



RTCA SC-214 / EUROCAE WG-78

Advanced Data Communication Baseline 2 Standards

Baseline 2 Tutorial

Melbourne (FL), March 2013



Objectives



Provide tutorial on
SC214/WG78 Baseline 2

To get operational
feedback from
Users (Airlines,
Pilots,
Controllers...)



**Global endorsement of
Baseline 2 Standards**

- ▶ History and Background
 - ▶ Current Datalink Operations
 - ▶ SC214/WG78 Mission

- ▶ Baseline 2 Capabilities Overview
 - ▶ Baseline 2 Services
 - ▶ CPDLC Capabilities and messages
 - ▶ ADS-C Capabilities and messages
 - ▶ FIS Capabilities

- ▶ Next Steps



History & Background



▶ Current Datalink (Industry) Standards and Implementations

	Remote/Oceanic	Domestic / En route
Operational, Safety & Performance (SPR)	ED122/DO306	ED120/DO290
Interoperability (INTEROP)	ED100/DO258	ED110/DO280
Current implementations	FANS 1/A(+), Deployed in many remote/oceanic areas	Baseline 1 and FANS 2/B(+), Being deployed in Europe (SES Datalink Services Implementing Rule)

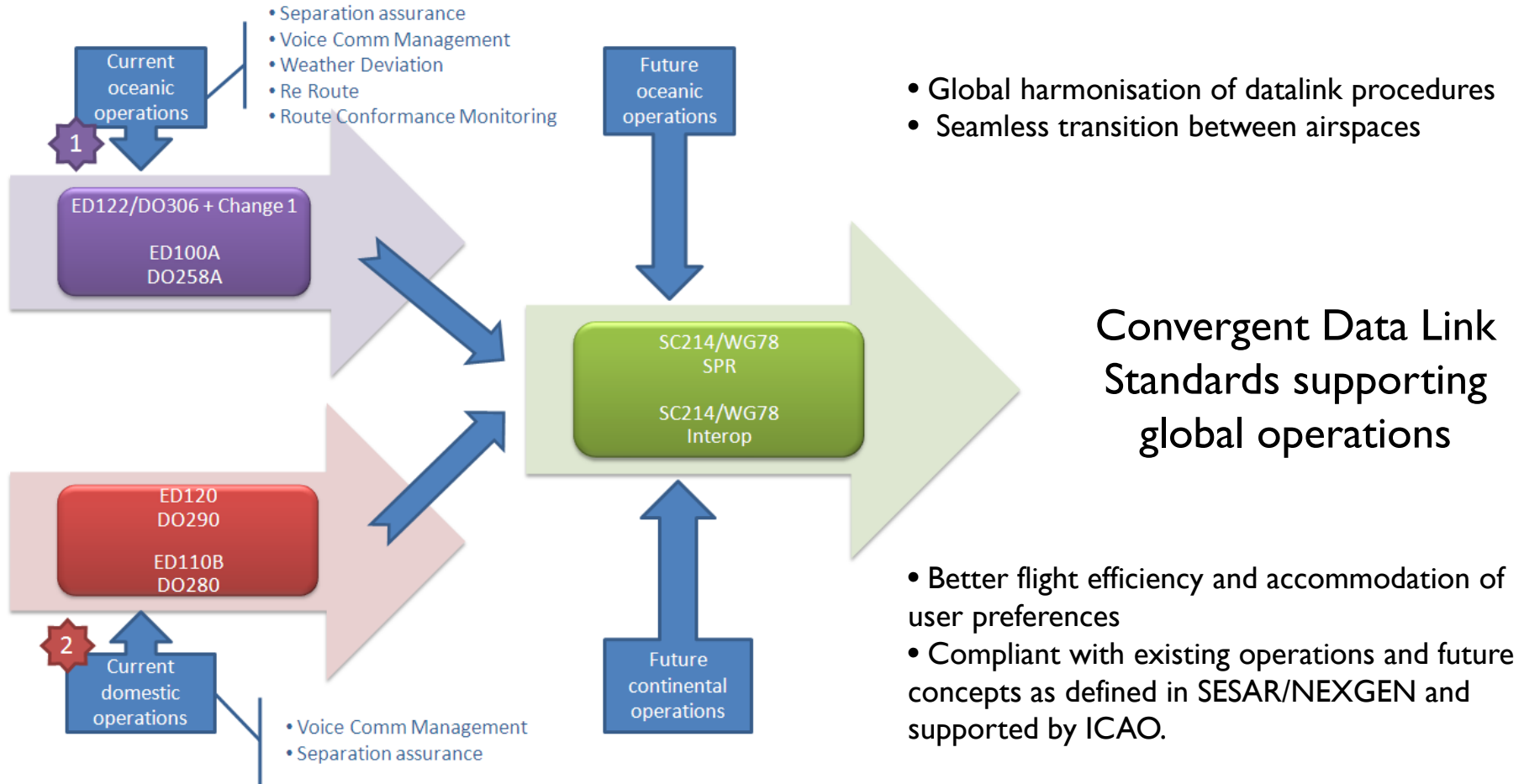
- ▶ Current standards are not interoperable and requires dual implementations to support both environments (costly, different procedures, no seamless operational transition...)

=> Need for global datalink standards:

- ▶ Ensuring operational and technical convergence
- ▶ Covering all flight phases (airport, terminal, en-route) and airspace types (domestic, remote/oceanic)



History & Background





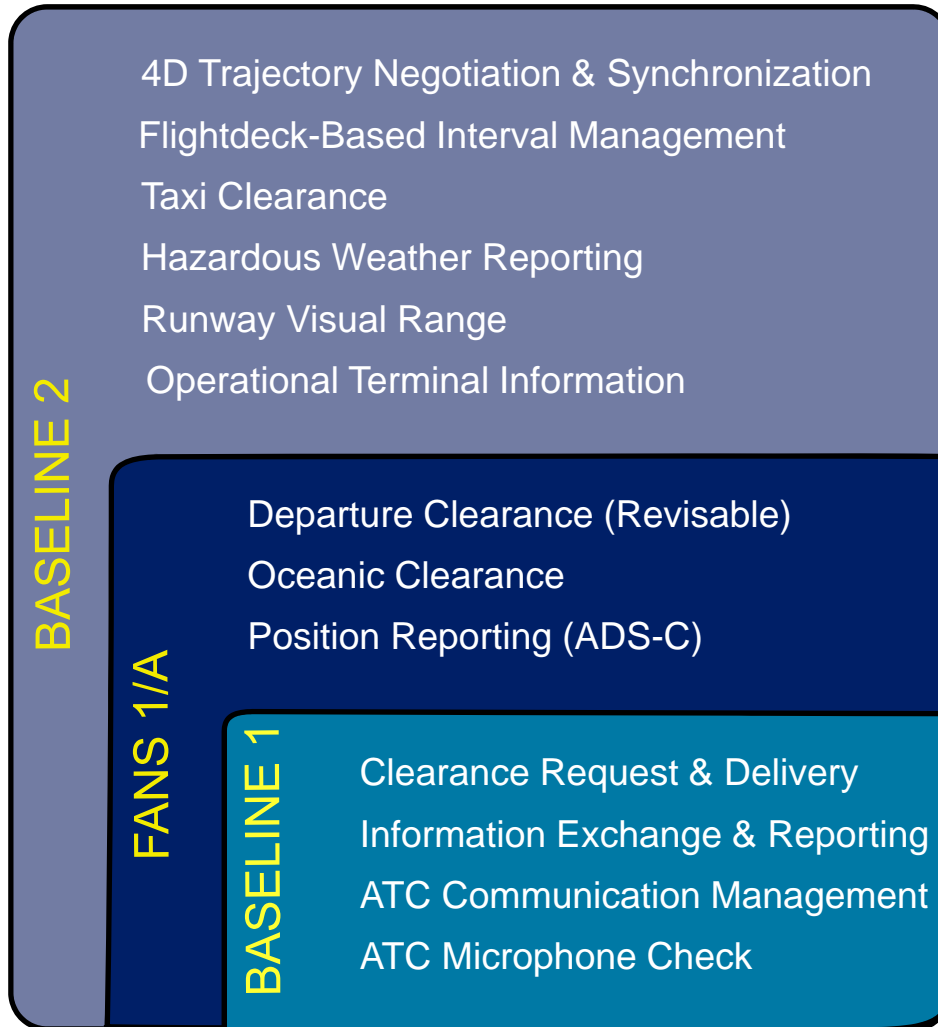
SC214/WG78 Mission



- ▶ Deliver Safety and Performance Requirements (SPR) and Interoperability requirements (Interop) for Advanced Data Link Air Traffic Services (ATS) to support:
 - ▶ NextGen
 - ▶ SESAR
 - ▶ Future oceanic/remote operations
 - ▶ ICAO Global Air Navigation Plan (ASBU)
- ▶ Support implementation of aircraft data comm systems that will operate in both continental and oceanic environments (i.e. convergent SPR/Interop Standards), for all types of airspaces (Airport, terminal, domestic en-route and oceanic/remote en-route)
- ▶ Define data link services and applications independent from the underlying network technology
- ▶ Target for Publication : March 2014



Datalink Operational Capabilities



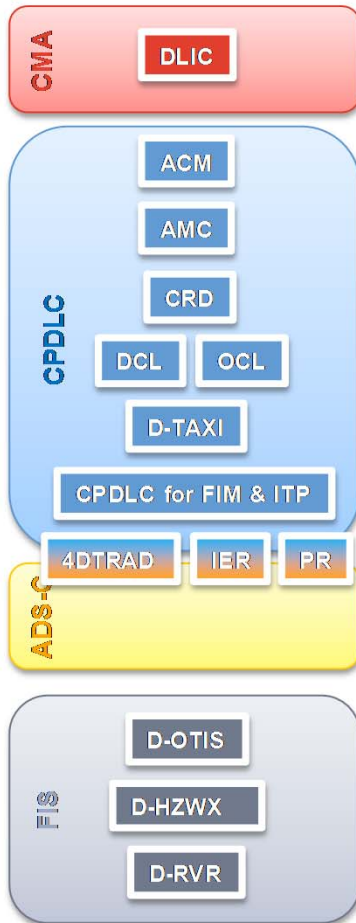
- ▶ **Data Comm Baseline 2:**
 - ▶ Initial TBO
 - ▶ Surface Management
 - ▶ Flight Information Service
 - ▶ Continental & Oceanic
 - ▶ Supported by Enhanced (Ground/) Flight Deck Automation (FMS Loading, Msg Accessibility/Alerting, Conditional Clearance monitoring, Graphical Display)
- ▶ **FANS I/A:**
 - ▶ Complex Clearance Delivery
 - ▶ Continental & Oceanic
 - ▶ FMS Loading
- ▶ **ATN Baseline I (FANS 2/B)**
 - ▶ Airborne Clearance Delivery
 - ▶ Automatic Transfer of Voice Comm



Baseline 2 Scope



Convergent SPR Baseline 2



- ▶ New service to support Trajectory Based Operations
 - ▶ 4DTRAD (4D Trajectory Data Link)

- ▶ New Service to support Surface Operations
 - ▶ D-TAXI (Data Link Taxi)

- ▶ New Services to support Interval Management
 - ▶ ITP (In Trail Procedure)
 - ▶ FIM (Flight Interval Management)

- ▶ New Services to support Flight Information Services
 - ▶ D-OTIS (Datalink Operational Terminal Information Service)
 - ▶ D-RVR (Datalink Runway Visual Range)
 - ▶ D-HZWX (Datalink Hazardous Weather)

- ▶ Enhancement of existing operations
 - ▶ ACM (ATC Communication Management)
 - ▶ AMC (ATC Microphone Check)
 - ▶ CRD (Clearance Request and Delivery)
 - ▶ IER (Information Exchange and Report)
 - ▶ DCL (Departure Clearance)
 - ▶ OCL (Oceanic Clearance)
 - ▶ PR (Position Report)

⇒ **Datalink Applications (CPLDC, ADS-C and FIS) have been optimized/enhanced to support those services!**



4DTRAD Service Overview



- ▶ Air-Ground Data Link part of the Global TBO Concept as defined in SESAR and NEXGEN.
 - ▶ Consistent with Navigation performance requirements as defined by SC227/WG85
 - ▶ Assumptions on Ground-Ground coordination
- ▶ Use of CPLDC (Route, enhanced RTA and speed schedule clearances) and ADS-C (EPP & ETA/Min/Max Contracts)
- ▶ 4DTRAD aims to improve flight optimization by allowing Air-Ground Trajectory Synchronisation and RTA agreement (Less trajectory changes, Reduction of Pilot/Controller workload, Less emission (optimum flight profile)). It supports Air-Ground Datalink exchanges for:
 - ▶ Route Negotiation and 4D Clearance request, delivery, and revision
 - ▶ RTA and Speed Schedule Clearance delivery, and revision
 - ▶ Trajectory Conformance Monitoring
- ▶ Includes ITBO (initial Trajectory Based operation) to allow provision of TBO without ADS-C EPP data



D-TAXI Service Overview



- ▶ Based on D-TAXI Concept from SESAR and NEXGEN.
 - ▶ Available during Surface and Airport approach phases of flight
 - ▶ Coordination with WG217/WG44 for Airport Mapping database standard consistency
 - ▶ Consistent with the current voice phraseology
- ▶ Use of CPLDC (New messages)
- ▶ D-TAXI aims to improve surface operations by reducing the number of Controllers/Flight Crew voice exchanges and allowing better air-ground automation. It supports Air-Ground Datalink exchanges for:
 - ▶ Startup, Pushback, and (*Departure & Arrival*) Taxi clearance request, delivery, and revision
 - ▶ Special airport operations such as taxiing to/from a de-icing area exchanges
 - ▶ Onboard D-TAXI Graphical depiction
- ▶ **Not used to clear crossing of Active Runways**



FIM Service Overview



- ▶ Air-Ground Datalink part of FIM Concept as defined in SCI86/WG51 and DO-328/ED195
 - ▶ Only CPLDC requirements to support FIM
 - ▶ FIM is largely based on ADS-B capabilities
- ▶ Use of CPLDC (New messages)
- ▶ FIM-Spacing aims to improve means for managing traffic flows and aircraft spacing by allowing a range of Interval Management (IM) Operations whose goal is precise inter-aircraft spacing. It supports Datalink Air-Ground exchanges to achieve and/or maintain an Assigned Spacing Goal relative to a Target Aircraft
 - ▶ FIM Target aircraft identification
 - ▶ FIM clearance request, delivery, and revision
 - ▶ FIM Report and termination



ITP Service Overview



- ▶ Air-Ground Datalink part of ITP Concept as defined in GOLD and EDI59/DO312
 - ▶ Only CPLDC requirements to support ITP
 - ▶ FIM largely based on ADS-B capabilities
- ▶ Use of CPLDC (New messages)
- ▶ ITP aims to improve flight level changes in procedural airspace by allows a climb-through or descend-through maneuver between properly equipped aircraft, using a new distance-based longitudinal separation minimum during the maneuver. It supports Datalink Air-Ground exchanges for:
 - ▶ ITP Target aircraft identification
 - ▶ ITP clearance request, delivery, and revision



DCL Service Overview



- ▶ DCL (Departure Clearance)
 - ▶ Based on SESAR and NEXGEN Concepts.
 - ▶ Closely coordinated with FAA DCIT trials and design activities for FAA DL operations
 - ▶ Use of CPLDC (enhancement of existing messages)
 - ▶ DCL aims to provide automated assistance for requesting and delivering departure clearances and information by allowing Air-Ground Datalink exchanges for:
 - ▶ Departure clearance request, delivery, and revision



OCL Service Overview



- ▶ OCL (Oceanic Clearance)
 - ▶ based on current OCL operations (A623)
 - ▶ Use of CPLDC (enhancement of existing messages)
 - ▶ OCL allows the flight crew to request Oceanic Clearance from Downstream ATSU. It supports Air-Ground Datalink exchanges for:
 - ▶ CPLDC Connection Management (establishment, termination) with downstream ATSU
 - ▶ Oceanic clearance request, delivery, and revision



ACM Service Overview



- ▶ Enhancement of existing services (CE, CT, Baseline I ACM).
 - ▶ Automatic system configuration for latency, LACK status and associated timer
 - ▶ Asynchronous Data and Voice transfer
 - ▶ CPLDC Status: In-Use / Not-in-Use
- ▶ Prerequisite for all CPLDC based services
- ▶ Use of CPLDC (enhancement of existing messages and new messages)
- ▶ It supports Air-Ground Datalink exchanges for:
 - ▶ CPLDC Connection management, establishment, transfer, and termination
 - ▶ Change of Frequency



CRD Service Overview



- ▶ Enhancement of existing services (Oceanic CRD, Baseline I ACL)
 - ▶ e.g. Time to second, ATW Position, Direction, holding instruction, ...
- ▶ Use of CPLDC (new and enhanced existing messages)
- ▶ CRD supports Air-Ground Datalink exchanges for:
 - ▶ Clearance request, delivery and revision
 - ▶ Clearance negotiation
 - ▶ Expect request and delivery



IER Service Overview



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- ▶ Enhancement of existing services (Oceanic IER, Baseline I ACL).
- ▶ Use of CPLDC and ADS-C
- ▶ IER supports Air-Ground Datalink exchanges for:
 - ▶ reports/confirmation messages provided by the aircraft
 - ▶ requests from the flight crew for information
 - ▶ information provided by the controller to the flight crew;
 - ▶ emergency situation information



PR Service Overview



- ▶ Based on PR Service defined in GOLD
- ▶ Available during En-route phase of flight
- ▶ Use of CPLDC (Manual) and ADS-C (Automatic)
- ▶ Provide the controller/ground system with the capability to obtain:
 - ▶ aircraft provided position information
 - ▶ complementary information:
 - ▶ current speed information (air and ground speeds),
 - ▶ current meteorological information (aircraft's wind, temperature, turbulence, and humidity information) and
 - ▶ projected route (next and next+1 waypoints)



AMC Service Overview



- ▶ Enhancement of existing services (Baseline I AMC).
 - ▶ It does not require specification of frequency
- ▶ Use of CPLDC (enhancement of existing messages)
- ▶ IER provides Controller with ground automation to request a set of aircraft or all aircraft in his airspace to check stuck microphone.



CPDLC Overview



- ▶ **Baseline 2 CPLDC provides enhanced capabilities required by future operations, and supports reduction of Pilot/Controller Workload and human error, e.g:**
 - ▶ Rules for Flight deck automation for efficient use of CPLDC
 - ▶ FMS auto-loading that will allow CPLDC Message to be processed automatically upon Pilot request
 - ▶ Conditional Clearance Monitoring to allow execution of the clearance when the condition is met
 - ▶ Automatic system configuration when transferring from an airspace to another one (e.g. Latency Value, Lack status, and associated timer ...)
 - ▶ Simplification of Alert/Urgent Attribute: One attribute with three level (High, Medium, None) to delineate the type of alerting and queuing required upon message receipt.
 - ▶ Number of CPLDC Message elements is extended to 7 into single CPLDC message



CPDLC Message Set **RTCA**

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- ▶ Based on Voice Phraseology and Starting from PANS ATM (ICAO Doc 4444) Ed 15th
- ▶ New CPDLC message elements created and some existing CPDLC message elements modified to support new/enhanced ATS Data Link services, e.g.
 - ▶ 4DTRAD (4D Trajectory exchanges)
 - ▶ D-TAXI (Taxi route clearances and information)
 - ▶ Departure Clearance (DCL)
 - ▶ Oceanic Clearance (OCL)
 - ▶ CPDLC for Flight Interval Management (FIM)
- ▶ Message set encompass lessons learned from current operations
 - ▶ new message elements **replacing standardized Free Text** as in GOLD v1 (e.g. ITP, relayed messages)
 - ▶ **deletion of unused/unsafe messages** (e.g. Cruise climb, Specific Expect messages)
 - ▶ **replacement of ambiguous messages** (e.g. AT TIME/POSITION initiation/completion)
- ▶ Message set will take benefit of aircraft/ground system enhanced capabilities (e.g. FMS auto-loading, Trajectory management)



CPDLC Message Set **RTCA**

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- ▶ **Closely coordinated with ICAO OPLINKP**
 - ▶ Initiated at OPLINKP-WG/WHL I in October 2010

- ▶ Relying on assessment of the operational need for each message, leading to message deletions, revisions and additions
 - ▶ Analysis coordinated by WG78/SC214 with wide inputs from
 - Pilots
 - Human factors specialists
 - Controllers (Eurocontrol, FAA, ISAVIA acting as NAT representative, NATS, Nav Canada, Airways New Zealand, Air Service Australia...)
 - ANSPs representatives (taking credit from both FANS I/A and ATN BI operations)
 - Ground systems specialists, and
 - Aircraft manufacturers



CPDLC Message Set



- ▶ **Baseline 2 Message Set support the following message categories:**
 - ▶ Route
 - ▶ Report
 - ▶ Vertical
 - ▶ Lateral
 - ▶ Speed
 - ▶ Contact Monitor Surveillance
 - ▶ Advisory
 - ▶ Surface
 - ▶ Cross
 - ▶ Spacing
 - ▶ Emergency
 - ▶ System Management Messages

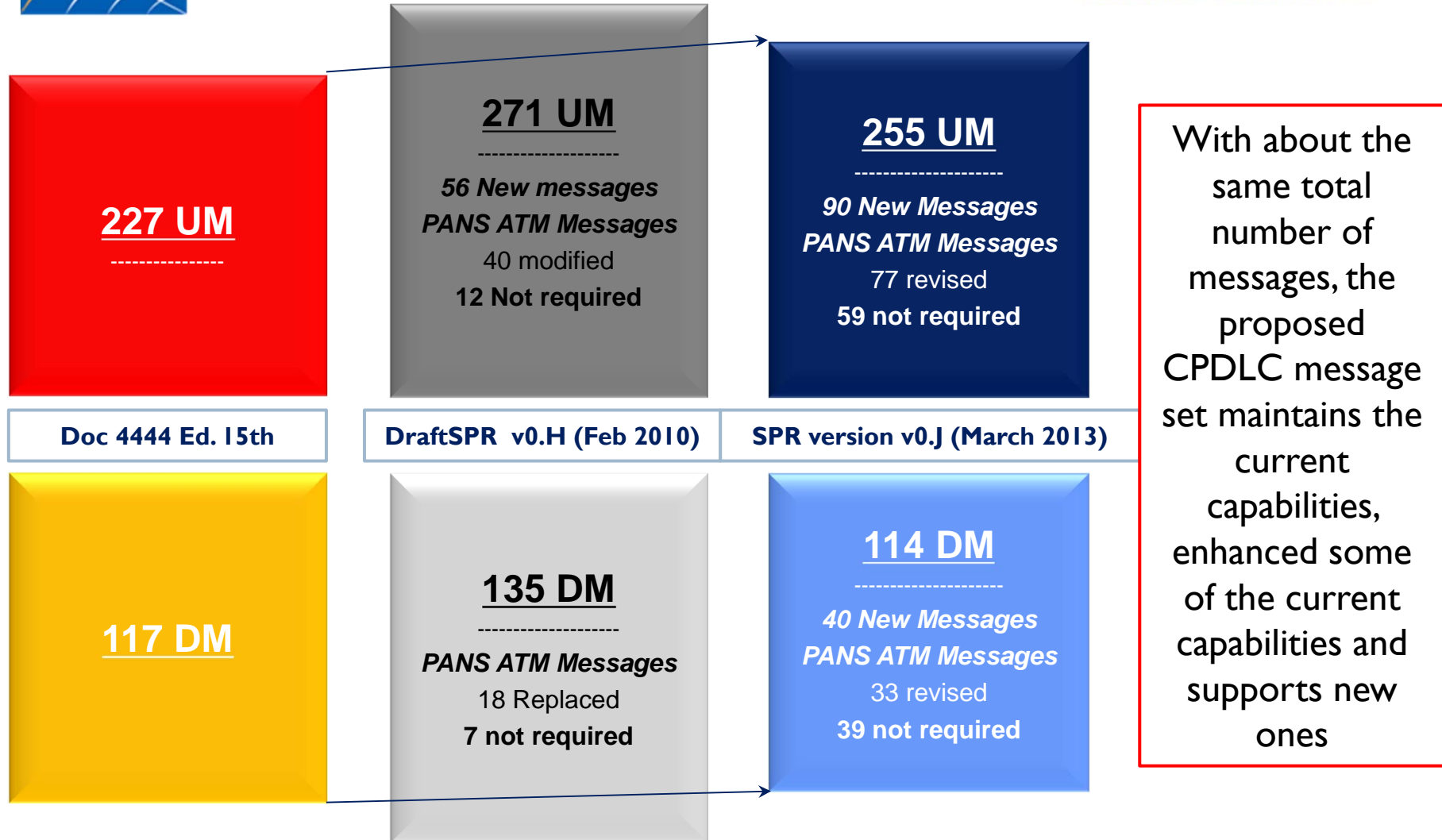
- ▶ **Advanced capabilities:**
 - ▶ Time to second for messages used in 4DTRAD / required by Advanced Navigation Capabilities
 - ▶ Provision of Along Track Waypoint to Position for crossing message



CPDLC Message Set



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ADS-C Overview



- ▶ Enhancement of implemented ADS-C capabilities
 - ▶ Turbulence definition independent from the aircraft type
 - ▶ New turbulence deviation event
 - ▶ Emergency mode
 - ▶ Provision of emergency status in each ADS-C downlink message
 - ▶ Event types:

Lateral deviation

Vertical rate deviation

Level range deviation

Waypoint change

Airspeed change

Ground speed change

Level change

FOM change

Vertical clearance deviation

Aircraft out of vertical boundaries

Airspeed range deviation

EPP flight plan change

EPP next waypoint in horizon

EPP tolerance

RTA status change



ADS-C Overview



- ▶ **Additional capabilities to support 4DTRAD service:**
 - ▶ (EPP) Extended Projected Profile
 - ▶ Up to 128 wpts (Lat/Lon, Fix, Level/Speed constraints, ETA,)
 - ▶ Provision of Speed Schedule
 - ▶ EPP Contract events:
 - Flight Plan Change
 - EPP Next waypoint in horizon
 - EPP Tolerance
 - ▶ ETA Min/Max
 - ▶ Provision of ETA information for the specified Waypoint.
 - ▶ RTA Status Change event contract



FIS Overview



- ▶ **Baseline 2 FIS capabilities support provision of:**
 - ▶ **D-OTIS (Datalink Operational Terminal Information) Service**
 - ▶ It provides flight crews with compiled meteorological and operational flight information for aerodromes comprised of ATIS, NOTAM, and VOLMET. The data may be tailored for the specific flight crew need and to the departure, approach or landing phases of flight (*en-route related information is out-of-scope*)
 - ▶ **D-RVR (Datalink Runway Visual range) Service**
 - ▶ It provides flight crews with Runway Visual Range (RVR) information for aerodromes during periods of low visibility
 - ▶ **D-HZWX (Datalink – Hazardous Weather) Service**
 - ▶ It provides flight crews with flight critical weather information which may affect the safety of aircraft operations
 - ▶ It includes Special Air Reports (SAR) and Significant Meteorological Information (SIGMET)
- ▶ **Information provided on Flight Crew request and on regular interval/update occurrence basis bringing benefit for:**
 - ▶ **Availability in time and space**
 - ▶ No need to be on the VHF coverage of the airport/FIR for which information is requested.
 - ▶ Information/ updated information is made available to aircrew for consideration at the appropriate time.
 - ▶ **Less flight crew workload**
 - ▶ Flight information filtered according to the actual needs of the aircrew (keywords, validity period, operator profile, RVR period or threshold, ...)
 - ▶ Automatic cancellation



Standards Validation



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- ▶ **SC-214/WG-78 Validation Subgroup (VSG) is charged with assisting with the validation of the developing standards**
 - ▶ Provides guidance on validation objectives and scenarios for requirements and services via the **Validation Plan**
 - ▶ Analyze and compile input from validation projects via **Validation Report**
- ▶ **Validation Report Function**
 - ▶ Documents Service / Application / Validation Objectives / Requirements level
 - ▶ Covered (or not) by one or several external and internal projects and activities
 - ▶ Supporting validation means
 - ▶ Technical and operational validation status
 - ▶ Maturity and criticality assessment
 - ▶ Identifies gaps in validation coverage, potential risk areas
 - ▶ Estimation of validation coverage as expected by **End of 2013**
 - ▶ Continually updated based on latest received information by VSG
- ▶ **Validation Report Releases**
 - ▶ Two more interim releases planned for 2013, with the final release at the end of 2013 in order to support publication decisions

First standard getting prototype validation feedback before final publication



Conclusion



- ▶ SC214/WG78 Baseline 2 convergence would allow
 - ▶ Defining consistent ATS Datalink applications and services for **all types of airspaces** and will **highly facilitate convergence** in the associated operational procedures.
 - ▶ Setting up a **consistent ATS Datalink safety and performance framework around the world**.
 - ▶ **Developing and certifying a unique and converged avionics solution** that would support ATS Datalink services in all airspaces. This would be beneficial for aircraft manufacturers and avionics suppliers, but even more for operators.
 - ▶ **Developing and certifying a unique and converged ground solution** that would support all ATS Datalink services, supporting synergy for ATSPs that have to manage both oceanic and domestic airspaces.



NEXT STEPS



- ▶ After 5 years of work, WG78/SC214 on the finish line ... targeting release of Baseline 2 standards by Mar 2014
- ▶ Two remaining opportunities to provide feedback on the proposed scope of Baseline 2 standards:
 - ▶ Apr-May 2013: WG78/SC214 review, based on a consolidated draft of SPR & Interop documents
 - ▶ Sep-Oct 2013: WG78/SC214 Final Review (FRAC/Open Consultation)

Comments from ALL are more than welcomed !!!

WG78/SC214 website:

http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/atc_comms_services/sc214/

Documents to review can be found under the “Current documents” section



CPDLC Msg Set



QUESTIONS ?