Data Communications Program

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Integrating NextGen Capabilities



Program Overview

- Provides data communications services between pilots and air traffic controllers, supplementing existing voice communications capabilities
- Provides a data link between ground automation systems and flight deck avionics for air traffic control (ATC) clearances, instructions, traffic flow management, and flight crew requests
- Controllers will be able to deliver instructions with a push of a button and without the need to utilize voice frequencies
- Enables the transmission of complex instructions to be quickly and correctly loaded into an aircraft's flight management system, upon acceptance by the pilot
- Enables NextGen Initiatives and Trajectory-Based Operations







Global Data Link Deployments





Program Background

- Air-ground digital communications has been an objective since 1960s
- Initial Mission Need Statement for Data Comm approved in 1991
- Controller Pilot Data Link Communications (CPDLC) Program 1998-2004

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- Miami ARTCC deployment 2002-2003
- Program terminated in October 2004/FFP2
- Restructured program
 - IARD 2006
 - IID 2008
- Segment 1 Phase 1 (S1P1) FID in 2012
 - Departure Clearance (DCL) Service in Tower domain
 - Delivers infrastructure to include airground network service (ERAM, TDLS, DCNS, FTI, Avionics)
 - Infrastructure provides foundation for S1P2 services
 - Completed all three Keysite IOCs and In-Service Decision (ISD)
- Segment 1 Phase 2 (S1P2) Initial En Route Services FID in 2014
 - Split the FIDs for Initial and Full En-route services due to budget constraints
 - Started software development for Initial services





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Data Comm Benefits





Evolution of Services

Strategy is to deploy services incrementally

- Implements basic services at airport towers initially
- Leverages existing equipage
- Delivers ground system infrastructure for future services (i.e., En Route) with initial deployment

Program Phases

- Segment 1 Phase 1 (S1P1): Baselined May 2012
 - Initial Controller Pilot Data Link Communications (CPDLC) Departure Clearance (DCL) Tower Services (Baseline Waterfall 2016-2019, Challenge Waterfall 2015-2016)
- Segment 1 Phase 2 (S1P2):
 - Initial En Route services Baselined October 2014 (Baseline Waterfall 2019-2021)
 - Full En Route services To be baselined in 2016 (subject to budget availability)
- Segment 2 (S2)
 - Adds advanced trajectory services still in concept development and Agency strategic planning

Program is aligned with industry expectations

- One of the four high priority NextGen/NAC focus capabilities (NIWG)
 - Report delivered to Congress in October 2014
 - Re-validated as a top four priority during Rolling Plan Update discussions January 2016
- NAC recommendation: Tower Service "DCL via Data Comm" (Tier 2) and En Route Service "CPDLC/Weather Reroutes" (Tier 1B) – September 2013
- Included in RTCA Task Force 5 Operational Improvements September 2009



Program Services Roadmap



Data Comm Enterprise Components

• En Route Automation Modernization (ERAM)

- Software enhancements to provide Data Comm functionality
- Tower Data Link System (TDLS)
 - Software enhancements to provide Data Comm functionality

• FAA Telecommunications Infrastructure (FTI)

- Circuits to provide connectivity between interfacing NAS systems over a private IP network
- Provides NAS Enterprise Security Gateway (NESG) as a secure interface access point for data exchange between systems inside and outside the NAS

Data Comm Network Service (DCNS)

- Air/ground network to provide connectivity between the ground system and the aircraft
- Leverages existing networks of Communication Service Providers (CSP) -ARINC and SITA
- Avionics
 - Aircraft equipped with Future Air Navigation System (FANS) 1/A avionics and VHF Data Link (VDL) radios



System-of-Systems Architecture



Data Comm CPDLC Message Data Flow





S1P1 Tower Service Acquisition Program Baseline (APB) Milestones

	Acquisition Program Baseline (APB) Milestones	APB Date	Actual Date
✓	ERAM Preliminary Design Review (PDR)	September 2011	September 2011
✓	ERAM Critical Design Review (CDR)	March 2012	March 2012
\checkmark	FID: Final Investment Decision for ERAM & TDLS	May 2012	May 2012
✓	DCIS Contract Award	July 2012	September 2012
\checkmark	TDLS Preliminary Design Review (PDR)	December 2012	October 2012
\checkmark	TDLS Critical Design Review (CDR)	August 2013	July 2013
	ERAM Initial Test Release (ITR)	June 2014	April 2014
√	Operational Test (OT&E)	November 2015	March 2015
✓	First-Site Initial Operational Capability (IOC)	March 2016	August 2015
\checkmark	In-Service Decision (ISD)	December 2016	December 2015
\checkmark	Operational Readiness Decisions (ORD)	April 2017	September 2015
	Last-Site IOC	May 2019	

Key: Complete

te On Track

May Be Missed

Missed





S1P1 Tower Service - Operational Readiness

- Completed Independent Operational Assessment (IOA) and received In-Service Decision (ISD) in 2015
- Achieved Initial Operating Capability (IOC) at all three Key Sites and have started the waterfall
 - Salt Lake City (SLC), key site August 7, 2015
 - Houston Intercontinental (IAH), key site September 3, 2015
 - Houston Hobby (HOU), key site September 10, 2015
 - New Orleans (MSY), first site in the waterfall January 21, 2016
 - Austin (AUS) February 4, 2016
 - Louisville (SDF) February 10, 2016
 - Newark (EWR) February 12, 2016
 - San Antonio (SAT) February 19, 2016
 - Kennedy (JFK) February 25, 2016
 - Indianapolis (IND) March 7, 2016
 - Los Angeles (LAX) March 10, 2016
 - Sites have been on continuous operations since their IOCs
- Continuing coordination with industry and field sites to support waterfall activities
 - Conducting Air Traffic and Tech Ops training
 - Operators conducting flight crew training



S1P1 Tower Service Implementation Challenge Waterfall

Key Sites				Group A			Group B			Group C					
Site Name	Site	ARTCCID	IOC	Site Name	Site	ARTCC	IOC	Site Name	Site	ARTC	IOC	Site Name	Site	ARTC	IOC
	ID				ID	ID			ID	CID			ID	CID	
KS 1: Salt Lake City	SLC	ZLC	08/07/15	New Orleans	MSY	ZHU	01/21/16	Louisville	SDF	ZID	02/10/16	Newark	EWR	ZNY	02/12/16
KS 2: Houston Intel	IAH	ZHU	09/03/15	Austin	AUS	ZHU	02/04/16	Indianapolis	IND	ZID	03/07/16	J F Kennedy	JFK	ZNY	02/25/16
KS 3: Houston Hobby	нои	ZHU	09/10/15	San Antonio	SAT	ZHU	02/19/16	Memphis	MEM	ZME	04/04/16	La Guardia	LGA	ZNY	03/14/16
NAP-NAP Intgr Compl	N/A	ZLC/ZTL	09/30/15	Los Angeles	LAX	ZLA	03/10/16	Nashville	BNA	ZME	04/18/16	Teterboro	TEB	ZNY	03/28/16
				Las Vegas	LAS	ZLA	03/28/16	Denver	DEN	ZDV	05/09/16	Westchester	HPN	ZNY	04/11/16
				San Diego	SAN	ZLA	04/11/16	Atlanta	ATL	ZTL	05/23/16	Philadelphia	PHL	ZNY	04/25/16
				John Wayne	SNA	ZLA	04/25/16	Charlotte	CLT	ZTL	06/07/16	Boston	BOS	ZBW	05/16/16
				Burbank	BUR	ZLA	05/09/16	Jacksonville	JAX	ZIX	06/28/16	Bradley	BDL	ZBW	06/14/16
			Ontario	ONT	ZLA	05/23/16	Orlando	MCO	ZJX	07/13/16	Detroit	DTW	ZOB	07/06/16	
			San Francisco	SFO	ZOA	06/14/16	Miami	MIA	ZMA	08/03/16	Cleveland	CLE	ZOB	07/20/16	
			Oakland	OAK	ZOA	06/28/16	Ft Lauderdale	FLL	ZMA	08/17/16	Pittsburgh	PIT	ZOB	08/03/16	
				San Jose	SIC	ZOA	07/13/16	Tampa	TPA	ZMA	08/31/16	Balt/Wash	BWI	ZDC	08/24/16
				Sacramento	SMF	ZOA	07/27/16	Palm Beach	PBI	ZMA	09/15/16	Dulles	IAD	ZDC	09/08/16
				Phoenix	PHX	ZAB	08/17/16	St Louis	STL	ZKC	10/06/16	Reagan	DCA	ZDC	09/22/16
				Albuquerque	ABQ	ZAB	08/31/16	Kansas City	MCI	ZKC	10/20/16	Raleigh/Durham	RDU	ZDC	10/06/16
			Seattle	SEA	ZSE	09/22/16	Minn-St Paul	MSP	ZMP	11/10/16	Chicago Midway	MDW	ZAU	10/27/16	
I DLS SITES CO	or K	ey	_	Portland	PDX	ZSE	09/22/16					Chicago O'Hare	ORD	ZAU	11/10/16
Planned CPDLC DCL Si	te			Dallas Love	DAL	ZFW	10/13/16								
Site Operational				Dallas FTW	DFW	ZFW	10/27/16								

- Waterfall reflects challenge schedule dates (calendar year)
 - Baseline schedule Tower deployment dates are 2016-2019



The Data Comm Stakeholder Cloud



S1P1 Tower Service – Operator Coordination

- FedEx, UPS, United, Southwest, Delta, American, USAF, British Airways, Air New Zealand, Cargolux, Emirates, Air India, SAS, Etihad, and Austrian Airlines all conducting operations with Data Comm
 - Additional domestic and international operators will participate as Data Comm services are activated at more airports
- Coordinating with air carriers to support the waterfall
 - Scheduling aircraft to support waterfall deployment
 - Aircrew training
 - Interface testing with Airline Operation Centers (AOC) dispatch automation systems



S1P1 Tower Service - Ground Automation and Network Services

- Completed En Route Automation Modernization (ERAM) hardware installation and integration at parent Air Route ARTCCs (ZLC, ZTL, ZHU, ZID, and ZNY) to support the waterfall
 - Completed NAP to NAP Integration of National ARTCCs (ZLC/ZTL) September 2015
 - Additional releases planned as necessary to support PTR fixes throughout implementation
- Completed Tower Data Link Services (TDLS) software modifications to support the implementation waterfall
 - Additional releases planned as necessary to support PTR fixes throughout implementation
- Data Comm Network Service (DCNS) providing air-ground VHF Data Link Mode 2 (VDL-2) communications
 - Service volumes being ordered at airports 'just-in-time' as program progresses through the waterfall
- FAA Telecommunications Infrastructure (FTI) will be used to provide ground-ground communications
 - All required services have been ordered and cutover



Data Comm Equipage

DATA COMM AIRCRAFT



- 1,494 Data Comm equipped aircraft operating in the NAS as of February 25, 2016
 - o Includes FANS/VDL-2, FANS/POA, business jets, and international aircraft
- 674 aircraft have been equipped through the Data Comm equipage initiative



Data Comm Operational Metrics

	Industry	FAA	Metric Measured		
	Enhanced safety by reduced communication errors	Safety	Probable Reduction in Pilot Readback Error		
	Reduced communication time between controllers and pilots which increases controller productivity	Pilot/Controller Efficiency	Minutes of Comm Time Saved		
	Increased airspace capacity and efficiency	Flight Throughput	Max Departures per 15 Min Periods during Revision Events		
Operational Metrics	Reduced delays, fuel burn, and carbon emissions	Flight Efficiency and Environment	Flight EfficiencyAverage Arrival Delay,Delayed Arrival Aircraft,Average Gate Departure Delay,Gate Departure Delayed Aircraft,Average Taxi-Out Delay, andTaxi-Out Delayed AircraftEnvironmentCalculated CO2 Emissions fromEstimated Taxi Fuel Burn by Aircraft Type		
	Improved re-routing around weather and congestion	Flight Efficiency	Qualitative Analysis with Controllers and Operators		
	Increased flexibility and accommodation of user requests	Pilot/Controller Efficiency	Qualitative Analysis with Controllers and Operators		



Data Comm Operational Metrics

	Industry	FAA	Metric Measured
Operational Metrics	DataComm Usage - This category of metric tracks whether the system is being used operationally and therefore whether the system and procedures are operationally suitable and performing as designed.	System Utilization	Eligible Flights, Participating Flights, Flights w/ Successful Logons, Flights w/ Successful Session Establishments, Flights w/ Initial Clearance Requests, Flights w/ Initial Clearance Received, Percent of Flights Using CPDLC DCL, Flights w/ Revised Route Clearance Received, Percent of Total Flights Receiving Revised CPDLC DCL, Percent of Revised Flights Receiving Revised CPDLC DCL, Percent of Revisions Delivered Using CPDLC DCL, Flights w/ Revised EDCT Clearance Received, Flights w/ Revised EDCT Clearance Received, Flights w/ Revised Altitude Clearance Received, Flights w/ Revised Departure Frequency Received, Flights w/ Revised Departure Contact, Flights w/ Revised Departure Local Info, Flights w/ Revised Squawk Code, Flights w/ Revised Departure Procedure
	Minutes of Comm Time Saved - This category of metric tracks how many controller/pilot communications minutes have been saved by the implemented DataComm functions. The metric is broadly covered by comparing known voice communication times with the communication times observed during DataComm exchanges.	Pilot/Controller Efficiency	Minutes of Comm Time Saved



Data Comm Operational Metrics

	Industry	FAA	Metric Measured			
	Airspace Throughput - This category of metric tracks the impact on peak departure rates, by airport, for both routine operations and weather or other disruption events.	Flight Throughput	Max Departures per 15 Min Periods during Revision Events			
	Ground Delays - This category of metric tracks the impact on taxi time changes, on taxi-time variability, and airport recovery which translates into schedule predictability for aircraft operators.	7	Taxi Time Savings and Time to Zero Delay			
Operational Metrics	Efficiency - This category of metric tracks the impact on taxi-time, gate delay and number of cancelled flights.	Flight Efficiency	Average Arrival Delay, Delayed Arrival Aircraft, Average Gate Departure Delay, Gate Departure Delayed Aircraft, Taxi-Out Time Average Taxi-Out Delay, and Taxi-Out Delayed Aircraft Actual Block Time			
	Fuel Burn - This category of metric tracks the impact on the amount of fuel burned during ground operations and during the departure phase of flight.		Taxi Fuel Burn			
	Implementation - Industry will jointly track with the FAA the operational milestones published by the program.	Program Status	Airport and Aircraft Equipage			



S1P2 Initial En Route Services - Status

Developed En Route Initial Services execution strategy

- Initial Services use cases complete and coordinated with NATCA
 - Initial Services Computer Human Interface (CHI) approved by CHI User Team and ERAM National User Team
- Initial Services deployment strategy briefed to external stakeholders
 - Validated strategy with industry through the joint FAA-industry Data Comm Implementation Team (DCIT) and the NextGen Implementation Working Group (NIWG)
 - Working planning details with industry through DCIT
- Started development of ERAM software enhancements to support Data Comm Initial En Route Services
 - Completed prototype code in November 2014
 - Completed S1P2 En Route Services CHI Demo with En Route Controllers from multiple facilities
 - Initial En Route services on track to be delivered starting in CY2019



Program Challenges

- The commitments to the NAC for deployment of Tower services reflect program challenge dates and not program baseline dates
 - Challenge dates assume more risk in the coordination and field implementation of Controller Pilot Data Link Communications (CPDLC) service to the towers

Training

- Development and acceptance of training materials
- Timing of training to support initial operations at a site
- Operator flight crew training to support waterfall
- Operator commitment /coordination and support of the Tower Services waterfall
 - Equipped aircraft and operations to support Data Comm services
 - Support to FAA site testing and air-to-ground interoperability
- Coordination of the delivery and integration of the component subsystems

 ERAM/TDLS/DCNS/FTI
- Site coordination
 - Coordinating across multiple facilities and operators to transition to Data Comm



Program Summary

- Started Tower Service Implementation Waterfall
 - Received In-Service Decision (ISD) and completed IOCs for Tower Services at Salt Lake City (SLC), Houston Intercontinental (IAH), Houston Hobby (HOU), New Orleans (MSY), Austin (AUS), Louisville (SDF), Newark (EWR), San Antonio (SAT), Kennedy (JFK), Indianapolis (IND), and Los Angeles (LAX)
- Coordinating with field personnel to meet accelerated dates from industry and NextGen
 - Conducting Air Traffic and Tech Ops Training
- Coordinating with industry to support test and turn-up
 - Positive Feedback from stakeholder community
- Proceeding with En Route Service development and planning for Advanced Services
 - Industry and controller buy-in on Initial Services deployment strategy – Re-planning Full En Route Services due to FAA
 - budget constraints, still targeting FID in 2016



