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MITRE WORKING NOTE

TDDS High-Level Description

Configurations 1 and 2

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Abstract

The Terminal Data Distribution System (TDDS) is a planned terminal enhancement to implement System-Wide Information Management (SWIM) Segment 1. This document contains a high level description of the TDDS functionality. This description is intended to promote coordination among stakeholders to ensure agreement at this level before work on lower levels of detail, such as system requirements and interface requirements, proceeds. The description is divided into two standalone sections, one section each for two different tower configurations. The distinction between the two tower configurations represented is that one does not have the Electronic Flight Strip (EFS) system, but rather retains Flight Data Input/Output (FDIO), and one does have EFS at the tower. Both configurations will exist concurrently since not all towers are planned to receive EFS.

Keywords: SWIM, Terminal, tower, TDDS

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1 Introduction and Background

The Terminal Data Distribution System (TDDS) is a planned terminal enhancement to implement System-Wide Information Management (SWIM) Segment 1. This document contains a high level description of the TDDS functionality. The description is divided into two standalone sections, one section each for two different tower configurations. The first configuration is based on Flight Data Input/Output (FDIO) remaining in place but not interfaced with TDDS. This configuration includes a TDDS interface with the Electronic Flight Strip (EFS) Transfer System (EFSTS) via the Event Extractor (EE). The second configuration is based on EFS replacing FDIO and EFSTS. This configuration includes a TDDS interface with EFS. It is expected that both configurations will exist and will depend on whether a tower is equipped with EFS or not.

The description has been coordinated with the system engineering teams from ATO-T, ATO-E, and ATO-R and are being used to facilitate a common understanding of the TDDS capability among the stakeholders. The intent is to achieve agreement before proceeding to lower-level details such as developing requirements. CAASD will continue to work with ATO-T to build upon these products to begin developing TDDS requirements. The next steps are to define TDDS services and to define data exchange at a lower level of detail.

2 TDDS High-Level Description—Configuration 1

2.1 Introduction

The TDDS is a new terminal system that is being planned for implementation in the 2012-13 time period. The TDDS will provide enhanced data exchange capabilities using System-Wide Information Management (SWIM) capabilities. This description of TDDS focuses on functionality to support SWIM Segment 1 capabilities.

This description is intended to promote coordination among stakeholders to ensure agreement at this level before work on lower levels of detail, such as system requirements and interface requirements, proceeds.

Note: To clearly delineate the TDDS functional boundaries the description below is worded as if TDDS is a separate system. However the TDDS functions described could be allocated to existing or future systems rather than to a separate system. The decision on allocation is still an open issue.

2.2 Function Descriptions

The TDDS will interface with the following tower systems:

Tower Data Link System (TDLS)—to provide flight data received from En Route Automated Replacement System (ERAM) to TDLS. This will be an enhanced interface to what existed prior to TDDS which interfaced TDLS to ERAM via the FDIO flight strip printer port. It will remove the dependency of the TDLS/Pre-departure Clearance (PDC) function to receive flight data from the FDIO interface. The interface will also receive flight data available in TDLS and distribute the data.

Runway Visual Range (RVR)—to receive RVR data and to distribute the data. This data is already distributed by TFM for approximately 50 airports. TDDS will provide a more flexible distribution capability than is currently available

Event Extractor (EE)—to receive flight event/status data extracted by the EE from data provided by EFSTS and Airport Surface Detection Equipment--Model X (ASDE-X) systems and distribute the data.

The TDDS will interface with ERAM to exchange flight data and with TFMS to exchange flight event/status and other data. The TDDS will be capable of interfacing with other user systems to distribute data to them.

All functions will be provided using SWIM services and software protocols.

Relevant interfaces existing prior to TDDS implementation are depicted in Appendix A.

TDDS is planned to be located at Terminal Radar Control Facilities (TRACONs) and interface with one or more towers. A tower could be co-located with the TDDS TRACON or remote from the TRACON. Figures 1 and 2 illustrate the TDDS connectivity for remote towers and co-located sites.

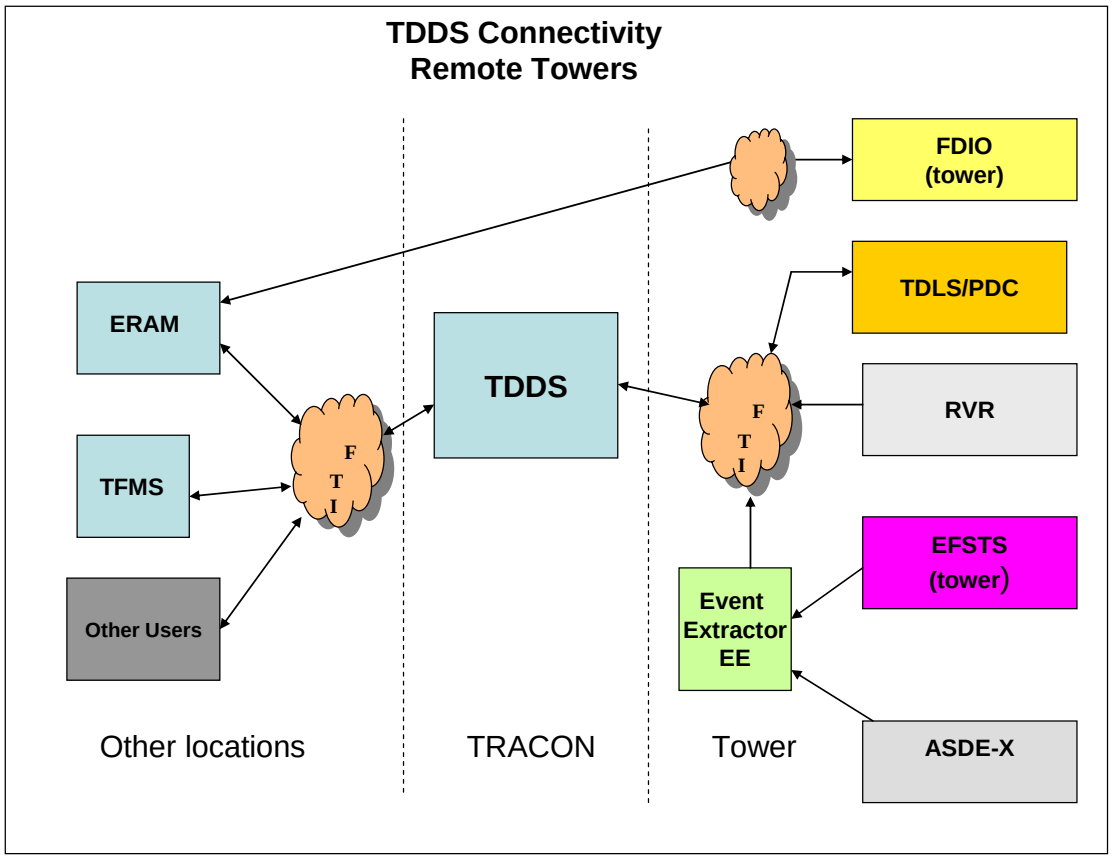

Figure 1. TDDS Connectivity Remote Towers

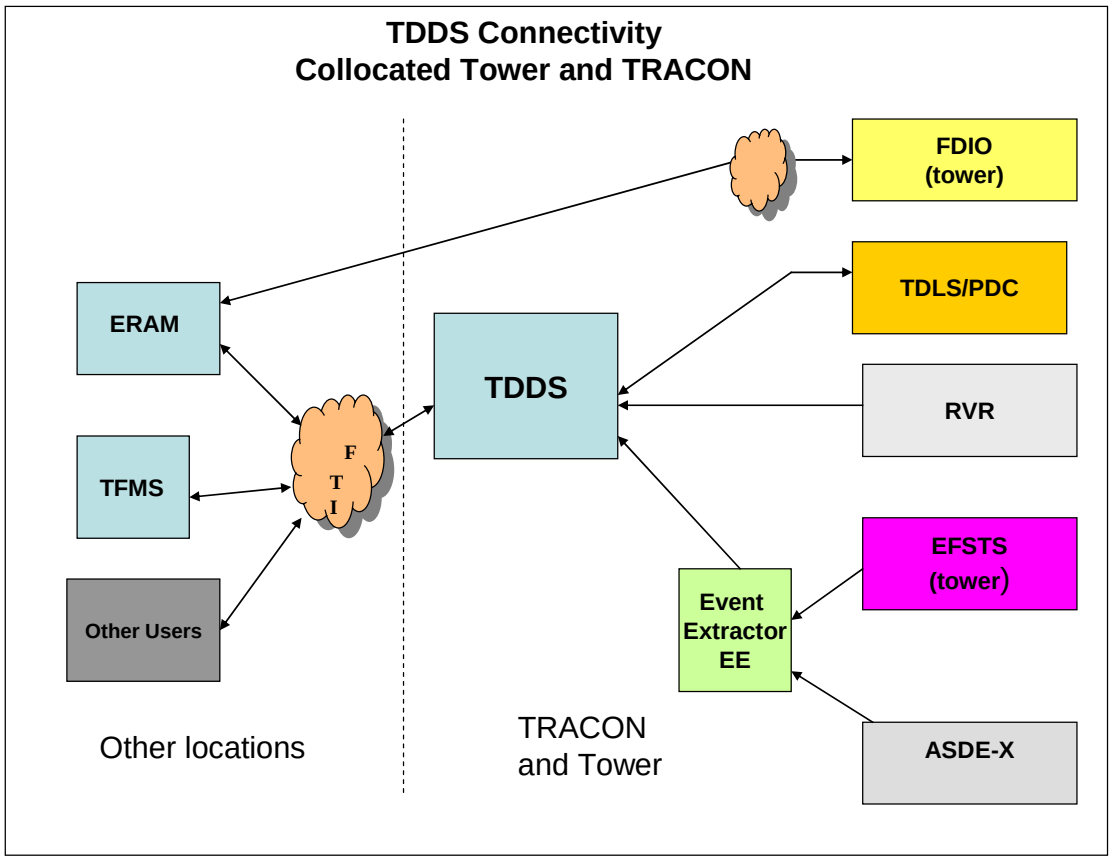

Figure 2. TDDS Connectivity Collocated Tower and TRACON

2.3 TDDS Data Exchange

This section addresses exchange of operational data. It does not address system control data exchange such as acknowledgements, health messages, or data base reconstitution. System control exchanges will be addressed in lower levels of definition.

2.3.1 ERAM Data Exchange

The data received by TDDS from ERAM is as follows:

Table 1. Data received by TDDS from ERAM

Data	TDDS Function
For Proposed Departure Flights from TDDS airports	
Full route, Aircraft ID, Number, Special Aircraft Indicator/Aircraft Type/Special Equipment, CID, ADR/ADAR (PDR/PDAR) alphanumerics, Requested Altitude, Assigned beacon code, Revision Number, Departure Airport, Proposed Departure Time, EDCT, Destination Airport, Remarks	Forward to TDLS

The data sent by TDDS to ERAM is as follows:

Table 2. Data sent by TDDS to ERAM

Data	Source
Pre-departure Clearance Delivery Status	TDLS
RVR Data	RVR

2.3.2 TFMS Data Exchange

No data is received by TDDS from Traffic Flow Management System (TFMS).

The data sent by TDDS to TFMS is as follows:

Table 3. Data sent by TDDS to TFMS

Data	Source
Extracted Flight Event/Status Data	Event Extractor
RVR Data	RVR

2.3.3 Deleted

2.3.4 TDLS Data Exchange

The data received by TDDS from TDLS is as follows:

Table 4. Data received by TDDS from TDLS

Data	TDDS Function	Expected Subscriber(s)
Pre-departure Clearance Delivery Status	Make available to subscribers via SWIM	ERAM
Parking Gate (departures)	Make available to subscribers via SWIM	TFMS
Assigned Runway (departures)	Make available to subscribers via SWIM	ERAM and TFMS

The data sent by TDDS to TDLS is as follows:

Table 5. Data sent by TDDS to TDLS

Data (for Proposed Departures only)	Source
Full route, Aircraft ID, CID, ADR/ADAR (PDR/PDAR) alphanumerics, Requested Altitude, Assigned beacon code, Revision Number,	ERAM

Data (for Proposed Departures only)	Source
Departure Airport, Proposed Departure Time, EDCT Destination Airport, Remarks	

2.3.5 Event Extractor Data Exchange

The data received by TDDS from the Event Extractor is as follows:

Table 6. Data received by TDDS from the Event Extractor

Data	TDDS Function	Expected Subscriber(s)
Extracted Flight Event/Status Data	Make available to subscribers via SWIM	ERAM and TFMS

No data is sent by TDDS to the Event Extractor.

2.3.6 Runway Visual Range Data Exchange

The data received by TDDS from RVR is as follows:

Table 7. Data received by TDDS from RVR

Data	TDDS Function	Expected Subscriber(s)
RVR Data	Make available to subscribers via SWIM	ERAM and TFMS

No data is sent by TDDS to RVR.

2.4 Threads

Example threads are contained in Appendix B. These illustrate some of the functionality of TDDS but are not intended to be exhaustive. Additional threads will be developed as needed to clarify TDDS functionality.

2.5 TDDS Extensibility

Some potential TDDS enhancements beyond Segment 1 have been identified:

Interface TDDS with CARTS/STARS to enhance TRACON data exchange with ERAM, such as obtaining additional flight data from ERAM and providing controller entered flight data to ERAM. Also, disseminate TRACON originated data to other users.

Disseminate additional tower originated flight status data such as departure lineup and gate-hold data.

Provide additional flight data, such as Air Route Traffic Control Center (ARTCC) Traffic Management Unit (TMU)-entered Approval Request (APREQ) times and reroute status, from ERAM to tower.

Disseminate airport status data such as current and planned airport configuration.

Plans for TDDS beyond Segment 1 remain to be determined.

3 TDDS High-Level Description—Configuration 2

3.1 Introduction

The TDDS is a new terminal system that is being planned for implementation in the 2012-13 time period. The TDDS will provide enhanced data exchange capabilities using SWIM capabilities. This description of TDDS focuses on functionality to support SWIM Segment 1 capabilities.

This description is intended to promote coordination among stakeholders to ensure agreement at this level before work on lower levels of detail, such as system requirements and interface requirements, proceeds.

Note: To clearly delineate the TDDS functional boundaries the description below is worded as if TDDS is a separate system. However the TDDS functions described could be allocated to existing or future systems rather than to a separate system. The decision on allocation is still an open issue.

3.2 Function Descriptions

The TDDS will interface with the following tower systems:

EFS—to exchange flight and other data with ERAM. EFS will replace FDIO and EFSTS at some towers. The interface with ERAM will be an enhancement to the ERAM-FDIO interface in order to provide improved access to data in the ERAM flight object. Towers that do not have EFS will continue to use FDIO which will directly interface with ERAM rather than interfacing via TDDS.

TDLS—to provide flight data received from ERAM to TDLS. This will be an enhanced interface to what existed prior to TDDS which interfaced TDLS to ERAM via the FDIO flight strip printer port. It will remove the dependency of the TDLS/PDC function to receive flight data from the FDIO interface. The interface will also receive flight data available in TDLS and distribute the data.

RVR—to receive RVR data and to distribute the data. This data is already distributed by TFM for approximately 50 airports. TDDS will provide a more flexible distribution capability than is currently available.

EE—to receive flight event/status data extracted by the Event Extractor from data provided by EFS and ASDE-X systems and distribute the data.

The TDDS will interface with ERAM to exchange flight and other data and with TFMS to exchange flight event/status and other data. The TDDS will be capable of interfacing with other user systems to distribute data to them.

All functions will be provided using SWIM services and software protocols.

Relevant interfaces existing prior to TDDS implementation are depicted in Appendix A.

TDDS is planned to be located at TRACONs and interface with one or more towers. A tower could be co-located with the TDDS TRACON or remote from the TRACON. Figures 3 and 4 illustrate the TDDS connectivity for remote towers and co-located sites.

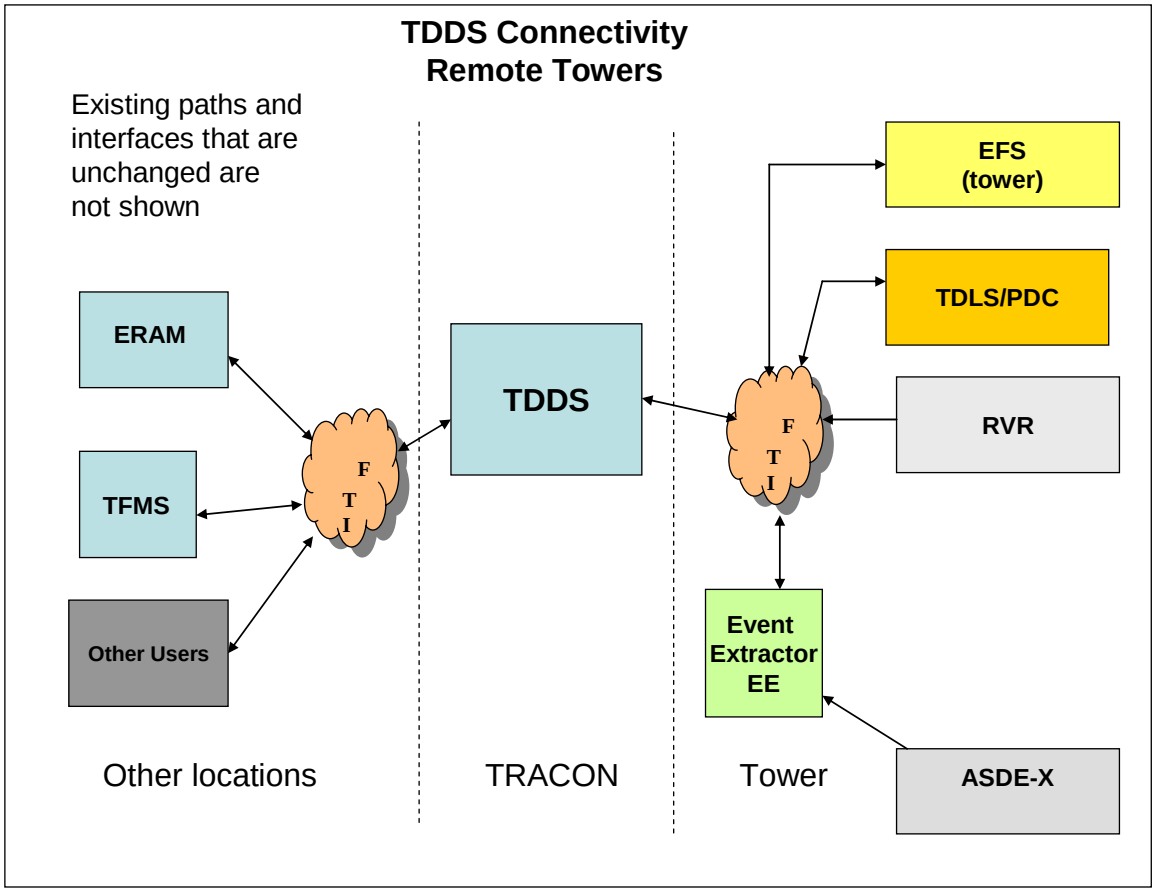

Figure 3. TDDS Connectivity Remote Towers

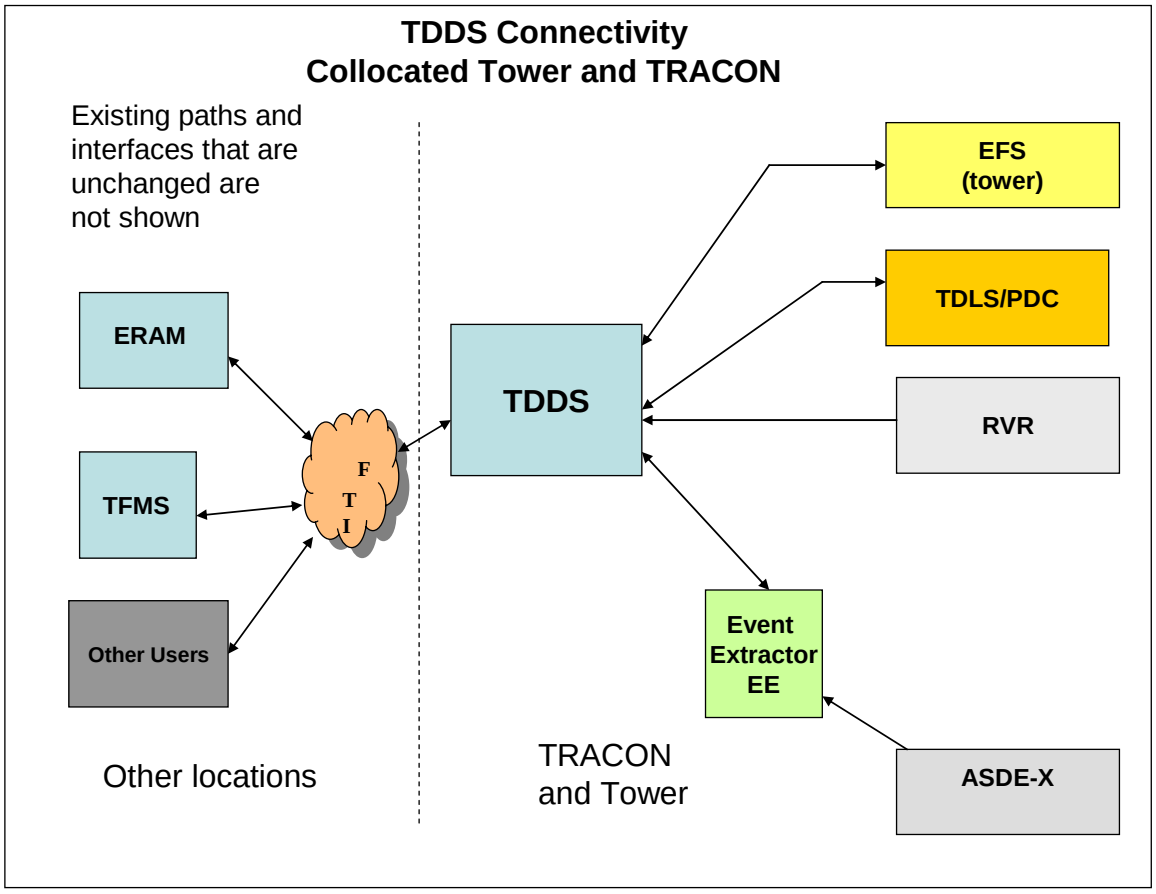

Figure 4. TDDS Connectivity Collocated Tower and TRACON

3.2.1 Assumptions

Assumptions that have been made that affect this description are as follows:

Systems that receive data via the FDIO strip printer port pre-EFS will receive that data via EFS in the Segment 1 timeframe. This includes systems that receive flight data via FDIO and systems that receive other data via FDIO such as IDS which receives GI and Wx data via FDIO. To support this capability, ERAM will provide FDIO strip data to TDDS and TDDS will provide that data to EFS.

EFS will provide to TDDS flight event/status updates equivalent to what's available from EFSTS pre-TDDS and TDDS will forward that to the EE. The EE will make the extracted event/status available for dissemination to subscribers. Other options for providing EFS

flight event/status updates to the EE were considered but were not selected. One option (Option 1) was to have EFS provide the data directly to the EE rather than passing it through the TDDS; however, this would mean an additional EFS interface. Another option (Option 2) was to connect EFS to TDDS through the EE; however, this would mean that ERAM-to-EFS flight data and EFS-to-ERAM controller messages would have to pass through the EE potentially placing higher reliability requirements on the EE. (See Figures 5-7 below.)

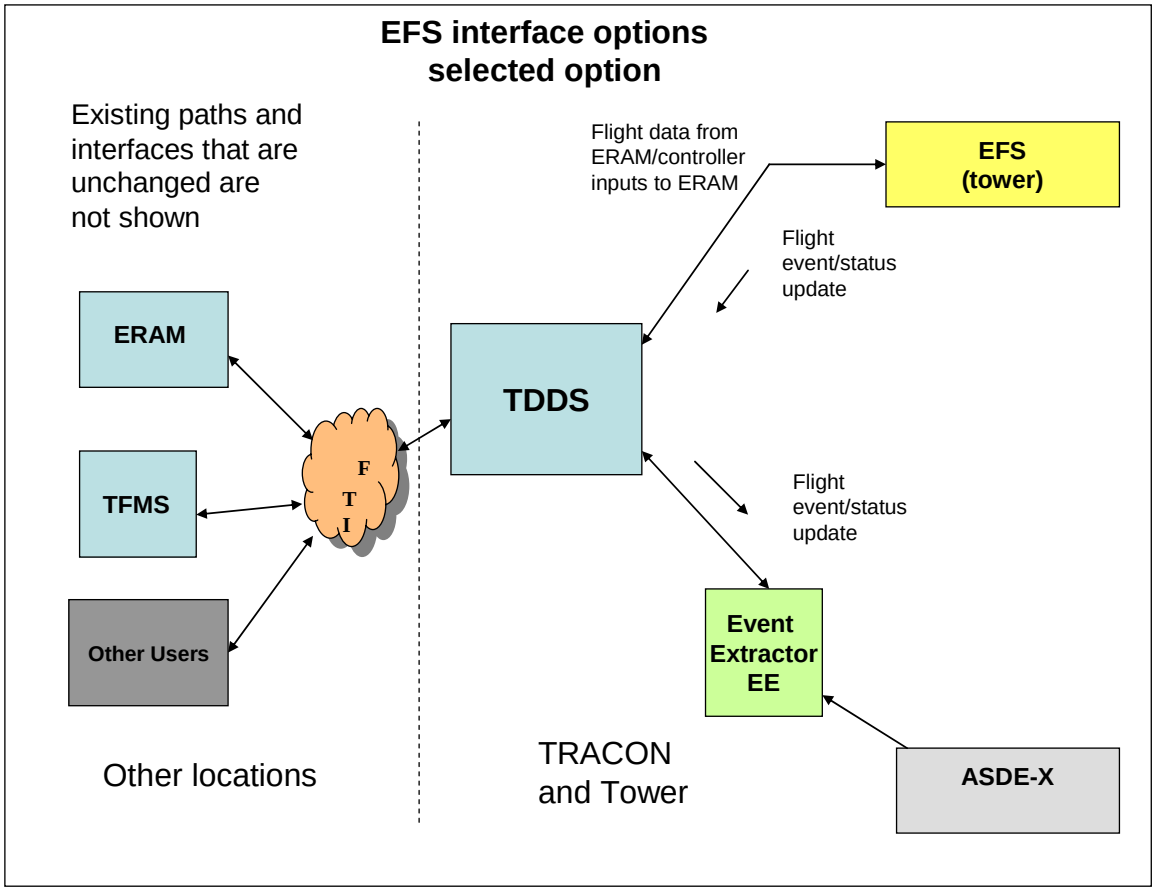

Figure 5. EFS Interface Options Selected Option

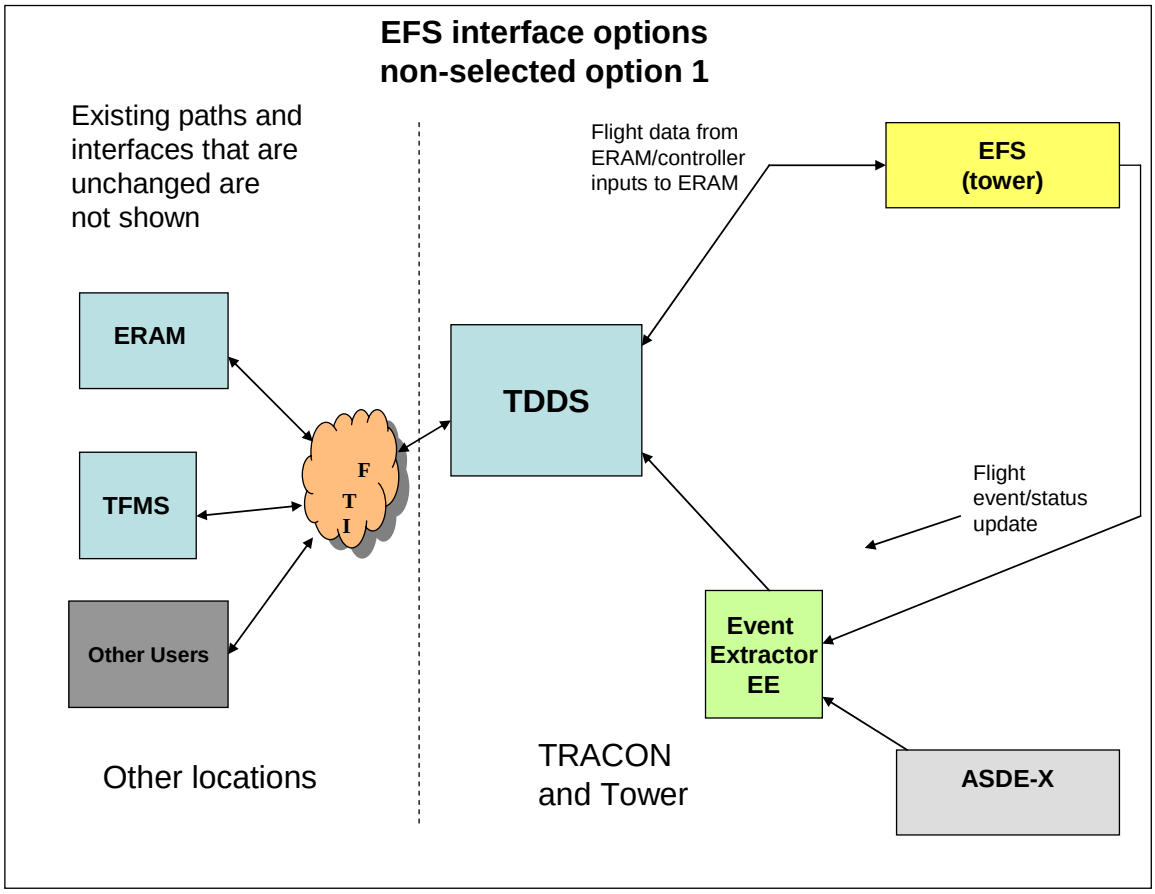

Figure 6. EFS Interface Options Non-Selected Option 1

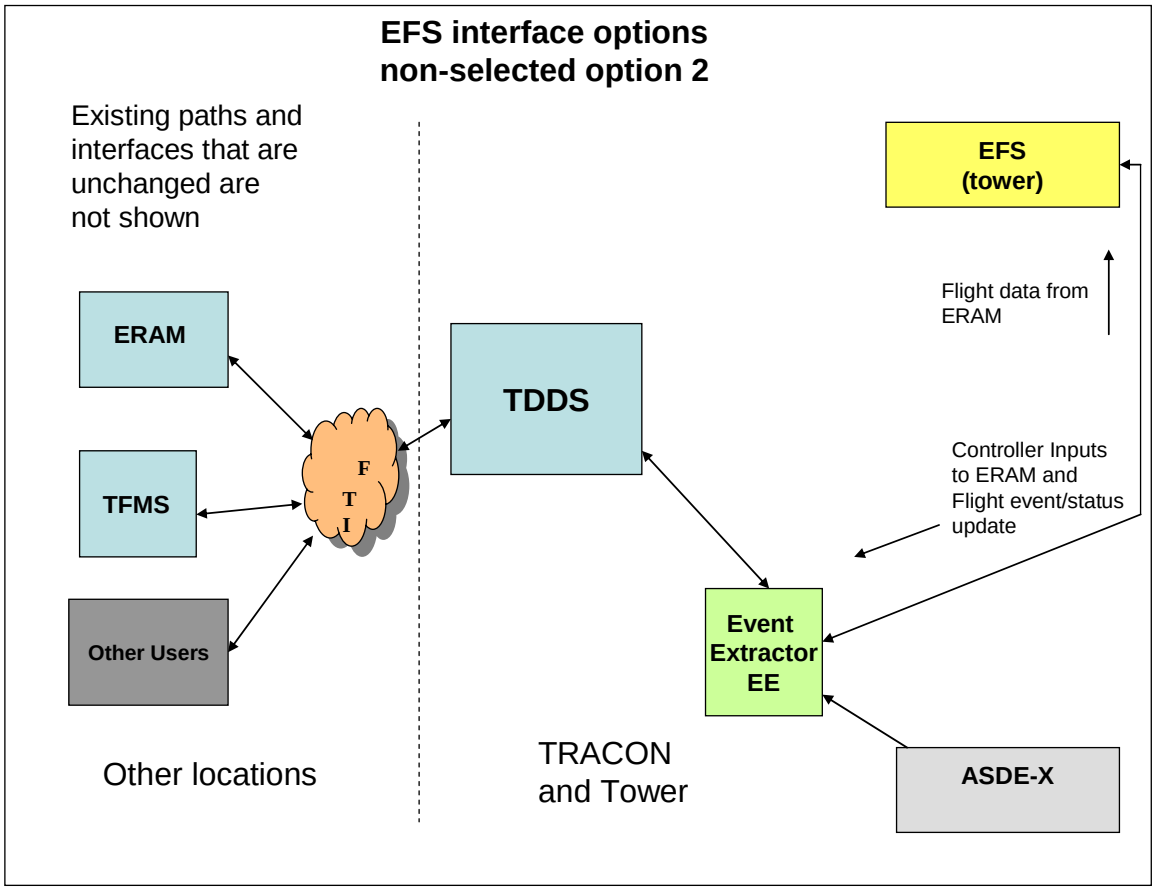

Figure 7. EFS Interface Options Non-Selected Option 2

3.3 TDDS Data Exchange

This section addresses exchange of operational data. It does not address system control data exchange such as acknowledgements, health messages, or data base reconstitution. System control exchanges will be addressed in lower levels of definition.

3.3.1 ERAM Data Exchange

The data received by TDDS from ERAM is as follows:

Table 8. Data received by TDDS from ERAM

Data	TDDS Function
For Proposed Departure Flights from TDDS airports	
Full route, Aircraft ID, Number, Special Aircraft Indicator/Aircraft Type/Special Equipment, CID, ADR/ADAR (PDR/PDAR) alphanumerics, Requested Altitude, Assigned beacon code, Revision Number, Departure Airport, Proposed Departure Time, EDCT, Destination Airport, Remarks	Forward to TDLS and EFS
For Arrival Flights to TDDS airports	
Aircraft ID, Revision number, Number, Special Aircraft Indicator/Aircraft Type/Special Equipment, Computer Identification (CID), Beacon Code, Previous Posted Fix Before Coordination Fix, Arrival Coordination Fix, Calculated Time of Arrival at Coordination Fix, Destination Point,	Forward to EFS

Data	TDDS Function
For Proposed Departure Flights from TDDS airports	
Remarks, Altitude category (IFR, VFR or OTP)	
Other Messages	
Accept/Reject/Error response to controller entered message	Forward to EFS
Response to controller request for data (flight/weather data)	Forward to EFS
General Information Message	Forward to EFS
For all Outputs that would go to a FDIO strip printer at a TDDS airport	
Text Data (strip image format) *	Forward to EFS

* this data is provided so that EFS can continue to support the legacy systems that receive Departure and Arrival Flight Strips, GI and Weather messages via the FDIO passive printer port.

The data sent by TDDS to ERAM is as follows:

Table 9. Data sent by TDDS to ERAM

Data	Source
Controller entered flight data and flight data changes (note)	EFS
Controller entered weather data	EFS
Controller entered General Information Message	EFS
Pre-departure Clearance Delivery Status	TDLS
RVR Data	RVR

Note--it is expected that this will include additional data than is currently sent to ERAM from terminal, for example, runway assignment.

3.3.2 TFMS Data Exchange

No data is by TDDS received from TFMS.

The data sent by TDDS to TFMS is as follows:

Table 10. Data sent by TDDS to TFMS

Data	Source
Extracted Flight Event/Status Data	Event Extractor
RVR Data	RVR

3.3.3 EFS Data Exchange

The data received by TDDS from EFS is as follows:

Table 11. Data received by TDDS from EFS

Data	TDDS Function
Controller entered flight data and flight data updates	Forward to ERAM
Controller entered weather data	Forward to ERAM
Controller entered General Information Message	Forward to ERAM
Controller entered flight status/event data	Forward to Event Extractor

The data sent by TDDS to EFS is as follows:

Table 12. Data sent by TDDS to EFS

Data	Source
See Table 8 for data received from ERAM and forwarded to EFS	

3.3.4 TDLS Data Exchange

The data received by TDDS from TDLS is as follows:

Table 13. Data received by TDDS from TDLS

Data	TDDS Function	Expected Subscriber(s)
Pre-departure Clearance Delivery Status	Make available to subscribers via SWIM	ERAM
Parking Gate (departures)	Make available to subscribers via SWIM	TFMS
Assigned Runway (departures)	Make available to subscribers via SWIM	ERAM and TFMS

The data sent by TDDS to TDLS is as follows:

Table 14. Data sent by TDDS to TDLS

Data (for Proposed Departures only)	Source
Full route, Aircraft ID, CID, ADR/ADAR (PDR/PDAR) alphanumerics, Requested Altitude, Assigned beacon code, Revision Number, Departure Airport, Proposed Departure Time, EDCT Destination Airport, Remarks	ERAM

3.3.5 Event Extractor Data Exchange

The data received by TDDS from the Event Extractor is as follows:

Table 15. Data received by TDDS from the Event Extractor

Data	TDDS Function	Expected Subscriber(s)
Extracted Flight Event/Status Data	Make available to subscribers via SWIM	ERAM and TFMS

The data sent by TDDS to the Event Extractor is as follows:

Table 16. Data sent by TDDS to the Event Extractor

Data	Source
Controller entered Flight Event/Status Data	EFS

3.3.6 Runway Visual Range Data Exchange

The data received by TDDS from RVR is as follows:

Table 17. Data received by TDDS from RVR

Data	TDDS Function	Expected Subscriber(s)
RVR Data	Make available to subscribers via SWIM	ERAM and TFMS

No data is sent by TDDS to RVR.

3.4 Threads

Example threads are contained in Appendix C. These illustrate some of the functionality of TDDS but are not intended to be exhaustive. Additional threads will be developed as needed to clarify TDDS functionality.

3.5 TDDS Extensibility

Some potential TDDS enhancements beyond Segment 1 have been identified:

Interface TDDS with Common Automated Radar Terminal System (CARTS)/Standard Terminal Automation Replacement System (STARS) to enhance TRACON data exchange

with ERAM, such as obtaining additional flight data from ERAM and providing controller entered flight data to ERAM. Also, disseminate TRACON originated data to other users.

Disseminate additional tower originated flight status data such as departure lineup and gate-hold data.

Provide additional flight data, such as ARTCC TMU-entered APREQ times and reroute status, from ERAM to tower.

Disseminate airport status data such as current and planned airport configuration.

Plans for TDDS beyond Segment 1 remain to be determined.

Acronyms

APREQ	Approval Request
ARTCC	Air Route Traffic Control Center
ASDE-X	Airport Surface Detection Equipment--Model X
CARTS	Common Automated Radar Terminal System
EDCT	Expected Departure Clearance Time
EE	Event Extractor
EFS	Electronic Flight Strip
EFSTS	Electronic Flight Strip Transfer System
ERAM	En Route Automated Replacement System
FDIO	Flight Data Input/Output
PDC	Pre-departure Clearance
RVR	Runway Visual Range
STARS	Standard Terminal Automation Replacement System
SWIM	System-Wide Information Management
TDDS	Terminal Data Distribution System
TDLS	Tower Data Link System
TFMS	Traffic Flow Management System
TMU	Traffic Management Unit
TRACON	Terminal Radar Control Facility

Appendix A Interfaces Existing Prior to TDDS Implementation

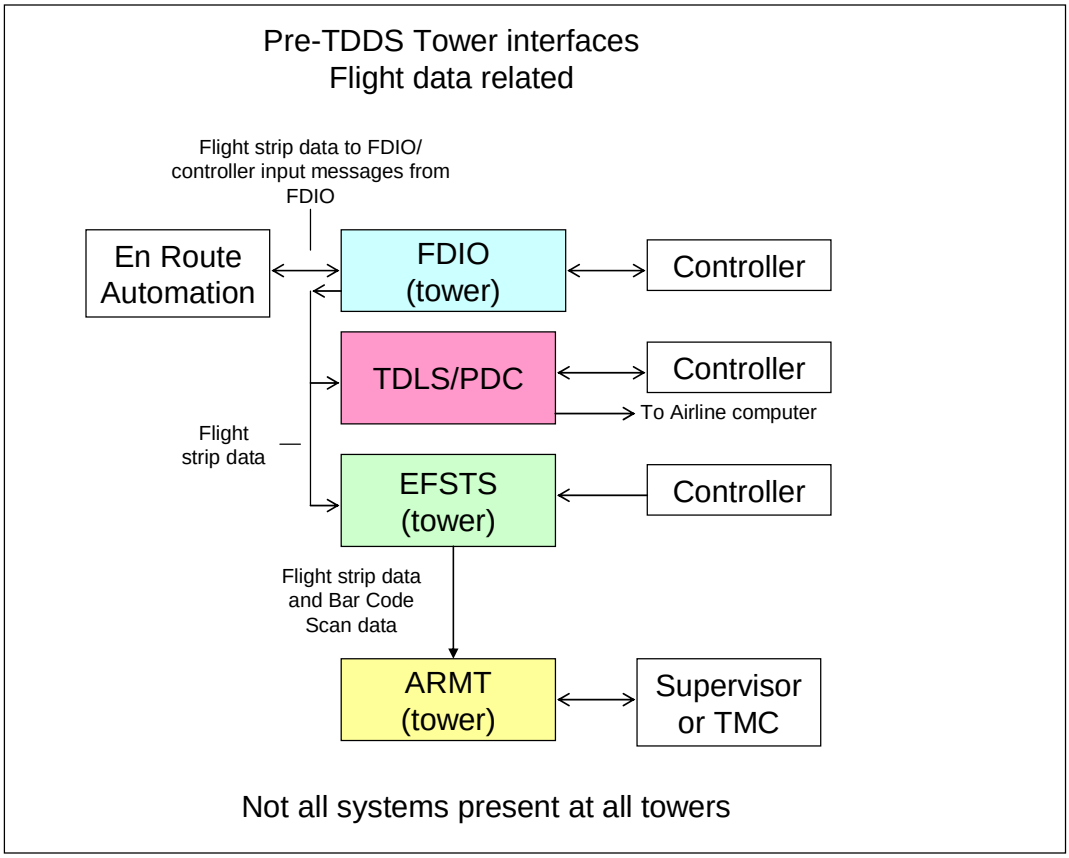

Figure 8. Pre-TDDS Tower Interfaces Flight Data Related

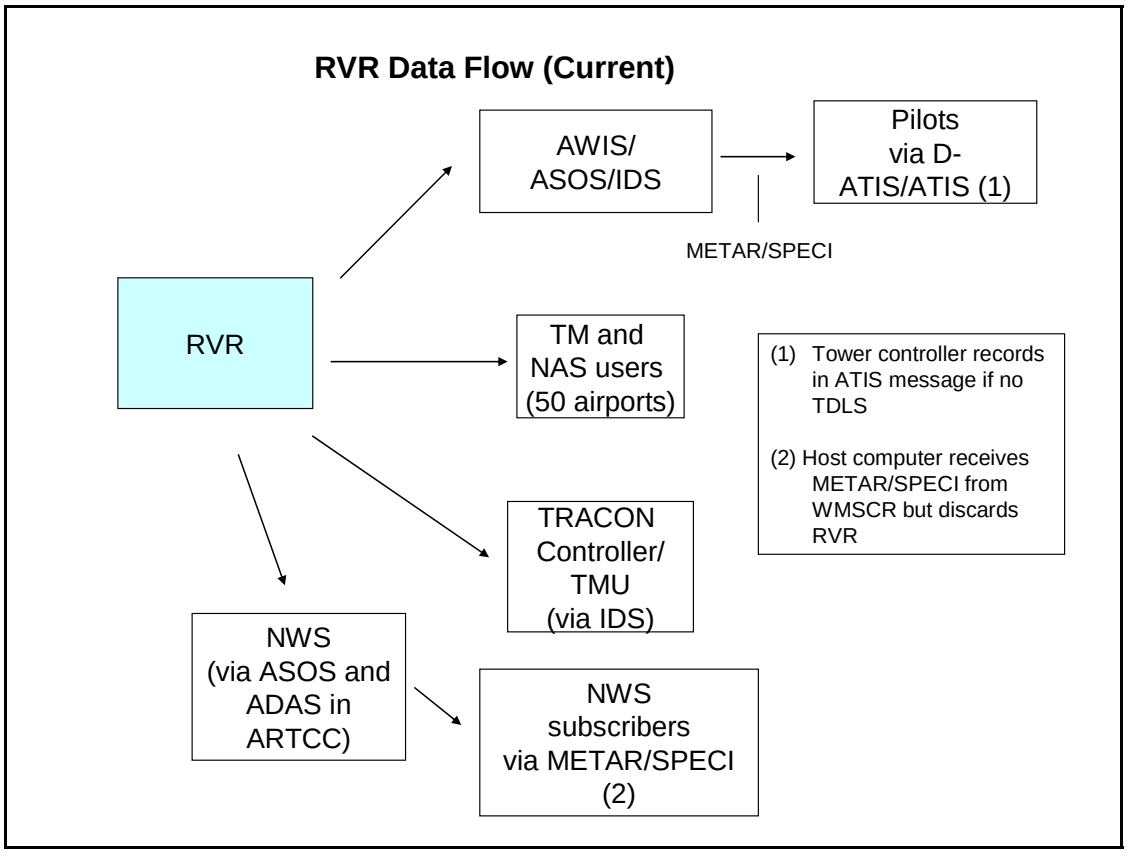

Figure 9. RVR Data Flow (Current)

Appendix B Configuration 1—Example Threads

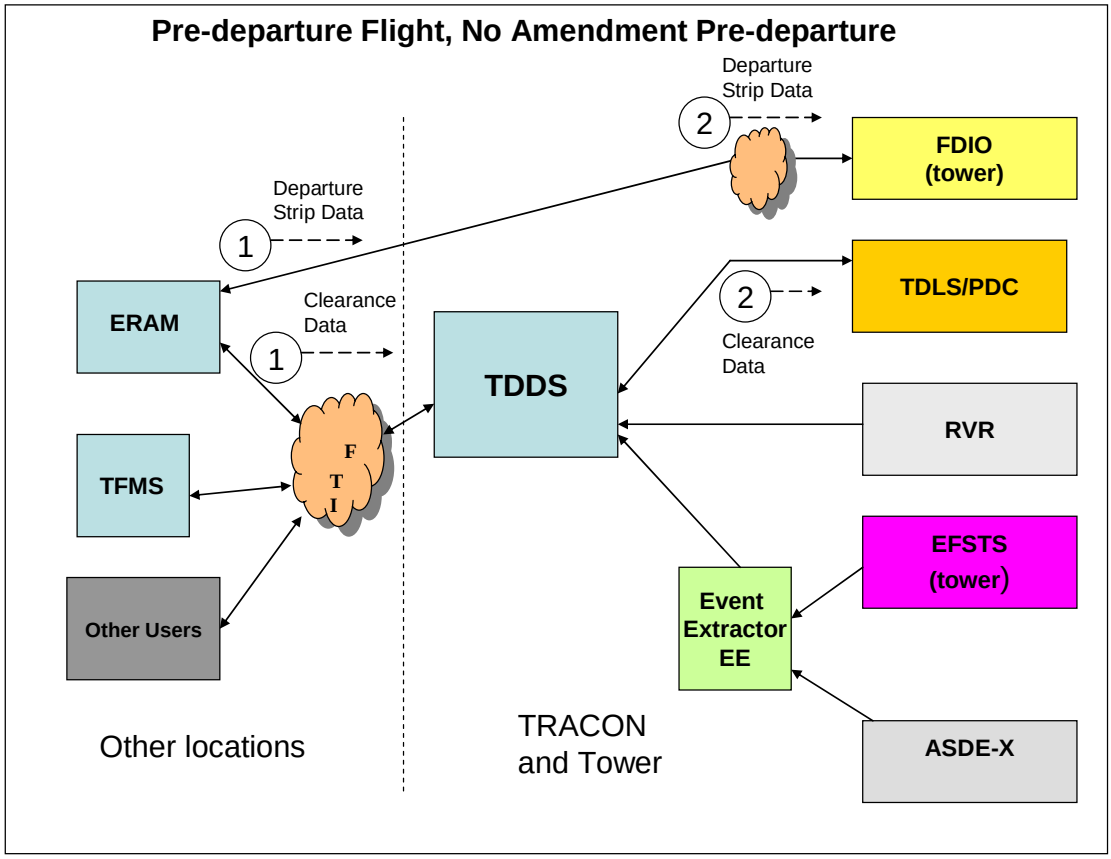

Figure 10. Example 1, Part 1 of 2

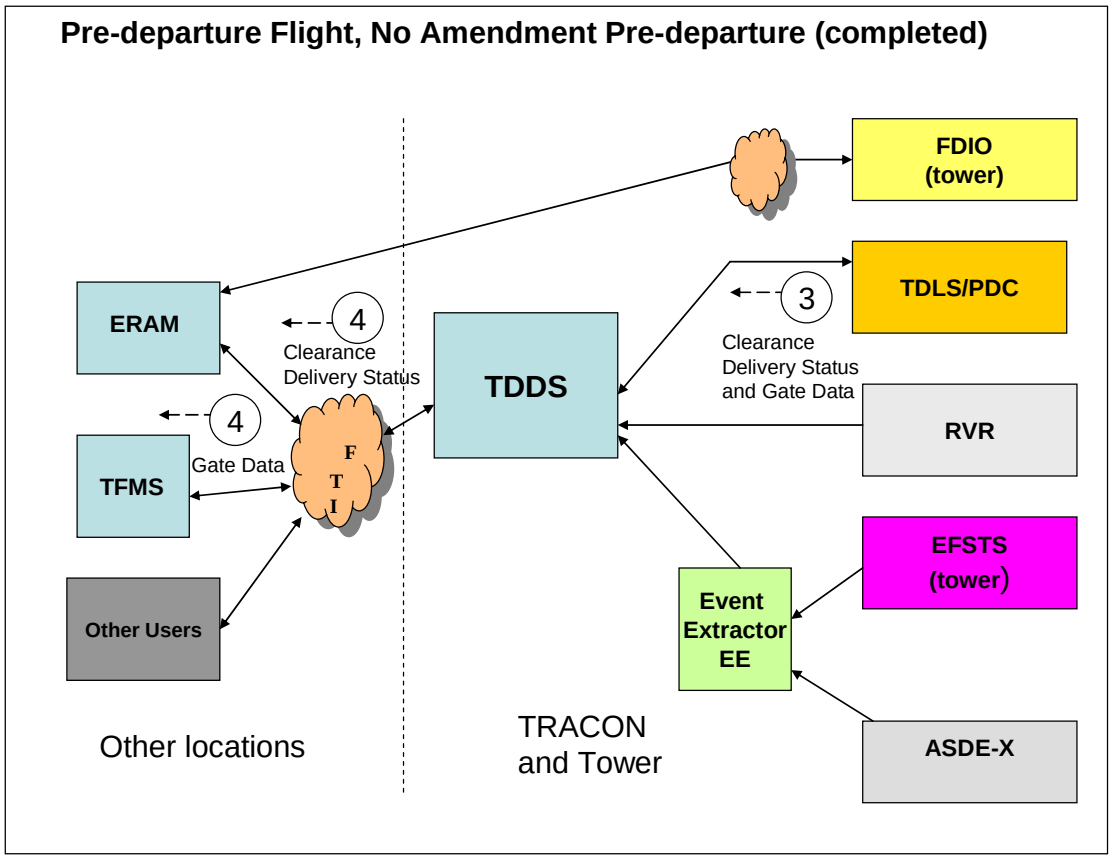

Figure 11. Example 1, Part 2 of 2

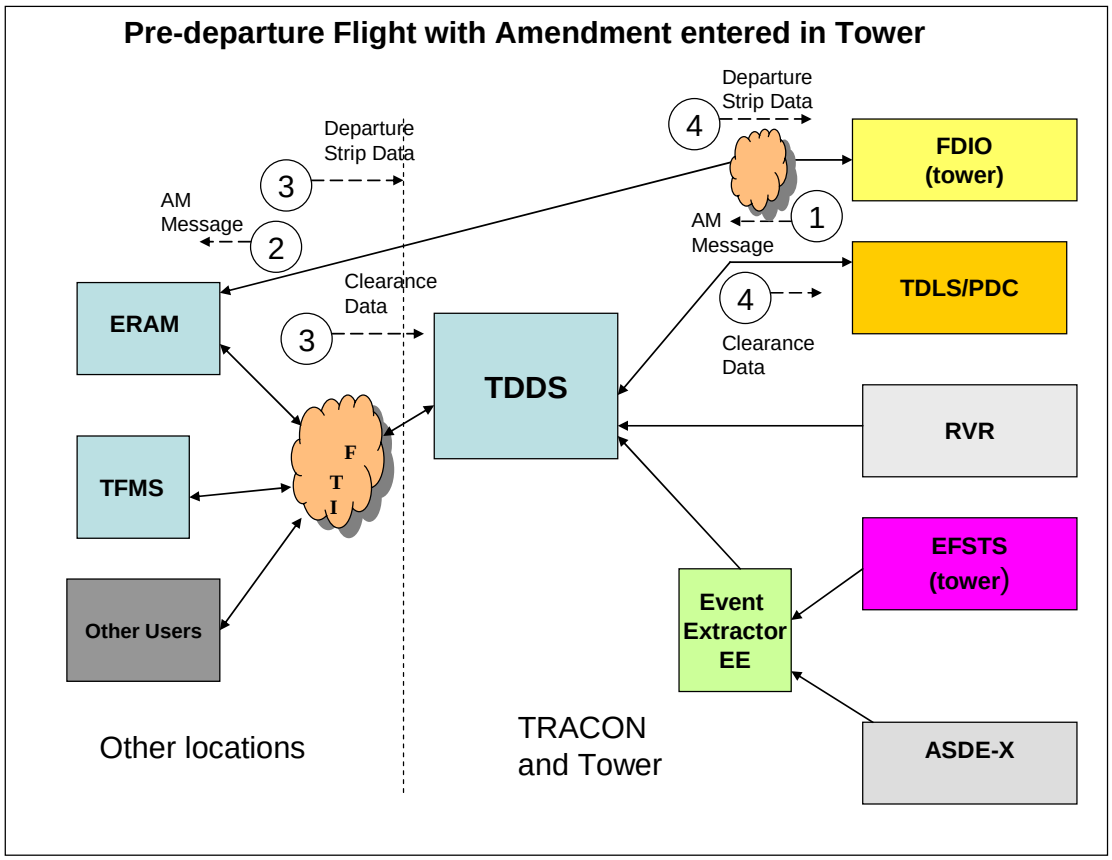

Figure 12. Example 2, Part 1 of 2

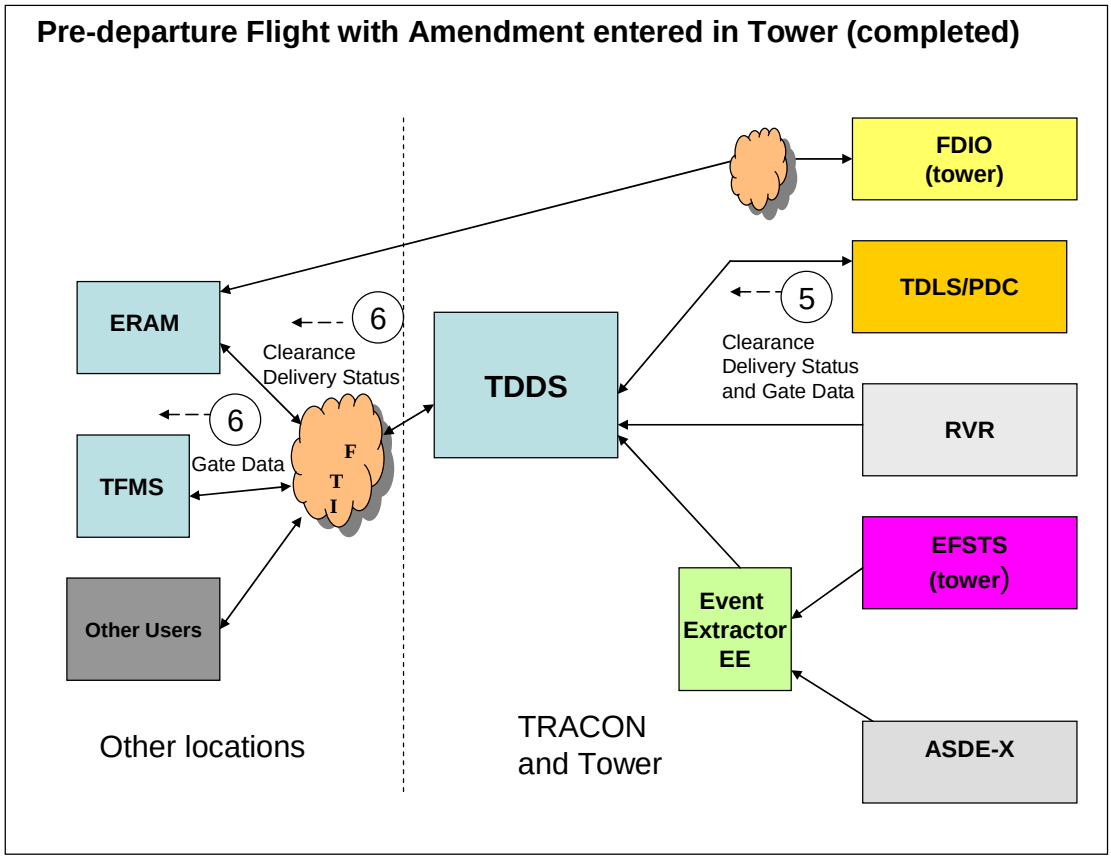

Figure 13. Example 2, Part 2 of 2

Appendix C Configuration 2—Example Threads

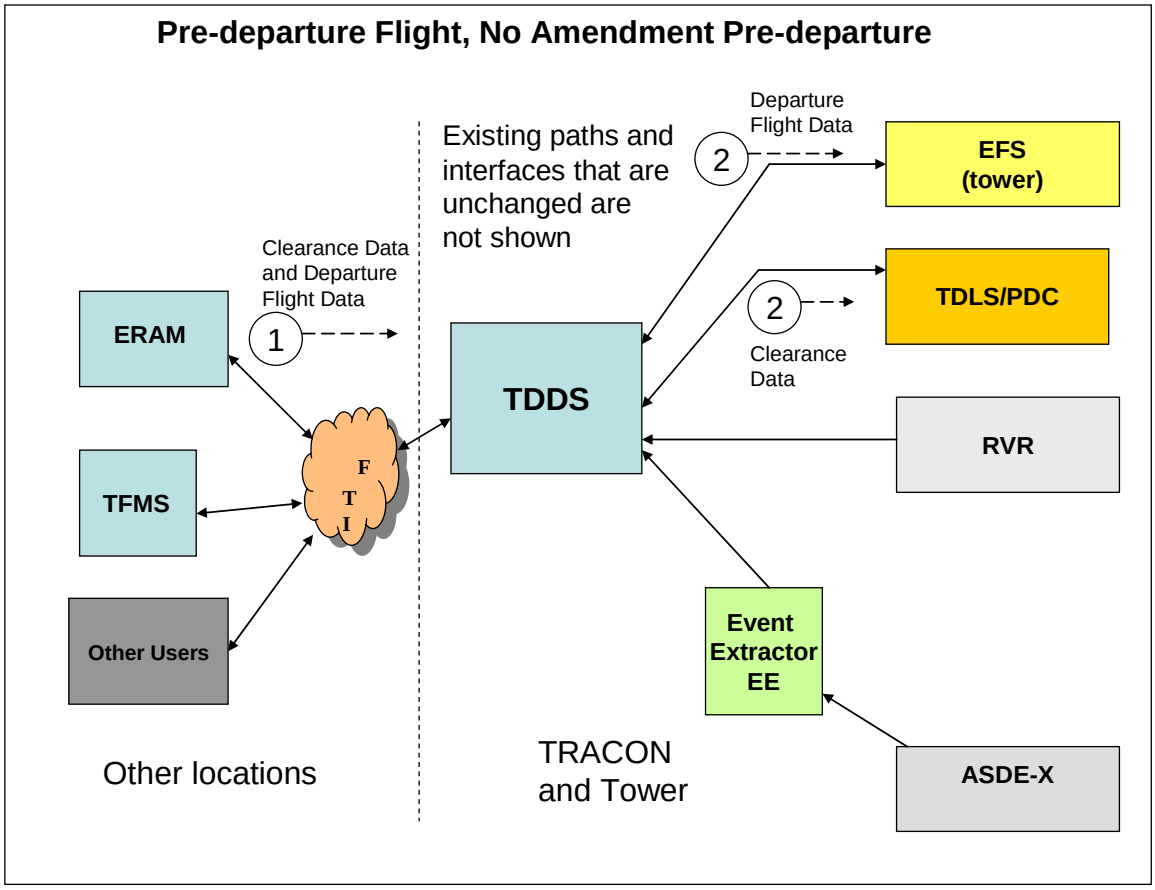

Figure 14. Example 1, Part 1 of 2

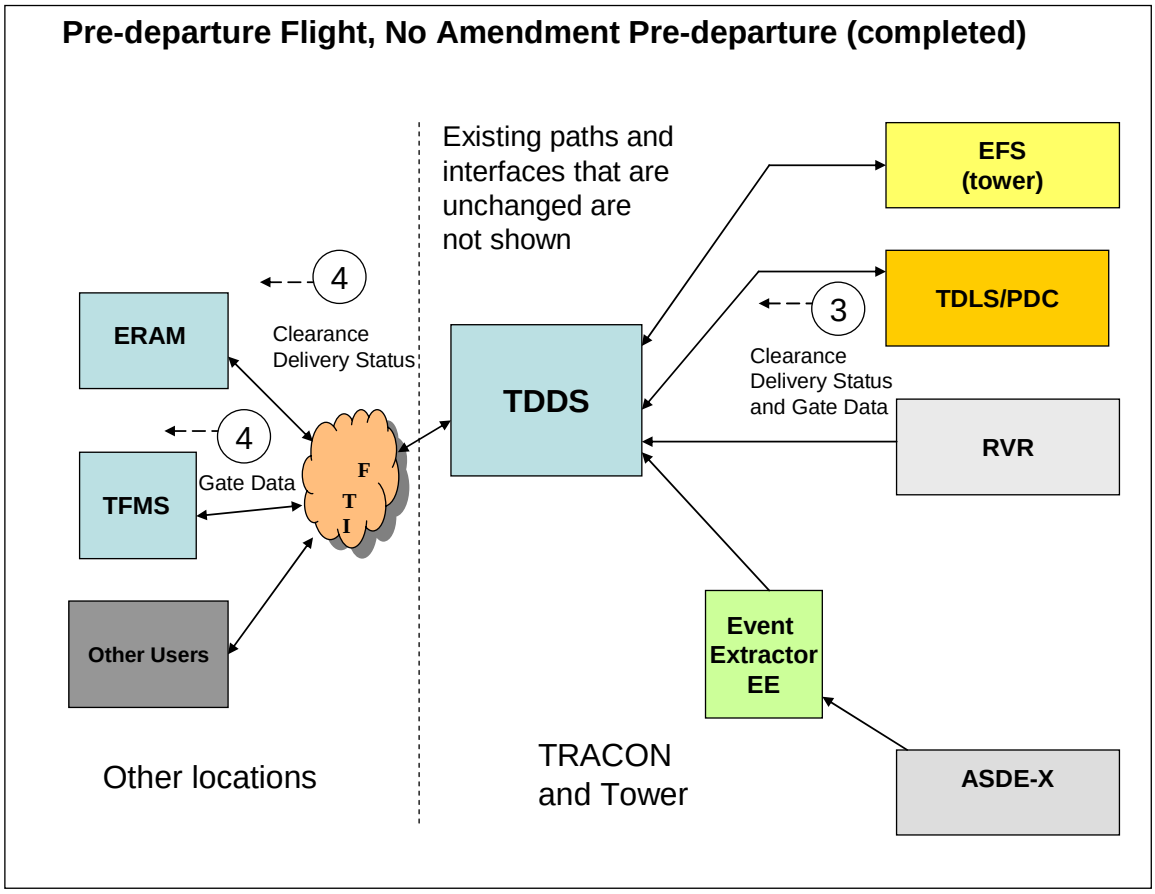

Figure 15. Example 1, Part 2 of 2

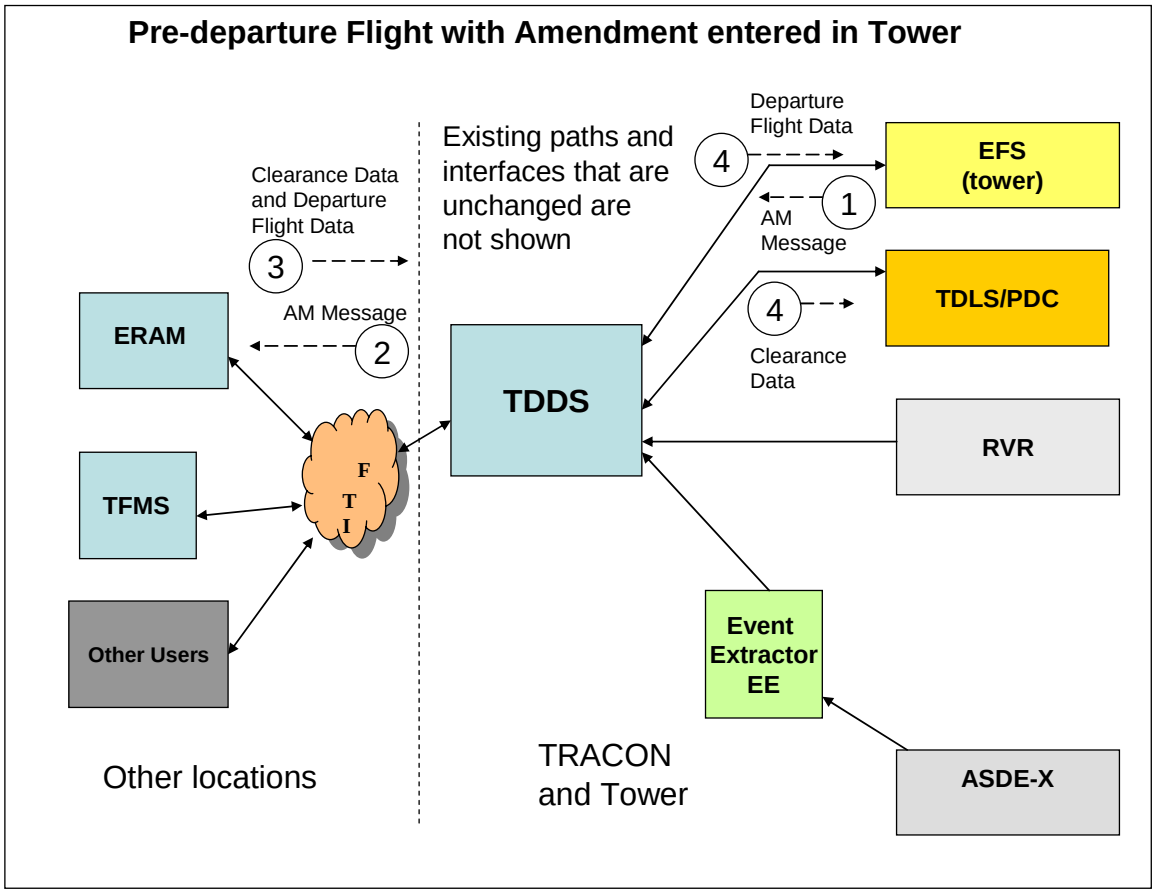

Figure 16. Example 2, Part 1 of 2

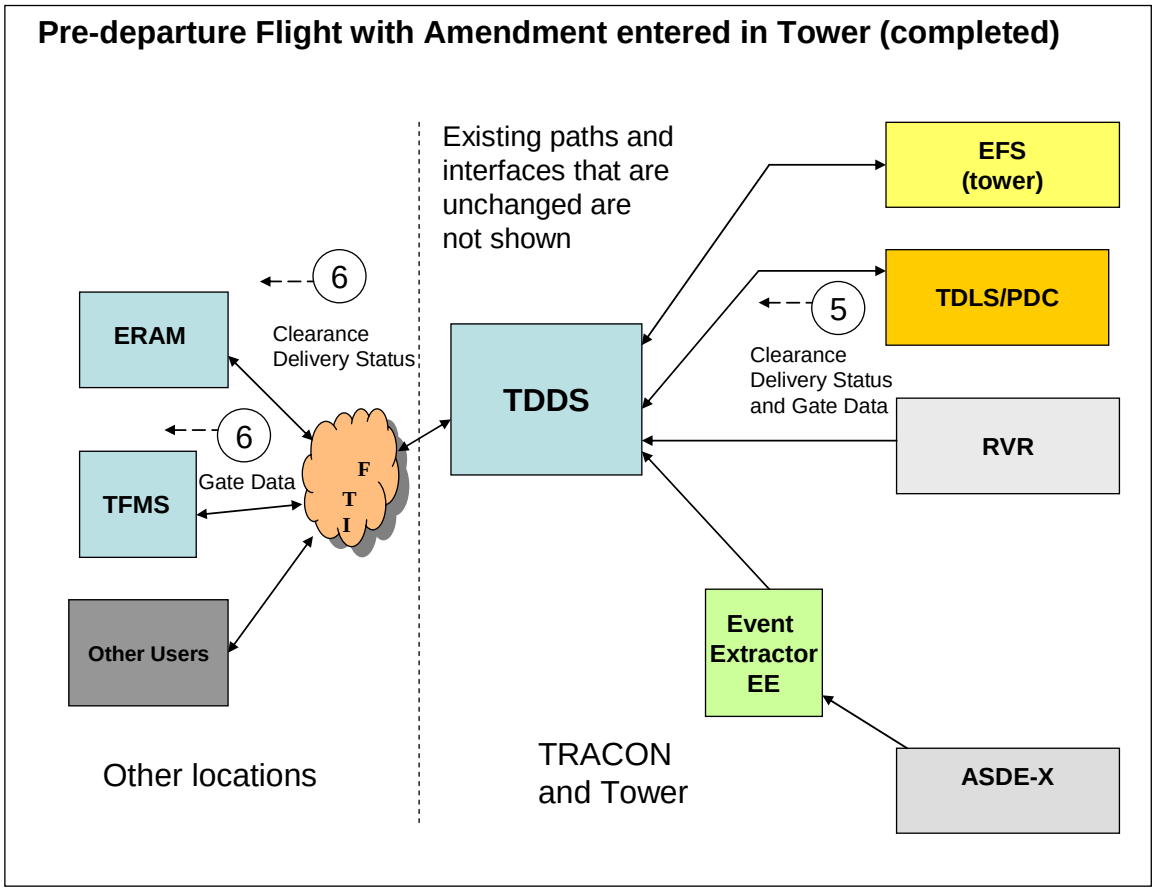

Figure 17. Example 2, Part 2 of 2