US Department of Transportation
Federal Aviation Administration

KAUS Facility Coordination Plan
For the
Data Communications Service

Version 2.0
1/14/2016

Air Traffic Organization
Program Management Organization
Enterprise Services Directorate
Data Communications Program

Federal Aviation Administration
800 Independence Ave, SW
Washington, DC 20591

FOREWORD

This document details the Federal Aviation Administration (FAA) planned approach to facility coordination regarding the Data Communications end-to-end data communications service within the National Airspace System (NAS). This document is a product of the Air Traffic Organization, Program Management Organization, Enterprise Services Directorate, Data Communications Program Management Office. The Data Communications Program Manager has coordinated this plan with the En Route Automation Modernization Program, En Route and Terminal First and Second Level Maintenance. This Coordination Plan is included in the *Concept of Operations (ConOps) for Data Communications*.

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REVISION HISTORY

Rev	Name	Description	Date
0.1	Leo Parsio Hal Ludwig Lynn Ahpeatone Amy Murray John Wozniak, Jr.	Initial draft	May 2015
0.2	John Wozniak, Jr. Leo Parsio Jesse Wijntjes Hal Ludwig Fausto Hidalgo Chad Gayer	Peer review changes	09 June 2015
0.3	John Wozniak, Jr.	Final edits	22 June 2015
1.0	John Wozniak, Jr.	Final	8 July 2015
2.0	John Wozniak, Jr. Leo Parsio	Updates to remove duplicate contents	2 Dec 2015

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1 Introduction

This plan captures facility coordination requirements from the programmatic perspective. FAA orders determine individual organizational responsibilities as well as defining execution of these responsibilities. The implementation of Data Communications end-to-end service requires coordinated efforts in following areas;

- Terminal domain
- En Route domain
- Commercial Service Provider (CSP)
- Flight deck avionics interoperability
- Air carriers

This plan in not intended to supersede or usurp any existing FAA Order or Notice, rather provide segue to multi organizational engagement. Acronyms and a glossary of terms used in this plan are included in Appendices A and B, respectively. References governing system and service certifications and other documents that support this plan are listed in Appendix C. Appendix D contains the Second Level Facility Coordination Guide.

1.1 Description

The Data Communications Program (DCP) is a Next Generation Air Transportation System (NextGen) foundation program. It transitions communications between pilots and air traffic controllers from a voice-based to a data-driven Air Traffic Control (ATC) communication system. Data Communications encompasses a network that provides service covering multiple domains, and uses a combination of currently deployed NAS infrastructure and new assets as the platform for that service. In provision of the end-to-end service, data communications service will utilize:

- En Route Automation System (EAS)
    - National Application (NAP) Subsystem added to EAS event based certification
    - NAP Subsystem is incorporated in the CFAD service certification
- Tower Data Link Service (TDLS)
    - Data Communications Service added
- FAA Telecommunications Infrastructure (FTI)
- Commercial Service Providers (CSP[1]) for the air-ground link
- Certified aircraft avionics and displays.

The FAA is the integrator of this transformational capability. Implementation of Data Communications requires extensive coordination between two service domains, two first and second level maintenance organizations, multiple first level monitoring control centers and a Commercial Service Provider. Refer to both the *Concept of*

[1] The two current CSPs are Rockwell Collins (legacy - Aeronautical Radio, Incorporated (ARINC) and Société Internationale de Télécommunications Aéronautiques (SITA).

Operations for Data Communications for a detailed description of data communications, and, the approved *Maintenance Concept of Operations for Data Communications*.

1.2 Implementation

DCP will implement the data communications service in two segments:

- Segment 1 (S1) – basic capabilities (as a supplement to voice) for controllers and flight crews to transfer ATC clearances, requests, instructions, notifications, voice frequency communications transfers, and flight crew reports.
    - Phase 1 (S1P1) – Departure Clearance (DCL) capability between controllers at airport towers and aircraft equipped with the Future Air Navigation System (FANS) avionics.

      The DCL and flight deck revisions capability will be delivered by TDLS with the EAS providing aircraft logon and flight data association capability.

    - Phase 2 (S1P2) extends Data Comm service to the En Route domain.
- Segment 2 (S2) – integrates data communication service to aircraft with Aeronautical Telecommunications Network (ATN) equipment, adds taxi instructions in the tower environment and expands S1 en route capabilities to include limited conformance management and initial four-dimensional (4-D) routes.

The *Concept of Operations for Data Communications* provides more detail on the implementation of data communications.

1.3 Facility Coordination

Initial Facility Coordination is a function of the program office. This includes facility orientation, sharing of the program schedule as well as the implementation schedule. From a NAS Operations perspective; Technical Operations owns the responsibility of In-Service NAS Management. Second Level Maintainers are responsible (with regard to the Data Communications capability) for the delivery of the software modifications (system specific) enabling this new capability. This Facility Coordination Plan will arm both Second Level Maintenance organizations with a tool that ensures complete coordination with Air Traffic, Operators, and Technical Operations Control Centers (TOCC).

The rationale for having implementation of a Data Communications Facility Coordination Plan is due to Data Communications being a true service level architecture leveraging existing legacy NAS systems, services and CSPs. There is no singular FAA Order that speaks to complete ownership of implementation of services in this type of environment. Rather a series of FAA Orders and Maintenance Handbooks that define specific organizational elements exist. This document provides guidance to all organizational stake holders regarding complete facility coordination during the implementation of the Data Communications capability.

Facility coordination begins with the Data Communications PMO. The Operations Leads engage both managerial elements of a facility as well as both second level maintainers. The second level organization responsible for the pending software implementation is responsible for notification of both the first- (includes monitor and reporting) and additional second-level maintainers to ensure facilities and additional resources are properly coordinated. This coordination encompasses Air Traffic Control, Technical Operations Services, CSPs, Air Carriers, etc. The goal is to ensure seamless execution of multi system modifications across both the Terminal and En Route Domains during the multi phased delivery of the capability.

Figure 1 shows the data communications service architecture. The purpose of this Facility Coordination document is to synchronize the delivery of the Data Communications capability. Appendix D provides the initial coordination guidance for second level maintainers in all elements of field operations.

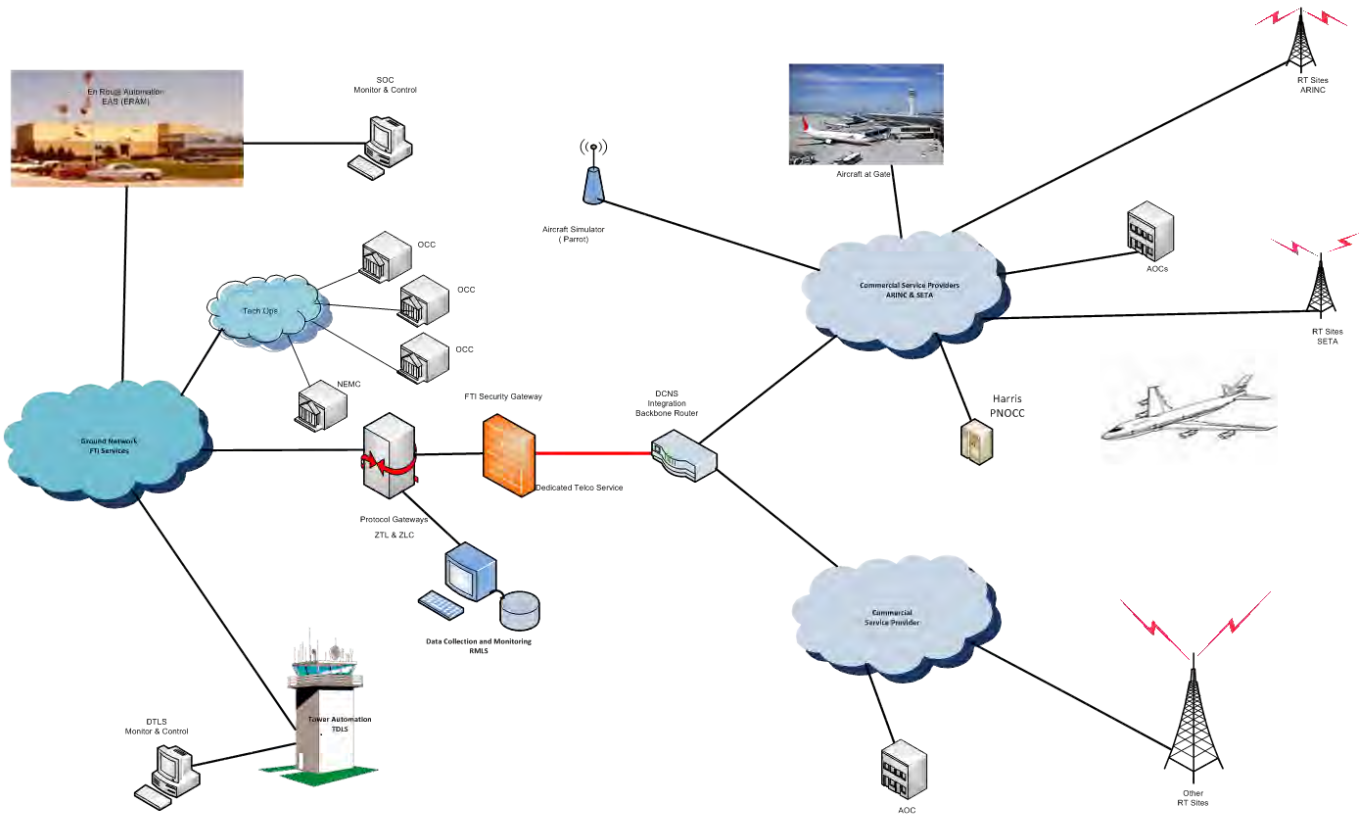


Figure 1 Data Communications Components

2 Roles and Responsibilities

Multiple organizational elements in multiple domains have functional responsibilities in the data communications coordination efforts. This section describes these responsibilities.

2.1 Coordination Basics

The delivery of Data Communications capability requires leveraging all existing coordination tools in use today. The expectation is every organization will augment their coordination process with elements of this plan, ensuring smooth installation of system modifications, system enhancements and infrastructure improvements.

2.2 Data Communications PMO

The program office is responsible for initial implementation scheduling. DCP Operations remains responsible for overall coordination of activities while any upgrade is being performed. This includes on-site activities.

2.3 Technical Operations

TOCCs responsible for NAS coordination will remain responsible for event coordination across all users, NOTAM issue, and system / service interruption management.

2.4 Second Level

Both Second-Level Engineering (SLE) organizations are responsible for the integration of their systems and the delivery of the necessary modifications and software to their respective NAS systems. They continue to be responsible for initial NAS coordination referencing the expected work (modifications, infrastructure improvements, etc) they are responsible for with Technical Operations TOCCs and the DCP Operations Leads. Guidance is captured in Appendix D of this Facility Coordination Plan. NOTE: Initial facility coordination is the responsibility of the Program Office, with second level responsible for NAS coordination.

2.5 Harris (Avionics – CSP)

Harris Corporation is the contractor that provides the segue to the Operator community. This includes management of the CSP as well as interface with the Operators and avionics manufactures.

The Aviation Safety, Aircraft Certification Service is responsible for establishing standards for certification of airborne communications equipment and the Aviation Safety, Flight Standards Service is responsible for operational approval for use. Vendor-provided services will be verified, and airborne communications equipment certified, as a precursor to data communications service certification.

3 Data Communication Facility Coordination

The following sections document telcon information and contact information. For monthly activity and a detailed daily schedule see Appendix 3. For an example of the status note template see Appendix 4.

3.1 Daily Bridge Numbers

Telcon information will be provided in advance to the test participants. Testing may complete earlier or later depending upon availability of the system.

Schedule template per night (All times are local to the facility)

Time	Event	Telcon Info
See App D.	Before Test Huddle	(866) xxx-xxxx pc xxxxxx
See App D.	Validation using STR	(866) xxx-xxxx pc xxxxxx
See App D.	Post Test Review of Issues	(866) xxx-xxxx pc xxxxxx
See App D.	AIMS Input	
See App D.	Status Complete	

3.2 Data Comm Point of Contact (POC)

During on-site Key site Activities contact the Data Comm Point of Contact (POC):

Name	Organization/Position	Email	Phone
Leo Parsio	ERAM SLE (Principal)	leo.parsio@faa.gov	609-203-8677
Mark Thiessen	IFCET (Principal)	mark.thiessen@faa.gov	405-613-5421
John Wozniak, Jr	DCP Operations (TOS)	john.wozniak-jr@faa.gov	405-426-2899
Gregg Anderson	DCP Operations (AT)	gregg.anderson@faa.gov	202-236-1290

PRINCIPLE can be contact anytime by phone, text or email.

3.3 Site Points of Contact

Salt Lake City ARTCC

Name	Title/Org	Email	Phone
Jamie Beert	ZLC POFM	jamie.beert@faa.gov	(801) 320-2591
Carl Lapray	ZLC TOM	carl.lapray@faa.gov	801-320-2228
Stan Zgorzelski	ZLC SOC Manager	stan.zgorzelski@faa.gov	801-320-2528
Minh Nguyen	ZLC -ARTCC Automation SSC Manager	minh.nguyen@faa.gov	801-320-2342

Atlanta ARTCC

Name	Title/Org	Email	Phone
Cheryl White	ZTL POFM	cheryl.white@faa.gov	770-210-7653
Terry Gadd	ZTL TOM	terry.gadd@faa.gov	770-210-7613
Latonia Vickers	ZTL SOC Manager	latonia.vickers@faa.gov	770-210-7759
Bill Kaufman	ZTL -ARTCC Automation SSC Manager	william.kaufman@faa.gov	770-210-7757

Houston ARTCC

Name	Title/Org	Email	Phone
Willie Vest	ZHU POFM	willie.vest@faa.gov	281-230-5678
Valdrie Buford	ZHU SOC Manager	valdrie.l.buford@faa.gov	281-230-5420
Robert Molloy	ZHU -ARTCC Automation SSC Manager	robert.molloy@faa.gov	281-230-5408
Ed Thaggard	ZHU NAS NOM	william.e.thaggard@faa.gov	281-230-5310

Austin-Bergstrom International Airport ATCT

Name	Title/Org	Phone	Email
Donnie Bamburg	Tech Ops Support	512-369-7900	donald.r.bamburg@faa.gov
Nicholas Bialek	NATCA Article 48 Rep	512-369-7841	nickbialek@gmail.com
Jeffrey Brennan	NATCA Article 48 Rep Management	512-369-7800	jeffrey.s.brennan@faa.gov
Kevin Canipe	NATCA Fac Rep	479-252-0407	austinfacrep@gmail.com
Tim Lyke	Tech Ops Support	512-369-7956	tim.lyke@faa.gov
Bob Morris	ATM	512-369-7801	bob.morris@faa.gov
Mike Powers	AT FLM	512-369-7800	mike.powers@faa.gov
Jesse Tamez	Tech Ops SSC Manager	512-369-7951	jesse.tamez@faa.gov

PMO On-Site Support

NAME	Title/Org	Phone Numbers	E-mail
Ray Martinez	NATCA SME (EWR)	732-278-8349	mikezulu10@aol.com
Matt Maki	DOT/VOLPE TDLS SME	617-874-6699	Matthew.Maki@dot.gov
Joey Ruffino	NATCA SME	281-382-4871	ajruffino@hotmail.com
David Suess	CTR –Technician	262-960 4646	david.suess@veracity-eng.com
Joseph Yanosky	FAA Tech Ops TDLS SME (ATL)	404-968-7975	joseph.yanosky@faa.gov
Jerry Poole	CTR-ATC SME	706-362-3509	jerrypoole66@gmail.com
Ron Olson	CTR-ATC SME	303-250-8658	ron.olson@bigtexassky.com
Brian Bridwell	CTR-ATC SME	904-557-8159	bbridwell@cgh-tech.com
Steve Wells	CTR-ATC SME	209-324-4142	swells@cghtech.com

3.4 Documentation for Deployment

ERAM Second Level Engineering (SLE) and TIMS/TDLS engineering team members have developed the following documentation:

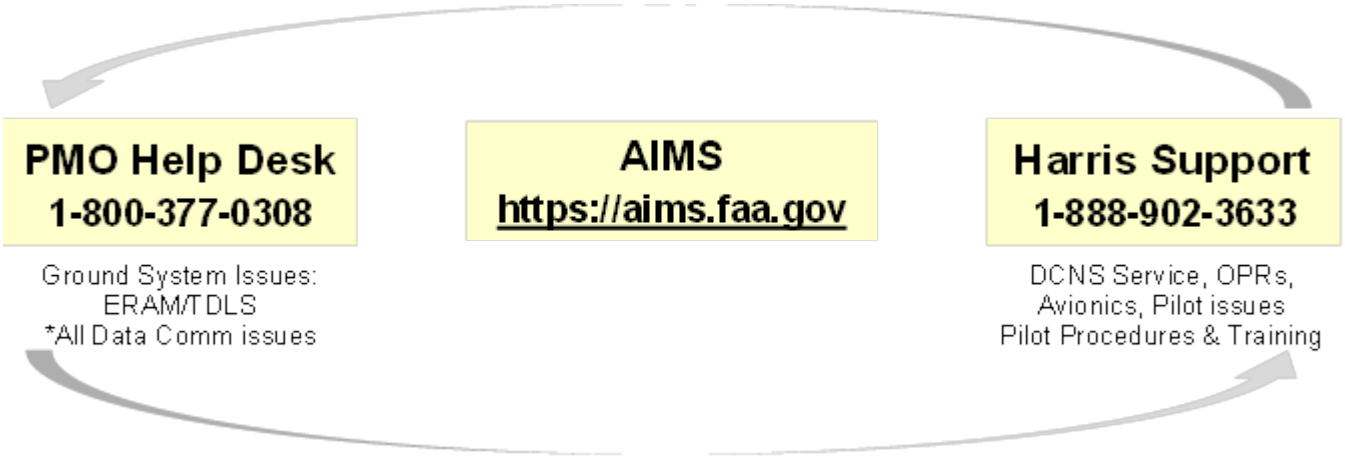
System Technical Reports (STR) or Document	**Phase**	**Title**	**Applicability**
SSM-TDLS-014	Phase 0		KAUS
SSM-ERAM-186 Rev. B	Phase 0		N/A
STR-ERAM-055	Phase 1	TEDC (TDLS Interface) Turn-up Procedures	ZHU, KAUS
STR-ERAM-058	Phase 4	DCL Functional Verification	ZLC, ZTL, ZHU, KAUS
DFV	-	Data Comm Functional Verification	ZHU, KAUS
Site Coordination Document	-	Site Coordination Document	All
Daily Schedule	-	Daily Schedule for Houston Center (ZHU), Austin-Bergstrom International Airport (AUS)	All

3.5 Issue Reporting / Help Desk / Local Bridge Contact

All system / service issues (system failures, service interruptions, reduced service situations) are reported through the TOCCs.

- Equipment and service issues are reported through the normal first level reporting mechanisms
- Elevation of issues to SLE is through the Help Desk

SLE (both Terminal and En Route) Help Desk: 1-800-377-0308



AIMS Template – please see Appendix 1

OPR Template – please see Appendix 2

3.6 NOTAMS

The TOCC will use the event notification tool to post this event. The following is an example of NOTAM reporting expectations.

NOTAMs and ATIS updates (voice and data) will be necessary for the STR-ERAM-055, TDLS TEDC Turn-up (Phase 1) – SLC and also for STR-ERAM-055 TDLS TEDC Turn-up (Phase 1) – BOI activities. Airway Transportation System Specialists (ATSS) at the Air Traffic Control Tower (ATCT) will post the NOTAMs. The Clearance Delivery Controller at the ATCT will post ATIS updates.

> **Sample wording for the Data Comm Phase activity NOTAM is a follows:**
>
> **“”SLC (BOI) Departure Clearance Service (PDC) OTS [timeframe] xxyyzz-aabbcc. Use voice.””**

A NOTAM will be sent 6-12 hours in advance.

3.7 Initial Operating Capability (IOC) Criteria for CPDLC

- ❑ STR-ERAM-055 and STR-ERAM-058, run successfully including the DCL Function Verification (DFV) completed and witnessed by Site Personnel.

- ❑ All Certification checks/procedures completed successfully at the National/Parent Air Route Traffic Control Centers (ARTCC), and TDLS tower. Systems / Services certified prior to and during the 72-hour run to verify that Certification checks/procedures do not impact any services.

- ❑ Air Traffic (AT) and Technical Operations (TO) final draft procedures, TIBS, Handbooks, etc. are available

- ❑ FAA 2nd Level Engineering (En Route, Inter-Facility Communications Engineering Team (IFCET)) issue tracking, including the HARRIS Network Help Desk are ready to support the Data Comm End-to-End System.

- ❑ Formal training and certification of Air Traffic and Technical Operations staff has been completed in accordance with Technical Training and Quota Management agreements.

- ❑ Sufficient numbers of Flight Crews and Flight Dispatchers have been trained to participate in DFV Dry Run and Test Conduct and continue into operations.

- ❑ The facilities agree that the system has had a suitable number of operations to assess service operational readiness. Ten (10) successful Controller Pilot Data Link Communications (CPDLC) DCL flights.

- ❑ All AT, TO, and Flight Standards (if necessary) staff involved in witnessing the DFV at the participating sites have sufficient confidence that the system and procedures work suitably to make the required FAA facility log entries and get Aircraft Ops Spec Approval.

- ❑ Successful Certification of Systems and Services at the National/Parent ARTCCs, and TDLS tower.

    - ❑ Successful aircraft logon, and session establishment,

    - ❑ Successful downlink clearance request (DM25),

    - ❑ Successful initial clearances (Cleared as Filed (CAF) UM79, UM80),

    - ❑ Successful revised clearances (UM79, UM80) single element revisions, [Note: UM83 – will not be sent until switch is turned on]

    - ❑ Proper route content,

    - ❑ Proper downlink responses,

- ❑ Successful connection termination,
- ❑ Successful management of non-nominal conditions including:
    - o Ability to make and interpret logon queries
    - o Add/Remove Aircraft from Blocked List

- ❑ Aircraft Operator:
    - ❑ A056 approved by POI
    - ❑ Training complete; pilot and dispatcher
    - ❑ Sufficient back office automation to support operations

3.8 Certification / Recertification

Service Level Certification is at the Service Delivery Point (SDP). For Phase 1, CPDLC Service Level Certification is required at the ATCT, TDLS. Certification is required for live testing.

Interruptions in the data communications service will necessitate recertification. Interruptions may be detected through a number of means including indications on the system displays, outage reports from commercial service providers or by Air Traffic Controllers at operating positions within terminal or en route ATC facilities.

Once a data communications service interruption has been detected, an ATSS will determine the severity of the interruption. The ATSS will also determine if the interruption is the responsibility of the FAA or the FTI / Data Communications Integrated Services (DCIS) vendor. Interruptions determined to be the responsibility of the vendor will be corrected by the vendor who will also be responsible for verifying the service as required.

If the interruption is determined to be the responsibility of the FAA, then a data communications service component ATSS may be notified to trouble shoot the malfunctioning data communications component, isolate the fault, perform corrective maintenance, perform the system certification procedures outlined in the applicable Maintenance Handbook (MHB), and provide return to service notifications. System and service recertification is completed IAW system Maintenance Hand Books. Data Communications support and the Second Level Support on site will assist with trouble shooting activities.

3.9 Program Office / Second Level Contacts

Data Communications Program Office / Second Level Contacts

Name	Title/Org	Email	Phone
Jesse Wijntjes	DCP Program Manager	jesse.wijntjes@faa.gov	(202) 267-8102
Gregg Anderson	DCP Operations Lead (AT)	gregg.anderson@faa.gov	(202) 236-1290
John Wozniak, Jr	DCP Operations Lead (TO)	john.wozniak-jr@faa.gov	(405) 423-2899
Kevin Grimm	DCP Engineering Lead	kevin.grimm@faa.gov	(202) 267-8364
Peter Muraca	DCP Integration Lead	peter.muraca@faa.gov	(609) 485-5261
Hal Ludwig	DCP Implementation Lead	hal.ludwig@noblis.com	(202) 414-2005
Chad Geyer	DCP NATCA (Art 48 Rep)	cageyer9@msn.com	(661) 713-9091
Fausto Hidalgo	DCP PASS (Art 13 Rep)	fausto.hidalgo@faa.gov	(305) 716-1204
Matthew Roland	DCP PASS (Art 13 Rep)	matthew.roland@faa.gov	(859) 907-1949
Quincy Maxwell	DCP NAGE (National Rep)	quincy.maxwell@faa.gov	(281) 230-5628
Bruce Notley	IFECT SLE (TIMS/TDLS)	bruce.notley@faa.gov	(405) 954-9375
Lynn Ahpeatone	IFECT SLE	lynn.ctr.ahpeatone@faa.gov	(405) 954-0615
Leo Parsio	ERAM SLE (POC)	leo.parsio@faa.gov	(609) 203-8677

Appendix A Acronyms

ADS-B	Automatic Dependent Surveillance - Broadcast
ARINC	Aeronautical Radio, Incorporated
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
ATM	Air Traffic Management
ATN	Aeronautical Telecommunications Network
ATSS	Airway Transportation System Specialist
BEP	Back End Processor
ConOps	Concept of Operations
CPDLC	Controller Pilot Data Link Communications
CSP	Commercial Service Provider
DCIS	Data Communications Integrated Services
DCL	Departure Clearance
DCNS	Data Communication Network Service
DCP	Data Communications Program
DFV	DCL Functional Verification
DSR	Display System Replacement
EAS	En Route Automation System
ECG	En Route Communications Gateway
ERAM	En Route Automation Modernization
ERIDS	En Route Information Display System
FAA	Federal Aviation Administration
FANS	Future Air Navigation System

FDIO	Flight Data Input-Output
FEP	Front End Processor
FTI	FAA Telecommunications Infrastructure
HADDS	Host ATM Data Distribution System
HCS	Host Computer System
IFCET	Inter-Facility Communications Engineering Team
MHB	Maintenance Handbook
NAP	National Application Subsystem
NAS	National Airspace System
NextGen	Next Generation Air Transportation System
NNEW	NextGen Network Enabled Weather
NVS	NAS Voice Switch
OPR	Office of Primary Responsibility
OT	Operational Test
PNOCC	Primary National Operations Control Center
RF	Radio Frequency
RMLS	Remote Maintenance Logging System
S1	Segment One
S1P1	Segment One Phase One
S1P2	Segment One Phase Two
S2	Segment Two
SDP	Service Delivery Point

SITA	Société Internationale de Télécommunications Aéronautiques
SOC	Service Operations Centers
SSC	Systems Service Center
SWIM	System Wide Information Management
TDLS	Tower Data Link Service
TIMS	Tower Information Management System
TOCC	Technical Operations Control Center
URET	User Request Evaluation Tool
VDL2	VHF Data Link Mode 2
VHF	Very High Frequency

Appendix B Glossary

Certification	The determination and validation that a system, subsystem, or service is providing or is capable of providing the advertised service to the user. Certification includes an independent determination, which ascertains the quality of advertised services, and a validation, which officially confirms and documents the determination in the maintenance log.
Certification Parameter	Selected critical indicators of the quality of the required advertised services being provided to the user of systems, subsystems, equipment, and services.
Commercial Service Provider	Commercial companies providing air-to-ground communications to commercial airlines. Rockwell Collins /ARINC and SITA are the current data communications CSPs. ARINC established in 1929, is a major provider of transport communications and systems engineering solutions for eight industries including aviation. ARINC was sold to Rockwell Collins in August 2013. SITA was founded in February 1949 by 11 airlines in order to bring about shared infrastructure cost efficiencies by combining their communications networks. SITA headquarters is Geneva, Switzerland. Their Primary National Operations Control Center (PNOCC) is in Montreal, Canada.
Corrective Maintenance	Maintenance performed to identify or correct a problem.
Daily	As used in stating a maintenance schedule, daily is intended to mean once every calendar day for those locations staffed with maintenance personnel 7 days a week. At other locations, daily is intended to mean every calendar day a specialist is on duty. The schedule may be reduced to a minimum of 3 times a week, with not more than 3 days between successive occurrences, at un-staffed locations.
Data Communications	A data-based controller to pilot air traffic control communication system.

Data Communication Integration Service	A provisioned service similar to FTI, but will focus on the air-to-ground portion of the data communication service and the support to the program on managing, e.g., the Aircraft Equipage Initiative. The DCIS and FTI operating together will provide the required telecommunications network infrastructure necessary to provide the end-to-end data communications service. Harris Corporation is the DCIS vendor.
Data Communications Network Service	The data communication end-to-end service that includes the systems and networks at the SDPs, FTI and CSPs.
En Route Automation System	An en route control system that processes surveillance information, aircraft flight information (flight plan), weather data, critical data pertaining to the NAS and its infrastructure; calculates and projects flight and track information to provide for the expeditious movement of aircraft operating in the ARTCC environment. EAS is comprised of hardware and software infrastructure deployed to the ARTCC via the En Route Automation System (ERAM) program. Lockheed Martin is the EAS vendor.
En Route Automation Modernization	The program that replace the following components of the en route control system: • User Request Evaluation Tool (URET) • Host Computer System (HCS) • Display System Replacement (DSR) • Host Air Traffic Management (ATM) Data Distribution System (HADDS) • En Route Communications Gateway (ECG) • En Route Information Display System (ERIDS) The ERAM program replaces hardware and rewrites the ATC software used at en route centers. Its initial purpose is to modernize ATC automation systems and expand capacity.
Event	Any occurrence, which may or may not be significant.
Event-based Certification	System and subsystem certification when some maintenance or administrative activities occur.

FAA Telecommunications Infrastructure	A telecommunications network that provides nearly all voice, data and video telecommunications services within the FAA's operational ATC system. In 2002 the FAA awarded a contract to Harris Corporation to provide the required telecommunications network which manages 21,000 services at more than 5,000 facilities. Data Comm will use FTI to carry the ground-to-ground portion of the data communications service. The FTI and the Data Communication Network Service (DCNS) operating together will provide the required telecommunications network infrastructure necessary to provide the end-to-end data communications service.
Interruption	A break in continuity, the loss or unavailability of a facility/service, regardless of duration or cause.
Key Performance Parameter	A selected parameter of the system, subsystem, or equipment, which is a critical indicator of whether or not it is performing its intended function. These parameters are clearly identified in maintenance handbooks with an arrow and are used as troubleshooting aids to logically segment signal flow through the equipment.
Monitor and Control	A device designed to detect when a designated parameter has deviated beyond its prescribed tolerance/limit, and then to activate an alarm to this effect or alter the operation or both.
National Application Subsystem	The NAP is a subsystem of National EAS sites in Atlanta (ZTL) and Salt Lake City (ZLC). The NAP subsystem is the Data Comm central processing and data management center and protocol gateway.

Next Generation Air Traffic Control System	NextGen is an umbrella term for the ongoing, wide-ranging transformation of the NAS, including the national system of airports, to ensure future safety, capacity and environmental needs are met. NextGen will fundamentally change the way air traffic is managed by combining new technologies for surveillance, navigation, and communications with workforce training, procedural changes, and airfield development. It will deploy transformational programs including Automatic Dependent Surveillance - Broadcast (ADS-B), Data Comm, NextGen Network Enabled Weather (NNEW), NAS Voice Switch (NVS), and System Wide Information Management (SWIM). These core technologies provide the communication, navigation, and surveillance technology to support the more sophisticated information flows that will allow better use of airspace capacity.
Outage	The loss of a facility/service for one minute or more.
Performance Checks	A periodic scheduled test, measurement, or observation of normal operating controls and functions, which is necessary to determine whether a system is operating within its established tolerances and limits.
Periodic Maintenance	Any scheduled activities that include performance checks and/or maintenance tasks.
Restoration	The maintenance activities required to return a system, subsystem, equipment, or service to normal use following an interruption, equipment failure, or out-of-tolerance/-limit condition.
Service	An end product, resulting from a specific combination of system(s), subsystem(s), and/or equipment(s), delivered to a user (internal or external to the FAA) of the NAS.
Service Delivery Point	The system where the data communications service is delivered. TDLS at the airport ATCT and EAS at the ARTCC are the DCNS SDPs.
Software	A set of programs, procedures, rules, and documentation concerned with the operation of a data processing system; for example, compilers, library routines, and manuals.
Subsystem	A portion of a system that performs a specific function.

System	A combination of subsystem(s), equipment and/or software whose individual functions produce by engineering design a specific operating product in the NAS.
Tower Data Link Services	TDLS comprises a set of Data Communication services providing information from ATCT to aircraft flight crews. TDLS has been implemented at 74 ATCTs. TDLS provides DCL, emulation of Flight Data Input/Output (FDIO) Cathode Ray Tube and Replacement Alpha Numeric Keyboard (CRT/RANK) functions, and Digital Automatic Terminal Information Service (D-ATIS).
Tower Information Management System	TIMS is the TDLS Back End Processor (BEP). Messages generated by TDLS sites are forwarded to the TIMS co-located with NESG at Atlanta and Salt Lake City. CSPs connect to the TIMS servers via the TDLS Front End Processors (FEP) connected to the NESGs. The TIMS servers forward messages via the FEP to the external CSP.
Validation	Validation is the second step in the certification process. It involves the act of making an official statement or declaration in a certification log entry.
Verification	A process similar to certification except performed by Non-Federal personnel.
VHF Data Link Mode 2	A means of sending information between aircraft and ground stations. Aeronautical VHF data links use the 117.975 – 137 MHz band assigned by the International Telecommunication Union to Aeronautical Mobile Services (Route). Mode 2 is the only VDL mode being implemented operationally to support CPDLC. Networks of ground stations providing VDL Mode 2 service have been deployed by Rockwell Collins / ARINC and SITA with varying levels of coverage.

Appendix C References

FAA Order 3000.57 Air Traffic Organization Technical Operations Training and Personnel Certification, July 16, 2009

FAA Order 6000.15F General Maintenance Handbook for National Airspace System (NAS) Facilities January 5, 2011

FAA Order 6000.30E National Airspace System Maintenance Policy, July 11, 2007

FAA Order 6030.41, Notification for Unscheduled Facility and Service Interruptions

JO 6000.200 Change 3 Maintenance of FAA Telecommunications Infrastructure (FTI) Services, March 2, 2011

JO 6000.203 National Airspace System (NAS) En Route and Oceanic Operations Automation Services Support Responsibilities, December 1, 2011

JO 6000.204 Maintenance of National Airspace System (NAS) Telecommunication Services, June 15, 2012

JO 6000.51B Air Traffic Organization Responsibilities for the Support of National Airspace System Terminal Automation Services, August 27, 2009

JO 6100.1H, Maintenance of NAS En Route Stage A - Air Traffic Control System

JO 6140.17 Remote Monitoring and Logging System (RMLS) Maintenance Handbook

N JO 6550.11, Interim Maintenance Procedures for the Tower Data Link Services II (TDLS2) Equipment

ATO Technical Operations Services Maintenance Concept of Operations for 2014 and Beyond, May 27, 2011

Final Program Requirements for Data Communications v 1.7, August 30, 2011

Concept of Operations for Data Communications v 0.2 Draft, September 2013

Maintenance Concept of Operations for Data Communications v 0.3 Draft, September 2013

Appendix D Issue and Status Templates and Detailed Schedules

Contents:

Attachment 1 – AIMS Template

Attn: PMO ATS Help Desk **FAX: 609-485-5949**

AIMS Database Entry Form

Controller Name:

Phone # or E-mail:

Date: Time:

SME:

Terminal: Category: ☐ Tech Ops ☐ Air Traffic

Report Type:
☐ Trouble Report
☐ Adaptation Request
☐ Engineering Request

Priority:
☐ CRITICAL
☐ HIGH
☐ MED
☐ LOW

Functional System:
☐ ERAM ☐ IDSR
☐ TDLS

Functional Capability:
☐ Data Comm S1P1

Attachments:
☐ File name _____

Flight Plan Information: *(Attach Strip(s) if able)*

CID	Aircraft ID	BCN Code	Altitude	Route

Title:

Description:

NOTE: Work Around data should be put in the PON comments field

Expected Results: (use White board in AIMS)

Operational Impact (Crit or High Only):

AIMS #

Attachment 2 – OPR Template

Data Comm

Operational Problem Report Ticket

Helpdesk Contact Information:

Phone: (888) 902-3633 (Opt 4)
Fax: (321) 837-5621
Email: OPR@Harris.com

(Fields marked with BOLD* are required)

General Information	
Incident Date:*	
Location:*	
Incident Time:	
Organization:	
Role:	

Flight Information	
Flight ID:*	
Tail #:	
Strip ID:	
Carrier:	

☐ Non-Flight Related

☐ Multiple Flights

(if multiple, include information on each flight in Problem Description)

Submitter Information	
Full Name:	
Phone:	
Email:	

Contact Representative (for your organization)	
Full Name:	
Phone:	
Email:	

☐ Same as Submitter

Problem Description:*

Attach strip here, if available:

US Department of Transportation
Federal Aviation Administration

Data Communications
Maintenance Concept of Operations
Version 1.0 Final
19 December 2014

Air Traffic Organization
Program Management Organization
Enterprise Services Directorate
Data Communications Program Office

Federal Aviation Administration
800 Independence Ave, SW
Washington, DC 20591

Foreword

This document provides the Federal Aviation Administration's (FAA) maintenance concept of operations for managing Data Communications services within the National Airspace System (NAS). This document is a product of the Air Traffic Organization, Program Management Organization, Enterprise Services Directorate, Data Communications Program (DCP) Management Office. The Enterprise Services Directorate has coordinated this document with the En Route Automation Modernization Program Management Office, En Route and Oceanic Second-Level Engineering, Technical Operations Services (TOS) Operations Support Directorate, National Enterprise Operations (NEO), and TOS Second-Level Engineering.

Concur

Jo L. Tarrh
Director / Operations Support

Date 1/12/2015

Concur

Richard Morgan
Director / National Enterprise Operations

Date 12/22/2014

Approved

Malcolm Andrews
Director / Enterprise Services

Date 12/18/14

Revision History

Rev	Name	Description	Date
0.1	John Wozniak, Jr.	Initial draft (50%) of the iMCO	July 18, 2011
0.2	John Wozniak, Jr.	Revised the iMCO to provide program details. Replaced Section 2 Program Overview.	January 14, 2013
0.3	James Victorine John Wozniak, Jr.	Revised Section 4 Maintenance Workforce Structure and Section 6 Remote Maintenance Monitor and Control.	March 22, 2013
1.0	James Victorine Tonyia Bellina	Final. Incorporates comments from Technical Operations Services, Operations Support and National Enterprise Operations Directorates.	19 December 2014

Table of Contents

1 Introduction

A maintenance concept is a statement of broad concept or planned approach that governs the maintenance levels and type of maintenance activities performed for an equipment, machine, plant, or system.

1.1 Scope

This Data Communications Maintenance Concept of Operations (MCO) defines the Technical Operation Services (TOS) organizational requirements and operating procedures for Data Communications.

1.2 Authority

Title 49 of the United States Code requires the FAA to manage the use of the national airspace and the movement of air traffic in that airspace. The National Airspace System (NAS) is a complex collection of systems, procedures, facilities, aircraft, and people. These components work together as one system to ensure that safe and efficient services are provided to the flying public, airlines, and airports.

1.3 Organizational Responsibility and Policy

The ATO, assigned by the FAA Administrator, is responsible for providing NAS services. The Chief Operating Officer, assigned to the Vice President of TOS, ensures that the NAS operates at the required levels of service. In accordance with the FAA Administrator's NAS maintenance policy, [1] TOS must support NAS modernization by ensuring that the implementation and integration efforts are properly coordinated. TOS must develop or assist in the development of a maintenance concept tailored to the specific approach used for acquisition. TOS must determine the standards used for maintenance regardless of the chosen maintenance concept. The Vice President of Technical Operations Services must ensure that the maintenance concept determination is made as early in the program's lifecycle as practicable.

[1] FAA Order 6000.30, National Airspace System (NAS) Maintenance Policy

2 Program Overview

Data communications (Data Comm) will assume an ever-increasing role in controller to flight crew communication, contributing significantly to increased efficiency, capacity, and safety of the NAS. The evolution of data communications in the operational environment is based upon the incremental implementation of advanced communication capabilities. Data Comm represents the first phase of the transition from the current voice system to an International Civil Aviation Organization (ICAO)-compliant system in which digital communication becomes an alternate and eventually predominant mode of communication.

The Data Communications Program (DCP) will implement Data Comm in two segments. Data Comm Segment One (S1), implemented in 2015 and beyond, will concentrate on implementing data communications capabilities in the tower and en route environments as a supplement to voice communications and will serve as the initial building block for future data communications-based operations. In the tower environment, Data Comm capabilities will provide for new methods for delivery of Departure Clearances (DCL) and revisions to the flight deck. In the en route environment, Data Comm will provide the basic capabilities for controllers and flight crews to transfer Air Traffic Control (ATC) instructions, notifications, voice frequency communication transfers, and flight crew requests and reports as a supplement to voice. Data Comm S1, Phase 1 (S1P1) provides DCL service to aircraft with the Future Air Navigation System (FANS) equipment. Data Comm S1, Phase 2 (S1P2) extends Data Comm to the en route ATC environment. S1 Phase 3 (S1P3) provides additional en route services. This automation will free controllers from repetitive voice exchanges that are currently required, and will improve safety by reducing ambiguities and errors that can occur during these voice exchanges. This will allow the controllers to put more focus on non-routine events that require human intervention.

Data Comm Segment Two (S2), implemented in 2025 and beyond, integrates Data Comm service to aircraft with Aeronautical Telecommunications Network (ATN) equipment, adds taxi instructions in the tower environment and expands Data Comm S1 en route capabilities to include limited[2] conformance management and initial 4-D routes. The DCP will introduce trajectory conformance management to monitor the trajectory-based clearances by providing the means for the aircraft and the ground system to exchange data without the direct involvement of the flight crew or controller. The aircraft's capability to fly its cleared route of flight accurately and improvements in conformance predictability, either through ground automation improvements, interaction with traffic flow management and flight operations centers, or through the provision of aircraft intent data, will increase the precision of trajectory modeling and enable new concepts in separation assurance. The exact mechanism for this capability is still to be determined.

2.1 Tower Environment

In 2013, the DCP implemented the Data Comm DCL capability in two Tower environments[3] using a commercial off-the-shelf (COTS)-based product, the Data Comm Trials Automation Platform (DTAP).[4]

[2] The DCP implements these capabilities in the en route environment on a limited basis at certain airports with aircraft meeting capability requirements.
[3] The two airports, Memphis (MEM) and Newark (EWR) will operate for one year each under HADDS and FDIO test NAS Change Proposals (NCP).
[4] The vendor is Harris/Thales.

In 2015, the DCP implements Data Comm S1 capabilities with a technology refresh of the Tower Data Link Services (TDLS).

- New TDLS servers, new operating system, revised TDLS software, new display workstations at 73 ATCTs
- Introduction of Tower Information Management System (TIMS) equipment at the two National Enterprise Management Centers (NEMC) in Atlanta, GA and Salt Lake City, UT
- TDLS support systems at the Inter-facility Communications Engineering Team (IFCET) second-level maintenance organization located at the Mike Monroney Aeronautical Center (MMAC) in Oklahoma City
- TDLS training systems at the FAA Academy in Oklahoma City, OK

The technology refresh consists of:

- TDLS v11.0 is a technology refresh of the TDLS and TIMS:
    - Changes the name of the Pre-Departure Clearance (PDC) application to DCL (PDC capability remains)
    - Reroutes all PDC and Digital Automatic Terminal Information Service (D-ATIS) message traffic off of the National Airspace Data Interchange Network (NADIN) II X.25 network and onto the FAA Telecommunications Infrastructure (FTI) Transmission Control Protocol/Internet Protocol (TCP/IP) network
    - Introduces the TIMS at NEMC sites to provide data exchange between TDLS and Data Comm systems in the En Route environment.
    - Replaces TDLS and TIMS servers and operating system and replaces TDLS workstations.
    - Changes the graphical user interface to the TDLS interface.
    - Provides a negligible change to the X-Terminal applications.
- TDLS v12.0 provides the basic Data Comm S1 capabilities for controllers and flight crews to transfer ATC clearances, requests, instructions, notifications, voice frequency communications transfers, and flight crew reports as a supplement to voice to and from the en route environment.

2.2 En Route Environment

The DCP will implement Data Comm S1 capabilities in the En Route environment using the En Route Automation System (EAS). EAS processes surveillance information, aircraft flight information (flight plan), weather data, and critical data pertaining to the NAS and its infrastructure, calculates and projects flight and track information to display the movement of aircraft operating in the Air Route Traffic Control Center (ARTCC) environment. EAS infrastructure is deployed to ARTCCs by the En Route Automation and Modernization (ERAM) Program.

The Data Comm Segment 1 application (TDLS v12.0) will interface ERAM Program Segments 1, 2, and 3 for content generation and utilize the Digital Very High Frequency (VHF) Aeronautical Mobile Communications Infrastructure for delivery to the aeronautical system (aircraft).

To implement Data Comm S1 capabilities, EAS changes include:

- Establishment of two Data Comm National sites at Atlanta and Salt Lake City ARTCCs
    - Addition of EAS National Application (NAP) subsystem equipment at the National sites

    - Functions and computer-human interface (CHI) elements added to EAS Monitor and Control (M&C)
    - Additional EAS NAP subsystem-specific roll-up status icons in the System Summary window
    - EAS Scenario Control window includes the option to run scenarios from a non-national site synchronized with the NAP subsystem
- Changes to Conflict Probe Processor at all EAS sites:
    - Serves as proxy for Blocked List/Logon data processing
    - Adds Ethernet card for data exchange with assigned ATCT TDLS
- Changes to the adapted Air Traffic Specialist (ATS) workstation at all EAS sites
    - Logon Query and Blocked List display and user data management functions
    - Individually adaptable capabilities for each ATS workstation
- Added external interfaces at all EAS sites
    - TDLS status and interface details added to External Interfaces window
    - NAP subsystem interface status to National sites added to External Interfaces window
    - Roll-up status of NAP services and M&C Interface to the National sites

The Data Comm architecture ensures that there is geographic diversity by locating redundant Data Comm EAS equipment at each of the two National Air Route Traffic Control Centers (ARTCCs) in Atlanta and Salt Lake City who will alternate serving as the active and backup national ARTCC to provide protection from catastrophic regional events, like blackouts and weather events. The backup national ARTCC is up and operational 24 hours a day and data is continuously synchronized to the active to provide a "warm standby." The backup Data Comm National EAS can be switched to the active National EAS with an administrative failover action ("promotion") executed by TOS personnel at the accepting site.

2.3 Leased or Provisioned Services

A leased or provisioned service (in support of NAS operations) is a service-only contract that could include research, development, procurement, implementation, monitoring, and/or operational functionality, from a vendor in accordance with the Contract Data Requirements List (CDRL) associated with a contract document available through the appropriate program office. The FAA will define the requirements and specifications for leased or provisioned services but typically, the FAA will not own or maintain any equipment used to produce these services. TOS will define the technical performance measures that the FAA will use to provide oversight through monitoring and confirmation of the delivery of leased or provisioned services. Technical Operations Control Centers (TOCC)[5] will provide NAS event management for leased or provisioned services, and coordinate and document their availability.

2.3.1 Data Communication Network Service

The Data Communications Network Service (DCNS) is a leased service procurement designed to provide Data Comm in the aeronautical environment. The FAA will use a Data Communications Integration Support (DCIS) contractor (Harris Corporation) to integrate the commercial service provider (CSP)

[5] Operations Control Centers (OCC), Service Operations Centers (SOC), and National Enterprise Management Centers (NEMC)

infrastructure that connects the airline operations center (ground/ground) and aircraft (air/ground) telecommunications equipment and networks with FAA Telecommunications Infrastructure (FTI). The current CSPs are the Societe Internationale de Telecommunications Aeronautiques (SITA) and Aeronautical Radio, Incorporated (ARINC). CSPs (SITA and ARINC) are responsible for maintaining their equipment and networks and provide notification to DCIS contractor (Harris) of potential impacts to the Data Communications Network Service (DCNS) resulting from their maintenance activities. The DCIS contractor provides coordination and notification of CSP maintenance activities with the NEMCs. NEMC is responsible for DCIS network performance monitoring and event coordination with affected Service Area OCCs and ARTCC SOCs.

2.3.2 FAA Telecommunications Infrastructure

FTI is a vendor-provided (Harris) integrated telecommunications network for most FAA telecommunications resources, including Data Comm. The FTI:

- Provides telecommunications services that meet the performance requirements of the user between the service delivery points (SDP).
- Network uses commercial-off-the-self (COTS) equipment (defined to include hardware, software, and firmware) and commercially available terrestrial/wireless and space segment communication resources.
- Provides operations, management, and control of the FTI network.
- Provides all necessary quality assurance, and configuration management of the FTI network.
- Provides technical support services, training, and documentation for the FTI network.
- Provides engineering, installation, testing, and implementation of the FTI network.
- Provides network security at a level acceptable to the FAA.
- Provides real time and non-real time performance and management information.
- Provides telecommunications services ordering and provisioning.

The NEMCs' responsibilities for managing the FTI will not change with the introduction of Data Communications in the NAS.

3 Technical Operations Services Maintenance Philosophy

The TOS *Maintenance Concept of Operations for 2014 and Beyond*, dated May 27, 2011, defines the principles of operations for the organizations that manage and maintain the NAS infrastructure. This MCO provides a framework to guide NAS Enterprise Architecture Road Maps, policy decisions, implementation efforts, and guidance for maintaining emerging and existing systems and services.

The TOS maintenance philosophy emphasizes the use of credentialed specialists to ensure the efficient maintenance of NAS assets. The primary goal is ***to provide expected levels of service availability with minimal equipment-related delays at an acceptable cost***. Strategic use of remote monitoring technology, establishing customer priorities, and centralizing control centers promote timely mobilization of technical resources based on pre-established response requirements. The maintenance program is based on Reliability Centered Maintenance (RCM) engineering analysis. A multi-tiered workforce provides the necessary level of expertise that will be available to assist in meeting the expectations consistent with the facilities role in the NAS.

TOS identifies changing operational environments and determines needs to sustain each NAS system or service at the required level of service throughout the entire life cycle in accordance with the maintenance concept. TOS assists the requirements, acquisition, and logistics organizations in translating these needs into effective life cycle support plans that include at least the following elements:

- maintenance planning
- maintenance staffing
- maintenance support facilities
- packaging, handling, storage, and transportation
- supply support
- support equipment
- technical data
- computer resources support
- training

TOS monitors system and service operating performance, maintains equipment, accurately reports system and service availability in accordance with the National Airspace Performance Reporting System (NAPRS) process, and certifies systems and services.

The Data Comm maintenance strategy uses FAA-organic maintenance on FAA-owned equipment and provisioned maintenance services by telecommunication service providers. TOS monitors the data communications operating performance, maintains and certifies the EAS and TDLS equipment, and accurately reports system and service availability in accordance with the NAPRS process.

NEMCs are the national control centers for networked services and systems. The NEMC is the primary source for all NAS Internet Protocol (IP) monitoring capability and national coordination entity for NAS service providers. The NEMC has equipment capable of seeing through the FTI network to the FTI network interfaces. Because the SCTP protocol limits the NEMCs ability to perform intrusion detection, the SOCs at the national sites will function as a secondary monitoring source by reporting specific security-related events that are annunciated via an aural alarm and display in the EAS Events window. The NEMC monitors the DCIS and FTI contractor's technical performance and has full responsibility for

coordinating the DCIS contractor maintenance activities with TOCCs and field sites. Although the DCIS contractor is responsible for technology upgrades of the deployed systems, the FAA retains oversight responsibility and service design ownership.

The TOCCs do not have access to the type of network monitoring equipment required to perform initial fault isolation. When a TOCC receives a report that an IP service is not functioning properly, it should contact the assigned NEMC to request verification and troubleshooting support. If the NEMC determines that the likely cause of the problem is related to a DCIS or FTI service issue, it will ask the TOCC to open a trouble ticket with the DCIS or FTI Primary Network Operations Control Center (PNOCC). The NEMC will work closely with the end users and the PNOCC to troubleshoot and restore the service, but all initial and final coordination must be accomplished by the responsible TOCC.

4 Maintenance Workforce Structure

The FAA will provide maintenance for Data Communications using three levels of maintenance support in accordance with FAA Order 6000.30 *National Airspace System Maintenance Policy* and TOS's *Maintenance Concept of Operations for 2014 and Beyond*. TOS has full responsibility for coordinating the impact of maintenance activities and reporting the status of Data Communications and the related NAS systems.

Roles and responsibilities for Data Comm activities extend across domains and systems. Each FAA-maintained NAS asset is assigned a control center that monitors its operation, handles user service issues regarding the device / equipment, and initiates corrective action. The control centers, OCC, SOC, or NEMC serve as an initial screening point for calls about service issues from the field and other operational facilities. TOS work with the air traffic facility or with a neighboring control center to gauge the operational situation and give guidance to Air Traffic management and flow control on procedural solutions to keep traffic flowing. The control center specialists work with the representative reporting the issue to isolate the fault to a particular system by drilling down using existing automated monitor and control tools to determine whether the issue merits a repair call. The specialists open event management logs, initiate NOTAMs, and coordinate with appropriate internal entities (such as local site first-level and second-level engineering maintenance support) and external entities (such as third party vendors) to initiate a repair. They also ensure the issue is resolved, report the status, and close the event log using the appropriate systems.

Airway Transportation Systems Specialists (ATSS) support the certification, maintenance, and sustainment of local NAS systems. They are trained, credentialed, and certified in the operation of a particular class of NAS systems (e.g., Navigation, Communications, Surveillance), and are located in central locations to support a geographic area. They perform periodic maintenance, as well as system and service restoration. After the system is restored to normal operation, the ATSS will certify the system and associated service, document the repair, and notify the control center of the restoration of service.

The NEMC sites are established by the FAA TOS NEO Directorate to act as the hub for several communications services, including, but not limited to FTI, NMR, and Bandwidth Manager. These NEMCs are located on the FAA's Salt Lake City, Utah and Atlanta, Georgia and are adjacent to the national ARTCC sites. The NEMC houses the FAA's National Enterprise Security Gateway (NESG), an existing capability and a key interface to the TIMS routers for the TDLS network. The NEMC will also be the point where DCNS monitoring information is provided via National Enterprise Management System to the Remote Monitoring and Logging System (RMLS) network. The expectation is that TIMS local monitoring is provided by NEO personnel at the NEMC.

Data Comm will utilize the FTI IP network to move data within the FAA Data Comm infrastructure. A third party vendor operates the FTI. The FTI Primary Network Operations Control Center (PNOCC), located in Melbourne, FL and Backup (BNOCC) located in Smyrna, GA provides network monitoring and technical support for FAA telecommunications, and reports to the FTI Program Office. The FTI components of the Data Comm Program will be operated as they are today. The role of the FTI PNOCC is not anticipated to experience significant change with the introduction of Data Comm into the NAS. However, there will be additional circuits and connectivity that will require tracking, monitoring, and management by the FTI vendor and the FAA. FTI monitoring is not currently integrated with FAA remote monitoring tools and has its own processes and procedures for monitoring and control.

The DCNS provides both ground-ground and air-ground communications capability in order to deliver bi-directional traffic between SDPs. TOS will perform the core monitoring function using each system's M&C component and ultimately augmented these with an integrated display using the current FAA RMM&C system, the RMLS Maintenance Automation System Software/Monitor and Control Function (MASS/MCF) application. The DCP will establish a process for TOS personnel to interact and coordinate events with the DCIS vendor, similar to how events are currently managed and coordinated with the FTI provider.

Second-level support will be performed by the En Route second-level engineering and the Tower second-level engineering teams, with particular focus on interconnect/interfaces between systems for trouble shooting. A new FAA Data Communications Post-Implementation Support Team has been created. The support team is chaired by the DCP Systems Engineer and includes stakeholder members from FAA organization charged with a maintenance responsibility. The focus of the support team is to work with the second-level engineering groups to ensure the complete end-to-end support required to resolve interoperability issues

Detailed procedures for Data Comm-related event management, certification, maintenance, and use of monitoring tools will be documented per FAA procedures, e.g. within handbooks and standard operating procedures (SOP).

4.1 Data Comm Departure Clearance Trials

Initially, the DCP will demonstrate the departure clearance capability with the DTAP, the Departure Clearance Trials system. DTAP is installed at two sites: MEM and EWR. The DTAP vendor (Harris/Thales) provides Air Traffic training, and first, second, and depot-level maintenance/support. FAA ATSSs are responsible only for DTAP event-based system certification. The DTAP prototype will be removed from the NAS at the completion of the trials. The FAA will continue their maintenance responsibilities for the TDLS and EAS during and after the trails.

4.2 Maintenance in the Tower Domain

For the production system, the Data Comm Tower environment/domain encompasses personnel and equipment at 73 TDLS facilities and two TIMS facilities at the NEMCs.

Air Traffic Controllers in the ATC Tower will continue to be responsible for providing departure clearances, maintaining separation and efficient movement of aircraft operating on the taxiways and runways of the airport itself, as well as those in the air near the airport. They will continue to report TDLS operational issues to their AT supervisor and implement a service work-around as needed (e.g. falling back to PDC or switching to voice for clearance delivery). Initially, the majority of aircraft will not be equipped with Data Comm capability, in which case the near term departure clearances will be via PDC and voice communications.

The ATC Tower AT Supervisor will continue to act as the AT facility lead in coordinating with other facilities, coordinating with Controllers and the appropriate OCC. The En Route Air Traffic Supervisor will oversee the Specialists who coordinate with Tower facilities to investigate Logon issues reported by aircraft.

ATSSs at the local ATCT System Support Centers (SSC) will be responsible for the management, operation, maintenance, and certification of the TDLS. ATSSs will monitor the operating and technical performance, and report system and service status in accordance with the NAPRS process. The ATSS role in the Tower will remain unchanged:

- Support the installation and implementation of the local system
- Install software and subsequent software releases
- Monitor system status and alarms, locally and remotely by Remote Maintenance Monitor and Control (RMM&C)
- Manage system configuration and security
- Analyze system performance for degradation
- Extract data for system performance trend analysis
- Perform event-based system and subsystem certification
- Perform scheduled service certification at the SDP
- Perform fault isolation and restoration
- Perform scheduled and preventive maintenance.

The OCCs will continue their role as a centralized coordination point for monitoring and coordinating restoral of NAS systems and services within their service area, including Data Comm. With the introduction of Data Comm in TDLS v12.0, OCCs will have the capability to remotely monitor TDLS using the RMLS MASS/MCF application. They will have the status of the DCNS network, and will coordinate with towers when outages affect the service. OCCs will isolate issues to the appropriate sub-system, open trouble tickets against defective systems, and facilitate coordination with second-level support.

The Inter-Facility Communications Engineering Team (IFCET) at the Mike Monroney Aeronautical Center (MMAC) is responsible for TDLS second-level maintenance/support. Two Data Comm tower support systems will be available at the MMAC. IFCET will assist ATSSs to maintain and restore the TDLS system and services to an operational status, respond to system or equipment anomalies that are beyond first-level technical or resource capabilities, and provide enhancement of facility performance. IFCET will:

- Develop technical documentation and data.
- Develop and publish maintenance and certification procedures, standards, and tolerances in a Maintenance Handbook (MHB)
- Provide a Help Desk Hot Line number for first-level maintenance personnel
- Provide assistance to first-level maintenance personnel with TDLS restoration activities
- Develop engineering and software modifications to enhance system performance
- Provide TDLS equipment and software configuration management

Additionally, IFCET will be responsible for second-level support for the Tower Information Management System (TIMS) and TDLS Monitor and Control (TMC) interfaces, and will assume the lead role for coordinating Data Comm service end-to-end issue resolutions.

4.3 Maintenance in the En Route Domain

The En Route domain/environment for Data Comm encompasses personnel and equipment at18 non-national ARTCCs, two national ARTCC sites located on the Atlanta, GA and Salt Lake City, UT, with second-level engineering support provided by the engineering services based at the William J Hughes Technical Center (WJHTC) in Atlantic City, New Jersey with EAS capability developed and maintained by the EAS vendor.

Each TDLS system is assigned to a specific EAS, the parent ARTCC. EAS at the parent ARTCC will add a new Ethernet Card to the CPP and the EAS Monitor and Control (M&C) will have additional icons to monitor the assigned TDLS systems and the connection to the National ARTCC sites. The role of the ATSSs at the parent ARTCC SSC will be unchanged. The ATSS will be responsible for the management, operation, maintenance, and certification of EAS equipment and services.

The EAS will not have RMLS capability to remotely monitor and control EAS[6]. NAS Area Specialists (NAS) and NAS Operations Managers (NOM) at the parent ARTCC SOCs will use the EAS M&C to monitor the external interfaces to assigned TDLS systems and monitor the National Application (NAP) service interface to the National ARTCC sites. NAS/NOMs will also perform system and service outage coordination.

Data Comm introduces new equipment and capabilities to the EAS at the two National ARTCCs. ATSSs at the National ARTCC SSCs will continue to perform their first-level maintenance responsibilities on the EAS to include the new equipment. The backup National ARTCC acts as a "warm standby" for the active site and can be switched to the active Data Comm National ARTCC with an administrative failover action ("promotion") executed by TOS personnel at the accepting site.

NAS/NOMs at National SOCs (Atlanta and Salt Lake) will also perform system and service outage coordination and use the EAS M&C function to monitor:

- NAP subsystem interface to non-National sites
    - Abbreviated Flights Interface (AFI) status
    - Blocked List/Log On Query (BLKQC) status
    - M&C Interface status
- NAP subsystem router status
- NAP subsystem processor status
- External interfaces to assigned TDLS systems
- External interfaces to DCNS, TIMS, and sync status with the backup National site

Seven Data Comm En Route support systems will be available at the William J. Hughes Technical Center (WJHTC) and two training systems at the FAA Academy. EAS second-level maintenance is performed locally by Field Automation Support Team (FAST) Specialists and nationally by Second-Level Engineers (SLE) at the En Route and Oceanic Second-Level Engineering at the WJHTC and MMAC. The responsibilities of EAS second-level Maintenance are similar to TDLS second-level maintenance and will not change with the introduction of Data Comm capability in the NAS.

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[6] EAS has a TOS waiver from remote monitoring. The ARTCC SOC locally monitors the EAS 24 hours per day.

4.4 Depot Level Maintenance/Support

For the DCL trials, DTAP depot level maintenance will be provided by the DTAP vendor.

For the production Data Comm environment, TOS is responsible for logistics policy and guidance for depot level maintenance/support. The FAA Logistics Center (FAALC) will provide integrated supply-support chain management, depot support, and logistics services. This support includes the capability to manage and perform depot-level repair activities, provide failure trend analysis, and provide logistics resources and assets for the Data Comm infrastructure. FAA Depot Level Maintenance/Support responsibilities on TDLS and EAS will not change with the introduction of Data Comm in the NAS.

4.5 Leased or Provisioned Services

The DCP retains contractual oversight of the DCIS contract through 2029. The DCP is responsible for operations and maintenance (O&M) funding and award fee management. NEMC provides technical supervision of maintenance provided by the DCIS contractors. NEO is responsible for coordinating contractor maintenance activities with the appropriate TOCCs (OCC, ARTCC SOC, or).

5 Service, System, and Subsystems Certification

Certification determines and validates that a system, subsystem, or service is providing, or is capable of providing, the advertised service to the user. The NAS Policy and Service Planning Team has conducted a certification analysis and determined that the FAA will require certification of the DTAP system and Data Communications service. Appendix C provides the Data Communications Certification Plan.

6 Remote Maintenance Monitor and Control

FAA Order 6000.53 Remote Maintenance Monitoring Interface Development and Implementation defines the requirements for NAS systems to provide RMM&C capabilities and the roles and responsibilities for the development and implementation of the RMM&C interfaces to the RMLS.

FAA Order 6000.30 establishes the requirement for RMM&C. RMM&C is a recognized and preferred means of performing maintenance on the NAS. The ATO will increase usage of RMM&C when it is cost effective and there is an operational benefit. TOS is responsible for determining RMM&C requirements including which NAS systems must have RMM&C. TOS determines the priority and the remote operational information required from a NAS system.

TOS will remotely perform maintenance activities including:

- Monitor system status and alarms
- Manage and control system configuration
- Perform fault isolation and restoration
- Conduct trend analysis of system performance
- Perform maintenance
- Perform certification

The Maintenance Automation Program has conducted an RMM&C analysis and determined that the DCP is required to provide an interface to the RMLS that will meet the RMM and RMM&C requirements of FAA Orders 6000.30 and 6000.53. Appendix D provides the RMM&C Concept of Operations.

7 Employee Credentialing and Proficiency

Technical Operations Training and Development is responsible for ensuring the proficiency of the ATSS workforce. The Operational Technical Training Team (OTTT) addresses training development during the planning stages of new equipment deployment, while monitoring the training for accuracy throughout the equipment's life cycle. To that end, the OTTT members in the terminal and en route domains participated in the DCP Training Workgroup to provide guidance in the planning of ATSS training described in this section.

OTTT is responsible to validate that contractor-developed training is in accordance with FAA Standard 028 Contract Training Programs and complies with FAA Training Order 3000.57 Air Traffic Organization Technical Operations Training and Personnel Certification.

All Data Comm maintenance training will include:

- A Task and Skills Analysis (TASA) report for first-level maintenance position classification
- A Training Development Plan (TDP) for conducting maintenance training
- A Course Design Guide (CDG) for each developed course.

The type of media selected for training determines the type of other deliverables required:

- Distance learning or Web-based courses will include storyboards, e-learning courseware, and final exam.
- Instructor-led training (ILT) courses will include a course schedule, instructor guide, student guide, laboratory guide, and final exam.
- Correspondence Study will include student manual, laboratory guide, and final exam.

Program training development management activities include technical interchange meetings and/or in-process reviews. Course validation activities include contractor presentation of the course (course walk-through), course operational tryout, and first course conduct (FCC). For ILT, the contractor may also be required to conduct one or more class conducts until the FAA Academy has the resources to assume responsibility for conducting resident Data Comm training.

The On-the-Job Training (OJT) and Certification Team coordinates with new product teams to determine OJT and Performance Exam (PE) requirements and provides final approval of the OJT packages from the planning stages and throughout the entire life cycle of the equipment.

7.1 Data Communication Common Training

The DCP Training Workgroup identified introductory knowledge that apply to all jobs, both technical and air traffic, in both the terminal and en route environments, and within the three tiers of maintenance support. The DCP will use a contractor (GENCO Systems) to develop courses/modules for common training delivered on the electronic Learning Management System (eLMS). Common training subjects will include the system and service description, system architecture, and the end-to-end service flow, Air Traffic overview covering ‘log-on’ and specifics of controller flight deck interaction, maintenance overview covering the maintenance responsibilities of the three tiers of maintenance support in the terminal and en route environments, service/system certification covering the TDLS and EAS certification requirements and responsibilities, and Remote Maintenance Monitor and Control covering the RMLS

MASS/MCF status messages and control commands. The target audience is all first-level maintenance/support personnel in both the terminal and en route environments.

7.2 Data Communications First-Level Maintenance Training

Training for ATSSs at TDLS and EAS facilities will provide the knowledge, skills, and abilities required to perform system certification, preventative and corrective maintenance, equipment and software modifications, maintenance logging, and technical documentation tasks in the Data Comm environment. Subjects will include an overview of the system (theory), normal operations, operator functions, software loading and management, periodic maintenance procedures, failure detection, hardware and software diagnostics, troubleshooting procedures, RMM&C restoration procedures, remove and replace procedures, and certification procedures.

For ATSSs charged with a certification responsibility, the FAA will develop a performance-based course and an exam that demonstrates student proficiency. This ensures our specialists can successfully assume watch standing duties and maintenance responsibilities once they have been granted their certification credentials.

The development of TDLS equipment-specific first-level maintenance training is the responsibility of the FAA Academy. The development of EAS-specific training is the responsibility of the ERAM Program and will be developed by the EAS vendor.

7.2.1 TDLS / TIMS Training

Legacy TDLS v10 maintenance training is a two-week Enhanced Hands-on Training/Demonstration of Proficiency (EHoT/DoP) course. The FAA Academy will develop a correspondence study course providing TDLS v10-trained and newly-hired ATSSs TDLS v11.0 knowledge, features, functions, and maintenance procedures.

TDLS v12.0 ‘delta’ maintenance three-day EHoT/DoP course will provide TDLS v11-trained ATSSs the changes to TDLS from v11.0 to v12.0. The course will be conducted at the FAA Academy.

TDLS v12.0 maintenance (attrition) two-week EHoT/DoP course will provide training to newly-hired ATSSs.

The OJT and Certification Team will develop a national OJT/PE for those ATSSs who fail the TDLS v11.0 or v12.0 courses. The OJT/PE will be administered at the ATSS’s SSC.

TDLS v10.09 introduces the TIMS at NEMC sites to provide data exchange between TDLS and Data Comm systems in the en route environment. TOS specialists responsible for maintaining TIMS will be provided formal maintenance training. The delivery method and length of the course is yet to be defined.

7.2.2 En Route Automation System Training

Data Comm S1P1 EAS system overview training will be presented in a Web-based training (WBT) ‘delta’ course delivered on eLMS that provides an overview of Data Comm S1P1 EAS system concept of operations, physical and functional architecture, certification requirements overview, and an interactive presentation of the system management impacts (M&C workstation interface). The target audience is

EAS-trained ATSSs, Systems Specialists (SS), NAS/NOMs, and SLE/FAST at all sites. The training duration is estimated to be two hours.

Data Comm S1P1 EAS national site system management training will be presented in an ILT ‘delta’ course that provides Data Comm S1P1 system management of national site NAP resources. The course will be delivered to national ARTCC for ATSSs, SSs, NAS/NOMS, and FAST support personnel and conducted at the WJHTC for SLE support personnel. Training duration is estimated to be eight hours.

Data Comm S1P1 EAS national site system maintenance training will be presented in an ILT ‘delta’ course that provides Data Comm S1P1 system and software maintenance of national site NAP resources. The course will be delivered at the national ARTCC for ATSSs, SSs, and FAST support personnel and at the WJHTC for SLE support personnel. Training duration is estimated to be three days.

The FAA Academy teaches and maintains three EAS courses; EAS System Management, EAS System Maintenance, and EAS System Administration. The FAA Academy will need to update these courses to incorporate the Data Comm S1P1‘delta’ content.

7.3 Data Communications Second-Level Maintenance Training

En route second-level maintenance training will delivered in a three-day seminar to provide knowledge, skills, and abilities that permit Government engineers/technicians to perform assistance with restoration activities, resolve system or equipment anomalies beyond the first-level maintenance resource capabilities, and develop enhancements to improve system performance.

The development of TDLS equipment-specific second-level maintenance training is the responsibility of the FAA Academy.

7.4 Refresher Training

Refresher training is required. Refresher training will be delivered in a WBT format (to the fullest extent practical) that includes system (theory), normal operations, operator training, software loading and management, and troubleshooting procedures. Refresher training will be conducted within three years of the initial training.

8 Maintenance Documentation

Data Comm technical documentation will include TDLS and EAS operator manuals, software operating manuals, Technical Instruction Books, specifications, drawings, and all commercially available COTS operator and maintenance manuals. The TDLS and EAS second-level maintenance/support organizations will also publish the Maintenance Handbook to support maintenance and certification.

For TDLS, IFCET is responsible to update existing technical documentation and MHB at each version release (10.09, 11.0 and 12.0). For EAS, the ERAM program office is responsible to ensure that the FAA provides an appropriate review of vendor-developed technical documentation for depth of content and compliance with publishing requirements.

Technical documentation is an important component of the DCP ability to deliver a Data Comm capability to the NAS. A delay in either the terminal or en route environment will have an adverse impact on the entire DCP. The TDLS and EAS second-level maintenance/support organizations are responsible to ensure that the technical documentation is at a level of detail that supports operational test and evaluation (OT&E) and training development. The DCP will coordinate and integrate technical documentation delivery in a manner that will not affect OT&E and training delivery schedules.

9 NAS Management

TOS will integrate the Data Comm systems and services into the established organizational hierarchy used for in-service management of NAS systems. This will include:

- Establishing policy and oversight at the Headquarters
- Assigning second-level support
- Ensuring policy administration at the Service Areas
- Monitoring at the SDP or control centers as appropriate
- Certifying systems and services at the SDP.

Appendix A Acronyms

AFI	Abbreviated Flights Interface
ARINC	Aeronautical Radio, Incorporated
ARTCC	Air Route Traffic Control Centers
AT	Air Traffic
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
ATN	Aeronautical Telecommunications Network
ATO	Air Traffic Organization
ATS	Air Traffic Specialist
ATSS	Airway Transportation Systems Specialist
BLKQC	Blocked List/Logon Query
CDG	Course Design Guide
CDRL	Contract Data Requirements List
CHI	Computer-Human Interface
COTS	Commercial-off-the-Shelf
Data Comm	Data Communications
D-ATIS	Digital Automatic Terminal Information Service
DCIS	Data Communications Integration Services
DCL	Departure Clearance
DCP	Data Communications Program
DCNS	Data Communications Network Service
DoP	Demonstration of Proficiency
DTAP	Data Comm Trials Automation Platform
EAS	En Route Automation System
EHoT	Enhanced Hands on Training
eLMS	electronic Learning Management System
ERAM	En Route Automation Modernization Program

eTPR	Electronic Technical Performance Record
FAA	Federal Aviation Administration
FAALC	FAA Logistics Center
FANS 1A+	Future Air Navigation System
FAST	Field Automation Support Specialists
FCC	First Course Conduct
FDIO	Flight Data Input/Output
FID	Final Investment Decision
FSEP	Facilities, Services, and Equipment Profile
FTI	FAA Telecommunications Infrastructure
GFE	Government Furnished Equipment
HADDS	
HF	Human Factors
HFDS	Human Factors design Standard
HW	Hardware
ICAO	International Civil Aviation Organization
IETMS	Interactive Electronic Technical Manual System
IFCET	Inter-Facility Communications Engineering Team
IID	Initial Investment Decision
ILS	Integrated Logistics Support
ILT	Instructor Led Training
IOA	Independent Operational Assessment
IOC	Initial Operating Capability
IP	Internet Protocol
ISD	In-Service Decision
ISP	Integrated Support Plan
ISS	Information Systems Security
JRC	Joint Resources Committee

LAN	Local Area Network
LOA	Letter of Agreement
LOB	Line of Business
LRU	Lowest Replacement Unit
M&C	Monitor and Control
MASS/MCF	Maintenance Automation System Software/Monitor and Control Function
MCO	Maintenance Concept of Operations
MMAC	Michael Monroney Aeronautical Center
NADIN	National Airspace Data Interchange Network
NAP	National Application Subsystem
NAPRS	National Airspace Performance Reporting System
NAS	National Airspace System
NAS	NAS Area Specialist
NASTEP	NAS Technical Evaluation Program
NCP	NAS Change Proposal
NEMC	National Enterprise Management Center
NESG	National Enterprise Security Gateway
NextGen	Next Generation Air Transportation System
NOM	NAS Operations Manager
NOTAM	Notice to Airmen
OCC	Operations Control Center
OJT	On-the-Job Training
O&M	Operations and Maintenance
OT&E	Operational Test and Evaluation
PDC	Pre-Departure Clearance
PE	Performance Exam
PIREP	Pilot Report
PNOCC	Primary Network Operations Control Center

QA	Quality Assurance
QC	Quality Control
RCM	Reliability Centered Maintenance
RMM	Remote Maintenance Monitoring
RMM&C	Remote Maintenance Monitoring and Control
RMLS	Remote Maintenance Logging System
RMSET	Remote Maintenance System Engineering Team
S1	Segment 1
S1P1	Segment 1 Phase 1
S1P2	Segment 1 Phase 2
S2	Segment 2
SDP	Service Delivery Point
SLE	Second-Level Engineering
SITA	Societe Internationale de Telecommunications Aeronautiques
SLA	Service Level Agreement
SME	Subject Matter Expert
SNMP	Simple Network Management Protocol
SOC	Services Operations Center
SOP	Standard Operating Procedure
SSC	System Support Center
SW	Software
TASA	Task and Skills Analysis
TBD	To Be Determined
TCP/IP	Transmission Control Protocol/Internet Protocol
TDLS	Tower Data Link Services
TDP	Training Development Plan
TI	Technical Instructions
TIMS	Tower Information Management System
TMC	TDLS Monitor and Control

TOS	Technical Operations Services
TPR	Technical Performance Records
TRACON	Terminal Radar Approach Control Facility
U.S.	United States
VHF	Very High Frequency
WAN	Wide Area Network
WBT	Web-Based Training
WJHTC	William J. Hughes Technical Center

Appendix B References

FAA Order 1100.157 National Systems Engineering Divisions Maintenance Program Procedures, Operational Support

FAA Order 1380.40 Airway Facility Sector Level Staffing Standard System.

FAA-D-2494 Rev B Technical Instruction Book Manuscript: Electronic, Electrical, And Mechanical Equipment, Requirements For Preparation Of Manuscript And Production Of Books.

FAA Order Number 3000.57, Air Traffic Organization Technical Operations Training and Personnel Certification Programs.

FAA Order 6000.5 Facility, Service, and Equipment Profile (FSEP).

FAA Order 6000.15 W/Change 1 and 2 General Maintenance Handbook for NAS Facilities.

FAA Order Number 6000.30 National Airspace System Maintenance Policy.

FAA Order 6000.50 Technical Operations National Airspace System (NAS) Integrated Risk Management.

FAA Order 6000.51 Air Traffic Organization Responsibilities for the Support of National Airspace System Terminal Automation Services.

FAA Order 6000.53 Remote Maintenance Monitoring Interface Development and Implementation.

FAA Order JO 6000.204 Maintenance of NAS Telecommunication Services

> This order cancels Order JO 6000.22B, Maintenance of Analog Lines, Order JO 6000.47A, Maintenance of Digital Transmission Channels, and Order JO 6000.200, Maintenance of FAA Telecommunications Infrastructure (FTI) Services.

FAA Order 6040.15 National Airspace Performance Reporting System.

FAA Standard 028C Contract Training Programs.

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Appendix C Data Communications Certification Plan

US Department of Transportation
Federal Aviation Administration

Data Communications
Certification Plan
Version 1.0 Final
19 December 2014

Air Traffic Organization
Program Management Organization
Enterprise Services Directorate
Data Communications Program

Federal Aviation Administration
800 Independence Ave, SW
Washington, DC 20591

FOREWORD

This document details the Federal Aviation Administration (FAA) planned approach to certification of the end-to-end data communications service within the National Airspace System (NAS). This document is a product of the Air Traffic Organization, Program Management Organization, Enterprise Services Directorate, Data Communications Program. The Data Communications Program Manager has coordinated this plan with the En Route Automation Modernization Program, En Route and Oceanic 2nd Level Engineering, NAS Policy and Service Planning Team, and the Inter-Facility Communications Engineering Team. The certification plan is included in the *Data Communications Maintenance Concept of Operations*.

REVISION HISTORY

Rev	Name	Description	Date
0.1	Robert Hensen James Victorine	Initial draft	June 2014
0.2	James Victorine	Final draft	21 November 2014
1.0	James Victorine	Final. Incorporates comments from Technical Operations Services, Operations Support and National Enterprise Operations Directorates.	19 December 2014

TABLE OF CONTENTS

1 Introduction

This plan captures organizational certification requirements. Technical Operations certifications analysis and FAA orders determine data communication end-to-end service delivery and identifies organizational roles and responsibilities for system development and support for certification. Acronyms and a glossary of terms used in this plan are included in Appendices 1 and 2, respectively. References governing system and service certifications and other documents that support this plan are listed in Appendix 3.

1.1 Description

The Data Communications Program (DCP) is a Next Generation Air Transportation System (NextGen) foundation program. It transitions communications between pilots and air traffic controllers from a voice-based to a data-driven Air Traffic Control (ATC) communication system. Data communications encompasses a network that provides service covering multiple domains, and uses a combination of currently deployed National Airspace System (NAS) infrastructure and new assets as the platform for that service. In provision of the end-to-end service, data communications service will utilize:

- En Route Automation System (EAS)
  - National Application (NAP) Subsystem added to EAS event based certification
  - NAP Subsystem and external interfaces is incorporated in the CFAD service certification
- Tower Data Link Service (TDLS)
  - Data Communications Service added
- FAA Telecommunications Infrastructure (FTI)
- Commercial Service Providers (CSP[1]) for the air-ground link
- Certified aircraft avionics and displays.

Refer to the *Concept of Operations for Data Communications* for a detailed description of data communications.

1.2 Implementation

DCP will implement the data communications service in two segments:

- Segment 1 (S1) – basic capabilities (as a supplement to voice) for controllers and flight crews to transfer ATC clearances, requests, instructions, notifications, voice frequency communications transfers, and flight crew reports.

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[1] The two current CSPs are Aeronautical Radio, Incorporated (ARINC) and Société Internationale de Télécommunications Aéronautiques (SITA).

- Phase 1 (S1P1) – Controller-Pilot Data Link Communications (CPDLC) capability between controllers at airport towers and aircraft equipped with the Future Air Navigation System (FANS) avionics.
  - The initial CPDLC capability will be demonstrated in the Departure Clearance Trials using the Data Communications Trails Automation Platform (DTAP[2]) with en route automation providing flight data transfer capability and Flight Data Input-Output (FDIO) for flight revision correlation.
  - The CPDLC and flight deck revisions production capability will be delivered by TDLS with the EAS providing aircraft logon and flight data transfer capability.
- Phase 2 (S1P2) extends Data Comm service to the En Route domain.
- Phase 3 (S1P3) provides additional en route services.

- Segment 2 (S2) – integrates data communication service to aircraft with Aeronautical Telecommunications Network (ATN) equipment, adds taxi instructions in the tower environment and expands S1 en route capabilities to include limited conformance management and initial 4-D routes.

The *Concept of Operations for Data Communications* provides more detail on the implementation of data communications.

1.3 Certification Requirements

FAA Order 6000.15F, *General Maintenance Handbook for National Airspace System (NAS) Facilities* defines certification as: "*…the determination and validation that a system, subsystem, or service is providing or is capable of providing the advertised service to the user. Certification includes an independent determination, which ascertains the quality of advertised services, and a validation, which officially confirms and documents the determination in the maintenance log.*"

When a functional need is established for the NAS, that need is managed through the Acquisition Management System (AMS), producing a set of critical specifications that are used to build or purchase a subsystem, system or service. If that subsystem, system or service has functions that require certification, then processes are set in place for the establishment of methods to certify.

The independent discretionary judgment about the provision of advertised services, the need to separate profit motivations from operational decisions, and the desire to minimize liability make the regulatory function of certification and NAS oversight an inherently governmental function. The Technical Operations Airway Transportation System Specialist (ATSS) is the certifying official who may use any method, including those listed in FAA Order 6000.15, to make an informed judgment on the ability of systems to provide the service.

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[2] DTAP is a commercial off-the-self (COTS) product modified for the Departure Clearance Trails. The COTS vendor is Thales. The capability will be demonstrated at Memphis (MEM) and Newark (EWR) airports.

The data communications service spans multiple FAA-owned and operated tower and en route automation platforms and encompass vendor-provided services such as FTI, CSP ground-to-ground and air-to-ground networks, and privately-held airborne communications equipment. The following categories of performance are to being used to certify data communications service.

- Latency
- Data Integrity
- Availability

Data communication components are illustrated in Figure 1 below. Appendix 2 Glossary provides descriptions of the systems and services used to deliver the end-to-end data communication service.

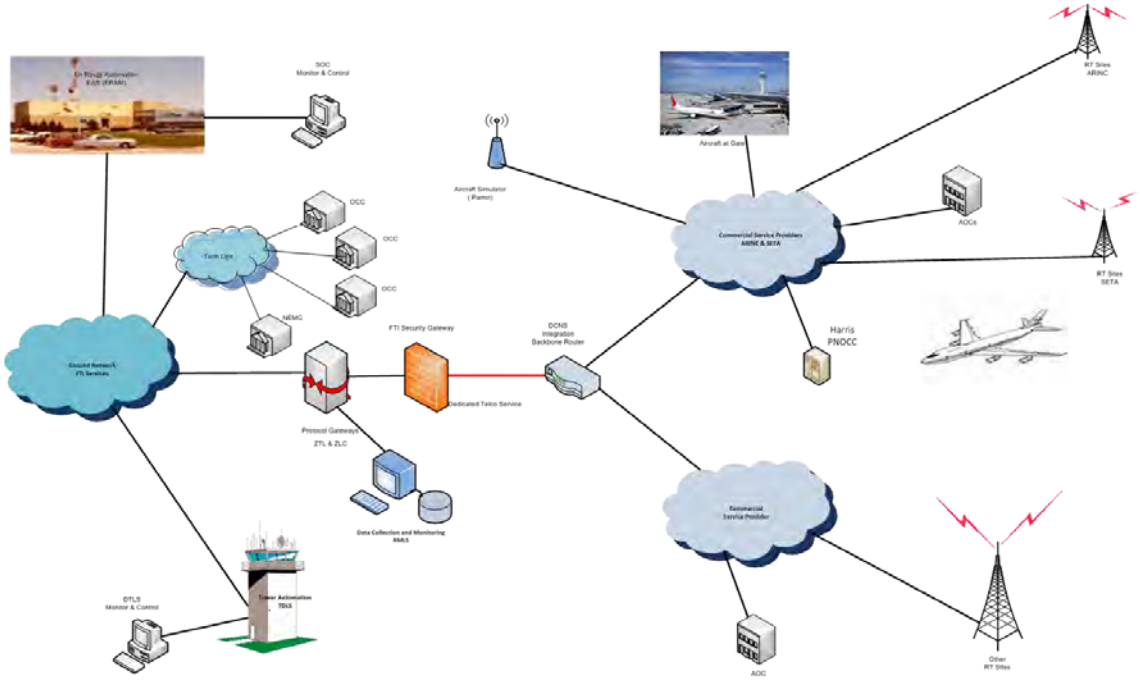

Figure 1 Data Communications Components

2 Roles and Responsibilities

Multiple organizational elements in multiple domains have functional responsibilities in the data communications certification. This section describes these responsibilities.

2.1 Certification Analysis

The rules to determine which systems, subsystems, and services require certification are governed by FAA Order 6000.15, *General Maintenance Handbook for National Airspace System (NAS) Facilities*. The NAS Policy and Service Planning Team is the Technical Operations organization responsible for developing certification policy, conducting the analysis to determine if certification is required for new FAA systems or services, establishing certification requirements, and reviewing the standards, procedures, and guidelines for performing certification.

2.2 Training & Personnel Certification

FAA Order 3000.57, *Air Traffic Organization Technical Operations Training and Personnel Certification* specify the procedures and policies necessary to implement and sustain uniform national Technical Operations Training and Personnel Certification Programs. The FAA grants certification authority to individuals who have attained a professional level, and are responsible for the operation and performance of NAS facilities.

The Technical Training Requirements Group is responsible for validation and approval of Technical Operations personnel training and the administration of the Technical Operations Training and Personnel Certification Programs. The group will work with the DCP, in coordination with the En Route Automation Modernization (ERAM) Program and the Inter-Facility Communications Engineering Team (IFCET), to ensure training development delivers training so that certifying officials possess the requisite knowledge and skills to assume full responsibility for attesting to the operational status of EAS and TDLS systems, subsystems, and services delivering data communications.

2.3 Maintenance Handbooks

An effective maintenance program must contain comprehensive, accurate, and usable technical documentation. FAA Order 6000.15, *General Maintenance Handbook for National Airspace System (NAS) Facilities* contains a description of directives, defines their hierarchy, and provides guidance on their use. The specific certification procedures are included in system-specific Maintenance Handbooks (MHB).

MHBs are developed by the systems second level support organization. En Route and Oceanic 2nd Level Engineering is the office of primary responsibility (OPR) to develop, publish, and distribute the EAS MHB. IFCET is the OPR for the TDLS MHB. Both organizations are responsible for developing certifiable parameters, certification procedures, and critical performance parameters that are checked during periodic maintenance and included in the certification tables for their system.

2.4 Certifying Official

FAA Order 3000.57, *Air Traffic Organization Technical Operations Training and Personnel Certification* specify the policies governing the training and credentialing of the ATSS who are responsible for performing system certifications and service certification at the service delivery point (SDP). System certifications include:

- DTAP at the trials Air Traffic Control Towers (ATCT)
- TDLS at ATCTs
- Parent EAS and national NAP Subsystem at Air Route Traffic Control Centers (ARTCC)

2.5 Provisioned Services

The FAA does not perform certification of vendor-provided provisioned services. However, verification is a similar quality control process used by non-Federal providers. The NEMC is responsible for providing oversight of the verification process for FTI and the ground-to-ground and air-to-ground CSP networks. Harris, the Data Communications Integrated Services (DCIS) vendor is responsible for maintaining the FTI and CSP network services and performing in accordance with the FTI and DCIS contracts.

2.6 Avionics

The Aviation Safety, Aircraft Certification Service is responsible for establishing standards for certification of airborne communications equipment and the Aviation Safety, Flight Standards Service is responsible for operational approval for use. Vendor-provided services will be verified, and airborne communications equipment certified, as a precursor to data communications service certification.

3 Data Communication Certification

Early in the acquisition, Technical Operations analyzed the intended scope, capability, and application of data communications service component functionality, and evaluating the operational characteristics. By comparing those characteristics to certification criteria contained in FAA Order 6000.15, *General Maintenance Handbook for National Airspace System (NAS) Facilities*, they determine whether or not certification is required.

During the development phase of the subsystem, system, or service, critical measurements are made to insure the specifications are being met. These measurements are made when the subsystem, system or service is producing the advertised function or set of functions for which it was designed. These measurements are used to determine the critical measurable parameters for that subsystem, system or service. The MHB OPR develops the procedural instructions that measure those parameters within the acceptable tolerance variance. The certifying official (Technical Operations ATSS) uses the procedures and critical performance measures to make a certification determination.

3.1 Certification Analysis

The NAS Policy and Service Planning Team conducted a certification analysis and determined that the FAA requires certification of:

- DTAP system
- Data Comm Service (for S1P1, TDLS only)
- NAP subsystem (event-based)
- NAP service level expected to be incorporated in the CFAD service certification

Appendix 4 Certification Analysis summarizes those analyses.

As part of the data communications service certification process, the second level support organizations will update the EAS and TDLS MHBs that include changes to certification procedures required for the new Data Comm Service certification. Updates to MHBs will be distributed to the field after the case file/NAS Change Proposal (NCP) review process.

3.2 System Certification

System certifications are event-based, at commissioning or as a result of an outage caused by either a scheduled or unscheduled maintenance action.

1. A service experiences an outage or reduction of service.

   - A previously planned (scheduled) event) has been recorded in a Remote Maintenance Logging System (RMLS) Event Manager log entry.

   - Unplanned (unscheduled) outage or loss of service. If an unscheduled event, Technical Operations Control Center (TOCC), the Operations Control Center (OCC) of the associated TDLS or EAS ARTCC Service Operations Centers (SOC), initiates restoration activities and coordination and documents these in RMLS Event Manager log entry.

2. Maintenance personnel (vendor or ATSS) perform repair actions, run diagnostics, and send test messages to verify the repair is effective.

3. Certifying official (ATSS) run system certification routines, as specified in MHB.

4. Certifying official validates the certification results in an RMLS Simplified Automated Logging (SAL) certification log entry and informs the TOCC, per local standard operating procedure (SOP), that service is now available.

For DTAP, the vendor is responsible for all first level maintenance activities. The ATSS at the DTAP Systems Service Center (SSC) is the certifying official for DTAP event-based system certification.

For the production systems, the ATSS at the TDLS SSC will continue to perform first level maintenance and event-based certification of the TDLS system. The ATSS at

ARTCC SSC will continue to perform event-based certification of the EAS and subsystems (NAP and NAP service level).

3.3 Service Certification

Service certification is performed periodically and is completed where the data communications service delivery component resides, the SDP.

1. ATSS performs service certification at the SDP (e.g., TDLS or EAS) periodically (e.g., daily, weekly, or otherwise) as defined by the MHB.

2. Vendor service providers verify their service is available per their contractual requirements.

3. Certifying official (ATSS) documents the certification results in an RMLS SAL certification log entry.

A fixed target, a set of aircraft avionics mounted and permanently available to respond to messages from ground automation, will be used as a means of validating correct operation of the ground system and one particular air/ground path. The fixed target has the advantage of always being available regardless of existing traffic for a facility, and a single target could respond to messages from multiple SDPs.

Technical Operations personnel will invoke a certification script from the SDP (EAS or TDLS). The script will inject test messages onto the FTI network, through the DCIS network to a very high frequency (VHF) Data Link Mode 2 (VDL-2) ground station over the radio frequency (RF) link to a vendor (Harris)-provided fixed target that will then respond back to the originating SDP accordingly. The fixed target will be provided as part of the DCIS, owned and maintained by Harris, and will support messaging through both CSP (ARINC and SITA) networks.

3.4 Recertification

Interruptions in the data communications service will necessitate recertification. Interruptions may be detected through a number of means including indications on the system displays, outage reports from commercial service providers or by Air Traffic Controllers at operating positions within terminal or en route ATC facilities.

Once a data communications service interruption has been detected, an ATSS will determine the severity of the interruption. The ATSS will also determine if the interruption is the responsibility of the FAA or the FTI / DCIS vendor. Interruptions determined to be the responsibility of the vendor will be corrected by the vendor who will also be responsible for verifying the service as required.

If the interruption is determined to be the responsibility of the FAA, then a data communications service component ATSS may be notified to trouble shoot the malfunctioning data communications component, isolate the fault, perform corrective maintenance, perform the system certification procedures outlined in the applicable MHB, and provide return to service notifications. System and service recertification,

when required, are performed as described in sections 3.2 System Certification and 3.3 Service Certification above.

4 Operational Test and Evaluation

The goal of the data communications test program is to verify all requirements and validate the operational effectiveness and suitability of the data communications service for use in the NAS, and the NAS infrastructure is ready to accept the system. In that respect, the data communications test program will provide the basis for development of certification criteria and verification and validation of certification procedures.

The Data Communications Integrated Test Team develops the Data Communications Test and Evaluation Master Plans (TEMP). The Data Communications TEMP defines the overall data communications test and evaluation (T&E) program phase and includes the decomposition of critical operational issues into measures of effectiveness, measures of suitability, and most importantly when considering certification issues, measures of performance.

The data communications test program will include integration testing, developmental testing (DT), operational testing (OT), key site testing and Independent Operational Assessment (IOA). Integration testing will be conducted by FAA organizations and support contractors in order to develop the end-to-end integrated system prior to formal testing. These integration activities will include planning, engineering, test, analysis, and issue resolution.

Harris, the DCIS vendor will supervise functional testing of participating CSPs, and DT will be performed as part of the development effort in each operational domain. Harris will ensure that training participants receive the applicable knowledge and skills needed to operate, monitor, maintain, and support DCNS hardware and software during test and evaluation activities. The Data Comm Program will ensure that FAA personnel participating in T&E activities, which include hands-on experience, are trained.

The FAA will conduct OT at the William J. Hughes Technical Center (WJHTC) Data Communications T&E Laboratories. IOA will be conducted at key sites. FAA site personnel will perform all activities normally accompanying a major system software upgrade (to EAS and TDLS), including key site test activities.

FAA Technical Operations subject matter experts (SME) will exercise all certifications procedures in accordance with directives (Maintenance Hand Books) for each system, including event-based and service level certifications. Certification results during testing will be captured in OT&E out brief and shared with OPRs.

Appendix 1 Acronyms

ADS-B	Automatic Dependent Surveillance - Broadcast
AFS-001	Aviation Safety, Flight Standards Service
AIR-001	Aviation Safety, Aircraft Certification Service
AJI-23	Technical Training Requirements Group
AJM-213	En Route Automation Modernization Program
AJM-25	En Route and Oceanic 2nd Level Engineering
AJW-1B	NAS Policy and Service Planning Team
AJW-178	Inter-Facility Communications Engineering Team
ARINC	Aeronautical Radio, Incorporated
AMS	Acquisition Management System
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
ATM	Air Traffic Management
ATN	Aeronautical Telecommunications Network
ATSS	Airway Transportation System Specialist
BEP	Back End Processor
ConOps	Concept of Operations
COTS	Commercial Off-the-Shelf
CPDLC	Controller Pilot Data Link Communications
CSP	Commercial Service Provider
DCIS	Data Communications Integrated Services
DCL	Departure Clearance
DCNS	Data Communication Network Service
DCP	Data Communications Program
DSR	Display System Replacement

DT	Developmental Testing
DTAP	Data Comm Trials Automation Platform
EAS	En Route Automation System
ECG	En Route Communications Gateway
ERAM	En Route Automation Modernization
ERIDS	En Route Information Display System
FAA	Federal Aviation Administration
FANS	Future Air Navigation System
FDIO	Flight Data Input-Output
FEP	Front End Processor
FTI	FAA Telecommunications Infrastructure
HADDS	Host ATM Data Distribution System
HCS	Host Computer System
ICAO	International Civil Aviation Organization
IFCET	Inter-Facility Communications Engineering Team
IOA	Independent Operational Assessment
MHB	Maintenance Handbook
MMAC	Mike Monroney Aeronautical Center
NAP	National Application Processor
NAS	National Airspace System
NCP	NAS Change Proposal
NEMC	National Enterprise Management Center
NextGen	Next Generation Air Transportation System

NNEW	NextGen Network Enabled Weather
NVS	NAS Voice Switch
OCC	Operation Control Center
OPR	Office of Primary Responsibility
OT	Operational Test
PNOCC	Primary National Operations Control Center
RF	Radio Frequency
RMLS	Remote Maintenance Logging System
S1	Segment One
S1P1	Segment One Phase One
S1P2	Segment One Phase Two
S2	Segment Two
SAL	Simplified Automated Logging
SDP	Service Delivery Point
SITA	Société Internationale de Télécommunications Aéronautiques
SOC	Service Operations Centers
SOP	Standard Operating Procedures
SSC	Systems Service Center
SWIM	System Wide Information Management
T&E	Test and Evaluation
TDLS	Tower Data Link Service
TEMP	Test and Evaluation Master Plan
TIMS	Tower Information Management System
URET	User Request Evaluation Tool

VDL2	VHF Data Link
WJHTC	William J. Hughes Technical Center

Appendix 2 Glossary

Certification	The determination and validation that a system, subsystem, or service is providing or is capable of providing the advertised service to the user. Certification includes an independent determination, which ascertains the quality of advertised services, and a validation, which officially confirms and documents the determination in the maintenance log.
Certification Parameter	Selected critical indicators of the quality of the required advertised services being provided to the user of systems, subsystems, equipment, and services.
Commercial Service Provider	Commercial companies providing air-to-ground communications to commercial airlines. ARINC and SITA are the current data communications CSPs. ARINC established in 1929, is a major provider of transport communications and systems engineering solutions for eight industries including aviation. ARINC was sold to Rockwell Collins in August 2013. SITA was founded in February 1949 by 11 airlines in order to bring about shared infrastructure cost efficiencies by combining their communications networks. SITA headquarters is Geneva, Switzerland. Their Primary National Operations Control Center (PNOCC) is in Montreal, Canada.
Corrective Maintenance	Maintenance performed to identify or correct a problem.
Daily	As used in stating a maintenance schedule, daily is intended to mean once every calendar day for those locations staffed with maintenance personnel 7 days a week. At other locations, daily is intended to mean every calendar day a specialist is on duty. The schedule may be reduced to a minimum of 3 times a week, with not more than 3 days between successive occurrences, at un-staffed locations.
Data Communications	A data-based controller to pilot air traffic control communication system.

Data Communication Integration Service	A provisioned service similar to FTI, but will focus on the air-to-ground portion of the data communication service. The DCIS and FTI operating together will provide the required telecommunications network infrastructure necessary to provide the end-to-end data communications service. Harris Corporation is the DCIS vendor.
Data Communications Network Service	The data communication end-to-end service that includes the systems and networks at the SDPs, FTI and CSPs.
Data Communications Trials Automation Platform	DTAP (a commercial product of Thales) is the DCL Trials system in S1P1. DTAP automation creates a DCL by presenting to the controller for review, a proposed DCL that was created using en route automation data. The controller may modify the DCL with local data and approves the DCL. After controller approval, DTAP makes the DCL available for a flight crew request. Upon delivery of the DCL to the aircraft, the automation system forwards a copy of the DCL to the Airline Operations Center (AOC). DCL Trials will validate the concept of operation for the delivery of departure clearances and revised departure clearances through advanced automation and Controller Pilot Data Link Communications (CPDLC).
En Route Automation System	An en route control system that processes surveillance information, aircraft flight information (flight plan), weather data, critical data pertaining to the NAS and its infrastructure; calculates and projects flight and track information to provide for the expeditious movement of aircraft operating in the ARTCC environment. EAS is comprised of hardware and software infrastructure deployed to the ARTCC via the ERAM program. Lockheed Martin is the EAS vendor.

En Route Automation Modernization	The program that replace the following components of the en route control system: • User Request Evaluation Tool (URET) • Host Computer System (HCS) • Display System Replacement (DSR) • Host ATM Data Distribution System (HADDS) • En Route Communications Gateway (ECG) • En Route Information Display System (ERIDS) The ERAM program replaces hardware and rewrites the ATC software used at en route centers. Its initial purpose is to modernize ATC automation systems and expand capacity.
Event	Any occurrence, which may or may not be significant.
Event-based Certification	System and subsystem certification when some maintenance or administrative activities occur.
FAA Telecommunications Infrastructure	A telecommunications network that provides nearly all voice, data and video telecommunications services within the FAA's operational ATC system. In 2002 the FAA awarded a contract to Harris Corporation to provide the required telecommunications network which manages 21,000 services at more than 5,000 facilities. Data Comm will use FTI to carry the ground-to-ground portion of the data communications service. The FTI and the DCNS operating together will provide the required telecommunications network infrastructure necessary to provide the end-to-end data communications service.
Interruption	A break in continuity, the loss or unavailability of a facility/service, regardless of duration or cause.
Key Performance Parameter	A selected parameter of the system, subsystem, or equipment, which is a critical indicator of whether or not it is performing its intended function. These parameters are clearly identified in maintenance handbooks with an arrow and are used as troubleshooting aids to logically segment signal flow through the equipment.
Monitor and Control	A device designed to detect when a designated parameter has deviated beyond its prescribed tolerance/limit, and then to activate an alarm to this effect or alter the operation or both.
National Application Processor	The NAP is a subsystem of National EAS sites in Atlanta and Salt Lake City. The NAP subsystem …

Next Generation Air Traffic Control System	NextGen is an umbrella term for the ongoing, wide-ranging transformation of the NAS, including the national system of airports, to ensure future safety, capacity and environmental needs are met. NextGen will fundamentally change the way air traffic is managed by combining new technologies for surveillance, navigation, and communications with workforce training, procedural changes, and airfield development. It will deploy transformational programs including Automatic Dependent Surveillance - Broadcast (ADS-B), Data Comm, NextGen Network Enabled Weather (NNEW), NAS Voice Switch (NVS), and System Wide Information Management (SWIM). These core technologies provide the communication, navigation, and surveillance technology to support the more sophisticated information flows that will allow better use of airspace capacity.
Outage	The loss of a facility/service for one minute or more.
Performance Checks	A periodic scheduled test, measurement, or observation of normal operating controls and functions, which is necessary to determine whether a system is operating within its established tolerances and limits.
Periodic Maintenance	Any scheduled activities that include performance checks and/or maintenance tasks.
Restoration	The maintenance activities required to return a system, subsystem, equipment, or service to normal use following an interruption, equipment failure, or out-of-tolerance/-limit condition.
Service	An end product, resulting from a specific combination of system(s), subsystem(s), and/or equipment(s), delivered to a user (internal or external to the FAA) of the NAS.
Service Delivery Point	The system where the data communications service is delivered. TDLS at the airport ATCT and EAS at the ARTCC are the DCNS SDPs.
Software	A set of programs, procedures, rules, and documentation concerned with the operation of a data processing system; for example, compilers, library routines, and manuals.
Subsystem	A portion of a system that performs a specific function.

System	A combination of subsystem(s), equipment and/or software whose individual functions produce by engineering design a specific operating product in the NAS.
Tower Data Link Services	TDLS comprises a set of Data Communication services providing information from Airport Traffic Control Towers (ATCT) to aircraft flight crews. TDLS has been implemented at 74 ATCTs. TDLS provides DCL, emulation of Flight Data Input/Output (FDIO) Cathode Ray Tube and Replacement Alpha Numeric Keyboard (CRT/RANK) functions, and Digital Automatic Terminal Information Service (D-ATIS).
Tower Information Management System	TIMS is the TDLS Back End Processor (BEP). Messages generated by TDLS sites are forwarded to the TIMS co-located with NESG at Atlanta and Salt Lake City. CSPs connect to the TIMS servers via the TDLS Front End Processors (FEP) connected to the NESGs. The TIMS servers forward messages via the FEP to the external CSP.
Validation	Validation is the second step in the certification process. It involves the act of making an official statement or declaration in a certification log entry.
Verification	A process similar to certification except performed by Non-Federal personnel.
VHF Data Link Mode 2	A means of sending information between aircraft and ground stations. Aeronautical VHF data links use the 117.975 – 137 MHz band assigned by the International Telecommunication Union to Aeronautical Mobile Services (Route). Mode 2 is the only VDL mode being implemented operationally to support CPDLC. Networks of ground stations providing VDL Mode 2 service have been deployed by ARINC and SITA with varying levels of coverage.

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Appendix 3 References

FAA Order 3000.57 Air Traffic Organization Technical Operations Training and Personnel Certification, July 16, 2009

FAA Order 6000.15F General Maintenance Handbook for National Airspace System (NAS) Facilities January 5, 2011

FAA Order 6000.30E National Airspace System Maintenance Policy, July 11, 2007

FAA Order 6030.41, Notification for Unscheduled Facility and Service Interruptions

JO 6000.200 Change 3 Maintenance of FAA Telecommunications Infrastructure (FTI) Services, March 2, 2011

JO 6000.203 National Airspace System (NAS) En Route and Oceanic Operations Automation Services Support Responsibilities, December 1, 2011

JO 6000.204 Maintenance of National Airspace System (NAS) Telecommunication Services, June 15, 2012

JO 6000.51B Air Traffic Organization Responsibilities for the Support of National Airspace System Terminal Automation Services, August 27, 2009

JO 6100.1H, Maintenance of NAS En Route Stage A - Air Traffic Control System

JO 6140.17 Remote Monitoring and Logging System (RMLS) Maintenance Handbook

N JO 6550.11, Interim Maintenance Procedures for the Tower Data Link Services II (TDLS2) Equipment

ATO Technical Operations Services Maintenance Concept of Operations for 2014 and Beyond, May 27, 2011

Final Program Requirements for Data Communications v 1.7, August 30, 2011

Concept of Operations for Data Communications v 0.2 Draft, September 2013

Maintenance Concept of Operations for Data Communications v 0.3 Draft, September 2013

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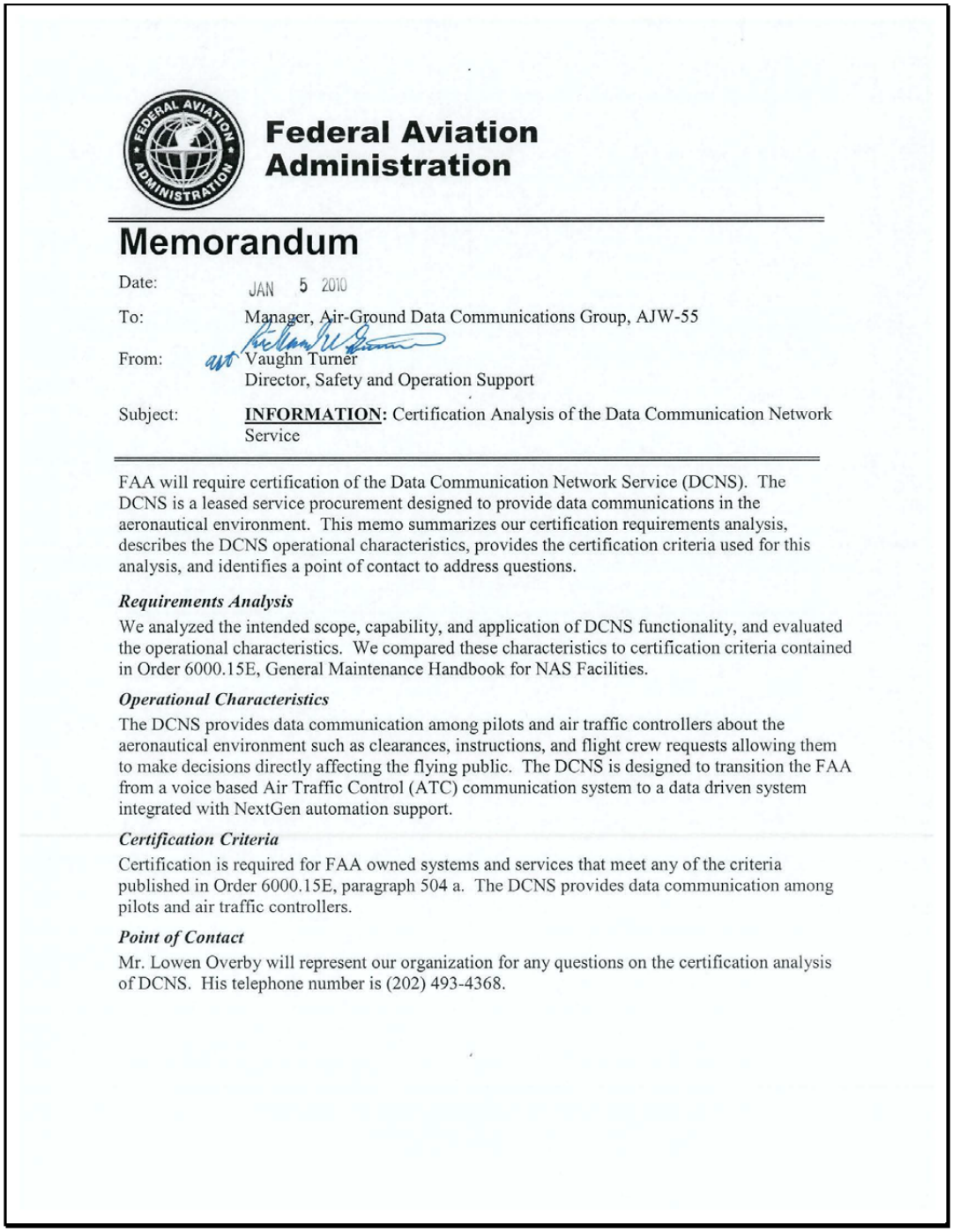
Appendix 4 Certification Analysis



Federal Aviation Administration

Memorandum

Date: JAN 5 2010

To: Manager, Air-Ground Data Communications Group, AJW-55

From: Vaughn Turner
Director, Safety and Operation Support

Subject: **INFORMATION:** Certification Analysis of the Data Communication Network Service

FAA will require certification of the Data Communication Network Service (DCNS). The DCNS is a leased service procurement designed to provide data communications in the aeronautical environment. This memo summarizes our certification requirements analysis, describes the DCNS operational characteristics, provides the certification criteria used for this analysis, and identifies a point of contact to address questions.

Requirements Analysis

We analyzed the intended scope, capability, and application of DCNS functionality, and evaluated the operational characteristics. We compared these characteristics to certification criteria contained in Order 6000.15E, General Maintenance Handbook for NAS Facilities.

Operational Characteristics

The DCNS provides data communication among pilots and air traffic controllers about the aeronautical environment such as clearances, instructions, and flight crew requests allowing them to make decisions directly affecting the flying public. The DCNS is designed to transition the FAA from a voice based Air Traffic Control (ATC) communication system to a data driven system integrated with NextGen automation support.

Certification Criteria

Certification is required for FAA owned systems and services that meet any of the criteria published in Order 6000.15E, paragraph 504 a. The DCNS provides data communication among pilots and air traffic controllers.

Point of Contact

Mr. Lowen Overby will represent our organization for any questions on the certification analysis of DCNS. His telephone number is (202) 493-4368.

Federal Aviation Administration

Memorandum

Date: OCT 03 2012

To: Sandra Anderson, Manager, Data Communications Program, AJM-34

From: Jo L. Tarr, Acting Director, Operations Support, AJW-1

Subject: **INFORMATION:** Certification Analysis of the Datacomm Terminal Automation Platform System

FAA will require certification for the Datacomm Terminal Automation Platform (DTAP) System. This memo summarizes our certification requirements analysis, describes the DTAP system operational characteristics, provides the certification criteria used for this analysis, and identifies a point of contact to address questions.

Requirements Analysis

We analyzed the intended scope, capability, and application of the DTAP functionality, and evaluated its operational characteristics. We compared these characteristics to certification criteria contained in Order 6000.15F, General Maintenance Handbook for National Airspace System (NAS) Facilities.

Operational Characteristics

DTAP enables necessary communications between the controller and the pilot. Specifically, DTAP provides a capability for routing pre-departure clearances to equipped aircraft during aircraft operations or to their Airline Operations Center (AOC) for traffic flow management. This capability enables the airline with the ability to submit requested flight plans at the Air Route Traffic Control Center (ARTCC) and for the Air Traffic Controller to review and approve them before issuing to the aircraft or airline through the automation system.

Certification Criteria

FAA requires certification for systems that meet the criteria published in Order 6000.15F, paragraph 502. The DTAP system functionality provides communication or communication control among pilots and air traffic control personnel during aircraft operations.

Point of Contact

Mr. Lowen Overby, NAS Policy and Services Planning, AJW-167 will represent our organization for any questions on the certification analysis of DTAP. Mr. Overby can be reached on (202) 493-4368.

cc: Lowen Overby, AJW-137
Ben Beddall, AJW-1B
Nicole Payne, AJW-1B
John Wozniak Jr. AJW-134
Sandra Anderson, AJM-34
Frane Bourne, AJW-17
Don Fitts, AJW-178
Scott Williams, AJI-214

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Appendix D Data Communications RMM&C Concept of Operations

US Department of Transportation
Federal Aviation Administration

Data Communications
Remote Maintenance Monitor and Control
Concept of Operations

19 December 2014

Air Traffic Organization
Program Management Organization
Enterprise Services Directorate
Data Communications Program Office

Federal Aviation Administration
800 Independence Ave, SW
Washington, DC 20591

Foreword

This document details the Federal Aviation Administrations (FAA) planned approach to monitoring of the Data Communications service within the National Airspace System (NAS). This document is a product of the Air Traffic Organization, Program Management Organization, Enterprise Services Directorate, Data Communications Program Management Office (DCP). The Enterprise Services Directorate has coordinated this plan with the En Route Automation Modernization Program Management Office, En Route and Oceanic second level engineering, Technical Operations Services (TOS) Operations Support Directorate, NAS Enterprise Organization and TOS second level engineering. This Remote Maintenance Monitor and Control Maintenance Concept of Operations (RMM&C ConOps) is an appendix of the Data Communications Program Concept of Operations.

This RMM&C ConOps is based on TOS Operations Support Directorate initial draft (85% complete) Maintenance Concept of Operations (MCO) delivery (September 2013). These draft versions of the organizational MCO and its supplemental RMM&C-specific appendix were authored by James Victorine (TOS support) with Mark Lynch (AJW-131) and John Wozniak, Jr. (AJW-134).

This Data Communications RMM&C ConOps was finished in collaboration with the TOS Operations Support Directorate, NAS Integration Engineering Group (NISG) and the DCP. The NISG delivered TOS's organizational monitoring requirements and are captured in the Data Communications final Program Requirements (fPR). These requirements are specific to TOS's ability to monitor the commercial service network (communication service providers CSP)), which supports the individual service volumes (SV) required for the delivery of the Data Communications capability. The lifecycle modernizing of remote monitor capability for the legacy Tower Data Link System (TDLS) is supported (funded) by the Data Communications Program Management Office (DCP), however, these are not reflected in the fPR and not part of the program baseline.

Revision History

Rev. #	Name	Description	Date
0.1	V. Gonzalez J. Wozniak Jr.	First draft to document the concept of operations.	July 2012
0.2	J. Victorine J. Wozniak, Jr. M. Lynch	Updated Network Enterprise Management System section and removed certification section.	September 2013
0.3	J. Wozniak, Jr.	Final draft	17 October 2014
1.0	J. Victorine	Final. Incorporates comments from the Technical Operations, Operations Support and National Enterprise Operations Directorates.	19 December 2014

Table of Contents

Executive Summary

Technical Operations Services (TOS) has an organizational responsibility to monitor National Airspace System (NAS) assets. This Remote Maintenance Monitor and Control (RMM&C) Concept of Operations (ConOps) defines, at a high level, how commercial service provider (CSP) service volume (SV) event class messages are delivered to the Federal Aviation Administration (FAA) from Harris Corporation. Once delivered, TOS is responsible for the management of these event class messages. Contractually, the utilization of the Aeronautical Radio, Incorporated (ARINC) and Société Internationale de Télécommunications Aéronautiques (SITA) networks is referred to as the Data Communications Network Service (DCNS). TOS organizational requirements have been delivered by the NAS Integration Support Group (NISG) and are captured in the Data Communications final Program Requirements (fPR). This finalized RMM&C ConOps is derived from the initial draft delivery from TOS NISG and captures local system monitoring and remote monitoring enhancements. These enhancements applied to the legacy monitoring capabilities the Tower Data Link Services (TDLS) and its new Tower Information Management Subsystem (TIMS). This legacy lifecycle enhancement is not captured in the program fPR and is not part of the program baseline. However, it is supported (funded) by the Data Communications Program (DCP).

Existing mechanisms are in place providing FAA TOS personnel situational awareness regarding NAS assets. Technical Operations Control Center (TOCC)[1] specialists are responsible for remote monitoring. The FAA's existing RMM&C capabilities are currently supported by the Remote Monitoring and Logging System (RMLS) Maintenance Automation System Software/Monitor and Control Function (MASS/MCF). Planned enhancements to this legacy platform are beyond the scope of the program.

The Data Communications RMM&C ConOps leverages the existing FAA monitoring tools (both local and remote) supporting monitoring in both the En Route and Terminal Service Domains. RMLS enhancements have been supported (funded) to accommodate CSP SV Remote Maintenance Monitoring (RMM; there is no control for SVs, this is outside the scope of the Harris contract) as well as enhancing (funding) those systems requiring RMM&C functionality, namely the TDLS and its TIMS subsystem. TOS second level support organizations, specifically the Remote Maintenance System Engineering Team (RMSET) are responsible for these enhancements. The En Route Automation System (EAS) has been enhanced (local monitoring) to capture the new EAS subsystem (National Application (NAP) Subsystem) required to support Data Communications log on capability. This is consistent with the organizational requirements delivered and captured in the fPR. The DCP System Engineering team has facilitated the delivery of these capabilities with RMSET, En Route Automation Modernization (ERAM)

[1] Technical Operations Control Center is a generic term that includes the National Operations Control Center (NOCC), the Atlantic, Pacific, and Mid-States Operations Control Centers (OCC), the NAS Enterprise Management Center (NEMC), and all Systems Operations Centers (SOC).

Program Management Office (PMO) and the Inter-Facility Communications Engineering Team (IFCET), the Terminal second level engineering organization, ensuring these capabilities support this service-oriented capability.

1.0 Purpose & Scope

This RMM&C ConOps defines how TOS will manage RMM for the CSPs (ARINC and SITA), who provide 'outside the fence' network service support and are referred contractually as the Data Communications Network Service (DCNS). This RMM&C ConOps also defines the monitoring enhancements to legacy En Route and Terminal systems. Specifically, enhancements to the EAS and its new NAP subsystem for local monitoring, and TDLS and its new subsystem TIMS migration to remote monitoring.

2.0 Elements

These elements constituted the scope of this document:

- Data Communications final Program Requirements (fPR)
- Data Communications Concept of Operations
- Data Communication Failure Modes and Effects Analysis
- TOS Maintenance Concept for 2014 and Beyond
- Data Communications MCO

3.0 Background

Data Communications capability is intended to increase safety and efficiency of Air Traffic Control (ATC) operations by automating some of the controller and pilot interactions. In Data Communications Phase 1, the Pre Departure Clearance (PDC) capability will continue and issuance of departure clearances will be executed in a more automated manner by Data Communications systems in aircraft, Tower, and En Route facilities. This automation will free controllers from repetitive voice exchanges that are currently required, and will improve safety by reducing the errors that can occur during these voice exchanges. This will allow the controllers to put more focus on non-routine events that require human intervention.

The system functional components to be integrated in order to provide the Data Comm Service are:

- Air Traffic Services (ATS) Facilites Notification (AFN) Application – Logon Service
- En Route Flight Data Processing (FDP) Application
- TDLS Controller Pilot Data Link Communications (CPDLC) Application – Departure Clearance (DCL) Service
- TIMS
- Administrative TIMS (TIMS ADM)
- DCNS
- NAS Enterprise Security Gateway (NESG)
- Protocol Gateway (PGW) Front End Processor (FEP)
- En Route Monitor and Control (M&C) Application
- Data Communications Ground System (DCGS) Back End Processor (BEP)
- Data Communications Monitoring (DCM) FEP

- DCM BEP
- RMLS
- Aircraft AFN Application

Utilization of the existing CSP networks is a key component of the 'return' portion of the message transaction between controller and pilot. CSP networks consist of one or more ground radio stations to deliver a service volume. DCNS includes two existing ARINC and SITA networks. These networks include:

- Very High Frequency (VHF) Digital Link Mode 2 (VDL-2) ground stations
  - VHF radios and antennas that provide line-of-sight coverage to aircraft on the ground and in the air
  - Message processing required to send ACARS messages over the VDL-2 Aviation VHF Link Control (AVLC) frames
- IP telecommunications network that provides ground-ground connectivity between the ground stations and message-processing facilities
- Aircraft Communications Addressing and Reporting System (ACARS) message routing to and from the ground stations that to ensure aircraft messages are routed to the correct ground station
- Aeronautical Telecommunication Network (ATN) Boundary Intermediate System (BIS) routers and air-ground routers to route and forward ATN messages and to provide ATN network service and interoperability (Data Comm Segment 2)
- Network monitoring/control and data recording/retention

Legacy mechanisms are in place that provide TOS personnel (with a maintenance monitoring responsibility), particularly the TOCCs, monitoring NAS situational awareness. FAA policy establishes that TOS must efficiently maintain the NAS infrastructure in a way that minimizes impact to NAS users. NAS Infrastructure system failures that have the most impact to NAS users must receive the highest priority response.[2] The FAA's existing RMM&C capabilities are currently hosted on the RMLS MASS/MCF. Enhancements to this system are the responsibility of TOS.

This RMM&C ConOps leverages existing FAA monitoring tools and processes within the En Route, Terminal and telecommunication network domains. The DCP also provides funding to enhance those systems that require migration to RMM&C, namely TDLS and its subsystem TIMS. TOS, specifically the Remote Maintenance System Engineering Team (RMSET), is working to enhance the legacy monitoring capabilities and integrate RMM&C functionality. RMSET scheduled delivery is late calendar year 2015 or early calendar year 2016. The DCP System Engineering has completed its requirement obligation regarding the delivery of SV event

[2] FAA Order JO 6030.31F, National Airspace System Infrastructure Failure Response

class messages from the vendor to the FAA. DCP has also funded the preponderance of the work required to enhance TDLS / TIMS to RMM&C compliance. DCP has also funded the entire work required to enhance the EASs M&C workstation at the Air Route Traffic Control Center (ARTCC) SOCs. This enhancement is consistent with the existing Computer Human Interface (CHI) and developed by the TOS ERAM User Team and the TOS subject matter experts (SMEs) attached to the program including collaborative formal engagement with the Professional Aviation Safety Specialists (PASS) Article 13 participants. The formal program Operational Test and Evaluation (OT&E) (scheduled for January 2015) will validate the EAS M&C capability. The RMLS MASS/MCF is not on the program critical path and will not be part of formal OT&E. However, the program will support RMSET in their delivery of the modifications expected in late 2015. CSP (ARINC and SITA networks) status is provided to TOS via Harris. Harris performs the core monitoring in accordance with the terms of the contract. TOS will perform supplemental SV monitoring using RMLS MASS/MCF. Event class messages are monitored in a facility SV approach by the three OCCs (Atlantic, Mid-States, Pacific). TDLS and TIMS are monitored via RMLS MASS/MCF at the three OCCs. The NEMC has first level maintenance responsibility for TIMS and will be provided a monitoring capability. As National Enterprise Operations (NEO) monitoring requirements change and new requirements defined, the appropriate interface to NEMC monitoring tools will be developed. The EAS is enhanced to reflect the new connectivity, hardware configurations and system interoperability via the existing local EAS M&C workstation. FAA Telecommunications Infrastructure (FTI) remains with Harris and the NEO.

The Data Communications architecture provides geographic diversity for protection from regional events, like blackouts and weather events with primary and secondary sites located at each of the two National ARTCCs in Atlanta and Salt Lake City. These are the EAS facilities that have been augmented with the NAP subsystem. The Facility Services and Equipment Profile (FSEP) reflect this enhancement. For EAS, the backup National ARTCC acts as a dual redundant "warm standby" for the active site and can be switched to the active Data Comm National ARTCC with an administrative failover action ("promotion") executed by TOS personnel at the accepting site. Warm standby is used here because the backup National ARTCC is up and operational 24-hours a day and data is continuously synchronized to it. Harris also provides geographic diversity, much the same way as the FAA ARTCCs. For TDLS, the TIMS uses an automatic failover system, which eliminates the need for a person to perform the switchover. These two levels of redundancy give Data Communications capability protection over a range of failure modes, and reduce the impact on existing resources. TDLS TIMS was beta tested in TDLS software build V10.09. TDLS hardware and software V11 delivery (calendar 2014) fully deploys TIMS capability and removes TDLS from the National Airspace Data Interchange Network (NADIN II). TDLS TIMS interface with RMLS to support RMM&C in the Terminal domain. This up-leveling of Terminal RMM&C is not supported in the DCP's fPR, however it is funded by the DCP. RMSET is expected to deliver this capability in December of 2015.

4.0 Assumptions

1. The FTI components of the DCP will be operated as it is today. FTI monitoring is not currently integrated with FAA remote monitoring tools and has its own processes and procedures for monitoring and control. The few new FTI circuits will follow existing facility owners. Example: If the ARTCC currently owns telco between the Air Traffic Control Tower (ATCT), the new tower direct connect between EAS and TDLS will be the responsibility of the ARTCC. These interfaces and the monitoring of these are integrated into the existing local EAS M&C.
2. In order for equipment that is connected to the DCNS to communicate with the TIMS at the NEMC facilities, a waiver has been approved to allow the deviations from FAA Orders JO 1370.114 and JO 1370.117. The Safety Risk Management Document (SRMD) for DataComm Connectivity via FTI, version 1.0, November 13, 2014 identified two hazards that were analyzed for risk and likelihood. These risks were categorized as low.
3. Second Level Support maintenance follows today's existing responsibilities. EAS second level maintenance is supported by the ERAM PMO (AJM-25). TDLS second level maintenance is supported by TOS's IFCET (AJW-178).
4. TDLS TIMS currently has no RMM&C capability. These features will be implemented in accordance with TOS RMSET second level support organization, currently scheduled for December 2015. TOS is changing the requirement so that the NEO has monitoring responsibility for TIMS.
5. Detailed procedures for Data Communications-related event management will be in accordance with National Airspace Performance Reporting System (NAPRS). Certification, both event based and service level are incorporated in the legacy NAS systems (EAS/TDLS). Certification and maintenance procedures will be incorporated into existing Maintenance Hand Books by the Office of Primary Responsibility (AJM-25 & AJW-178). Monitoring tools will continue to be legacy (RMLS) and documented FAA procedures, e.g. within handbooks and standard operating procedures (SOP) for M&C and RMM&C.
6. The Data Communications Program Office has established a Post Implementation Support process. This process supports interoperability issues, issues that transcend service domains as well as flight deck, Operators, etc. This Post Implementation Support process provides access to the DCIS contract for all stakeholder / legacy support organizations.
7. The Data Communications architecture is mature. The only evolving capabilities will be the addition of En Route SVs to support Phase 2 of the program.

5.0 Technical Discussion

Data Communications leverages existing local and remote monitoring tools to provide status reporting for situational awareness, restoration response, and outage notification. System monitoring remains with the OCCs and SOCs. The DCNS vendor (Harris) remotely monitors CSP networks. Note that TOS is evolving and has sponsored a new organization, the NEO directorate. NEO's focus will be enterprise management. When additional TOS requirements are received, the RMM&C ConOps will be adjusted to identify the changes in remote monitoring. This section presents the details of Data Comm remote monitoring using the current requirements.

5.1 RMM&C Requirement

The *Maintenance Concept of Operations for 2014 and Beyond* establishes RMM&C as the first action of all TOS personnel when responding to system outages and the preferred method to perform maintenance and restoration activities. TOS NISG Maintenance Automation Program (MAP) Office is the Technical Operations organization responsible for:

- Determining which NAS systems and services must have RMM&C
  - Completed
- Determining the priority and the remote operational information required from a NAS system
  - Priority for TDLS completed / CSP priority completed, contractual in nature
- Coordinating with the NAS subsystem program offices on the development, implementation, installation, and integration of RMM&C.[3]
  - Completed by the program

All NAS subsystems / services that are required to provide RMM&C capability have the appropriate interfaces (interface requirement documents (IRD) and interface control documents (ICD) completed) and will connect to RMLS. RMLS is a network consisting of server-based platforms at each OCC, protocol converters at ARTCCs, and Remote Monitoring Subsystems (RMS) at monitored NAS equipment sites. RMLS manages NAS subsystems by sending and receiving operational status notifications from the RMSs, The RMLS architecture is illustrated in Figure 1.

[3] FAA Order 6000.30E National Airspace System Maintenance Policy and FAA Order 6000.53C Remote Maintenance Monitoring Interface Development and Implementation

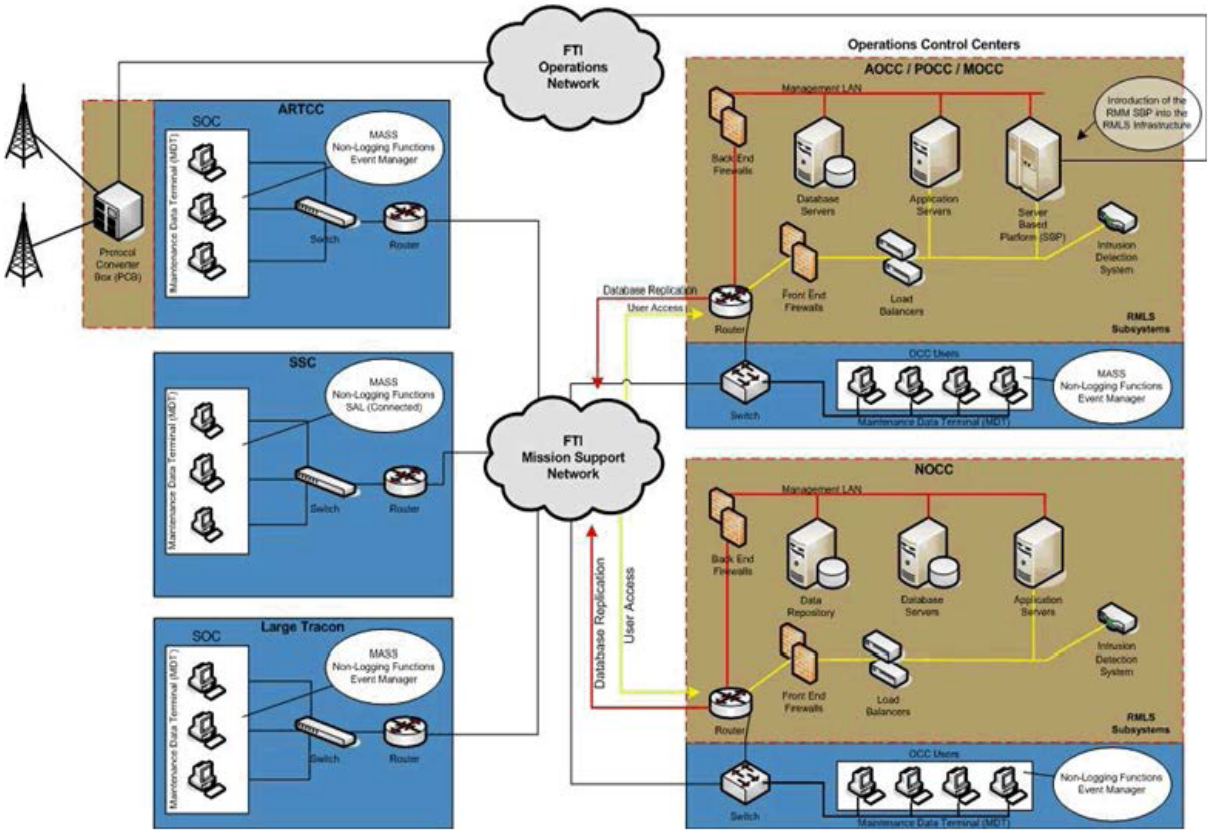

Figure 1: RMLS Architecture

TOCCs (OCCs, SOCs and NEMCs) observe the status of NAS operational assets using the RMLS MASS/MCF, a software tool that automates the monitoring and control of NAS facilities and subsystems. For NAS subsystems integrated into the RMLS, the MASS/MCF allows users to locally or remotely monitor the operational status of NAS RMS, e.g. monitor system status, view alarms or alerts, and analyze system performance. MASS/MCF is also a tool for remote control of certain NAS RMSs, and enables the Airway Transportation System Specialist (ATSS) to remotely issue commands to perform periodic maintenance, manage system configuration, perform fault isolation, and restore service to Air Traffic.

The Data Communications RMM&C capabilities will benefit from the FAA's monitoring improvement initiatives and leverage these changes to achieve the integrated and automated RMM&C requirement.

5.2 Operations & Maintenance

The principle responsibilities for Data Communications SV monitoring reside with Harris Corporation (contractually until 2029). TOS has an organizational responsibility as well. SV status is delivered to the FAA by the Harris Service Operations and Maintenance Subsystem (SOMS) tool via National Enterprise Management Center (NEMC). These responsibilities extend across both the terminal (phase 1) and en route domains (phase 2). System monitoring is consistent with legacy policy and procedures. However, TDLS will become RMM&C compliant late calendar 2015. This section provides a description of TOS's roles and responsibilities for Data Communications (SVs, EAS & TDLS) and is consistent with FAA Technical Operations *Maintenance Concept of Operations for 2014 and Beyond,* delivered organizational requirements (TOS, Operations Support Directorate / NISG), captured in the program's fPR. Appendix 1 provides the overall service flow and restoration to elements that cross organizational boundary roles and responsibilities.

Each FAA-maintained NAS asset is assigned a TOCC that monitors its operation, handles user service issues regarding the device / equipment, and initiates corrective action. The control centers, principally OCC's and SOC's in the case of Data Communication service volume, monitor and serve as an initial screening point for calls about service issues from the field and other operational facilities.

The Control Center Specialists work with the representative reporting the issue to isolate the fault to a particular system by drilling down using existing automated monitor and control tools to determine whether the issue merits a repair call. The specialists open event logs, initiate Notice to Airmen (NOTAM), if there is a loss or reduction of service, and coordinate with appropriate internal entities (such as local site first level and second level engineering maintenance support) and external entities (such as third party vendors) to initiate a repair. They also ensure the issue is coordinated with outside users. Track the issues until resolved, report the status, and close the event log using the appropriate systems.

A significant part of the Control Center Specialist's job is accomplished via telephone coordination, although they do have automated tools used to determine system status that have varying capabilities of status reporting and on-line reference material. Specialists work with the air traffic facility or with a neighboring control center to gauge the operational situation and give guidance to Air Traffic management and flow control on procedural solutions to keep traffic flowing.

5.2.1 Tower Domain

The Tower environment/domain encompasses personnel and equipment at 73 TDLS facilities, two NEMCs, and the IFCET second level maintenance located at the Mike Monroney Aeronautical Center (MMAC) in Oklahoma City.

Air Traffic Controllers in the ATC Tower will continue to be responsible for providing departure clearances, maintaining separation and efficient movement of aircraft operating on the taxiways and runways of the airport itself, as well as those in the air near the airport. They will continue to report TDLS operational issues to their AT supervisor and implement a service work-around as needed (e.g. falling back to PDC or switching to voice for clearance delivery). Initially, the majority of aircraft will not be equipped with Data Comm capability, in which case the near term departure clearances will be via PDC and voice communications.

The ATCT AT Supervisor will continue to act as the AT facility lead in coordinating with other facilities, coordinating with Controllers and the appropriate TOCC (OCC in this case). The En Route Air Traffic (AT) Supervisor will oversee the Specialists who coordinate with Tower facilities to investigate Logon issues reported by aircraft.

First level maintenance will be performed by TOS personnel, primarily ATSSs working at FAA System Support Centers (SSC). The ATSS role in the Tower will remain unchanged. Initially, Second Level Support (IFCET) will perform first level maintenance for the TIMS and TMC interfaces, and will assume the lead role for coordinating Data Comm service end-to-end issue resolutions. NEO personnel will assume a first level maintenance responsibility when properly armed with the necessary skills. Formal ATSS Software Specialist (SS)-type training for NEMC specialist charged with a TIMS first level maintenance responsibility is expected in the Summer of 2015.

The OCCs will continue their role as a centralized coordination point for monitoring and coordinating restoral of NAS systems and services, including Data Comm, working with the ARTCC SOCs, NEMC, vendors, first and second level maintenance support of EAS and TDLS, the NOCC, as well as other entities. The OCCs will monitor system operation within their service area, supporting the tower terminal environment; for the first time, TDLS operational status will be available via RMLS. They will have the status of the CSP SVs (DCNS network), and will coordinate with towers and users when outages impact the service. OCC specialists coordinate events that impact the NAS within their service area. They isolate system issues to the appropriate sub-system, open trouble tickets against defective systems, and facilitate coordination with Second Level support.

The Data Comm service from the TDLS system will be monitored in two principal ways:

1. Locally at each Tower facility using the TDLS AT user interface on the Cab X-Terminals.
2. By TOCC (OCC) personnel via the RMLS. The TDLS AT interface has limited monitoring capability, but does show:
    - The active processor
    - The status of the EAS/TDLS connection
    - The status of the CPDLC service
    - The status of the TDLS to TIMS interface

The key components to be monitored include: 73 TDLS facilities; three Tower Information Management Systems (TIMS), which includes the Administrative TIMS; and, the external interfaces and the DCNS.

A relevant example of telephone coordination by the OCC is with the current TDLS capabilities. Today, TDLS events are managed through the OCC with no remote TDLS monitoring capability available at the OCC. The OCC specialist first becomes aware of an issue by receiving a problem call from an Air Traffic facility. If necessary, the specialist opens a trouble ticket that must be investigated by an on-site ATSS.

The ATSSs support first level maintenance in the certification, maintenance and sustainment of NAS systems. They are trained, credentialed and certified in the operation of various classes of NAS systems (e.g., Navigation, Communications, Surveillance), and are located in central locations to support a geographic area. They perform periodic maintenance, as well as system and service restoration. After the system is restored to normal operation, the ATSS will certify the system and associated service, document the repair, and notify the control center of the restoration of service.

5.2.2 En Route Domain

The En Route domain/environment for Data Comm encompasses personnel and equipment at: 18 non-national ARTCCs; two national sites located on the Atlanta, GA and Salt Lake City, UT facilities; Second level engineering for En Route equipment and service is provided by the engineering services based at the William J Hughes Technical Center (WJHTC) in Atlantic City, NJ; and, its EAS software capability developed and maintained by a vendor.

5.2.3 Network Enterprise Management

The NEMC sites have been established by the FAA Enterprise Services Directorate to act as the hub for several communications services, including, but not limited to FTI, NMR, and Bandwidth Manager. These facilities are located at the NEMCs in Salt Lake City and Atlanta. The NEMC houses the FAA's National Enterprise Security Gateway (NESG), which is an existing capability and is a key interface in the Data Comm system architecture.

Harris Corporation operates the FTI Primary Network Operations Control Center (PNOCC), located in Melbourne, Florida. The PNOCC provides network monitoring and technical support for FAA telecommunications and reports to the FTI Program Office.

The role of the PNOCC is not anticipated to experience significant change with the introduction of Data Comm into the NAS. However, as the FTI, there will be additional circuits and connectivity that will require tracking, monitoring and management by the FTI vendor and the FAA. Monitoring of new circuits will be consistent with the monitoring of like circuits today.

In keeping with the Enterprise Services Directorate policy, key national functions of Data Comm are being established in the NEO, such as TIMS routers for the TDLS network in the NESG.

The NEMC will also likely be the point where DCNS monitoring information is provided to the RMM network.

5.3 Data Comm Network Service Integration

DCNS network is managed by Harris Corporation under contract with the FAA. DCNS components are the Service Delivery Subsystem (SDS), the CSP Component Networks, and the Service Operations and Monitoring Subsystem (SOMS). SOMS also includes the DCNS Common Data Storage (DCDS).

5.3.1 Service Delivery Subsystem

The SDS provides the FAA with a single (redundant) interface to the DCNS. The primary function of the SDS is to route messages to and from airlines and aircraft:

- Future Air Navigation System (FANS) 1/A+
- ACARS
- ATN (future – Data Comm Segment 2)

Redundant FANS 1/A+ gateways provide the interface to the NESG PGW FEP using Internet Protocol (IP) routing protocols. The design has no single points of failure.

5.3.2 CSP Networks

CSP networks consist of one or more ground radio stations to deliver a service volume. DCNS includes two existing networks: ARINC and SITA. These networks include:

- Very High Frequency (VHF) Digital Link Mode 2 (VDL-2) ground stations
  - VHF radios and antennas that provide line-of-sight coverage to aircraft on the ground and in the air
  - Message processing required to send ACARS messages over the VDL-2 Aviation VHF Link Control (AVLC) frames
- IP telecommunications network that provides ground-ground connectivity between the ground stations and message-processing facilities
- ACARS message routing to and from the ground stations that to ensure aircraft messages are routed to the correct ground station
- ATN BIS routers and air-ground routers to route and forward ATN messages and to provide ATN network service and interoperability (Data Comm Segment 2)
- Network monitoring/control and data recording/retention

5.3.3 Service Operations & Monitoring Subsystem

The SOMS provides a PNOCC, with contingency operations provided by a Backup NOCC (BNOCC). The SOMS provides the DCNS interface to the NAS Enterprise Messaging Service (NEMS) and interfaces to the CSP network operations centers. The DCDS timestamps and stores SDS and SOMS messages and retains the stored data for 30 days. The stored data may be retrieved by the FAA for event investigation.

As CSP events are received, they are processed, archived, and forwarded to a suite of applications to provide performance and availability status of the DCNS network. DCNS inbound traffic is comprised of active link, security event, ground station, and ARINC service volume state changes. ARINC performs the ground station-to-service volume correlation and provides both state changes. SITA provides only ground station state changes. DCNS PNOCC performs the service volume correlation that provides situational awareness and performance trending. The CSP data is collected, sorted and stored for interrogation of service availability and analysis and forwarded to RMLS via NEMS.

As Service Volume affecting events occur on the network, notifications are sent to the applicable DCNS support group, RMLS and to the DCNS customer. These service-affecting notifications are generated by Remedy, a commercial off-the-shelf (COTS) product that indicates the impact of the event, the old and new status of the service volume, and ticket number. The high-level DCNS architecture is illustrated below in Figure 2.

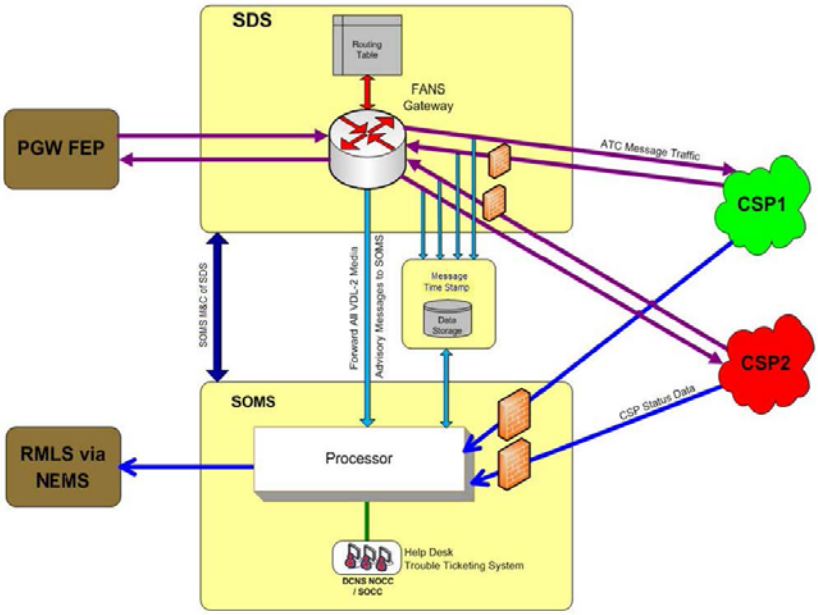

Figure 2. DCNS High-Level Architecture

5.3.4 DCNS RMMC Integration

Harris Corporation is responsible for the integration of DCNS. DCNS initial capability will be provided in Release Candidate Build One (RCB 1) including:

- Service Delivery Subsystem
  - FANS Gateway
  - Stream Control Transmission Protocol (SCTP) Interface
  - Airport Loading Level (ALL) 1 - 500 bps
  - Latency "as is"
  - Operations on Common Signaling Channel (CSC) only
  - SDS Interfaced with CSPs
  - Basic CSP system status (up/down, provider manually-entered into SOMS)
- Service Operations & Maintenance Subsystem
  - NEMS Interface
  - Manual CSP Data Input
  - Trouble Ticketing
  - DCNS Portal
- ARINC CSP
  - SDS Interface
  - ARINC 620 Conformance
  - Monitoring System Portal
- SITA CSP
  - Harris-SITA ACARS Core Processor and Back-end systems
  - A/G system simulation components
  - VHF Ground Computer (VGC) Software Baseline hosted
- R F Cloud/RF Attenuated Network
  - 5 inputs/outputs each going through a 50 dB RF attenuator
  - Connects Lab RF radios belonging to the ARINC and SITA Ground Stations to the "aircraft" radio using coax cables

RCB 1 will not include failover performance testing, an operational SOMS dashboard, nor allow FAA input of status information to SOMS.

6.0 Conclusions

Data Communications service volume monitoring will be preponderantly done by Harris and supplemented by the FAA with the Harris SOMS tool and the FAAs RMLS (when delivered, expected December 2015). The EAS NAP subsystem is monitored at the EAS M&C by the ARTCC SOC. There are no CHI changes to the existing EAS M&C. There is no RMM&C for EAS, which is legacy. Data Communications RMM&C in the Terminal domain will be accomplished with the integration of TDLS and TIMS into RMLS. TDLS RMM&C will be managed by the OCCs and TIMS managed by the NEMC via the RMLS MASS/MCF.

Appendix 1 Service Impact and Restoration

This appendix outlines five possible Data Communications service failures:

1. CSP Service Volume Out of Service
2. TDLS-EAS Direct Connect (TEDC) Out of Service at a Single Airport
3. Parent ARTCC (All Airports) Out of Service
4. TIMS East or West Out of Service
5. Active National Application (NAP) Site Degraded

These failures are not an all-inclusive list. The list does not include:

- Common failures where service delivery is unaffected, such as single-thread equipment failures to EAS or TDLS.
- Unlikely failures, such as dual, redundant equipment or software failures
- Catastrophic failure of a single site or national asset

Single thread failures to national assets, such as TIMS (4) or NAP (5) are included because these failures increase the risk of a total loss of Data Communications services.

The tables in this appendix identify:

- Failures – the location or equipment where a failure is likely to occur
- Indicators – the location where the failure is observed across the enterprise and the method of notification
- System Behaviors – how service delivery systems behave when the failure occurs
- Operational Impacts – specific Data Communications services affected by the failure
- System Impacts – the level of severity to the NAS
- Actions – how users and maintainers respond to the failure

CSP Service Volume Out of Service							
Failures	**Indicators**						
CSP	**DCNS PNOCC**	**Aircraft**	**ATCT**	**OCC**	**Parent SOC**	**NEMC**	**National SOC**
ARINC or SITA Service Volume	SOMS alert	Logon failures Clearance request/response times out	CPDLCs timeout *Note: TDLS MTM & X-Terminal Processor, interfaces & applications status are normal*	RMLS alert SOMS alert DCNS PNOCC contact ATCT AT report	None SOMS alert *Note: M&C indicators are normal*	None *Note: TIMS indicators are normal*	None SOMS alert *Note: M&C indicators are normal*
System Behaviors							
▪ Aircraft logons fail ▪ Aircraft clearance requests or responses held in the queue, but will begin to timeout after 10 minutes ▪ Processed clearances timeout after 10 minutes							
Operational Impacts							
▪ PDC service is unaffected ▪ Logon unavailable for aircraft using the CSP service ▪ TDLS cannot establish CPDLC sessions with affected aircraft ▪ Cannot process any new CPDLC clearances; clearances will need to be cleared by voice or PDC if stated in SDB or flight plan							
System Impacts							
▪ FANS flights using the service volume at the airport ▪ Possible airport flight delays at peak periods							

Actions – CSP Service Volume Out of Service	
DCNS PNOCC	✓ Initiate restoration (if necessary) ✓ Notify OCC
CSP	✓ Conduct restoration activities in accordance with DCNS service agreement
OCC	✓ Open RMLS event log ✓ Provide outage notifications ▪ ATCT AT ▪ AOCs (of affected flights)
ATCT AT	✓ Process affected flights using FDIO & strips ✓ Revert to voice ✓ Notify OCC
ATCT SSC	No action required
Parent ARTCC SOC	No action required
NEMC	No action required
National ARTCC SOC	No action required

TLDS-EAS Direct Connect (TEDC) Out of Service (Single TDLS Airport)							
Failures	**Indicators**						
FTI / TDLS	**Parent SOC**	**National SOC**	**Aircraft**	**ATCT**	**NEMC**	**OCC**	**DCNS PNOCC**
FTI	Audible alert TDLS degraded; airport down RMMCAT	Audible alert TDLS degraded; airport down	Logon failure Clearance request/response times out	CPDLC & TIMS down CPDLCs timeout	None *Note: NEMC does not have Enterprise monitoring responsibility*	ATCT AT report RMLS alert	OCC contact *Note: SOMS indicators are normal*
Dual TDLS equipment / software	Audible alert TDLS degraded; airport down	Audible alert Airport down	Logon failure Clearance request/response times out	Interfaces, applications &/or processors down CPDLCs timeout	None *Note: NEMC does not have Enterprise monitoring responsibility*	ATCT AT report RMLS alert	OCC contact *Note: SOMS indicators are normal*

System Behaviors

- Aircraft clearance requests or responses held in the queue, but will begin to timeout after 10 minutes

Operational Impacts

- PDC service is unaffected
- Flights in the Pending List, Pick List, and revisions are unaffected
- Aircraft logon unavailable after failure
- TDLS cannot establish CPDLC sessions after failure
- Cannot process any new CPDLC clearances; will need to be cleared by voice or PDC if stated in SDB or flight plan

System Impacts

- CPDLC service down, one airport
- Possible airport flight delays at peak periods

Actions – TEDC Out of Service (Single TDLS Airport)	
Parent ARTCC SOC	✓ FTI Failure ▪ Verify FTI outage in RMMCAT ▪ Initiate restoration ▪ Open RMLS event log ▪ Notify OCC
OCC	✓ TDLS Failure ▪ Notify ATCT SSC to initiate restoration ▪ Open RMLS event log ✓ Provide outage notifications ▪ AOCs of affected flights ▪ ATCT AT (FTI outage) ▪ DCNS PNOCC
ATCT AT	✓ Process flights using FDIO & strips OR revert to voice
ATCT SSC	✓ Conduct restoration activities on failed TDLS equipment
DCNS PNOCC	✓ Notify CSPs
National ARTCC SOC	No action required
NEMC	No action required

Parent ARTCC (All Airports) Out of Service							
Failures	**Indicators**						
FTI / EAS	**Parent SOC**	**National SOC**	**OCC**	**ATCT AT**	**AOC / Aircraft**	**DCNS PNOCC**	**NEMC**
FTI	Audible alert TDLS down; airports down RMMCAT	Audible alert TDLS down; airports down	Parent SOC contact	Logon failure Clearance request/response times out	CPDLC & TIMS down CPDLCs timeout	OCC Contact *Note: SOMS indicators are normal*	None
EAS – Dual equipment, active channel	Audible alert CDP down TAI down TDLS down Both AFIs down	Audible alert ERAM interface down	Parent SOC contact	ERAM interface down DCLs timeout	Logon failures	OCC contact *Note: SOMS indicators are normal*	None
System Behaviors							
▪ Aircraft logon failures ▪ DCL requests or responses timeout							
Operational Impacts							
▪ PDC service is unaffected ▪ Aircraft logon unavailable ▪ TDLS cannot establish CPDLC sessions ▪ Flights in the Pending List, Pick List, and revisions are unaffected ▪ Cannot process any new CPDLC clearances; will need to be cleared by voice or PDC if stated in SDB or flight plan							
System Impacts							
▪ CPDLC flights, all assigned airports ▪ Regional (multiple airports) flight delays							

Actions – Parent ARTCC (All Airports) Out of Service	
Parent ARTCC SOC	✓ Verify FTI outage in RMMCAT (FTI failure) ✓ Promote backup channel (dual EAS equipment failure) ✓ Initiate restoration ✓ Open RMLS event log ✓ Notify OCC ✓ Notify FDCS
Parent ARTCC SSC	✓ Perform restoration (EAS equipment)
OCC	✓ Provide outage notifications ▪ ATCTs AT ▪ AOCs in the Service Area ▪ DCNS PNOCC
ATCT AT	✓ Process flight data using FDIO & strips ✓ Revert to voice (if required)
DCNS PNOCC	✓ Notify CSPs
National ARTCC SOC	No action required
ATCT SSC	No action required
NEMC	No action required

TIMS (East or West) Out of Service							
Failures	**Indicators**						
TIMS	**NEMC**	**OCC**	**ATCT**	**Parent SOC**	**National SOC**	**Aircraft**	**DCNS PNOCC**
Single or dual node, one site	TIMS errors	RMLS alert	None *Note: MTM & X-Terminal indicators are normal*	None *Note: M&C indicators are normal*	None *Note: M&C indicators are normal*	None	None
System Behaviors							
▪ Service delivery is normal							
Operational Impacts							
▪ PDC service is unaffected ▪ CPDLC service is unaffected ▪ Aircraft logon is unaffected							
System Impacts							
▪ None; operational TIMS assumes message load							

Actions – TIMS (East or West) Out of Service	
NEMC (Failed Site)	✓ Notify the other NEMC ✓ Initiate restoration
NEMC (Other Site)	✓ Verify normal operation; monitor closely
OCC	No action required
ATCT AT	No action required
ATCT SSC	No action required
Parent ARTCC SOC	No action required
National ARTCC SOC	No action required
DCNS PNOCC	No action required

Active National Site Degraded

Failures	Indicators						
NAP	**National SOCs**	**Parent SOCs**	**AOC / Aircraft**	**NOCC**	**NEMC**	**DCNS PNOCC**	**ATCT**
Single thread equipment	Active site degraded Backup site normal	NAP interface degraded	Normal	National SOC contact *Note: RMLS indicators are normal*	NOCC contact *Note: TIMS indicators are normal*	NOCC contact *Note: SOMS indicators are normal*	OCC Contact *Note: X-Terminal & MTM indicators are normal*

System Behaviors

- NAP hardware error detection in 1 or 2 mil sec and less than 6-second automatic failover to redundant equipment
- Service delivery is normal

Operational Impacts

- Failed NAP providing single-thread Data Communications services; manual promotion of backup NAP to active is required
- PDC service is unaffected
- Aircraft logons are unaffected
- CPDLC sessions are unaffected
- Flights in the Pending List, Pick List, and revisions are unaffected

System Impacts

- None, unless backup NAP is not promoted within 00 seconds

Actions – Active National Site Degraded	
National SOCs	✓ Both National Sites ▪ Coordinate promotion of the backup site to active ▪ Notify FDCS ✓ Failed site ▪ Initiates restoration ▪ Notifies NOCC ▪ Opens RMLS event log
National ARTCC SSC (Failed Site)	✓ Perform restoration
NOCC / OCCs	✓ NOCC outage notifications ▪ OCCs ▪ NEMCs ▪ DCNS PNOCC ✓ OCCs outage notifications ▪ ATCT AT in the service area ▪ ATCT SSC in the service area
Parent ARTCC SOCs	No action required
NEMCs	No action required
DCNS PNOCC / CSPs	No action required
ATCT SSCs	No action required

Path to S1P1

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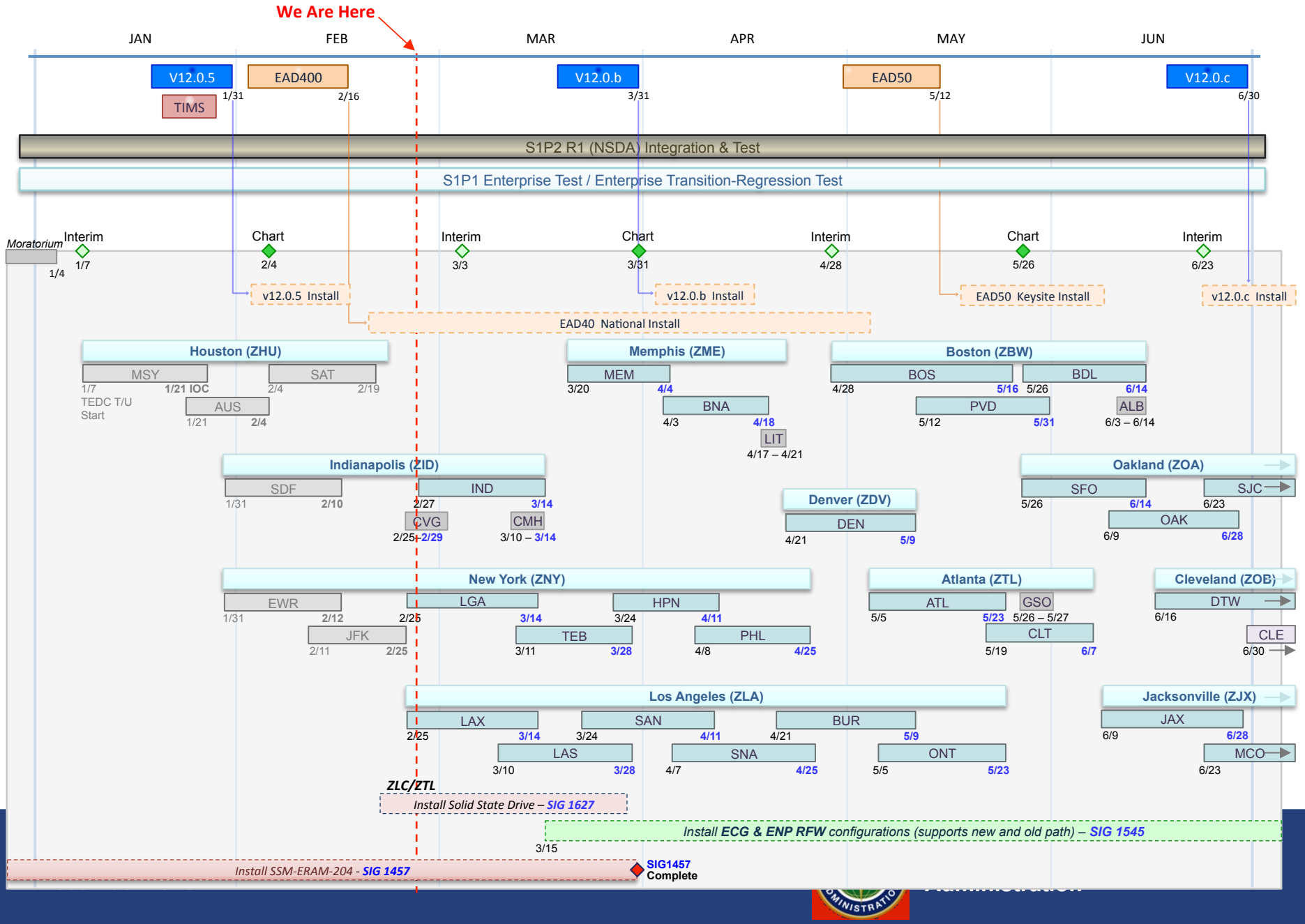

Data Communications – Tower Implementation

Key Sites			
Site Name	Site ID	ARTCC ID	IOC
Boise (Non-DCL)	BOI	ZLC	06/10/15
KS 1: Salt Lake City	SLC	ZLC	08/07/15
KS 2: Houston Intcl	IAH	ZHU	09/03/15
KS 3: Houston Hobby	HOU	ZHU	09/10/15
NAP – NAP Intgr Compl	N/A	ZLC/ZT	09/30/15

Group A			
Site Name	Site ID	ARTCC ID	IOC
New Orleans	MSY	ZHU	01/21/16
Austin	AUS	ZHU	02/04/16
San Antonio	SAT	ZHU	02/19/16
Los Angeles	LAX	ZLA	03/14/16
Las Vegas	LAS	ZLA	03/28/16
San Diego	SAN	ZLA	04/11/16
John Wayne	SNA	ZLA	04/25/16
Burbank	BUR	ZLA	05/09/16
Ontario	ONT	ZLA	05/23/16
San Francisco	SFO	ZOA	06/14/16
Oakland	OAK	ZOA	06/28/16
San Jose	SJC	ZOA	07/13/16
Sacramento	SMF	ZOA	07/27/16
Reno (Non-DCL)	RNO	ZOA	07/27/16
Phoenix	PHX	ZAB	08/17/16
Albuquerque	ABQ	ZAB	08/31/16
El Paso (Non-DCL)	ELP	ZAB	08/31/16
Seattle	SEA	ZSE	09/22/16
Portland	PDX	ZSE	09/22/16
Dallas Love	DAL	ZFW	10/13/16
Dallas FTW	DFW	ZFW	10/27/16
Will Rogers (Non-DCL)	OKC	ZFW	10/27/16
Honolulu (Non-DCL)	HNL		11/03/16
Anchorage (Non-DCL)	ANC		11/10/16

Group B			
Site Name	Site ID	ARTC C ID	IOC
Louisville	SDF	ZID	02/10/16
Cincinnati (Non-DCL)	CVG	ZID	02/29/16
Indianapolis	IND	ZID	03/14/16
Columbus (Non-DCL)	CMH	ZID	03/14/16
Memphis	MEM	ZME	04/04/16
Nashville	BNA	ZME	04/18/16
Adams Field (Non-DCL)	LIT	ZME	04/21/16
Denver	DEN	ZDV	05/09/16
Atlanta	ATL	ZTL	05/23/16
Charlotte	CLT	ZTL	06/07/16
Piedmont (Non-DCL)	GSO	ZTL	06/07/16
Jacksonville	JAX	ZJX	06/28/16
Orlando	MCO	ZJX	07/13/16
Miami	MIA	ZMA	08/03/16
Ft Lauderdale	FLL	ZMA	08/17/16
Tampa	TPA	ZMA	08/31/16
Palm Beach	PBI	ZMA	09/15/16
San Juan (Non-DCL)	SJU	ZMA	09/15/16
St Louis	STL	ZKC	10/06/16
Kansas City	MCI	ZKC	10/20/16
Tulsa (Non-DCL)	TUL	ZKC	10/20/16
Minn-St Paul	MSP	ZMP	11/10/16
Eppley Field (Non-DCL)	OMA	ZMP	11/10/16

Group C			
Site Name	Site ID	ARTC C ID	IOC
Newark	EWR	ZNY	02/12/16
J F Kennedy	JFK	ZNY	02/25/16
La Guardia	LGA	ZNY	03/14/16
Teterboro	TEB	ZNY	03/28/16
Westchester	HPN	ZNY	04/11/16
Philadelphia	PHL	ZNY	04/25/16
Boston	BOS	ZBW	05/16/16
Providence	PVD	ZBW	05/31/16
Bradley	BDL	ZBW	06/14/16
Albany (Non-DCL)	ALB	ZBW	06/14/16
Detroit	DTW	ZOB	07/06/16
Cleveland	CLE	ZOB	07/20/16
Pittsburgh	PIT	ZOB	08/03/16
Buffalo (Non-DCL)	BUF	ZOB	08/03/16
Balt/Wash	BWI	ZDC	08/24/16
Dulles	IAD	ZDC	09/08/16
Reagan	DCA	ZDC	09/22/16
Raleigh/Durham	RDU	ZDC	10/06/16
Andrews (Non-DCL)	ADW	ZDC	10/06/16
Chicago Midway	MDW	ZAU	10/27/16
Chicago O'Hare	ORD	ZAU	11/10/16
Milwaukee (Non-DCL)	MKE	ZAU	11/10/16

TDLS Sites Color Key	
CPDLC DCL Site	
Enhanced PDC Only Site	
Site Operational	