Performance specifications

Communication (RCP) and surveillance

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By: Tom Kraft, Chief Scientific and Technical Advisor for Aeronautical Communications, Aviation Safety, Federal Aviation Administration
Email: tom.kraft@faa.gov
Mobile: +1-202-369-2168

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Overview

- **Introduction**
- **Current activities**
- **Review the performance-based approach**
- **Introduction to performance specs**
- **RCP 240 performance spec**
- **Actual data**

Introduction

- **A number of performance specifications are under development**
  - RCP 240 when applied to data link systems, e.g., CPDLC over SATCOM (/D)
  - RCP 400 when applied to data link systems, e.g., CPDLC over HFDL (/D)
  - RCP 400 when applied to “non-traditional,” e.g., SATCOM voice systems (/V)
  - new RCP types, such RCP 60 or RCP 120 applied to continental (domestic) data link systems, e.g., CPDLC over VDL M2 (/D)
  - criteria for surveillance, e.g., position reporting criteria for different separation standards
- **The intent is for each specification to provide a globally consistent way to convey performance-based criteria for specific applications within a common framework**
- **Complements RNAV/RNP specifications for specific operational capabilities**

Current activities (1 of 2)

Communication or surveillance

- **North Atlantic (NAT), Asia-Pacific (ASIA-PAC), …**
  - ICAO Doc 9869, Manual on RCP
  - RTCA DO-306/EUROCAE ED-122, Oceanic SPR Standard
  - Drafts of RCP 240/D, RCP 400/D, and surveillance performance specifications
  - Work is progressing by an Ad Hoc Group developing a Global Operational Data Link Document (GOLD)
- **PARC CWG**
  - FANS 1/A over Iridium (FOI) - using (Draft) RCP 240/D
  - Satellite voice – (Under development) RCP 400/V

Current activities (2 of 2)

Communication or surveillance

- **Hawaiian Airlines (HAL) – Oakland Center (ZOA) FANS 1/A over HFDL trials - using (Draft) RCP 400/D and surveillance specs**
- **RTCA SC-214/EUROCAE WG-78, Data Communication Standards Group**
  - DO-264/ED-78A
  - RTCA DO-290/EUROCAE ED-122, Continental SPR Standard
  - DO-290/EUROCAE ED-122 leaves performance specifications to States based on allocated performance
  - Performance specifications will undoubtedly be needed

Performance-based approach (1 of 2)

Communication, navigation or surveillance

- **Apply when we implement a change and the change is predicated on communication, navigation and/or surveillance capability and performance**
  - New operational capabilities, such as reducing separation minimum or increasing airspace capacity
  - New systems, including those provided by commercial services, using different technologies, such as satellite services

Performance-based approach (2 of 2)

Communication, navigation or surveillance

- **Characterizes function and performance based on intended operations in any given airspace, not based on technology**
- **Global seamless operations and technical interoperability are imperative**
- **Results in “operationally-oriented” performance specifications, e.g., RNP 4, RCP 240, etc.**

Intro to performance specs (1 of 4)

Intended uses of a performance spec

- **Determine the viability of a particular technology**
- **Agreements/contractual arrangements with third-party service providers**
- **Operational authorizations, flight crew training/qualification**
- **Design approval of aircraft systems**
- **Safety oversight of service provisions and operations**
  - Qualification and acceptance systems and services, e.g., CSP & ANSP automation
  - Mixed-capability fleet operations, e.g., RCP 240, RCP 400, No RCP
  - Post-implementation monitoring

Intro to performance specs (2 of 4)

Considerations for a performance spec

- **Limit number of performance specs**
- **Associate performance specifications to the ATS function**
- **Correlate to functional capability**
- **Parameters and units of measure**
- **Points of measurement**
- **Allocate according to institutional boundaries**

Intro to performance specs (3 of 4)

Overview of a performance spec

- **Airspace specific considerations**
- **Performance parameter values**
- **Performance monitoring and alerting criteria**
- **Operational, safety, and performance criteria allocation**
  - ATS provider
  - Communication service provider (CSP)
  - Aircraft system
  - Aircraft operator

Intro to performance specs (4 of 4)

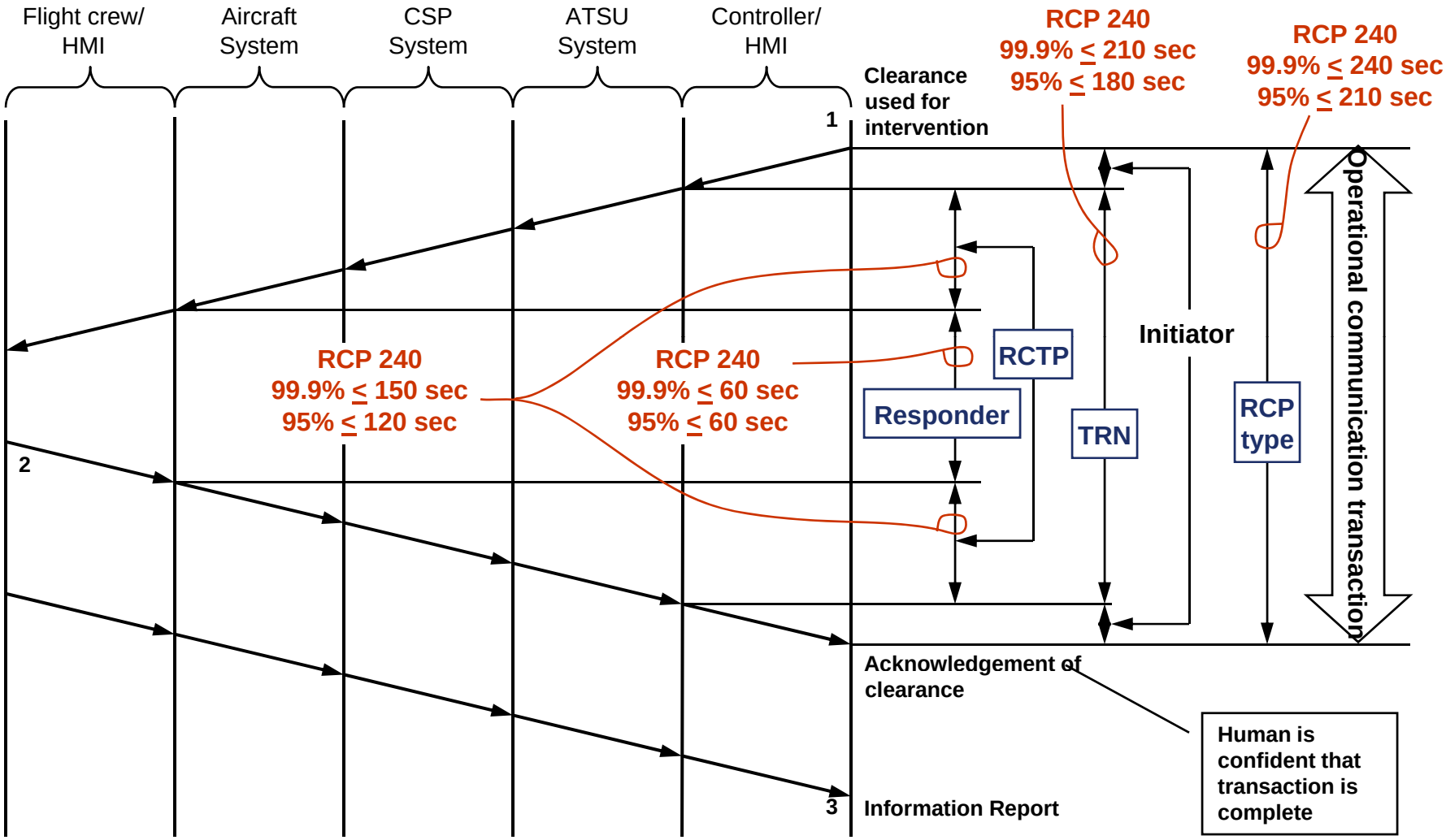
RCP terms and parameters

RCP specification	
Term	**Description**
Operational communication transaction	The process a human uses to initiate the transmission of an instruction, clearance, flight information, and/or request, and is completed when that human is confident that the transaction is complete.
RCP Expiration time (ET)	The maximum time for the completion of the operational communication transaction after which the initiator should revert to an alternative procedure.
RCP Nominal time (TT 95%)	The nominal time for the completion of the operational communication transaction at 95%.
RCP Continuity (C)	Probability that an operational communication transaction can be completed within the communication transaction time, ET or TT 95%.
RCP Availability (A)	Probability that an operational communication transaction can be initiated when needed.
RCP Integrity (I)	Acceptable rate of one or more undetected errors in a completed communication transaction.

RCP 240 – performance spec

RCP Specification				
RCP type			**RCP 240**	
Airspace specific considerations				
Interoperability	Specify interoperability criteria, e.g., FANS 1/A			
ATS Function	Specify ATS function(s), e.g., applicable separation standard			
Application	Specify controller-pilot ATC communication intervention capability, e.g., CPDLC application per ICAO Doc 4444, and RTCA DO-306/EUROCAE ED-122, Annex A			
RCP parameter values				
Transaction time (sec)		**Continuity (C) (probability)**	**Availability (A) (probability)**	**Integrity (I) (acceptable rate/flight hour)**
ET = 240		0.999	0.999 0.9999 (efficiency)	10^{-5}
TT 95% = 210		0.95		
RCP monitoring and alerting criteria				
Ref:	**Criteria**			
MA-1	The system shall be capable of detecting failures and configuration changes that would cause the communication service to no longer meet the RCP type for the intended function.			
MA-2	When the communication service can no longer meet the RCP type for the intended function, the flight crew and/or the controller shall take appropriate action.			

RCP 240 – time and continuity



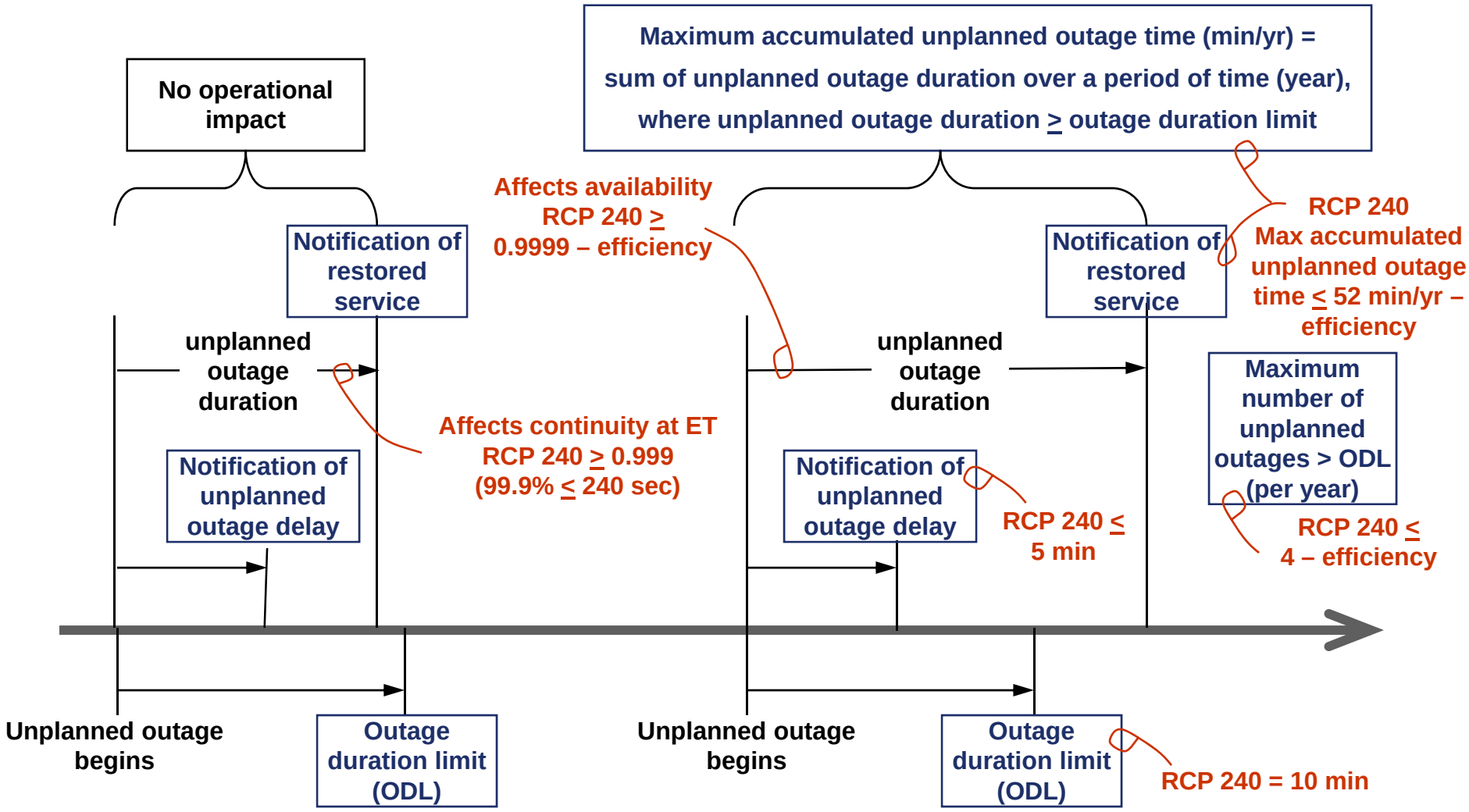
RCP 240 – RESP/INIT time allocations

RCP communication transaction time and continuity criteria			
Specification: RCP 240/D	**Application: CPDLC**		**Component: ATSP**
Transaction Time Parameter	**ET (sec), C = 99.9%**	**TT (sec), 95%**	**Compliance Means**
Transaction Time Value	240	210	Analysis, CSP contract
RCP Time Allocations			
Initiator	30	30	Analysis, simulations, safety and human factors assessments
TRN	210	180	Monitored, CSP contract
TRN Time Allocations			
Responder	60	60	Initially, by analysis, simulations, safety human factors assessments Post-implementation, monitored, estimated
RCTP	150	120	Monitored, estimated, CSP contract

RCP 240 – RCTP time allocations

RCTP communication transaction time and continuity criteria			
Transaction Time Parameter	**ET (sec), C = 99.9%**	**TT (sec), 95%**	**Compliance Means**
RCTP	**150**	**120**	**Monitored, estimated, CSP contract**
RCTP time allocation			
$RCTP_{ATSU}$	15	10	Pre-implementation demonstration
$RCTP_{CSP}$	120	100	Contract terms
$RCTP_{AIRCRAFT}$	15	10	Pre-implementation demonstration

RCP 240 – service availability

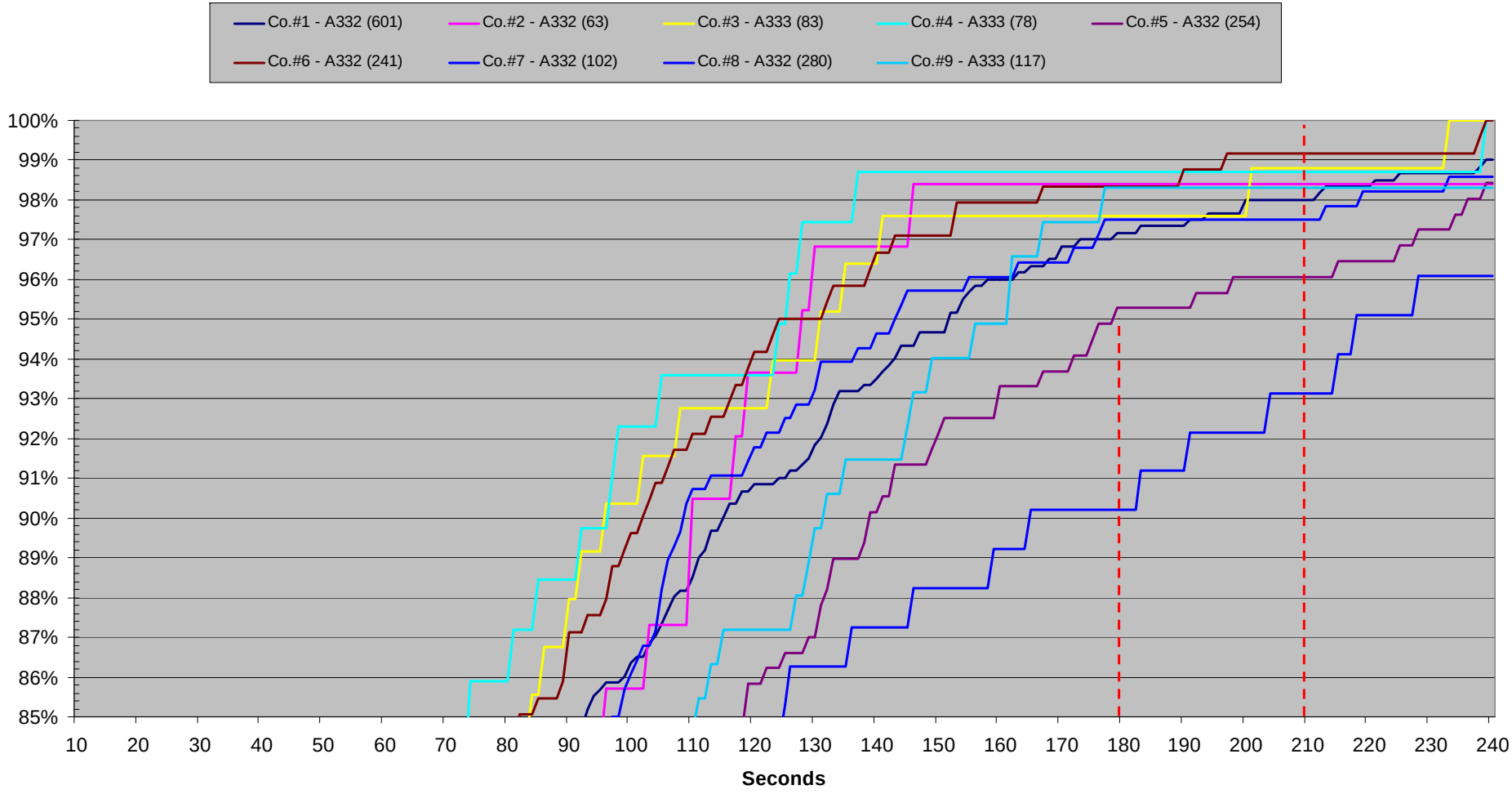


RCP 240 – other criteria

- **Aircraft system availability ≥ 0.999**
- **RCP monitoring and alerting – to detect and correct non-compliant situations**
- **27 safety requirements allocated to ATSP, aircraft system, and operator – related to availability, continuity and integrity**

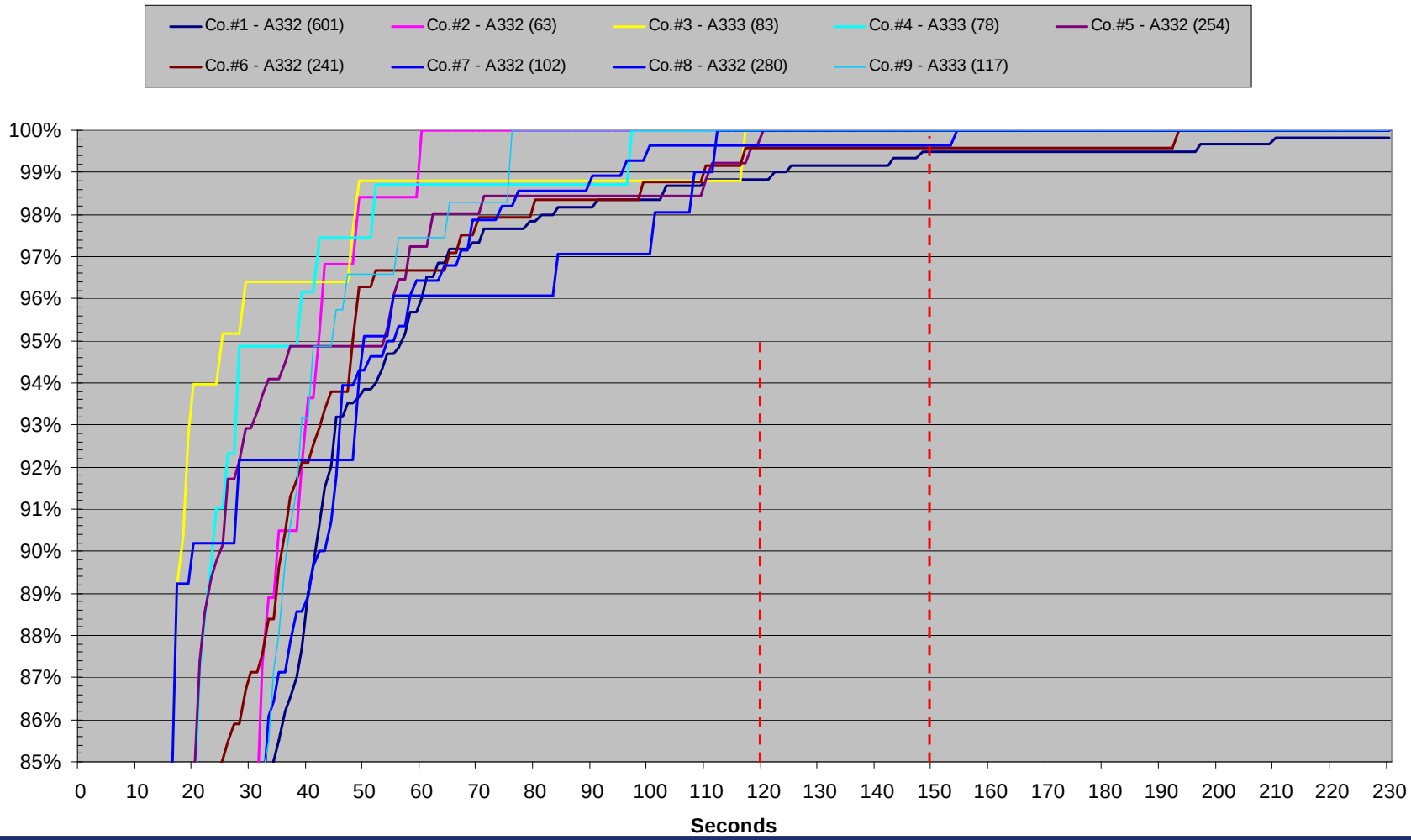
ZNY – May-Jul 08 A33x ACP

Actual communication performance → TRN



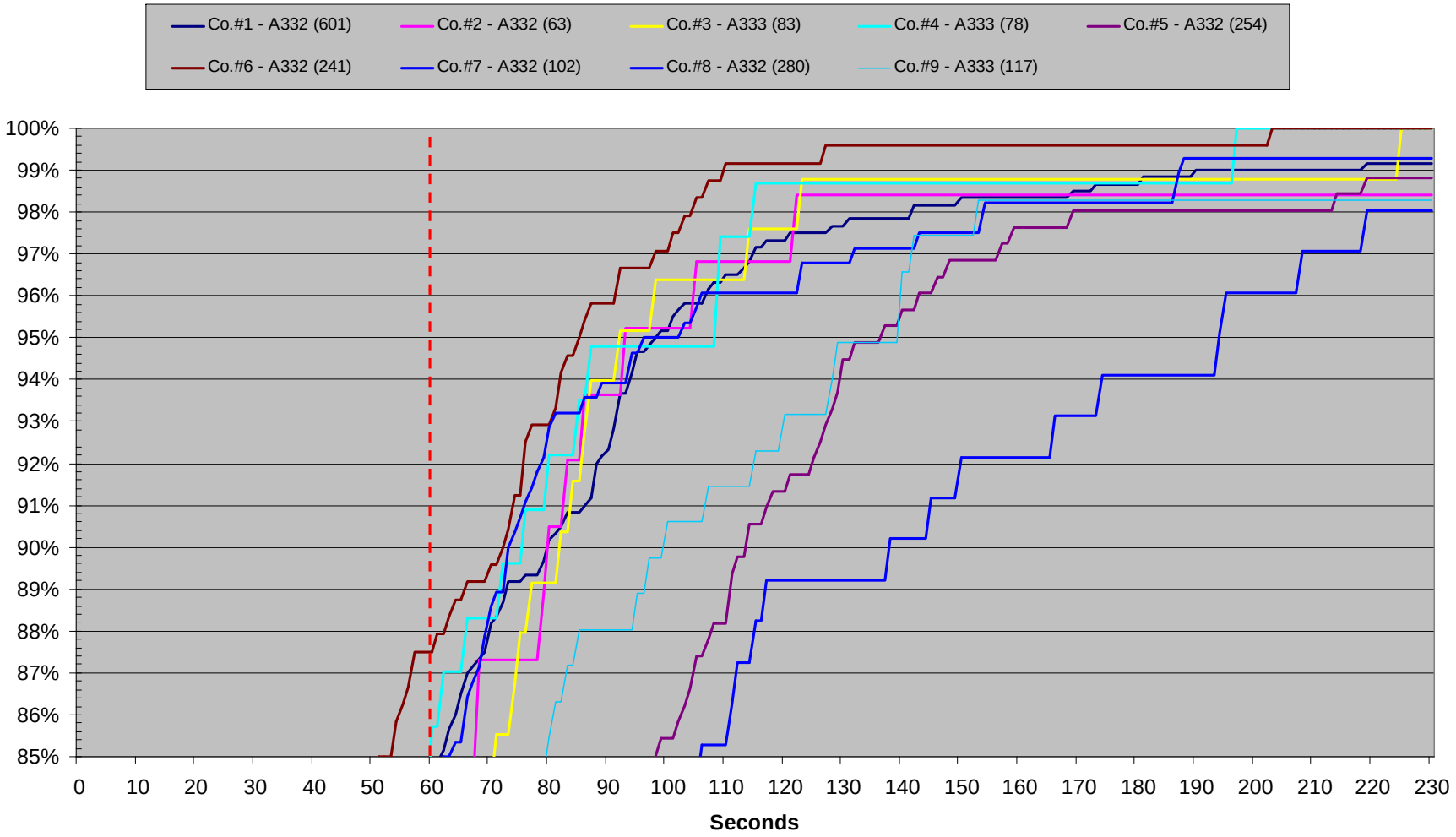
ZNY – May-Jul 08 A33x ACTP

Actual communication technical performance → RCTP



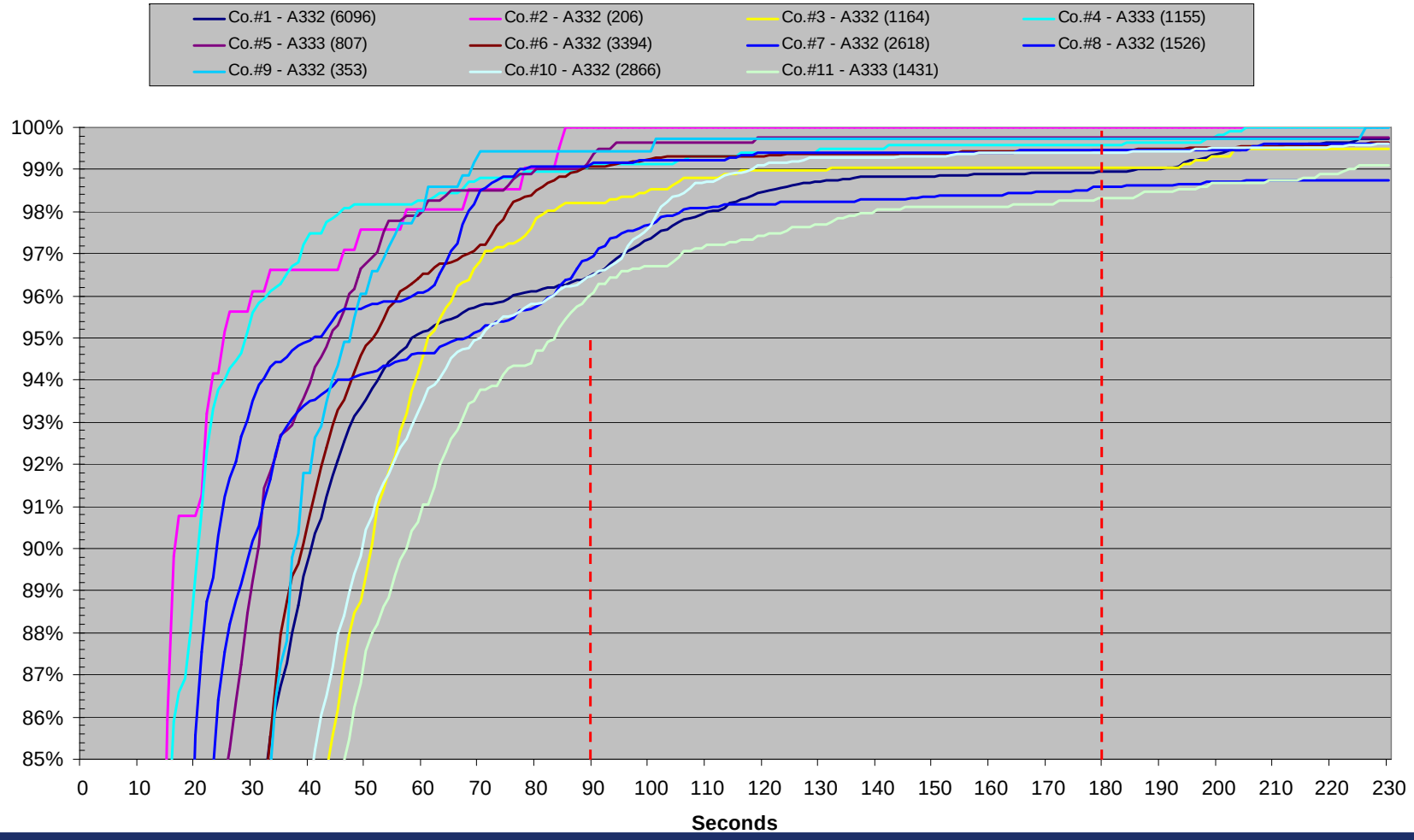
ZNY – May-Jul 08 A33x PORT

Actual pilot operational response time → Responder



ZNY – May-Jul 08 A33x ADS-C

Actual position report delivery time → Surveillance



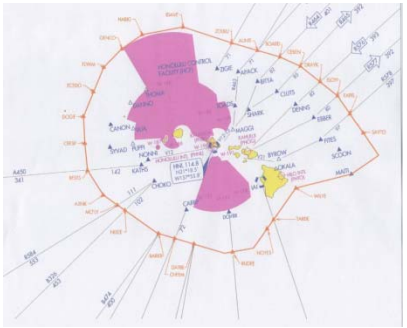
Plans for the GOLD Ad Hoc WG

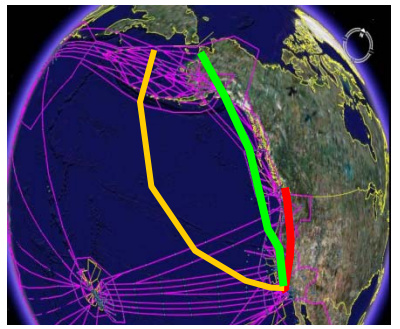
- **Complete performance specifications, e.g., RCP 240/D, RCP 400/D, possibly RCP 400/V**
- **Include qualification means**
  - Initial certification, authorizations, and service provision
  - Post-implementation monitoring and corrective action
- **Recommend PIRGs to endorse and recognize GOLD in regional documentation**
  - NAT SPG – June 2010
  - APANPIRG – September 2009

Savings from ZOA "changes" in 2008

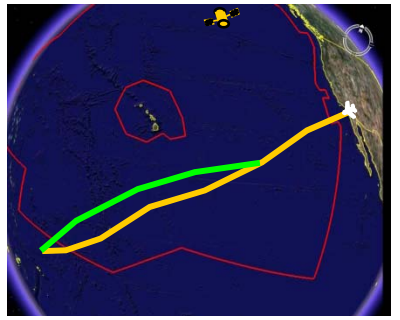
Saved 23.2 million kilograms (kg) of fuel
Reduced CO_2 emissions by 73.3 million kg

Projects	Mil kg
Hawaii ATS route changes	1.2
Central East Pacific (CEP) flex routes	6.8
Route entry point UPRs	1.09
Guam ATS route changes	2.4
Japan – Hawaii UPRs	2.88
San Francisco tailored arrival trials	1.0
California – Singapore UPRs	0.27
"WIDEN" oceanic gateway	3.6
Narita – Sydney/Brisbane UPRs	1.89
Asia – New Zealand/Caledonia UPRs	2.09





Saved 45,000 trees



Thank you

Remarks