Federal Aviation Administration

STARS Implementation and Lessons Learned

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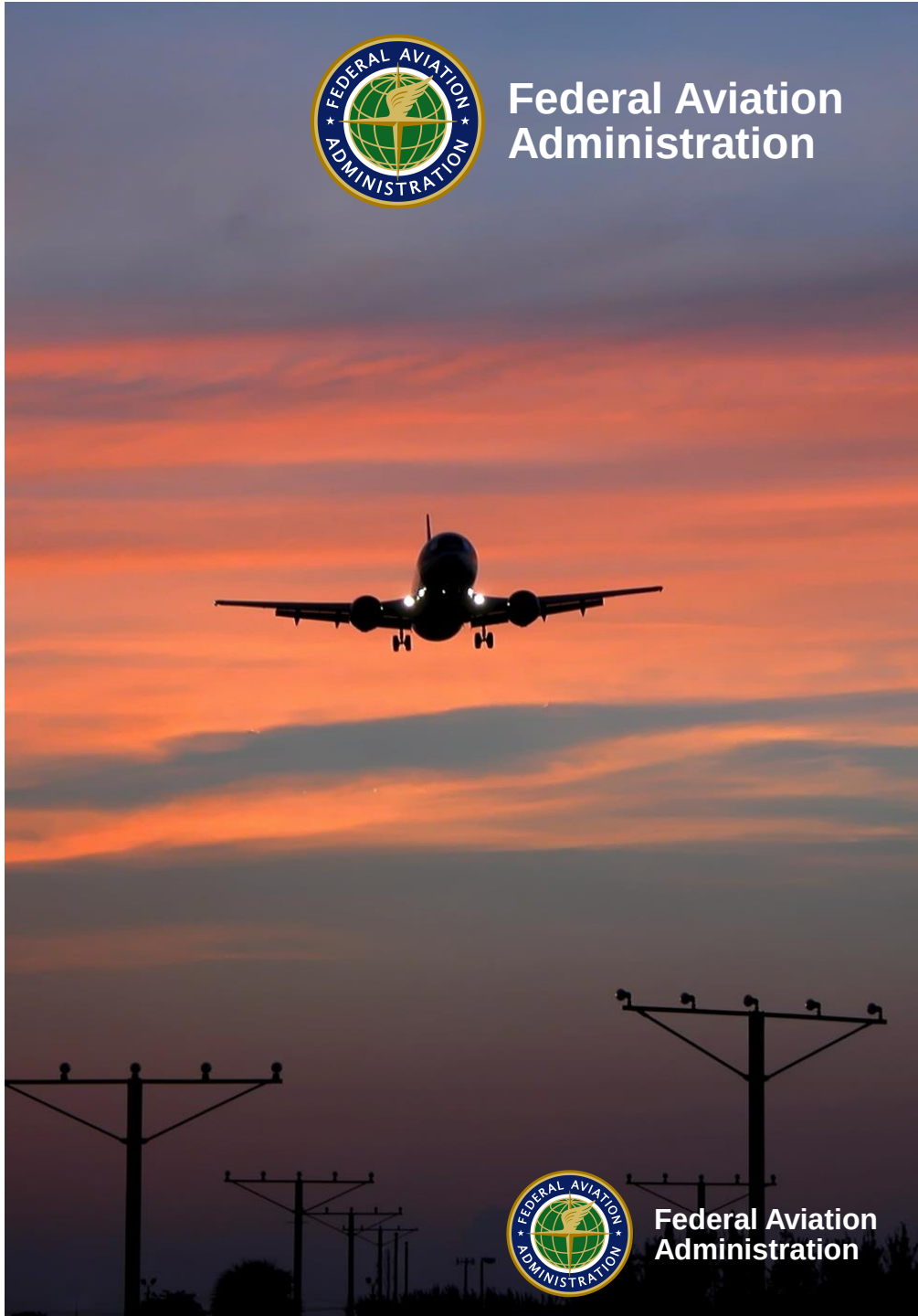


Purpose

The purpose of this presentation is to provide FAA Experience and Lessons Learned on its Standard Terminal Automation Replacement System (STARS) deployment.

The presentation will provide background on STARS and cover the deployment process from planning to training and some lessons learned from each of these steps.

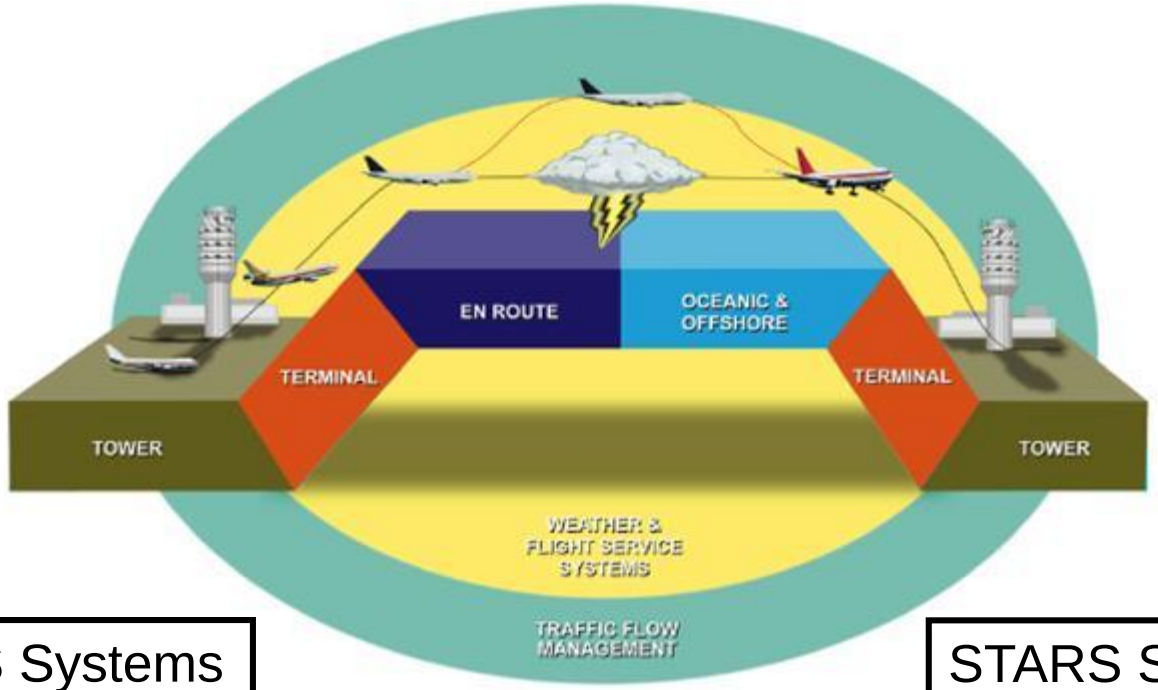
Agenda

- **STARS Background**
  - STARS Systems in the National Airspace System (NAS)
- **System Configuration Overview**
  - STARS G4 Configuration
  - STARS G4 ELITE Configuration
- **STARS Features**
- **Recent Program Enhancements**
- **Deployment Process**
  - Site Planning
  - Site Planning – Lessons Learned
  - Risk Planning Storyboard
  - Preparation and Logistics
  - Preparation and Logistics – Lessons Learned
  - Bulk Buy Storyboard
  - Training
  - Training – Lessons Learned
  - Keep those Documents Storyboard
  - Communication – Lessons Learned

STARS Background

- **Standard Terminal Automation Replacement System (STARS) is a joint FAA/DoD system to modernize the air traffic control systems at all of the nation's major airports and Department of Defense (DoD) facilities**
  - 149 FAA TRACONs, 96 DoD RAPCONs, and 420 Towers
  - Goal: Single terminal automation platform for the National Airspace System (NAS)
- **The program has progressed through three major acquisition phases:**
  - Phase 1 – Engineering development and limited deployment
    - Deployed to 47 mid-size FAA facilities and all of the DoD facilities.
  - Phase 2 – Deploy 5 FAA STARS systems and perform other system upgrades
  - Phase 3 – Replacement of all remaining FAA Terminal Automation systems
    - This includes the 11 "Large" TRACONS plus the remaining 97 smaller facilities

STARS Systems in the NAS



STARS Systems

1) TOWER
Airport Tower has control over the aircraft from the time the aircraft leaves the gate until takeoff. Then the aircraft is handed off to the TRACON.

2) TERMINAL
The aircraft generally climbs to the ceiling of the TRACON within 20 nmi of the airport. Control of the aircraft is then handed off to the En Route/Oceanic Center.

3) EN ROUTE/ OCEANIC
The cruise phase of the aircraft may be conducted with one or more En Route centers. En Route centers control the flight until it reaches the arrival phase.

STARS Systems

4) TERMINAL
During the arrival phase of the flight, control of the aircraft is transferred to the destination TRACON, generally at 40 nmi from the airport.

5) TOWER
The aircraft is handed off to the tower control for landing and taxi to the gate.

System Configuration Overview

- **STARS is a fault tolerant, redundant, terminal ATC system**
- **The STARS products include single towers to large TRACONs**
  - **STARS G4**
    - Large TRACONs and associated towers
    - Full Service Level (FSL) and Emergency Full Service Level (EFSL)
    - Quadruple redundant
  - **STARS G4 ELITE**
    - Intermediate to smaller TRACONs and associated towers
    - Same functional capabilities as STARS G4
    - Dual redundant with a reduced hardware footprint
- **Benefits**
  - Maintain safety while increasing cost effectiveness at terminal facilities across the NAS
  - Provides terminal automation foundation for future NextGen programs
  - Easy to maintain infrastructure for technicians
  - Common software baseline for all configurations
  - 80% reserve capacity for future enhancements
  - Predominantly Commercial Off-the-Shelf (COTS) equipment – reduced development costs

STARS Features

- **Modern processors and high-availability architecture network**
- **Open standards to facilitate growth and new interfaces – NextGen ready**
- **Modern multi-sensor tracking capability**
  - Advanced Multi-Radar Tracker (Fusion Tracker), Short and long range radars via serial feed, Mode S radar, Asterix radar input over IP, Automatic Dependent Surveillance Broadcast (ADS-B), Multi-lateration
- **Enhanced Traffic Management System (ETMS) Interface**
- **Continuous Data Recording (CDR) – fault and incident analysis**
- **Common controller interface - integrated local & remote tower controller displays**
- **Certified conflict alert, minimum safe altitude, Mode C intruder safety function**
- **3000 simultaneous track capacity**
- **Capacity for future enhancements**
- **Composite weather data display of six-level weather inputs**
- **Expanded geographic coverage area (1024 nm^2 in future software update)**
- **Extensive system monitoring and control capabilities**
- **One-way data distribution to multiple airport systems/users**
  - Applications Interface Gateway (AIG)
- **Large-screen, high-resolution full-color displays**

Future Program Enhancements

- **Deployment of the Linux Operating System**
- **Enhanced Converging Runway Display Aid (CRDA)**
- **All-purpose Structured EUROCONTROL Radar Information Exchange (ASTERIX) Interface to Radars**
- **Operational Internet Protocol (OPIP)**
- **Virtual ‘Camera’ Towers**
- **Improved Display of Weather**

Program Planning

Program Planning – Lessons Learned

- **Include early end-user software evaluations, known in the Terminal Automation Modernization and Replacement (TAMR) Program Office as "play dates"**
  - Have end-users participate in requirement development, design, and test of system software
  - Provide those end-users an opportunity to look at, and provide feedback on, the design and performance prior to vendor delivery and formal test
    - Fewer formal deliveries and tests will be required to close the gap between intent and deliverable
- **Establish collaborative relationships with labor unions/associations early in the planning phases of the program**
  - Doing so led to labor developing teams that supported the TAMR project
    - Teams supported familiarizations, site specific telcons, on-site activities, test events, and were great partners in issue resolution
  - Establish your labor union's/association's representatives during the planning and design phases
  - Develop labor teams during the deployment phase of the project to support the roll out of the new product
- **Have scheduled meetings with stakeholders to discuss possible waterfall changes***

* Lessons Learned Storyboard

Lessons Learned Storyboard

Waterfall Change Coordination

What was Expected: Changes to waterfall could be made without approval from stakeholders.

What Happened: Waterfall coordination evolved over time after seeing a need to have stakeholders' approval for any changes in the waterfall.

Recommendation: It is better to gain concurrence prior to changing the waterfall, not have support from key stakeholders could compromise success.

- Schedule meetings with stakeholders to discuss possible waterfall changes
  - It is important to have a schedule that is versatile and functional for stakeholders
- Create different views and reports to allow for ease of access

Deployment

Deployment Process

- **The deployment process encompasses a comprehensive, multi-step process to transition an operational (Air Traffic Control) ATC facility to STARS without impact to operations**
  - Site Planning
    - Site Survey
    - Site Transition Activation Management Plan (STAMP)
    - Site Implementation Review (SIR)
  - Preparation and Logistics
    - Site Design
    - Site Preparation
    - Equipment Delivery/Installation
  - Training
  - Operational Cut-over/Initial Operational Capability (IOC)

Site Planning

Primary Activities:

- **Site Survey**
  - Joint FAA and Raytheon team visits site to document hardware requirements, cable runs, interfaces, etc.
  - Lays groundwork for both Raytheon site design process and site preparation activities
- **Site Transition and Activation Management Plan**
  - Raytheon-delivered representation showing results of site survey (e.g., planned cable runs, numbers of hardware components, etc.)
- **Site Implementation Review**
  - On-site review with Raytheon and FAA teams to review Site Transition Activation Management Plan (STAMP) and other plans associated with site-specific implementation

Site Planning – Lessons Learned

- **Hold an Initial Site Survey (ISS) with the stakeholders on-site to iron out needs and expectations before meeting with the vendor at the Joint Site Survey**
  - Puts the Program Office and the site on the same page
  - Make sure expectations regarding funding and requirements are understood.
- **Alternative solutions needed for unique challenges**
  - Keep proper documentation of alternative solutions to inform future design changes
    - Prime vendor may not be as informed when designing a new baseline if there isn't proper documentation
- **Develop disciplined process for deciding when to update baseline design**
  - Some changes may be needed at multiple sites; therefore, may be cheaper to incorporate into baseline
    - Standardized baseline allows for streamlined testing and problem troubleshooting
  - Consistency is needed regarding when to add alternative solutions to the baseline
- **Risk planning: legacy material vs. upgrading infrastructure***
  - Short term benefits vs. long term challenges
    - Future need for retrofitting
    - Negative effects on the standardization of the Hardware (HW) baseline
- **Sites have different culture and coordination practices from each other***

* Lessons Learned Storyboard

Lessons Learned Storyboard

Risk Planning: Legacy Material vs. Upgrading Infrastructure

What was Expected: Could save up front costs by leaving first generation fiber lines from base of tower to tower.

What happened: Legacy material couldn't support new design, so was forced return to site and retrofit or replace legacy material costing more money and time.

Recommendation: Upgrade infrastructure at time of deployment to ensure that site can handle new technology and systems, and to prevent having to go back and retrofit at a later date.

Lessons Learned Storyboard

Sites have different culture and coordination practices from each other

What was Expected: All sites would have same coordination and culture.

What Happened: Coordination and culture varied at differing sites. Dictating "who" would complete a task and/or "how" a task would be completed created tension and led to problems in communication.

Recommendation: After identifying "what" needs to be done by "when," interview individual facilities on "who" and "how" they accomplish similar tasks on legacy systems, or other similar systems. Do not assume that site X has the same coordination and culture and site Y.

Preparation and Logistics

Primary Activities:

- **Site Design**
  - Contractor design activity developed detailed engineering drawings, bill of materials, etc. for specific site implementation
- **Site Preparation**
  - FAA activity carried out to prepare site for STARS installation in accordance with STAMP, Site Implementation Review (SIR)
  - Included rack installations, power, grounding, etc.
- **Equipment Delivery/Installation**
  - Contractor ships equipment to facility and assembles/installs and test at site in cooperation with FAA personnel
  - At the end of contractor's role is the formal contractual hardware acceptance by the FAA

Prep and Logistics – Lessons Learned

- **End of Life Considerations**
  - Earlier considerations for long-term sustainment
    - Allows for better evaluation of mitigation plans for End of Life (EOL) items
    - Cannot always buy one for one replacement parts
  - Commercial products can have relatively short production cycles
  - Qualification timeline can be lengthy
    - Product selection must consider functional fit, and technical requirements
    - Software changes required to incorporate new hardware components further complicate implementation planning

- **One bulk buy for full deployment vs. yearly bulk buys***
  - Full bulk buy mitigates the need for qualification of new parts to replace EOL items
  - Full bulk buys have higher upfront cost, could be offset from lower qualification costs
  - EOL issues force qualifying new parts, which benefit logistics and modernization

- **Clear roles and responsibilities between groups, particularly in the tracking of EOL materials or watch items**

* Lessons Learned Storyboard

Lessons Learned Storyboard

How much do we buy, and when do we buy it?

What was expected: Contractor did one year bulk buy. The advantage was cash flow by only having to pay contractor once a year.

What happened: Due to EOL, parts were not available anymore, which led to having to test and qualify new parts every year. The unintended advantage to this was that the parts are continuously modernized.

Solution: Spend time getting better data on EOL of parts. Based on price, technology need, and EOL, some items can be purchased in bulk, while others can be bought on a cycle. For example, if parts have a two year EOL, those parts can be bought in bulk every two years, so that the testing and qualifying occurs those years instead of every year.

Training

- **Training**
  - Parallel FAA activity to ensure air traffic personnel are trained and prepared to use the STARS system for operational use.
  - Also ensure training for the on-site maintenance personnel, who are responsible for support and certification of STARS in operational use

- **Operational Cut-over/Initial Operational Capability (IOC)**
  - FAA activity where site personnel determine their facility is ready to transition operations to STARS system
    - Supported by multiple FAA organizations on-site to answer questions and quickly address any issues

Training – Lessons Learned

- **COR Familiarization process was incredibly successful and similar instructional activities would be valuable to any program***
  - Transitioned to Program Officer familiarization and was used as an informational seminar in the onboarding process
  - Provided a concise introduction to the systems and various resources to be utilized while learning the system

- **Documentation and supporting rationale should be provided for all key program decisions**
  - Prevents loss of context
  - Provides reference documentation for external stakeholders, or for internal team members, during personnel training and transition

* Lessons Learned Storyboard

Lessons Learned Storyboard

Train, Learn, Repeat!

What was Expected: Program Office would be able to achieve key milestones based on baseline deployment practices.

What Happened: After the first two deployments, it became clear that the Program Office would not be able to achieve key milestones if the Engineering Services community had to learn about the system, best site prep practices, and expectations during every system installation.

Solution: Engineering Services for upcoming projects in the waterfall were brought to the WJHTC for one week to have a system overview, lessons learned, and expectations familiarization session. This yielded more efficient and better quality installations. It also was the kick-off point for building the relationships between the Program Office and Engineering Services. As an unintended benefit, we were able to multipurpose the system overview sessions. Most new hires on the TAMR program have attended the system overview portion of the COR Familiarization and have found it critical to their ability to support the mission of the program.

Communication – Lessons Learned

- **Establish cross discipline communication**
  - Needed more communication between teams
  - Establishment of Liaisons between teams
    - Ensures distribution and maintenance of cross team documentation
    - Serve as quick references for status of actions and ongoing activities between teams
    - Avoids duplicate communication
  - Systems Engineering participation in on-site events
    - Provides real world experience and allows for better appreciation of the challenges faced by deployment teams
- **Sharing the experience of a transition in regards to successes and challenges, from one site on the waterfall to another stimulates success of the program.**
  - Regularly review Lesson Learned and update them with new information
  - **Examples:**
    - As a new site is going through the transition from the legacy system, bring in Air Traffic, NATCA, Tech Ops, PASS and Multi-unit reps from one of the next sites to observe the transition
    - After the transition of the new site is complete and prior to the next site beginning transition, set-up a face-to-face meeting for an information exchange between the two sites
    - At the beginning of the fiscal year, all programs should plan appropriate travel budgets for Subject Matter Experts (SMEs)
    - Coordinate labor 45-60 days in advance of each SME event

Questions?