

CDM Memorandum

Subject: Protocol for Submission of Early Intent Messages to ETMS
To: Those interested in submitting Early Intent messages to ETMS
From: Mike Golibersuch and Ken Howard
Date: October 21, 2003
Doc Version: 1.2

Revision History			
Version	Date	Authors Initials	Description of Change
1.0	8/12/03	KH	Initial published version; includes planned enhancements for ETMS 7.8.
1.1	8/22/03	KH	Enhanced description of FP format and modified planned enhancements based on feedback of CDM GDPE Workgroup.
1.2	10/21/03	KH	Incorporated changes for ETMS 7.8 into the protocol. These are: the ability to accept messages over ARINC (section 2.1), the option of not using the EI packet header over ARINC (section 2.1-4), and the capability for ETMS to send replies (section 3.3).

1. Introduction

Beginning with the deployment of ETMS 7.6 in May 2003, ETMS began accepting Early Intent messages submitted by airlines over CDMNET. This document describes the communication protocol and formatting standards for Early Intent messages.

Early Intent messages provide a way for airlines to submit preliminary flight planning data directly to ETMS, prior to the time when a Flight Plan is formally filed with the NAS Host. Early Intent messages can be submitted anytime up to 24 hours prior to a flight's departure, and for traffic planning purposes will be handled by ETMS in much the same way that a filed Flight Plan is handled. However, the Early Intent message differs from the Flight Plan in two main ways:

- Early Intent message are processed only by ETMS. The host computer at the ARTCC will never see them.
- Flight Plan data filed with the Host and forwarded by the Host to ETMS will always take precedence over Early Intent data.

Airlines submit Early Intent messages using an extension of the existing CDMNET message exchange protocol. Early Intent messages can be submitted over the ARINC ADNS (teletype) network or over CDMNET. To simplify coding requirements for the airlines, Early Intent messages to ETMS will have the same format as Flight Plan (FP) messages submitted by airlines to the Host.

The existing CDM data exchange standards are described in two documents:

1. *CDM Protocol for CDMNET (7/19/00)*
2. *Message Formats for CDM Task 3 – Version 1. 2 (12/20/96)*

Airlines will be able to submit Early Intent messages to the operational ETMS in either of the following two ways:

- From an airline-provided application directly to ETMS via CDMNET. This method is covered in this document.
- By manually entering Early Intent flight plan data for selected flights on the Common Constraint Situation Display (CCSD), which will forward the data to ETMS. This method is not covered in this document.

This document describes the Early Intent capability as it will be fielded in ETMS 7.8. It includes the capabilities previously fielded in ETMS 7.6. Changes for ETMS 7.8 include:

- ETMS accepts FP message over the ADNS network.
- ETMS responds to FP messages with an explicit acceptance or rejection.

2. Submitting Early Intent Messages

Airlines can exchange Early Intent messages with the operational ETMS using either the ARINC ADNS network (sometimes referred to as the teletype network) or the CDMNET network.

2.1. Submitting EI over ARINC ADNS

Data exchange over the ADNS network uses a proprietary addressing and protocol. The use of the ADNS network for exchanging CDM message is described in Reference #2, and will not be covered here in its entirety.

EI messages sent over ADNS shall adhere to the following rules:

1. The messages shall be sent with a “QU” priority.
2. The messages shall be addressed to the FAA-defined ARINC addresses for sending CDM messages to ETMS.
3. The messages shall be formatted according to one of the following two options.
4. Option 1 (preferred): The body of the message shall be an EI packet header followed by a single FP message. The formatting of the message body is exactly the same as it is when sent over CDMNET. The format for the entire packet, shown in Example 1, is as follows:
 - a. The first line shall be the priority type (QU) and ARINC address for ETMS (ETMSADD). Note: This is not the real address for sending the messages.
 - b. The second line shall be the address from which the user submitted the message (USERADD).
 - c. The third line shall be the packet header. This is the same format for ADNS or CDMNET and is described in sections 2.3.
 - d. The fourth line shall contain a single FP. This is the same format for ADNS or CDMNET and is described in sections 2.3.

Example 1. ADNS Early Intent Message – Option 1

```
QU ETMSADD
USERADD 072303
EI RYN0506060017.01
FP RYN218 B727 0471 DAY P1215 290 DAY..PSB.J49.ALB..PSM/0129
```

5. Option 2: The body of the message may be simply a single FP message. No packet header need be included. The formatting of the FP message is exactly the same as it is when sent over CDMNET. The format for the entire packet, shown in Example 2, is as follows:
 - a. The first line shall be the priority type (QU) and ARINC address for ETMS (ETMSADD). Note: This is not the real address for sending the messages.
 - b. The second line shall be the address from which the user submitted the message (USERADD).
 - c. The third line shall be a single FP as described in section 2.3.

Example 2. ADNS Early Intent Message – Option 2

```
QU ETMSADD
USERADD 072303
FP RYN218 B727 0471 DAY P1215 290 DAY..PSB.J49.ALB..PSM/0129
```

2.2. Submitting EI over CDMNET

Data exchange over the CDMNET uses three types of dedicated TCP/IP socket connections, each of which is initiated by an airline client application. The three supported session types are: ADL, Flight Data (FD), and Simplified Substitution (SS). The details for how each type of session is established and maintained are covered in Reference #1, and are not repeated here.

Early Intent messages submitted by airlines to ETMS over CDMNET shall adhere to the following rules:

1. Early Intent messages shall be submitted either as part of an FD session or as part of an SS session, but not as part of an ADL session.
2. An Early Intent message shall be structured like any other CDMNET message. That is, it will consist of a 24-byte fixed length header, followed by a variable length message body containing the Early Intent packet.
3. The message header shall contain six 4-byte integers, which is the standard form for any CDMNET message. The fields are defined as follows:
 - a. Message Type (111 for Early Intent messages.)
 - b. Message Source (Not applicable for Early Intent messages. Value is 0.)
 - c. Message Destination (Not applicable for Early Intent messages. Value is 0.)
 - d. Airline Client Tag (Provided by Volpe.)
 - e. Message Sequence Number (Set by the submitting airline client.)
 - f. Byte length of the message body that follows.

4. The body of an Early Intent message shall consist of an EI packet, which in turn shall consist of an EI packet header followed by a *single* flight plan in proposed NAS FP format. This is described in Section 2.3.
5. An FP may not be included in either an FD or SS message.

Example 3 shows a sample CDMNET Early Intent message. Number shown in angle brackets are sent as binary integers. <NL> represents a new line included in the data stream.

Example 3. CDMNET Early Intent Message

```
<111><0><0><100><14><243>EI RYN0506060017.01<NL>
FP RYN218 B727 0471 DAY P1215 290 DAY..PSB.J49.ALB..PSM/0129
```

2.3. EI Packet Format

The standard EI packet, whether sent using ADNS or CDMNET, consists of two lines: the EI packet header and the FP message.

EI Packet Header Format

An EI packet header, as shown in Example 4, shall consist of the following:

- The packet type (EI)
- One space
- 3-character code of the data sender (An airline with an FAA-assigned three-letter code should use that code in the packet header; e.g., AAL, FDX. A data provider that is sending data for N-number flights should use the three-letter code assigned by FAA especially for this purpose.)
- 10-digit transmission date and time (month, day, hour, minute, and second)
- Period
- 2 digits for uniqueness (in case multiple messages are generated in the same second)

Example 4. Early Intent Packet Header

```
EI RYN0506060017.01<NL>
```

The client can optionally direct ETMS to send a reply only if there is an error, This is done by including the “NOACK” keyword in the header line as shown in Example 5. If the NOACK keyword is not present, ETMS will send a reply for every EI message.

Example 5. NOACK Keyword

```
EI RYN0506060017.01 NOACK<NL>
```

If a message is sent over ADNS, the client can optionally direct ETMS to send the reply to an address other than the return address. This is done by including the alternate return address on the EI packet header line as shown in the Example 6.

Example 6. Alternate Return Address

```
EI RYN0506060017.01 ALTNADD<NL>
```

In this case, the reply will go to the ARINC address “ALTNADD”.

FP Message Format

An FP message, as shown in Example 7, shall consist of the following fields, which appear from left to right:

Example 7. FP Message

FP RYN218 B727 0471 DAY P1215 290 DAY..PSB.J49.ALB..PSM/0129 NRP

01	Message Type (FP)
02	Call Sign (RYN218)
03	Aircraft Type (B727)
05	Airspeed (0471)
06	Departure Airport (DAY)
07	Departure Time; Phhmm, where the P means <i>proposed</i> (P1215)
09	Cruising Altitude (290)
10	Route of Flight/Estimated Time Enroute (DAY..PSB.J49.ALB..PSM/0129)
11	Remarks (optional); separated by a vertical bar (NRP)

Notes:

- Fields 06 and 07 can refer to a fix in a NAS flight plan, but for an EI-FP, these are assumed to always be departure airport and departure time.
- The remarks field can be used to send any text, as in a flight plan. ETMS has a particular set of remarks that it looks for and saves in the database. If one or more of these are present in an EI-FP, ETMS will save it. ETMS will ignore any other text. AT the time of this document, the defined ETMS remarks are:
 - NRP
 - LIFEGUARD
 - CATIII
 - ALTREV
 - SWAP
 - DVRSN
 - ADCUS
 - FCA
 - WXRTE
 - HAR
 - PTP

3. ETMS Processing

3.1. *Message Processing*

ETMS first checks that an EI message has been formatted correctly and sent by an authorized user. If an error is detected, ETMS discards the message immediately and sends a reply to the user.

ETMS then converts the FP data into an ETMS flight trajectory using the exact same processing as for a NAS flight plan. The conversion uses the current published FAA geographic data (a.k.a. 56-day data) to convert the field 10 into a series of waypoints and traffic management events (e.g., sector entries and sector exits). ETMS uses the aircraft type and cruising altitude to determine the vertical profile of the flight. If ETMS encounters any problem with the route conversion that prevents it from producing a reasonable trajectory, it discards the message and sends an error message to the user.

ETMS only applies the FP message to the database if that flight already exists. ETMS determines whether the FP matches an existing flight record using the following rules:

1. The flight ID, origin, and destination on the message must match an ETMS database record exactly.
2. The P time on the message must be within +/- 6 hours of the current ETD in ETMS.

Note: The date associated with the P time is determined by assuming that the P time is in the future of the message-received date/time.

If ETMS finds a matching record, ETMS only updates the record if it has not yet received a host flight plan (FZ) for that flight and the flight is not already active or completed. If these conditions are met, ETMS updates the database record with the data from the FP message, as follows:

1. ETMS replaces the aircraft type, cruising speed, cruising altitude, and route of flight in the database with the values from the FP message.
2. ETMS does NOT change the predicted ETD for the flight.
3. ETMS remodels the flight using the new trajectory from the FP along with the previous ETD.

The result of the re-modeling is subsequently used to generate all ETMS outputs: e.g., monitor/alert, FCA lists, and ADLs.

3.2. *Authorization and Error Checking*

Authorization and syntax checking will occur at several levels:

1. ETMS will reject a message if it does not follow the message format as specified in sections 2.1, 2.2, and 2.3.
2. ETMS will reject any message that is not from an authorized client.
 - a. For clients sending over CDMNET, ETMS verifies that the client sent the message from a valid IP address using a valid client tag for that flight.
 - b. For clients sending over ADNS, ETMS verifies that the client sent the message from a valid ADNS address for that flight.

- c. ETMS determines which addresses are authorized to update which flights using the same definition data as for the regular CDM message feed. An address may be authorized to update any flight with a certain three-letter code, only flights within a certain flight number range for a three-letter code, or flights with specified N-number flight IDs.
3. ETMS will reject a message if the embedded FP does not conform to NAS FP formatting standards.
4. ETMS will reject a message if the embedded FP does not specify a full point-to-point route, including estimated en route time.
5. ETMS will reject an Early Intent message if a flight plan has already been received from the Host.
6. ETMS will reject an Early Intent message if the flight is active.
7. ETMS will reject an Early Intent message if the flight is completed.
8. ETMS will reject an EI message in the event that the FP message does not match an existing ETMS flight record.

3.3. ETMS Replies

ETMS will send replies to the client software indicating the result of the EI packet processing very much along the lines of how it sends replies to the FD packets.

1. ETMS will optionally send a positive acknowledgment if the message is used to successfully update the ETMS database.
2. ETMS will send an error message if the message is rejected for any reason. Any type of error indicates that the ETMS database was not updated from the message.
3. The client should place the keyword “NOACK” on the packet header line if the client does not wish to receive positive acknowledgments. (ETMS will still send errors in this case.)
4. For CDMNET clients, ETMS will send replies to the client over the same socket on which the message was received.
5. For ADNS clients, ETMS will send replies to the return ADNS address unless an alternate address has been specified in the packet header line.

See section 2.3 for detailed formatting of the EI packet header line.

Following is a list of the error messages that ETMS may send in response to an EI-FP:

ERR320: NOT AUTHORIZED TO UPDATE THIS FLIGHT – Sender not authorized to update this flight from this connection.

ERR465: CRUISING SPEED MISSING. – No cruising speed field on the FP.

ERR466: AIRCRAFT TYPE MISSING. – No aircraft type field on the FP.

ERR467: DEPARTURE AIRPORT MISSING. – The field 10 on the FP does not start with an airport.

ERR468: ARRIVAL AIRPORT MISSING. – The field 10 on the FP does not end with an airport.

ERR469: DEPARTURE TIME MISSING. – No coordination time (P-time) field on the FP.

ERR470: COORDINATION FIX MISSING. – No coordination fix field on the FP.

ERR471: ALTITUDE MISSING. – No altitude field on the FP.

ERR472: ROUTE SYNTAX ERROR. – The field 10 cannot be converted to a flight trajectory.

ERR473: FLIGHT PLAN ALREADY PROCESSED. – ETMS has already processed a NAS flight plan (FZ) for this flight.

ERR474: FLIGHT ACTIVE. – This flight has already been activated in ETMS; i.e., the flight is airborne.

ERR475: FLIGHT COMPLETED. – This flight has already flown.

ERR476: ETD OUT OF RANGE. – ETMS has found a matching record in the database but the P-time on the FP is not within +/- 6 hours of the current ETMS ETD.

ERR477: ETMS DATABASE ERROR. – ETMS processing has failed for some internal reason (e.g., the database is down).

ERR478: FP MESSAGE CANNOT MATCH ANY ETMS ENTRY – ETMS does not find an existing database entry with a flight ID, origin, and destination matching the FP.

4. Potential Future Enhancements

Following are ideas for potential future enhancement of the EI-FP messages.

- If it becomes clear that ETMS is having trouble matching EI messages to the correct existing flight records created from CDM messages, we might want to consider adding the IGTD to the EI-FP format.
- We may want to develop a way to qualify the EI-FP message. That is, is this FP a user-preferred route given today's winds? Is it a response to a reroute or FCA advisory?