Traffic Flow Management System (TFMS) Collaborative Trajectory Options Program (CTOP) Interface Control Document (ICD) for the Traffic Flow Management-Modernization (TFM-M) Program

Final, Version 3.0

Contract Number: DTFAWA-04-C-00045

CDRL: E05

November 16, 2012

Prepared for:
U.S. Federal Aviation Administration

Prepared by:
CSC
North American Public Sector – Civil Group
15245 Shady Grove Road
Rockville, MD 20850

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TFMS CTOP ICD

APPROVAL SIGNATURE PAGE

APPROVAL SIGNATURES

PARTICIPANT	NAME	DATE

Revision History

Revision	Date	Author	Description of the Change
1.0	3/31/10	KH	Initial version.
1.1	5/3/10	KH	Disclaimer added to title page and footnotes indicating that this version is for evaluation only. “DRAFT” watermark added.
2.0	11/2/10	KH	Incorporated comments from CSC’s review of the document, changes from discussion with the Release 7 Deployment Team, and changes to keep in line with the updated System Requirements 1.7. Also changed terminology to reflect the renaming of SEVEN to CTOP.
2.1	01/21/11 01/21/11	KH ESS	Changed to be consistent with CTOP SRD v1.8. • SLOT tag is updated to include new slot format NOSLOT. • Section 3.12 is revised to discuss expansion of the legacy GDP/AFP messages and provide a list of the legacy unsolicited messages to be used by CTOP • Other general corrections are applied.
2.2	5/13/11

	10/18/11		• Revised the FOS_FCA_RESYNCH_REQ tag to FCA_RESYNCH_REQ tag. CR35037 • Revised the LIST_REQ tag to CTOP_LIST_REQ tag. CR 35038
2.3 Final	3/28/12	ESS	• Contractual Delivery • Revised the length of aircraft TYPE field to vary between 2 to 4 characters; CR35665 • Corrected Table 4-1 for the CTOP FCA Flight List Reply message under Phase 1 entry to “Not Supported”; CR35796
3.0 Final	11/16/12	ESS	• Contractual Delivery • Addresses CRs: 36217, 36218, 36326, 36361, 36588 • Miscellaneous revisions to address CACR 2 SW design • A brief description of the various CTOP advisories are presented in Section 4.4

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1. Introduction

1.1 Background

Because of bad weather or other airspace constraints, sometimes it is not possible for every flight to fly its most preferred route at its most preferred time. This means that some flights, and perhaps many flights, must be given a reroute, a delay, or perhaps both.. A new method for assigning these reroutes and delays has been developed. This new method is called the Collaborative Trajectory Options Program (CTOP). This new method is part of the overall Collaborative Airspace Constraint Resolution (CACR) enhancement and includes a new Traffic Management Initiative (TMI) and data interface.

The main elements of CTOP are that:

- The Federal Aviation Administration (FAA) decides what the airspace constraints are and how many flights can be allowed into selected areas.
- The flight operators send messages to the FAA that provide route options and state the preferences over the possible routes and delays.
- For the routes that are feasible for each flight given the constraint and the other traffic, the FAA selects for each flight the route and delay that the flight operator most prefers.
- The FAA informs the flight operator of the route and delay that it has been given.
- As conditions change, the FAA will as necessary change the route and delay that it has given to a flight and will inform the flight operator of this change.
- Also, flight operators can at any time send a message to the FAA to change its preferences.

Three points stand out as the essence of CTOP that most distinguishes it from current practices.

- The communication between the FAA and the flight operators is all electronic. There is no need for phone calls or for reading textual advisories.
- The flight operators are allowed to state their preferences in great detail, and in assigning routes these preferences are honored by the FAA insofar as the problem permits.
- Decisions on the routes and delays that are given to all of the affected flights are made by automation rather than by humans, which allows a finely tuned solution to the congestion problem that takes into account the special conditions of each flight.

In short, CTOP distributes the decision making between the FAA and the flight operators. The FAA decides what the constraints are in the system. The flight operators decide how important reroutes and delays are to them. The automation then matches up the constraints with the preferences to do the best job of assigning routes and delays, given the constraints that exist. (In this context, a constraint can be thought of as a situation that reduces capacity to the extent that not everyone is able to fly their most preferred route with no delay.)

1.2 Purpose and Scope

The purpose of this interface control document is to specify the details of the messages that the FAA's automation and a flight operator's automation exchange to perform the CTOP functionality. The heart of CTOP is the Trajectory Option Set (TOS) message, in which a flight operator lists the routes it is willing to fly and gives its preferences for the various routes and delays that it is willing to accept.

The messages described in this document include the following:

- Messages for TFMS to send CTOP airspace constraint definitions to the flight operators.
- Messages for the flight operators to send trajectory options to TFMS.
- Messages for TFMS to send CTOP Traffic Management Initiatives (TMIs) – including assigned routes and departure times – to the flight operators.
- Messages for the flight operator to substitute flights in a CTOP.
- Messages for establishing and maintaining a communications session.
- NOTE:
  - This document does not describe the interface for filing flight plans with ATC.
  - This document does not describe any data exchange for monitoring the status of the constraint other than how it impacts the specific flights belonging to the flight operator.
  - This document does not describe CTOP Advisory formats. CTOP Advisory formats are described in detail in Section 1.4 References, item 6.

This document provides the technical information required to design and develop the interfaces for the flight operator systems and TFMS. It covers the specifics of the communications protocol and message formats necessary for designing and developing software for supporting CTOP. Some description of the operational usage is also provided for context.

This document is not intended to explain how CTOP works or the advantages that it offers. A reader new to CTOP should turn to Section 1.4 References, items 1-3 for this perspective.

1.3 Terminology

The following terms might not be known to the reader or may have some intuitive ambiguity and so are defined here. These terms are used frequently throughout the document.

- Collaborative Trajectory Options Program (CTOP) – The type of TMI supported by this data exchange, as well as the concepts and algorithms that implement the TMI.
- Traffic Flow Management System (TFMS) – The FAA system that implements CTOP and that conducts the data exchange for the FAA.
- Flight Operator – An organization that operates flights in the National Airspace System (NAS) and is possibly impacted by a CTOP. Also could be an organization that acts on behalf of one or more flight operators.
- Flight Operator System (FOS) – The automation system that a flight operator uses to interact with TFMS and that conducts the CTOP data exchange for the FAA.
- Traffic Management Initiative (TMI) – A collection of flight specific constraints (for example, assigned departure times or routes) issued by the FAA to manage a traffic management problem.
- Trajectory – A combination of route text, altitude, speed, and departure time that specify the intended path of a flight through the NAS.
- Trajectory Option Set (TOS) – A set of trajectories for a given flight that is acceptable to the flight operator. A trajectory option includes data that defines the relative preferences and usability of the trajectories.

- Flow Constrained Area (FCA) – A data construct defined in TFMS for the purpose of controlling traffic (FCA). An FCA consists of a geographic boundary (line segments, polygon, or circle), a ceiling and floor altitude, a start and end time, and filtering criteria. A flight that intersects the boundary within the defined altitude range, between the start and end times, and meets the filtering criteria is part of the FCA. In the case where more than one of a CTOP's FEA/FCAs is intersected by a flight's trajectory, the first intersected FEA/FCA is considered to be the primary FEA/FCA.
- Slot – A piece of FCA capacity that can be assigned to a flight. If a traffic manager determines the capacity of an FCA is 30 flights an hour, one can think of that FCA as having 30 slots, each two minutes long, that can be given to flights wanting to traverse that FCA.

1.4 References

1. Michael Golibersuch. "Concept of Operations for Collaborative Airspace Constraint Resolution (CACR)", Version 1.3, October 26, 2011.
2. Michael Golibersuch, Donald Hurff. "Collaborative Airspace Constraint Resolution (CACR) System Requirements Guidance Document", Version 2.0a, March 23, 2012.
3. FAA. "CDM Message Protocol Specification", Final, Release 9, Version 2.5, November 19, 2012.
4. FAA. "Traffic Flow Management System-to-Airline Operation Center Network (TFMS-to-AOCNET) Interface Control Document (ICD) for the Traffic Flow Management-Modernization (TFM M) Program", Final, Release 9, November 16, 2012.
5. ICAO. "DOC 4444 ATM/501 Procedures for Air Navigation Services", 15th Edition, 2007.
6. FAA. "TFMS Advisories and General Messages Specification", Final, Release 9, Version 1.3, November 16, 2012

2. Sample CTOP Message Exchange

The CTOP message exchange allows a great deal of flexibility. Some flight operators might submit TOSes before any airspace constraint is issued by the FAA. Others might wait until constraints are published and then submit TOSes in response to the constraints. Others may not submit TOSes at all.

A good way to begin to understand the CTOP message exchange is to walk through a simple operational scenario. The following example is just one potential approach that gives a general idea of how the CTOP message exchange is used.

1. Flight operator sends TOSes to TFMS. Well before departure time, the flight operator submits TOSes for its long-haul flights. Each TOS contains several geographically diverse routes, each of which is a fairly fuel efficient route for the flight.
   a. The TOSes provide the TFMS with some options that can be exercised, if needed, at a reasonable cost to the flight operator.
   b. The flight operator specifies the relative cost of each trajectory option as the amount of delay it would take for the flight operator to want to switch to that option rather than its most preferred route.
   c. As there is no constraint or TMI, TFMS does not assign a route or a delay. In the absence of a flight plan, TFMS does use the least cost acceptable TOS option, as provided by the user, for modeling traffic demand. That is, TFMS assumes that a flight will fly the lowest cost trajectory option if no option is assigned. No data is transmitted back to the flight operator at this point.
2. TFMS sends CTOP TMI with airspace constraints and trajectory assignments to flight operator. The FAA defines one or more areas of airspace that are expected to constrain traffic flows; these airspaces are known as Flow Constrained Areas (FCAs). The traffic manager decides that the modeled demand for the FCA(s) is unacceptably high. The traffic manager uses TFMS to determine the best way to reduce the demand given the current TOS options. The solution consists of a set of assigned routes, arrival slots, and departure times for the constrained flights. If a flight does not have multiple route options, it is controlled by assigning it a departure time for its current route. That is, if there is only one route for a flight, it is delayed until there is available capacity to accept it on that route. When the TMI is implemented, TFMS sends out the FCA definition(s), the parameters of the CTOP, and the list of impacted flights with their trajectory assignments.
   a. The FCA data defines the geographic location of the constraint, the altitude limits, and the expected time range. The constraints are defined and published using the existing TFMS FCA functionality. When FCAs are used as part of a CTOP, they are specifically designated as being CTOP FCAs. The flight operator can use the constraint definition to determine possible routes for avoiding the constraints.
   b. TFMS sends a separate notification to the flight operator that a CTOP is now in effect. This includes the assigned route, departure time, and slot for each impacted flight for that flight operator. (The assigned departure time is also known as the controlled time of departure (CTD) and is issued as an EDCT. EDCT stands for Estimated Departure Clearance Time, and is the mechanism used to issue delays for GDPs and AFPs.)
   c. The flight operator system (FOS) alerts the appropriate personnel that a flight has been controlled by a CTOP.
3. Flight operator sends TOSes to TFMS. The flight operator monitors its flights and sends in new TOSes, as needed, for its flights as conditions change. The TOS updates may be in response to

assigned delays or may be due to other factors; for example, when a flight is fueled, the flight operator might update the TOS for that flight to eliminate route options that are no longer viable.

a. TFMS re-evaluates and adjusts the solution for a flight when a new TOS is received for that flight. That is, as TFMS learns of new flight operator preferences for a flight, it looks for ways to adjust the route and delay assigned to that flight so that the flight operator is given the best of the allowable assignments.

b. If TFMS changes the assigned route or departure time, it sends a new message to the flight operator notifying it of the change.

4. Flight operator sends substitutions to TFMS. The flight operator determines that the solution has a significant impact on its operation. It determines that it can cancel a flight using a conventional FX message and ripple other flights up into earlier slots to reduce the overall impact. It sends a CTOP substitution message to TFMS to swap the flights.

   a. A substitution message reassigns a set of flights to a set of slots. As part of a substitution, the flight operator can swap flights routed out of the FCA for slots going through the FCA.

   b. TFMS checks that the substitution is error-free and feasible. If errors are found, the entire message is rejected.

   c. If accepted, TFMS chooses the lowest cost trajectory options that use the new slots. It sends a message back to the flight operator confirming the substitution and sending the new trajectory assignments.

5. TFMS sends trajectory assignments to flight operator. As conditions change, the assignments may change as TFMS continually tries to give the flight operator the most preferred route and delay, given what is feasible. The changes could be automatic adjustments made by TFMS in response to changing data. The changes could be triggered by the FAA traffic manager, who sees that the constraint has changed. In either case, if the assignment changes for any of the flight operator's flights, TFMS immediately sends messages to notify the flight operator of the new assignments.

   a. TFMS sends a notification that a flight has a new assigned route, departure time, and slot.

   b. The flight operator system alerts the appropriate personnel that a flight has been modified.

6. Flight operator files flight plan/TFMS sends amendment messages. The flight operator files flight plans for the flights in the CTOP that are consistent with the CTOP-assigned trajectories. Once a flight plan is filed for a flight in a CTOP, TFMS checks whether the flight plan route conforms to the CTOP-assigned route. If the flight plan is not conformant and it is at least a configurable number of minutes (default is 45) prior to the P-time, TFMS sends an amendment message to ERAM to change the filed route to the CTOP-assigned route. TFMS sends a notification to the flight operator whenever it successfully amends a flight plan, so that the flight operator knows that a non-conformant route was filed and has been changed.)

NOTE: The step of the flight operator filing the flight plan is done through the normal flight plan filing mechanism and is outside the scope of the message exchange described in this document.

The remainder of this document describes the exact message types, formats, and protocols that support the above data exchange.

3. Overview of CTOP Data Exchange

This section describes the general approach to the CTOP data exchange and message processing as shown in figure 3-1 below.

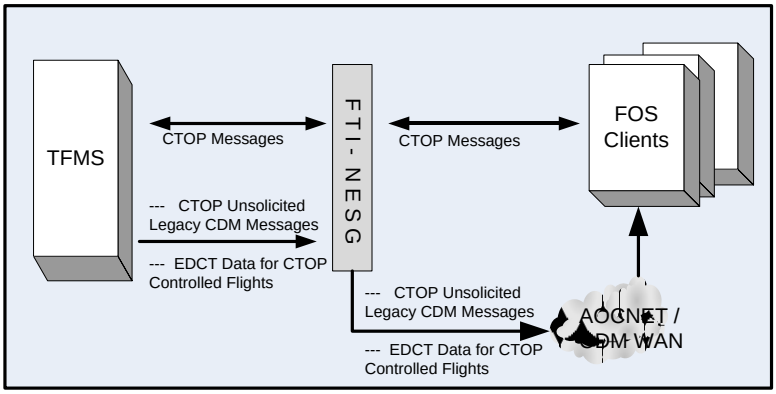

Figure 3-1 CTOP Data Exchange

3.1 Protocol Basics

The CTOP data exchange is modeled after the existing CDM data exchange for flight data updates, Ground Delay Programs (GDPs), and Airspace Flow Programs (AFPs) (see Section 1.4 References, items 3 and 4). The basic features of a CTOP session are as follows:

- The CTOP data exchange occurs through dedicated TCP/IP socket connections over private networks, either true private networks or virtual private networks (VPNs). This connection is solely for CTOP message exchange and is separate from any connections used for CDM, GDP, and AFP message exchange.
- The flight operator system (FOS) acts as the client and the TFMS acts as the server. That is, the FOS initiates the socket connection.
- TFMS provides a single connection point. TFMS provides multiple internal physical connection points transparent to the FOS. It is the responsibility of the FOS to persistently attempt to re-connect to TFMS, until a connection is made or re-established.
- The FOS determines whether to use a continuous socket connection or not (although a continuous connection is recommended for most users).
- TFMS sends dynamic update messages to an FOS only if that FOS has a connection open at the time the message is generated. If a socket is not open for that FOS, TFMS discards the message. There is no queuing and re-transmission of individual CTOP messages.
- The FOS is expected to use data requests to recover lost data as needed. The data requests allow the FOS to determine what CTOPs and FCAs are in place, what flights are impacted, and what their current trajectory assignments are.
- The FOS is responsible for ensuring that its data is in synchronization with the TFMS. If a message is sent to TFMS, the FOS should consider that message as having been accepted by the TFMS if a positive reply is received. If not, it is the responsibility of the FOS to correct and re-transmit the message.

- Only one concurrent session per FOS client is allowed. If TFMS receives a Connection Request message from a client that currently has a validated session connection, TFMS returns a Connection Rejected message to the client in response.

3.2 Session Overview

A CTOP data exchange session is expected to happen as follows:

- The flight operator system (FOS) opens a socket connection to the TFMS server and sends a Connection Request message.
- The TFMS server authorizes the connection and sends a Connection Accepted message.
- The FOS transmits messages, such as TOSes, to TFMS at any time. The TFMS, after doing error checking, responds to every message with some type of reply.
- TFMS transmits dynamic updates, such as new trajectory assignments, to the FOS at any time. Updates are sent any time there is a data change due to a CTOP for a flight operated by that flight operator. The dynamic messages are in addition to, and asynchronous with, replies to any messages or requests sent by the FOS.
- The FOS submits heartbeat requests, if desired, at any time. TFMS responds immediately with an acknowledgement. (These are useful during periods of inactivity to ensure the connection is still good.)
- The FOS terminates a session by closing the socket.
- TFMS terminates a session by transmitting a shutdown message and then closing the socket.

3.3 Data Compression

It is expected that some CTOP messages could be large, and since the messages are in XML format, they are very conducive to compression. For that reason compression has been introduced to the message formatting previously used for CDM message exchange. The CTOP Compression is performed using the open source algorithm from the zlib library.

3.4 Data Synchronization

The CTOP data exchange is designed primarily to support a continuous connection. In this mode, the FOS keeps a socket open continuously, sends updates to TFMS as they occur, and listens for updates from TFMS, which might be sent at any time. The continuous flow of updates keeps the FOS databases and TFMS databases synchronized.

The CTOP data exchange also supports a request/reply mode to support two different functions.

First, the request/reply mode can be used by an FOS to resynchronize its databases with TFMS after a startup or restart. This requires a number of requests, but all data is recoverable. For example, an FOS could request a list of all the current CTOPs and then request the full data for each CTOP. This provides a list of all the flights in the CTOP and their current trajectory assignments.

3.5 Authorization Checking

TFMS performs authorization checking for all connections and uses the connection information to determine what data is accepted over the connection and what data is sent out over the connection. This works as follows:

- TFMS verifies that the IP address of a connecting client is authorized to connect and uses the IP address to tag the connection with the name of the flight operator and to associate that operator's configuration data with the connection.
- TFMS accepts any non-flight specific CTOP messages (for example, requesting a list of the current CTOPs) from any authorized connection.
- TFMS accepts flight-specific CTOP TOS messages for any flight for which the connecting flight operator is configured to have CTOP flight data message privileges. (NOTE: This is a separate configuration setting from the authorizations for the general CDM messages. It is similar in format and function to the current settings.)
- TFMS accepts flight-specific CTOP Substitution messages for any flight for which the connecting flight operator is configured to have CTOP substitution privileges. (NOTE: This is the same configuration setting as the authorizations for the GDP/AFP substitution messages.)
- TFMS sends non-flight-specific CTOP messages (for example, the creation of a CTOP FCA) to any authorized connection.
- TFMS sends flight-specific CTOP messages (for example, a trajectory assignment) to any authorized connection that is configured to get data for those flights. (NOTE: This is a separate configuration setting from the flight operator that gets GDP and AFP updates. It is similar in format to the current settings.)
- TFMS sends unsolicited messages to any flight operators who are configured to receive GDP/AFP messages for their CTOP controlled flights via the GDP/AFP connection. These unsolicited messages are used to notify the flight operators when a flight is controlled by a CTOP, when its CTOP control times change, or when its flights are no longer CTOP controlled.

3.6 Flight Identification

It is important that the data exchange be unambiguous about which flight the data refers to. For example, if a flight operator sends a TOS to TFMS, how does one ensure that TFMS applies the TOS to the same flight record that the flight operator intended?

The FAA and flight operators have adopted a successful approach to unique flight identification for the CDM message exchange that is extended to CTOP. Each message containing flight data must include four fields used to identify the flight:

- Flight ID (a.k.a., call sign) – The flight identifier that the flight uses to operate. Example: AAL145, N237G. (a.k.a. ACID)
- Origin Airport – Example: BOS, EGGL.
- Destination Airport – Example: BOS, EGGL.
- Initial Gate Time of Departure (IGTD) – The first gate departure time submitted to TFMS for a flight. For a flight in OAG, corresponds to the OAG scheduled departure time. Described by a full date and time.

A gate time is used, if possible, for IGTD. If not, the first runway time is used. The creation of the IGTD is done as follows:

- For a flight created from OAG schedule data, the IGTD is the scheduled gate departure time.
- For a flight created from a CDM message, the IGTD is the gate departure time from the first CDM message.

- For a flight created from a flight plan, the IGTD is the P-time from the first flight plan received.
- Example: 200912221345 (December 22, 2009 at 1345Z).

The client has primary responsibility for maintaining these fields, as it is the client that creates the flight and controls the itinerary. The client is required to update these fields as needed. For example, if a flight is going to operate using a different flight ID, the client system must update the TFMS to change the flight ID for the flight. Similarly, if a destination changes, the client must update TFMS. Departure time updates do NOT require a change to the IGTD.

The maintenance of these identifying fields must be done through the normal CDM messaging. It is expected that the values sent by the flight operator on the CTOP messages are consistent with the values from the latest CDM messages. For example, if a flight is going to operate using a different call sign, the flight operator must send a CDM Flight Modify message changing the ACID field. Before that FM, CTOP messages would be expected to use the original ACID.

3.7 TOS Data Synchronization

TOSes may be sent from a FOS to TFMS at any time. At the same time, trajectory assignment updates may be sent from TFMS to a FOS at any time. It is important for the FOS to know whether an update received from TFMS is based on the current TOS or not. Given that a flight can be uniquely identified, it is a relatively straightforward matter to keep the TOSes synchronized. When the FOS submits a TOS for a flight, it provides a sequence number for that TOS. For example, the first TOS sent for a flight could be given a sequence number of 1. When the FOS sends a new TOS for that flight, it would be given sequence number 2. (TFMS simply stores and sends back the sequence number, so the FOS could use a different numbering scheme if desired.) TFMS stores the TOS sequence number for a flight whenever it updates the TOS. When TFMS generates any message that is based on the TOS, such as a trajectory assignment, it echoes back the current TOS sequence number for the flight. The FOS can then validate that it is synchronized with TFMS for that flight.

TOS synchronization is especially important when the FOS submits a TOS update for a flight that is already in a CTOP. When the FOS submits a new TOS, it expects a trajectory update based on that TOS. However, TFMS could happen to be sending a trajectory update for that flight at that time based on the old TOS. The TOS sequence number allows the FOS to determine with certainty when it has received a trajectory assignment based on the new TOS.

3.8 Slot Types and Names

TFMS assigns a slot that corresponds to the time at which a flight can enter or cross an FCA in the CTOP program. The slot is identified by the FCA name and the entry time. A letter suffix is added to the entry time to make the name unique (for example, FCA001.200912231345A). This entry slot corresponds notionally to the slots used in GDPs and AFPs.

A flight will be assigned at most one slot in a CTOP program, even if its assigned trajectory intersects more than one FCA in the CTOP. In the case where more than one FCA is intersected, the first FCA in the CTOP that the assigned trajectory intersects is considered to be the primary FCA, and the flight is assigned a slot only for that FCA. The expectation is that CTOP programs will be constructed such that it will rarely be the case that a trajectory would intersect more than one FCA in a CTOP. While CTOP programs can consist of several FCAs, the general thinking is that CTOPs will involve “side by side” or altitude stratified FCAs, where different trajectory options could intersect different FCAs, but no one trajectory option would intersect several FCAs in the program.

For the flights whose assigned trajectory avoids all the CTOP FCA(s), the slot name indicates “NOSLOT”.

3.9 Trajectory Assignment Feedback

When TFMS assigns a trajectory to a flight, using the CTOP algorithm, it may be difficult for the flight operator to understand why a particular option was selected, how the TOS data affected that selection, and what the options are for adjusting the assignments using substitutions. To help with this understanding, TFMS provides feedback as part of a trajectory assignment. TFMS not only identifies which trajectory option has been assigned, but also provides information about each trajectory option, why it was or was not selected, and how it could be used in substitutions.

TFMS accomplishes this by including the following information for each trajectory option when a trajectory assignment is made:

- Is this option the assigned route? [This is indicated by a Boolean (TRUE/FALSE) variable named ASSIGNED.]
- What was the adjusted cost for this trajectory option? The CTOP algorithm computes the delay for each option, adds it to the relative trajectory cost provided by the user, and selects the option with the lowest adjusted cost as the assigned route. Seeing the adjusted cost for each TOS option helps the flight operator understand how their TOS affected the solution. [This is provided in the ADJUSTED_COST field.]
- What FCAs in the CTOP are intersected by this trajectory? This helps the flight operator know what the options are for substituting this flight into another flight's slot. For example, if the flight operator owns a slot in FCA001, any flight that has a trajectory option that intersects FCA001 is a potential candidate for using that slot. [This is provided in an FCA_LIST containing FCA_NAME and FCA_ID fields.]
- What is the earliest time that the flight would arrive at each intersected FCA? This is computed based on the route, speed, altitude, aircraft type, and the departure constraints provided in the TOS. These times also help the flight operator know what the substitution options are. For example, if the flight operator owns a slot in FCA001 and a flight that could intersect FCA001, this tells the operator whether the flight could get there early enough to use the slot. [This is provided in the FCA_EARLIEST_ENTRY field.].

3.10 Route, Altitude, and Speed Format

Beginning with Release 5, TFMS has the ability to accept routes specified in ICAO format (ICAO field 15c, Section 1.4 References, item 5). However, TFMS only processes the ICAO format in a limited sense. TFMS accepts the route string with altitude and speed changes in the route text, but strips them out. TFMS models routes as if flying the initial cruising speed and altitude for the entire length of the route, until start of descent. TFMS uses the "stripped route" as the assigned route and for sending to ERAM as part of route amendment messages.

TFMS also accept altitude and speed in the ICAO format, but only uses a subset of the allowed forms. . Altitude must be provided in format for ICAO field 15b (Section 1.4 References, item 5) but only using the "F" prefix for flight level. Speed must be provided in format for ICAO field 15a (Section 1.4 References, item 5) but only using the "N" prefix for knots.

3.11 Conformance Status

A critical part of the CTOP process is that the flight operator files a flight plan that is conformant with the CTOP assigned route when a flight is part of a CTOP. A question arises from this: How does a flight operator know whether the flight plan they file is conformant or not? There is no explicit conformance indicator sent from TFMS to a FOS when a flight plan is filed. However, TFMS has a requirement to

amend the route whenever a flight plan is filed that is not conformant, as long as it is before the flight strip (and Pre-Departure Clearance (PDC)) has printed. TFMS also has a requirement to notify the flight operator whenever one of these amendments is successfully sent to ERAM; this is done by sending a CTOP Flight Plan Amendment message. As a consequence, the flight operator can monitor conformance status, at least during the time period where the flight operator can amend the flight plan, by monitoring the CTOP Flight Plan Amendment messages.

3.12 CTOP Compatibility Mode

The FAA recognizes that some flight operators, at least initially, will not implement the new CTOP message interface. These operators do not submit TOSes, but their flights are still subject to CTOP programs. For these flights, TFMS automatically assigns the flight plan route as the assigned route, and assigns the amount of delay needed to not overload the FCA(s). If the flight operator amends the flight plan route, TFMS adjusts the delay as needed. For example, if a flight is in a CTOP, and then the flight plan is amended to avoid all the FCAs for that CTOP, the delay is removed for that flight. As a result, a flight operator that is not participating in the CTOP message exchange can still manage its flights in the CTOP – as long as it knows what delays it has been assigned.

Extension of the GDP/AFP Message Set. In order to promote the use of CTOP and ease the transition of flight operators into the new message exchange, TFMS notifies flight operators of CTOP-generated delays using the notification mechanisms available for GDPs and AFPs; namely, the EDCT Lookup web page available on the FAA web site fly.faa.gov, and the automated CDM messages used to transmit control times for GDPs and AFPs, as documented in Section 1.4 References, items 3 & 4. The exact format and usage of the GDP/AFP messages is provided in Section 1.4 References, item 4.

CTOP-Controlled Flights in the ADL. An ADL may include many CTOP-controlled flights in its flight list(s). It uses the same data item values and formatting for CTOP-controlled flights as described above for the GDP/AFP message set. Additionally, TFMS maintains the ADL's format for CTL_ELEMENT and sets it as follows for CTOP-controlled flights.

- CTL_ELEMENT – Location Identifier of the airport (for GDPs) or FCA (for AFPs or CTOPs) at which the flight's time is currently being controlled.
- A newly specified data element CTL_PRGM has been added to the ADL for the CTOP controlled flights. . The CTL_PRGM is set equal to a flight's controlling CTOP_SHORT_NAME. This is only for CTOP. For GDPs & GSs, it is set to the airport name. For AFPs, it is set to the AFP's FCA name. For CTOPs, it is set to the unique 6 character CTOP_SHORT_NAME.

4. Message Types

Following is a general description of all the message types used in the CTOP data exchange. Each message is associated with a numerical message type, shown in square brackets. (The numerical message types are used later in the message format and are included here for reference). The detailed message formats are described in Section 5.

4.1 CTOP Session Messages

The CTOP Session messages are used to start, maintain, and close a CTOP message exchange session. These messages are important only to the automation. These correspond exactly to the session message used in the CDM message and GDP/AFP data exchanges.

The CTOP Session messages are summarized as follows:

- Connection Request [1] – Sent from the FOS to TFMS after the socket is first opened to ensure that the FOS is authorized to connect and send data. This must be the first message after the socket connection is made. It should only be sent at this time.
- Connection Accepted [2] – Sent from TFMS to the FOS in response to a Connect Request if the connection is authorized.
- Connection Rejected [3] – Sent from TFMS to the FOS in response to a Connect Request if the connection is not authorized. TFMS closes the connection after writing this message.
- Heartbeat Request [10] – Sent from the FOS to TFMS to establish that the connection to TFMS is still working. This can be useful for keeping the connection from being dropped during long periods of inactivity.
- Heartbeat Reply [11] – Sent from TFMS to the FOS in response to a Heartbeat Request.
- Shutdown [5] – Sent from TFMS to the FOS in the event that TFMS shuts down the connection. The FOS should begin trying to re-connect to TFMS using the single TFMS IP address when it gets this message.

The detailed formats for the CTOP session messages are provided in section 5.3.1.

4.2 CTOP FCA Messages

The CTOP FCA messages are used to keep the FOS fully informed as to what CTOP FCAs are currently defined in the system. (The term “CTOP FCA” is used to refer to an FCA that is included in a proposed or active CTOP and has therefore become CTOP-eligible.) TFMS sends messages to create a CTOP FCA whenever a traffic manager issues either a proposed or actual CTOP based on that FCA. TFMS then sends updates to a CTOP FCA whenever a traffic manager edits, or deletes a CTOP FCA. The CTOP FCA data does not automatically include the list of flights impacted by the FCA. However, the FOS can request an FCA flight list, if desired.

It is important that a CTOP FCA be uniquely identified. Since TFMS creates and issues the CTOP FCAs, TFMS is responsible for tagging each FCA with a unique ID. The FCA ID is an encoded identifier suitable for use by the automation but not for display to the user (an FCA name is provided for user display). An FOS should assume that any CTOP FCA message with a new FCA ID is the creation of a new CTOP FCA. A message that contains a previously issued FCA ID is an update to that FCA, even if the FCA name changes. For example, an FCA can be created with an FCA_ID of

"fca.cdmb.lxpc103.20040713161706" and an FCA_NAME of "FCA007". A later message might have the same FCA_ID ("fca.cdmb.lxpc103.20040713161706") but a different FCA_NAME ("FCADC1"). This second message should be applied as an update to the data from the first message. Every message sent by TFMS for an FCA contains the FCA ID.

It is also important that a FOS know whether it has the latest definition for an FCA. Whenever an FCA is updated, TFMS records the time at which the update was stored (LASTUPDATE). When a CTOP is issued based on an FCA, TFMS sends not only the FCA_ID and FCA_NAME, but also the LASTUPDATE time. A FOS can then verify that it has the latest definition for that FCA. If not, the FOS can request an update for that FCA.

The FCA data structure in TFMS allows the definition of an FCA domain and type. The domain defines what facilities can view the FCA. The type defines the FCA for issuing a constraint (FCA). CTOP FCAs always have a type of "FCA".

A CTOP FCA can lose its CTOP-eligible status in two ways. If an FCA is deleted from the proposed or active CTOP that was causing the FCA to be CTOP-eligible, when the revised proposed or active CTOP is issued, TFMS sends a CTOP FCA Delete message. If an active CTOP that was causing the FCA to be CTOP-eligible is cancelled, the FCA is no longer CTOP-eligible and TFMS sends a CTOP FCA Delete message. The client should not expect any further updates for an FCA after its status has been changed to not-CTOP-eligible, unless that status is changed back to CTOP-eligible.

If the FOS restarts or is started up cold, it can synchronize its data by requesting a list of all the current FCAs, and then requesting a full definition for each of the current FCAs (re-synch). If desired the FOS can also request the FCA flight list.

The CTOP FCA messages are summarized as follows:

- CTOP FCA [300] – Sent from TFMS to the FOS when an FCA becomes CTOP-eligible or a CTOP-eligible FCA is updated. The FCA is uniquely identified so that the FOS can easily and reliably determine whether the FCA is new or an update to an existing FCA.
- CTOP FCA List Request [301] – Sent from the FOS to TFMS to request a list of all FCAs currently included in any Proposed or Active CTOP TMI, along with when they were last updated. This can be used by the FOS to verify whether its data is current and as part of a data recovery processes after a crash or a cold start.
- CTOP FCA List Reply [302] – Sent from TFMS to the FOS in response a CTOP FCA List Request.
- CTOP FCA Re-synch Request [303] – Sent from the FOS to TFMS to request the full definition data for a FCA currently included in an Active or Proposed CTOP TMI. This can be used by the FOS to recover the current FCA definition after a crash or a cold start.
- CTOP FCA Re-synch Reply [304] – Sent from TFMS to the FOS in response a CTOP FCA Request. The content of this reply has the same format as the CTOP FCA message.
- CTOP FCA Flight List Request [305] – Sent from the FOS to TFMS to request the list of flight operator's flights affected by the FCA currently included in an Active or Proposed CTOP TMI. This can be used by the FOS to determine which of its flights might be involved in a CTOP.
- CTOP FCA Flight List Reply [306] – Sent from TFMS to the FOS in response a CTOP FCA Flight List Request. The list includes all flights that have at least one TOS option that would intersect the FCA.

- CTOP FCA Request Error [307] – Sent from TFMS to the FOS when data is requested for an FCA that does not exist or is not currently included in an active or proposed CTOP. Could be returned for either a CTOP FCA Re-synch Request or a CTOP FCA Flight List Request.
- CTOP FCA Delete [308] – Sent from TFMS to the NAS User when a previously CTOP-eligible FCA is losses its CTOP-eligibility (e.g., when an active CTOP containing the FCA is canceled or active or proposed CTOP is re-issued after the FCA has been removed from the CTOP). The FOS should not expect any more data for this CTOP FCA.

The detailed formats for the CTOP FCA messages are provided in section 5.

4.3 CTOP Trajectory Messages

The CTOP Trajectory messages are used by the Flight Operator System (FOS) to communicate trajectory option sets (TOSes) to TFMS. The TOS provides the TFMS with user-preferred, ranked route options for a flight. TOSes may be generated automatically by the FOS or could be triggered by manual actions taken by the flight operator; that is for the flight operator to determine. The TOS data is used by TFMS in two ways:

- Demand Modeling – If there is no CTOP in place for a flight and no flight plan has yet been filed, TFMS uses the TOS to determine a route of flight for predicting traffic demands. TFMS uses the least cost acceptable trajectory option as the predicted route. The term “acceptable” means that the TOS option meets any timing constraints that the user has specified in the TOS. If there are multiple options tied for the least cost, TFMS uses the option with the lowest trajectory index.
- CTOP TMIs – If there is an airspace constraint, TFMS uses the TOS trajectory options to determine a combination of delays and route assignments that resolve the constraint.

A CTOP TOS message provides data to TFMS for a specific flight. The existing CDM Flight Create (FC), Flight Modify (FM), and Flight Cancel (FX) messages also provide data to TFMS. It is expected that TFMS will receive a mix of TOSes and CDM messages for any given flights. This raises questions as to how these messages interact. Following is a summary of how this interaction is handled:

- Flights should first be created with a CDM FC or FM message before a TOS is sent. It is possible that a flight already exists in TFMS from OAG schedule data or from a flight plan, but the best way to ensure the acceptance of a TOS message is to first send an FC or FM.
- The data that identifies a flight – ACID, ORIG, DEST, and IGTD – must be maintained using the CDM FM messages.
- TOS messages must contain the same ACID, ORIG, DEST and IGTD that has been created and maintained using the FC and FM messages. If the TOS does not match an existing TFMS flight database entry, TFMS rejects the TOS.
- Data fields that appear in both the TOS and the FM messages are updated by TFMS from the last message received, regardless of the message type. These data fields are the aircraft type (TYPE) and the Earliest Runway Time of Departure (ERTD).
- If a flight is cancelled by a CDM FX message, it is considered cancelled regardless of any TOS messages received. The flight may be reinstated only by a CDM FC message.

Similarly, TFMS may receive trajectory data from the TOS, Early Intent messages (EI), and NAS Flight Plans (FP). TFMS always stores the trajectory options from the latest TOS. These are stored separately from the routes received on EIs and FPs. The question is: which route should be used for modeling the expected impact of the flight on the NAS (for example, what sectors are impacted)? TFMS applies the following rules:

- TFMS models the flight using the latest FP route, if available.
- If the above is not available, TFMS models the flight using the trajectory assigned by a CTOP, if available.
- If none of the above is available, TFMS models the flight using the least cost acceptable TOS option (and if there are ties, the tied option with the lowest sequence number), if a TOS has been accepted. .
- If none of the above is available, TFMS models the flight using the latest conventional EI, if that EI has been received within a configurable time period of the flight's departure.
- If none of the above is available and the flight is in a conventional required reroute, TFMS models the flight using the assigned route from the conventional reroute.
- If none of the above is true, TFMS models the flight using the route from the latest EI, if that EI has been received outside the configurable time period of the flight's departure.
- If none of the above is true, TFMS models the flight using the TFMS historical route.

TFMS validates a TOS message as follows:

- TFMS determines whether the flight already exists in the TFMS database. If not, it rejects the entire TOS.
- TFMS determines whether the flight operator is authorized to modify this flight. If not, it rejects the entire TOS.
- TFMS validates that the route text in each trajectory option can be parsed and converted into waypoints. If not, it rejects only the trajectory options that have an "unparsable" route. Route text is expected to be in ICAO format (field 15c, Section 1.4 References, item 5).
- TFMS determines whether, for each possible future departure time, the TOS has at least one valid trajectory option for that time. If not, TFMS rejects the entire TOS. (NOTE: This validation will not be supported in the first phase of CTOP implementation, but will be supported in the second release.)
- TFMS ensures that the number of TOS options does not exceed a configurable limit. If not, it rejects the entire TOS.
- TFMS ensures that the time that has elapsed between the submission of this TOS and the submission of the previous accepted TOS is not less than a configurable limit. . If not, it rejects the entire TOS. (NOTE: This validation will not be supported in the first phase of CTOP implementation, but will be supported in the second release.)

If all of these tests pass, TFMS accepts the TOS, or at least the valid subset of the TOS, and applies it to the TFMS database.

TFMS uses a TOS to completely replace a previous TOS. If the flight operator wishes to update any TOS data, it must send in a complete new TOS for the flight with a complete definition of the current TOS for that flight. For example, if a flight operator has submitted an Earliest Runway Time of Departure (ERTD) for a flight and wishes to clear the ERTD, it must submit a complete new TOS with all the current trajectory options but with the ERTD field updated.

To help an FOS maintain data synchronization, the FOS can request the current TOS for a flight from TFMS at any time.

The CTOP Trajectory messages are summarized as follows:

- CTOP TOS Message [320] – Sent from the FOS to TFMS. Contains the trajectory option set for a single flight. A TOS can be submitted only for flights that already exist in the TFMS database. Each TOS includes a sequence number that is unique for that flight. This is used to correlate trajectory update messages with the TOSes.
- CTOP TOS Reply [321] – Sent from TFMS to the FOS in response to a valid CTOP TOS Message. Indicates that the message has been completely accepted. (NOTE: If a CTOP is in effect, the TOS could cause a new trajectory assignment if the flight was already in the CTOP, or could cause the flight to become a pop-up in that CTOP. If so, TFMS generates additional CTOP messages as described in the next section. Those messages include the TOS sequence number so that the FOS can verify that they were based on the updated TOS.)
- CTOP TOS Error [322] – Sent from TFMS to the FOS in response to an invalid, or partially invalid, CTOP TOS Message. Indicates that either the entire message was rejected, or one or more trajectory options were rejected. The reply contains the reason(s) for the rejection(s).
- CTOP TOS Re-synch Request [323] – Sent from the FOS to TFMS to request the current TOS for a specific flight.
- CTOP TOS Re-synch Reply [324] – Sent from TFMS to the FOS in response to a valid CTOP TOS Re-synch Request. Message content is the same as for a CTOP TOS Message.
- CTOP TOS Re-synch Error [325] – Sent from TFMS to the FOS in response to an invalid CTOP TOS Re-synch Request.

The detailed formats for the CTOP trajectory messages are provided in section 5.3.3.

4.4 CTOP TMI Messages

CTOPs are created and maintained by the FAA traffic managers; TFMS sends a message whenever a traffic manager creates, edits, or cancels a CTOP. The CTOP data includes the name of the CTOP, the list of flights impacted by the CTOP, and the assigned trajectories for those flights. Once a CTOP is issued, TFMS sends individual messages whenever the trajectory assignment changes for a flight in that CTOP; this includes new flights added to the CTOP (pop-ups) and existing flights removed from the CTOP flight list (drop-outs). A flight operator system (FOS) can use these messages to keep its data about flights in a CTOP up to date without requesting a new list. If the FOS restarts or is started up cold, it can synchronize its data by requesting a list of all the current CTOPs (CTOP List), and then requesting a full set of data for each of the current CTOPs (CTOP Re-synch). The re-synch reply includes the current list of flights and their trajectory assignments. The FOS can then listen for changes (trajectory changes, pop-ups, and drop-outs) from that time forward.

A CTOP trajectory assignment consists of the assigned route text, altitude, and speed (extracted from one of the user-provided trajectory options), a slot, and optionally a Controlled Time of Departure (CTD (a.k.a., EDCT). The assigned trajectory could take the flight through a CTOP FCA. The slot represents the time the flight must enter the FCA and the CTD is the departure time needed to hit that entry time. Alternatively, the assigned trajectory could take the flight out of all CTOP FCAs. In this case, no slot or CTD is assigned, signifying that the flight can depart whenever it wants on that route.

When a CTOP is first issued, the flight list includes every flight that could potentially affect any FCA controlled by that CTOP. However, a flight may be controlled completely, partially, or not at all by the CTOP being issued. Flight data fields are provided to allow the flight operator to figure out exactly how the CTOP affects the flight. There are three distinct cases:

- If a flight in this CTOP is also in a GDP or GS, the control times are determined by the GDP/GS. If a flight in this CTOP is also in an AFP, the flight may get its control time from the AFP, depending on the order in which the CTOP and the AFP were issued. . In any event, when a flight in a CTOP is controlled by another type of program, TFMS sends notifications (slot lists) using the normal GDP/GS/AFP messages. The flight operator substitutes these flights using the normal GDP/GS/AFP substitution messages. However, TFMS still determines and sends an assigned route for these flights as part of this CTOP. Such a flight is indicated as exempt with an exempt reason of GDP, GS, or AFP. The control element is the GDP/GS airport name or AFP FCA name. The flight has an assigned trajectory but no slot assignment or CTD from this CTOP.
- If a flight in this CTOP is in a higher ranked CTOP, the flight gets no control times or route assignment as part of this CTOP. Such a flight is indicated as exempt with an exempt reason of CTOP. The control element is the name of the flight's primary FCA in the higher ranked CTOP. The flight has no assigned trajectory, slot assignment, or CTD from this CTOP.
- If a flight in this CTOP does not meet either of the above criteria, it is controlled by this CTOP. Such a flight is indicated as exempt or not based on whether it meets the exemption parameters for this CTOP; if it does, the exemption reason is PARAM. A flight may also be exempt from the CTOP allocation because it has been manually overridden by a traffic manager (this includes the case of a traffic manager using the Dynamic Exception feature to OK a filed route); in this case, the exemption reason is MANUAL. The control element is the name of the flight's primary FCA in this CTOP. The flight has an assigned trajectory, slot assignment, and optionally a CTD from this CTOP.

Once a CTOP is first issued, revisions to the TMI include only the flights that have changed. If the CTOP TMI parameters are revised without affecting any flights, only the parameters are sent. If the automatic revision causes flights to be re-allocated without any parameter changes, only the modified flights are sent. TFMS sends flight-specific data to an FOS only for flights managed by that flight operator.

The flight operator should consider any CTOP data to override previously received CTOP data. For example, if a traffic manager changes the ranking of a CTOP to be higher than another CTOP that is already in place, TFMS sends a new CTOP message that may include new trajectory assignments for flights that were previously controlled by a different CTOP. The FOS must process this data as an override of the previous trajectory assignments.

A CTOP TMI can be issued as either proposed or actual. A proposed CTOP is for advisory purposes only; that is, the CTDs and assigned routes in a proposed CTOP are hypothetical and are not put into effect. An actual CTOP is an active constraint that causes flights to be delayed and rerouted. No dynamic updates, such as new trajectory assignments, pop-ups or drop-outs, are sent for a proposed CTOP. It is a one-shot set of data sent only to tell the user how a potential CTOP might impact their flights.

A CTOP should be considered to be active until either a CTOP Cancel message is received or the CTOP expires. A CTOP is considered to be expired when all of the controlled time intervals are in the past and all the controlled flights have landed. Once a CTOP is cancelled or expired, the CTOP can be deleted from the flight operator's database.

Formatted CTOP advisories are used to notify users that a Collaborative Trajectory Options Program is being considered or has been implemented. . The details of the formatted advisories are presented in Section 1.4 References, item 6.

A Collaborative Trajectory Options Program (CTOP) Advisory – Proposed is transmitted when the implementation of a CTOP TMI is being considered..

A Collaborative Trajectory Options Program (CTOP) Advisory – Actual is transmitted when a CTOP TMI is implemented.

A Collaborative Trajectory Options Program (CTOP) Cancel - Proposed is transmitted when TFM Specialists are considering canceling a CTOP.

A Collaborative Trajectory Options Program (CTOP) Cancel - Actual is transmitted when TFM Specialists have implemented the cancellation of an actual CTOP TMI.

The CTOP TMI messages are summarized as follows:

- CTOP TMI [330] – Sent from TFMS to the FOS when a CTOP is either created or revised such that any of the CTOP parameters change. The CTOP TMI message identifies the FCA(s) on which it is based as well as other CTOP parameters, such as the program start and end times. The CTOP TMI message may include the list of flight operator's flights that are impacted by the CTOP, along with the assigned route text, altitude, and speed, the CTOP slot, and optionally the CTD for each of those flights. If a new CTOP is being issued, the message always includes all the flights in the CTOP. If a CTOP is being modified, the message includes only those flights whose data changes. If no flights are affected, only the complete CTOP definition is sent but with no flight list.
    - (NOTE: If trajectory assignments are updated for a CTOP without any changes to the CTOP definition, as in automatic revision, these are sent as trajectory assignment messages [331].)
    - (NOTE: For a proposed CTOP, the list of flights that have data changes is determined relative to the current actual CTOP data, not as compared to a previous, proposed CTOP. That is, if no CTOP is currently in place and two proposed CTOP TMI messages are issued, each includes all of the flights in the CTOP. If a CTOP is already in place, a proposed CTOP TMI message always includes all flights that are changed relative to the actual CTOP currently in place. In short, any proposed CTOP TMI message completely replaces any previous proposed CTOP TMI message and attempts to mimic what the actual CTOP TMI message would look like.)
- CTOP Trajectory Assignment [331] – Sent from TFMS to the FOS when a new trajectory assignment has been made by TFMS for one or more individual flights. This includes assignments made automatically by the CTOP algorithms and manual assignments made by a traffic manager using the manual override function. The trajectory assignment includes the assigned route text, altitude, and speed, and optionally the CTOP slot and the CTD to which each flight has been assigned. The slot, if included, is the slot currently assigned to the flight. The trajectory assignment also includes feedback for each TOS option to help support the substitution process. The trajectory assignment message also includes the TOS sequence number to identify which TOS the assignment was based on. If no TOS has been submitted for a flight but a flight plan has been filed, the trajectory assignment is based on the flight plan; this is indicated in the assignment message. If no TOS or flight plan has been submitted, TFMS models the flight using the best available route, but does not issue an assigned route for the flight; again, this is indicated in the assignment message. In all cases, the trajectory assignment message includes a CTD if the flight is modeled on a trajectory that intersects at least one of the CTOP FCAs during a controlled time bin. A CTOP Trajectory Assignment message can be triggered by a TOS update, an automatic revision or a Traffic Manager override. If a Trajectory Assignment contains more than one flight, they must all be triggered by the same CTOP.
- CTOP Pop-up [332] – Sent from TFMS to the FOS for a flight that becomes known to a CTOP TMI after that TMI became active. This enables the FOS to keep its data about flights in a CTOP up to date without requesting a new list. The pop-up data includes the trajectory assignment (route and optional CTD) for the pop-up flight when the CTOP for which the message is being sent is controlling the flight's CTOP trajectory assignment. The pop-up message will include a

slot assignment for the flight if a slot is available that would not involve assigning a delay to the flight that exceeds a pop-up delay limit parameter. . Otherwise the delay limit amount of delay is assigned to the flight, but no slot is assigned. Pop-up flights that do not get a slot cannot be used in substitutions until a CTOP re-allocation assigns a slot to the flight. The pop-up message also includes the TOS sequence number to identify on which TOS the assignment was based.

- CTOP Drop-out [333] – Sent from TFMS to the FOS when one or more flights that were previously in a CTOP drop out of the CTOP. This enables the FOS to keep its data about flights in a CTOP up to date without requesting a new list. The drop-out(s) may be due to a data update for a flight that takes it out of a CTOP, or a change in the CTOP definition (reduction in scope) that eliminates previously controlled flights. The drop-out message also includes the TOS sequence number to identify which TOS the assignment was based on.
- CTOP List Request [334] – Sent from the FOS to TFMS to request a list of all the currently active CTOPs. This can be used by the FOS to verify whether its data is current and as part of a data recovery processes after a crash or a cold start.
- CTOP List Reply [335] – Sent from TFMS to the FOS in response a CTOP List Request.
- CTOP Re-synch Request [336] – Sent from the FOS to TFMS to request the full state for a current CTOP. This can be used by the FOS to refresh its data for a CTOP and as part of a data recovery processes after a crash or a cold start. .
- CTOP Re-synch Reply [337] – Sent from TFMS to the FOS in response to a valid CTOP Re-synch Request. The content of this reply has the same format as the CTOP message. It includes the list of all the flight operator's flights impacted by the CTOP and their current assignments.
- CTOP Re-synch Error [338] – Sent from TFMS to the FOS in response to an invalid CTOP Request. The reply includes the reason for the error.
- CTOP Trajectory Assignment Re-synch Request [339] – Sent from the FOS to TFMS to request the current trajectory assignment for a specific flight.
- CTOP Trajectory Assignment Re-synch Reply [340] – Sent from TFMS to the FOS in response to a valid CTOP Trajectory Request. Message content is the same as for a CTOP Trajectory Assignment.
- CTOP Trajectory Assignment Re-synch Error [341] – Sent from TFMS to the FOS in response to an invalid CTOP Trajectory Request. The reply includes the reason for the error.
- CTOP Cancel [342] – Sent from TFMS to the FOS when an active CTOP has been cancelled (a.k.a. purged) within TFMS. Includes a list of the flights previously controlled by this CTOP that are no longer controlled by any CTOP. The FOS should not expect any more data for this CTOP.
- CTOP Flight Plan Amendment [343] – Sent from TFMS to the FOS whenever TFMS sends a flight plan amendment for a flight in a CTOP TMI that is successfully accepted by ERAM.
- CTOP Suspend [344] – Sent from TFMS when CTOP message processing is suspended to allow a traffic manager to manually revise a CTOP. (TFMS does not send a CTOP Suspend message for an automatic revision, as the interruption in processing should be brief.) No CTOP substitutions are accepted when processing is suspended; TOSes are queued and processed once processing is resumed. A CTOP Suspend is followed by a CTOP Resume.
- CTOP Resume [345] – Sent from TFMS when CTOP processing is resumed. (See explanation for CTOP Suspend.)

The detailed formats for the CTOP TMI messages are provided in section 5.3.4.

4.5 CTOP Substitution Messages

The CTOP Substitution messages are used by the flight operator to modify the CTOP FCA solution by trading the position of one or more flights in the solution with other flights in the solution. This is done by swapping the slots that have been assigned to two or more flights. When a flight is swapped into a slot, TFMS determines whether a trajectory option exists for the flight that allows the flight to hit the FCA at the assigned slot time (this may be the trajectory already assigned to the flight). If so, TFMS assigns the lowest cost trajectory that does so. For this reason, the reply to a successful substitution message includes trajectory assignments as well as a confirmation of the new slot assignments.

A CTOP solution may include both flights whose trajectory intersects the CTOP FCA(s), and flights whose trajectory avoids the CTOP FCA(s). A flight that avoids the FCA(s) has no slot. Such a flight can operate whenever it wants as long as it avoids the CTOP FCAs. A substitution message can be used to swap a flight that avoids the FCA(s) with a flight that has a slot in an FCA as long as the trajectory options for those flights support the new assignments.

A flight operator will have two options with respect to how a substitution request is treated. The operator can request *strict* processing or *flexible* processing. With strict processing, TFMS is constrained to swapping the slots exactly as requested by the operator. If trajectory options exist that allow the flights to use the requested slots, the substitution request is accepted. TFMS picks the lowest cost trajectory options that allow those slots to be used. If the slots cannot be swapped exactly as requested, the request is rejected. With flexible processing, TFMS can look for other trajectory options that do not use the requested slots in the strict sense. TFMS also considers trajectory options that route or delay flights out of all the FCAs in the CTOP. TFMS again picks the lowest adjusted cost option out of any option that meets these criteria. If any such option is found, TFMS accepts the substitution request.

TFMS validates a substitution message as follows:

- TFMS determines whether the flight already exists in the TFMS database. If not, it rejects the substitution message.
- TFMS determines whether the flight operator is authorized to substitute the slots for this flight. If not, it rejects the substitution message.
- TFMS validates that the slots being assigned in the substitution message already belong to the set of flights in the substitution message.
- TFMS determines that each flight has a feasible trajectory option for the slots to which the flight is being assigned.
    - If a flight is assigned to a conventional slot, the flight must have a trajectory option that allows it to arrive at the FCA between X minutes before and Y minutes after the slot time, where X and Y are the configurable system limits.
    - If a flight is assigned to no slot for an FCA, the flight must have a trajectory option that avoids that FCA.
    - In *flexible mode*, TFMS considers any option that either uses a slot or avoids all FCAs in the CTOP.
    - NOTE: TFMS applies a tolerance when determining whether a flight can meet its new slot time in a substitution. That is, TFMS will consider that a flight can meet its subbed slot time as long as the flight can enter the FCA within X minutes prior to or Y minutes after the slot time, where X and Y are system-configurable parameters. If TFMS allows a substitution using the slot tolerances, it does not change the slot to which the flight is assigned. For example, if a sub requests that Flight A be assigned to a slot for FCA001 at 1715Z (FCA001.201011011715A), and the flight is predicted to enter FCA001 at 1717Z, and the

slot tolerance is greater than or equal to 2 minutes, TFMS would allow the substitution and assign the 1715Z slot (FCA001.201011011715A) to Flight A. TFMS does not change the slot as a result of the tolerance being used.

The CTOP Substitution messages are summarized as follows:

- CTOP Substitution Message [350] – Sent from the FOS to TFMS. Contains a set of flights and the requested slot assignments for those flights. The purpose of the message is to re-assign existing flights to existing slots.
- CTOP Substitution Reply [351] – Sent from TFMS to the FOS in response to a valid CTOP Substitution Message. Includes the trajectory assignments – including the new slots – that resulted from the slot swapping.
- CTOP Substitution Error [352] – Sent from TFMS to the FOS in response to an invalid CTOP Substitution Message. Contains reason(s) for the error.

The detailed formats for the CTOP substitution messages are provided in section 5.3.5.

4.6 Supported Message Types

CTOP Messages are implemented and tested in TFMS Release 7 (Phase 1) and TFMS Release 9 (Phase 2). Messages that were implemented in Phase 1 were limited to those request/reply pairs that are initiated by the FOS.Messages initiated by TFMS (e.g.,, CTOP FCA, CTOP TMI) are implemented and tested in Phase 2. Table 4-1 illustrates the full set of messages implemented in the two phases..

Table 4-1. CTOP Message Set

Subsystem A TFMS AP	Messages	Data Flow	Phase 1	Phase 2	Subsystem B FOS AP
External Portal Message Interface Server	Connection Request	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	Connection Accepted	A → B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	Connection Rejected	A → B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	Shutdown	A → B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	Heartbeat Request	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	Heartbeat Reply	A → B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP FCA	A → B	Not Supported	Fully Implemented	FOS Client AP

Subsystem A TFMS AP	Messages	Data Flow	Phase 1	Phase 2	Subsystem B FOS AP
External Portal Message Interface Server	CTOP FCA List Request	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP FCA List Reply	A → B	Empty List Returned	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP FCA Re-Synch Request	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP FCA Re-Synch Reply	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP FCA Flight List Request	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP FCA Flight List Reply	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP FCA Request Error	A → B	Partially Implemented – Will return an error stating message is not supported.	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP FCA Delete	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP TOS Message	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP TOS Reply	A → B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP TOS Error	A → B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP TOS Re-Synch Request	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP TOS Re-Synch Reply	A → B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP TOS Re-Synch Error	A → B	Fully Implemented		FOS Client AP

Subsystem A TFMS AP	Messages	Data Flow	Phase 1	Phase 2	Subsystem B FOS AP
External Portal Message Interface Server	CTOP TMI	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Trajectory Assignment	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Pop-up	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Drop-out	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP List Request	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP List Reply	A → B	Empty List Returned	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Re-Synch Request	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP Re-Synch Reply	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Re-Synch Error	A → B	Partially Implemented – Will return an error stating message is not supported.	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Trajectory Assignment Re-Synch Request	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP Trajectory Assignment Re-Synch Reply	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Trajectory Assignment Re-Synch Error	A → B	Partially Implemented – Will return an error stating message is not supported.	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Cancel	A → B	Not Supported	Fully Implemented	FOS Client AP

Subsystem A TFMS AP	Messages	Data Flow	Phase 1	Phase 2	Subsystem B FOS AP
External Portal Message Interface Server	CTOP Flight Plan Amendment	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Suspend	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Resume	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Substitution Message	A ← B	Fully Implemented		FOS Client AP
External Portal Message Interface Server	CTOP Substitution Reply	A → B	Not Supported	Fully Implemented	FOS Client AP
External Portal Message Interface Server	CTOP Substitution Error	A → B	Partially Implemented – Will return an error stating message is not supported.	Fully Implemented	FOS Client AP

5. Message Formats

CTOP uses the same general approach to message formatting as for the CDM, GDP/AFP, and Substitution data exchanges, while introducing several enhancements. The general approach is that an individual message consists of a fixed-length binary header followed by an optional, variable-length payload, referred to as the data buffer. This approach to message packaging was adopted to simplify the programming. Once a socket connection is established, both the client and server can initiate a read of 24 bytes on the socket. Once 24 bytes are read, the client or server can see whether any additional bytes are expected, and if so how many, by looking at the byte count in the header. The client or server can then read that additional number of bytes. Once the expected number of bytes is read, the client or server triggers the processing of the data buffer, using the message type from the header to invoke the correct processing for that message. The process then initiates the next 24-byte read.

5.1 General Header Format

The header identifies the message type and the size of the data buffer to follow. The data buffer is optional; if no data buffer is present, the data buffer length is set to zero. The header is a fixed-size (24-byte) binary header consists of six four-byte integers. The integers currently in use for CDM message exchange (1, 4, 5, and 6) are preserved. Integers 2 and 3, currently not in use by CDM, are used to enhance the CDM approach in two ways. The full header format is defined as follows:

- Integer 1: Message Type. The value for each message type is defined in section 5.3.
- Integer 2: Message Time (formerly Message Source). Time at which the message is generated in UNIX timestamp format (number of seconds since January 1, 1970).
- Integer 3: Uncompressed Size. Size of the data buffer when uncompressed. Set to zero if there is no data buffer. If the data buffer is not compressed, the uncompressed size equals the Data Buffer Length.
- Integer 4: Client Tag. A numerical code assigned by the FAA for each connection. Every message must contain this assigned code.
- Integer 5: Sequence Number. FOS-assigned number used to associate a reply with the initiating message or request. When the FOS sends a message or request for which it expects a reply, the FOS can assign a sequence number. TFMS includes that sequence number on the associated reply. The use of the sequence number is optional, but highly recommended.
- Integer 6: Data Buffer Length: The number of bytes to follow the binary header. If the Data Buffer Length is less than the Uncompressed Size, the data buffer is compressed. Compression is performed using the open source deflate algorithm from the zlib library.

Several important notes about the message formatting:

- It is expected that all messages generated by the server are compressed; however, the message format allows for uncompressed messages to be sent. It is up to the client to determine whether to compress the messages it generates. Any implementing system should be able to accommodate either compressed or uncompressed messages.
- The timestamp provided in integer 2 is always generated by the server and is for optional use by the client. It can be used to help monitor the health of the data feed. It is also optional whether the client fills this field for messages that it generates.

5.2 General Data Buffer Format

CTOP introduces several new data types (TOS, FCA) that are highly complex and structured. These would not be practical if expressed in the simple order-dependent format used for the current CDM and GDP/AFP data. Instead, XML formatting is used for the CTOP messages. The specific formatting for each message type is described in section 5.3. Every data element in the message data buffer is a tagged element. There is no use of attributes, other than in the header line. Also, data elements within a message at the same level are not order dependant. i.e., TFMS will accept elements at the same level in any order. The general format for each data buffer is as follows:

```
<xml version="1.0" standalone="yes"?>
<msg_type>
     message contents…
</msg_type>
```

The XML formats for each message type are described in section 5.3. The descriptions are provided in table format and include the following columns:

- **Tag** – The name of the tag as it appears in the message.
- **Lev** – The nesting depth of the element in the XML structure.
- # – The number of these elements that can be present within the parent. "1+" is used to indicate one or more.
- **Req?** – Describes whether the element is required, optional etc. Possible values are:
  - Y – Required.
  - N – Optional.
  - Y* – Must be present if the parent is present.
  - **%** – Used to flag a set of optional elements, one of which must be defined within a parent container. The set consists of elements on consecutive rows within a table. The first element of the set is signaled by "/%", the last element by "%/". The elements of the set must have the same level (Lev).
- **Parent** – The container element inside which this element appears. For example, *FCA* is the parent of *FCA_ID*.
- **Description –** Describes the element and provides an example.

To avoid needless duplication, the tables do not define the specific syntax of each data element; those are provided in section 6.

Examples of the major message types are provided in Appendix A.

5.3 Individual Message Formats

This section defines the message-specific formatting. The integer values included in the header are shown in square brackets to differentiate them from normal ASCII data. The square brackets themselves are not part of the header. The XML format of the data buffers is shown in tables, as described in Section 5.2. If no data buffer is expected, the Data Buffer Format is shown as "N/A".

5.3.1 CTOP Session Message Formats

Note these messages are the same in both format and values with the CDM and GDP/AFP/Substitution protocols.

Connection Request [1]

- Message Type: [1]
- Message Time: [Unix time, optional]
- Uncompressed Size: [0]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [0]
- Data Buffer Format: N/A

Connection Accepted [2]

- Message Type: [2]
- Message Time: [Unix time]
- Uncompressed Size: [0]
- Client Tag: [pre-defined value]
- Sequence Number: [value from Connection Request]
- Data Buffer Length: [0]
- Data Buffer Format: N/A

Connection Rejected [3]

- Message Type: [3]
- Message Time: [Unix time]
- Uncompressed Size: [0]
- Client Tag: [pre-defined value]
- Sequence Number: [value from Connection Request]
- Data Buffer Length: [0]
- Data Buffer Format: N/A

Shutdown [5]

- Message Type: [5]
- Message Time: [Unix time]
- Uncompressed Size: [0]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [0]
- Data Buffer Format: N/A

Heartbeat Request [10]

- Message Type: [10]
- Message Time: [Unix time, optional]
- Uncompressed Size: [0]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [0]
- Data Buffer Format: N/A

Heartbeat Reply [11]

- Message Type: [11]
- Message Time: [Unix time]
- Uncompressed Size: [0]
- Client Tag: [pre-defined value]
- Sequence Number: [value from Heartbeat Request]
- Data Buffer Length: [0]
- Data Buffer Format: N/A

5.3.2 CTOP FCA Message Formats

CTOP FCA [300]

- Message Type: [300]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-1.

Table 5-1. CTOP FCA Message XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS <FOS_OUTPUT> Data </FOS_OUTPUT>
FCA_BROADCAST	2	1	Y	FOS_OUTPUT	Container to identify this specific message type <FOS_BROADCAST> Data </FOS_BROADCAST>
FCA_ID[1]	3	1	Y	FCA_ BROADCAST	System-generated unique identifier for FCA to be used for message correlation. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
NAME[1]	3	1	Y	FCA_ BROADCAST	Name of FCA as created by the traffic management specialist. Example: <NAME>FCA007<NAME>
DOMAIN[2]	3	1	Y	FCA_ BROADCAST	Defines who can see this FCA. Example: <DOMAIN>PUBLIC</DOMAIN>
LASTUPDATE[3]	3	1	Y	FCA_ BROADCAST	Date and time the FCA was last updated. Example: <LASTUPDATE>200211071016</LASTUPDATE>
REASON	3	1	Y	FCA_ BROADCAST	Reason for the FCA. Example: <REASON>WEATHER</REASON>
TYPE	3	1	Y	FCA_ BROADCAST	Type of FCA (must be FCA). Example: <TYPE>FCA</TYPE>
COLOR_ID	3	1	Y	FCA_ BROADCAST	Color index indicating the color that TFMS is using to draw the FCA polygon. Example: <COLOR_ID>17</COLOR_ID>
START	3	1	Y	FCA_ BROADCAST	Start date and time for the FCA. Flight entering or crossing the FCA after this time are considered in the FCA. Example: <START>200211071115</START>
END	3	1	Y	FCA_ BROADCAST	End date and time for the FCA. Flight entering or crossing the FCA before this time are considered in the FCA. Example: <END>200211071115</END>
EXTENDED	3	1	Y	FCA_ BROADCAST	Flag to indicate whether the FCA is extended. (Extended FCAs stay in the system for more than 24 hours.) Example: <EXTENDED>FALSE</EXTENDED>
LOOK_AHEAD[4]	3	1	Y	FCA_ BROADCAST	Time range in hours from current time over which TFMS will provide flight data for the FCA. Example: <LOOK_AHEAD>6</LOOK_AHEAD>

Tag	Lev	#	Req ?	Parent	Description
FSM_ELIGIBLE	3	1	Y	FCA_ BROADCAST	Flag to indicate whether the FCA is eligible to be monitored by FSM. Example: <FSM_ELIGIBLE>TRUE</FSM_ELIGIBLE>
POLYGON[5,6]	3	1	/%	FCA_ BROADCAST	Container for data elements defining a polygon FCA. Example: <POLYGON> data </POLYGON>
LINE[5,7]	3	1	%	FCA_ BROADCAST	Container for data elements defining a line FCA. Example: <LINE> data </LINE>
CIRCLE[5,8]	3	1	%	FCA_ BROADCAST	Container for data elements defining a circle FCA. Example: <CIRCLE> data </CIRCLE>
NAS[5]	3	1	%/	FCA_ BROADCAST	Container for data elements defining a NAS element FCA. Example: <NAS> data </NAS>
CEILING	4	1	Y*	LINE, CIRCLE or POLYGON	Upper altitude of FCA in 100s feet. Example: <CEILING>600</CEILING>
FLOOR	4	1	Y*	LINE, CIRCLE or POLYGON	Lower altitude of FCA in 100s feet. Example: <FLOOR>240</FLOOR>
POINTS	4	1	Y*	LINE, CIRCLE or POLYGON	The points of the polygon or line that defines the shape of the FCA. Example: <POINTS>4255N/07633W 4244N/07517W 4203N/07505W </POINTS>
DIRECTION[10]	4	1	Y*	LINE or POLYGON	Direction of movement for a moving FCA in degrees. Example: < DIRECTION>180</ DIRECTION>
SPEED[10]	4	1	Y*	LINE or POLYGON	Speed of movement for a moving FCA in knots. Example: < SPEED>15</ SPEED>
DRAWING	4	1	Y*	LINE or POLYGON	For moving FCAs, defines how to associate the FCA position as represented by POINTS to a time. If TRUE, POINTS represents the position at the START time. If FALSE, POINTS represents the position at the time it was last updated (LASTUPDATE). Example: <DRAWING>TRUE</DRAWING>
CENTER	4	1	Y*	CIRCLE	Center point for a circle FCA. Example: <CENTER>4255N/07633W</CENTER>
RADIUS	4	1	Y*	CIRCLE	Radius for a circle FCA in nautical miles. Example: <RADIUS>45</RADIUS>

Tag	Lev	#	Req ?	Parent	Description
AIRPORT	4	1	/%	NAS	Indicates that the NAS-element category is airport. Content is the airport name. Example: <AIRPORT>DTW</AIRPORT>
SECTOR	4	1	%	NAS	Indicates that the NAS-element category is sector in its dynamic state. Content is the sector name. Example: <SECTOR>ZOB24</SECTOR>
BASE_SECTOR	4	1	%	NAS	Indicates that the NAS-element category is a sector in its baseline state. Content is the sector name. Example: <BASE_SECTOR>ZOB24</BASE_SECTOR>
TRACON	4	1	%	NAS	Indicates that the NAS-element category is Tracon. Content is the TRACON name. Example: <TRACON>ZMPMSP</TRACON>
ARTCC	4	1	%	NAS	Indicates that the NAS-element category is ARTCC. Content is the ARTCC name. Example: <ARTCC>ZOB</ARTCC>
FIX	4	1	%	NAS	Indicates that the NAS-element category is a fix. Content is the fix name. Example: <FIX>VUZ</FIX>
SUA	4	1	%/	NAS	Indicates that the NAS-element category is special use area. Content is an SUA name. Example: <SUA>DEEPWOODS</SUA>
PRIMARY_FILTER[11]	3	1	N	FCA_ BROADCAST	Container for criteria for filtering the flights in an FCA. Example: <PRIMARY_FILTER> data </PRIMARY_FILTER>
CONDITIONS	4	1	Y*	PRIMARY_ FILTER	Container for the conditions that define the filter. Example: <CONDITIONS> data </CONDITIONS>
ANY[12,14]	5	1	/%	CONDITIONS	Container for filtering conditions that should be “OR’ed” when applying the filters. Example: <ANY> data </ANY>
ALL[13,14]	5	1	%/	CONDITIONS	Container for filtering conditions that should be “AND’ed” when applying the filters. Example: <ALL> data </ALL>
DEPARTS_ANY	6	1	/%	ANY or ALL	Departure inclusion filter. Only flights departing from one of these are included in the FCA. Example: <DEPARTS_ANY>BOS ZNY</DEPARTS_ANY>

Tag	Lev	#	Req ?	Parent	Description
DEPARTS_NONE	6	1	%	ANY or ALL	Departure exclusion filter. Flights departing from any one of these are excluded from the FCA; all other departures are included. Example: <DEPARTS_NONE>BOS ZNY</DEPARTS_NONE>
ARRIVES_ANY	6	1	%	ANY or ALL	Arrival inclusion filter. Only flights arriving at one of these are included in the FCA. Example: <ARRIVES_ANY>BOS ZNY</ARRIVES_ANY>
ARRIVES_NONE	6	1	%	ANY or ALL	Arrival exclusion filter. Flights arriving at any one of these are excluded from the FCA; all other arrivals are included. Example: <ARRIVES_NONE>BOS ZNY</ARRIVES_NONE>
TRAVERSE_ANY	6	1	%	ANY or ALL	Traversal inclusion filter. Only flights traversing at least one of these are included in the FCA. Example: <TRAVERSE_ANY>ZNY ZNY24 WAVEY</TRAVERSE_ANY>
TRAVERSE_ALL	6	1	%	ANY or ALL	Traversal inclusion filter. Only flights traversing all of these are included in the FCA. Example: <TRAVERSE_ALL>ZNY ZNY24 WAVEY</TRAVERSE_ALL>
TRAVERSE_NONE	6	1	%	ANY or ALL	Traversal exclusion filter. Flights traversing at least one of these are excluded from the FCA; all other flights are included. Example: <TRAVERSE_NONE>ZNY ZNY24 WAVEY</TRAVERSE_NONE>
USE_ AIRWAY_ANY	6	1	%	ANY or ALL	Airway inclusion filter. Only flights using at least one of these are included in the FCA. Example: <USE_ AIRWAY_ANY>J60 J6</USE_ AIRWAY_ANY>
USE_ AIRWAY_ALL	6	1	%	ANY or ALL	Airway inclusion filter. Only flights using all of these are included in the FCA. Example: <USE_ AIRWAY_ALL>J60 J6</USE_ AIRWAY_ALL>
USE_ AIRWAY_NONE	6	1	%	ANY or ALL	Airway exclusion filter. Flights using at least one of these are excluded from the FCA; all other flights are included. Example: <USE_ AIRWAY_NONE>J60 J6</USE_ AIRWAY_NONE>
LOCATED_ANY	6	1	%	ANY or ALL	Location inclusion filter. Only flights currently located in one of these are included in the FCA. Example: <LOCATED_ANY>ZNY ZNY24</LOCATED_ANY>
LOCATED_NONE	6	1	%	ANY or ALL	Location exclusion filter. Flights currently located in any one of these are excluded from the FCA; all other flights are included. Example: <LOCATED_NONE>ZNY ZNY24</LOCATED_NONE>
TYPE_ANY	6	1	%	ANY or ALL	Aircraft type inclusion filter. Only flights with one of these types are included in the FCA. Example: <TYPE_ANY>B737 B757</TYPE_ANY>

Tag	Lev	#	Req ?	Parent	Description
TYPE_NONE	6	1	%	ANY or ALL	Aircraft type exclusion filter. Flights with any one of these types are excluded from the FCA; all other flights are included. Example: <TYPE_NONE>B737 B757</TYPE_NONE>
REMARKS_ANY	6	1	%	ANY or ALL	Flight plan remarks inclusion filter. Only flights with one of these remarks are included in the FCA. Example: <REMARKS_ANY>NRP</REMARKS_ANY>
REMARKS_ALL	6	1	%	ANY or ALL	Flight plan remarks inclusion filter. Only flights with all of these remarks are included in the FCA. Example: <REMARKS_ALL>NRP</REMARKS_ALL>
REMARKS_NONE	6	1	%	ANY or ALL	Flight plan remarks exclusion filter. Contains one or more predefined remarks separated by spaces. Flights with any one of these remarks are excluded from the FCA; all other flights are included. Example: <REMARKS_NONE>LIFEGUARD</REMARKS_NONE>
HEADING_IS	6	1	%	ANY or ALL	Heading inclusion filter. Only flights whose headings are within the given tolerance of the given heading are included in the FCA. Example: <HEADING_IS>270 45</HEADING_IS>
HEADING_NOT	6	1	%	ANY or ALL	Heading exclusion filter. Flights with headings that are within the given tolerance of the given heading are excluded from the FCA; all other flights are included. Example: <HEADING_NOT>270 45</HEADING_NOT>
ACID_ANY	6	1	%	ANY or ALL	Aircraft ID (ACID, a.k.a., call sign) inclusion filter. Only flights with one of those ACIDs are included in the FCA. Example: <ACID_ANY>AAL123 DAL456</ACID_ANY>
ACID_NONE	6	1	%	ANY or ALL	Aircraft ID (ACID, a.k.a., call sign) exclusion filter. Contains one or more ACIDs separated by spaces. Flights with those ACIDs are excluded from the FCA; all other flights are included. Example: <ACID_NONE>AAL123 DAL456</ACID_NONE>
FLIGHT_LEVEL	6	1	%	ANY or ALL	Flight level inclusion filter. Only flights within the specified flight level range when they first cross the FCA boundary are considered to be in the FCA. Example: <FLIGHT_LEVEL>600 240</FLIGHT_LEVEL>
AIRCRAFT_CATEGORY_ANY	6	1	%	ANY or ALL	Aircraft category inclusion filter. Only flights with one of these categories are included in the FCA. Example: <AIRCRAFT_CATEGORY_ANY>J </AIRCRAFT_CATEGORY_ANY>
WEIGHT_CLASS_ANY	6	1	%	ANY or ALL	Weight class inclusion filter. Only flights with one of these weight classes are included in the FCA. Example: <WEIGHT_CLASS_ANY>H L</WEIGHT_CLASS_ANY>
USER_CATEGORY_ ANY	6	1	%	ANY or ALL	User category inclusion filter. Only flights with one of these user categories are included in the FCA. Example: <USER_CATEGORY_ANY>T F C </USER_CATEGORY_ANY>

Tag	Lev	#	Req ?	Parent	Description
STATUS	6	1	%	ANY or ALL	Flight status inclusion filter (ACTIVE or PROPOSED). If ACTIVE, only airborne flights are considered to be in the FCA. If PROPOSED, only flights that have not yet departed are considered to be in the FCA. Example: < STATUS>ACTIVE</ STATUS>
RVSM	6	1	%	ANY or ALL	Reduced Vertical Separation Minimum (RVSM) inclusion filter. (COMPLIANT or NON-COMPLIANT). If COMPLIANT, only RVSM-compliant flights are considered to be in the FCA. If NON-COMPLIANT, only flights that are not RVSM-compliant are considered to be in the FCA. Example: <RVSM>COMPLIANT</RVSM>
DEPARTURE_TIME_ RANGE	6	1	%	ANY or ALL	Departure time inclusion filter. Only flights that depart within the given time range are considered to be in the FCA. Example: <DEPARTURE_TIME_RANGE>200912231600 200912232359</DEPARTURE_TIME_RANGE>
ARRIVAL_TIME_ RANGE	6	1	%/	ANY or ALL	Arrival time inclusion filter. Only flights that arrive within the given time range are considered to be in the FCA. Example: <ARRIVAL_TIME_RANGE>200912231600200912232359 </ARRIVAL_TIME_RANGE>

Notes:

[1]The FCA_ID is the stable, unique identifier for an FCA, whereas the FCA_NAME can be changed by the traffic manager.

[2]The domain for a CTOP FCA is always PUBLIC.

[3]The LASTUPDATE time is changed every time an FCA definition is updated. The FOS can store the LASTUPDATE time and use it to determine whether it has the latest definition for an FCA.

[4]An FCA only contains flight data for a given amount of time, which may be different than the lifespan of the FCA. For example, a traffic manager can create an FCA to exist for 24 hours, but only show flights for the next 6 hours at any given time. The time range for which the FCA exists is defined by the START and END values. The time range for which data is available is defined by the LOOK_AHEAD value.

[5]There are four fundamental types of /FCAs: polygon, line, circle, and NAS. One and only one of the corresponding containers must exist in an FCA definition.

[6]A polygon FCA is a free-form shape drawn by the creator of the FCA. It is defined by the vertices of a polygon. A polygon should be drawn by connecting the vertices in the sequence given using line segments. An additional line segment is automatically drawn from the last vertex to the first.

[7]A line FCA is a free-form shape that consists of one or more contiguous line segments drawn by the creator of the FCA. It is defined by the end points of the line segments. A line segment should be drawn by connecting the points in the order given using line segments. The last point is NOT connected to the first.

[8]A circle FCA has a center-point and radius, again selected by the creator. A circle FCA also contains the vertices of a polygon that approximates the circle. The circle can be drawn by either recreating the circle or using the polygon approximation.

[9] Previously existing footnote was removed.

[10]A traffic manager can designate movement for an FCA. The movement is defined by a direction and speed. Movement can be defined only for line and polygon FCAs, and not for extended FCAs. . Movement attributes are generally available for FCAs and are included here for completeness, but moving FCAs will not allowed in CTOP programs.. That is, the SPEED must be zero for a CTOP FCA.

[11]A traffic manager can associate filters with an FCA. Without any filtering, any flight that intersects the FCA geometry between the START and END times is considered to be in the FCA. If filters are defined, only flights that meet those filters are considered to be in the FCA.

[12]An ANY filter container may contain multiple filters. When applying the filters, any flight intersecting the FCA that meets any one or more of the filters in the ANY container is considered to be in the FCA. For example, if ANY contains filters for BOS departures and LGA arrivals, the flight list would include all flights departing BOS plus all flights arriving LGA.

[13]An ALL filter container may contain multiple filters. When applying the filters, a flight intersecting the FCA must meet every filter in the ALL container to be considered in the FCA. For example, if ALL contains filters for BOS departures and LGA arrivals, the flight list would include only those flights that are flying from BOS to LGA.

[14]The inclusion of the individual filter tags in either the ALL or ANY container is optional. For example, the DEPARTS_ANY tag may appear in an ALL container or may be omitted. If any filter type is omitted, the meaning is that no filtering for that criterion is to be applied. For example, if DEPARTS_ANY is omitted from either an ANY or ALL container, no flight should be excluded due to its departure location.

CTOP FCA List Request [301]

- Message Type: [301]
- Message Time: [Unix time, optional]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-2.

Table 5-2. CTOP FCA List Request XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version=”1.0” standalone=”yes”?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.

Tag	Lev	#	Req ?	Parent	Description
FOS_INPUT	1	1	Y	None	Container for the message data sent to the TFMS from the FOS client <FOS_INPUT> Data </FOS_INPUT>
FCA_LIST_REQ	2	1	Y	FOS_INPUT	Element to identify this specific message type <FCA_LIST_REQ/>

CTOP FCA List Reply [302]

- Message Type: [302]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP FCA List Request]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-3.

Table 5-3. CTOP FCA List Reply XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS <FOS_OUTPUT> Data </FOS_OUTPUT>
FCA_LIST[1]	2	1	Y	FOS_OUTPUT	Container for the requested FCA list. Example: <FCA_LIST> data </FCA_LIST>
FCA	3	1+	N	FCA_LIST	Container for an FCA. Example: <FCA> data </FCA>

Tag	Lev	#	Req ?	Parent	Description
FCA_ID[2]	4	1	Y*	FCA	System-generated unique identifier of FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_NAME[2]	4	1	Y*	FCA	Name of FCA as created by the traffic management specialist. Example: <FCA_NAME>FCA007</FCA_NAME>
LASTUPDATE[3]	4	1	Y*	FCA	Date and time the FCA was last updated. Example: <LASTUPDATE>200211071016</LASTUPDATE>

[1]It is possible for there to be no CTOP FCAs. In this case the reply comes back as an empty list; that is:

<FCA_LIST>

</FCA_LIST>

[2]The FCA_ID is the stable, unique identifier for an FCA, whereas the FCA_NAME can be changed by the traffic manager.

[3]The LASTUPDATE time is changed every time an FCA definition is updated. The FOS can compare the LASTUPDATE time with the one it has stored to determine whether it has the latest definition for an FCA.

CTOP FCA Re-synch Request [303]

- Message Type: [303]
- Message Time: [UNIX time. Optional]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-4.

Table 5-4. CTOP FCA Re-synch Request XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_INPUT	1	1	Y	None	Container for the message data sent to TFMS from the FOS client <FOS_INPUT> Data </FOS_INPUT>
FCA_RESYNCH_REQ	2	1	Y	FOS_INPUT	Container to identify this specific message type <FCA_RESYNCH_REQ>

Tag	Lev	#	Req ?	Parent	Description
					Data </FCA_RESYNCH_REQ>
FCA_ID	3	1	Y	FCA_ RESYNCH_ REQ	System-generated unique identifier of the requested FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>

CTOP FCA Re-synch Reply [304]

This message is for a good reply only. If there is an error (for example, if the requested FCA does not exist), TFMS returns a CTOP FCA Request Error message.

- Message Type: [304]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP FCA Re-synch Request]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-5.

Table 5- 5. CTOP FCA Re-synch Reply XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS <FOS_OUTPUT> Data </FOS_OUTPUT>
FCA_RESYNCH_REPLY	2	1	Y	FOS_OUTPUT	Container to identify this specific message type <FCA_RESYNCH_REPLY> Data </FCA_RESYNCH_REPLY>
FCA_ID[1]	3	1	Y	FCA_ RESYNCH_ REPLY	System-generated unique identifier for FCA to be used for message correlation. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
NAME[1]	3	1	Y	FCA_ RESYNCH_ REPLY	Name of FCA as created by the traffic management specialist. Example: < NAME>FCA007< NAME>

Tag	Lev	#	Req ?	Parent	Description
DOMAIN[2]	3	1	Y	FCA_ RESYNCH_ REPLY	Defines who can see this FCA. Example: <DOMAIN>PUBLIC</DOMAIN>
LASTUPDATE[3]	3	1	Y	FCA_ RESYNCH_ REPLY	Date and time the FCA was last updated. Example: <LASTUPDATE>200211071016</LASTUPDATE>
REASON	3	1	Y	FCA_ RESYNCH_ REPLY	Reason for the FCA. Example: <REASON>WEATHER</REASON>
TYPE	3	1	Y	FCA_ RESYNCH_ REPLY	Type of FCA (must be FCA). Example: < TYPE>FCA</ TYPE>
COLOR_ID	3	1	Y	FCA_ RESYNCH_ REPLY	Color index indicating the color that TFMS is using to draw the FCA polygon. Example: <COLOR_ID>17</COLOR_ID>
START	3	1	Y	FCA_ RESYNCH_ REPLY	Start date and time for the FCA. Flight entering or crossing the FCA after this time are considered in the FCA. Example: <START>200211071115</START>
END	3	1	Y	FCA_ RESYNCH_ REPLY	End date and time for the FCA. Flight entering or crossing the FCA before this time are considered in the FCA. Example: <END>200211071115</END>
EXTENDED	3	1	Y	FCA_ RESYNCH_ REPLY	Flag to indicate whether the FCA is extended. (Extended FCAs stay in the system for more than 24 hours.) Example: <EXTENDED>FALSE</EXTENDED>
LOOK_AHEAD[4]	3	1	Y	FCA_ RESYNCH_ REPLY	Time range in hours from current time over which TFMS will provide flight data for the FCA. Example: <LOOK_AHEAD>6</LOOK_AHEAD>
FSM_ELIGIBLE	3	1	Y	FCA_ RESYNCH_ REPLY	Flag to indicate whether the FCA is eligible to be monitored by FSM. Example: <FSM_ELIGIBLE>TRUE</FSM_ELIGIBLE>
POLYGON[5,6]	3	1	/%	FCA_ RESYNCH_ REPLY	Container for data elements defining a polygon FCA. Example: <POLYGON> data </POLYGON>
LINE[5,7]	3	1	%	FCA_ RESYNCH_ REPLY	Container for data elements defining a line FCA. Example: <LINE> data </LINE>
CIRCLE[5,8]	3	1	%	FCA_ RESYNCH_ REPLY	Container for data elements defining a circle FCA. Example: <CIRCLE> data </CIRCLE>

Tag	Lev	#	Req ?	Parent	Description
NAS[5,9]	3	1	%/	FCA_ RESYNCH_ REPLY	Container for data elements defining a NAS element FCA. Example: <NAS> data </NAS>
CEILING	4	1	Y*	LINE, CIRCLE or POLYGON	Upper altitude of FCA in 100s feet. Example: <CEILING>600</CEILING>
FLOOR	4	1	Y*	LINE, CIRCLE or POLYGON	Lower altitude of FCA in 100s feet. Example: <FLOOR>240</FLOOR>
POINTS	4	1	Y*	LINE, CIRCLE or POLYGON	The points of the polygon or line that defines the shape of the FCA. Example: <POINTS>4255N/07633W 4244N/07517W 4203N/07505W </POINTS>
DIRECTION[10]	4	1	Y*	LINE or POLYGON	Direction of movement for a moving FCA in degrees. Example: < DIRECTION>180</ DIRECTION>
SPEED[10]	4	1	Y*	LINE or POLYGON	Speed of movement for a moving FCA in knots. Example: < SPEED>15</ SPEED>
DRAWING	4	1	Y*	LINE or POLYGON	For moving FCAs, defines how to associate the FCA position as represented by POINTS to a time. If TRUE, POINTS represents the position at the START time. If FALSE, POINTS represents the position at the time it was last updated (LASTUPDATE). Example: <DRAWING>TRUE</DRAWING>
CENTER	4	1	Y*	CIRCLE	Center point for a circle FCA. Example: <CENTER>4255N/07633W</CENTER>
RADIUS	4	1	Y*	CIRCLE	Radius for a circle FCA in nautical miles. Example: <RADIUS>45</RADIUS>
AIRPORT	4	1	/%	NAS	Indicates that the NAS-element category is airport. Content is the airport name. Example: <AIRPORT>DTW</AIRPORT>
SECTOR	4	1	%	NAS	Indicates that the NAS-element category is sector in its dynamic state. Content is the sector name. Example: <SECTOR>ZOB24</SECTOR>
BASE_SECTOR	4	1	%	NAS	Indicates that the NAS-element category is a sector in its baseline state. Content is the sector name. Example: <BASE_SECTOR>ZOB24</BASE_SECTOR>
TRACON	4	1	%	NAS	Indicates that the NAS-element category is Tracon. Content is the TRACON name. Example: <TRACON>ZMPMSP</TRACON>
ARTCC	4	1	%	NAS	Indicates that the NAS-element category is ARTCC. Content is the ARTCC name. Example: <ARTCC>ZOB</ARTCC>

Tag	Lev	#	Req ?	Parent	Description
FIX	4	1	%	NAS	Indicates that the NAS-element category is a fix. Content is the fix name. Example: <FIX>VUZ</FIX>
SUA	4	1	%/	NAS	Indicates that the NAS-element category is special use area. Content is an SUA name. Example: <SUA>DEEPWOODS</SUA>
PRIMARY_FILTER[11]	3	1	N	FCA_ RESYNCH_ REPLY	Container for criteria for filtering the flights in an FCA. Example: <PRIMARY_FILTER> data </PRIMARY_FILTER>
CONDITIONS	4	1	Y*	PRIMARY_ FILTER	Container for the conditions that define the filter. Example: <CONDITIONS> data </CONDITIONS>
ANY[12,14]	5	1	/%	CONDITIONS	Container for filtering conditions that should be “OR’ed” when applying the filters. Example: <ANY> data </ANY>
ALL[13,14]	5	1	%/	CONDITIONS	Container for filtering conditions that should be “AND’ed” when applying the filters. Example: <ALL> data </ALL>
DEPARTS_ANY	6	1	/%	ANY or ALL	Departure inclusion filter. Only flights departing from one of these are included in the FCA. Example: <DEPARTS_ANY>BOS ZNY</DEPARTS_ANY>
DEPARTS_NONE	6	1	%	ANY or ALL	Departure exclusion filter. Flights departing from any one of these are excluded from the FCA; all other departures are included. Example: <DEPARTS_NONE>BOS ZNY</DEPARTS_NONE>
ARRIVES_ANY	6	1	%	ANY or ALL	Arrival inclusion filter. Only flights arriving at one of these are included in the FCA. Example: <ARRIVES_ANY>BOS ZNY</ARRIVES_ANY>
ARRIVES_NONE	6	1	%	ANY or ALL	Arrival exclusion filter. Flights arriving at any one of these are excluded from the FCA; all other arrivals are included. Example: <ARRIVES_NONE>BOS ZNY</ARRIVES_NONE>
TRAVERSE_ANY	6	1	%	ANY or ALL	Traversal inclusion filter. Only flights traversing at least one of these are included in the FCA. Example: <TRAVERSE_ANY>ZNY ZNY24 WAVEY</TRAVERSE_ANY>

Tag	Lev	#	Req ?	Parent	Description
TRAVERSE_ALL	6	1	%	ANY or ALL	Traversal inclusion filter. Only flights traversing all of these are included in the FCA. Example: <TRAVERSE_ALL>ZNY ZNY24 WAVEY</TRAVERSE_ALL>
TRAVERSE_NONE	6	1	%	ANY or ALL	Traversal exclusion filter. Flights traversing at least one of these are excluded from the FCA; all other flights are included. Example: <TRAVERSE_NONE>ZNY ZNY24 WAVEY</TRAVERSE_NONE>
USE_ AIRWAY_ANY	6	1	%	ANY or ALL	Airway inclusion filter. Only flights using at least one of these are included in the FCA. Example: <USE_ AIRWAY_ANY>J60 J6</USE_ AIRWAY_ANY>
USE_ AIRWAY_ALL	6	1	%	ANY or ALL	Airway inclusion filter. Only flights using all of these are included in the FCA. Example: <USE_ AIRWAY_ALL>J60 J6</USE_ AIRWAY_ALL>
USE_ AIRWAY_NONE	6	1	%	ANY or ALL	Airway exclusion filter. Flights using at least one of these are excluded from the FCA; all other flights are included. Example: <USE_ AIRWAY_NONE>J60 J6</USE_ AIRWAY_NONE>
LOCATED_ANY	6	1	%	ANY or ALL	Location inclusion filter. Only flights currently located in one of these are included in the FCA. Example: <LOCATED_ANY>ZNY ZNY24</LOCATED_ANY>
LOCATED_NONE	6	1	%	ANY or ALL	Location exclusion filter. Flights currently located in any one of these are excluded from the FCA; all other flights are included. Example: <LOCATED_NONE>ZNY ZNY24</LOCATED_NONE>
TYPE_ANY	6	1	%	ANY or ALL	Aircraft type inclusion filter. Only flights with one of these types are included in the FCA. Example: <TYPE_ANY>B737 B757</TYPE_ANY>
TYPE_NONE	6	1	%	ANY or ALL	Aircraft type exclusion filter. Flights with any one of these types are excluded from the FCA; all other flights are included. Example: <TYPE_NONE>B737 B757</TYPE_NONE>
REMARKS_ANY	6	1	%	ANY or ALL	Flight plan remarks inclusion filter. Only flights with one of these remarks are included in the FCA. Example: <REMARKS_ANY>NRP</REMARKS_ANY>
REMARKS_ALL	6	1	%	ANY or ALL	Flight plan remarks inclusion filter. Only flights with all of these remarks are included in the FCA. Example: <REMARKS_ANY>NRP</REMARKS_ANY>
REMARKS_NONE	6	1	%	ANY or ALL	Flight plan remarks exclusion filter. Contains one or more predefined remarks separated by spaces. Flights with any one of these remarks are excluded from the FCA; all other flights are included. Example: <REMARKS_NONE>LIFEGUARD</REMARKS_NONE>

Tag	Lev	#	Req ?	Parent	Description
HEADING_IS	6	1	%	ANY or ALL	Heading inclusion filter. Only flights whose headings are within the given tolerance of the given heading are included in the FCA. Example: <HEADING_IS>270 45</HEADING_IS>
HEADING_NOT	6	1	%	ANY or ALL	Heading exclusion filter. Flights with headings that are within the given tolerance of the given heading are excluded from the FCA; all other flights are included. Example: <HEADING_NOT>270 45</HEADING_NOT>
ACID_ANY	6	1	%	ANY or ALL	Aircraft ID (ACID, a.k.a., call sign) inclusion filter. Only flights with one of those ACIDs are included in the FCA. Example: <ACID_ANY>AAL123 DAL456</ACID_ANY>
ACID_NONE	6	1	%	ANY or ALL	Aircraft ID (ACID, a.k.a., call sign) exclusion filter. Contains one or more ACIDs separated by spaces. Flights with those ACIDs are excluded from the FCA; all other flights are included. Example: <ACID_NONE>AAL123 DAL456</ACID_NONE>
FLIGHT_LEVEL	6	1	%	ANY or ALL	Flight level inclusion filter. Only flights within the specified flight level range when they first cross the FCA boundary are considered to be in the FCA. Example: <FLIGHT_LEVEL>600 240</FLIGHT_LEVEL>
AIRCRAFT_CATEGORY_ANY	6	1	%	ANY or ALL	Aircraft category inclusion filter. Only flights with one of these categories are included in the FCA. Example: <AIRCRAFT_CATEGORY_ANY>J</AIRCRAFT_CATEGORY_ANY>
WEIGHT_CLASS_ANY	6	1	%	ANY or ALL	Weight class inclusion filter. Only flights with one of these weight classes are included in the FCA. Example: <WEIGHT_CLASS_ANY>H L</WEIGHT_CLASS_ANY>
USER_CATEGORY_ANY	6	1	%	ANY or ALL	User category inclusion filter. Only flights with one of these user categories are included in the FCA. Example: <USER_CATEGORY_ANY>T F C</USER_CATEGORY_ANY>
STATUS	6	1	%	ANY or ALL	Flight status inclusion filter (ACTIVE or PROPOSED). If ACTIVE, only airborne flights are considered to be in the FCA. If PROPOSED, only flights that have not yet departed are considered to be in the FCA. Example: < STATUS>ACTIVE</ STATUS>
RVSM	6	1	%	ANY or ALL	Reduced Vertical Separation Minimum (RVSM) inclusion filter. (COMPLIANT or NON-COMPLIANT). If COMPLIANT, only RVSM-compliant flights are considered to be in the FCA. If NON-COMPLIANT, only flights that are not RVSM-compliant are considered to be in the FCA. Example: <RVSM>COMPLIANT</RVSM>

Tag	Lev	#	Req ?	Parent	Description
DEPARTURE_TIME_ RANGE	6	1	%	ANY or ALL	Departure time inclusion filter. Only flights that depart within the given time range are considered to be in the FCA. Example: <DEPARTURE_TIME_RANGE>200912231600 200912232359</DEPARTURE_TIME_RANGE>
ARRIVAL_TIME_ RANGE	6	1	%/	ANY or ALL	Arrival time inclusion filter. Only flights that arrive within the given time range are considered to be in the FCA. Example: <ARRIVAL_TIME_RANGE>200912231600 200912232359</ARRIVAL_TIME_RANGE>

Notes:

[1]The FCA_ID is the stable, unique identifier for an FCA, whereas the FCA_NAME can be changed by the traffic manager.

[2]The domain for a CTOP FCA is always PUBLIC.

[3]The LASTUPDATE time is changed every time an FCA definition is updated. The FOS can store the LASTUPDATE time and use it to determine whether it has the latest definition for an FCA.

[4]An FCA only contains flight data for a given amount of time, which may be different than the lifespan of the FCA. For example, a traffic manager can create an FCA to exist for 24 hours, but only show flights for the next 6 hours at any given time. The time range for which the FCA exists is defined by the START and END values. The time range for which data is available is defined by the LOOK_AHEAD value.

[5]There are four fundamental types of /FCAs: polygon, line, circle, and NAS. One and only one of the corresponding containers can exist in an FCA definition.

[6]A polygon FCA is a free-form shape drawn by the creator of the FCA. It is defined by the vertices of a polygon. A polygon should be drawn by connecting the vertices in the sequence given using line segments. An additional line segment is automatically drawn from the last vertex to the first.

[7]A line FCA is a free-form shape that consists of one or more contiguous line segments by the creator of the FCA. It is defined by the end points of the line segments. A line segment should be drawn by connecting the points in the order given using line segments. The last point is NOT connected to the first.

[8]A circle FCA has a center-point and radius, again selected by the creator. A circle FCA also contains the vertices of a polygon that approximates the circle. The circle can be drawn by either recreating the circle or using the polygon approximation.

[9]A NAS element FCA contains the type and name of the NAS element on which the FCA is based; for example: an airport (BOS) or a TRACON (ZMPMSP). The FCA file does not contain the location information for a NAS element FCA. That is, to draw a NAS-element FCA, the application needs an independent source of the NAS element locations and boundaries. (Issue: Will NAS element FCAs be used for CTOP? See Section 7.1, Open Issues, for a complete description.)

[10]A traffic manager can designate movement for an FCA. The movement is defined by a direction and speed. Movement can be defined only for line and polygon FCAs, and not for extended FCAs. Movement attributes are generally available for FCAs and are included here for

completeness, but moving FCAs will not allowed in CTOP programs. That is, the FCA_SPEED must be zero for a CTOP FCA.

[11]A traffic manager can associate filters with an FCA. Without any filtering, any flight that intersects the FCA geometry between the START and END times is considered to be in the FCA. If filters are defined, only flights that meet those filters are considered to be in the FCA.

[12]An ANY filter container may contain multiple filters. When applying the filters, any flight intersecting the FCA that meets any one or more of the filters in the ANY container is considered to be in the FCA. For example, if ANY contains filters for BOS departures and LGA arrivals, the flight list would include all flights departing BOS plus all flights arriving LGA.

[13]An ALL filter container may contain multiple filters. When applying the filters, a flight intersecting the FCA must meet every filter in the ALL container to be considered in the FCA. For example, if ALL contains filters for BOS departures and LGA arrivals, the flight list would include only those flights that are flying from BOS to LGA.

[14]The inclusion of the individual filter tags in either the ALL or ANY container is optional. For example, the DEPARTS_ANY tag may appear in an ALL container or may be omitted. If any filter type is omitted, the meaning is that no filtering for that criterion is to be applied. For example, if DEPARTS_ANY is omitted from either an ANY or ALL container, no flight should be excluded due to its departure location.

CTOP FCA Flight List Request [305]

- Message Type: [305]
- Message Time: [Unix time, optional]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-6.

Table 5- 6. CTOP FCA Flight List Request XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_INPUT	1	1	Y	None	Container for the message data sent to TFMS from the FOS client <FOS_INPUT> Data </FOS_INPUT>
FCA_FLT_LIST_REQ	2	1	Y	FOS_INPUT	Container to identify this specific message type <FCA_FLT_LIST_REQ>

Tag	Lev	#	Req ?	Parent	Description
					Data </FCA_FLT_LIST_REQ>
FCA_ID	3	1	Y	FCA-FLT_LIST_REQ	System-generated unique identifier of the requested FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>

CTOP FCA Flight List Reply [306]

This message is for a good reply only. If there is an error, TFMS returns a CTOP FCA Request Error message.

- Message Type: [306]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP FCA Flight List Request]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-7.

Table 5-7. CTOP FCA Flight List Reply XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
FCA_FLIGHT_LIST	2	1	Y	FOS_OUTPUT	Container for the FCA for which the flight list was requested. Example: <FCA_FLIGHT_LIST> data </FCA_FLIGHT_LIST>
FCA_ID	3	1	Y	FCA_FLIGHT_LIST	System-generated unique identifier of FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_NAME	3	1	Y	FCA_FLIGHT_LIST	Name of FCA as created by the traffic management specialist. Example: <FCA_NAME>FCA007<FCA_NAME>

Tag	Lev	#	Req ?	Parent	Description
LASTUPDATE	3	1	Y	FCA_FLIGHT_LIST	Date and time the FCA was last updated. Example: <LASTUPDATE>200211071016</LASTUPDATE>
FLIGHT_LIST[1]	3	1	Y	FCA_FLIGHT_LIST	Container for the requested flight list. Example: <FLIGHT_LIST> data </FLIGHT_LIST>
FLIGHT	4	1+	N	FLIGHT_LIST	Container for a flight. Example: <FLIGHT> data </FLIGHT>
ACID	5	1	Y*	FLIGHT	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	5	1	Y*	FLIGHT	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	5	1	Y*	FLIGHT	Destination airport. Example: <DEST>ORD</DEST>
IGTD	5	1	Y*	FLIGHT	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>

[1]It is possible for there to be no flights in the specified CTOP FCA. In this case the reply comes back with an empty flight list; that is:

<FLIGHT_LIST>

</FLIGHT_LIST>

CTOP FCA Request Error [307]

This message is used when a CTOP FCA requested in either a Re-synch Request or Flight List Request cannot be found.

- Message Type: [307]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP FCA Request]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-8.

Table 5-8. CTOP FCA Request Error XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS <FOS_OUTPUT> Data </FOS_OUTPUT>
FCA_ERROR	2	1	Y	FOS_OUTPUT	Container for the FCA request error response. Example: <FCA_ERROR> data </FCA_ERROR>
FCA_ID	3	1	Y	FCA_ERROR	System-generated unique identifier of the requested FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_NAME	3	1	N	FCA_ERROR	Name of FCA as created by the traffic management specialist. Example: <FCA_NAME>FCA007</FCA_NAME>
LASTUPDATE	3	1	N	FCA_ERROR	Date and time the FCA was last updated. Example: <LASTUPDATE>200211071016</LASTUPDATE>
ERROR	3	1	Y	FCA_ERROR	Container for one error code/text <ERROR> data </ERROR>
ERROR_CODE[1]	4	1	Y	ERROR	System-generated error code. Example: <ERROR_CODE>706</ERROR_CODE>
ERROR_TEXT[1]	4	1	Y	ERROR	Text explaining the reason for the error. Example: <ERROR_TEXT>Requested FCA does not exist.</ERROR_TEXT>

[1]Sample error codes and text are provided in Appendix B.

CTOP FCA Delete [308]

- Message Type: [308]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [size of compressed XML message]

- Data Buffer Format: See Table 5-9.

Table 5-9. CTOP FCA Delete XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
FCA_DELETE_ BROADCAST	2	1	Y	FOS_OUTPUT	Container to identify this specific message type <FCA_DELETE_BROADCAST> Data </FCA_DELETE_BROADCAST>
FCA_ID	3	1	Y	FCA_DELETE _BROADCAST	System-generated unique identifier of the requested FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>

5.3.3 CTOP Trajectory Message Formats

CTOP TOS Message [320]

- Message Type: [320]
- Message Time: [Unix time, optional]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-10.

Table 5-10. CTOP TOS Message XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.

Tag	Lev	#	Req ?	Parent	Description
FOS_INPUT	1	1	Y	None	Container for the message data sent to TFMS from the FOS client <FOS_INPUT> Data </FOS_INPUT>
TOS_MESSAGE	2	1	Y	FOS_INPUT	Container to identify this specific message type <TOS_MESSAGE> Data </TOS_MESSAGE>
UNIQUE_FLT_ID_DATA	3	1	Y	TOS_ MESSAGE	Container for the flight identification data. Example: <UNIQUE_FLT_ID_DATA> data </ UNIQUE_FLT_ID_DATA>
ACID[1]	4	1	Y	UNIQUE_FLT _ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG[1]	4	1	Y	UNIQUE_FLT _ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST[1]	4	1	Y	UNIQUE_FLT _ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD[1]	4	1	Y	UNIQUE_FLT _ID_DATA	Initial gate time of departure. Example: <IGTD>200211071016</IGTD>
TOS_SEQ_NO[2]	3	1	Y	TOS_ MESSAGE	The TOS sequence number for this TOS submission for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
TYPE	3	1	Y	TOS_ MESSAGE	Aircraft type. Example: <TYPE>B757</TYPE>
ERTD[3]	3	1	N	TOS_ MESSAGE	Earliest Runway Time of Departure (ERTD) – the earliest date and time the flight can depart even if the constraint is lifted. Example: <ERTD>200912291551</ERTD>
TRAJ_OPTION_LIST	3	1	Y	TOS_ MESSAGE	Container for the trajectory option list. Example: <TRAJ_OPTION_LIST> data </TRAJ_OPTION_LIST>
TRAJ_OPTION[5]	4	1+	Y	TRAJ_OPTION _LIST	Container for a single trajectory option for this flight. Example: <TRAJ_OPTION> data </TRAJ_OPTION>
TRAJ_INDEX[6]	5	1	Y	TRAJ_OPTION	Index used to differentiate the trajectory options for the purpose of generating replies. Example: <TRAJ_INDEX>1</TRAJ_INDEX>

Tag	Lev	#	Req ?	Parent	Description
REL_TRAJ_COST[7]	5	1	N	TRAJ_OPTION	Relative trajectory cost – the relative cost of one trajectory as compared to another for this flight expressed in minutes of delay. Example: <REL_TRAJ_COST>30</REL_TRAJ_COST>
RTE_MIN_NOTIF_ TIME[8]	5	1	N	TRAJ_OPTION	Route minimum notification time – the minimum amount of notice prior to departure time for the flight to switch to this trajectory. Example: <RTE_MIN_NOTIF_TIME>30</RTE_MIN_NOTIF_TIME>
TRAJ_VALID_START[9]	5	1	N	TRAJ_OPTION	Trajectory valid start time – the earliest departure time for which this trajectory can be used by this flight. Example: <TRAJ_VALID_START>200912291551 </TRAJ_VALID_START>
TRAJ_VALID_END[10]	5	1	N	TRAJ_OPTION	Trajectory valid end time – the latest departure time for which this trajectory can be used by this flight. Example: <TRAJ_VALID_END>200912291551 </TRAJ_VALID_END>
ROUTE[11]	5	1	Y	TRAJ_OPTION	The route of flight as it would be submitted on a flight plan in ICAO format. Example: <ROUTE>GRABE2 OKM J181 EOS/N0478F350 J181 BAILI BENKY1</ROUTE>
ALT	5	1	Y	TRAJ_OPTION	The requested cruising altitude is it would be submitted on a flight plan. Example: <ALT>F330</ALT>
SPEED	5	1	Y	TRAJ_OPTION	The requested cruising speed is it would be submitted on a flight plan. Example: <SPEED>N0478</SPEED>

Notes:

[1]TFMS accepts a TOS only if the flight already exists in its database. The ACID, ORIG, DEST, and IGTD are used to match the TOS with the existing entry.

[2]The TOS_SEQ_NO is a unique number for this flight. It is included on every TFMS message that is based on the TOS data to allow the FOS to verify that an update is based on the latest TOS.

[3]If the ERTD is omitted, TFMS uses the last ERTD submitted on a CDM message, if any. If no ERTD has been provided, TFMS follows the same order of precedence as for GDPs.

[4]Previously existing footnote was removed.

[5]The message may contain multiple trajectory options. At least one option must have an unbounded end time(that is, have no TRAJ_END_TIME value), at least one option must have an unbounded start time, and there may be no gaps in time when there is not a valid option (for example, a 2-option TOS where one option has an unbounded start but ends at 0900, and the other option starts at 1000 and has an unbounded end, would not be acceptable because of the gap when there is no option between 0900 and 1000. . NOTE: This validation will not be supported in the first phase of CTOP implementation, but will be supported in the second release.) If TFMS finds an error with a trajectory option, it still accepts the message as long as the accepted trajectory options meet the criteria for a valid TOS.

[6]The trajectory index (TRAJ_INDEX) helps the FOS associate replies with the TOS message. The options in a TOS should be given indexes of 1, 2, 3 etc. to make them unique within the flight. If TFMS rejects one of the options, the index is provided to help the FOS identify which option had the error. In addition, the trajectory index will be used as a tie breaker when two or more valid options have the same adjusted cost.

[7]The relative trajectory cost (RTC) is used by the flight operator to specify how much it prefers one trajectory over another for this flight. TFMS determines a trajectory assignment by first figuring out how much departure delay would be required for the flight to use each trajectory option, and then picking the option that has the least cost (sum of departure delay plus RTC). This may be best understood by an example. Consider that the flight operator provides two trajectory options. The most efficient trajectory has an RTC of zero. The other, less efficient trajectory has an RTC of 30. This tells the CTOP algorithm that it should use the first trajectory unless it requires more than 30 minutes additional delay over the second trajectory. If the CTOP algorithm determines that 40 minutes delay is needed to use the first trajectory while no delay is needed to take the second trajectory, the CTOP algorithm assigns the second trajectory as its combined cost (30+0) is less than that for the first trajectory (0+40). Note that if no trajectory has been assigned by a CTOP, TFMS models the flight using the lowest cost trajectory. That is, TFMS assumes that this is the flight operator's most preferred trajectory and therefore the one it uses if no constraint is applied. If no RTC is provided for a trajectory option, TFMS assumes RTC is 0 for that option.

[8]If the RTE_MIN_NOTIF_TIME is omitted, the CTOP assumes that the trajectory can be assigned regardless of the amount of notification time available.

[9]If the TRAJ_VALID_START is omitted, the CTOP assumes that the trajectory can be assigned for any departure time as early as the original planned departure time.

[10]If the TRAJ_VALID_END is omitted, the CTOP assumes that the trajectory can be used no matter how late a departure time is assigned.

[11]A route must be "parsable" by TFMS; that is, TFMS must be able to perform route conversion to derive waypoints and other data from the route text.

CTOP TOS Reply [321]

- Message Type: [321]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP TOS Message]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-11.

Table 5-11. CTOP TOS Reply XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.

Tag	Lev	#	Req ?	Parent	Description
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
TOS_REPLY	2	1	Y	FOS_OUTPUT	Container for the reply to the TOS message. Example: <TOS_REPLY> data </TOS_REPLY>
UNIQUE_FLT_ID_DATA	3	1	Y	TOS_ REPLY	Container for the flight identification data. Example: < UNIQUE_FLT_ID_DATA > data </ UNIQUE_FLT_ID_DATA>
ACID	4	1	Y	UNIQUE_FLT _ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	4	1	Y	UNIQUE_FLT _ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	4	1	Y	UNIQUE_FLT _ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD	4	1	Y	UNIQUE_FLT _ID_DATA	Initial gate time of departure. Example: <IGTD>200211071016</IGTD>
TOS_SEQ_NO[1]	3	1	Y	TOS_REPLY	The TOS sequence number for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>

[1]The TOS_SEQ_NO in the reply contains the value from the TOS message.

CTOP TOS Error [322]

- Message Type: [322]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP TOS Message]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-12.

Table 5-12. CTOP TOS Error XML Format

Tag	Lev	#	Req ?	Parent	Description

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
TOS_ERROR_REPLY	2	1	Y	FOS_OUTPUT	Container to identify this specific message type <TOS_ERROR_REPLY> Data </TOS_ERROR_REPLY>
UNIQUE_FLT_ID_DATA	3	1	Y	TOS_ERROR_ REPLY	Container for the flight identification data. Example: < UNIQUE_FLT_ID_DATA > data </ UNIQUE_FLT_ID_DATA>
ACID	4	1	Y	UNIQUE_FLT _ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	4	1	Y	UNIQUE_FLT _ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	4	1	Y	UNIQUE_FLT _ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD	4	1	Y	UNIQUE_FLT _ID_DATA	Initial gate time of departure. Example: <IGTD>200211071016</IGTD>
TOS_SEQ_NO[1]	3	1	Y	TOS_ERROR_ REPLY	The TOS sequence number for this TOS submission for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
RESULT[2]	3	1	Y	TOS_ERROR_ REPLY	Indicates whether this was a full rejection or a partial rejection. Example: <RESULT>REJECT</RESULT>
ERROR_LIST	3	1	N	TOS_ERROR_ REPLY	Container for repeating errors <ERROR_LIST> data </ERROR_LIST>
ERROR	4	1+	Y*	ERROR_LIST	Container for one error code/text. <ERROR> data </ERROR>
ERROR_CODE[3,4]	5	1	Y*	ERROR	System-generated error code. Example: <ERROR_CODE>526</ERROR_CODE>
ERROR_TEXT[3,4]	5	1	Y*	ERROR	Text explaining the reason for the error. Example: <ERROR_TEXT>REQUESTED FLIGHT NOT FOUND</ERROR_TEXT>

Tag	Lev	#	Req ?	Parent	Description
TRAJ_OPTION_LIST	3	1	N	TOS_ERROR_ REPLY	Container for the trajectory option list. Example: <TRAJ_OPTION_LIST> data </TRAJ_OPTION_LIST>
TRAJ_OPTION[5]	4	1+	Y*	TRAJ_OPTION _LIST	Container for a single trajectory option for this flight. Example: <TRAJ_OPTION> data </TRAJ_OPTION>
TRAJ_INDEX[6]	5	1	Y*	TRAJ_OPTION	Index used to differentiate the trajectory options for the purpose of generating replies. Example: <TRAJ_INDEX>1</TRAJ_INDEX>
ERROR_LIST	5	1	Y*	TRAJ_OPTION	Container for repeating errors <ERROR_LIST> data </ERROR_LIST>
ERROR	6	1+	Y*	ERROR_LIST	Container for one error code/text <ERROR> data </ERROR>
ERROR_CODE[4,7]	7	1	Y*	ERROR	System-generated error code. Example: <ERROR_CODE>317</ERROR_CODE>
ERROR_TEXT[4,7]	7	1	Y*	ERROR	Text explaining the reason for the error. Example: <ERROR_TEXT>VALID END TIME IS IN THE PAST</ERROR_TEXT>

[1]The TOS_SEQ_NO in the reply contains the value from the TOS message.

[2]If the value of RESULT is “PARTIAL_ACCEPT”, then the TOS was used by TFMS to replace the previous TOS. However, only some of trajectory options were accepted. Those that were rejected are included in the error reply. If the RESULT is “REJECT”, the entire TOS was rejected and the TFMS database was not changed.

[3]ERROR_CODE and ERROR_TEXT can only exist at level 2 if the entire message was rejected (RESULT = REJECT).

[4]Sample error codes and text are provided in Appendix B.

[5]TRAJ_OPTION containers appear only for any trajectories that are rejected by TFMS. The value of RESULT in this case could be either REJECT or PARTIAL_ACCEPT.

[6]The trajectory index (TRAJ_INDEX) helps the FOS associate replies with the TOS message.

[7]The existence of the error code and text is required for a TRAJ_OPTION container.

CTOP TOS Re-synch Request [323]

- Message Type: [323]
- Message Time: [Unix time, optional]

- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-13.

Table 5-13. CTOP TOS Re-synch Request XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_INPUT	1	1	Y	None	Container for the message data sent to TFMS from the FOS client <FOS_INPUT> Data </FOS_INPUT>
TOS_REQ	2	1	Y	FOS_INPUT	Container for the data defining the flight being requested. Example: <TOS_REQ> data </TOS_REQ>
ACID	3	1	Y	TOS_REQ	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	3	1	Y	TOS_REQ	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	3	1	Y	TOS_REQ	Destination airport. Example: <DEST>ORD</DEST>
IGTD	3	1	Y	TOS_REQ	Initial gate time of departure. Example: <IGTD>200211071016</IGTD>

CTOP TOS Re-synch Reply [324]

This message only used for a good reply.

- Message Type: [324]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP TOS Re-synch Request]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-14.

Table 5-14. CTOP TOS Re-synch Reply XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. < FOS_OUTPUT> Data </ FOS_OUTPUT>
TOS_RESYNCH_REPLY	2	1	Y	FOS_OUTPUT	Container to identify this specific message type < TOS_RESYNCH_REPLY> Data </ TOS_RESYNCH_REPLY>
UNIQUE_FLT_ID_DATA	3	1	Y	TOS_ RESYNCH_ REPLY	Container for the flight identification data. Example: < UNIQUE_FLT_ID_DATA> data </ UNIQUE_FLT_ID_DATA>
ACID[1]	4	1	Y	UNIQUE_FLT _ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG[1]	4	1	Y	UNIQUE_FLT _ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST[1]	4	1	Y	UNIQUE_FLT _ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD[1]	4	1	Y	UNIQUE_FLT _ID_DATA	Initial gate time of departure. Example: <IGTD>200211071016</IGTD>
TOS_SEQ_NO[2]	3	1	Y	TOS_ RESYNCH_ REPLY	The TOS sequence number for this TOS submission for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
TYPE	3	1	Y	TOS_ RESYNCH_ REPLY	Aircraft type. Example: <TYPE>B757</TYPE>
ERTD[3]	3	1	N	TOS_ RESYNCH_ REPLY	Earliest Runway Time of Departure (ERTD) – the earliest date and time the flight can depart even if the constraint is lifted. Example: <ERTD>200912291551</ERTD>
TRAJ_OPTION_LIST	3	1	Y	TOS_ RESYNCH_ REPLY	Container for the trajectory option list. Example: <TRAJ_OPTION_LIST> data </TRAJ_OPTION_LIST>

Tag	Lev	#	Req ?	Parent	Description
TRAJ_OPTION[5]	4	1+	Y	TRAJ_OPTION _LIST	Container for a single trajectory option for this flight. Example: <TRAJ_OPTION> data </TRAJ_OPTION>
TRAJ_INDEX[6]	5	1	Y	TRAJ_OPTION	Index used to differentiate the trajectory options for the purpose of generating replies. Example: <TRAJ_INDEX>1</TRAJ_INDEX>
REL_TRAJ_COST[7]	5	1	N	TRAJ_OPTION	Relative trajectory cost – the relative cost of one trajectory as compared to another for this flight expressed in minutes of delay. Example: <REL_TRAJ_COST>30</REL_TRAJ_COST>
RTE_MIN_NOTIF_ TIME[8]	5	1	N	TRAJ_OPTION	Route minimum notification time – the minimum amount of notice prior to departure time for the flight to switch to this trajectory. Example: <RTE_MIN_NOTIF_TIME>30</RTE_MIN_NOTIF_TIME>
TRAJ_VALID_START[9]	5	1	N	TRAJ_OPTION	Trajectory valid start time – the earliest departure time for which this trajectory can be used by this flight. Example: <TRAJ_VALID_START>200912291551 </TRAJ_VALID_START>
TRAJ_VALID_END[10]	5	1	N	TRAJ_OPTION	Trajectory valid end time – the latest departure time for which this trajectory can be used by this flight. Example: <TRAJ_VALID_END>200912291551 </TRAJ_VALID_END>
ROUTE[11]	5	1	Y	TRAJ_OPTION	The route of flight as it would be submitted on a flight plan in ICAO format. Example: <ROUTE>GRABE2 OKM J181 EOS/N0478F350 J181 BAILI BENKY1</ROUTE>
ALT	5	1	Y	TRAJ_OPTION	The requested cruising altitude is it would be submitted on a flight plan. Example: <ALT>F330</ALT>
SPEED	5	1	Y	TRAJ_OPTION	The requested cruising speed is it would be submitted on a flight plan. Example: <SPEED>N0478</SPEED>

Notes:

[1]TFMS accepts a TOS only if the flight already exists in its database. The ACID, ORIG, DEST, and IGTD are used to match the TOS with the existing entry.

[2]The TOS_SEQ_NO is a unique number for this flight. It is included on every TFMS message that is based on the TOS data to allow the FOS to verify that an update is based on the latest TOS.

[3]If the ERTD is omitted, TFMS uses the last ERTD submitted on a CDM message, if any. If no ERTD has been provided, TFMS follows the same order of precedence as for GDPs.

[4]Previously existing footnote was removed.

[5]The message may contain multiple trajectory options. At least one option must have an unbounded end time(that is, have no TRAJ_END_TIME value), at least one option must have an

unbounded start time, and there may be no gaps in time when there is not a valid option (for example, a 2-option TOS where one option has an unbounded start but ends at 0900, and the other option starts at 1000 and has an unbounded end, would not be acceptable because of the gap when there is no option between 0900 and 1000. . NOTE: This validation will not be supported in the first phase of CTOP implementation, but will be supported in the second release). If TFMS finds an error with a trajectory option, it still accepts the message as long as the accepted trajectory options meet the criteria for a valid TOS.

[6]The trajectory index (TRAJ_INDEX) helps the FOS associate replies with the TOS message. The options in a TOS should be given indexes of 1, 2, 3 etc. to make them unique within the flight. If TFMS rejects one of the options, the index is provided to help the FOS identify which option had the error. In addition, the trajectory index will be used as a tie breaker when two or more valid options have the same adjusted cost.

[7]The relative trajectory cost (RTC) is used by the flight operator to specify how much it prefers one trajectory over another for this flight. TFMS determines a trajectory assignment by first figuring out how much departure delay would be required for the flight to use each trajectory option, and then picking the option that has the least cost (sum of departure delay plus RTC). This may be best understood by an example. Consider that the flight operator provides two trajectory options. The most efficient trajectory has an RTC of zero. The other, less efficient trajectory has an RTC of 30. This tells the CTOP algorithm that it should use the first trajectory unless it requires more than 30 minutes additional delay over the second trajectory. If the CTOP algorithm determines that 40 minutes delay is needed to use the first trajectory while no delay is needed to take the second trajectory, the CTOP algorithm assigns the second trajectory as its combined cost (30+0) is less than that for the first trajectory (0+40). Note that if no trajectory has been assigned by a CTOP, TFMS models the flight using the lowest cost trajectory. That is, TFMS assumes that this is the flight operator's most preferred trajectory and therefore the one it uses if no constraint is applied. If no RTC is provided for a trajectory option, TFMS assumes RTC is 0 for that option.

[8]If the RTE_MIN_NOTIF_TIME is omitted, the TFMS assumes that the trajectory can be assigned regardless of the amount of notification time available.

[9]If the TRAJ_VALID_START is omitted, the TFMS assumes that the trajectory can be assigned for any departure time as early as the original planned departure time.

[10]If the TRAJ_VALID_END is omitted, the TFMS assumes that the trajectory can be used no matter how late a departure time is assigned.

[11]A route must be "parsable" by TFMS; that is, TFMS must be able to perform route conversion to derive waypoints and other data from the route text.

CTOP TOS Re-synch Error [325]

This message only used for an error reply.

- Message Type: [325]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP TOS Re-synch Request]
- Data Buffer Length: [size of compressed XML message]

- Data Buffer Format: See Table 5-15.

Table 5-15. CTOP TOS Re-synch Error XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
TOS_RESYNCH_ERROR	2	1	Y	FOS_OUTPUT	Container to identify this specific message type <TOS_RESYNCH_ERROR> Data </TOS_RESYNCH_ERROR>
UNIQUE_FLT_ID_DATA	3	1	Y	TOS_ RESYNCH_ ERROR	Container for the flight identification data. Example: < UNIQUE_FLT_ID_DATA> data </ UNIQUE_FLT_ID_DATA>
ACID	4	1	Y	UNIQUE_FLT _ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	4	1	Y	UNIQUE_FLT _ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	4	1	Y	UNIQUE_FLT _ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD	4	1	Y	UNIQUE_FLT _ID_DATA	Initial gate time of departure. Example: <IGTD>200211071016</IGTD>
TOS_SEQ_NO	3	1	N	TOS_ RESYNCH_ ERROR	The TOS sequence number of the TOS submission to which the error message applies. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
ERROR_LIST	3	1	Y	TOS_ RESYNCH_ ERROR	Container for repeating errors <ERROR_LIST> data </ERROR_LIST>
ERROR	4	1+	Y	ERROR_LIST	Container for a single error code and text <ERROR> data </ERROR>
ERROR_CODE[1]	5	1	Y	ERROR	System-generated error code.[1] Example: <ERROR_CODE>286</ERROR_CODE>

Tag	Lev	#	Req ?	Parent	Description
ERROR_TEXT[1]	5	1	Y	ERROR	Text explaining the reason for the error.[1] Example: <ERROR_TEXT>REQUESTED FLIGHT DOES NOT EXIST</ERROR_TEXT>

[1]Sample error codes and text are provided in Appendix B.

5.3.4 CTOP TMI Message Formats

CTOP TMI [330]

- Message Type: [330]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-16.

Table 5-16. CTOP TMI Message XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
CTOP_TMI_ BROADCAST[1]	2	1	Y	FOS_OUTPUT	Container to identify this specific message type <CTOP_TMI_BROADCAST> Data </CTOP_TMI_BROADCAST>
CTOP_NAME	3	1	Y	CTOP_TMI_ BROADCAST	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[18]	3	1	Y	CTOP_TMI_ BROADCAST	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>
LASTUPDATE[2]	3	1	Y	CTOP_TMI_ BROADCAST	Date and time the CTOP was last updated. Example: <LASTUPDATE>200211071016</LASTUPDATE>
CTOP_RANK	3	1	Y	CTOP_TMI_	Numerical ranking indicating the precedence level of this CTOP relative to other CTOPs. Example:

Tag	Lev	#	Req ?	Parent	Description
				BROADCAST	<CTOP_RANK>3</CTOP_RANK>
TMI_STATUS	3	1	Y	CTOP_TMI_ BROADCAST	Indicates whether the CTOP is proposed or actual. Example: <TMI_STATUS>ACTUAL</TMI_STATUS>
REFRESH_INTERVAL[3]	3	1	N	CTOP_TMI_ BROADCAST	Defines how often TFMS checks the FCA bin triggers. Example: <REFRESH_INTERVAL>5</REFRESH_INTERVAL>
AUTO_REVISION	3	1	Y	CTOP_TMI_ BROADCAST	Defines whether automatic revision is enabled for the CTOP. <AUTO_REVISION>TRUE</AUTO_REVISION>
AR_FIRST_TIME_BIN	3	1	N	CTOP_TMI_ BROADCAST	The start time of the first time bin to which auto-revision will be applied. Present only if AUTO-REVISION is TRUE. <AR_FIRST_TIME_BIN>201109171015</AR_FIRST_TIME_BIN>
AR_LAST_TIME_BIN	3	1	N	CTOP_TMI_ BROADCAST	The start time of the last time bin to which auto-revision will be applied. Present only if AUTO-REVISION is TRUE. <AR_LAST_TIME_BIN>201109171215</AR_LAST_TIME_BIN>
SMOOTHING_FACTOR[3]	3	1	Y	CTOP_TMI_ BROADCAST	Defines the number of time bins over which the CTOP algorithm should smooth. Example: <SMOOTHING_FACTOR>3</SMOOTHING_FACTOR>
EXEMPT_CRITERIA	3	1	Y	CTOP_TMI_ BROADCAST	Container for holding the exemption criteria. Example: <EXEMPT_CRITERIA> data </EXEMPT_CRITERIA>
ACTIVE	4	1	Y	EXEMPT_ CRITERIA	Indicates whether active flights are exempt. Example: <ACTIVE>TRUE</ACTIVE>
INTERNATIONAL	4	1	Y	EXEMPT_ CRITERIA	Indicates whether international flights are exempt. Example: <INTERNATIONAL>TRUE</INTERNATIONAL>
ACID_ANY	4	1	N	EXEMPT_ CRITERIA	List of exempt ACIDs. If none, omit this tag. Example: <ACID_ANY>AAL123 UAL456</ACID_ANY>
ARRIVES_ANY	4	1	N	EXEMPT_ CRITERIA	List of exempt arrival centers and/or airports. If none, omit this tag. Example: <ARRIVES_ANY>BOS ZNY</ARRIVES_ANY>
DEPARTS_ANY	4	1	N	EXEMPT_ CRITERIA	List of exempt departure centers and/or airports. If none, omit this tag. Example: <DEPARTS_ANY>ZLA ZSEA SLC</DEPARTS_ANY>
EXEMPT_BY_TIME	4	1	N	EXEMPT_ CRITERIA	Flights whose ETD is earlier than the current time plus this value when the program is issued or revised are exempt. Example: <EXEMPT_BY_TIME>45</EXEMPT_BY_TIME>
POPUP_DELAY_LIMIT	3	1	Y	CTOP_TMI_ BROADCAST	When a flight first pops up in a CTOP, TFMS will attempt to find an available slot for the flight without exceeding the popup delay limit, and otherwise will assign the delay limit amount of delay to the flight. The popup delay limit is expressed in minutes. Example: <POPUP_DELAY_LIMIT>180</POPUP_DELAY_LIMIT>

Tag	Lev	#	Req ?	Parent	Description
FCA_LIST	3	1	Y	CTOP_TMI_ BROADCAST	Container for the list of FCAs that are part of this CTOP. Example: <FCA_LIST> data </FCA_LIST>
FCA	4	1+	Y	FCA_LIST	Container for an FCA. Example: <FCA> data </FCA>
FCA_ID	5	1	Y	FCA	System-generated unique identifier of FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_NAME	5	1	Y	FCA	Name of FCA as created by the traffic management specialist. Example: <FCA_NAME>FCA007<FCA_NAME>
LASTUPDATE	5	1	Y	FCA	Date and time the FCA was last updated. Example: <LASTUPDATE>200211071016</LASTUPDATE>
ROLLING[3]	5	1	N	FCA	Indicates whether the set of time bins defined for automatic revision and the trigger values for this FCA are absolute or relative to the current time. Example: <ROLLING>FALSE</ROLLING>
FCA_BIN_SIZE	5	1	Y	FCA	The size of the FCA time bins, in minutes. Example: <FCA_BIN_SIZE>15</FCA_BIN_SIZE>
FCA_BIN_LIST	5	1	Y	FCA	Container for the repeating time bins. <FCA_BIN_LIST> data </FCA_BIN_LIST>
FCA_BIN	6	1+	Y	FCA_BIN_LIS T	Container for a time bin for the FCA that is part of the CTOP. Time bins are 15-minutes long. Example: <FCA_BIN> data </FCA_BIN>
FCA_BIN_TIME	7	1	Y	FCA_BIN	Start time of the bin. Example: <FCA_BIN_TIME>201911071815</FCA_BIN_TIME>
FCA_BIN_CAPACITY	7	1	Y	FCA_BIN	Capacity for this time bin. Example: <FCA_BIN_CAPACITY>32</FCA_BIN_CAPACITY>
FCA_BIN_ CONTROLLED	7	1	Y	FCA_BIN	Indicates whether the time bin is being actively controlled by the CTOP allocation algorithm. Example: <FCA_BIN_CONTROLLED>TRUE</FCA_BIN_CONTRO LLED>
FCA_BIN_AUTO_ REVISION[3]	7	1	N	FCA_BIN	Defines whether a time bin is governed by automatic revision. <FCA_BIN_AUTO_REVISION>TRUE</FCA_BIN_AUTO _REVISION>
FCA_BIN_HIGH_ TRIGGER[3]	7	1	N	FCA_BIN	The amount above or below capacity that will trigger an automatic revision.

Tag	Lev	#	Req ?	Parent	Description
					Example: <FCA_BIN_HIGH_TRIGGER>5</FCA_BIN_HIGH_TRIGGER>
FCA_BIN_LOW_TRIGGER[3]	7	1	N	FCA_BIN	The amount above or below capacity that will trigger an automatic revision. Example: <FCA_BIN_LOW_TRIGGER>5</FCA_BIN_LOW_TRIGGER>
FLIGHT_LIST[4]	3	1	N	CTOP_TMI_BROADCAST	Container for the flight list of impacted flights. Example: <FLIGHT_LIST> data </FLIGHT_LIST>
FLIGHT	4	1+	Y	FLIGHT_LIST	Container for a trajectory assignment for a single flight. Example: <FLIGHT> data </FLIGHT>
UNIQUE_FLT_ID_DATA	5	1	Y	FLIGHT	Container for flight identification data. <UNIQUE_FLT_ID_DATA> data </UNIQUE_FLT_ID_DATA>
ACID	6	1	Y	UNIQUE_FLT_ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	6	1	Y	UNIQUE_FLT_ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	6	1	Y	UNIQUE_FLT_ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD	6	1	Y	UNIQUE_FLT_ID_DATA	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>
ERTD	5	1	N	FLIGHT	Earliest Runway Time of Departure (ERTD) – the earliest date and time the flight can depart even if the constraint is lifted. Example: <ERTD>200912291551</ERTD>
TRAJ_SOURCE	5	1	Y	FLIGHT	Indicates the source of the trajectory data that TFMS used for the trajectory assignment. Example: < TRAJ_SOURCE>TOS</TRAJ_SOURCE>
CTL_EXEMPT	5	1	Y	FLIGHT	Indicates whether the flight was processed as an exempt flight. Example: <CTL_EXEMPT>FALSE</CTL_EXEMPT>
EXEMPT_REASON[5]	5	1	N	FLIGHT	Indicates the reason why a flight was exempt. Example: <EXEMPT_REASON>GDP</EXEMPT_REASON>
CTL_ELEMENT	5	1	Y	FLIGHT	Location Identifier of the airport (for GDPs) or FCA (for AFPs or CTOPs) at which the flight's time is currently being controlled. Example:

Tag	Lev	#	Req ?	Parent	Description
					<CTL_ELEMENT>FCA123</CTL_ELEMENT>
CTL_PRGM	5	1	Y	FLIGHT	The name of the TMI currently controlling the times for a flight, either: the name of an airport for a GDP, the name of the FCA for an AFP or the CTOP_SHORT_NAME for a CTOP. Example: <CTL_PRGM>CTP001</CTL_PRGM>
TOS_SEQ_NO[6]	5	1	N	FLIGHT	The sequence number of the TOS used for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
SLOT[8]	5	1	N	FLIGHT	Name of an assigned slot assigned by this CTOP. Example: <SLOT>FCA001.200911271745A</SLOT> or <SLOT>NOSLOT</SLOT>
CTD[9]	5	1	N	FLIGHT	The controlled date and time of departure for the flight assigned by any TMI. Example: <CTD>201002271745</CTD>
TRAJ_OPTION_LIST[10]	5	1	Y	FLIGHT	Container for the trajectory option list. Example: <TRAJ_OPTION_LIST> data </TRAJ_OPTION_LIST>
TRAJ_OPTION	6	1+	Y	TRAJ_OPTION_LIST	Container for a single trajectory option for this flight. Example: <TRAJ_OPTION> data </TRAJ_OPTION>
TRAJ_INDEX[11]	7	1	N	TRAJ_OPTION	The index for the selected trajectory, as provided in the TOS message. Example: <TRAJ_INDEX>1</TRAJ_INDEX>
ASSIGNED[12]	7	1	Y	TRAJ_OPTION	An indicator of whether this is the assigned trajectory. Example: <ASSIGNED>TRUE</ASSIGNED>
ADJUSTED_COST[13]	7	1	Y	TRAJ_OPTION	The adjusted cost that the flight would incur if this were the assigned trajectory option. Example: <ADJUSTED_COST>25</ADJUSTED_COST>
MANUAL_OVERRIDE[14]	7	1	N	TRAJ_OPTION	Indicates whether the trajectory was assigned manually by a traffic manager. Example: <MANUAL_OVERRIDE>FALSE</MANUAL_OVERRIDE>
REL_TRAJ_COST	7	1	N	TRAJ_OPTION	Relative trajectory cost – the relative cost of one trajectory as compared to another for this flight expressed in minutes of delay. Example: <REL_TRAJ_COST>30</REL_TRAJ_COST>
ROUTE[15]	7	1	N	TRAJ_OPTION	The route of flight assigned by the CTOP in ICAO format. Example: <ROUTE>GRABE2 OKM J181 EOS/N0478F350 J181 BAILI BENKY1</ROUTE>

Tag	Lev	#	Req ?	Parent	Description
ALT[15]	7	1	N	TRAJ_OPTION	The cruising altitude assigned by the CTOP in hundreds of feet. Example: <ALT>F330</ALT>
SPEED[15]	7	1	N	TRAJ_OPTION	The cruising speed assigned by the CTOP in knots. Example: <SPEED>N0478</SPEED>
FCA_LIST[16]	7	1	Y	TRAJ_OPTION	Container for the list of FCAs that are part of this CTOP and are intersected by this trajectory option. Example: <FCA_LIST> data </FCA_LIST>
FCA	8	1+	N	FCA_LIST	Container for an FCA. Example: <FCA> data </FCA>
FCA_ID	8	1	Y*	FCA	System-generated unique identifier of FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_EARLIEST_ENTRY	8	1	Y*	FCA	Earliest time that the flight could enter the FCA on this trajectory option. <FCA_EARLIEST_ENTRY>201003041421 <FCA_EARLIEST_ENTRY>

[1]A CTOP TMI message is sent for either the first issuance of a CTOP or any revision that changes the CTOP parameters.

[2]The LASTUPDATE time is the time the CTOP was issued or revised. This time is used to interpret other CTOP parameters which are relative to the issuance time, such as the EXEMPT_BY_TIME and ROLLING parameters.

[3]Value required only if AUTO_REVISION is true for the CTOP. If ROLLING is TRUE, the bin values of FCA_BIN_HIGH_TRIGGER, FCA_BIN_LOW_TRIGGER, and FCA_BIN_AUTO_REVISION are relative to the current time; that is, as the current time moves from one time bin to the next, these values roll to the next time bin. . (Note that the rolling option will not be supported in the first two phases of CTOP, but may be added in a later release. . Until this capability is added, if this tag is present, its value will always be FALSE.)

[4]When a CTOP TMI message is sent for the first issuance of a program, the message includes a trajectory assignment for every flight impacted by the program. When a CTOP is revised, the message includes only those trajectory assignments that are changed during the revision. If no flights are changed, such as when automated revision is turned off, no flight list is included.

[5]EXEMPT_REASON is included if and only if CTL_EXEMPT is TRUE.

[6]If no TOS has been submitted for this flight, TOS_SEQ_NO is omitted. The TOS_SEQ_NO allows the FOS to check that the CTOP was issued using what the FOS believes is the latest TOS for each flight.

[7]Previously existing footnote was removed.

[8]The format of the slot name consists of FCA name, entry time, and suffix (for example, FCA001.200911271745A). . For the flights whose trajectory avoids the CTOP FCA(s), the slot name indicates “NOSLOT”.

[9]If no CTD is provided, the flight may depart any time using the assigned ROUTE, ALT, and SPEED.

[10]TFMS includes all the current TOS trajectory options as part of the trajectory assignment to provide feedback to the FOS as to why an option was selected or not. One and only one trajectory option has an ASSIGNED value of TRUE. If no TOS has been submitted for the flight, the trajectory option list includes one option containing the trajectory information used by TFMS.

[11]The trajectory index (TRAJ_INDEX) helps the FOS associate the trajectory assignment with the TOS option. If no TOS has been submitted for the flight, TRAJ_INDEX is omitted. If a traffic manager has manually entered a route for a flight, the TRAJ_INDEX is omitted.

[12]If a TOS and/or flight plan have been processed for a flight, one and only one trajectory option has an ASSIGNED value of TRUE. If neither a TOS or flight plan has been processed, there is only one trajectory option and the value of ASSIGNED is FALSE.

[13]ADJUSTED_COST is the total cost that a flight would incur if the CTOP were to assign the flight to a trajectory. The ADJUSTED_COST is the sum of the delay that CTOP would have to give the flight on that trajectory plus the REL_TRAJ_COST of the trajectory. TFMS picks the route with the lowest adjusted cost.

[14]MANUAL_OVERRIDE is meaningful only for the assigned route (ASSIGNED=TRUE). If not present, its assumed value is FALSE. A manually assigned route may be selected manually from the submitted TOS options or may be entered manually by a traffic manager. In the latter case, the TRAJ_OPTION container contains no TRAJ_INDEX.

[15]ROUTE, ALT, and SPEED are required if ASSIGNED=TRUE; otherwise they do not appear.

[16]If the flight would not intersect any FCAs on this trajectory option, the FCA_LIST is empty.

[17]Previously existing footnote was removed.

[18]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Trajectory Assignment [331]

- Message Type: [331]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-17.

Table 5-17. CTOP Trajectory Assignment XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1		None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
TRAJ_ASSIGN_ BROADCAST	2	1	Y	FOS_OUTPUT	Container to identify this specific message type <TRAJ_ASSIGN_BROADCAST> Data </TRAJ_ASSIGN_BROADCAST>
CTOP_NAME	3	1	Y	TRAJ_ASSIGN _BROADCAST	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[15]	3	1	Y	TRAJ_ASSIGN _BROADCAST	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>
FLIGHT_LIST[1]	3	1	Y	TRAJ_ASSIGN _BROADCAST	Container for the flight list of impacted flights with new assignments. Example: <FLIGHT_LIST> data </FLIGHT_LIST>
FLIGHT	4	1+	Y	FLIGHT_LIST	Container for a trajectory assignment for a single flight. Example: <FLIGHT> data </FLIGHT>
UNIQUE_FLT_ID_DATA	5	1	Y	FLIGHT	Container for flight identification data. <UNIQUE_FLT_ID_DATA> data </UNIQUE_FLT_ID_DATA>
ACID	6	1	Y	UNIQUE_FLT _ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	6	1	Y	UNIQUE_FLT _ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	6	1	Y	UNIQUE_FLT _ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD	6	1	Y	UNIQUE_FLT _ID_DATA	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>

Tag	Lev	#	Req ?	Parent	Description
ERTD	5	1	N	FLIGHT	Earliest Runway Time of Departure (ERTD) – the earliest date and time the flight can depart even if the constraint is lifted. Example: <ERTD>200912291551</ERTD>
TRAJ_SOURCE	5	1	Y	FLIGHT	Indicates the source of the trajectory data that TFMS used for the trajectory assignment. Example: < TRAJ_SOURCE>TOS</TRAJ_SOURCE>
CTL_EXEMPT	5	1	Y	FLIGHT	Indicates whether the flight was processed as an exempt flight. Example: <CTL_EXEMPT>FALSE</CTL_EXEMPT>
EXEMPT_REASON[2]	5	1	N	FLIGHT	Indicates the reason why a flight was exempt. Example: <EXEMPT_REASON>GDP</EXEMPT_REASON>
CTL_ELEMENT	5	1	Y	FLIGHT	Location Identifier of the airport (for GDPs) or FCA (for AFPs or CTOPs) at which the flight's time is currently being controlled. Example: <CTL_ELEMENT>FCA123</CTL_ELEMENT>
CTL_PRGM	5	1	Y	FLIGHT	The name of the TMI currently controlling the times for a flight, either: the name of an airport for a GDP, the name of the FCA for an AFP or the CTOP_SHORT_NAME for a CTOP. Example: <CTL_PRGM>CTP001</CTL_PRGM>
TOS_SEQ_NO[3]	5	1	N	FLIGHT	The sequence number of the TOS used for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
SLOT[5]	5	1	N	FLIGHT	Name of an assigned slot assigned by this CTOP. Example: <SLOT>FCA001.200911271745A</SLOT> or <SLOT>NOSLOT</SLOT>
CTD[6]	5	1	N	FLIGHT	The controlled date and time of departure for the flight assigned by any TMI. Example: <CTD>201002271745</CTD>
TRAJ_OPTION_LIST[7]	5	1	Y	FLIGHT	Container for the trajectory option list. Example: <TRAJ_OPTION_LIST> data </TRAJ_OPTION_LIST>
TRAJ_OPTION	6	1+	Y	TRAJ_OPTION _LIST	Container for a single trajectory option for this flight. Example: <TRAJ_OPTION> data </TRAJ_OPTION>
TRAJ_INDEX[8]	7	1	N	TRAJ_OPTION	The index for the selected trajectory, as provided in the TOS message. Example: <TRAJ_INDEX>1</TRAJ_INDEX>
ASSIGNED[9]	7	1	Y	TRAJ_OPTION	An indicator of whether this is the assigned trajectory. Example: <ASSIGNED>TRUE</ASSIGNED>

Tag	Lev	#	Req ?	Parent	Description
ADJUSTED_COST[10]	7	1	Y	TRAJ_OPTION	The adjusted cost that the flight would incur if this were the assigned trajectory option. Example: <ADJUSTED_COST>25</ADJUSTED_COST>
MANUAL_ OVERRIDE[11]	7	1	N	TRAJ_OPTION	Indicates whether the trajectory was assigned due to a manual override by a traffic manager. Example: <MANUAL_OVERRIDE>TRUE</MANUAL_OVERRIDE>
REL_TRAJ_COST	7	1	N	TRAJ_OPTION	Relative trajectory cost – the relative cost of one trajectory as compared to another for this flight expressed in minutes of delay. Example: <REL_TRAJ_COST>30</REL_TRAJ_COST>
ROUTE[12]	7	1	N	TRAJ_OPTION	The route of flight assigned by the CTOP in ICAO format. Example: <ROUTE>GRABE2 OKM J181 EOS/N0478F350 J181 BAILI BENKY1</ROUTE>
ALT[12]	7	1	N	TRAJ_OPTION	The cruising assigned by the CTOP in hundreds of feet. Example: <ALT>F330</ALT>
SPEED[12]	7	1	N	TRAJ_OPTION	The cruising speed assigned by the CTOP in knots. Example: <SPEED>N0478</SPEED>
FCA_LIST[13]	7	1	Y	TRAJ_OPTION	Container for the list of FCAs that are part of this CTOP and are intersected by this trajectory option. Example: <FCA_LIST> data </FCA_LIST>
FCA	8	1+	N	FCA_LIST	Container for an FCA. Example: <FCA> data </FCA>
FCA_ID	9	1	Y*	FCA	System-generated unique identifier of FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_EARLIEST_ENTRY	9	1	Y*	FCA	Earliest time that the flight could enter the FCA on this trajectory option. <FCA_EARLIEST_ENTRY>201003041421 <FCA_EARLIEST_ENTRY>

[1]If the trajectory assignment message is triggered by a TOS update, it contains only one flight. However, if the message is triggered by an automated revision, it may contain many flights.

[2]EXEMPT_REASON is included if and only if CTL_EXEMPT is TRUE.

[3]If no TOS has been submitted for this flight, TOS_SEQ_NO is omitted. The TOS_SEQ_NO allows the FOS to check that the CTOP was issued using what the FOS believes is the latest TOS for each flight.

[4]Previously existing footnote was removed..

[5]The format of the slot name consists of FCA name, entry time, and suffix (for example, FCA001.200911271745A). For the flights whose trajectory avoids the CTOP FCA(s), the slot name indicates "NOSLOT".

[6]If no CTD is provided, the flight may depart any time using the assigned ROUTE, ALT, and SPEED.

[7]TFMS includes all the current TOS trajectory options as part of the trajectory assignment to provide feedback to the FOS as to why an option was selected or not. One and only one trajectory option has an ASSIGNED value of TRUE. If no TOS has been submitted for the flight, the trajectory option list includes one option containing the trajectory information used by TFMS.

[8]The trajectory index (TRAJ_INDEX) helps the FOS associate the trajectory assignment with the TOS option. If no TOS has been submitted for this flight, TRAJ_INDEX is omitted.

[9]If a TOS and/or flight plan have been processed for a flight, one and only one trajectory option has an ASSIGNED value of TRUE. If neither a TOS or flight plan has been processed, there is only one trajectory option and the value of ASSIGNED is FALSE.

[10]The ADJUSTED_COST is the total cost that a flight would incur if the CTOP were to assign the flight to a trajectory. The ADJUSTED_COST is the sum of the delay that CTOP would have to give the flight on that trajectory plus the REL_TRAJ_COST of the trajectory. TFMS picks the route with the lowest adjusted cost.

[11]MANUAL_OVERRIDE is meaningful only for the assigned trajectory (ASSIGNED=TRUE). If not present, its assumed value is FALSE. A manually assigned trajectory may be selected from the submitted TOS options or may be entered manually by a traffic manager. In the latter case, the TRAJ_OPTION container contains no TRAJ_INDEX.

[12]ROUTE, ALT, and SPEED are required if ASSIGNED=TRUE; otherwise they do not appear.

[13]If the flight would not intersect any FCAs on this trajectory option, the FCA_LIST is empty.

[14]Previously existing footnote was removed.

[15]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Pop-up [332]

- Message Type: [332]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-18.

Table 5-18. CTOP Pop-up Message XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
POP_UP	2	1	Y	FOS_OUTPUT	Container for a single pop-up flight. Includes the trajectory assignment. Example: <POP_UP> data </POP_UP>
CTOP_NAME	3	1	Y	POP_UP	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[13]	3	1	Y	POP_UP	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>
UNIQUE_FLT_ID_DATA	3	1	Y	POP_UP	Container for flight identification data. <UNIQUE_FLT_ID_DATA> data </UNIQUE_FLT_ID_DATA>
ACID	4	1	Y	UNIQUE_FLT_ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	4	1	Y	UNIQUE_FLT_ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	4	1	Y	UNIQUE_FLT_ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD	4	1	Y	UNIQUE_FLT_ID_DATA	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>
ERTD	3	1	N	POP_UP	Earliest Runway Time of Departure (ERTD) – the earliest date and time the flight can depart even if the constraint is lifted. Example: <ERTD>200912291551</ERTD>
TRAJ_SOURCE[12]	3	1	N/ Y[12]	POP_UP	Indicates the source of the trajectory data that TFMS used for the trajectory assignment. Example: < TRAJ_SOURCE>TOS</TRAJ_SOURCE>
CTL_EXEMPT[12]	3	1	N/ Y[12]	POP_UP	Indicates whether the flight was processed as an exempt flight. Example: <CTL_EXEMPT>FALSE</CTL_EXEMPT>

Tag	Lev	#	Req ?	Parent	Description
EXEMPT_REASON[1,12]	3	1	N	POP_UP	Indicates the reason why a flight was exempt. Example: <EXEMPT_REASON>GDP</EXEMPT_REASON>
CTL_ELEMENT[12]	3	1	N/ Y[12]	POP_UP	Location Identifier of the airport (for GDPs) or FCA (for AFPs or CTOPs) at which the flight's time is currently being controlled Example: <CTL_ELEMENT>FCA123</CTL_ELEMENT>
CTL_PRGM[12]	3	1	N/ Y[12]	POP_UP	The name of the TMI currently controlling the times for a flight, either: the name of an airport for a GDP, the name of the FCA for an AFP or the CTOP_SHORT_NAME for a CTOP. Example: <CTL_PRGM>CTP001</CTL_PRGM>
TOS_SEQ_NO[2]	3	1	N	POP_UP	The sequence number of the TOS used for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
SLOT[3,12]	3	1	N	POP_UP	Name of an assigned slot assigned by this CTOP. Example: <SLOT>FCA001.200911271745A</SLOT> or <SLOT>NOSLOT</SLOT>
MAX_POPUP_DELAY_ APPLIED[12]	3	1	N/ Y[12]	POP_UP	An indicator of whether the popup delay has been applied to a flight. Example: < MAX_POPUP_DELAY_APPLIED> TRUE </ MAX_POPUP_DELAY_APPLIED>
CTD[4 12]	3	1	N	POP_UP	The controlled date and time of departure for the flight assigned by any TMI. Example: <CTD>201002271745</CTD>
TRAJ_OPTION_LIST[5]	3	1	Y	POP_UP	Container for the trajectory option list. Example: <TRAJ_OPTION_LIST> data </TRAJ_OPTION_LIST>
TRAJ_OPTION	4	1+	Y	TRAJ_OPTION _LIST	Container for a single trajectory option for this flight. Example: <TRAJ_OPTION> data </TRAJ_OPTION>
TRAJ_INDEX[6]	5	1	N	TRAJ_OPTION	The index for the selected trajectory, as provided in the TOS message. Example: <TRAJ_INDEX>1</TRAJ_INDEX>
ASSIGNED[7,12]	5	1	N/ Y[12]	TRAJ_OPTION	An indicator of whether this is the assigned trajectory. Example: <ASSIGNED>TRUE</ASSIGNED>
ADJUSTED_COST[8,12]	5	1	N/ Y[12]	TRAJ_OPTION	The adjusted cost that the flight would incur if this were the assigned trajectory option. Example: <ADJUSTED_COST>25</ADJUSTED_COST>
MANUAL_	5	1	N	TRAJ_OPTION	Indicates whether the trajectory was assigned due to a manual

Tag	Lev	#	Req ?	Parent	Description
OVERRIDE[11,12]					override by a traffic manager. Example: <MANUAL_OVERRIDE>FALSE</MANUAL_OVERRIDE>
REL_TRAJ_COST[12]	5	1	N	TRAJ_OPTION	Relative trajectory cost – the relative cost of one trajectory as compared to another for this flight expressed in minutes of delay. Example: <REL_TRAJ_COST>30</REL_TRAJ_COST>
ROUTE[9,12]	5	1	N	TRAJ_OPTION	The route of flight assigned by the CTOP in ICAO format. Example: <ROUTE>GRABE2 OKM J181 EOS/N0478F350 J181 BAILI BENKY1</ROUTE>
ALT[9,12]	5	1	N	TRAJ_OPTION	The cruising assigned by the CTOP in hundreds of feet. Example: <ALT>F330</ALT>
SPEED[9,12]	5	1	N	TRAJ_OPTION	The cruising speed assigned by the CTOP in knots. Example: <SPEED>N0478</SPEED>
FCA_LIST[10]	5	1	N	TRAJ_OPTION	Container for the list of FCAs that are part of this CTOP and are intersected by this trajectory option. Example: <FCA_LIST> data </FCA_LIST>
FCA	6	1+	N	FCA_LIST	Container for an FCA. Example: <FCA> data </FCA>
FCA_ID	7	1	Y*	FCA	System-generated unique identifier of FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_EARLIEST_ENTRY	7	1	Y*	FCA	Earliest time that the flight could enter the FCA on this trajectory option. <FCA_EARLIEST_ENTRY>201003041421 <FCA_EARLIEST_ENTRY>

[1]EXEMPT_REASON is included if and only if CTL_EXEMPT is TRUE.

[2]If no TOS has been submitted for this flight, TOS_SEQ_NO is omitted. The TOS_SEQ_NO allows the FOS to check that the CTOP was issued using what the FOS believes is the latest TOS for each flight.

[3]A pop-up flight will receive a SLOT assignment only if there is an unallocated slot available such that the delay that would be assigned to the flight to meet that slot time would not exceed a popup delay limit parameter. . If not, the flight gets the popup delay, but does not get a slot assignment (and therefore will not be subbable) until the next time the CTOP is revised.

[4]If no CTD is provided, the flight may depart any time using the assigned ROUTE, ALT, and SPEED.

[5]TFMS includes all the current TOS trajectory options as part of the trajectory assignment to provide feedback to the FOS as to why an option was selected or not. One and only one trajectory

option has an ASSIGNED value of TRUE. If no TOS has been submitted for the flight, the trajectory option list includes one option containing the trajectory information used by TFMS.

[6]The trajectory index (TRAJ_INDEX) helps the FOS associate the trajectory assignment with the TOS option. If no TOS has been submitted for this flight, TRAJ_INDEX is omitted.

[7]If a TOS and/or flight plan have been processed for a flight, one and only one trajectory option has an ASSIGNED value of TRUE. If neither a TOS or flight plan has been processed, there is only one trajectory option and the value of ASSIGNED is FALSE.

[8]ADJUSTED_COST is the total cost that a flight would incur if the CTOP were to assign the flight to a trajectory. The ADJUSTED_COST is the sum of the delay that CTOP would have to give the flight on that trajectory plus the REL_TRAJ_COST of the trajectory. TFMS picks the route with the lowest adjusted cost.

[9]ROUTE, ALT, and SPEED are required if ASSIGNED=TRUE; otherwise they do not appear.

[10]If the flight would not intersect any FCAs on this trajectory option, the FCA_LIST is empty.

[11] The Manual Route field would not normally be set to TRUE in a Pop-up message. It would take a relatively unusual set of operational events to result in a previously manually overridden flight becoming a pop-up in another CTOP. The decision as to whether or not manual overrides should be maintained in the event of a change in CTOP control will be determined during detailed design.

[12]The fields related to trajectory assignment are only included if the flight is receiving a trajectory assignment from this CTOP (as specified in the CTOP_SHORT_NAME field).

[13]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Drop-out [333]

- Message Type: [333]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-19.

Table 5-19. CTOP Drop-out Message XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.

Tag	Lev	#	Req ?	Parent	Description
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
DROP_OUT	2	1	Y	FOS_OUTPUT	Container for a single drop-out flight. Example: <DROP_OUT> data </DROP_OUT>
CTOP_NAME	3	1	Y	DROP_OUT	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[2]	3	1	Y	DROP_OUT	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>
FLIGHT_LIST	3	1	Y	DROP_OUT	Container for the flight list of drop out flights with new assignments. Example: <FLIGHT_LIST> data </FLIGHT_LIST>
FLIGHT	4	1+	Y	FLIGHT_LIST	Container for the flight identification data for a single drop out flight. Example: <FLIGHT> data </FLIGHT>
ACID	5	1	Y	FLIGHT	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	5	1	Y	FLIGHT	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	5	1	Y	FLIGHT	Destination airport. Example: <DEST>ORD</DEST>
IGTD	5	1	Y	FLIGHT	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>
TOS_SEQ_NO[1]	5	1	N	FLIGHT	The sequence number of the TOS currently in use for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>

[1]If no TOS has been submitted for this flight, TOS_SEQ_NO is omitted. The TOS_SEQ_NO allows the FOS to check that the DROP_OUT reflects what the FOS believes is the latest TOS for each flight.

[2]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP List Request [334]

- Message Type: [334]
- Message Time: [Unix time, optional]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-20.

Table 5-20. CTOP ListRequest XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_INPUT	1	1	Y	None	Container for the message data sent to TFMS from the FOS client. <FOS_INPUT> Data </FOS_INPUT>
CTOP_LIST_REQ	2	1	Y	FOS_INPUT	Element to identify this specific message type <CTOP_LIST_REQ/>

CTOP List Reply [335]

- Message Type: [335]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP List Request]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-21.

Table 5-21. CTOP List Reply XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
CTOP_LIST[1]	2	1	Y	FOS_OUTPUT	Container for list of current CTOPs. Example: <CTOP_LIST> data </CTOP_LIST>
CTOP_NAME	3	1+	N	CTOP_LIST	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>

Tag	Lev	#	Req ?	Parent	Description
CTOP_SHORT_NAME[2]	3	1+	N	CTOP_LIST	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>

[1]It is possible for there to be no active CTOPs. In this case the reply comes back as an empty list; that is:

<CTOP_LIST>

</CTOP_LIST>

[2]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Re-synch Request [336]

- Message Type: [336]
- Message Time: [Unix time, optional]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-22.

Table 5-22. CTOP Re-synch Request XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_INPUT	1	1	Y	None	Container for the message data sent to TFMS from the FOS client. <FOS_INPUT> Data </FOS_INPUT>
CTOP_REQ	2	1	Y	FOS_INPUT	Container for the CTOP request. Example: <CTOP_REQ> data </CTOP_REQ>
CTOP_NAME	3	1	Y	CTOP_REQ	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>

Tag	Lev	#	Req ?	Parent	Description
CTOP_SHORT_NAME[1]	3	1	Y	CTOP_REQ	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>

[1]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Re-synch Reply [337]

This message is for a good reply only. If there is an error, TFMS returns a CTOP Re-synch Error reply.

- Message Type: [337]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP Re-synch Request]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5- 23.

Table 5-23. CTOP Resynch Reply XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
CTOP_TMI_RESYNCH_REPLY[1]	2	1	Y	FOS_OUTPUT	Container to identify this specific message type < CTOP_TMI_RESYNCH_REPLY> Data </ CTOP_TMI_RESYNCH_REPLY>
CTOP_NAME	3	1	Y	CTOP_TMI_RESYNCH_REPLY	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[19]	3	1	Y	CTOP_TMI_RESYNCH_REPLY	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>

Tag	Lev	#	Req ?	Parent	Description
LASTUPDATE[2]	3	1	Y	CTOP_TMI_ RESYNCH_ REPLY	Date and time the CTOP was last updated. Example: <LASTUPDATE>200211071016</LASTUPDATE>
CTOP_RANK	3	1	Y	CTOP_TMI_ RESYNCH_ REPLY	Numerical ranking indicating the precedence level of this CTOP relative to other CTOPs. Example: <CTOP_RANK>3</CTOP_RANK>
TMI_STATUS[18]	3	1	Y	CTOP_TMI_ RESYNCH_ REPLY	Indicates the CTOP is-actual. Example: <TMI_STATUS>ACTUAL</CTOP_STATUS>
REFRESH_INTERVAL[3]	3	1	N	CTOP_TMI_ RESYNCH_ REPLY	Defines how often TFMS checks the FCA bin triggers. Example: <REFRESH_INTERVAL>5</REFRESH_INTERVAL>
AUTO_REVISION	3	1	Y	CTOP_TMI_ RESYNCH_ REPLY	Defines whether automatic revision is enabled for the CTOP. <AUTO_REVISION>TRUE</AUTO_REVISION>
AR_FIRST_TIME_BIN	3	1	N	CTOP_TMI_ RESYNCH_ REPLY	The start time of the first time bin to which auto-revision will be applied. Present only if AUTO-REVISION is TRUE. <AR_FIRST_TIME_BIN>201109171015</AR_FIRST_TIME_BIN>
AR_LAST_TIME_BIN	3	1	N	CTOP_TMI_ RESYNCH_ REPLY	The start time of the last time bin to which auto-revision will be applied. Present only if AUTO-REVISION is TRUE. <AR_LAST_TIME_BIN>201109171215</AR_LAST_TIME_BIN>
SMOOTHING_FACTOR[3]	3	1	Y	CTOP_TMI_ RESYNCH_ REPLY	Defines the number of time bins over which the CTOP algorithm should smooth. Example: <SMOOTHING_FACTOR>3</SMOOTHING_FACTOR>
EXEMPT_CRITERIA	3	1	Y	CTOP_TMI_ RESYNCH_ REPLY	Container for holding the exemption criteria. Example: <EXEMPT_CRITERIA> data </EXEMPT_CRITERIA>
ACTIVE	4	1	Y	EXEMPT_ CRITERIA	Indicates whether active flights are exempt. Example: <ACTIVE>TRUE</ACTIVE>
INTERNATIONAL	4	1	Y	EXEMPT_ CRITERIA	Indicates whether international flights are exempt. Example: <INTERNATIONAL>TRUE</INTERNATIONAL>
ACID_ANY	4	1	N	EXEMPT_ CRITERIA	List of exempt ACIDs. If none, omit this tag. Example: <ACID_ANY>AAL123 UAL456</ACID_ANY>
ARRIVES_ANY	4	1	N	EXEMPT_ CRITERIA	List of exempt arrival centers and/or airports. If none, omit this tag. Example: <ARRIVES_ANY>BOS ZNY</ARRIVES_ANY>
DEPARTS_ANY	4	1	N	EXEMPT_ CRITERIA	List of exempt departure centers and/or airports. If none, omit this tag. Example: <DEPARTS_ANY>ZLA ZSEA SLC</DEPARTS_ANY>

Tag	Lev	#	Req ?	Parent	Description
EXEMPT_BY_TIME	4	1	N	EXEMPT_ CRITERIA	Flights whose ETD is earlier than the current time plus this value when the program is issued or revised are exempt. Example: <EXEMPT_BY_TIME>45</EXEMPT_BY_TIME>
POPUP_DELAY_LIMIT	3	1	Y	CTOP_TMI_ RESYNCH_ REPLY	When a flight first pops up in a CTOP, TFMS will attempt to find an available slot for the flight without exceeding the popup delay limit, and otherwise will assign the delay limit amount of delay to the flight. The popup delay limit is expressed in minutes. Example: <POPUP_DELAY_LIMIT>180</POPUP_DELAY_LIMIT>
FCA_LIST	3	1	Y	CTOP_TMI_ RESYNCH_ REPLY	Container for the list of FCAs that are part of this CTOP. Example: <FCA_LIST> data </FCA_LIST>
FCA	4	1+	Y	FCA_LIST	Container for an FCA. Example: <FCA> data </FCA>
FCA_ID	5	1	Y	FCA	System-generated unique identifier of FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_NAME	5	1	Y	FCA	Name of FCA as created by the traffic management specialist. Example: <FCA_NAME>FCA007<FCA_NAME>
LASTUPDATE	5	1	Y	FCA	Date and time the FCA was last updated. Example: <LASTUPDATE>200211071016</LASTUPDATE>
ROLLING[3]	5	1	N	FCA	Indicates whether the set of time bins defined for automatic revision and the trigger values for this FCA are absolute or relative to the current time. Example: <ROLLING>FALSE</ROLLING>
FCA_BIN_SIZE	5	1	Y	FCA	The size of the FCA time bins, in minutes. Example: <FCA_BIN_SIZE>15</FCA_BIN_SIZE>
FCA_BIN_LIST	5	1	Y	FCA	Container for the repeating time bins. <FCA_BIN_LIST> data </FCA_BIN_LIST>
FCA_BIN	6	1+	Y	FCA_BIN_ LIST	Container for a time bin for the FCA that is part of the CTOP. Time bins are 15-minutes long. Example: <FCA_BIN> data </FCA_BIN>
FCA_BIN_TIME	7	1	Y	FCA_BIN	Start time of the bin. Example: <FCA_BIN_TIME>201911071815</FCA_BIN_TIME>
FCA_BIN_CAPACITY	7	1	Y	FCA_BIN	Capacity for this time bin. Example: <FCA_BIN_CAPACITY>32</FCA_BIN_CAPACITY>

Tag	Lev	#	Req ?	Parent	Description
FCA_BIN_ CONTROLLED	7	1	Y	FCA_BIN	Indicates whether the time bin is being actively controlled by the CTOP allocation algorithm. Example: <FCA_BIN_CONTROLLED>TRUE</FCA_BIN_CONTROLLED>
FCA_BIN_AUTO_ REVISION[3]	7	1	N	FCA_BIN	Defines whether a time bin is governed by automatic revision. <FCA_BIN_AUTO_REVISION>TRUE</FCA_BIN_AUTO_REVISION>
FCA_BIN_HIGH_ TRIGGER[3]	7	1	N	FCA_BIN	The amount above or below capacity that will trigger an automatic revision. Example: <FCA_BIN_HIGH_TRIGGER>5</FCA_BIN_HIGH_TRIGGER>
FCA_BIN_LOW_ TRIGGER[3]	7	1	N	FCA_BIN	The amount above or below capacity that will trigger an automatic revision. Example: <FCA_BIN_LOW_TRIGGER>5</FCA_BIN_LOW_TRIGGER>
FLIGHT_LIST[4]	3	1	N	CTOP_TMI_ RESYNCH_ REPLY	Container for the flight list of impacted flights. Example: <FLIGHT_LIST> data </FLIGHT_LIST>
FLIGHT	4	1+	Y	FLIGHT_LIST	Container for a trajectory assignment for a single flight. Example: <FLIGHT> data </FLIGHT>
UNIQUE_FLT_ID_DATA	5	1	Y	FLIGHT	Container for flight identification data. <UNIQUE_FLT_ID_DATA> data </UNIQUE_FLT_ID_DATA>
ACID	6	1	Y	UNIQUE_FLT _ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	6	1	Y	UNIQUE_FLT _ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	6	1	Y	UNIQUE_FLT _ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD	6	1	Y	UNIQUE_FLT _ID_DATA	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>
ERTD	5	1	N	FLIGHT	Earliest Runway Time of Departure (ERTD) – the earliest date and time the flight can depart even if the constraint is lifted. Example: <ERTD>200912291551</ERTD>

Tag	Lev	#	Req ?	Parent	Description
TRAJ_SOURCE	5	1	Y	FLIGHT	Indicates the source of the trajectory data that TFMS used for the trajectory assignment. Example: < TRAJ_SOURCE>TOS</TRAJ_SOURCE>
CTL_EXEMPT	5	1	Y	FLIGHT	Indicates whether the flight was processed as an exempt flight. Example: <CTL_EXEMPT>FALSE</CTL_EXEMPT>
EXEMPT_REASON[5]	5	1	N	FLIGHT	Indicates the reason why a flight was exempt. Example: <EXEMPT_REASON>GDP</EXEMPT_REASON>
CTL_ELEMENT	5	1	Y	FLIGHT	Location Identifier of the airport (for GDPs) or FCA (for AFPs or CTOPs) at which the flight's time is currently being controlled Example: <CTL_ELEMENT>FCA123</CTL_ELEMENT>
CTL_PRGM	5	1	Y	FLIGHT	The name of the TMI currently controlling the times for a flight, either: the name of an airport for a GDP, the name of the FCA for an AFP or the CTOP_SHORT_NAME for a CTOP. Example: <CTL_PRGM>CTP001</CTL_PRGM>
TOS_SEQ_NO[6]	5	1	N	FLIGHT	The sequence number of the TOS used for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
SLOT[8]	5	1	N	FLIGHT	Name of an assigned slot assigned by this CTOP. Example: <SLOT>FCA001.200911271745A</SLOT> or <SLOT>NOSLOT</SLOT>
CTD[9]	5	1	N	FLIGHT	The controlled date and time of departure for the flight assigned by any TMI. Example: <CTD>201002271745</CTD>
TRAJ_OPTION_LIST[10]	5	1	Y	FLIGHT	Container for the trajectory option list. Example: <TRAJ_OPTION_LIST> data </TRAJ_OPTION_LIST>
TRAJ_OPTION	6	1+	Y	TRAJ_OPTION _LIST	Container for a single trajectory option for this flight. Example: <TRAJ_OPTION> data </TRAJ_OPTION>
TRAJ_INDEX[11]	7	1	N	TRAJ_OPTION	The index for the selected trajectory, as provided in the TOS message. Example: <TRAJ_INDEX>1</TRAJ_INDEX>
ASSIGNED[12]	7	1	Y	TRAJ_OPTION	An indicator of whether this is the assigned trajectory. Example: <ASSIGNED>TRUE</ASSIGNED>
ADJUSTED_COST[13]	7	1	Y	TRAJ_OPTION	The adjusted cost that the flight would incur if this were the assigned trajectory option. Example: <ADJUSTED_COST>25</ADJUSTED_COST>

Tag	Lev	#	Req ?	Parent	Description
MANUAL_OVERRIDE[14]	7	1	N	TRAJ_OPTION	Indicates whether the trajectory was assigned manually by a traffic manager. Example: <MANUAL_OVERRIDE>FALSE</MANUAL_OVERRIDE>
REL_TRAJ_COST	7	1	N	TRAJ_OPTION	Relative trajectory cost – the relative cost of one trajectory as compared to another for this flight expressed in minutes of delay. Example: <REL_TRAJ_COST>30</REL_TRAJ_COST>
ROUTE[15]	7	1	N	TRAJ_OPTION	The route of flight assigned by the CTOP in ICAO format. Example: <ROUTE>GRABE2 OKM J181 EOS/N0478F350 J181 BAILI BENKY1</ROUTE>
ALT[15]	7	1	N	TRAJ_OPTION	The cruising altitude assigned by the CTOP in hundreds of feet. Example: <ALT>F330</ALT>
SPEED[15]	7	1	N	TRAJ_OPTION	The cruising speed assigned by the CTOP in knots. Example: <SPEED>N0478</SPEED>
FCA_LIST[16]	7	1	Y	TRAJ_OPTION	Container for the list of FCAs that are part of this CTOP and are intersected by this trajectory option. Example: <FCA_LIST> data </FCA_LIST>
FCA	8	1+	N	FCA_LIST	Container for an FCA. Example: <FCA> data </FCA>
FCA_ID	9	1	Y*	FCA	System-generated unique identifier of FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_EARLIEST_ENTRY	9	1	Y*	FCA	Earliest time that the flight could enter the FCA on this trajectory option. <FCA_EARLIEST_ENTRY>201003041421 <FCA_EARLIEST_ENTRY>

[1]A CTOP TMI message is sent for either the first issuance of a CTOP or any revision that changes the CTOP parameters.

[2]The LASTUPDATE time is the time the CTOP was issued or revised. This time is used to interpret other CTOP parameters which are relative to the issuance time, such as the EXEMPT_BY_TIME and ROLLING parameters.

[3]Value required only if AUTO_REVISION is true for the CTOP. If ROLLING is TRUE, the bin values of FCA_BIN_HIGH_TRIGGER, FCA_BIN_LOW_TRIGGER, and FCA_BIN_AUTO_REVISION are relative to the current time; that is, as the current time moves from one time bin to the next, these values roll to the next time bin. (Note that the rolling option will not be supported in the first two phases of CTOP, but may be added in a later release. Until this capability is added, if this tag is present, its value will always be FALSE.)

[4]When a CTOP TMI message is sent for the first issuance of a program, the message includes a trajectory assignment for every flight impacted by the program. When a CTOP is revised, the message includes only those trajectory assignments that are changed during the revision. If no flights are changed, such as when automated revision is turned off, no flight list is included.

[5]EXEMPT_REASON is included if and only if CTL_EXEMPT is TRUE.

[6]If no TOS has been submitted for this flight, TOS_SEQ_NO is omitted. The TOS_SEQ_NO allows the FOS to check that the CTOP was issued using what the FOS believes is the latest TOS for each flight.

[7]Previously existing footnote was removed..

[8]The format of the slot name consists of FCA name, entry time, and suffix (for example, FCA001.200911271745A). For the flights whose trajectory avoids the CTOP FCA(s), the slot name indicates “NOSLOT”.

[9]If no CTD is provided, the flight may depart any time using the assigned ROUTE, ALT, and SPEED.

[10]TFMS includes all the current TOS trajectory options as part of the trajectory assignment to provide feedback to the FOS as to why an option was selected or not. One and only one trajectory option has an ASSIGNED value of TRUE. If no TOS has been submitted for the flight, the trajectory option list includes one option containing the trajectory information used by TFMS.

[11]The trajectory index (TRAJ_INDEX) helps the FOS associate the trajectory assignment with the TOS option. If no TOS has been submitted for the flight, TRAJ_INDEX is omitted. If a traffic manager has manually entered a route for a flight, the TRAJ_INDEX is omitted.

[12]If a TOS and/or flight plan have been processed for a flight, one and only one trajectory option has an ASSIGNED value of TRUE. If neither a TOS or flight plan has been processed, there is only one trajectory option and the value of ASSIGNED is FALSE.

[13]ADJUSTED_COST is the total cost that a flight would incur if the CTOP were to assign the flight to a trajectory. The ADJUSTED_COST is the sum of the delay that CTOP would have to give the flight on that trajectory plus the REL_TRAJ_COST of the trajectory. TFMS picks the route with the lowest adjusted cost.

[14]MANUAL_OVERRIDE is meaningful only for the assigned route (ASSIGNED=TRUE). If not present, its assumed value is FALSE. A manually assigned route may be selected manually from the submitted TOS options or may be entered manually by a traffic manager. In the latter case, the TRAJ_OPTION container contains no TRAJ_INDEX.

[15]ROUTE, ALT, and SPEED are required if ASSIGNED=TRUE; otherwise they do not appear.

[16]If the flight would not intersect any FCAs on this trajectory option, the FCA_LIST is empty.

[17]Previously existing footnote was removed.

[18] The system will not provide data for a proposed, cancelled, expired, or non-existent CTOP. This message is only sent to the NAS User that originated the request.

[19]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Re-synch Error [338]

This message is for an error reply only.

- Message Type: [338]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP Re-synch Request]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-24.

Table 5-24. CTOP Re-synch Error XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
CTOP_ERROR	2	1	Y	FOS_OUTPUT	Container for the error. Example: <CTOP_ERROR> data </CTOP_ERROR>
CTOP_NAME	3	1	Y	CTOP_ERROR	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[2]	3	1	Y	CTOP_ERROR	System generated 6 character identifier/name for the CTOP TMI Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>
ERROR	3	1	Y	CTOP_ERROR	Container for a single error code and text <ERROR> data </ERROR>
ERROR_CODE[1]	4	1	Y	ERROR	System-generated error code. Example: <ERROR_CODE>272</ERROR_CODE>
ERROR_TEXT[1]	4	1	Y	ERROR	Text explaining the reason for the error. Example: <ERROR_TEXT>REQUESTED CTOP DOES NOT EXIST<ERROR_TEXT>

[1]Sample error codes and text are provided in Appendix B.

[2]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Trajectory Assignment Re-synch Request [339]

- Message Type: [339]
- Message Time: [Unix time, optional]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-25.

Table 5-25. CTOP Trajectory Assignment Re-synch Request XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_INPUT	1	1	Y	None	Container for the message data sent to TFMS from the FOS client <FOS_INPUT> Data </FOS_INPUT>
TRAJ_ASSIGN_REQ	2	1	Y	FOS_INPUT	Container for the flight being requested. Example: <TRAJ_ASSIGN_REQ> data </TRAJ_ASSIGN_REQ>
ACID	3	1	Y	TRAJ_ASSIGN_REQ	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	3	1	Y	TRAJ_ASSIGN_REQ	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	3	1	Y	TRAJ_ASSIGN_REQ	Destination airport. Example: <DEST>ORD</DEST>
IGTD	3	1	Y	TRAJ_ASSIGN_REQ	Initial gate time of departure. Example: <IGTD>200211071016</IGTD>

CTOP Trajectory Assignment Re-synch Reply [340]

- Message Type: [340]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP Trajectory Assignment Re-synch Request]
- Data Buffer Length: [size of compressed XML message]

- Data Buffer Format: See Table 5-26.

Table 5-26. CTOP Trajectory Assignment Re-synch Reply XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1		None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
TRAJ_ASSIGN_RESYNCH_REPLY	2	1	Y	FOS_OUTPUT	Container to identify this specific message type <TRAJ_ASSIGN_RESYNCH_REPLY> Data </ TRAJ_ASSIGN_RESYNCH_REPLY>
CTOP_NAME	3	1	Y	TRAJ_ASSIGN_RESYNCH_REPLY	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[15]	3	1	Y	TRAJ_ASSIGN_RESYNCH_REPLY	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>
FLIGHT_LIST[1]	3	1	Y	TRAJ_ASSIGN_RESYNCH_REPLY	Container for the flight list of impacted flights with new assignments. Example: <FLIGHT_LIST> data </FLIGHT_LIST>
FLIGHT	4	1+	Y	FLIGHT_LIST	Container for a trajectory assignment for a single flight. Example: <FLIGHT> data </FLIGHT>
UNIQUE_FLT_ID_DATA	5	1	Y	FLIGHT	Container for flight identification data. <UNIQUE_FLT_ID_DATA> data </UNIQUE_FLT_ID_DATA>
ACID	6	1	Y	UNIQUE_FLT_ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	6	1	Y	UNIQUE_FLT_ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	6	1	Y	UNIQUE_FLT_ID_DATA	Destination airport. Example: <DEST>ORD</DEST>

Tag	Lev	#	Req ?	Parent	Description
IGTD	6	1	Y	UNIQUE_FLT _ID_DATA	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>
ERTD	5	1	N	FLIGHT	Earliest Runway Time of Departure (ERTD) – the earliest date and time the flight can depart even if the constraint is lifted. Example: <ERTD>200912291551</ERTD>
TRAJ_SOURCE	5	1	Y	FLIGHT	Indicates the source of the trajectory data that TFMS used for the trajectory assignment. Example: < TRAJ_SOURCE>TOS</TRAJ_SOURCE>
CTL_EXEMPT	5	1	Y	FLIGHT	Indicates whether the flight was processed as an exempt flight. Example: <CTL_EXEMPT>FALSE</CTL_EXEMPT>
EXEMPT_REASON[2]	5	1	N	FLIGHT	Indicates the reason why a flight was exempt. Example: <EXEMPT_REASON>GDP</EXEMPT_REASON>
CTL_ELEMENT	5	1	Y	FLIGHT	Location Identifier of the airport (for GDPs) or FCA (for AFPs or CTOPs) at which the flight's time is currently being controlled Example: <CTL_ELEMENT>FCA123</CTL_ELEMENT>
CTL_PRGM	5	1	Y	FLIGHT	The name of the TMI currently controlling the times for a flight, either: the name of an airport for a GDP, the name of the FCA for an AFP or the CTOP_SHORT_NAME for a CTOP. Example: <CTL_PRGM>CTP001</CTL_PRGM>
TOS_SEQ_NO[3]	5	1	N	FLIGHT	The sequence number of the TOS used for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
SLOT[5]	5	1	N	FLIGHT	Name of an assigned slot assigned by this CTOP. Example: <SLOT>FCA001.200911271745A</SLOT> or <SLOT>NOSLOT</SLOT>
CTD[6]	5	1	N	FLIGHT	The controlled date and time of departure for the flight assigned by any TMI. Example: <CTD>201002271745</CTD>
TRAJ_OPTION_LIST[7]	5	1	Y	FLIGHT	Container for the trajectory option list. Example: <TRAJ_OPTION_LIST> data </TRAJ_OPTION_LIST>
TRAJ_OPTION	6	1+	Y	TRAJ_OPTION _LIST	Container for a single trajectory option for this flight. Example: <TRAJ_OPTION> data </TRAJ_OPTION>
TRAJ_INDEX[8]	7	1	N	TRAJ_OPTION	The index for the selected trajectory, as provided in the TOS message. Example: <TRAJ_INDEX>1</TRAJ_INDEX>
ASSIGNED[9]	7	1	Y	TRAJ_OPTION	An indicator of whether this is the assigned trajectory.

Tag	Lev	#	Req ?	Parent	Description
					Example: <ASSIGNED>TRUE</ASSIGNED>
ADJUSTED_COST[10]	7	1	Y	TRAJ_OPTION	The adjusted cost that the flight would incur if this were the assigned trajectory option. Example: <ADJUSTED_COST>25</ADJUSTED_COST>
MANUAL_ OVERRIDE[11]	7	1	N	TRAJ_OPTION	Indicates whether the trajectory was assigned due to a manual override by a traffic manager. Example: <MANUAL_OVERRIDE>FALSE</MANUAL_OVERRIDE>
REL_TRAJ_COST	7	1	N	TRAJ_OPTION	Relative trajectory cost – the relative cost of one trajectory as compared to another for this flight expressed in minutes of delay. Example: <REL_TRAJ_COST>30</REL_TRAJ_COST>
ROUTE[12]	7	1	N	TRAJ_OPTION	The route of flight assigned by the CTOP in ICAO format. Example: <ROUTE>GRABE2 OKM J181 EOS/N0478F350 J181 BAILI BENKY1</ROUTE>
ALT[12]	7	1	N	TRAJ_OPTION	The cruising assigned by the CTOP in hundreds of feet. Example: <ALT>F330</ALT>
SPEED[12]	7	1	N	TRAJ_OPTION	The cruising speed assigned by the CTOP in knots. Example: <SPEED>N0478</SPEED>
FCA_LIST[13]	7	1	Y	TRAJ_OPTION	Container for the list of FCAs that are part of this CTOP and are intersected by this trajectory option. Example: <FCA_LIST> data </FCA_LIST>
FCA	8	1+	N	FCA_LIST	Container for an FCA. Example: <FCA> data </FCA>
FCA_ID	9	1	Y*	FCA	System-generated unique identifier of FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_EARLIEST_ENTRY	9	1	Y*	FCA	Earliest time that the flight could enter the FCA on this trajectory option. <FCA_EARLIEST_ENTRY>201003041421 <FCA_EARLIEST_ENTRY>

[1]If the trajectory assignment message is triggered by a TOS update, it contains only one flight. However, if the message is triggered by an automated revision, it may contain many flights.

[2]EXEMPT_REASON is included if and only if CTL_EXEMPT is TRUE.

[3]If no TOS has been submitted for this flight, TOS_SEQ_NO is omitted. The TOS_SEQ_NO allows the FOS to check that the CTOP was issued using what the FOS believes is the latest TOS for each flight.

[4]Previously existing footnote was removed..

[5]The format of the slot name consists of FCA name, entry time, and suffix (for example, FCA001.200911271745A). For the flights whose trajectory avoids the CTOP FCA(s), the slot name indicates "NOSLOT".

[6]If no CTD is provided, the flight may depart any time using the assigned ROUTE, ALT, and SPEED.

[7]TFMS includes all the current TOS trajectory options as part of the trajectory assignment to provide feedback to the FOS as to why an option was selected or not. One and only one trajectory option has an ASSIGNED value of TRUE. If no TOS has been submitted for the flight, the trajectory option list includes one option containing the trajectory information used by TFMS.

[8]The trajectory index (TRAJ_INDEX) helps the FOS associate the trajectory assignment with the TOS option. If no TOS has been submitted for this flight, TRAJ_INDEX is omitted.

[9]If a TOS and/or flight plan have been processed for a flight, one and only one trajectory option has an ASSIGNED value of TRUE. If neither a TOS or flight plan has been processed, there is only one trajectory option and the value of ASSIGNED is FALSE.

[10]The ADJUSTED_COST is the total cost that a flight would incur if the CTOP were to assign the flight to a trajectory. The ADJUSTED_COST is the sum of the delay that CTOP would have to give the flight on that trajectory plus the REL_TRAJ_COST of the trajectory. TFMS picks the route with the lowest adjusted cost.

[11]MANUAL_OVERRIDE is meaningful only for the assigned route (ASSIGNED=TRUE). If not present, its assumed value is FALSE. A manually assigned route may be selected manually from the submitted TOS options or may be entered manually by a traffic manager. In the latter case, the TRAJ_OPTION container contains no TRAJ_INDEX.

[12]ROUTE, ALT, and SPEED are required if ASSIGNED=TRUE; otherwise they do not appear.

[13]If the flight would not intersect any FCAs on this trajectory option, the FCA_LIST is empty.

[14]Previously existing footnote was removed.

[15]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Trajectory Assignment Re-synch Error [341]

- Message Type: [341]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from CTOP Trajectory Assignment Re-synch Request]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-27.

Table 5-27. CTOP Trajectory Assignment Re-synch Error XML Format

Tag	Lev	#	Req ?	Parent	Description

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
TRAJ_ASSIGN_ERROR	2	1	Y	FOS_OUTPUT	Container for the error. Example: <TRAJ_ASSIGN_ERROR> data </TRAJ_ASSIGN_ERROR>
UNIQUE_FLT_ID_DATA	3	1	Y	TRAJ_ASSIGN_ERROR	Container for flight identification data. <UNIQUE_FLT_ID_DATA> data </UNIQUE_FLT_ID_DATA>
ACID	4	1	Y	UNIQUE_FLT_ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	4	1	Y	UNIQUE_FLT_ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	4	1	Y	UNIQUE_FLT_ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD	4	1	Y	UNIQUE_FLT_ID_DATA	Initial gate time of departure. Example: <IGTD>200211071016</IGTD>
TOS_SEQ_NO[1]	3	1	N	TRAJ_ASSIGN_ERROR	The sequence number of the TOS used for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
ERROR_LIST	3	1	Y	TRAJ_ASSIGN_ERROR	Container for repeating errors. <ERROR_LIST> data </ERROR_LIST>
ERROR	4	1+	Y	ERROR_LIST	Container for a single error code and text. <ERROR> data </ERROR>
ERROR_CODE[2]	5	1	Y	ERROR	System-generated error code. Example: <ERROR_CODE>272</ERROR_CODE>
ERROR_TEXT[2]	5	1	Y	ERROR	Text explaining the reason for the error. Example: <ERROR_TEXT>REQUESTED FLIGHT DOES NOT EXIST</ERROR_TEXT>

[1]If no TOS has been submitted for this flight, TOS_SEQ_NO is omitted. The TOS_SEQ_NO allows the FOS to check that the CTOP was issued using what the FOS believes is the latest TOS for each flight.

[2]Sample error codes and text are provided in Appendix B

CTOP Cancel [342]

- Message Type: [342]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-28.

Table 5-28. CTOP Cancel Message XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
CTOP_CANCEL	2	1	Y	FOS_OUTPUT	Container for the message data. Example: <CTOP_CANCEL> data </CTOP_CANCEL>
CTOP_LIST	3	1	Y	CTOP_CANCEL	Container for repeating CTOPs <CTOP_LIST> data </CTOP_LIST>
CTOP	4	1+	Y	CTOP_LIST	Container for one CTOP. <CTOP> data </CTOP>
CTOP_NAME	5	1	Y	CTOP	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[2]	5	1	Y	CTOP	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>

Tag	Lev	#	Req ?	Parent	Description
FLIGHT_LIST[1]	5	1	Y	CTOP	Container for the flight list of impacted flights. Example: <FLIGHT_LIST> data </FLIGHT_LIST>
FLIGHT	6	1+	Y	FLIGHT_LIST	Container for a single flight. Example: <FLIGHT> data </FLIGHT>
ACID	7	1	Y	FLIGHT	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	7	1	Y	FLIGHT	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	7	1	Y	FLIGHT	Destination airport. Example: <DEST>ORD</DEST>
IGTD	7	1	Y	FLIGHT	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>

[1]Includes only those flights that were previously controlled by this CTOP and that are no longer controlled by any CTOP. These flights are no longer constrained by a CTOP assigned route.

[2]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Flight Plan Amendment [343]

- Message Type: [343]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-29.

Table 5-29. CTOP Flight Plan Amendment Message XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.

Tag	Lev	#	Req ?	Parent	Description
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
CTOP_FP_AMEND	2	1	Y	FOS_OUTPUT	Container for a single drop-out flight. Example: <CTOP_FP_AMEND> data </CTOP_FP_AMEND>
UNIQUE_FLT_ID_DATA	3	1	Y	CTOP_FP_AMEND	Container for flight identification data. < UNIQUE_FLT_ID_DATA> Data </ UNIQUE_FLT_ID_DATA>
ACID	4	1	Y	UNIQUE_FLT_ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	4	1	Y	UNIQUE_FLT_ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	4	1	Y	UNIQUE_FLT_ID_DATA	Destination airport. Example: <DEST>ORD<DEST>
IGTD	4	1	Y	UNIQUE_FLT_ID_DATA	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>
TOS_SEQ_NO[1]	3	1	N	CTOP_FP_AMEND	The sequence number of the TOS in place for this flight at the time of the amendment. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
ROUTE	3	1	N	CTOP_FP_AMEND	The route of flight assigned by the CTOP and used for the amendment, in ICAO format. Example: <ROUTE>GRABE2 OKM J181 EOS/N0478F350 J181 BAILI BENKY1</ROUTE>
CTOP_NAME	3	1	Y	CTOP_FP_AMEND	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[2]	3	1	Y	CTOP_FP_AMEND	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>

[1]If no TOS has been submitted for this flight, TOS_SEQ_NO is omitted. The TOS_SEQ_NO allows the FOS to check that the CTOP was issued using what the FOS believes is the latest TOS for each flight.

[2]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Suspend [344]

- Message Type: [344]

- Message Time: [Unix time, optional]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-30.

Table 5-30. CTOP Suspend XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
CTOP_SUSPEND	2	1	Y	FOS_OUTPUT	Container for the CTOP suspend message. Example: <CTOP_SUSPEND> data </CTOP_SUSPEND>
CTOP_NAME	3	1	Y	CTOP_SUSPEND	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[1]	3	1	Y	CTOP_SUSPEND	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>

[1]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Resume [345]

- Message Type: [345]
- Message Time: [Unix time, optional]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [0]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-31.

Table 5-31. CTOP Resume XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
CTOP_RESUME	2	1	Y	FOS_OUTPUT	Container for the CTOP resume message. Example: <CTOP_RESUME> data </CTOP_RESUME>
CTOP_NAME	3	1	Y	CTOP_ RESUME	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[1]	3	1	Y	CTOP_ RESUME	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>

[1]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

5.3.5 CTOP Substitution Message Formats

CTOP Substitution Message [350]

- Message Type: [350]
- Message Time: [Unix time, optional]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [client-assigned value]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-32.

Table 5-32. CTOP Substitution Message XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.

Tag	Lev	#	Req ?	Parent	Description
FOS_INPUT	1	1	Y	None	Container for the message data sent to TFMS from the FOS client. <FOS_INPUT> Data </FOS_INPUT>
CTOP_SUB_REQ	2	1	Y	FOS_INPUT	Container for a substitution request. Example: <CTOP_SUB_REQ> data </CTOP_SUB_REQ>
CTOP_NAME	3	1	Y	CTOP_SUB_ REQ	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[2]	3	1	Y	CTOP_SUB_ REQ	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>
CTOP_SUB_MODE	3	1	Y	CTOP_SUB_ REQ	Specifies STRICT or FLEXIBLE processing for the sub request. Example: <CTOP_SUB_MODE>STRICT</CTOP_SUB_MODE>
FLIGHT_LIST	3	1	Y	CTOP_SUB_ REQ	Container for the flights being substituted. Example: <FLIGHT_LIST> data </FLIGHT_LIST>
FLIGHT	4	2+	Y	FLIGHT_LIST	Container for a flight. Example: <FLIGHT> data </FLIGHT>
UNIQUE_FLT_ID_DATA	5	1	Y	FLIGHT	Container for flight identification data. < UNIQUE_FLT_ID_DATA> Data </ UNIQUE_FLT_ID_DATA >
ACID	6	1	Y	UNIQUE_FLT _ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	6	1	Y	UNIQUE_FLT _ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	6	1	Y	UNIQUE_FLT _ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD	6	1	Y	UNIQUE_FLT _ID_DATA	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>
SLOT[1]	5	1	Y	FLIGHT	Name of an assigned slot. Example: <SLOT>FCA001.200911271745A</SLOT> or <SLOT>NOSLOT</SLOT>

[1]The format of the slot name consists of FCA name, entry time, and suffix (for example, FCA001.200911271745A). For the flights whose trajectory avoids the CTOP FCA(s), the slot name indicates "NOSLOT".

[2]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Substitution Reply [351]

- Message Type: [351]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [from CTOP Substitution Message]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-33.

Table 5-33. CTOP Substitution Reply XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
CTOP_SUB_REPLY	2	1	Y	FOS_OUTPUT	Container for a reply to a valid substitution. Example: <CTOP_SUB_REPLY> data </CTOP_SUB_REPLY>
CTOP_NAME	3	1	Y	CTOP_SUB_ REPLY	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[9]	3	1	Y	CTOP_SUB_ REPLY	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>
FLIGHT_LIST	3	1	Y	CTOP_SUB_ REPLY	Container for the flights that were substituted. Example: <FLIGHT_LIST> data </FLIGHT_LIST>

Tag	Lev	#	Req ?	Parent	Description
FLIGHT	4	2+	Y	FLIGHT_LIST	Container for a flight. Example: <FLIGHT> data </FLIGHT>
UNIQUE_FLT_ID_DATA	5	1	Y	FLIGHT	Container for flight identification data. <UNIQUE_FLT_ID_DATA> Data </UNIQUE_FLT_ID_DATA>
ACID	6	1	Y	UNIQUE_FLT_ID_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	6	1	Y	UNIQUE_FLT_ID_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	6	1	Y	UNIQUE_FLT_ID_DATA	Destination airport. Example: <DEST>ORD</DEST>
IGTD	6	1	Y	UNIQUE_FLT_ID_DATA	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>
ERTD	5	1	N	FLIGHT	Earliest Runway Time of Departure (ERTD) – the earliest date and time the flight can depart even if the constraint is lifted. Example: <ERTD>200912291551</ERTD>
TOS_SEQ_NO[1]	5	1	N	FLIGHT	The current TOS sequence number for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
SLOT[2,3]	5	1	N	FLIGHT	Name of an assigned slot. Example: <SLOT>FCA001.200911271745A</SLOT> or <SLOT>NOSLOT</SLOT>
TRAJ_OPTION_LIST[4]	5	1	Y	FLIGHT	Container for the trajectory option list. Example: <TRAJ_OPTION_LIST> data </TRAJ_OPTION_LIST>
TRAJ_OPTION	6	1+	Y	TRAJ_OPTION_LIST	Container for a single trajectory option for this flight. Example: <TRAJ_OPTION> data </TRAJ_OPTION>
TRAJ_INDEX[5]	7	1	N	TRAJ_OPTION	The index for the selected trajectory, as provided in the TOS message. Example: <TRAJ_INDEX>1</TRAJ_INDEX>
ASSIGNED[6]	7	1	Y	TRAJ_OPTION	An indicator of whether this is the assigned trajectory. Example: <ASSIGNED>TRUE</ASSIGNED>
ADJUSTED_COST[7]	7	1	Y	TRAJ_OPTION	The adjusted cost that the flight would incur if this were the

Tag	Lev	#	Req ?	Parent	Description
					assigned trajectory option. Example: <ADJUSTED_COST>25</ADJUSTED_COST>
REL_TRAJ_COST	7	1	N	TRAJ_OPTION	Relative trajectory cost – the relative cost of one trajectory as compared to another for this flight expressed in minutes of delay. Example: <REL_TRAJ_COST>30</REL_TRAJ_COST>
ROUTE	7	1	N	TRAJ_OPTION	The route of flight assigned by the CTOP in ICAO format. Example: <ROUTE>GRABE2 OKM J181 EOS/N0478F350 J181 BAILI BENKY1</ROUTE>
ALT	7	1	N	TRAJ_OPTION	The cruising assigned by the CTOP in hundreds of feet. Example: <ALT>F330</ALT>
SPEED	7	1	N	TRAJ_OPTION	The cruising speed assigned by the CTOP in knots. Example: <SPEED>N0478</SPEED>
CTD	7	1	N	TRAJ_OPTION	The controlled date and time of departure for the flight assigned by any TMI. If not present, the flight can depart at any time on the assigned route. Example: <CTD>201002271745</CTD>
FCA_LIST[8]	7	1	Y	TRAJ_OPTION	Container for the list of FCAs that are part of this CTOP and are intersected by this trajectory option. Example: <FCA_LIST> data </FCA_LIST>
FCA	8	1+	N	FCA_LIST	Container for an FCA. Example: <FCA> data </FCA>
FCA_ID	9	1	Y*	FCA	System-generated unique identifier of FCA. Example: <FCA_ID>fca.cdmb.lxpc103.20040713161706</FCA_ID>
FCA_EARLIEST_ENTRY	9	1	Y*	FCA	Earliest time that the flight could enter the FCA on this trajectory option. <FCA_EARLIEST_ENTRY>201003041421 <FCA_EARLIEST_ENTRY>

[1]If no TOS has been submitted for this flight, TOS_SEQ_NO is omitted. The TOS_SEQ_NO allows the FOS to check that the CTOP was issued using what the FOS believes is the latest TOS for each flight.

[2]The format of the slot name consists of FCA name, entry time, and suffix (for example, FCA001.200911271745A). For the flights whose trajectory avoids the CTOP FCA(s), the slot name indicates “NOSLOT”.

[3]A SLOT returned in the reply is the slot requested in the substitution even if a slot tolerance is used when processing the substitution. For example, if the substitution requests slot FCA001.200911271745A for a flight that cannot enter the FCA until 1747, and the tolerance is

greater than or equal to 2 minutes, the substitution is allowed and slot FCA001.200911271745A is assigned to the flight.

[4]TFMS includes all the current TOS trajectory options as part of the substitution response to provide feedback to the FOS as to why an option was selected or not. One and only one trajectory option has an ASSIGNED value of TRUE. If no TOS has been submitted for the flight, the trajectory option list includes one option based on the flight plan route.

[5]The trajectory index (TRAJ_INDEX) helps the FOS associate the trajectory assignment with the TOS option. If no TOS has been submitted for this flight, TRAJ_INDEX is omitted.

[6]If a TOS and/or flight plan have been processed for a flight, one and only one trajectory option has an ASSIGNED value of TRUE. If neither a TOS or flight plan has been processed, there is only one trajectory option and the value of ASSIGNED is FALSE.

[7]ADJUSTED_COST is the total cost that a flight would incur if the CTOP were to assign the flight to a trajectory. The ADJUSTED_COST is the sum of the delay that CTOP would have to give the flight on that trajectory plus the REL_TRAJ_COST of the trajectory. TFMS picks the route with the lowest adjusted cost.

[8]If the flight would not intersect any FCAs on this trajectory option, the FCA_LIST is empty.

[9]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

CTOP Substitution Error [352]

- Message Type: [352]
- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [from CTOP Substitution Message]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-34.

Table 5-34. CTOP Substitution Error XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>

Tag	Lev	#	Req ?	Parent	Description
CTOP_SUB_ERROR	2	1	Y	FOS_OUTPUT	Container for an error response to an invalid substitution request. Example: <CTOP_SUB_ERROR> data </CTOP_SUB_ERROR>
CTOP_NAME	3	1	Y	CTOP_SUB_ ERROR	User-provided long-form name for the CTOP TMI. Example:<CTOP_NAME>DC_METROS</CTOP_NAME>
CTOP_SHORT_NAME[6]	3	1	Y	CTOP_SUB_ ERROR	System generated 6 character identifier/name for the CTOP TMI. Example: <CTOP_SHORT_NAME>CTP121</CTOP_SHORT_NAME>
ERROR_LIST	3	1	/%	CTOP_SUB_ERROR	Container for repeating errors. <ERROR_LIST> data </ERROR_LIST>
ERROR[1]	4	1+	Y*	ERROR_LIST	Container for one error code and text. Example: <ERROR> data </ERROR>
ERROR_CODE[2]	5	1	Y*	ERROR	System-generated error code. Example: <ERROR_CODE>272</ERROR_CODE>
ERROR_TEXT[2]	5	1	Y*	ERROR	Text explaining the reason for the error. Example: <ERROR_TEXT>REQUESTED FLIGHT DOES NOT EXIST</ERROR_TEXT>
FLIGHT_LIST	3	1	%/	CTOP_SUB_ ERROR	Container for the flights that had errors. Example: <FLIGHT_LIST> data </FLIGHT_LIST>
FLIGHT[3]	4	1+	Y*	FLIGHT_ LIST	Container for a flight.[3] Example: <FLIGHT> data </FLIGHT>
UNIQUE_FLT_ID_DATA	5	1	Y*	FLIGHT	Container for flight identification data. <UNIQUE_FLT_ID_DATA> Data </UNIQUE_FLT_ID_DATA>
ACID	6	1	Y*	UNIQUE_FLT_I D_DATA	Aircraft identifier as it will be or has been filed on the flight plan. Example: <ACID>UAL123</ACID>
ORIG	6	1	Y*	UNIQUE_FLT_I D_DATA	Origin airport. Example: <ORIG>DFW</ORIG>
DEST	6	1	Y*	UNIQUE_FLT_I D_DATA	Destination airport. Example: <DEST>ORD</DEST>

Tag	Lev	#	Req ?	Parent	Description
IGTD	6	1	Y*	UNIQUE_FLT_ID_DATA	Initial gate time of departure. Example: <IGTD>200911071016</IGTD>
TOS_SEQ_NO[4]	5	1	N	FLIGHT	The current TOS sequence number for this flight. Example: <TOS_SEQ_NO>3</TOS_SEQ_NO>
SLOT[5]	5	1	N	FLIGHT	Name of a requested slot. Example: <SLOT>FCA001.200911271745A</SLOT> or <SLOT>NOSLOT</SLOT>
ERROR_LIST	5	1	Y*	FLIGHT	Container for repeating errors. <ERROR_LIST> data </ERROR_LIST>
ERROR[1]	6	1+	Y*	ERROR_LIST	Container for one error code and text. Example: <ERROR> data </ERROR>
ERROR_CODE[2]	7	1	Y*	ERROR	System-generated error code. Example: <ERROR_CODE>272</ERROR_CODE>
ERROR_TEXT[2]	7	1	Y*	ERROR	Text explaining the reason for the error. Example: <ERROR_TEXT>REQUESTED FLIGHT DOES NOT EXIST</ERROR_TEXT>

[1]An error can appear at either the CTOP or FLIGHT level. At least one error must appear in the reply, but it could appear at either level. There may be multiple errors associated with each flight. . All errors associated with each flight are reported.

[2]Sample error codes and text are provided in Appendix B.

[3]TFMS includes only flights for which an error was detected in the substitution error response.

[4]If no TOS has been submitted for this flight, TOS_SEQ_NO is omitted. The TOS_SEQ_NO allows the FOS to check that the CTOP was issued using what the FOS believes is the latest TOS for each flight.

[5]The format of the slot name consists of FCA name, entry time, and suffix (for example, FCA001.200911271745A). For the flights whose trajectory avoids the CTOP FCA(s), the slot name indicates “NOSLOT”.

[6]CTOP_SHORT_NAME is created by TFMS and the values are assigned uniquely so that they can be used reliably to identify CTOP TMIs in CTOP messaging.

5.3.6 Generic Error Response Message Format

Generic Error Response [999]

This message is used when a request received from the FOS cannot be identified or the message contents cannot be parsed to construct the associated error response defined for the request received.

- Message Type: [999]

- Message Time: [Unix time]
- Uncompressed Size: [size of uncompressed XML message]
- Client Tag: [pre-defined value]
- Sequence Number: [value from received request]
- Data Buffer Length: [size of compressed XML message]
- Data Buffer Format: See Table 5-35.

Table 5-35. Generic Error Response XML Format

Tag	Lev	#	Req ?	Parent	Description
<xml version="1.0" standalone="yes"?>	1	1	Y	None	First line of tagged elements to make the FCA file XML compliant. Can be ignored.
FOS_OUTPUT	1	1	Y	None	Container for the message data sent to the FOS client from TFMS. <FOS_OUTPUT> Data </FOS_OUTPUT>
GEN_ERROR_ RESPONSE	2	1	Y	FOS_OUTPUT	Container for the error response. Example: <GEN_ERROR_RESPONSE> Data </GEN_ERROR_RESPONSE>
ERROR	3	1	Y	GEN_ERROR_ RESPONSE	Container for one error code and text. Example: <ERROR> data </ERROR>
ERROR_CODE[1]	4	1	Y	ERROR	System-generated error code. Example: <ERROR_CODE>500</ERROR_CODE>
ERROR_TEXT[1]	4	1	Y	ERROR	Text explaining the reason for the error. Example: <ERROR_TEXT>Unknown message type.</ERROR_TEXT>

[1]The full list of error codes and error text values are found in Appendix B.

6. Data Element Syntax

This section provides the detailed syntax for all the data elements that appear in section 5.3. Each data element is described by the following fields:

- Name – The name of the data element as it appears in the XML format.
- Description – A brief description of the data element.
- Format/Range/Allowable Values – The syntax, range of values or list of specific values that can appear in that data element. Also provides units, where applicable.
- Examples – One or more examples of the data element.

Table 6-1. CTOP Data Element Syntax

Name	Description	Format/Range/Allowable Values	Example(s)
ACID	Aircraft identifier; a.k.a. Flight identifier.	2 to 7 characters starting with a letter.	AAL178 N12GJ
ACID_ANY	Aircraft identifiers used for inclusion in an FCA or for exemption from a CTOP.	One or more ACIDs separated by spaces.	AAL178 N12GJ
ACID_NONE	Aircraft identifiers used for exclusion from an FCA.	One or more ACIDs separated by spaces.	AAL178 N12GJ
ACTIVE	Defines whether active flights should be exempt or not. (TRUE = Exempt)	One of “TRUE” or “FALSE”.	TRUE
ADJUSTED_COST	The total cost that a flight would incur on a given trajectory option in a CTOP. Is a sum of two values: the delay that the CTOP would have to assign to the flight on this trajectory to avoid exceeding demand, and the flight-operator-provided relative trajectory cost. ADJUSTED_COST is expressed as minutes of delay,	1 to 3 digits Minutes	46
AIRCRAFT_ CATEGORY_ ANY	Aircraft categories used for inclusion in an FCA.	One or more single letter aircraft categories separated by spaces. Allowable categories are J (jet), P (piston prop), and T (turbo-prop).	J P T

Name	Description	Format/Range/Allowable Values	Example(s)
AIRPORT	Airport name for a NAS element type FCA.	3 or 4 characters.	BOS LFPG AK12
ALT	Initial cruise altitude. Uses ICAO format for flight level (field 15b, Section 1.4 References, item 5).	"F" followed by three digits. Hundreds of feet.	F330
ARRIVAL_ TIME_RANGE	Arrival time range for inclusion in an FCA.	Start time and end time separated by a space. Times in standard time format.	200912231600 200912232359
ARRIVES_ANY	Arrival airports and/or ARTCCs for inclusion in an FCA, or for exemption from a CTOP.	One or more airport and/or center names separated by spaces.	ZNY BOS
ARRIVES_NONE	Arrival airports and/or ARTCCs for exclusion from an FCA.	One or more airport and/or center names separated by spaces.	ZNY BOS
AR_FIRST_TIME_ BIN	Start time of the first time bin to which auto-revision will be applied.	yyyymmddhhmm	201109171015
AR_LAST_TIME_ BIN	Start time of the last time bin to which auto-revision will be applied.	yyyymmddhhmm	201109171215
ARTCC	ARTCC name for a NAS element type FCA.	3 characters.	ZBW
ASSIGNED	Indicates that a trajectory option has been assigned by TFMS as part of a CTOP.	One of "TRUE" or "FALSE".	TRUE
AUTO_REVISION	Variable defining whether the automatic revision method of allocation is being applied to an FCA.	One of "TRUE" or "FALSE".	FALSE
BASE_SECTOR	Sector name for a NAS element type FCA when in its baseline state.	5 characters.	ZBW35
CEILING	Upper altitude of an FCA.	3 digits. Expressed as hundreds of feet. Maximum value is 600.	600 090
CENTER	Center point for a CIRCLE FCA.	One point in standard lat/long format.	4255N/07633W

Name	Description	Format/Range/Allowable Values	Example(s)
COLOR_ID	The color selected for an FCA by the traffic manager	An integer from 0 to 35. See Appendix C for definition of color values.	23
CTD	Controlled Time of Departure. A departure time assigned by TFMS as part of a CTOP. A corresponding EDCT will be issued for a flight with a CTD.	12 digits Standard time format.	200912232357
CTL_ELEMENT	Location Identifier of the airport (for GDPs) or FCA (for AFPs or CTOPs) at which the flight's time is currently being controlled	3 to 6 characters, letters and numbers. • Airport Location Identifier – 3 Characters • FCA Name – Exactly 6 characters ("FCAddd") •	DCA, FCA007, FCA123
CTL_EXEMPT	Indicates that a flight was exempt from the CTOP for which the message is being generated. See entry for EXEMPT_REASON for further explanation.	One of “TRUE” or “FALSE”	TRUE
CTL_PRGM	A flight's controlling TMI's name. For GDPs & GSs, set to the airport name. For AFPs, set to the AFP's FCA name. For CTOPs, set to the CTOP’s 6 character short name	3 to 6 characters, letters and numbers. • Airport Location Identifier – 3 Characters • FCA Name – Exactly 6 characters • CTOP Short Name - Exactly 6 characters	DCA, FCA007, CTP123
CTOP_ ELIGIBLE	Indicates whether an FCA is available for CTOP modeling.	One of “TRUE” or “FALSE”.	TRUE
CTOP_NAME	Text describing the CTOP. Created by the traffic manager.	1 to 30 characters	DC_METROS
CTOP_RANK	Number ranking the precedence of a CTOP as compared to other CTOPs.	1 or 2 characters Lower number is a higher ranking.	5

Name	Description	Format/Range/Allowable Values	Example(s)
CTOP_SHORT_NAME	System generated unique 6 character identifier/name for the CTOP TMI. The CTOP_SHORT_NAME can be used to identify a specific CTOP TMI.	Unique CTOP Identifier (assigned by TFMS)– 6 Characters "CTP" followed by "ddd" where range of ddd is 000-999	CTP123
CTOP_SUB_MODE	Determines whether a substitution request is processed using the strict or flexible processing/	STRICT or "FLEXIBLE"	STRICT
DEPARTS_ANY	Departure airports and/or ARTCCs for inclusion in an FCA, or for exemption from a CTOP.	One or more airport and/or center names separated by spaces.	ZNY BOS
DEPARTS_NONE	Departure airports and/or ARTCCs for exclusion from an FCA.	One or more airport and/or center names separated by spaces.	ZNY BOS
DEPARTURE_TIME_RANGE	Departure time range for inclusion in an FCA.	Start time and end time separated by a space. Times in standard time format.	200912231600 200912232359
DEST	Destination airport for a flight.	3 or 4 characters.	BOS LFPG AK12
DIRECTION	The direction of movement for a moving FCA.	1 to 3 digits Degrees, 0 to 359.	15 275
DOMAIN	Defines what facilities can see an FCA or other data element.	"PUBLIC"	PUBLIC
DRAWING	Indicates how to draw a moving FCA. If DRAWING is TRUE, the POINTS define the position at the FCA START time. If FALSE, the POINTS define the position at the LASTUPDATE time.	One of "TRUE" or "FALSE".	TRUE
END	The end date and time for an FCA.	12 digits. Standard time format.	201003042359
ERROR_CODE	The numerical code for an error response.	3 digits	301
ERROR_TEXT	The textual description of an error condition.	Up to 100 characters.	REQUESTED FCA DOES NOT EXIST.

Name	Description	Format/Range/Allowable Values	Example(s)
ERTD	Earliest Runway Time of Departure. The earliest time that the flight can depart.	12 digits Standard time format.	201003251750
EXEMPT_BY_ TIME	If a flight has an ETD earlier than the time of the CTOP issuance plus this value, it is treated as exempt.	1 to 3 digits, minutes.	45
EXEMPT_ REASON	The reason for a flight being exempt from a CTOP. A flight can be exempt due to being in another TMI; in this case the reason is GDP, GS, AFP, or CTOP. A flight can be controlled by this CTOP but exempt from delay because it meets the user-defined exemption parameters; in this case the reason is PARAM. A flight can be exempt because it has been manually overridden by a traffic manager; in this case the reason is MANUAL.	One of “AFP”, “CTOP”, “GDP”, “GS”, “MANUAL”, or “PARAM”	GDP
EXTENDED	Indicates whether an FCA has a time range of more than 24 hours.	One of “TRUE” or “FALSE”.	TRUE
FCA_BIN_AUTO_ REVISION	Defines whether an FCA time bin is enabled for automatic revision.	One of “TRUE” or “FALSE”.	TRUE
FCA_BIN_ CAPACITY	The capacity of an FCA time bin. Related to FCA_BIN_SIZE, particularly in ENTRY mode.	1 to 3 digits The number of flights that can enter the FCA during the time bin (ENTRY mode).	25
FCA_BIN_ CONTROLLED	Defines whether an FCA time bin is being actively controlled under a CTOP or not.	One of “TRUE” or “FALSE”.	TRUE
FCA_BIN_HIGH_ TRIGGER	Defines the amount of that a demand has to exceed capacity to trigger a CTOP allocation in automatic revision mode.	1 or 2 digits The number of flights that can enter the FCA during the time bin (ENTRY mode).	5

Name	Description	Format/Range/Allowable Values	Example(s)
FCA_BIN_LOW_ TRIGGER	Defines the amount of that a demand has to fall below capacity to trigger a CTOP allocation in automatic revision mode.	1 or 2 digits The number of flights that can enter the FCA during the time bin (ENTRY mode).	5
FCA_BIN_SIZE	Defines the number of minutes in a bin for an FCA in a CTOP.	1 or 2 digits Minutes	15
FCA_BIN_TIME	Defines the start of an FCA bin in a CTOP.	12 digits Standard time format	201003251750
FCA_EARLIEST_ ENTRY	The earliest time that a flight could reach a given FCA on a given trajectory option as computed by TFMS.	12 digits Standard time format.	201003041421
FCA_ID	The system generated unique identifier for an FCA.	Up to 64 characters.	Fca.cdmb.lxpc103.200 90713161706
FCA_TYPE	Whether an FCA data structure defines an FCA or FEA.	One of “FCA” or “FEA”.	FCA FEA
FIX	Fix name for a NAS element type FCA.	3 to 5 characters.	VUZ DEWEY
FLIGHT_LEVEL	Flight level range for inclusion of flights in an FCA	Two, 3-digit numbers separated by a space. Top flight level followed by bottom flight level. In hundreds of feet.	350 180
FLIGHT_STATUS	Flight status for inclusion in an FCA.	One of “ACTIVE” or “PROPOSED”,	ACTIVE
FLOOR	Lower altitude of an FCA.	3 digits. Expressed as hundreds of feet. Minimum value is 000	000 090
FSM_ELIGIBLE	Indicates whether an FCA is accessible through FSM.	One of “TRUE” or “FALSE”.	TRUE
HEADING_IS	Heading filter for including flights in an FCA.	Two 1 to 3 digits numbers separated by space. Heading and tolerance, 0 to 359 degrees.	270 20
HEADING_NOT	Heading filter for excluding flights from an FCA.	Two 1 to 3 digits numbers separated by space. Heading and tolerance, 0 to 359 degrees.	270 20

Name	Description	Format/Range/Allowable Values	Example(s)
IGTD	Initial Gate Time of Departure; the gate time of departure from the first message processed by TFMS for a flight.	12 digits. Standard time format.	201003041401
INTERNATIONAL	Defines whether international flights should be exempt or not. (TRUE = Exempt)	One of “TRUE” or “FALSE”.	TRUE
LASTUPDATE	The time the definition of an FCA or other data item was updated.	12 digits. Standard time format.	201003041401
LOCATED_ANY	Sectors, and/or ARTCCs for inclusion in an FCA. Flights that are currently located in any of the elements are included.	One or more sector, and/or center names separated by spaces.	ZBW35 ZNY
LOCATED_NONE	Fixes, sectors, and/or ARTCCs for exclusion from an FCA. Flights that are currently located in any of the elements are excluded.	One or more sector, and/or center names separated by spaces.	ZBW35 ZNY
LOOK_AHEAD	The time into the future for which FCA flight data will be generated and displayed.	2 digits. Number of hours. Maximum value is 24.	6
MANUAL_OVERRIDE	Indicates that a route was either selected manually by a traffic manager from the available TOS options or was entered manually by a traffic manager. In the latter case, there is no TRAJ_INDEX for that TRAJ_OPTION.	One of “TRUE”, “FALSE”.	TRUE
NAME	The FCA name as defined by the traffic manager	FCAs must be exactly 6 characters and start with “FCA”.	FCA001
ORIG	Origin airport for a flight.	3 or 4 characters.	BOS LFPG AK12

Name	Description	Format/Range/Allowable Values	Example(s)
PMNT	Program Minimum Notification Time. The minimum amount of notice prior to departure time that a flight needs to get a new trajectory assignment.	1 to 3 digits Minutes	60
POINTS	The points of the line segments or polygon that define the location of the FCA.	Points of latitude/longitude separated by spaces. Each point is in Standard Lat/Long format. Minimum of 2, maximum of 64 points.	4255N/07633W 4224N/07517W
POPUP_DELAY_LIMIT	When a flight first pops up in a CTOP, TFMS will attempt to find an available slot for the flight without exceeding the popup delay limit, and otherwise will assign the delay limit amount of delay to the flight.	1 to 3 digits. Minutes	180
RADIUS	The radius for a CIRCLE FCA.	1 to 4 digits. Nautical miles	300
REASON	The reason for an FCA, as defined by a traffic manager.	One of: “NONE”, “WEATHER”, “VOLUME”, “RUNWAY”, “EQUIPMENT”, “OTHER”.	WEATHER
REFRESH_INTERVAL	Defines how often the TFMS should check the time bin triggers for automatic revision.	1 or 2 digits Minutes	5
REL_TRAJ_COST	The cost of a trajectory option, relative to other options, expressed as departure delay.	1 to 3 digits 0 to 999 Minutes	60
REMARKS_ ALL	All flight plan remark keywords are needed for inclusion in an FCA.	One or more keywords separated by spaces. Allowable keywords are: “NRP”, “LIFEGUARD”, “CATIII”, “ALTRV”, “SWAP”, “DVRSN”, “ADCUS”, “3DUPT”, and “WXRTE”.	NRP SWAP WXRTE
REMARKS_ ANY	List of flight plan remark keywords for inclusion in an FCA.	One or more keywords separated by spaces. Allowable keywords are: “NRP”, “LIFEGUARD”, “CATIII”, “ALTRV”, “SWAP”, “DVRSN”, “ADCUS”, “3DUPT”, and “WXRTE”.	NRP SWAP WXRTE

Name	Description	Format/Range/Allowable Values	Example(s)
REMARKS_ NONE	List of flight plan remark keywords for exclusion from an FCA.	One or more keywords separated by spaces. Allowable keywords are: “NRP”, “LIFEGUARD”, “CATIII”, “ALTRV”, “SWAP”, “DVRSN”, “ADCUS”, “3DUPT”, and “WXRTE”.	NRP SWAP WXRTE
ROLLING	Defines whether the set of time bins defined for automatic revision and the automatic revision trigger values for those time bins is absolute or relative to the current time.	One of “TRUE” or “FALSE”.	TRUE
ROUTE	Text string defining the route of flight. Uses ICAO field 15c format. As specific in Section 1.4 References, item 5.	Variable length text string	`IOW J10 OBH EKR/N0441F390 DTA RUMPS OAL MOD3`
RVSM	Reduced Vertical Separation Minimum status for inclusion in an FCA.	One of “COMPLIANT” or “NON-COMPLIANT”.	COMPLIANT
SECTOR	Sector name for a NAS element type FCA.	5 characters.	ZBW35
SLOT	A piece of FCA capacity assigned to a flight as part of a CTOP. Also represents the case where no FCA capacity has been assigned to a flight as part of a CTOP since the flight’s trajectory avoids all the FCA in the CTOP (i.e.,, NOSLOT).	22 characters FCA name, “.”, entry time, one letter suffix. Note 1: All times are in standard time format. Note 2: The one letter suffixes ensure that the slot names are unique. <u>NOSLOT</u> 6 Characters ,”NOSLOT”	FCA001.20100329173600A <u>NOSLOT</u> NOSLOT
SMOOTHING_ FACTOR	Defines the number of time bins over which TFMS should smooth the demand in a CTOP. Specific to an FCA.	1 digit Number of bins.	3

Name	Description	Format/Range/Allowable Values	Example(s)
SPEED (Child tag of a POLYGON or Line tags in FCA messages)	The speed of a moving FCA.	1 to 3 digits Knots	20
SPEED (Child tag of TRAJ_OPTION tags in TOS and TMI messages)	Requested cruising speed for a flight. Uses ICAO format for knots (message field 15a, Section 1.4 References, item 5).	"N" followed by 4 digits Knots	N0378
Standard Lat/Long format	Format use for a point of latitude/longitude.	12 characters 4 digits latitude (degrees and minutes), "N" or "S", "/", 5 digits longitude (degrees and minutes), "E" or "W".	4255N/07633W 4224N/07517W
Standard Time Format	Time format used for most time fields.	12 digits. All time fields are expressed as four digits of year and two digits each of month, date, hour, and minute; that is yyyymmddhhmm. All times are in Zulu time.	201003041401
START	The start date and time for an FCA.	12 digits. Standard time format.	201003041700
SUA	SUA name for a NAS element type FCA.	3 to 32 characters.	DEEPWOODS
TMI_STATUS	Indicates whether the TMI is proposed or actual.	One of "ACTUAL" and "PROPOSED".	ACTUAL
TOS_SEQ_NO	The TOS sequence number for a flight. Each time a new TOS is sent for a flight, a new TOS sequence number should be sent.	1 to 3 digits	2
TRACON	TRACON name for a NAS element type FCA.	6 characters.	ZBWBOS
TRAJ_INDEX	Trajectory index. A unique index for each trajectory option in a TOS.	1 or 2 digits 1 to 99	1
RTE_MIN_NOTIF_TIME	The minimum notification time, relative to departure time, that the flight operator needs for a trajectory option to be assigned.	1 to 3 digits 0 to 999 Minutes	30

Name	Description	Format/Range/Allowable Values	Example(s)
TRAJ_SOURCE	The source of trajectory data used by TFMS for a flight as part of a CTOP allocation. The source could be a TOS message, a flight plan (FP), an early intent flight plan (EIFP), or a TFMS historical route (HIST).	One of "TOS", "FP", EIFP", or "HIST".	TOS
TRAJ_VALID_ START	The time at which a trajectory option starts being usable.	12 digits Standard time format	201004011200
TRAJ_VALID_ END	The time at which a trajectory option stops being usable.	12 digits Standard time format	201004011459
TRAVERSES_ALL	Fixes, sectors, and/or ARTCCs for inclusion in an FCA. Only flights that traverse all of the elements are included.	One or more fix, sector, and/or center names separated by spaces.	WHITE WAVEY ZBW35 ZNY
TRAVERSES_ANY	Fixes, sectors, and/or ARTCCs for inclusion in an FCA. Flights that traverse any of the elements are included.	One or more fix, sector, and/or center names separated by spaces.	WHITE WAVEY ZBW35 ZNY
TRAVERSES_ NONE	Fixes, sectors, and/or ARTCCs for exclusion from an FCA.	One or more fix, sector, and/or center names separated by spaces.	WHITE WAVEY ZBW35 ZNY
TYPE	Aircraft type; a.k.a. equipment type.	From 2 to 4 characters, starting with letter.	E6, DC7, A320
TYPE_ANY	Aircraft types for inclusion in an FCA.	One or more aircraft types separated by spaces.	B737 B73S
TYPE_NONE	Aircraft types for exclusion from an FCA.	One or more aircraft types separated by spaces.	B737 B73S
USE_AIRWAY_ ALL	Airways for inclusion in an FCA. Only flights that traverse all of the airways are included.	One or more fix, sector, and/or center names separated by spaces.	WHITE WAVEY ZBW35 ZNY
USE_AIRWAY_ ANY	Airways for inclusion in an FCA. Flights that traverse any of the airways are included.	One or more fix, sector, and/or center names separated by spaces.	WHITE WAVEY ZBW35 ZNY
USE_AIRWAY_ NONE	Airways for exclusion from an FCA.	One or more fix, sector, and/or center names separated by spaces.	WHITE WAVEY ZBW35 ZNY

Name	Description	Format/Range/Allowable Values	Example(s)
USER_ CATEGORY_ ANY	User categories used for inclusion in an FCA.	One or more single letter user categories separated by spaces. Allowable categories are “C” (air carrier), “F” (freight/cargo), “G” (general aviation), “M” (military), and “T” (air taxi).	C F T M
WEIGHT_ CLASS_ ANY	Aircraft weight classes used for inclusion in an FCA.	One or more single letter weight classes separated by spaces. Allowable weight classes are “H” (heavy), “L” (large), and “S” (small).	H L S

A. Sample Messages

Appendix A provides examples of selected CTOP message types. The examples include the binary header as well as the ASCII text, where applicable. The binary header is shown as a sequence of integers separated by spaces. In reality, these are a sequence of packed, four-byte integers in binary format. The ASCII portion of the message, when it exists, starts after the sixth integer. From that point on, the example can be mostly taken literally. Line breaks in the examples correspond to ASCII newline characters in the data buffer. The only exception is that indenting is used in the examples to improve readability. The indents will not be represented as spaces or tabs in the data buffer. All messages are shown in uncompressed form. If compressed, the data buffer size is less than the uncompressed size.

A.1 CTOP Session Sample Messages

Sample Connection Request Message

A connection request message consists of only a binary header. The first value, the message type, is “1” for a connection message. The fourth value is the client tag. The fifth value is the sequence number. The buffer sizes, compressed and uncompressed, are zero as there is no data buffer.

The sample message follows:

```
1|0|0|103|1|0
```

Sample Connection Accepted Message

A connection accepted message also consists of only a binary header. The first value, the message type, is “2” for a connection message. The second value is the current UNIX time. The fourth value reflects back the client tag from the connection request. The fifth value is the sequence number from the connection request.

The sample message follows:

```
2|1234567|0|103|1|0
```

A.2 CTOP FCA Sample Messages

Sample FCA Message

An FCA message starts with the binary header including the message type (first integer), current UNIX time (second integer), uncompressed size (third integer), client tag (fourth integer), and size of the XML message (sixth integer).

The sample message follows:

```
300|1234567|839|103|0|839<xml version=”1.0” standalone=”yes”?>
<FOS_OUTPUT>
    <FCA_BROADCAST>
   <FCA_ID>fca.cdmb.lxpc103.20091107131617</FCA_ID>
   <NAME>FCA007<NAME>
   <DOMAIN>PUBLIC</DOMAIN>
   <LASTUPDATE>200211071016</LASTUPDATE>
   <REASON>NONE</REASON>
   <TYPE>FCA</TYPE>
```

```
   <COLOR_ID>17</COLOR_ID>
   <START>200911071400</START>
   <END>200911071959</END>
   <EXTENDED>FALSE</EXTENDED>
   <LOOK_AHEAD>6</LOOK_AHEAD>
   <FSM_ELIGIBLE>FALSE</FSM_ELIGIBLE>
   <POLYGON>
      <CEILING>600</CEILING>
      <FLOOR>240</FLOOR>
      <POINTS>4255N/07633W 4244N/07517W 4203N/07505W</POINTS>
      < DIRECTION>180</ DIRECTION>
      < SPEED>5</ SPEED>
      <DRAWING>TRUE</DRAWING>
   </POLYGON>
   <PRIMARY_FILTER>
      <CONDITIONS>
         <ANY>
            <DEPARTS_ANY>BOS ZNY</DEPARTS_ANY>
            <TRAVERSE_ANY>WHITE WAVEY</TRAVERSE_ANY>
            <AIRCRAFT_CATEGORY_ANY>J</AIRCRAFT_CATEGORY_ANY>
         </ANY>
      </CONDITIONS>
</PRIMARY_FILTER>
</FCA_BROADCAST>
</FOS_OUTPUT>
```

Sample FCA List Request Message

An FCA list request message also consists of only a binary header including the message type (first integer), client tag (fourth integer), and sequence number (fifth integer).

The sample message follows:

```
301|0|0|103|123|0<xml version="1.0" standalone="yes"?>
<FOS_INPUT>
  <FCA_LIST_REQ/>
</FOS_INPUT>
```

Sample FCA List Reply Message

The FCA list reply message starts with the binary header including the message type (first integer), current Unix time (second integer), uncompressed size (third integer), client tag (fourth integer), the sequence number from the request (fifth integer), and size of the XML message (sixth integer). In this example there are two CTOP FCAs when the request is made.

The sample message follows:

```
302|1234567|310|103|123|310<xml version="1.0" standalone="yes"?>
<FOS_OUTPUT>
 <FCA_LIST>
   <FCA>
      <FCA_ID>fca.cdmb.lxpc103.20100713161706</FCA_ID>
      <FCA_NAME>FCA007<NAME>
      <LASTUPDATE>201007131617</LASTUPDATE>
   </FCA>
   <FCA>
      <FCA_ID>fca.fsa.lxstn07.20100713133454</FCA_ID>
      <FCA_NAME>FCADC3<NAME>
      <LASTUPDATE>201007131428</LASTUPDATE>
   </FCA>
 </FCA_LIST>
</FOS_OUTPUT>
```


A.3 CTOP Trajectory Sample Messages

Sample TOS Message

A TOS message starts with the binary header including the message type (first integer), uncompressed size (third integer), client tag (fourth integer), and size of the XML message (sixth integer).

The sample message follows:


```
320|0|744|103|0|744<xml version="1.0" standalone="yes"?>
<FOS_INPUT>
 <TOS_MESSAGE>
<UNIQUE_FLT_ID_DATA>
   <ACID>UAL123</ACID>
   <ORIG>ORD</ORIG>
   <DEST>SFO</DEST>
   <IGTD>201003041945</IGTD>
  </UNIQUE_FLT_IS_DATA>
  <TOS_SEQ_NO>1</TOS_SEQ_NO>
  <TYPE>B757</TYPE>
  <ERTD>201003041957</ERTD>
  <TRAJ_OPTION_LIST>
      <TRAJ_OPTION>
         <TRAJ_INDEX>1</TRAJ_INDEX>
         <REL_TRAJ_COST>10</REL_TRAJ_COST>
         <ROUTE>IOW J10 OBH EKR/N0441F390 DTA RUMPS OAL MOD3</ROUTE>
         <ALT>F380</ALT>
         <SPEED>N0433</SPEED>
      </TRAJ_OPTION>
      <TRAJ_OPTION>
         <TRAJ_INDEX>2</TRAJ_INDEX>
```

```
        <REL_TRAJ_COST>20</REL_TRAJ_COST>
        <RTE_MIN_NOTIF_TIME>60</RTE_MIN_NOTIF_TIME>
        <TRAJ_VALID_END>201003042100</TRAJ_VALID_END>
        <ROUTE>PLL FOD J94 ONL J48 RUMPS OAL MOD3</ROUTE>
        <ALT>F390</ALT>
        <SPEED>N0441</SPEED>
      </TRAJ_OPTION>
  </TRAJ_OPTION_LIST>
</TOS_MESSAGE>
</FOS_INPUT>
```


A.4 CTOP TMI Sample Messages

Sample CTOP TMI Message

A CTOP TMI message starts with the binary header including the message type (first integer), current UNIX time (second integer), uncompressed size (third integer), client tag (fourth integer), and size of the XML message (sixth integer).

The sample message follows:


```
330|1234567|2617|103|0|2617<xml version="1.0" standalone="yes"?>
<FOS_OUTPUT>
    <CTOP_TMI_BROADCAST>
   <CTOP_NAME>DC_METRO</CTOP_NAME>
    <CTOP_SHORT_NAME>CTP124</CTOP_SHORT_NAME>
    <LASTUPDATE>200211071016</LASTUPDATE>
    <CTOP_RANK>1</CTOP_RANK>
    <TMI_STATUS>ACTUAL</TMI_STATUS>
    <REFRESH_INTERVAL>5</REFRESH_INTERVAL>
    <AUTO_REVISION>FALSE</AUTO_REVISION>
    <SMOOTHING_FACTOR>3</SMOOTHING_FACTOR>
    <EXEMPT_CRITERIA>
      <ACTIVE>TRUE</ACTIVE>
      <INTERNATIONAL>TRUE</INTERNATIONAL>
      <ARRIVES_ANY>ZNY ZDC BOS</ARRIVES_ANY>
      <EXEMPT_BY_TIME>30</EXEMPT_BY_TIME>
    </EXEMPT_CRITERIA>
    <POPUP_DELAY_LIMIT>180</POPUP_DELAY_LIMIT>
    <FCA_LIST>
      <FCA>
          <FCA_ID>fca.cdmb.lxpc103.20100713161706</FCA_ID>
          <FCA_NAME>FCA007<NAME>
          <LASTUPDATE>201007131617</LASTUPDATE>
          <ROLLING>FALSE</ROLLING>
          <FCA_BIN_SIZE>2</FCA_BIN_SIZE>
```

```
        <FCA_BIN_LIST>
         <FCA_BIN>
          <FCA_BIN_TIME>201007131500</FCA_BIN_TIME>
          <FCA_BIN_CAPACITY>20</FCA_BIN_CAPACITY>
          <FCA_BIN_CONTROLLED>TRUE</FCA_BIN_CONTROLLED>
          <FCA_BIN_AUTO_REVISION>TRUE</FCA_BIN_AUTO_REVISION>
          <FCA_BIN_HIGH_TRIGGER>4</FCA_BIN_HIGH_TRIGGER>
          <FCA_BIN_LOW_TRIGGER>2</FCA_BIN_LOW_TRIGGER>
         </FCA_BIN>
         <FCA_BIN>
          <FCA_BIN_TIME>201007131515</FCA_BIN_TIME>
          <FCA_BIN_CAPACITY>18</FCA_BIN_CAPACITY>
          <FCA_BIN_CONTROLLED>TRUE</FCA_BIN_CONTROLLED>
          <FCA_BIN_AUTO_REVISION>FALSE</FCA_BIN_AUTO_REVISION>
         </FCA_BIN>
       </FCA_BIN_LIST>
     </FCA>
   </FCA_LIST>
   <FLIGHT_LIST>
     <FLIGHT>
      <UNIQUE_FLT_ID_DATA>
        <ACID>UAL123</ACID>
        <ORIG>ORD</ORIG>
        <DEST>SFO</DEST>
        <IGTD>201007131345</IGTD>
      </UNIQUE_FLT_ID_DATA>
      <TRAJ_SOURCE>TOS</TRAJ_SOURCE>
      <CTL_EXEMPT>FALSE</CTL_EXEMPT>
      <CTL_ELEMENT>FCA123</CTL_ELEMENT>
      <CTL_PRGM>CTP124</CTL_PRGM>
      <TOS_SEQ_NO>1</TOS_SEQ_NO>
      <ERTD>201007131353</ERTD>
      <TRAJ_OPTION_LIST>
          <TRAJ_OPTION>
             <TRAJ_INDEX>1</TRAJ_INDEX>
             <ASSIGNED>FALSE</ASSIGNED>
             <ADJUSTED_COST>37</ADJUSTED_COST>
             <REL_TRAJ_COST>10</REL_TRAJ_COST>
             <FCA_LIST>
                <FCA>
                   <FCA_ID>fca.cdmb.lxpc103.20100713161706</FCA_ID>
                   <FCA_EARLIEST_ENTRY>201007131503</FCA_EARLIEST_ENTR
                   Y>
                </FCA>
             </FCA_LIST>
```

```
        </TRAJ_OPTION>
        <TRAJ_OPTION>
           <TRAJ_INDEX>2</TRAJ_INDEX>
           <ASSIGNED>TRUE</ASSIGNED>
           <ADJUSTED_COST>0</ADJUSTED_COST>
           <REL_TRAJ_COST>20</REL_TRAJ_COST>
           <ROUTE>PLL FOD J94 ONL J48 RUMPS OAL MOD3</ROUTE>
           <ALT>F390</ALT>
           <SPEED>N0441</SPEED>
           <FCA_LIST>
           </FCA_LIST>
        </TRAJ_OPTION>
     </TRAJ_OPTION_LIST>
  </FLIGHT>
  <FLIGHT>
   <UNIQUE_FLT_ID_DATA>
     <ACID>UAL456</ACID>
     <ORIG>ORD</ORIG>
     <DEST>SFO</DEST>
     <IGTD>201007131445</IGTD>
   </UNIQUE_FLT_ID_DATA>
   <TRAJ_SOURCE>TOS</TRAJ_SOURCE>
   <CTL_EXEMPT>TRUE</CTL_EXEMPT>
   <EXEMPT_REASON>PARAM</EXEMPT_REASON>
   <CTL_ELEMENT>FCA123</CTL_ELEMENT>
  <CTL_PRGM>CTP124</CTL_PRGM>
   <TOS_SEQ_NO>1</TOS_SEQ_NO>
   <ERTD>201007131453</ERTD>
   <SLOT>FCA007.20100713161700A</SLOT>
      <TRAJ_OPTION_LIST>
        <TRAJ_OPTION>
           <TRAJ_INDEX>1</TRAJ_INDEX>
           <ASSIGNED>TRUE</ASSIGNED>
           <ADJUSTED_COST>17</ADJUSTED_COST>
           <REL_TRAJ_COST>10</REL_TRAJ_COST>
           <ROUTE>IOW J10 OBH EKR/N0441F390 DTA RUMPS OAL
           MOD3</ROUTE>
           <ALT>F380</ALT>
           <SPEED>N0433</SPEED>
           <CTD>201007131510</CTD>
           <FCA_LIST>
              <FCA>
                 <FCA_ID>fca.cdmb.lxpc103.20100713161706</FCA_ID>
                 <FCA_EARLIEST_ENTRY>201007131600</FCA_EARLIEST_ENTR
                 Y>
```

```
                </FCA>
             </FCA_LIST>
          </TRAJ_OPTION>
          <TRAJ_OPTION>
             <TRAJ_INDEX>2</TRAJ_INDEX>
             <ASSIGNED>FALSE</ASSIGNED>
             <ADJUSTED_COST>20</ADJUSTED_COST>
             <REL_TRAJ_COST>20</REL_TRAJ_COST>
             <FCA_LIST>
             </FCA_LIST>
          </TRAJ_OPTION>
       </TRAJ_OPTION_LIST>
    </FLIGHT>
</FLIGHT_LIST>
</CTOP_TMI_BROADCAST>
</FOS_OUTPUT>
```


Sample Trajectory Assignment Message

A trajectory assignment message starts with the binary header including the message type (first integer), current UNIX time (second integer), uncompressed size (third integer), client tag (fourth integer), and size of the XML message (sixth integer).

The sample message follows:


```
331|1234567|836|103|0|836<xml version="1.0" standalone="yes"?>
<FOS_OUTPUT>
 <TRAJ_ASSIGN_BROADCAST>
<CTOP_NAME>DC_METRO</CTOP_NAME>
   <CTOP_SHORT_NAME>CTP124</CTOP_SHORT_NAME>
   <FLIGHT_LIST>
    <FLIGHT>
      <UNIQUE_FLT_ID_DATA>
        <ACID>UAL123</ACID>
        <ORIG>ORD</ORIG>
        <DEST>SFO</DEST>
        <IGTD>201007131345</IGTD>
     </UNIQUE_FLT_ID_DATA>
     <ERTD>201007131353</ERTD>
     <TOS_SEQ_NO>1</TOS_SEQ_NO>
     <CTOP_NAME>DC_METRO</CTOP_NAME>
     <CTOP_SHORT_NAME>CTP124</CTOP_SHORT_NAME>
     <TRAJ_SOURCE>TOS</TRAJ_SOURCE>
     <CTL_EXEMPT>FALSE</CTL_EXEMPT>
     <CTL_ELEMENT>FCA123</CTL_ELEMENT>
     <CTL_PRGM>CTP124</CTL_PRGM>
       <TRAJ_OPTION_LIST>
```

```
      <TRAJ_OPTION>
         <TRAJ_INDEX>1</TRAJ_INDEX>
         <ASSIGNED>FALSE</ASSIGNED>
         <ADJUSTED_COST>37</ADJUSTED_COST>
         <REL_TRAJ_COST>10</REL_TRAJ_COST>
         <FCA_LIST>
            <FCA>
               <FCA_ID>fca.cdmb.lxpc103.20100713161706</FCA_ID>
               <FCA_EARLIEST_ENTRY>201007131503</FCA_EARLIEST_ENTRY>
            </FCA>
         </FCA_LIST>
      </TRAJ_OPTION>
      <TRAJ_OPTION>
         <TRAJ_INDEX>2</TRAJ_INDEX>
         <ASSIGNED>TRUE</ASSIGNED>
         <ADJUSTED_COST>20</ADJUSTED_COST>
         <REL_TRAJ_COST>20</REL_TRAJ_COST>
         <ROUTE>PLL FOD J94 ONL J48 RUMPS OAL MOD3</ROUTE>
         <ALT>F390</ALT>
         <SPEED>N0441</SPEED>
         <FCA_LIST>
         </FCA_LIST>
      </TRAJ_OPTION>
     </TRAJ_OPTION_LIST>
    </FLIGHT>
</FLIGHT_LIST>
</TRAJ_ASSIGN_BROADCAST>
</FOS_OUTPUT>
```


A.5 CTOP Substitution Sample Messages

Sample Substitution Request Message

A substitution request message starts with the binary header including the message type (first integer), uncompressed size (third integer), client tag (fourth integer), and size of the XML message (sixth integer).

In this example, the substitution request is attempting to move UAL123 into slot FCA007.20100713161700A and to move UAL456 out of any of the CTOP FCAs.

The sample message follows:


```
350|0|454|103|0|454<xml version="1.0" standalone="yes"?>
<FOS_INPUT>
 <CTOP_SUB_REQ>
   <CTOP_NAME>DC_METRO</CTOP_NAME>
   <CTOP_SHORT_NAME>CTP124</CTOP_SHORT_NAME>
   <CTOP_SUB_MODE>STRICT</CTOP_SUB_MODE>
   <FLIGHT_LIST>
```

```
      <FLIGHT>
        <UNIQUE_FLT_ID_DATA>
           <ACID>UAL123</ACID>
           <ORIG>ORD</ORIG>
           <DEST>SFO</DEST>
           <IGTD>201007131345</IGTD>
         </UNIQUE_FLT_ID_DATA>
         <SLOT>FCA007.20100713161700A</SLOT>
      </FLIGHT>
      <FLIGHT>
         <UNIQUE_FLT_ID_DATA>
           <ACID>UAL456</ACID>
           <ORIG>ORD</ORIG>
           <DEST>SFO</DEST>
           <IGTD>201007131445</IGTD>
         <UNIQUE_FLT_ID_DATA>
         <SLOT>NOSLOT</SLOT>
      </FLIGHT>
   </FLIGHT_LIST>
 </CTOP_SUB_REQ>
</FOS_INPUT>
```

Sample Substitution Reply Message

A substitution reply message starts with the binary header including the message type (first integer), current UNIX time (second integer), uncompressed size (third integer), client tag (fourth integer), and size of the XML message (sixth integer).

In this example, the substitution request has been approved. TFMS returns new trajectory assignments to accommodate the new slots (or lack of slots).

The sample message follows:

```
351|1234567|1724|103|0|1724<xml version="1.0" standalone="yes"?>
<FOS_OUTPUT>
 <CTOP_SUB_REPLY>
   <CTOP_NAME>DC_METRO</CTOP_NAME>
   <CTOP_SHORT_NAME>CTP124</CTOP_SHORT_NAME>
   <FLIGHT_LIST>
      <FLIGHT>
         <UNIQUE_FLT_ID_DATA>
           <ACID>UAL123</ACID>
           <ORIG>ORD</ORIG>
           <DEST>SFO</DEST>
           <IGTD>201007131345</IGTD>
         </UNIQUE_FLT_ID_DATA>
         <ERTD>201007131353</ERTD>
         <TOS_SEQ_NO>1</TOS_SEQ_NO>
```

```
        <SLOT>FCA007.20100713161700A</SLOT>
        <TRAJ_OPTION_LIST>
           <TRAJ_OPTION>
              <TRAJ_INDEX>1</TRAJ_INDEX>
              <ASSIGNED>TRUE</ASSIGNED>
              <ADJUSTED_COST>123</ADJUSTED_COST>
              <REL_TRAJ_COST>10</REL_TRAJ_COST>
              <ROUTE>IOW J10 OBH EKR/N0441F390 DTA RUMPS OAL
              MOD3</ROUTE>
              <ALT>F380</ALT>
              <SPEED>N0433</SPEED>
              <CTD>201007131430</CTD>
              <FCA_LIST>
                 <FCA>
                    <FCA_ID>fca.cdmb.lxpc103.20100713161706</FCA_ID>
                    <FCA_EARLIEST_ENTRY>201007131503</FCA_EARLIEST_ENTR
                    Y>
                 </FCA>
              </FCA_LIST>
           </TRAJ_OPTION>
           <TRAJ_OPTION>
              <TRAJ_INDEX>2</TRAJ_INDEX>
              <ASSIGNED>FALSE</ASSIGNED>
              <ADJUSTED_COST>0</ADJUSTED_COST>
              <REL_TRAJ_COST>20</REL_TRAJ_COST>
              <FCA_LIST>
              </FCA_LIST>
           </TRAJ_OPTION>
        </TRAJ_OPTION_LIST>
     </FLIGHT>
     <FLIGHT>
        <UNIQUE_FLT_ID_DATA>
          <ACID>UAL456</ACID>
          <ORIG>ORD</ORIG>
          <DEST>SFO</DEST>
          <IGTD>201007131445</IGTD>
        </UNIQUE_FLT_ID_DATA>
<ERTD>201007131453</ERTD>
        <TOS_SEQ_NO>1</TOS_SEQ_NO>
        <TRAJ_OPTION_LIST>
           <TRAJ_OPTION>
              <TRAJ_INDEX>1</TRAJ_INDEX>
              <ASSIGNED>FALSE</ASSIGNED>
              <ADJUSTED_COST>17</ADJUSTED_COST>
              <REL_TRAJ_COST>10</REL_TRAJ_COST>
```

```
            <FCA_LIST>
               <FCA>
                  <FCA_ID>fca.cdmb.lxpc103.20100713161706</FCA_ID>
                  <FCA_EARLIEST_ENTRY>201007131600</FCA_EARLIEST_ENTR
                  Y>
               </FCA>
            </FCA_LIST>
         </TRAJ_OPTION>
         <TRAJ_OPTION>
            <TRAJ_INDEX>2</TRAJ_INDEX>
            <ASSIGNED>TRUE</ASSIGNED>
            <ADJUSTED_COST>0</ADJUSTED_COST>
            <REL_TRAJ_COST>20</REL_TRAJ_COST>
            <ROUTE>PLL FOD J94 ONL J48 RUMPS OAL MOD3</ROUTE>
            <ALT>F390</ALT>
            <SPEED>N0441</SPEED>
            <FCA_LIST>
            </FCA_LIST>
         </TRAJ_OPTION>
      </TRAJ_OPTION_LIST>
   </FLIGHT>
 </FLIGHT_LIST>
</CTOP_SUB_REPLY>
<FOS_OUTPUT>
```


Sample Substitution Error Message

A substitution error message starts with the binary header including the message type (first integer), current UNIX time (second integer), uncompressed size (third integer), client tag (fourth integer), and size of the XML message (sixth integer).

In this example, the substitution request has been approved. TFMS returns new trajectory assignments to accommodate the new slots (or lack of slots).

The sample message follows:


```
352|1234567|376|103|0|376<xml version="1.0" standalone="yes"?>
<FOS_OUTPUT>
 <CTOP_SUB_ERROR>
   <CTOP_NAME>DC_METRO</CTOP_NAME>
   <CTOP_SHORT_NAME>CTP124</CTOP_SHORT_NAME>
   <FLIGHT_LIST>
      <FLIGHT>
         <UNIQUE_FLT_ID_DATA>
           <ACID>UAL123</ACID>
           <ORIG>ORD</ORIG>
           <DEST>SFO</DEST>
           <IGTD>201007131345</IGTD>
```

```
        </UNIQUE_FLT_ID_DATA>
        <SLOT>FCA007.20100713161700A</SLOT>
        <ERROR_LIST>
          <ERROR>
             <ERROR_CODE>541</ERROR_CODE>
             <ERROR_TEXT>NO VALID TRAJECTORY FOR REQUESTED
        SLOT(S)</ERROR_TEXT>
           </ERROR>
        </ERROR_LIST>
      </FLIGHT>
    </FLIGHT_LIST>
 </CTOP_SUB_ERROR>
</FOS_OUTPUT>
```

B. Error Codes and Text

This section provides a sample set of error messages.

Error Code	Error Text	Description
000	REQUEST NOT CURRENTLY SUPPORTED	The processing required for this data request is not currently implemented.
500	UNKNOWN MESSAGE TYPE	Returned in response to any message for which TFMS encounters an unrecognized message type.
501	Free form message text that describes the specific field in error, for example, “The value ‘12345’ of element ‘IGTD’ is not valid”.	Returned in response to any message for which TFMs encounters an unrecognized message format for a known message type.
510	REQUESTED FCA NOT FOUND	The FCA with the requested FCA_ID is not currently in defined in the TFMS database
520	FLIGHT NOT IN TFMS	Flight entered in the TOS message is not in the TFMS data base.
521	NOT AUTHORIZED TO SEND TOS/RESYNCH FOR THIS FLIGHT	The flight operator has submitted a TOS for a flight that it is not authorized to send according to the adapted airline definition data.
522	ROUTE CANNOT BE PARSED BY TFMS	The route could not be modeled and one or more errors were found
523	ROUTE CANNOT BE PARSED BY ERAM	The route could not be modeled and one or more errors were found
524	DUPLICATE TOS OPTION TRAJECTORY INDEX	An option has the same trajectory index number as another option.
525	NO UNBOUNDED TRAJECTORY OPTION	The message does not contain at least one valid TOS option that has an unbounded Trajectory Valid End Time (TVET). The TVET is considered to be unbounded for a TOS option when the optional TVET was not provided for that option.
526	REQUESTED FLIGHT	The f light requested in a TOS-resynch request is

Error Code	Error Text	Description
	NOT FOUND	not currently defined in TFMS
527	NO TOS DEFINED FOR THIS FLIGHT	The flight requested in the TOS resynch request does not have a TOS defined for it.
528	INVALID SPEED	The entered speed cannot be zero
530	REQUESTED CTOP NOT FOUND	The entered CTOP name not found in TFMS
540	NOT AUTHORIZED TO SEND SUBSTITUTION FOR THIS FLIGHT	The flight operator has submitted a substitution message for a flight that it is not authorized to send according to the adapted airline definition data.
541	FLIGHT NOT IN CTOP	The specified flight is not in the specified CTOP
542	NO VALID TRAJECTORY FOR REQUESTED SLOT(S)	
543	SLOT NOT OWNED BY FLIGHT IN THIS MESSAGE	
544	ROUTE AND ALTITUDE EQUAL TO ANOTHER OPTION	An option has the same route and altitude as another but different speed. When the parameter “Route Altitude Seed Check” is set to “REJECT” , reject all TOS options in the message that have the same route and altitude fields but different speeds.
545	OPTION DUPLICATE OF ANOTHER OPTION	A TOS option is a duplicate of another TOS option. A TOS option is a duplicate of another TOS option when every data item in the option is exactly the same as in another option.
546	TVST LATER THAN TVET	The Trajectory Valid Start Time(TVST) is greater than the Trajectory Valid End Time(TVET) when both are provided. .
547	TVET IN THE PAST	The Trajectory Valid End Time (TVET) is in the past as compared to the current clock time.
548	TOS OPTIONS EXCEED MAX TOS OPTIONS ALLOWED CURRENTLY SET AT ( )	A TOS message has been received having options greater than the configured maximum a TOS message can contain. The maximum number of options that a message can contain is defined by the parameter “Max TOS Options”. The current value of this parameter is included in the message.
549	AIRCRAFT TYPE NOT ADAPTED	Aircraft type in the message is not an adapted aircraft type.

Error Code	Error Text	Description
550	FLIGHT CANCELED OR COMPLETED	Flight has been cancelled or completed
551	INVALID TOS OPTIONS	One or more of the specified TOS options is not valid. An error is included for each option that failed validation.
552	TOS SEQUENCE NUMBER NOT GREATER THAN CURRENTLY STORED	The TOS_SEQ_NO given in the message is equal or lower than the current TOS sequence number for the flight in TFMS.
553	SUBSTITUTION REQUEST MUST INCLUDE MORE THAN ONE FLIGHT	In a substitution message, 2 or more flights must be present to meaningfully swap flights in the slot.
554	A SLOT TAG IS REQUIRED FOR EACH FLIGHT IN A SUBSTITUTION REQUEST	A SLOT tag is explicitly required in a substitution request message, even when NOSLOT assignment is desired for a flight.
555	REQUESTED FCA NOT INCLUDED IN AN ACTIVE / PROPOSED CTOP	Returned in response to a CTOP FCA Flight List Request or a CTOP FCA Re-synch Request for an FCA which is not included in an Active or Proposed CTOP
556	REQUESTED CTOP NOT ACTIVE	Returned in response to a CTOP Re-synch Request for a CTOP which is not currently active
557	FLIGHT NOT CONTROLLED BY ACTIVE CTOP	Returned in response to a CTOP Trajectory Assignment Re-synch Request for a flight which is not currently controlled by an active CTOP

C. Color Values

The following table provides information for interpreting the color indices included in the CTOP FCA message format. The indices are defined using the COLOR_ID XML tag. These are useful if an FOS wants to display FCAs exactly as they appear to the traffic manager who created them.

COLOR_ID	Motif Color Name	RGB Value
0	Black	0 0 0
1	Gray40	102 102 102
2	Gray60	153 153 153

COLOR_ID	Motif Color Name	RGB Value
3	Azure3	193 205 205
4	White	255 255 255
5	AntiqueWhite2	238 223 204
6	Red4	139 0 0
7	Red1	255 0 0
8	OrangeRed	255 69 0
9	Coral	255 114 86
10	LightPink	255 182 193
11	Bisque	255 228 196
12	Purple3	125 38 205
13	Plum	197 72 155
14	Magenta3	205 0 205
15	VioletRed1	255 62 150
16	Plum1	255 187 255
17	LightCyan	224 255 255
18	RoyalBlue4	39 64 139
19	Blue	0 0 255
20	SteelBlue3	79 148 205
21	SkyBlue	114 159 255
22	Cyan	0 255 255
23	PaleTurquoise	175 238 238
24	OliveDrab4	105 139 34
25	LimeGreen	0 175 20
26	DarkSeaGreen	143 188 143
27	Khaki3	205 198 115
28	LightSeaGreen	32 178 170
29	Chartreuse	127 255 0
30	Chocolate3	205 102 29
31	Orange	255 135 0
32	Gold	218 170 0
33	LightSalmon1	255 160 122
34	Yellow	255 255 0
35	LightGoldenrodYellow	250 250 210