Network Manager

EUROCONTROL

FUM Implementation Guide

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1 Introduction

1.1 Identification

(1) This document forms part of the "ETFMS" documentation.

(2) This document has a document reference of "APTAPT/USD/FUM_Impl_Guide ".

(3) This document has a Title of "FUM Implementation Guide".

1.2 Purpose

(1) The purpose of this document is to provide a short description on how the FUM can best be used such that it will help when developing the applications and software that will use the FUM. This document also contains a short description of other ETFMS messages and inputs that have a strong relationship with FUM messages such as the EFD message.

(2) This results in a Reference & Implementation guide for FUM messages.

(3) The detailed FUM message syntax and semantic requirements from a "NMOC external" point of view, i.e. requirements for implementation of FUM messages by "external" (i.e. ATC and CDM Airport systems and Advanced ATC TWR systems) are described in Doc Ref 1 (see below).

(4) This document Following the CP1 Regulation and the SWIM Transition policy, this document has been updated with a new section, listing the related high level requirements and de adlines for the transition of FUM messages to SWIM.

1.3 Scope

(1) The intended audience of this document is anybody who would like to have an overview of the FUM messages. This includes Airports, ANSPs, operational staff and software developers.

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2 References

2.1 External

(1) This document makes reference to the following external documents, an external document being defined as a document not produced by the NM:

None

2.2 NM

(1) NM referenced documents **shall** take precedence over any referenced external documents wherever conflict arises between them. The following documents are referenced within this document:

(2) Doc Ref 1: Flight Progress Messages, ref APT/USD/MSG_INTF, Edition 2.900, author Hans Koolen, Ioana Coliban, dated 01/10/2023.

(3) Doc Ref 2: DPI and API Implementation Road Map, ref APT/USD/DPI_API_Impl_RM, Edition 2.400, author Hans Koolen, Tarja Kettunen, dated 01/10/2023.

(4) Doc Ref 3: NM B2B web services reference manuals

The NM B2B web services reference manuals are published in the Eurocontrol One-SKY teams B2B library. Access to the library can be requested to NM.customersupport@eurocontrol.int. More info can also be found on "www.eurocontrol.int/services/nm-b2b-web-services"

(5) Doc Ref 4: Airport CDM manual – Edition 5.0, dated March 2017.

(6) Doc Ref 5: NM B2B web services – Flight Management Use cases, Business documentation for Flight Management, Edition 1.3, author(s) B. Queval, A. Nesic, dated 01/08/2022.

3 Introduction

3.1 CP1 Regulation and Transition to SWIM

(1) SWIM is one of the ATM functionalities identified by the ATM Master Plan and by the ICAO GANP for ATM modernisation. In Europe, the CP1 EU Implementing Regulation mandates the use of SWIM for the exchange of aeronautical, meteorological, network and flight information by the end of 2025.

(2) EUROCONTROL has developed SWIM specifications, which are means of compliance with CP1. The NM B2B Services have demonstrated conformance with the EUROCONTROL Specifications for SWIM and compliance with the CP1 regulation.

(3) In order to progress with the SWIM implementation at European level, NM has developed a policy for the transition to SWIM, describing guiding principles for the data exchanges with stakeholders and for the transitioning from current technologies. This Policy reflects the CP1 IR deployment scope and was approved by NDOP in 2018. Those principles led to the following approach:

a) CP1 IR mandates NM, ANSPs and (a set of) airports to implement the departure planning information exchange (DPI) and the flight update messages (FUM) via SWIM by **31/12/2025.**

b) After this deadline, NM will support the current messages for **two additional years**

c) The Target sunset date for DPI and FUM for all airports (in CP1 or not) and ANSPs is **31/12/2027.**

d) New NM services, required by CP1 (e.g. API messages) or other, will not be provided via old messaging technologies, only via NM B2B Services.

(4) The remaining part of the section describes the FUM messages and the corresponding implementation via the B2B services. Migration of DPI messages from AFTN to NM B2B services is described in the DPI and API Implementation Roadmap document.

3.2 Airport CDM Implementation Manual

(1) The overall Airport CDM process is described in the Airport CDM Implementation Manual (Doc Ref 4). This document also describes the link between the CDM implementation milestones and the reception of FUM messages.

(2) The FUM Implementation Guide describes the FUM message with all the required and available details.

(3) To be able to place the FUM messages in the appropriate A-CDM context or any other Airport Operation that might want to use Estimated LanDing Times (ELDTs) from NMOC, it might be useful to read the relevant parts in the Airport CDM Implementation Manual. This will also ease the reading and understanding of this FUM Implementation Guide.

(4) Note that this document may also be useful for Airports that are interested in receiving and using Estimated Landing Times (ELDTs) from NM via other sources such as ETFMS Flight Data (EFD) messages of via B2B WEB services.

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3.3 Objectives

(1) The overall objective of the FUM messages is to link the airport of destination with the ATM network in order to better coordinate ATFCM with CDM Airport operations and to ensure on time update of the flight data at the destination airport.

(2) The Flight Update Message (FUM) provides airports of destination mainly with the estimated landing time (ELDT) of a flight.

(3) The FUM data is usually provided to the Airport Platform from where it can be shared with all actors at the airport of destination to improve their planning (e.g. calculate more accurate ELDT, EIBT, TOBT,…).

3.4 Benefits of FUM messages

3.4.1 Introduction

(1) The purpose of FUM is to make NMOC partners aware of the situation of a given flight, in particular regarding the Estimated LanDing Time (ELDT), through a message that can be automatically processed.

(2) The message can be provided to Airports of Destination of flights.

3.4.2 Benefits

(1) The FUM message provides a way for the Airports and the ATFCM process to be integrated, supporting therefore the management of the network. They contribute to the common picture of the network situation, facilitating its understanding and further decision making.

(2) They allow the Airport to have a better knowledge of the traffic to its destination and to take it into account in its own processes.

(3) They allow a best adjustment between Airport and ATC capacity.

(4) Although intended for exchanging messages between systems, the FUM is a short message that can be used directly by persons, and also rather easily integrated in systems.

(5) They improve the short term forecast of the traffic situation for the airport.

(6) They enable airlines to get a better view of their respective fleet situation before actual arrival of the flight.

(7) They will support the management of critical situation at Airports and the impact on other actors.

(8) Information that the flight is diverting or has diverted. The FUM is sent to both the old and the new Airport of Destination.

3.5 Pre-requisites

(1) The NMOC can provide FUM messages to Airports of destination of flights.

(2) However, the systems at the airport should be ready to receive FUM messages before the NMOC can provide FUM messages for live data.

(3) The NMOC can provide FUM messages off-line for testing and evaluation purposes.

(4) The provision of FUM messages will be included in the Service Agreement between NMOC and the ANSP concerned.

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3.6 How to request FUM messages?

(1) Applicants are encouraged to first check the service eligibility and accountability conditions prior to requesting the FUM service to ensure eligibility requirements are met.

(2) Requests for FUM messages can be made via the NM Service Request Form, which can be found here: https://www.eurocontrol.int/network-operations/access-service-request-form

(3) After the NM Service Request Form has been completed, the applicant will receive a confirmation of processing.

(4) For all first time requests, users are required to complete a Service Agreement.

(5) The NM will activate the new service after all documentation has been received and approved. The customer will be notified by e-mail.

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4 FUM

4.1 What are the main data items in the FUM?

(1) The main purpose of the FUM is to provide an airport of destination with the Estimated LanDing Time (ELDT) of a flight.

(2) The FUM also contains the Estimated Time Over (ETO) of the last point en-route or of the Inbound Approach Fix (IAF).

(3) The FUM also contains the status of the flight in ETFMS (e.g. filed, delayed by ATFM, updated by CDM or Advanced TWR Airport, Airborne,…).

(4) The FUM may also contains the APTYPE field. It indicates that the departure airport is a CDM Airport, an advanced TWR airport or a standard airport.

(5) The CDMSTATUS-field in the FUM provides the status of the flight during the turnaround process at the airport of departure if the APTYPE is CDMAirport or AdvancedTWR airport.

(6) A complete description of the FUM can be found in the Flight Progress messages document (Doc Ref 1) which can be downloaded from the NM website.

4.2 When is the FUM provided?

(1) A FUM will be sent 3hrs before the estimated landing time of the flight, even if it is not yet airborne.

(2) For flights with a flying time longer than 3 hours, the first FUM is provided as soon as the flight is reported as airborne. This is especially useful for long-haul flights (e.g. departing from Singapore) as it would allow airports of destination to be informed quicker about the ELDT.

(3) FUM updates are provided when the ELDT changes by more than 5min or when the status of the flight changes.

(4) The first FUM may be provided later than 3hrs before ELDT, if the flight plan is filed later.

4.3 How is the FUM composed?

(1) The FUM is sent by the NMOC's Enhanced Tactical Flow Management System (ETFMS). This system is used for Air Traffic Flow & Capacity Management (ATFCM) in the ECAC zone.

(2) ETFMS receives (ICAO) flight plan data and flight plan data updates for all IFR/GAT flights in the ECAC area.

(3) This flight plan data is updated with pre-departure updates from CDM Airports or Advanced ATC TWR airports via the DPI messages.

(4) After take-off the flight data is further updated with airborne data updates from ANSPs and from Aircraft Operators.

(5) The airborne data updates consist e.g. of surveillance data updates, flight plan activation messages from ACCs, Oceanic Clearance messages,…

(6) Several Aircraft Operators send estimates for landing times based upon ACARS messages for long haul flights.

(7) Note that NM/ETFMS validates each update message it receives and messages that are considered as erroneous are rejected and do not result in a flight data update and in transmission of a FUM message.

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4.4 How can the FUM be used best?

4.4.1 Flight Status

(1) The FUM contains the status of the flight. This status should be used as an indicator of the reliability of the ELDT. When the flight is Airborne (AA, ATC_Activated status), the FUM data is more accurate compared to before airborne time. The flight status should be used in the processing of the FUM.

(2) An airport may decide to only use FUM messages for airborne flights because these are most accurate.

(3) If an airport would like to be informed if a flight, which is still at the outstation, is delayed by ATFM (CTOT), it should also use the FUMs if the flight is not yet airborne (e.g. with the status FS or SI (see Doc Ref 1 for more details)).

(4) If an airport would like to receive FUMs that contain flight updates from CDM Airports or Advanced TWR Airports (via DPI messages), it should use FUMs that contain the corresponding status.

4.4.2 CDMStatus and APtype

(1) The CDMstatus-field can be used to follow the progress of the flight during the turnaround process at the airport of departure. For example CDMSTATUS="a" or "actual off block" indicates that the flight is taxiing.

(2) The APTYPE-field shows if the airport of departure is a CDM airport or an advanced TWR type of airport.

4.4.3 Prioritisation of various sources of ELDTs

(1) Usually an airport receives estimates of landing times from several sources. Examples are ELDTs from the national ANSP, mvt messages from handlers, ACARS messages from AOs,…

(2) None of these sources, including FUM, provide the same accuracy, the same completeness at the same time, so it is usually required to find a prioritisation rule to use each source at the appropriate moment.

(3) It is difficult for the NMOC to provide the best possible prioritisation rule, mainly because it may vary per airport. When the flight is inside the airspace controlled by the national ANSP, this national ANSP can usually provide better estimates than NM. Before entry into national airspace, the FUM data could be used. Movement messages from handlers and AOs may provide ELDTs earlier than 3 hours before landing.

(4) The flight status in the FUM should also be used to prioritise the data. For example: a data source that indicates that the flight is airborne should have priority over a data source that does not have this indication yet.

(5) A recommendation for prioritisation is:

1) local ATC systems (approach radar)
2) local ATC systems (multi-lateration)
3) Aircraft/airline FMS/ACARS
4) ELDT from NMOC for airborne traffic
5) Ground Handler Movement messages for airborne traffic
6) ELDT from NMOC for non-airborne traffic
7) Flight Plan (EOBT + TTLEET)
8) Ground Handler Movement messages for non-airborne traffic

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(6) Also FUMs triggered by DPI message updates from a departure airport that is a CDM airport or an Advanced TWR Airport may provide more accurate ELDTs than other sources

4.4.4 Use of ELDT versus ETO

(1) The FUM contains both the Estimated LanDing Time (ELDT) which is the touch-down time, and the ETO over the last route point. The name of the last-point en-route is also included in the FUM.

(2) The use of the ETO is recommended over the use of the ELDT because the ETO usually provides more accurate estimates.

(3) When the ETO is used, the receiver of the FUM must be able to calculate the elapsed time between the last-point en-route and the landing time.

4.4.1 Use of ATOT

(1) The ATOT field in the FUM message provides the best-know take-off time of the flight (at the departure airport).

(2) For departures from all airports, the ATOT field will contain the Actual Take-Off-Time as received from the ANSP, via FSA or CPR messages. The flight status will be ATC Activated (AA) in this cases.

(3) Before the flight is airborne, the ATOT field is only present under the following circumstances:

Departure type	When	Value of ATOT	Flight Status/ CDM Status
Standard airport	Clock reaches EOBT+taxitime	EOBT+taxitime, possibly shifted by 5min every 5min (FAM mechanism)	TA / --
CDM Airport – Regulated flights	At reception of T-DPI-s with TTOT inside STW	TTOT of T-DPI-s	TA / PRESEQUENCED
CDM Airport – non-Regulated flights	At reception of T-DPI-s	TTOT of T-DPI-s	TA / PRESEQUENCED
CDM/AAT Airports – all flights	At reception of A-DPI	TTOT of A-DPI	TA / ACTUALOFFBLOCK

4.5 Accuracy of FUM

4.5.1 ATFCM data

(1) The data that is provided in the FUM messages is extracted from the NMOC's ETFMS system. This system and its data is used by many users in ATFCM operations. This is the first guarantee for quality of data.

(2) It must be noted that the data is used for ATFCM operations and that it has an accuracy that is sufficient for ATFCM purposes.

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(3) For most flights, the flight data in ETFMS has an accuracy of +/- 5min around the actual time.

4.5.2 Selection of the STAR

(1) The ELDT in the FUM depends on the STAR that has been selected for the flight by ETFMS. ETFMS cannot always predict the STAR that will eventually be used by the flight and this may result in a less accurate ELDT.

(2) The selection of the STAR depends on the active landing-runway-in-use and if the runway-configuration in ETFMS is updated when the runway actually changes, ETFMS selects an appropriate STAR and the ELDT will be more accurate.

(3) The provided ETO is independent of the STAR and is therefore usually more accurate than the ELDT.

4.5.3 Effect of flight status

(1) It is obvious that the ELDTs and ETOs of airborne flights are more accurate than FUMs of flights that have not taken off yet. Delays may still occur before take-off.

(2) From CDM Airports and Advanced ATC TWR Airports, ETFMS receives flight updates via DPI messages and these result in more accurate FUM messages.

4.5.4 Accuracy & Completeness of data update messages from ATC

The NMOC receives surveillance data and flight plan activation messages from most ACCs in the ECAC area. However, the coverage is not complete yet.

(1) For flights that depart from not-covered areas, the FUMs will provide less accurate data. But as soon as the flight enters covered area, the FUMs will provide more accurate data.

(2) The NMOC is continuously trying to extend the coverage. The actual coverage of surveillance data (CPRs) and flight plan activation messages (FSAs) can be viewed on the NM web-site.

(3) The accuracy of the FUM depends on the data update messages that ETFMS receives from ANSPs and AOs.

(4) ETFMS validates all received messages and ignores messages that are considered as erroneous. However, in some exceptional cases, it is impossible to detect that the data in a message is erroneous, the message is processed, flight data is updated and a FUM is distributed. This occasionally leads to FUMs with less accurate ELDTs and ETOs.

4.5.5 Holdings

(1) ETFMS receives surveillance data from most ACCs in the ECAC area with an update rate of one position report per 30 seconds. This is usually not sufficient to identify that the flight is in a holding and consequently, FUM message provide less accurate data when the flight is in a holding.

4.5.6 Statistics

(1) The graph below is an example. It shows the accuracy of the ELDTs in FUMs to EBBR. The statistics are based upon FUMs with Airborne (AA) status and cover all landings on 21st June 2010.

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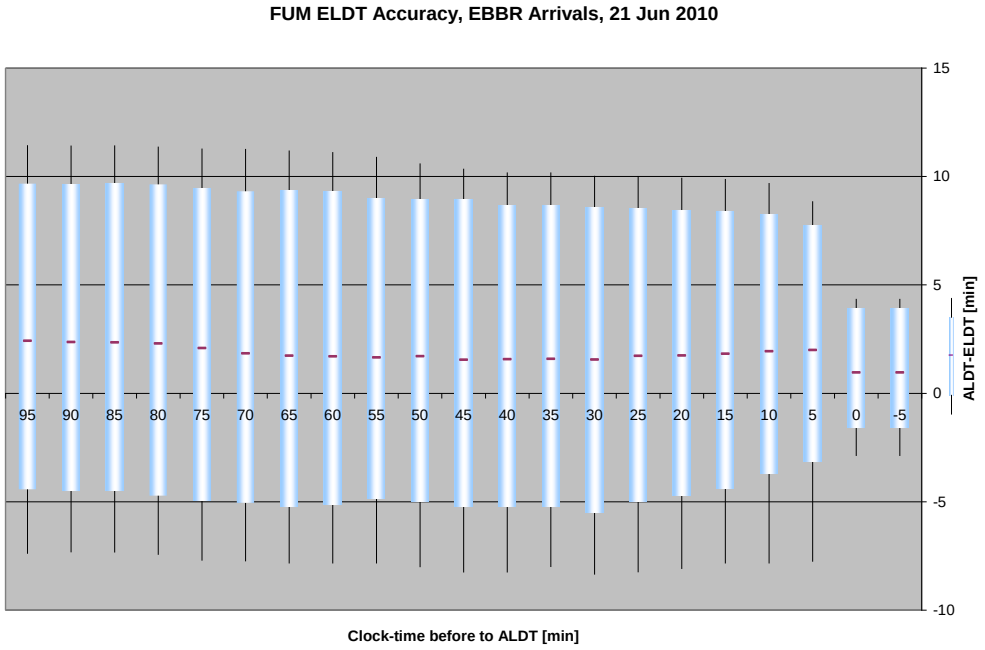
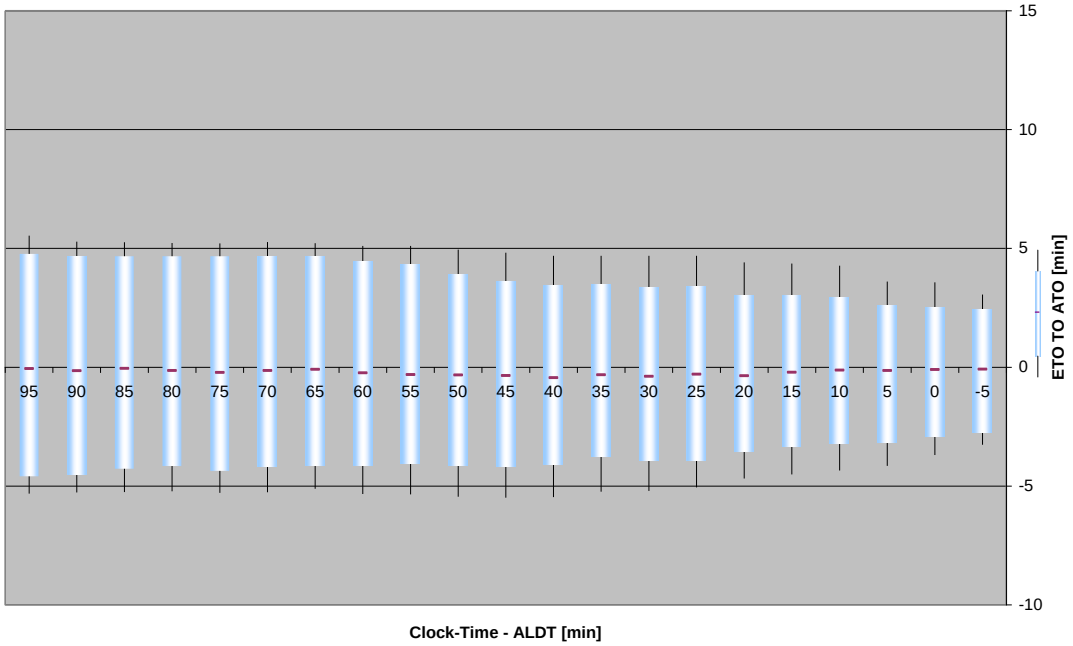


The graph shows an average ELDT accuracy of 1,5-3min (see red hyphen). Approximately 90% of the FUMs provide an ELDT with an accuracy between -5min and +10min. Approximately 5% of the FUMs provide an ELDT accuracy between +10 and +12min and approximately 5% of the FUMs provide an ELDT accuracy between -5 and -8min.

(2) The graph below is an example of the accuracy of the ETOs in FUMs to Brussels. The statistics are based upon FUMs with Airborne (AA) status and cover all landings on 21st June 2010.



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The graph shows an average ETO accuracy of 0min (see red hyphen). Approximately 90% of the FUMs provide an ELDT with an accuracy between -5min and +5min. Approximately 5% of the FUMs provide an ELDT accuracy between +5 and +6min and approximately 5% of the FUMs provide an ELDT accuracy between -5 and -6min.

(3) Comparing both graphs above shows that the ETOs provide more accurate estimates than the ELDTs.

4.6 What can the local ANSP do to improve the data in the FUM?

4.6.1 Runway updates

(1) As described above, the ELDT in the FUM depends on the STAR that ETFMS has selected for a flight.

(2) The STAR that ETFMS selects depends on the runway in use that is known by the NMOC. If the landing-runway-in-use known by ETFMS does not correspond to the actual landing-runway-in-use, ETFMS may select an incorrect STAR, which may result in a less accurate ELDT.

(3) In order to improve the ELDTs in the FUM messages, ATC at the airport and/or the FMP position in the ACC should change the active landing-runway-in-use in ETFMS each time a runway change occurs.

4.6.2 Accuracy of STAR definitions

(1) Normally the NMOC ENVironment system contains the STAR definitions as they have been defined in the AIP of each country.

(2) However, if the STAR definitions in the NMOC/ENV system do not fully correspond to the reality, it will result in less accurate ELDTs in the FUMs.

(3) It may therefore be necessary that the ANSP reviews the STAR definitions in the NMOC/ENV system.

4.7 FUM msg versus EFD msg and NM B2B web services

(1) Besides FUM messages the NMOC also provides ETFMS flight data in the form of EFD (ETFMS Flight Data) messages and flight data output via B2B web services.

(2) While the FUM basically contains the ELDT and ETO fields, the EFD message and the flight data output of the B2B web service contain almost all flight data that is available in ETFMS.

(3) The B2B web service flight data output, the EFD and the FUM are extracted from the flight data that is available in ETFMS and consequently all messages provide the same data accuracy for e.g. the ELDT and ETO.

(4) The first FUM is sent 3hrs before ELDT. The first EFD and B2B flight data output is sent when the flight plan data is received by ETFMS, i.e. much earlier.

(5) The FUM is distributed via AFTN. The EFD is distributed via a special network to the Entry Node. The Entry Node is the computer via which the ANSP provides the Surveillance Data (CPRs) to the NMOC. The B2B web service output is done via query-reply or publish-subscribe web services.

5 NM Software releases

5.1 Introduction

(1) The following section provides a short overview of the changes implemented in the previous software releases.

(2) It summarizes the outstanding issues for future releases and provides details, where available.

5.2 NM 27.0

5.2.1 Overview of changes in the last releases

(1) The following CRs were implemented in the NM 27.0 release:

CR number	Title
None	

(2) For implementation details, please refer to Doc Ref 1.

5.2.2 Overview of outstanding changes after NM 27.0

(1) The following CRs are planned for implementation after NMOC 27.0:

CR number	Title
None	

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APPENDIX A: Conversion table FUM data fields

B2B ↔ ADEXP

FUM messages can be provided by NMOC either via AFTN or via B2B Web Services.

In order to receive FUM equivalent data via B2B, users can subscribe to the FlightDataMessage.

In support of those airports wishing to implement FUM transmission via B2B, the table below shows the equivalent ADEXP field name for each B2B attribute.

B2B attribute	ADEXP
flightId.keys.aircraftId	ARCID
flightId.keys.aerodromeOfDeparture	ADEP
divertedAerodromeOfDestination if present, else flightId.keys.aerodromeOfDestination	ADES
flightId.keys.aerodromeOfDestination (but ADESOLD only present if divertedAerodromeOfDestination is present)	ADESOLD
estimatedTakeOffTime - taxiTime	EOBT+EOBD
flightId.keys.estimatedOffBlockTime	IOBT+IOBD
actualTimeOfArrival if present, else calculatedTimeOfArrival if present, else estimatedTimeOfArrival	ELDT
aircraftType	ARCTYP
filedRegistrationMark	REG
flightState + suspensionStatus	FLTSTATE
cdm.airportType	DEPAPTYPE
cdm.status	CDMSTATUS
can be derived from ctfmPointProfile if present, else rtfmPointProfile, else ftfmPointProfile	STAR
actualTakeOffTime	ATOT

Note: The syntax of the B2B fields may vary slightly compared with the syntax of the ADEXP fields.

For more detailed technical specifications on providing DPI using NM B2B web services please refer to Doc ref 5.

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APPENDIX B: Acronyms and Abbreviations

The following are the definitions of the Acronyms and Abbreviations that are particular to this document and not of a more general nature:

A

AA	ATC Activated (airborne)
Airport CDM	Airport CDM (CDM airport)
ACC	Area Control Center
ADEP	Aerodrome of Departure
ADES	Aerodrome of Destination
AFTN	Aeronautical Fixed Telecommunication Network
AIP	Aeronautical Information Publication
ANSP	Air Navigation Service Provider
AO	Aircraft Operator
AOBT	Actual Off-Block Time
ARCID	Aircraft Identification
ARCTYP	Aircraft Type (ADEXP)
ATC	Air Traffic Control
ATFCM	Air Traffic Flow and Capacity Management
ATO	Actual Time Over

B, C

CDM	Collaborative Decision Making
CFMU	Central Flow Management Unit
COBT	Computed Off-Block Time (CTOT – TaxiTime)
CPR	Correlated Position Report (surveillance data report)
CTOT	Calculated Take-Off Time

D

DEP	Departure Message
DES	De-suspension (message)
DPI	Departure Planning Information
DTW	Departure Tolerance Window

E

ECAC	European Civil Aviation Conference
EDIT	Estimated De-Icing Time
EFD	ETFMS Flight Data (message)
ELDT	Estimated LanDing Time
ENV	ENVironment
EOBD	Estimated Off-Block Date (off block date provided by IFPS)
EOBT	Estimated Off-Block Time (off block time provided by IFPS)

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ETFMS	Enhanced Tactical Flow Management System
ETO	Estimated Time Overhead
ETOT	Estimated Take-Off Time
EXIT	Estimated taXi-In Time
EXOT	Estimated taXi-Out Time

F

FAM	Flight Activation Monitoring
FCM	Flight Confirmation Message
FMP	Flow Management Position
FPL	Flight Plan Message (ICAO format)
FS	Filed Slot Allocated
FSA	First System Activation (flight plan activation message)
FUM	Flight Update Message

G, H

I

IFPLID	Initial Flight Plan Identification

K, L, M

MDI	Minimum Departure Interval

N

NA	Not applicable
NM	Network Manager
NMOC	Network Manager Operations Centre

O

OAT	Operational Air Traffic

P, Q

R

REA	REAdy (message)
RFI	Ready For Improvement
REG	aircraft REGistration

S

SI	Slot Issued
SID	Standard Instrument Departure
STAR	Standard Arrival Route
STW	Slot Tolerance Window

T

TOBT	Target Off-Block Time (from AO/Handler)
TSAT	Target Start-up Approval Time
TWR	Tower

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U, V, W, X, Y, Z

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