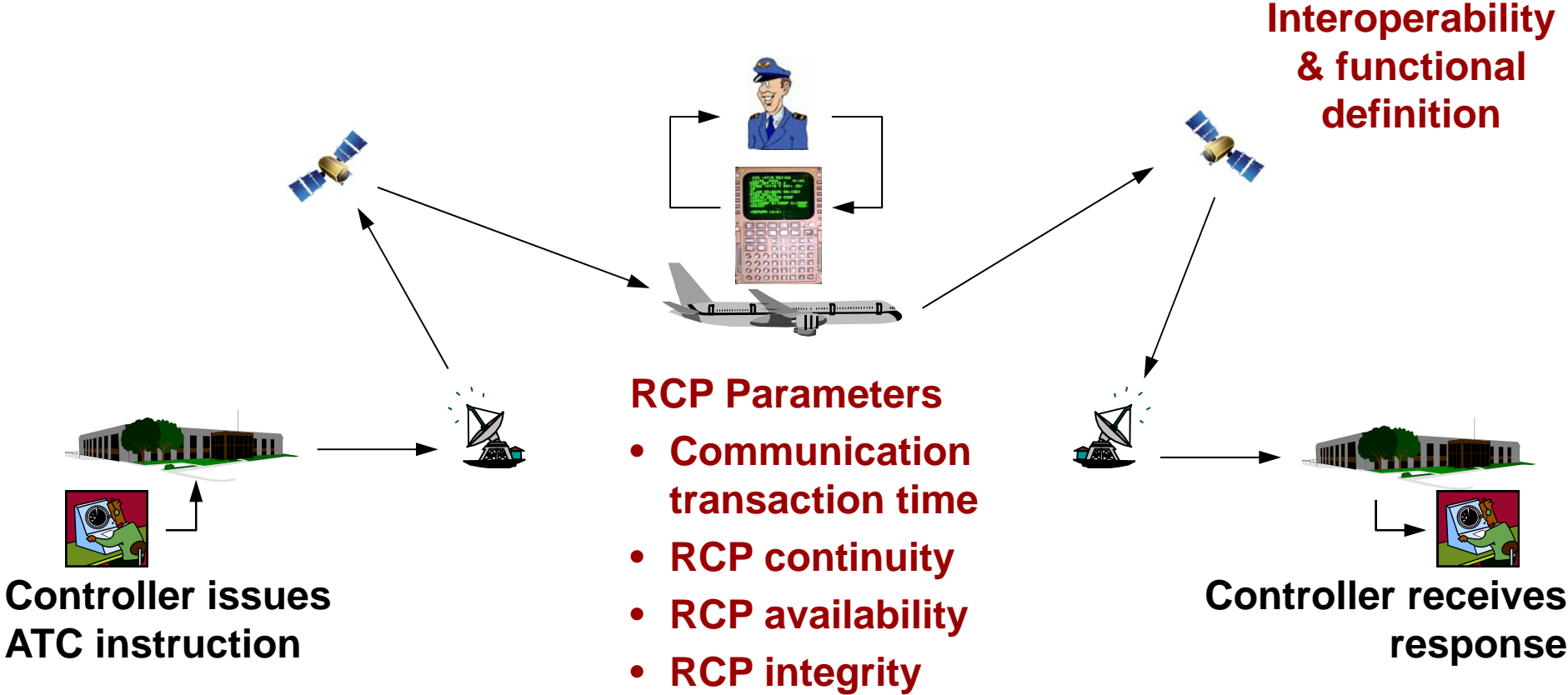
- **Doc 4444 – 30 and 50 NM longitudinal separation**

- 5.4.2.6.4.3.2 The communication system provided to enable the application of the separation minima in 5.4.2.6.4.3 shall allow a controller, within 4 minutes, to intervene and resolve a potential conflict by contacting an aircraft using the normal means of communication. ...
- 5.4.2.6.4.3.3 When an ADS-C periodic or waypoint change event report is not received within 3 minutes of the time it should have been sent, the report is considered overdue and the controller shall take action to obtain the report as quickly as possible, normally by ADS-C or CPDLC. ...

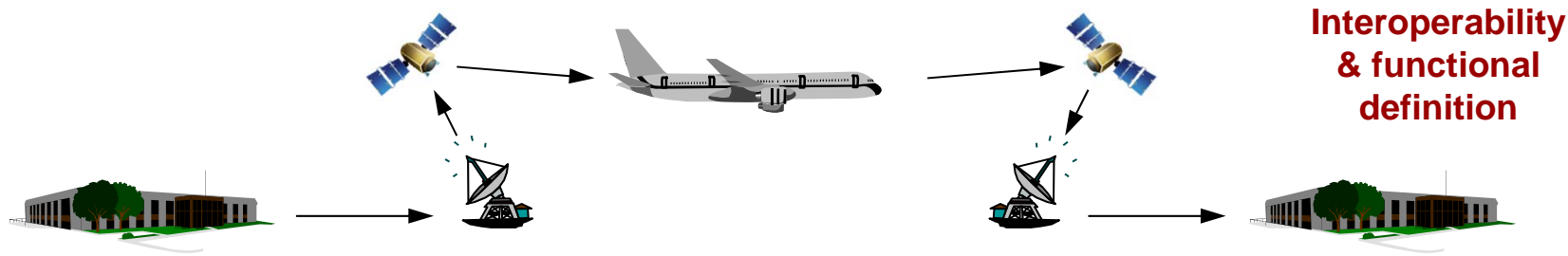


RCP 240 specification

Applies to controller's intervention capability



RCP 240 time and continuity

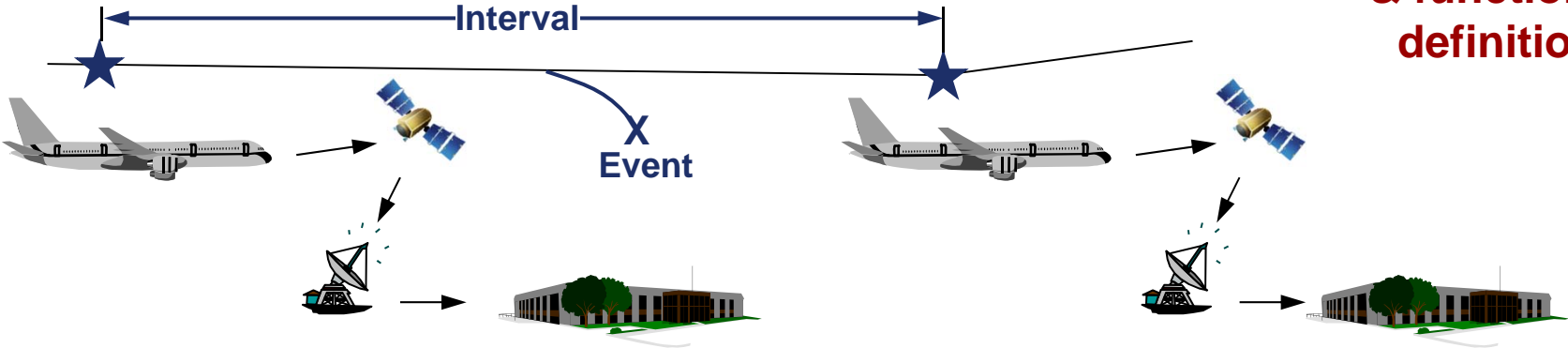


| | | RCP specification (communication transaction time) | | | | | | | | |
|-------|---------------------------------------|--|--------|-----------------|----------------------|-----------------|--------|-------------|--|-----|
| RCP | 240 | | | | | | | | | RCP |
| | Controller composes and sends message | ← Operational Performance (Monitored) → | | | | | | | Controller receives indication and confirms response | |
| | | Communication transaction time | | | | | | | | |
| 99.9% | Part of 30 | 210 | | | | | | | Part of 30 | ET |
| 95% | Part of 30 | 180 | | | | | | | Part of 30 | TT |
| | | RCTP (Ground to Air) | | PORT | RCTP (Air to Ground) | | | | | |
| 99.9% | | P(150) | | 60 | P(150) | | | | 99.9% | |
| 95% | | P(120) | | 60 | P(120) | | | | 95% | |
| | | ATSU system | CSP | Aircraft system | | Aircraft system | CSP | ATSU system | | |
| 99.9% | | P(15) | P(120) | P(15) | | P(15) | P(120) | P(15) | 99.9% | |
| 95% | | P(10) | P(100) | P(10) | | P(10) | P(100) | P(10) | 95% | |

RSP 180 specification

Applies to surveillance data

Time at position



RSP Parameters

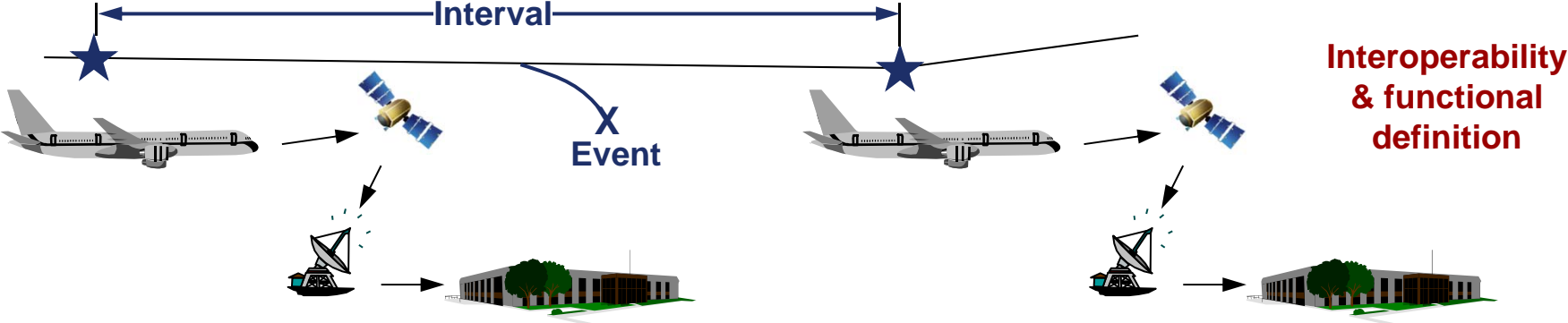
- Surveillance data transit time
- RSP continuity
- RSP availability
- RSP integrity



ATSU/controller receives the surveillance data



RSP 180 time and continuity



| RSP specification (surveillance data transit time) | | | | | | |
|--|---|--|-----|------------------------------------|-------|----|
| RSP | 180 | | | | RSP | |
| | Time at position (RNP at +/-1 sec UTC) | Operational Performance (Monitored) | | ATSU receives surveillance data | | |
| | | Surveillance data transit time | | | | |
| 99.9% | | 180 | | | | OD |
| 95% | | 90 | | | | DT |
| | | Aircraft system | CSP | ATSU system | | |
| 99.9% | | 5 | 170 | 5 | 99.9% | |
| 95% | | 3 | 84 | 3 | 95% | |



RCP 240 – RSP 180 availability

- **RCP 240 – RSP 180 aircraft availability requirement**
 - 0.999 availability – a single system can meet requirement
 - Carriage requirements for multiple communication radios are typically specified only for voice communications
- **RCP 240 – RSP 180 communication services availability requirements are as follows**

| RCP 240 – RSP 180 availability requirements | | | |
|--|------------|--------|----------------------------------|
| Availability parameter | Efficiency | Safety | Compliance means |
| Service availability (A_{CSP}) | 0.9999 | 0.999 | Contract/service agreement terms |
| Unplanned outage duration limit (min) | 10 | 10 | |
| Maximum number of unplanned outages | 4 | 48 | |
| Maximum accumulated unplanned outage time (min/yr) | 52 | 520 | |
| Unplanned outage notification delay (min) | 5 | 5 | |

Note.— DO 306/ED 122 specifies a requirement to indicate loss of the service. Unplanned outage notification delay is an additional time value associated with the requirement to indicate the loss to the ATS provider per the RCP/RSP related safety requirement (SR) 4 for the ANSP.

RCP 240 – RSP 180 integrity

- **RCP 240 – RSP 180 provide safety requirements for the components of the operational system**
 - Integrity issues discovered post-implementation are reported to the appropriate Regional/State monitoring agency and/or authorities for appropriate action
- **For RSP 180, the integrity criteria include accuracy of navigation position data and time at the position provided in the surveillance data (e.g., RNP 4 at +/- 1 sec UTC)**

| RCP 240 – RSP 180 availability requirements | | |
|---|---|---|
| Integrity parameter | Integrity value | Compliance means |
| Integrity (I) | Malfunction = 10^{-5} (per flight hour) | Analysis, safety requirements, development assurance level commensurate with integrity level, (compliance shown prior to operational implementation). See also RCP related safety requirement <u>SR-26</u> for the ATSP. CSP contract/service agreement. See also RCP integrity criteria for CSP, <u>paragraph B.2.1.2.</u> |



RCP 400 – RSP 400 (1 of 2)

- **Characterizes minimum performance of traditional systems; intended for new systems in current operations (e.g. CPDLC, ADSC, and SATVOICE)**
- **Doc 9869 and DO-306/ED-122 criteria – derived from Doc 4444**
 - 5.4.2.6.4.3.2 ... An alternative means shall be available to allow the controller to intervene and resolve the conflict within a total time of **10½ minutes**, should the normal means of communication fail.
 - 5.4.2.6.4.3.3 ... If a report is not received within **6 minutes** of the time the original report should have been sent, and there is a possibility of loss of separation with other aircraft, the controller shall take action to resolve any potential conflict(s) as soon as possible. The communication means provided shall be such that the conflict is resolved within a further **7½ minutes**.
 - Informal survey of participating ANSPs on when a response is late and when position report is overdue



RCP 400 – RSP 400 (2 of 2)

RCP 400 – RSP 400 specifications are the same as RCP 240 – RSP 180 specifications, except for:

| RCP – RSP parameter | RCP 400 | RCP 240 | RSP 400 | RSP 180 |
|---|---------|---------|----------------|---------------|
| Communication transaction time (seconds) | | | | |
| ET for communication transaction time | 400 | 240 | | |
| TT for communication transaction time | 350 | 210 | | |
| Surveillance data transit time (seconds) | | | | |
| OD for surveillance data report | | | 400 | 180 |
| DT for surveillance data report | | | 300 | 90 |
| Availability = 0.999 | | | | |
| Unplanned outage duration limit (minutes) | 20 min | 10 min | 20 min | 10 min |
| Integrity | | | | |
| Time accuracy requirement, per SVG M (proposed GOLD change) | | | +/- 30 sec UTC | +/- 1 sec UTC |

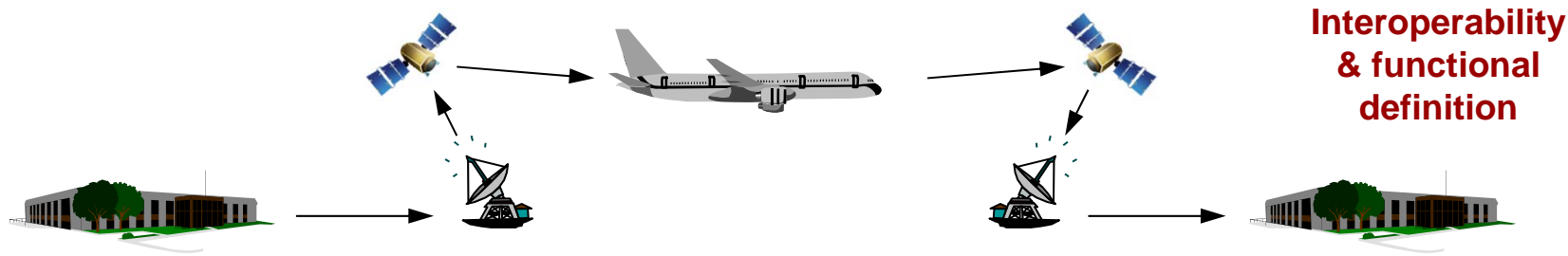


[New] RCP 150 specification

- **Planned for GOLD, 2nd Edition**
- **Based on Continental SPR (ED-120/DO-290)**
- **Intended to be applicable to communication performance in airspace where ATS surveillance services are provided**
 - Controller-initiated transactions
 - Flight crew-initiated transactions
 - Data link initiation capability

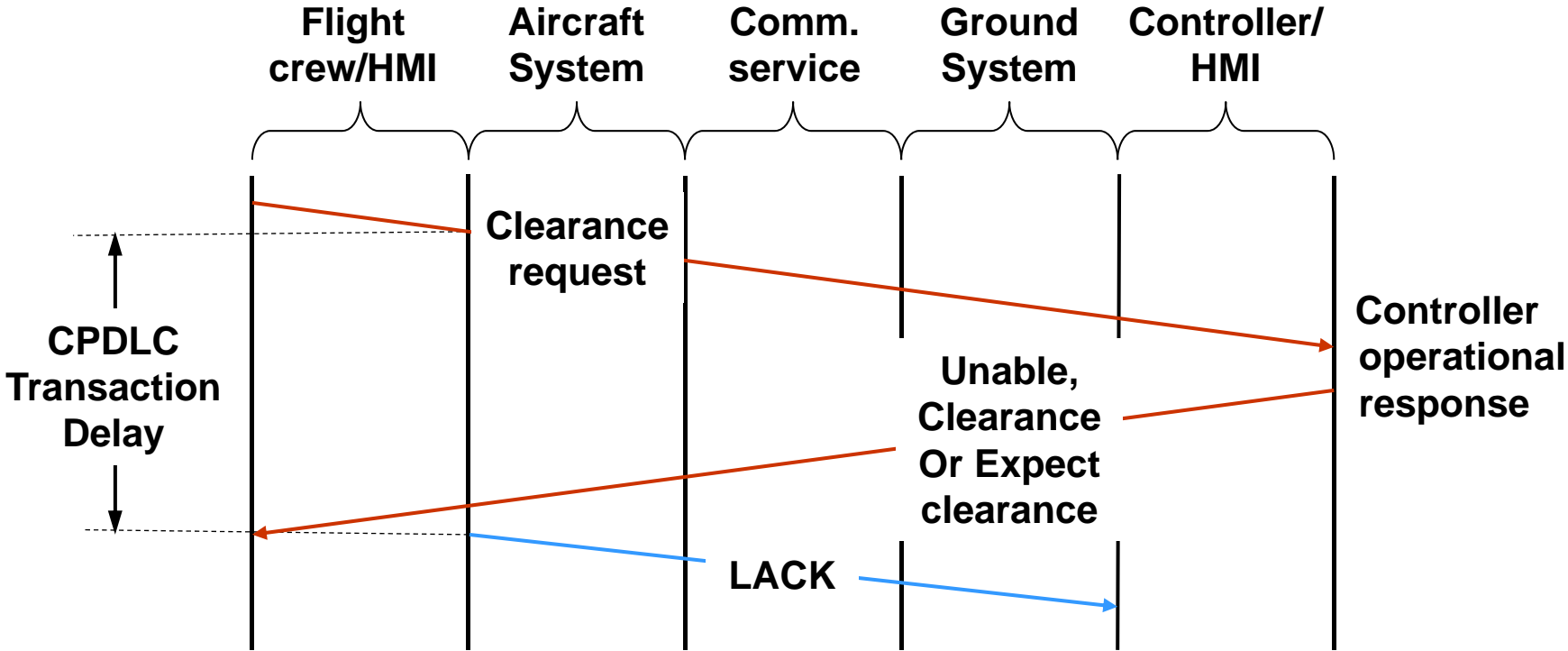


RCP 150 time and continuity

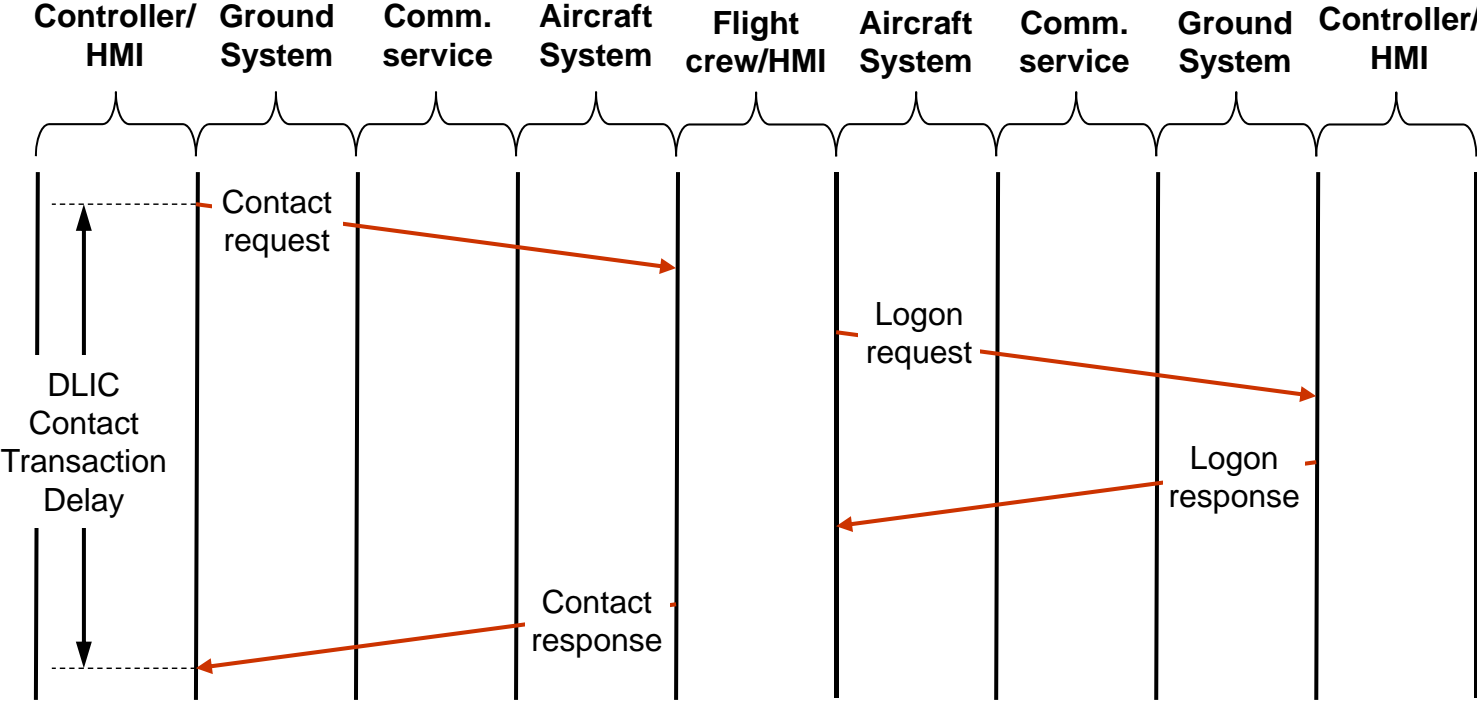


| | | RCP specification (communication transaction time) | | | | | | | | |
|-------|---------------------------------------|--|-------|-----------------|----------------------|-----------------|-------|-------------|--|-----|
| RCP | 150 | | | | | | | | | RCP |
| | Controller composes and sends message | ← Operational Performance (Monitored) → | | | | | | | Controller receives indication and confirms response | |
| | | Communication transaction time | | | | | | | | |
| 99.9% | Part of 30 | 120 | | | | | | | Part of 30 | ET |
| 95% | Part of 30 | 60 | | | | | | | Part of 30 | TT |
| | | RCTP (Ground to Air) | | PORT | RCTP (Air to Ground) | | | | | |
| 99.9% | | P(20) | | 100 | P(20) | | | | 99.9% | |
| 95% | | P(16) | | 44 | P(16) | | | | 95% | |
| | | ATSU system | CSP | Aircraft system | | Aircraft system | CSP | ATSU system | | |
| 99.9% | | P(14) | P(14) | P(6) | | P(6) | P(14) | P(14) | 99.9% | |
| 95% | | P(12) | P(12) | P(4) | | P(4) | P(12) | P(12) | 95% | |

Flight crew-initiated transaction

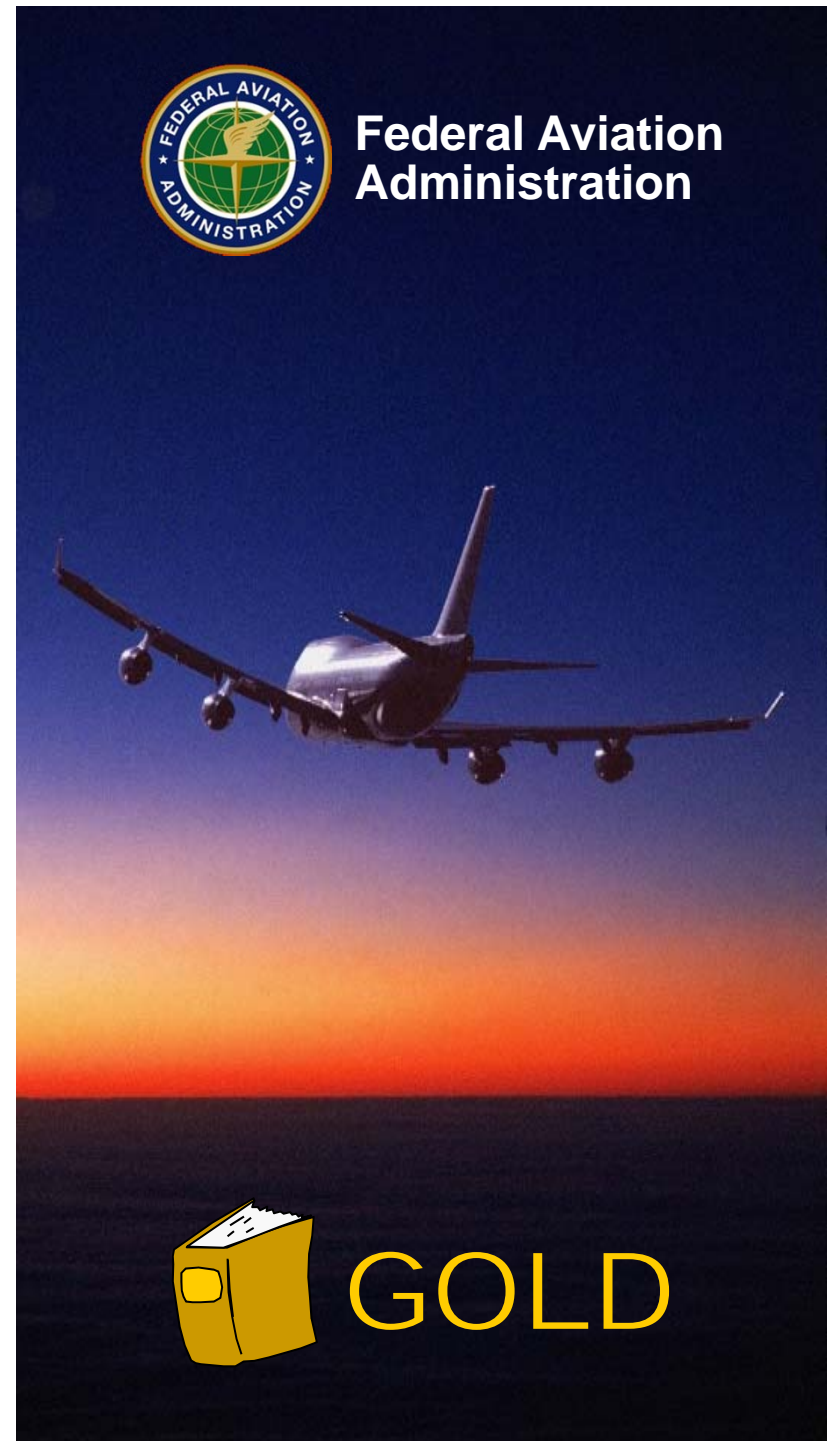


Data link initiation transaction



Performance based communication and surveillance

RCP – RSP compliance determination



Compliance determination – initial

ATS Provision

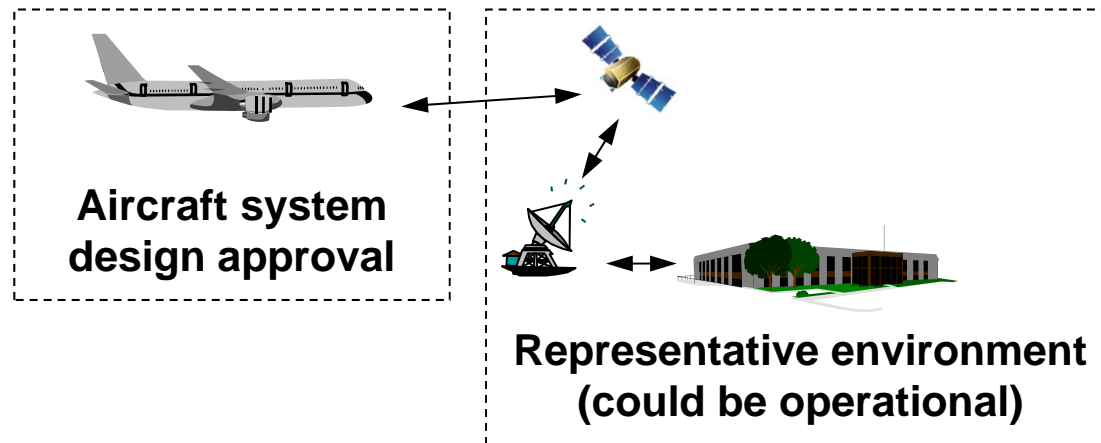
- **Consistent with SMS practices, ANSP specifies and prescribes appropriate safety requirements and ensures systems meet requirements; GOLD and RCP – RSP specifications provide criteria for ATS provision**
 - ATC system design and procedures
 - Controller and other ATS staff training, as appropriate
 - Contractual arrangements/service agreements with CSP(s)/SSP(s)
 - Operational trials
 - Notification of data link services, operator requirements, including aircraft equipage
 - Contingency and restoration of service procedures



Compliance determination – initial

Aircraft/avionics manufacturer

- Aircraft/avionics manufacturer obtains design approval, as appropriate, in accordance with National regulations; GOLD and RCP – RSP specifications provide criteria for avionics
- Aircraft/avionics manufacturer demonstrates operational performance with a representative ATS provision
- Demonstrations cannot be practically exhaustive



Compliance determination – initial

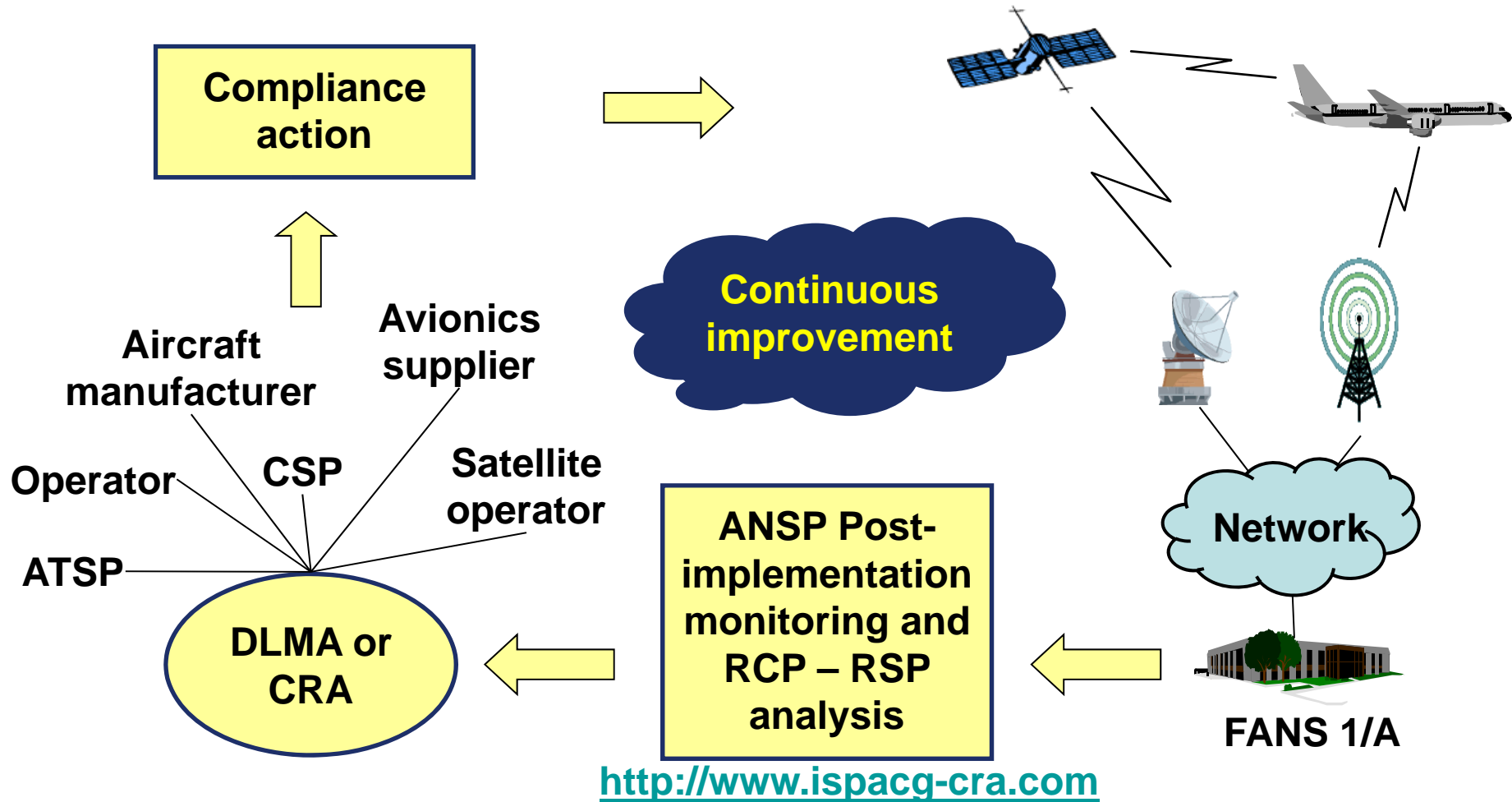
Operator

- **Operator obtains operational authorization, as appropriate, in accordance with National regulations; GOLD and RCP – RSP specifications provide criteria for operations and maintenance**
 - Contractual arrangements/service agreements with CSP(s)/SSP(s)
- **Operator demonstrates 6 months of acceptable RCP/RSP performance for the aircraft types in their fleet**
- **If substandard performance, ANSP and/or State of the Operator or State of Registry issues corrective action notice**
 - Considers severity of the deficiency and magnitude of the change
- **If non-compliance remains after the date indicated in the corrective action notice State of the Operator or State of Registry could remove the RCP [X] – RSP [Y] authorization**
 - The operator may still use CPDLC and ADS-C



Compliance determination – continued

Ways to manage change and performance

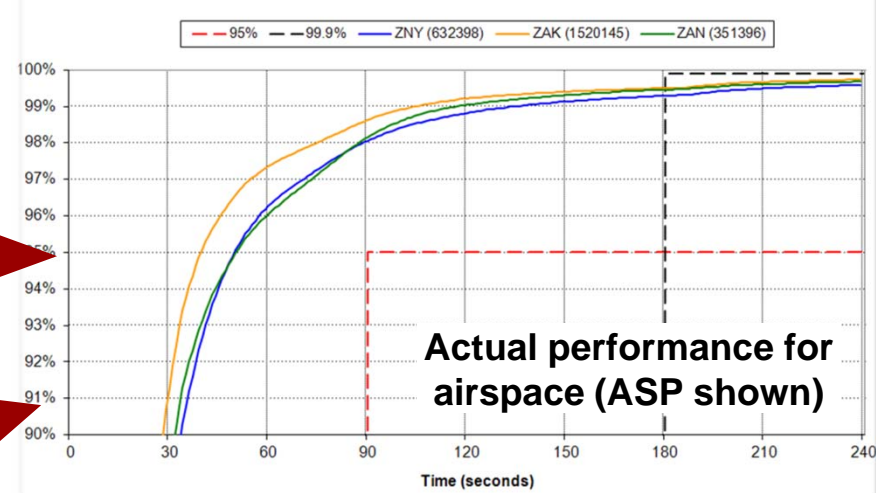
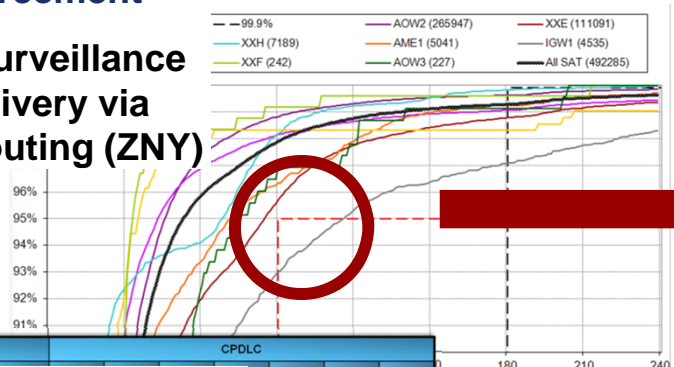


Compliance determination – continued

Ways to manage acceptable performance

CSP agreement

ASP for surveillance data delivery via different routing (ZNY)



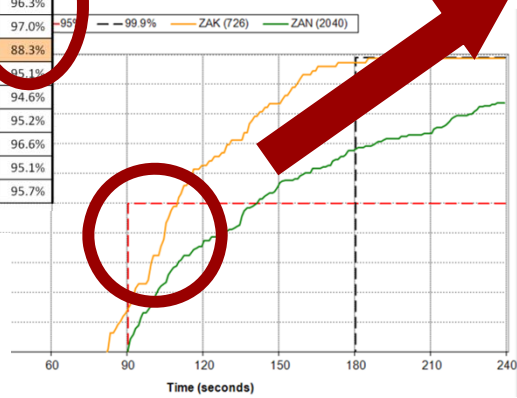
Actual performance for airspace (ASP shown)

| Operator Code | ADS-C | | CPDLC | | | | | | | | |
|---------------|--------|---------|-----------|----------|-------|------|-------|-------|-------|-------|-------|
| | P % | ACP 95% | ACP 99.9% | PORT 95% | | | | | | | |
| L | 3% | 97.5% | 98.2% | 91.8% | | | | | | | |
| AA | 3% | 99.4% | 99.6% | 96.6% | | | | | | | |
| BB | 1% | 99.0% | 99.6% | 96.3% | | | | | | | |
| FF | 3% | 98.6% | 99.6% | 97.0% | | | | | | | |
| DD | 5% | 97.0% | 97.2% | 88.3% | | | | | | | |
| A | 7% | 98.0% | 98.7% | 95.1% | | | | | | | |
| EE | 28,884 | 4.6% | 98.1% | 98.5% | 1,979 | 4.9% | 99.4% | 99.4% | 99.0% | 99.5% | 94.6% |
| GG | 27,607 | 4.4% | 98.8% | 99.7% | 1,860 | 4.6% | 99.3% | 99.5% | 98.9% | 99.1% | 95.2% |
| R | 24,279 | 3.8% | 96.9% | 99.7% | 1,148 | 2.9% | 99.6% | 99.8% | 99.0% | 99.3% | 96.6% |
| JJ | 24,022 | 3.8% | 99.6% | 99.9% | 862 | 2.1% | 100% | 100% | 99.4% | 99.4% | 95.1% |
| HH | 23,153 | 3.7% | 99.0% | 99.1% | 1,136 | 2.8% | 99.9% | 99.9% | 99.0% | 99.2% | 95.7% |

Operator approval
ASP, ACP, ACTP and PORT for different operators (ZNY)

Operator or aircraft system approval

ASP for an aircraft type (ZAK and ZAN)

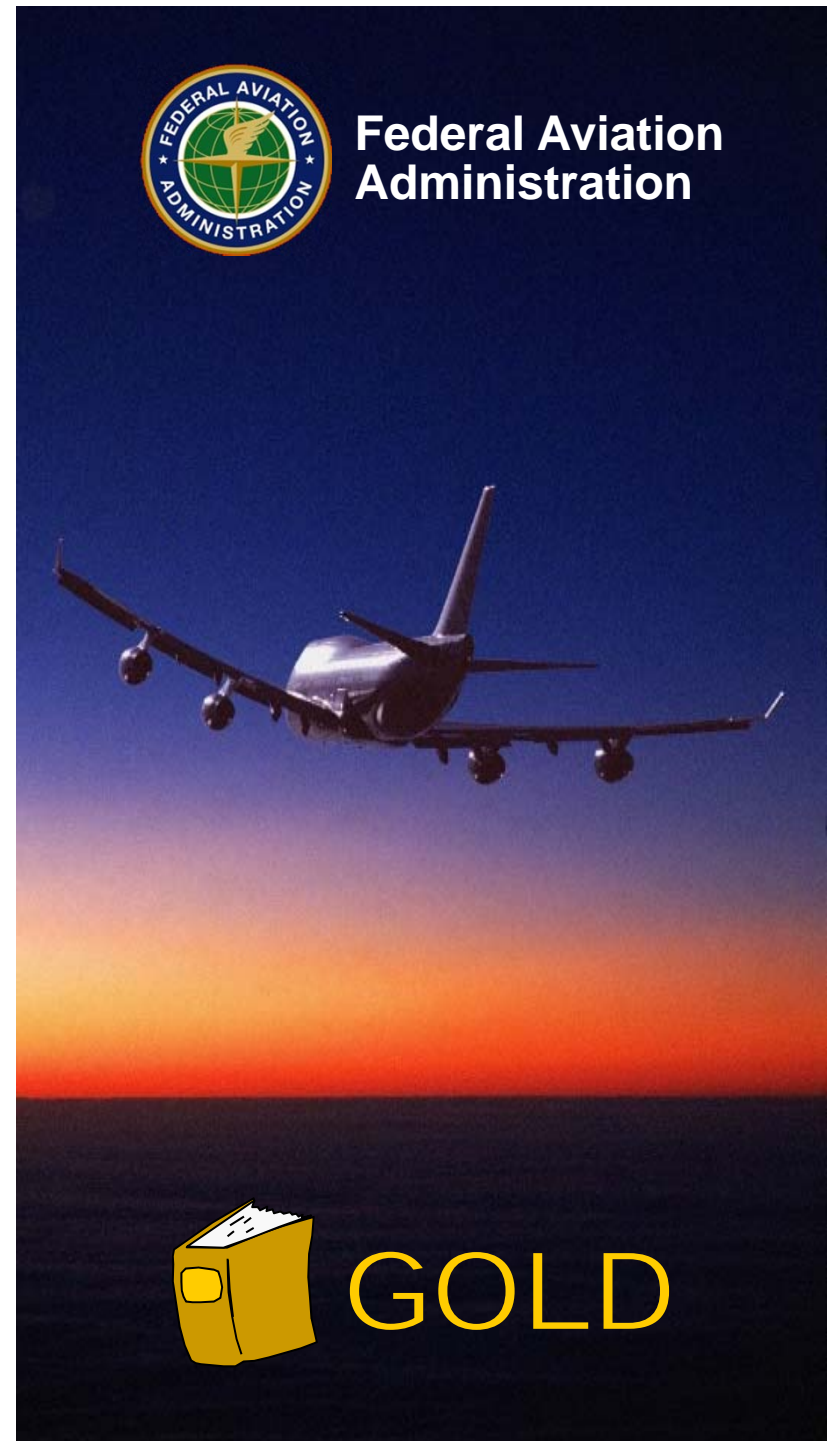


These issues do not help actual performance for airspace



Performance based communication and surveillance

Summary



Summary

- **GOLD provides means to develop global standards for communication and surveillance performance**
- **RCP/RSP provides means to meet SMS obligations**
- **RCP/RSP specifications are prescribed to ATS operations in specified airspace to provide basis for initial and ongoing compliance determination**
- **Operators / aircraft types and infrastructure are qualified against RCP / RSP specifications**
- **Change management through post-implementation monitoring and continuous improvement**



