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THE MORE AUTONOMOUS - AIRCRAFT IN THE FUTURE AIR TRAFFIC MANAGEMENT SYSTEM

D63 – AGP User Manual

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1 SCOPE

1.1 Identification

This Software User Manual applies to the MA-AFAS Project AOC Ground Platform (AGP).

This document has been produced by Skysoft Portugal and AMS-UK for the MA-AFAS programme on behalf of BAE Systems.

The objective of this User Manual is to provide a detailed description on how to install and use the MA-AFAS AGP.

1.2 System Overview

The “More Autonomous Aircraft in the Future ATM System” (MA-AFAS) program is focused on developing CNS-based avionics components that will provide aircraft greater flexibility within the ATM system. The program includes development of an operational concept; specification and implementation of avionics packages, ground systems and infrastructure to demonstrate the operational concept; and trials and further work towards implementation of the concept.

One of the themes of the programme is the Airline Operational Centre (AOC). MA-AFAS functional requirements for the Airborne AOC system are addressed in the following project documentation

- D13, Definition of ATM MA-AFAS Airborne and Ground Functionalities.
- D18, Airborne Systems Requirement Specification.
- D19, Airborne Equipment System Design and Architecture Document

To support trials of the MA-AFAS avionics package AOC functions, an AOC Ground Platform (AGP) was specified and developed by the AOC Theme. The AGP is a trials system which simulates the functions of an AOC end system on the ground. The aim is to validate the correct functioning of the avionics and crew interactions as well as the air-ground interoperability under real flight conditions. The platform is responsible for the support of four AOC functional areas:

- AOC Flight Plan
- AOC and A/C Maintenance
- A/C AOC CDM
- Asset Management

To enable a correct operational use of the all the system, additional functional aspects were included as part of the AGP platform environment:

- System Communications
- HMI

A description of the AGP high-level architecture and main functionality is included in [MA-AFAS D38].

1.3 Document Overview

The present document is structured as follows:

Chapter 1: The present chapter, containing a brief introduction to the document, together with the sketch of its structure.

Chapter 2: Provides the list of referenced documents.

Chapter 3: It contains an overview of the AGP software.

Chapter 4: Describes how to access the software.

Chapter 5: It contains a detailed description of the HMI interface and how to use it.

Chapter 6: It contains a detailed description of the fleet simulator and how to use it.

Chapter 7: Presents the list of abbreviations used within this document.

Annex A: Presents a table describing where each message is displayed

Annex B: It contains a description of the AGP Test Tool

Annex C: Describes the format of the AGP input data files

Annex D: Describes the AGP configuration file

2 REFERENCE DOCUMENTS

[RTCA 178B]	RTCA Software Considerations in Airborne Systems and Equipment Certification, December 1, 1992.
[MAAFAS D38]	MA-AFAS Ground System Requirements, Project Delivery D38, Issue 1
[AGP SDD]	MA-AFAS AGP Software Design Document, Version 1.1; June 16, 2002

3 SOFTWARE SUMMARY

3.1 Software application

The following diagrams provide the high level functional model of the AGP system. First, **Figure 1** presents the AGP context diagram.

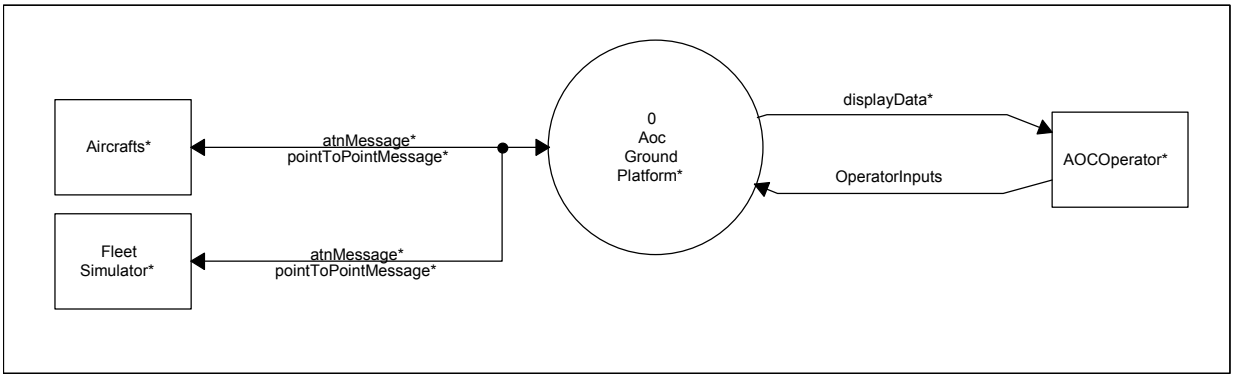


Figure 1 – AGP Context Diagram.

The AGP context diagram is an abstraction of the AGP and all entities that interact with it. These entities are described below:

- The AOC Ground Platform is the application that supports the monitoring of all aircraft from an airline perspective.
- The AOC Operator will be a user that provides inputs to the AGP, and uses the visual data presented on the AGP displays.
- The Aircraft are the entities that will exchange messages/data with AGP.
- The Fleet Simulator is a simulator of a certain number of aircraft and respective flights.

The diagram below (Figure 2) provides the functional breakdown of the AGP system into its three main modules: Communications, AGP Functions and HMI.

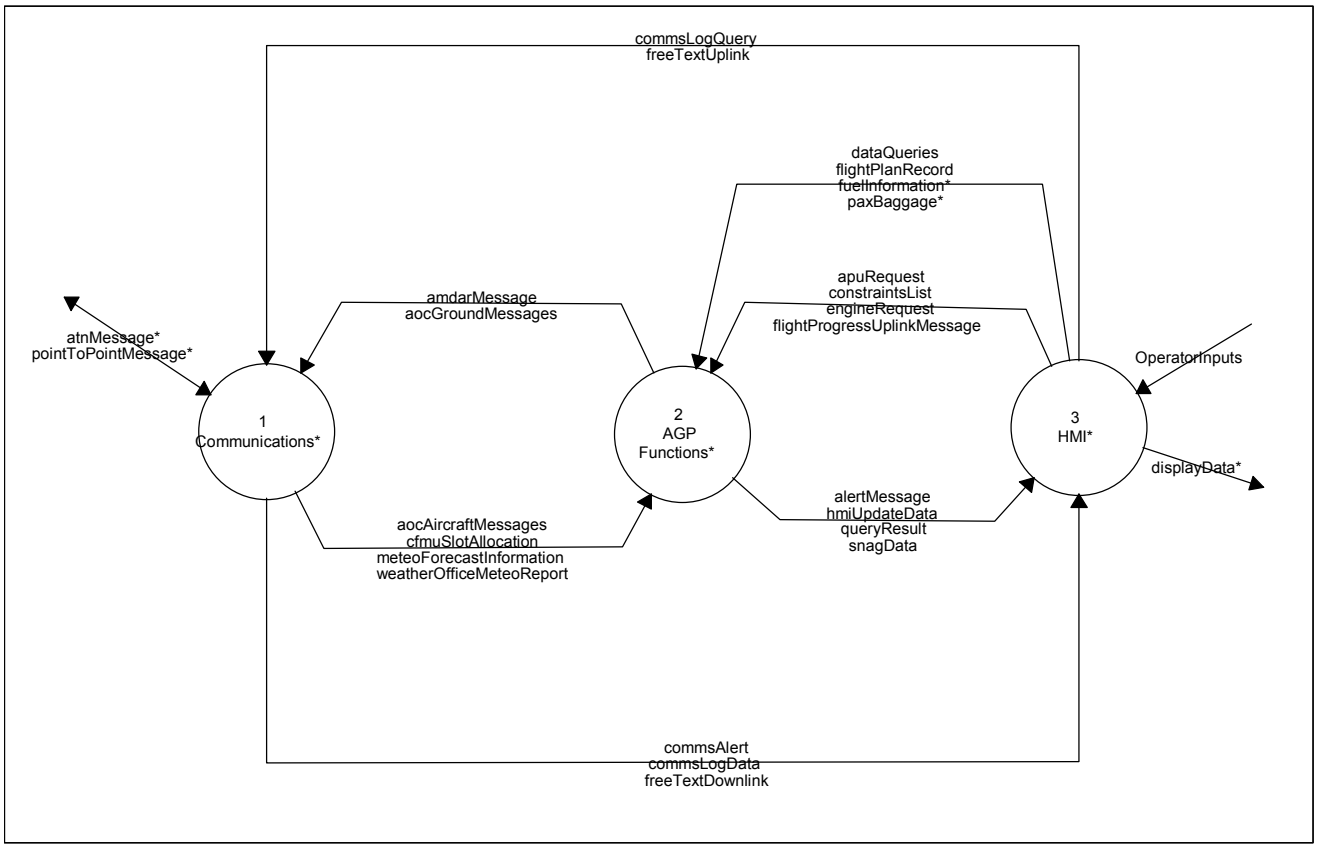


Figure 2 – AGP Functional Breakdown.

3.2 Software inventory

The following software files are required to run AOC Ground Platform:

- MAAFAS.exe
- FleetSim.exe
- glut32.dll
- Flight_Progress_Display.app
- av_rects.dat
- rects.dat
- courier.fnt
- times8.fnt
- Data.zip
- Forms.zip

3.3 Software/Hardware environment

The AGP is based on a single PC running the Windows NT Version 4 operating system, with a large (nominally 21”) display. The AOC functional processes are also capable of being hosted on the BAE SYSTEMS In-House Test Platform.

3.3.1 Visual display screen requirements:

It is recommended that the visual display screen must be at least a 19“ (ideal 21”) display monitor and capable of displaying a minimum screen resolution of 1280x1024.

If the AGP is required to be displayed at a screen resolution below 1280x1024, new files should be copied to the forms folder replacing the original ones. The new files can be found on the TBD folder. This enables the AGP to be displayed at a minimum screen resolution of 1024x768.

3.3.2 Other requirements:

3.3.2.1ASN.1 Compiler

The AOC Ground Platform uses Objective Sys, Inc. ASN1C. ASN1C is an ASN1 compiler that encodes and decodes C/C++ data structures in ASN1 messages. Along with its execution the AGP application will transmit and receive messages using the ASN1 compiler.

The ASN1 compiler needs a valid license file to encode and decode ASN1 messages, otherwise the AGP application will not be able to send or receive any messages.

3.3.2.2ATN Stack

In order to enable communications between the AGP and aircraft a Generic ATN Communications Service (provided by *Airtel ATN Ltd (Ireland))* should be set.

4 ACCESS TO THE SOFTWARE

4.1 First-time user of the software

4.1.1 Installation and setup

Installing the AGP software files requires that the files described below be copied to a pre-specified folder:

- MAAFAS.exe
- FleetSim.exe
- glut32.dll
- Flight_Progress_Display.app
- av_rects.dat
- rects.dat
- courier.fnt
- times8.fnt
- Data.zip
- Forms.zip

Afterwards, both the Data.zip and the Forms.zip files should be unzipped using a suitable application (e.g. WinZip), creating the Data and Forms folders. This step ends the AGP software installation.

4.1.2 Configuration

Several details concerning the AGP software can be modified offline by means of editing a configuration file. This configuration file is named “configurationData.dat” and can be found in the *Data* folder. The details of the configuration file are described in Appendix D.

4.1.3 Input Data Files

The AGP does not communicate with real ground systems. However, in order to provide a realistic environment to the AGP operator data provided by other ground systems such as CFMU and Weather Office must be available. This is achieved by loading on system start-up files containing the required data.

The data files supported by the AGP are SIGMET files (file extension .sig), TAF files (file extension .taf), METAR files (file extension .met), meteo forecast files (file extension .mtf), flight plan files (file extension .fp), a slot allocations file that should be named “slotAllocations.dat” and fleet simulator files (file extension .fs). Details about the format of these data files can be found in Appendix C.

4.2 Initiating a session

After the completion of the setup procedures the operator is able to start the AGP. This is done simply by double-clicking on the MAAFAS.exe file. The main console of the application –Flight Progress Display – should appear on the PC screen.

4.3 Stopping and suspending work

When the AGP operator intends to stop the AGP application click on Flight Progress Display "**X**" button (top-right) or go to Flight Progress Display File menu and click on the "Exit" entry.

4.4 Other software modules

The AGP application can be tested without communication with real aircraft. To support the simulation of air-ground communications, it was developed a simple aircraft *comms* emulator. This aircraft emulator, named AGP Test Tool can simulate the aircraft end system though sending and receiving messages between the AGP ground platform and the aircraft. The communication between the AGP and the AGP Test Tool is accomplished using the GACS ATN stack emulator provided by Airtel ATN Ltd. The AGP test tool is described in Appendix B.

Fleet Simulator is a simulation of company fleet, this module is able to simulate a group of 20 aircraft at same time. The detailed explanation of this module can be found at Section 6.

5 PROCESSING REFERENCE GUIDE

This section provides the standard procedures for the correct understanding and usage of the AGP displays.

5.1 Flight Progress Display

5.1.1 Capabilities

The Flight Progress Display (FPD) includes the main functionality of the AGP system. The FPD supports the display of dynamic flight data, such as flight planning, flight progress, and allows message exchange between AGP and registered flights. Figure 3 presents the layout of the FPD.

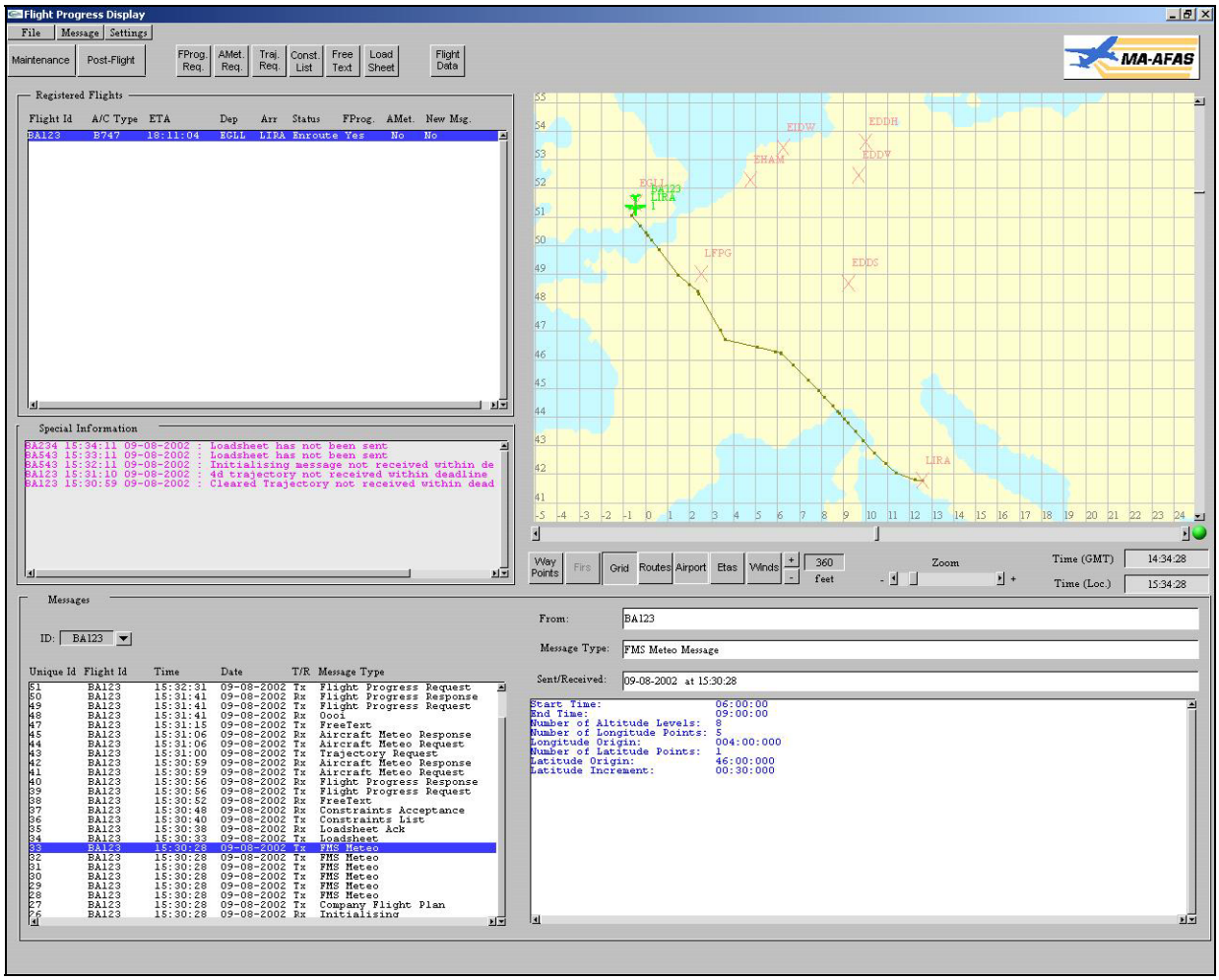


Figure 3 – The Flight Progress Display.

5.1.2 Flight Progress Display Overview and Conventions

As shown in the Figure 4 below, the FPD can be broken down in the following areas: menus, toolbars, registered flights, special information, messages and map.

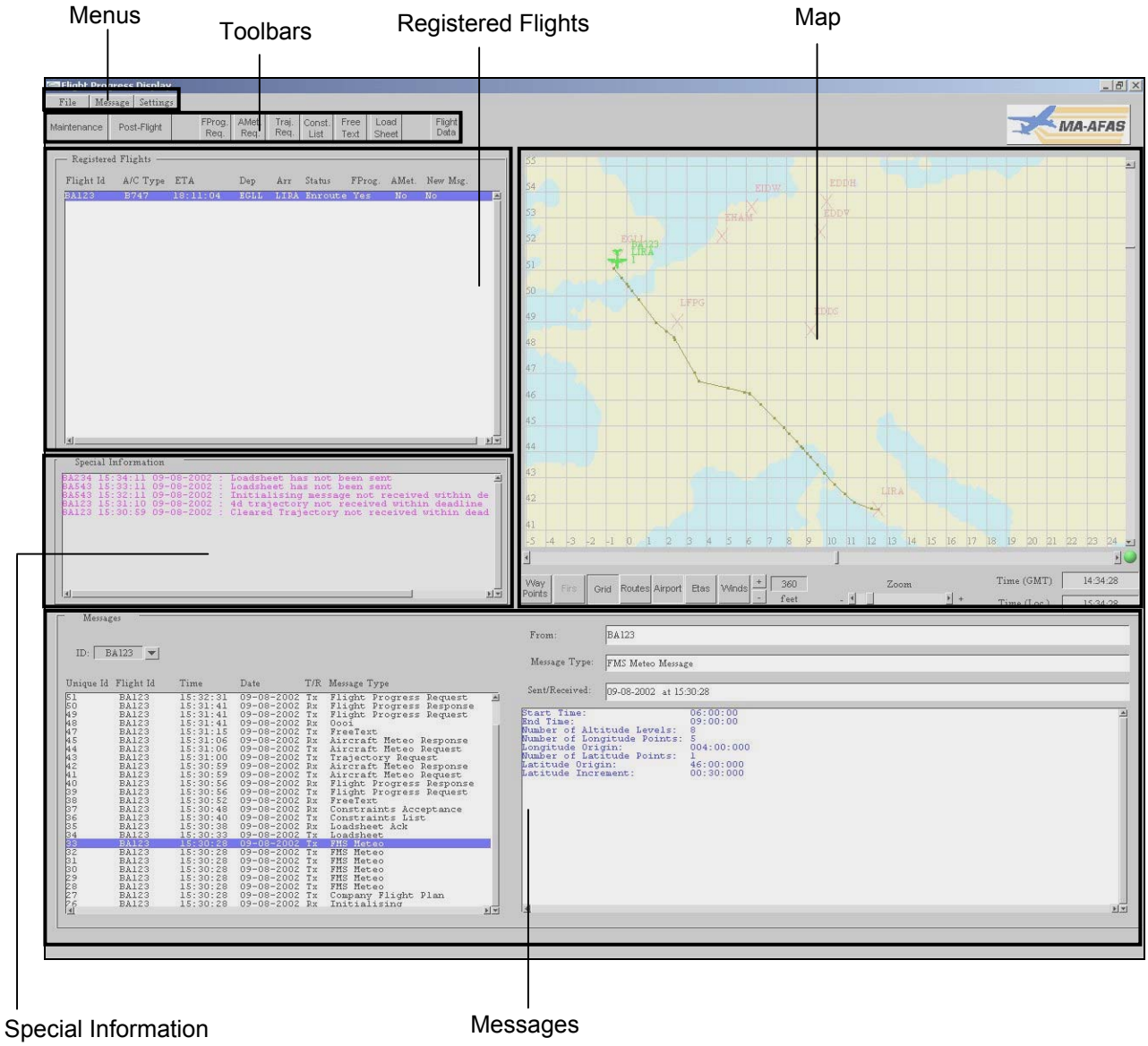


Figure 4 – Flight Progress Display main areas.

5.1.2.1 Menus

The menus of this display allow the AGP operator to set all configurable AGP settings, to send messages to the selected flight, toggle displays, and initialise the external GACS communications.

5.1.2.1.1 File Menu

Figure 5 – Flight Progress Display File Menu

The File Menu has four entries, and are described below:

Maintenance – This menu entry enables the operator to view the Maintenance Display.

Post-Flight – This menu entry enables the operator to view the Post-Flight Display.

Init AG Comms – In order to the AGP to communicate with external entities, communications should be started. Clicking in this menu entry starts AG Comms. After the start of the communications, the *red light* below the world map will change to a *green light*. The "AGComms Initialisations" form is then shown informing the operator of the successful communications start.

Exit - Clicking this entry shuts down the AGP application.

5.1.2.1.2 Message Menu

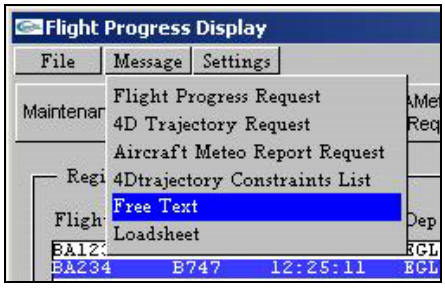


Figure 6 – FPD Message Menu

The Message Menu has six entries, described below:

Flight Progress Request – This menu entry enables the operator to compose and send a flight progress request message.

4DTrajectory Request – This menu entry enables the operator to compose and send a 4D trajectory request message.

Aircraft Meteo Request – This menu entry enables the operator to compose and send an aircraft meteo request message.

4DTrajectory Constraints List – This menu entry enables the operator to send a constraints list message.

Free Text – This menu entry enables the operator to compose and send a free text message.

Loadsheet – This menu entry enables the operator to compose and send a loadsheet message.

5.1.2.1.3 Settings Menu

The AGP settings can be permanently be set in configuration file (configurationData.dat inside data folder).

Figure 7 – FPD Settings Menu

The Settings Menu has three entries, described below:

Map Settings – Clicking in this menu entry, shows the "Map Settings" form. This form allows the operator to change ocean and continent map colours, grid settings (automatic/non-automatic), longitude and latitude delta (in degrees, and on non-automatic mode). The "Test" button allows the user to test the option changed. Clicking "Cancel" cancels all changes made, and clicking "Ok" button accepts all changes made.

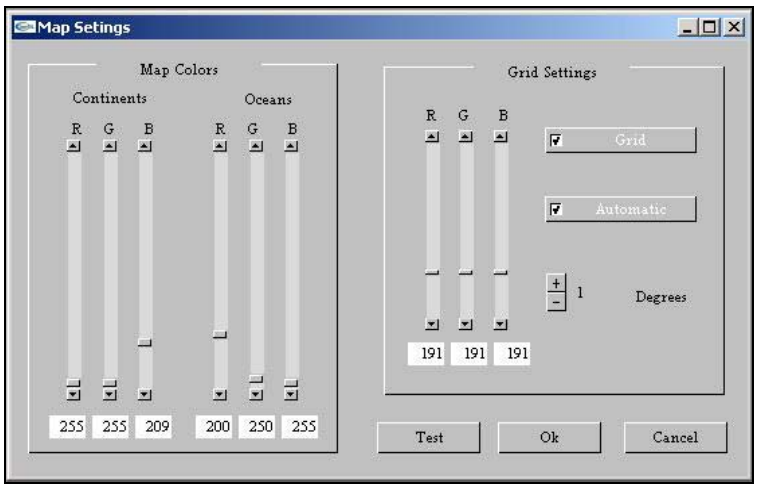


Figure 8 – Map Settings Form

Aircraft Settings – Clicking in this menu entry shows "Aircraft Settings" form. This form allows the operator to change aircraft colours, change wind colours, and change FIRs colours. Each item (aircraft, wind, and FIR) has a "Test" button, and clicking in one of the "Test" buttons testscolourr change to that particular item, clicking "Cancel" cancels all changes made, and clicking "Ok" button accepts all changes made.

Additionally the aircraft icon colour can be changed when aircraft is airborne or is on ground. To change between aircraft ground colour and aircraft airborne colour select in up-right combo box "airborne" or "ground".

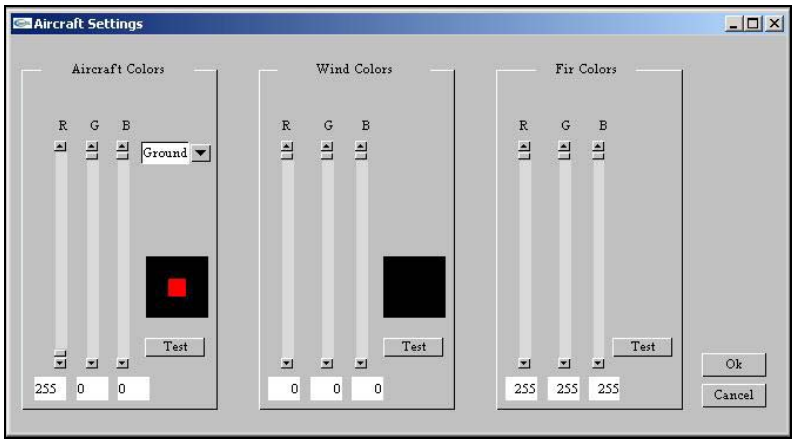


Figure 9 – Aircraft Settings Form

Comms Settings – This form allows the user to setup the communications parameters.

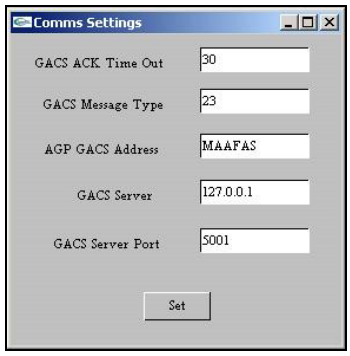


Figure 10 – Comms Settings Form

The configurable parameters presented in Figure 10 are described below:

- GACS acknowledgment time out, changeable in “GACS ACK time out” text box
- GACS message type, changeable in “GACS message type” text box
- AGP GACS Address, changeable in “AGP GACS address” text box
- GACS IP address, changeable in “GACS server” text box
- GACS server port, changeable in “GACS server port” text box.

Pressing “Set” button, sets initial parameters. Please note that changing parameters only has an effect on the AGP if done prior to enabling the AGComms. Also these new values are not kept when the application closes.

5.1.2.2 Toolbars

The toolbars included provide the most common features needed by the operator: uplink messages to a selected flight, query the AGP databases about flights progress information and toggle consoles.

5.1.2.2.1 Consoles Toolbar

The Consoles Toolbar includes two large size buttons, described below:

Maintenance – This button enables the operator to view the Maintenance Console.

Post-Flight – This button enables the operator to view the Post-Flight Console.

5.1.2.2.2 Message Toolbar

The Message Toolbar includes six buttons, described below:

Fprog. Req. – This button enables the operator to compose and send a flight progress request message.

Traj. Req. – This button enables the operator to compose and send a 4D trajectory request message.

Amet. Req. – This button entry enables the operator to compose and send an aircraft meteo request message.

Const. List – This button entry enables the operator to compose and send a constraints list message.

Free Text – This button enables the operator to compose and send a free text message.

Loadsheet – This button enables the operator to compose and send a loadsheet message.

5.1.2.2.3 Flight Data Toolbar

The Flight Data Toolbar only includes one button:

Flight Data – This button enables the operator to query the AGP database about flight progress data.

5.1.2.3 Registered Flights

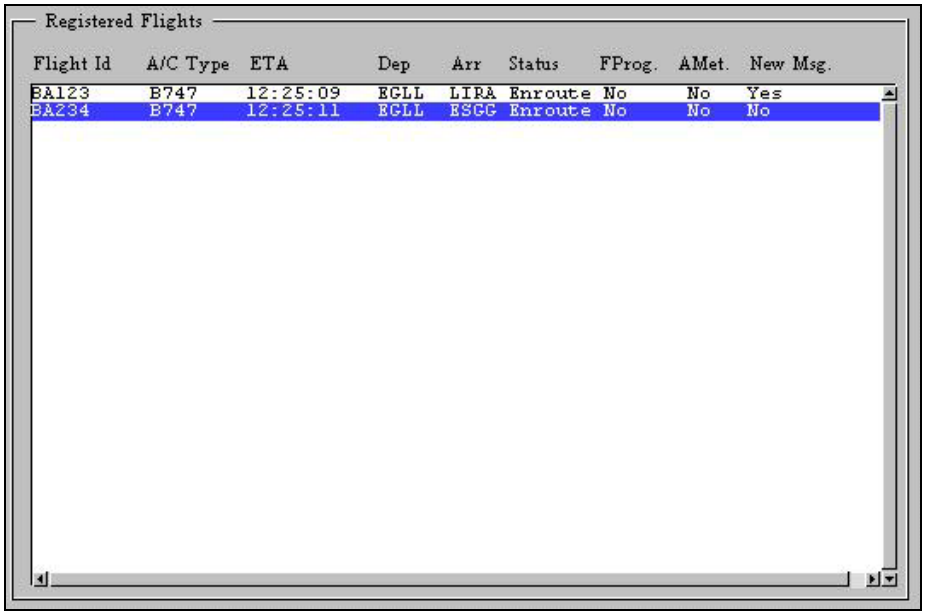


Figure 11 – Registered Flights

Registered Flights presents all the pertinent information concerning all flights registered with the AGP system (Figure 11). Details of each data field are explained below:

- Flight Id – Flight identifier.
- A/C Type – Aircraft Type.
- ETA – Estimated Time of Arrival.
- Dep – Departure airport
- Arr – Arrival airport
- Status – Current flight status (“Gate”, “Enroute”, or “Taxi”)
- Fprog. – “Yes” if flight progress reports messages are sent periodically, “No” otherwise.
- AMet. – “Yes” if aircraft meteo reports messages are sent periodically, “No” otherwise.
- New Msg. – “Yes” if flight is not selected and if new messages regarding that flight have arrived, “No” otherwise.

5.1.2.4 Special Information

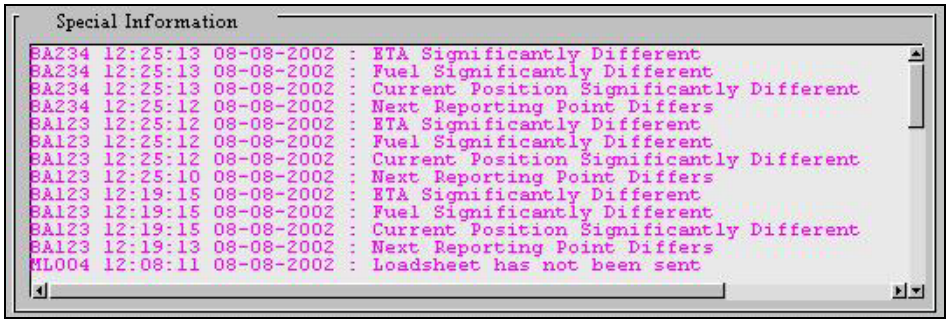


Figure 12 – Special Information

Special Information shows to the user the alerts generated by the AGP system (Figure 12). Each alert contains a set of data fields. Details of each data field are explained below:

- Flight Id – Flight Identifier.
- Time – Alert generation time.
- Date – Alert generation date.
- Description – Small description of the alert.

Although the criticality of this information, no audible alerts are generated.

5.1.2.5 Messages

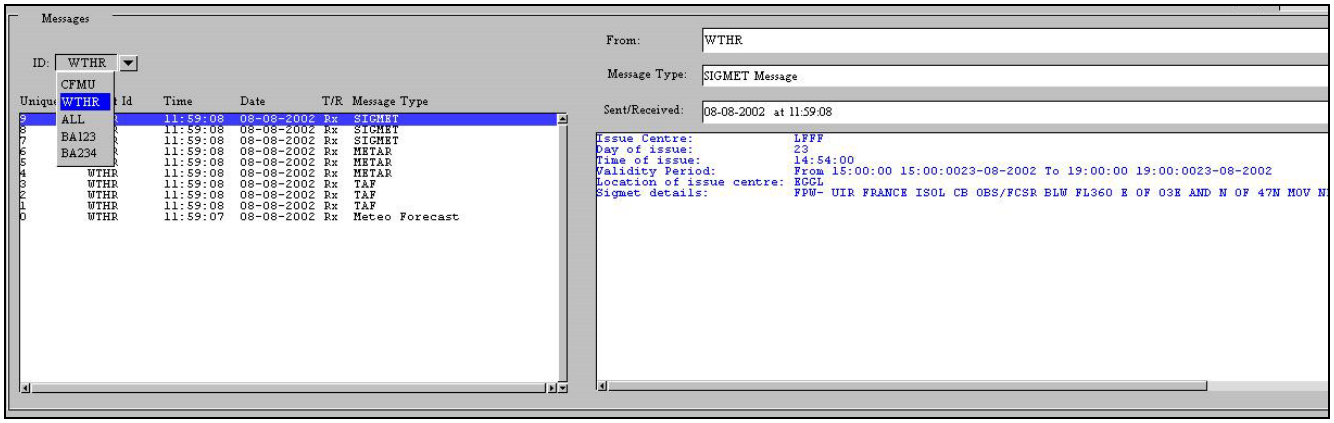


Figure 13 – Messages List

The Messages area presents the messages exchanged between the AGP and selected Flights, Central Flow Management Unit - CFMU, or Meteo Office - WHTR (refer to Figure 13). The left side includes a list of messages with a set of different data fields per each message displayed. The data fields are explained below:

- Unique Id – Message unique id.
- Flight Id – Flight that sent or received the message.
- Time – Time when a message is logged in the AGP.
- Date – Date when a message is logged in the AGP.
- T/R – “Tx” if message is a transmitted message, “Rx” if message is a received message.
- Message Type – Type of message.

Additionally Messages includes a Flight Combo Box, named “ID”. When clicking on an item, the Flight Combo Box allows the user to view messages from/to registered flights, weather information or CFMU messages.

The right side of the *Messages area* is responsible for the display of the message content details. The items included in the message details area are described below:

- From – Message sender / transmitter.
- Message Type – Type of message.
- Sent/Received – Time and date when a message is logged in AGP.
- Message Contents – Message data details.

5.1.2.6 Map

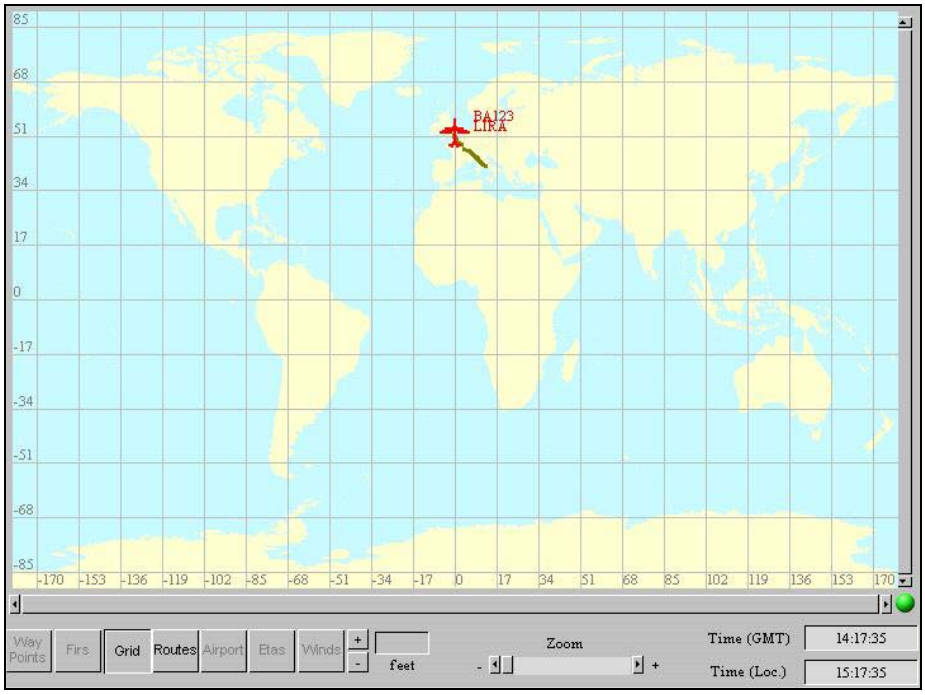


Figure 14 – World Map

Figure 14 presents the Map window. This window includes a world map picture where all registered flights are depicted.

A flight is depicted on the map using an aircraft icon following a given route. The aircraft icon can be shown in two different colours: one to represent the aircraft on the ground and another to represent the aircraft in the airborne state. The aircraft icon default colours can be changed in the map settings menu (please refer to *Settings Menu*).

A toolbar and a zoom scroll bar are also included within the Map features. The toolbar, located below the world map picture, allows the user to change map properties in the following way:

- Waypoints – Shows or hides waypoints.
- FIRs – Shows or hides FIRs.
- Grid- Shows or hides the grid.
- Routes – Shows or hides current flight routes.
- Airport – Shows or hides airports
- ETAs – Shows or hides ETAs for each waypoint at all flight routes.
- Winds - Shows or hides current wind information.

- + button – Increases the height at which the wind is depicted (ft).

- - button – Decreases the height at which the wind is depicted (ft).

The *light* located on the bottom-right corner of the world map picture provides the to operator the status of the air-ground communications. Green means that air-ground communications are set, red means that air-ground communications are off.

5.1.3 Processing procedures

The following processing procedures describe how to interact with Flight Progress Display.

5.1.3.1 Initialising Air-Ground Communications

After the setup of the initialisation procedures the operator is able to start the AGP communications with an external entity, i.e. real aircraft, fleet simulator aircraft or with simulated aircraft communications.

To start air-ground communications, click in the “Init AG Comms” entry on the FPD File Menu. If the initialisation of air-ground communications was successful, the *red light* below the world map will change to *green* and a form is shown to inform the operator regarding the successful communications set-up. If the initialisation of air-ground communications fails, the *red light* on the corner of the world map, remains red.

Additionally, the operator must make sure that communication parameters are set according to the communications stack available. The communication parameters can be changed through the edition of the default values on the configuration file or using the *comms* entry on the setting FPD menu.

Therefore if initialisation of the air-ground communications fails the operator should check if the communications infrastructure is properly set and configured.

5.1.3.2 Showing Maintenance display

To show the Maintenance Display click on the “Maintenance” button or on the Maintenance entry of the FPD File Menu. The Maintenance Display is shown, hiding the Flight Progress Display. The Maintenance button remains *pressed* until Maintenance Display is not exited.

Figure 15 – Clicking on the maintenance button

5.1.3.3 Showing Post-Flight display

To show the Post-Flight Display click on the “Post-Flight” button or on the Post-Flight entry of the FPD File Menu. The Post-Flight Display is shown, hiding the Flight Progress Display. The Post-Flight button remains *pressed* until Post-Flight Display is not exited.

Figure 16 – Clicking post-flight button

5.1.3.4 Selecting a flight

The operator needs to select a flight in order to send a message to it. Flight selection is an easy task in Flight Progress display and it can be achieved by clicking an a *flight* inside “Registered Flights”, or by clicking and

selecting a flight in the “ID” combo box inside “Messages” group. When the specified flight is selected the correspondent route is displayed on the world map.

Additionally the “ID” Combo box allows that operator to select “CFMU” to visualize all messages exchanged with Central Flow Management Unit, or to select “WHTR” to visualize all messages exchanged with meteorological office.

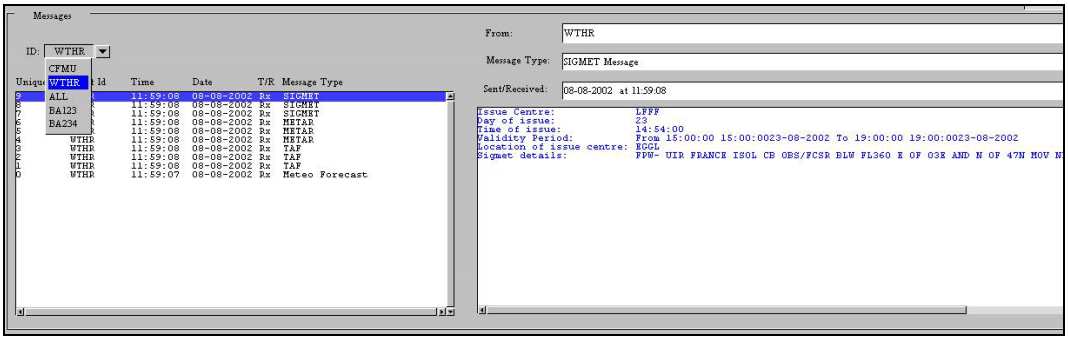


Figure 17 – Flight Selection

5.1.3.5 Sending Flight Progress requests

Pressing “FProg. Req.” button or the “Flight Progress Request” entry on the FPD Message menu allows the “Flight Progress Request” form to be shown, Figure 18.

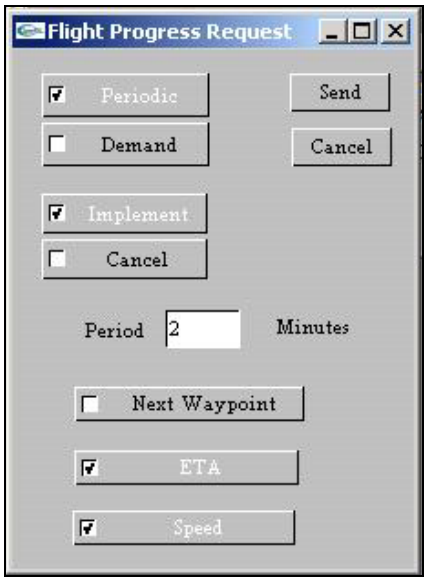


Figure 18 – Flight Progress Request Form

To send a Flight Progress Request message to a given aircraft the operator should make some choices concerning the intended request. The options are described below. After setting up the different options the operator is able to send a flight progress request to the selected aircraft by clicking the “Send” button. The “Cancel” button will close the Flight Progress Request form.

Periodic or Demand Reports

The operator must choose between the reception of periodic reports or the reception of one single report, by clicking, respectively, on “Periodic” or ”Demand”.

Implement or Cancel periodic contract

The operator must choose between the implementation of a periodical contract, between the AGP and a given flight, or to cancel existing contract by clicking, respectively, on “Implement” or clicking on “Cancel”.

Periodic Rate

When the periodic contracts option is chosen the operator must define the sending period rate by changing the “Period” text box value, which defines the periodical report rate. The time unit is minutes.

Report Data

The operator is allowed to choose the flight progress report content by ticking the Next Reporting Point, ETA, or Speed tick boxes.

5.1.3.6 Sending Aircraft Meteo requests

Pressing “AMet. Req” button or the “Aircraft Meteo Requests” entry on the FPD Message menu shows the “Aircraft Meteo Request” form.

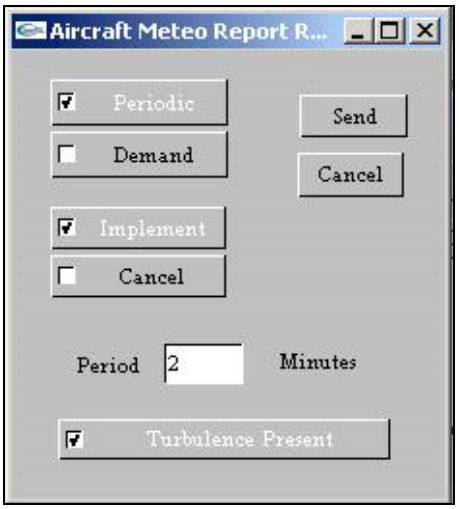


Figure 19 – Aircraft Meteo Request Form

To send a Aircraft Meteo Request message to a given aircraft the operator should make some choices concerning the intended request. The options are described below. After setting up the different options the operator can send aircraft meteo requests to a selected aircraft by clicking the “Send” button; the “Cancel” button will close the Aircraft Meteo Request form.

Periodic or Demand Reports

The operator must choose between the reception of periodic reports or the reception of one single report, by clicking, respectively, on “Periodic” or ”Demand”.

Implement or Cancel periodic contract

The operator must choose between the implementation of a periodical contract, between the AGP and a given flight, or to cancel existing contract by clicking, respectively, on “Implement” or clicking on “Cancel”.

Periodic Rate

When the periodic contracts option is chosen the operator must define the sending period rate by changing the “Period” text box value, which defines the periodical report rate. The time unit is minutes.

Report Data

The operator is allowed to choose the aircraft meteo report content(s): tick “Turbulence present” to request the inclusion turbulence data.

5.1.3.7 Sending Trajectory requests

Clicking in “Traj. Req.” button or the “4D Trajectory Request” entry on the FPD Message menu sends a trajectory request to the selected flight.

5.1.3.8 Sending Constraints List

Clicking in “Const. List” button or the “4D Trajectory Constraints List” entry on the FPD Message menu sends a Constraints List message (In-Flight Traffic Management Message) to the selected flight.
The unlinked constraints lists are retrieved from a alternate flight plan, if this alternate flight plan does not exist or the aircraft has passed its top of climb, the constraints list are not uplinked.
Sending again more Constraints List messages toggles between primary and alternate routes in route inside Constraints List message.

5.1.3.9 Sending Free Text message

Clicking in “Free Text” button, or the “Free Text” entry on the FPD Message menu, shows the “Send Free Text” form. The operator can write text to a maximum of 256 characters. If the operator intends to receive a confirmation of the free text message reception, tick “Confirmed” in “Free Text” form. Clicking the “Send” button sends a message to the selected flight. Pressing “Cancel” button will close the “Send Free Text” form.

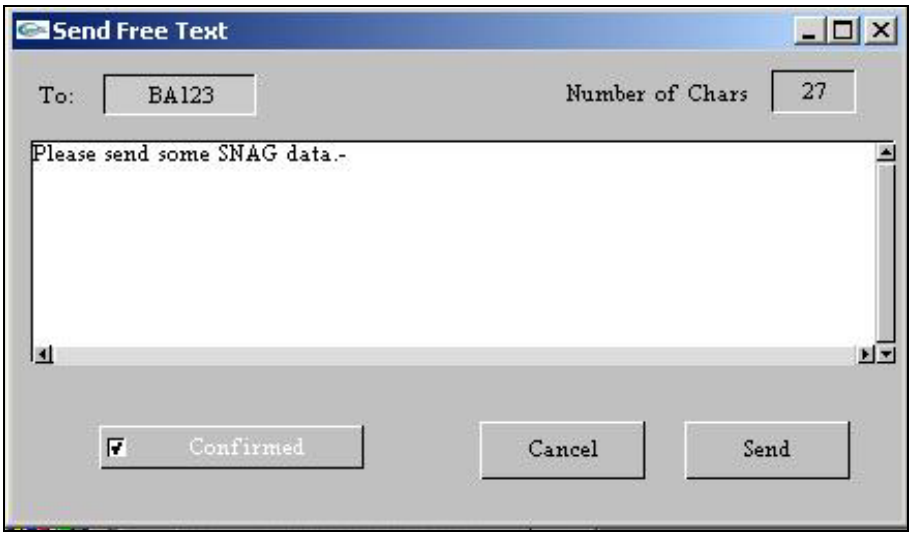


Figure 20 – Send Free Text Form

5.1.3.10 Sending Loadsheet

Clicking in “Loadsheet” button or the “Loadsheet” entry on the FPD Message menu shows the “Loadsheet” form.

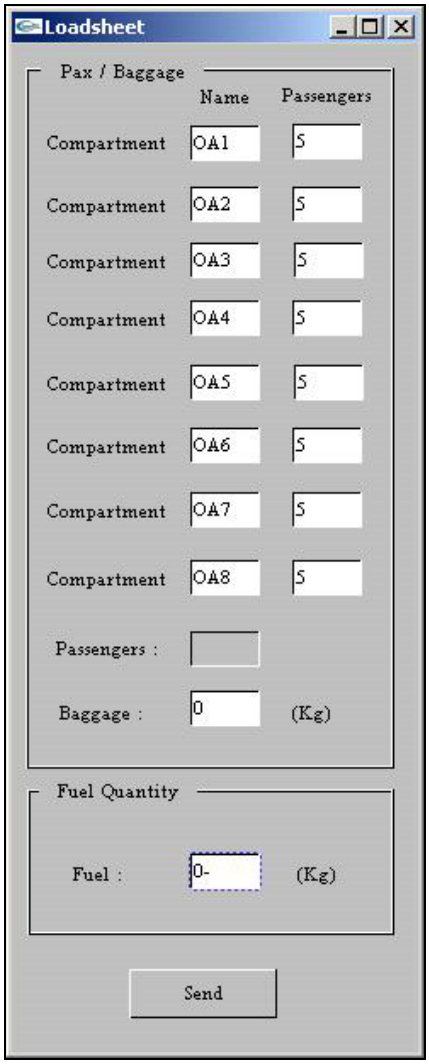


Figure 21 – Loadsheet Form

The “Pax / Baggage” group presents several items to be filled in: passenger compartment names, passenger compartment loads, and total baggage weight. To change passengers compartments names, passenger compartments loads, and total baggage weight the operator should click and change the data on the respective text box.

The “Fuel Quantity” group presents an initial fuel estimate. The Fuel value can be changed by clicking in “Fuel” text box and writing a new fuel value.

Clicking “Send” button will send a *loadsheet* message to a selected aircraft.

5.1.3.11 Querying AGP database

Clicking the “Flight Data” button queries the AGP database about the current flight data and status. This information is presented in two forms: a “Trajectory” form which shows the flight current trajectory; and a “OOOI” form which is only shown when the selected flight has sent at least one message included in the OOOI message set: Out / On / Off / In message.

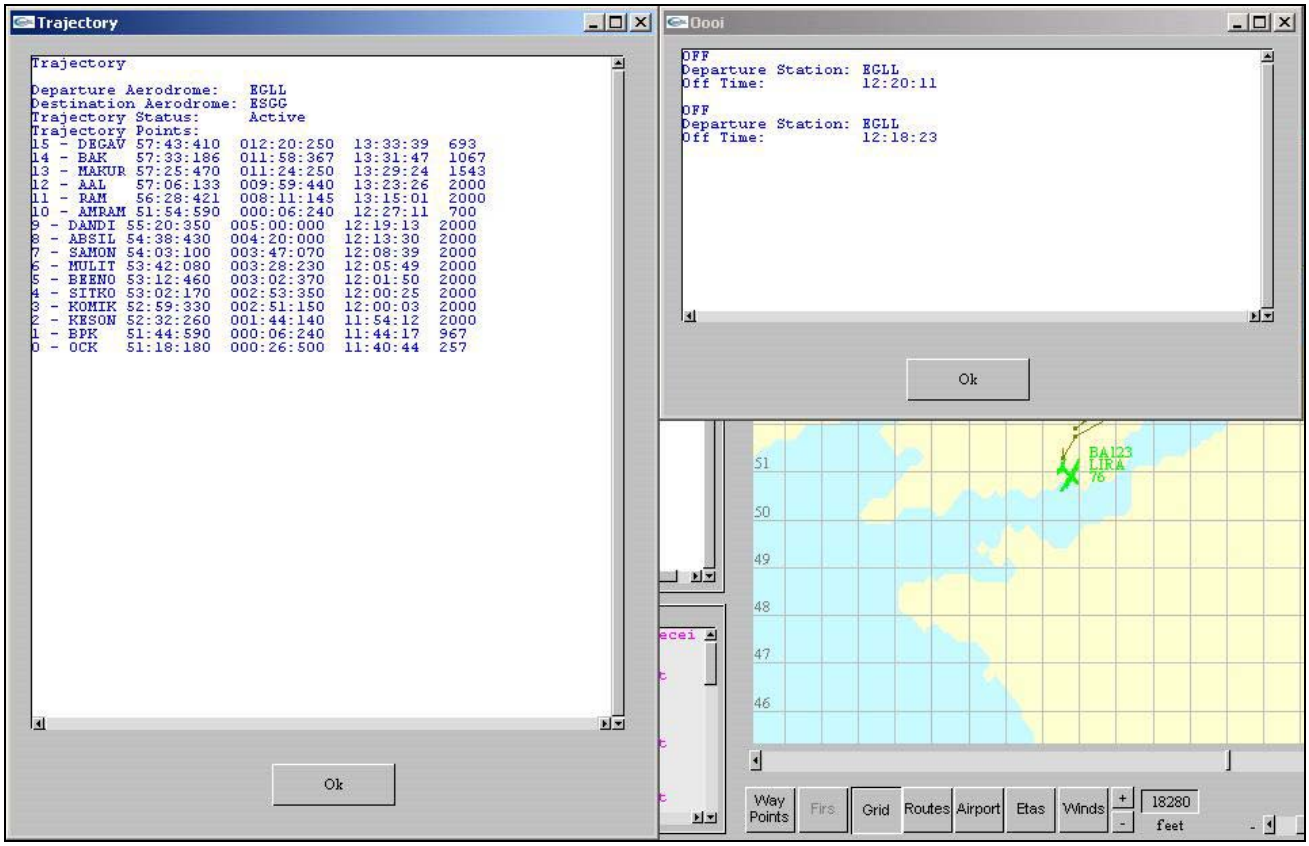


Figure 22 – Trajectory and OOOI Forms

5.1.3.12 Selecting a message

Clicking a message inside “Messages” message list selects a message and shows message details in the bottom-right of the FPD.

5.1.3.13 Showing message details

Double-Clicking a message inside “Messages” message list pops-up a “Message Contents” form, and message details are shown inside “Message Contents” form.

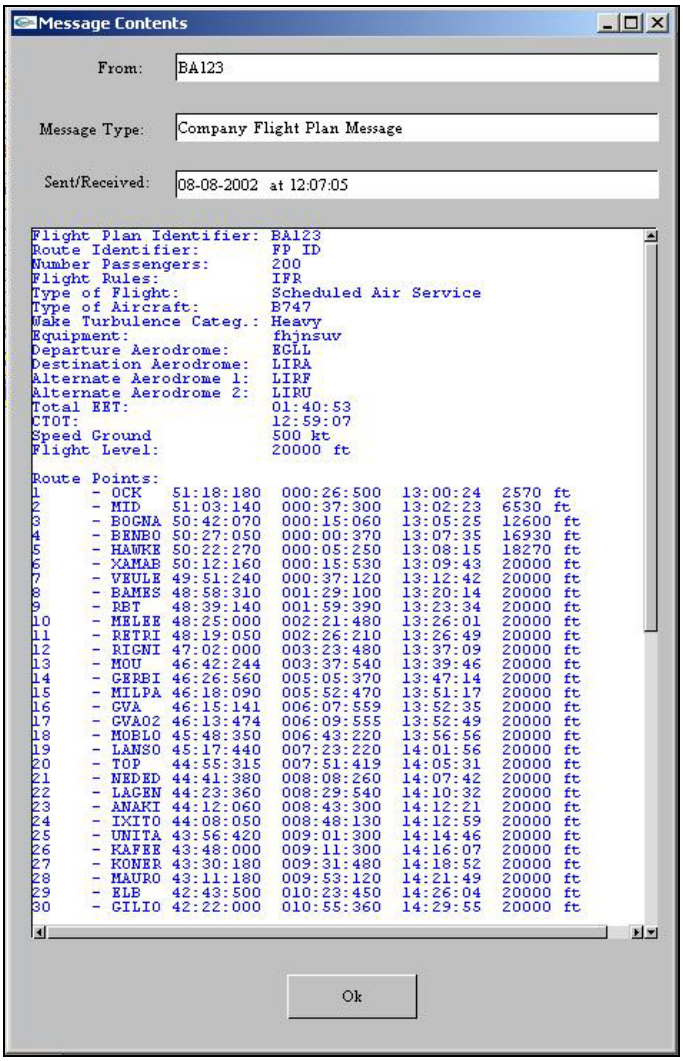


Figure 23 – Message Contents Form

5.1.3.14 Selecting Map Area

Pressing the left mouse key inside Map area and releasing left mouse key in other map area position, allows the user to select and view the specified map area in a greater detail.

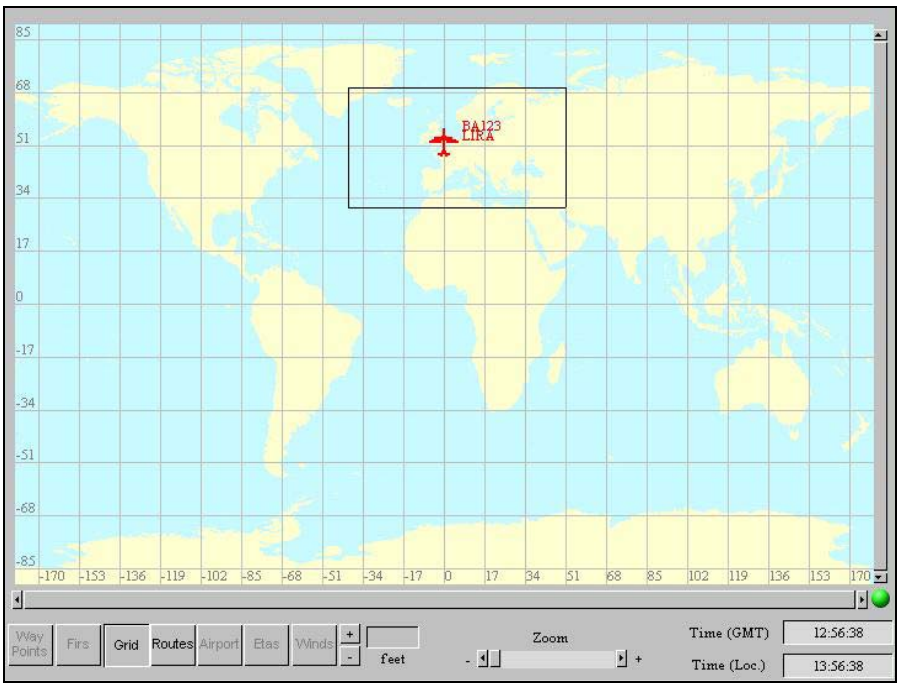


Figure 24 – Selecting Map Area

5.1.3.15 Displaying Waypoints

Pressing “Waypoints” button is only available from a pre-defined zoom level in order to avoid cluttering the display. Only when the “Waypoints” button is enabled, the operator is allowed to press it. When this button is pressed, all the waypoints included in the AGP Waypoint Database[1] are showed.

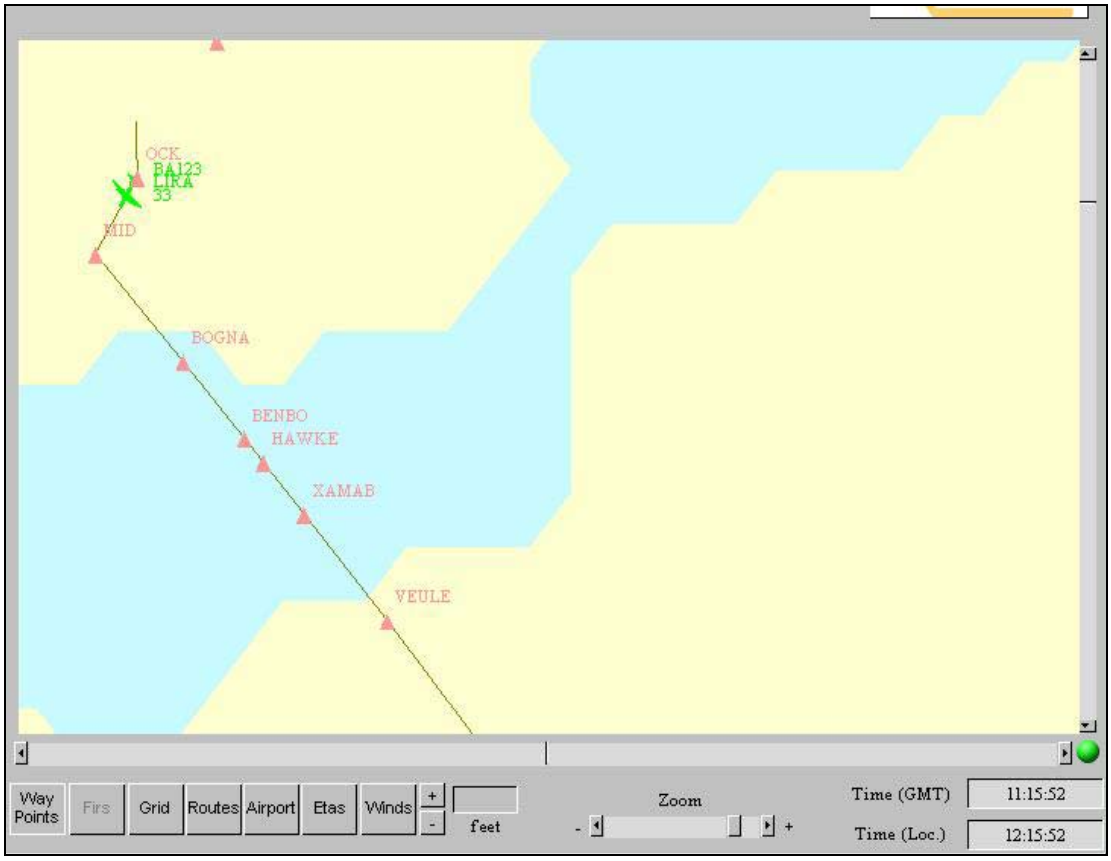


Figure 25 – Displaying Waypoints

[1] Waypoint information was, previously, extracted from a standard aeronautical navigation database.

5.1.3.16 Displaying FIRs

Pressing “Firs” button is only available from a pre-defined zoom level in order to avoid cluttering the display. Only when the “Firs” button is enabled, the operator is allowed to press it. When this button is pressed, all available FIR (Flight Information Region) information is presented[2].

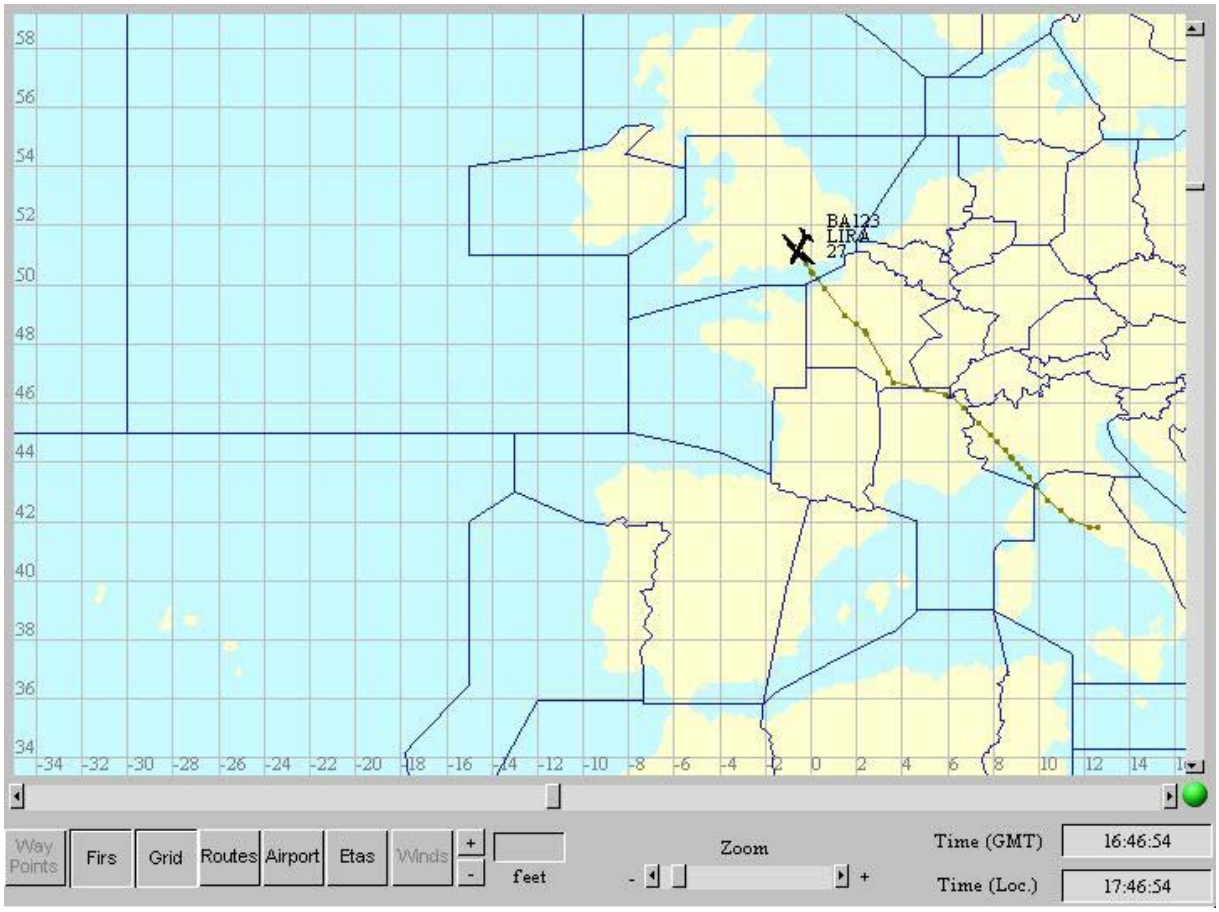


Figure 26 – Displaying Firs

[2] FIR information was, previously, extracted from a standard aeronautical navigation database.

5.1.3.17 Displaying Map Grid

Pressing “Grid” button shows the map grid. The grid has vertical and horizontal lines. A vertical line represents a longitude (longitude range between –180 to 180 degrees), and a horizontal line represents latitude (latitude range between –90 to 90 degrees).

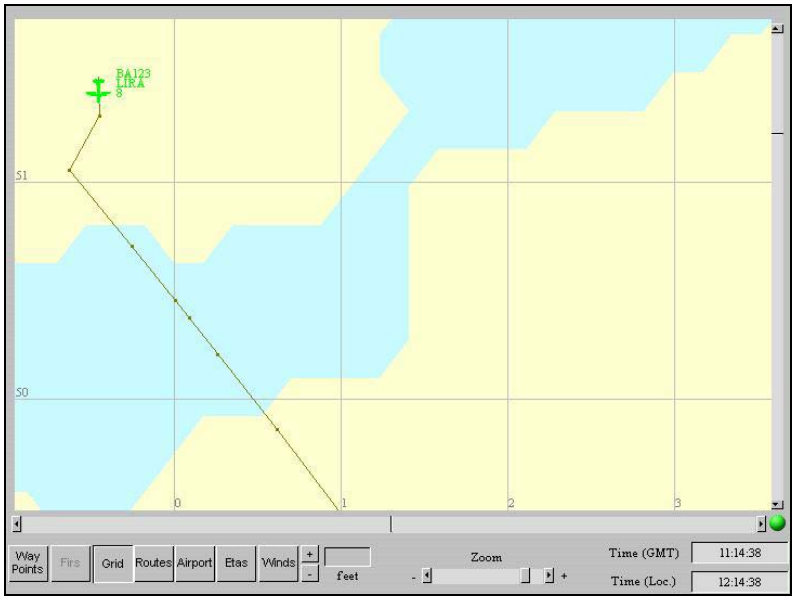


Figure 27 – Map Grid

5.1.3.18 Displaying Routes

Pressing “Routes” button shows the routes of all registered flights.

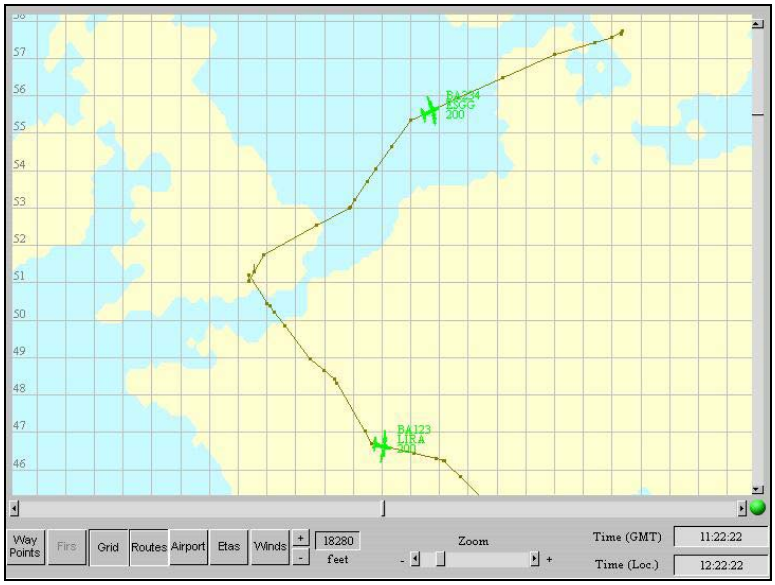


Figure 28 – Displaying Routes

5.1.3.19 Displaying Airports

To avoid cluttering on the map display, the “Airport” button is only *available* to the user from a pre-defined zoom level. When *enabled*, the “Airport” option will display airports icons according to the data defined in the airport database[3].

[3] Airports were previously extracted from a standard aeronautical navigation database.

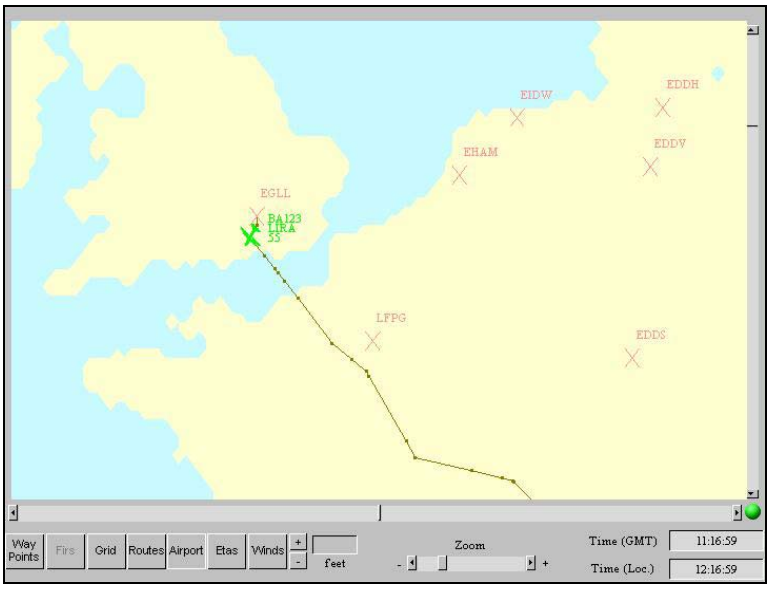


Figure 29 – Displaying Airports

5.1.3.20 Displaying ETAs

Pressing “Etas” button is only available from a pre-defined zoom level in order to avoid cluttering the display. When the “Etas” button is enabled, the operator can press it. When this button is pressed, the ETAs for all route waypoints are showed.

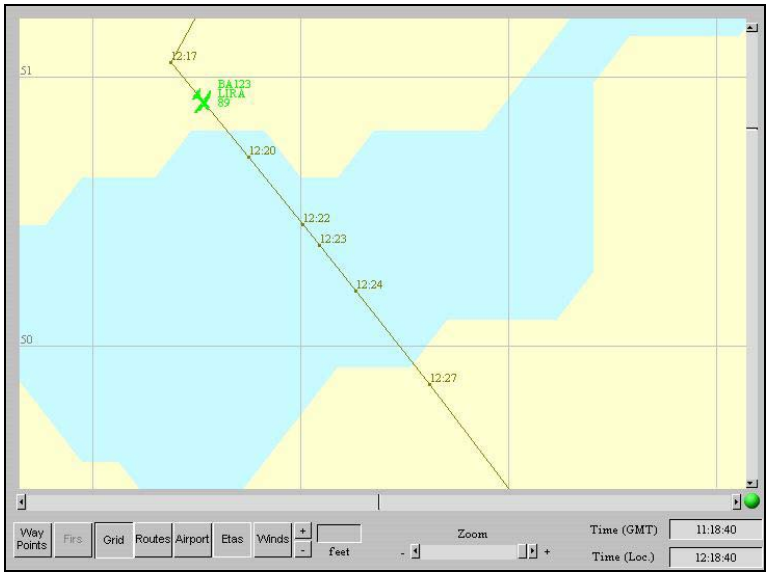


Figure 30 – Displaying ETAs

5.1.3.21 Displaying Winds

Pressing “Winds” button is only available from a pre-defined zoom level in order to avoid cluttering the display. When the “Winds” button is enabled and the button is pressed, available wind data is displayed on the Map.

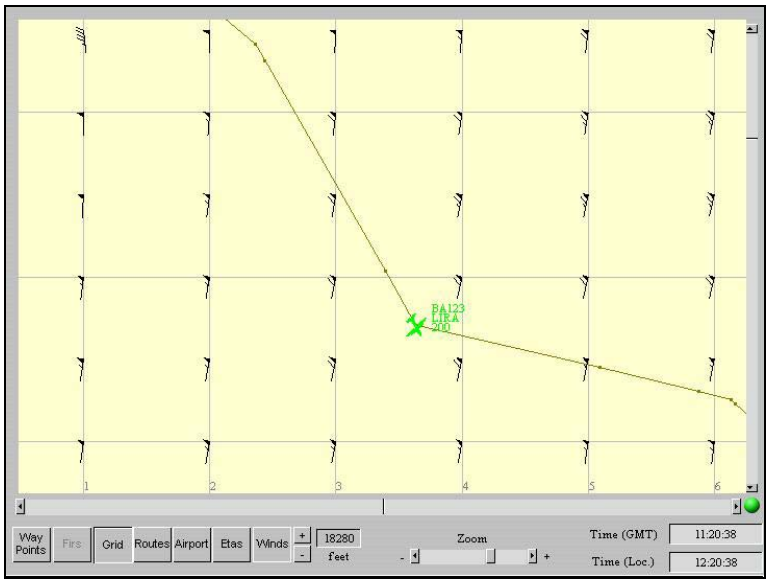


Figure 31 – Displaying Winds

5.1.3.21.1 Increasing Wind Level Altitude

Pressing “+” button is only available if the winds are being displayed. When the “+” button is enabled, the operator can press it in order to increase the wind level altitude (units in feet).

5.1.3.21.2 Decreasing Wind Level Altitude

Pressing “-” button is only available if the winds are being displayed. When the “-” button is enabled, the operator can press it in order to decrease the wind level altitude (units in feet).

5.1.3.22 Zooming-in and zooming-out

Zooming-in and zooming-out can be achieved by dragging “Zoom” scroll-bar below map. An alternative way to zoom-in is to select a map area as was described in a previous section.

5.2 Post-Flight Display

5.2.1 Capabilities

The Post-Flight display enables the AGP operator to analyse pertinent aircraft data from a completed flight. Post-Flight information also provides the fuel-usage data from a given flight. This information is provided through OOOI reports, and flight progress reports.

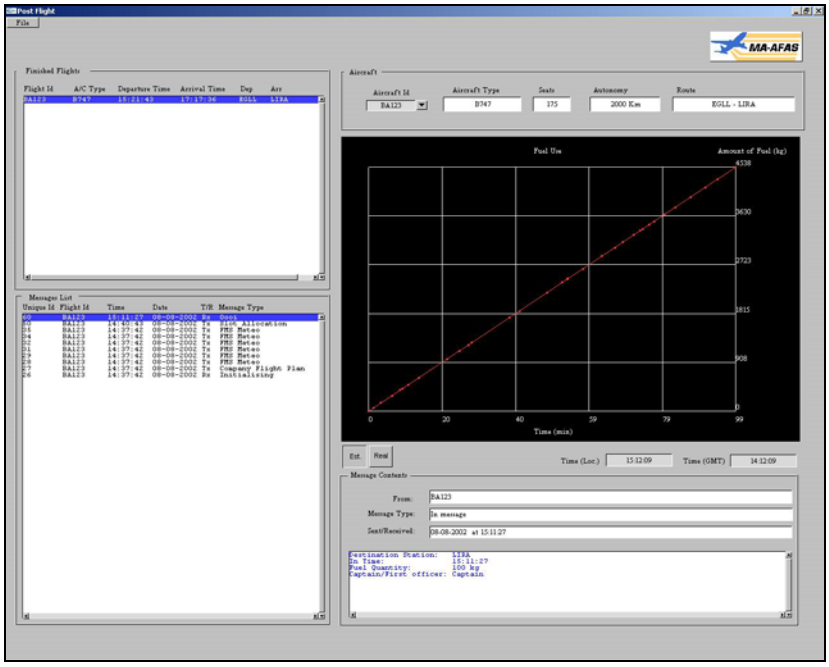


Figure 32 – The Post Flight Display.

5.2.2 Post-Flight Display Overview and Conventions

As shown in the figure below, the Post-Flight Display can be broken down in the following areas: menus, finished flights, messages list, message contents, aircraft and fuel usage graph.

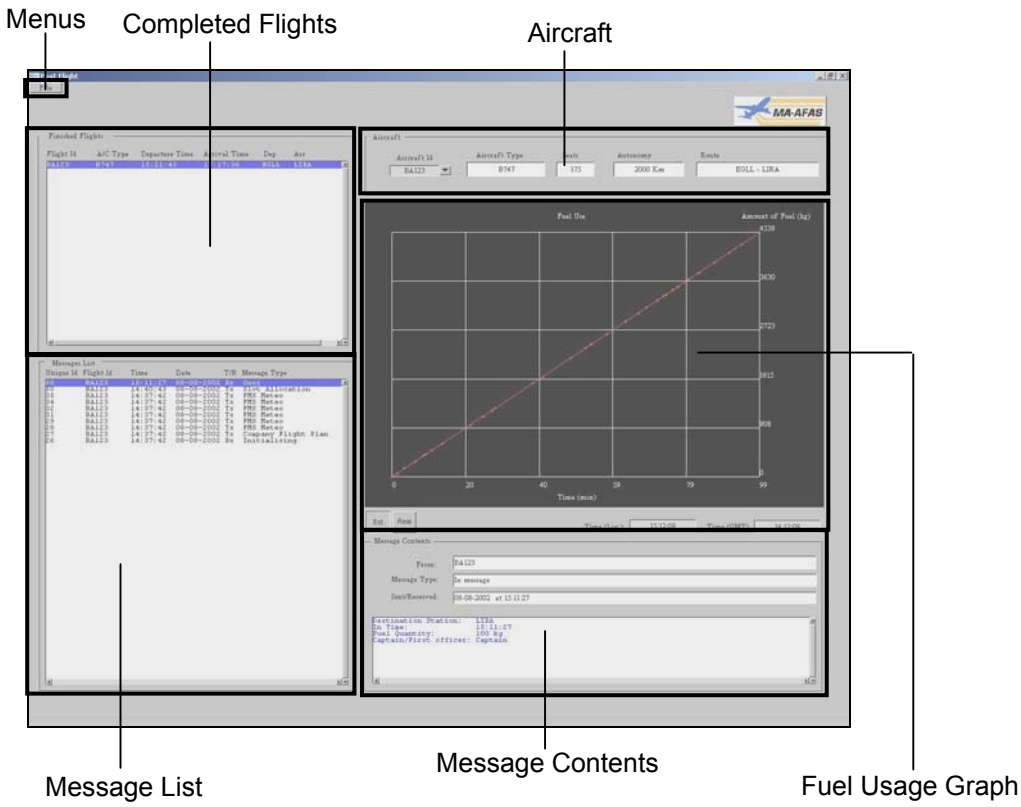


Figure 33 – Post Flight Display main areas

5.2.2.1 Menus

The menus include only the File menu.

5.2.2.1.1 File Menu

The File Menu has three entries, described below:

Exit - Clicking this menu entry, closes Post-Flight Display.

Flight Progress Display – This entry will be disabled until Flight Progress Display is closed.

Maintenance – Clicking “Maintenance“ entry shows Maintenance Display, hiding Post-Flight Display. This entry remains disabled while Maintenance Display is active.

Figure 34 – Post-Flight File

5.2.2.2 Finished Flights

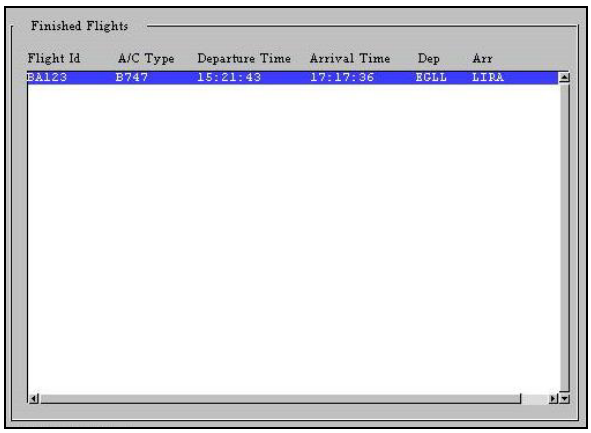


Figure 35 – Finished Flights

The Finished Flights display shows to the user information concerning the completed flights that are registered in the AGP system. For each flight a set of flight data information is available. Details of each data field are explained below:

- Flight Id – Flight id.
- A/C Type – Aircraft Type.
- Departure Time – Time at aircraft take off from departure.
- Arrival Time – Time at aircraft take on destination.
- Dep – Departure airport
- Arr – Arrival airport

5.2.2.3 Messages List

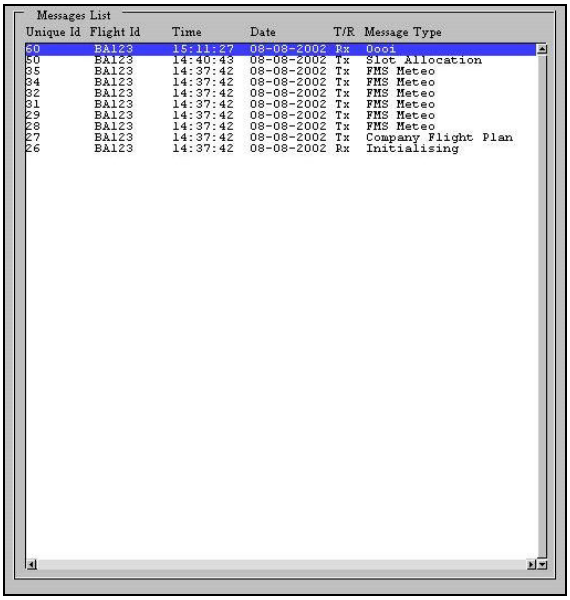


Figure 36 – Messages List

Messages List shows all the messages exchanged between the AGP and a selected flight. Each message entry is displayed has a set of data fields. Details of each data field are explained below:

- Unique Id – Message unique id.
- Flight Id – Flight Id that sent or received the message.
- Time – Time when a message is logged in AGP.
- Date – Date when a message is logged in AGP.
- T/R – “Tx” if message is a transmitted message, “Rx” if message is a received message.
- Message Type – Type of message.

5.2.2.4 Message Contents

Message Contents shows the details of a selected message as described below:

- From – Message sender / transmitter.
- Message Type – Type of message.
- Sent/Received – Time and date when a message is logged in AGP.
- Message data details.

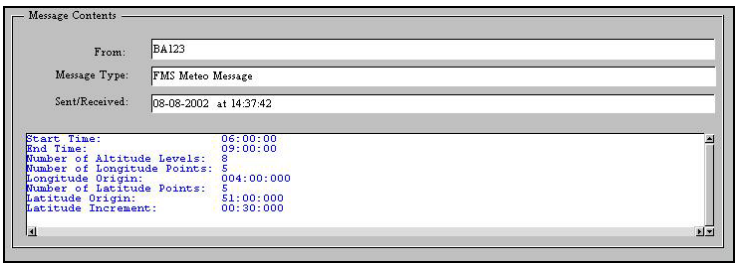


Figure 37 – Message Contents.

5.2.2.5 Aircraft

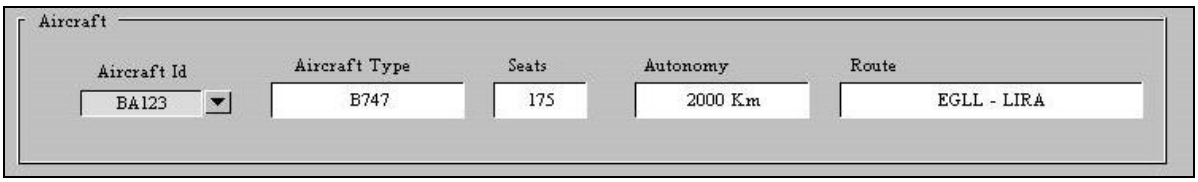


Figure 38 – Aircraft Details

The Aircraft group contains aircraft information as described below:

- Aircraft Id – Flight Identifier.
- Aircraft Type – Aircraft type.
- Seats – Passengers capacity.
- Autonomy – Aircraft Range.
- Route – Departure and destination.

5.2.2.6 Fuel Usage Graph

The graphics concerning fuel usage present the information regarding predicted and actual fuel consumption of a given aircraft.

The fuel usage presentation includes a graph window and a toolbar. The graph window is where the graph is actually depicted. The toolbar enables the user to change the variable that is being displayed on the graph window. The available graphs are:

- Estimated fuel usage: shows the fuel usage as was predicted by the original flight plan.
- Real fuel usage: presents the information concerning real consumption of fuel, according to the data available in OOOI and Flight Progress messages.

The AGP operator can change the graph being displayed using two buttons: “Est.” (for estimated) and “Real”, located below the graph window.

5.2.3 Processing procedures

5.2.3.1 Selecting a flight

The operator needs to select a flight in order to visualize the post-flight data. Flight selection can be achieved by clicking a flight inside “Finished Flights”, or by clicking and selecting a flight in “Aircraft Id” combo box inside “Aircraft” group.

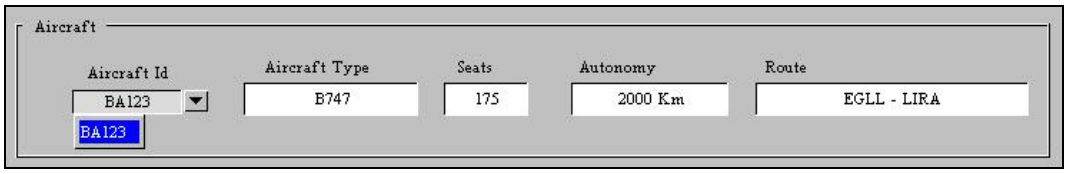


Figure 39 – Flight Selection

5.2.3.2 Selecting a message

Clicking a message inside “Messages List” selects a message and shows message details in the bottom-right of Post-Flight display.

5.2.3.3 Showing message details

Double-Clicking a message inside “Messages List” pops-up a “Message Contents” form, and n showed inside the “Message Contents” form.

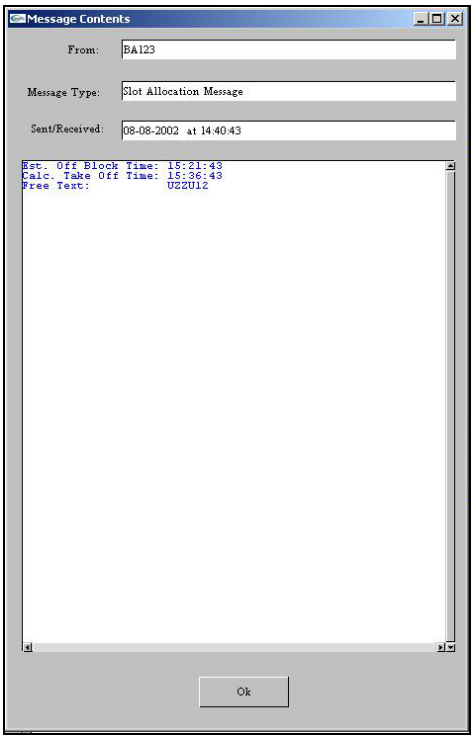


Figure 40 – Message Contents Form

5.2.3.4 Displaying Est. graph

Clicking in “Est.” button displays Est. graph. This graph shows the estimated fuel usage (y-axis in Kg) by time (x-axis in minutes).

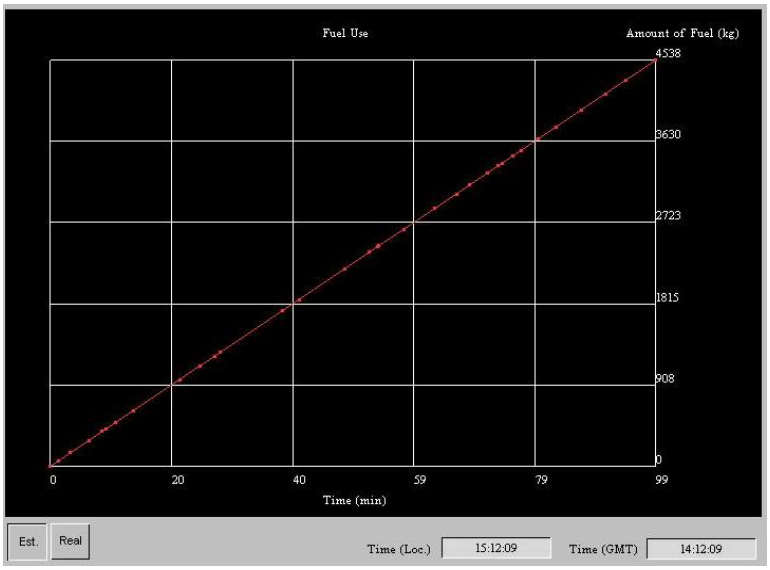


Figure 41 – Graphic representation of the Estimated Fuel.

5.2.3.5 Displaying Real graph

Clicking in “Real” button displays Real graph. This graphic representation shows the real fuel usage (y-axis in Kg) by time (x-axis in minutes).

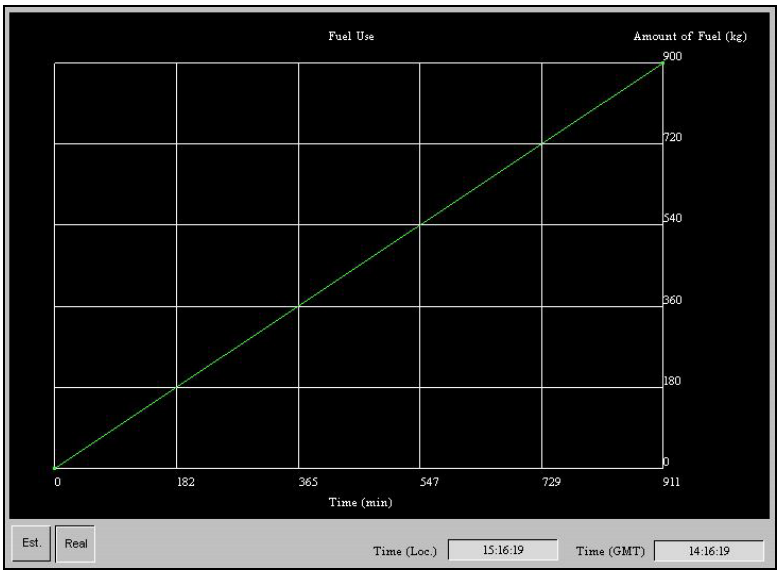


Figure 42 – Graphic representation of the Real Fuel.

5.3 Maintenance Display

5.3.1 Capabilities

The Maintenance Display allows the AGP operator to monitor flight information from a maintenance level perspective. The objective is to present maintenance data concerning all flights. This type of data is included in SNAG reports, APU reports, and engine status reports.

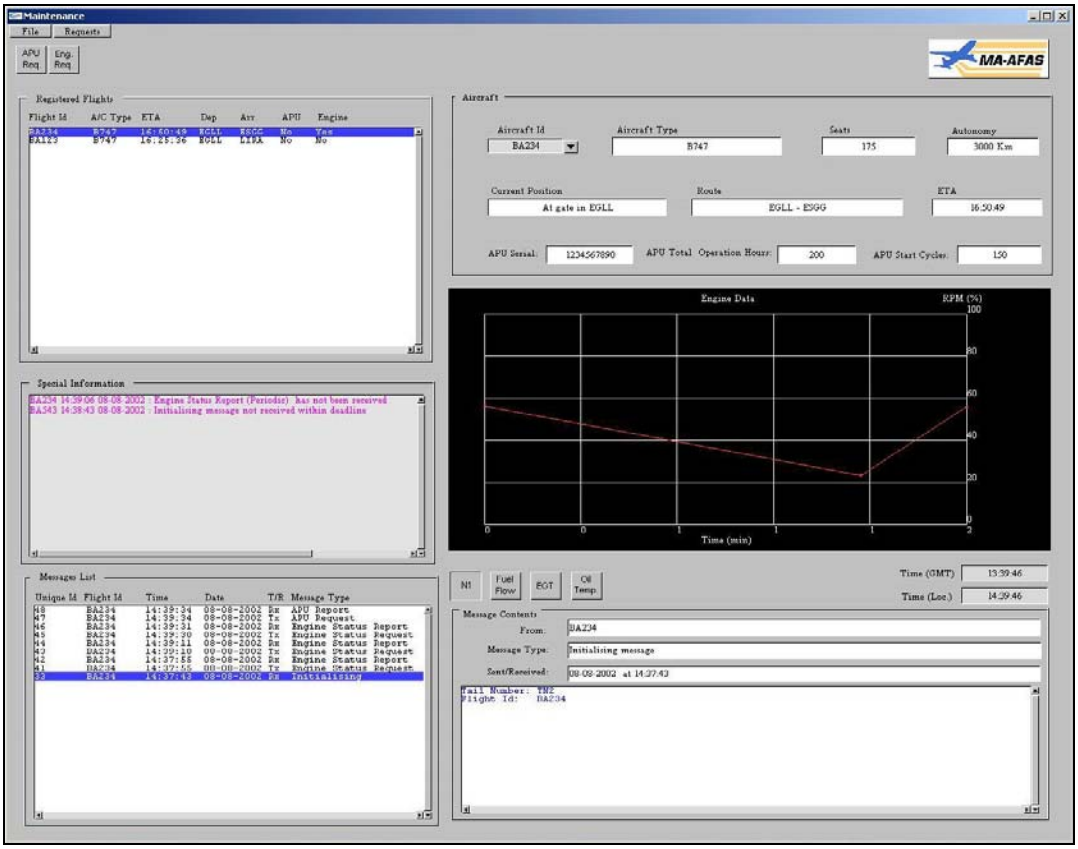


Figure 43 – The Maintenance Display.

5.3.2 Maintenance Display Overview and Conventions

As shown in the figure below, the Maintenance Display can be broken down in the following areas: menus, toolbars, registered flights, special information, aircraft, messages list, message contents and engines graph.

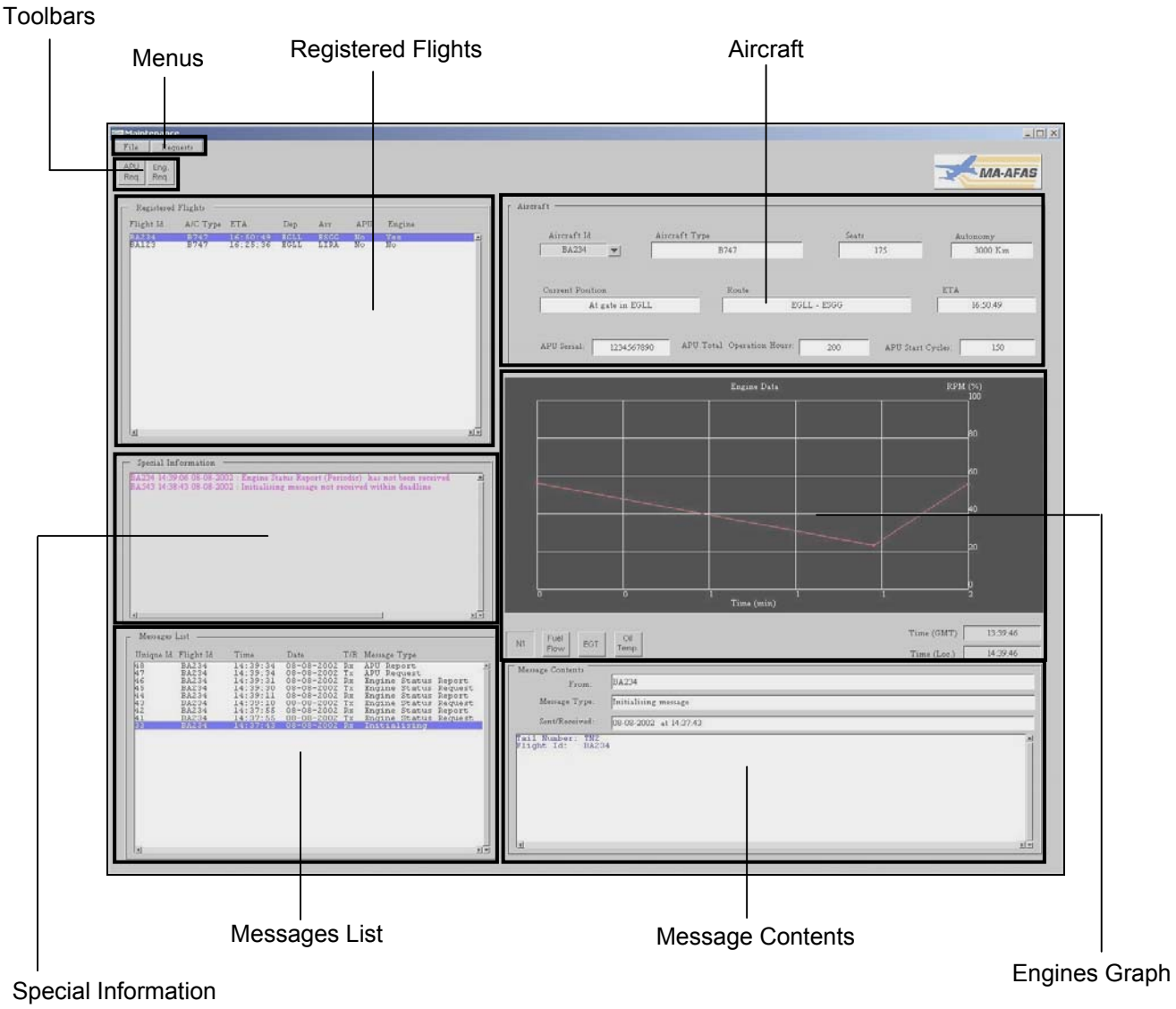


Figure 44 – Maintenance Display main areas.

5.3.2.1 Menus

The Menus of the current display allows the operator to send maintenance messages to the selected flight and to toggle displays.

5.3.2.1.1File Menu

Figure 45 – Maintenance File Menu

The File menu contains three entries, described below:

Exit - Clicking this menu entry, closes Maintenance Display.

Flight Progress Display – This entry will be disabled until Flight Progress Display is closed.

Post-Flight – This menu entry enables the operator to view the Post-Flight Display, hiding the Maintenance Display. This entry remains disabled while Post-Flight Display is active.

5.3.2.1.2 Requests Menu

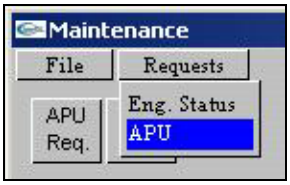


Figure 46 – Maintenance Requests Menu

The Requests Menu includes two entries, described below:

Eng. Status– This menu entry enables the operator to compose and send a engine status request message.

APU – This menu entry enables the operator to compose and send an APU request message.

5.3.2.2 Toolbars

The toolbar on this display provides the operator means to uplink maintenance related messages to a selected flight. This toolbar has two buttons, described below:

APU Req. – This button enables the operator to compose and send an APU request message.

Eng. Req. – This button enables the operator to compose and send a engine status request message.

5.3.2.3 Registered Flights

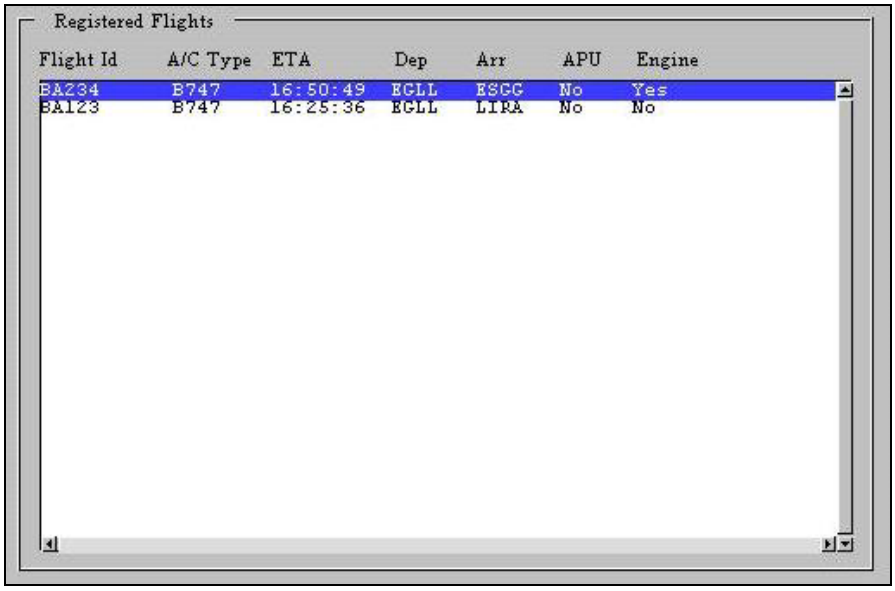


Figure 47 – Registered Flights

The Registered Flights window present information concerning all flights registered with the AGP system. For each flight a set of flight data information is available. Details of each data field are explained below:

- Flight Id – Flight identifier.
- A/C Type – Aircraft Type.
- ETA – Estimated Time of Arrival.
- Dep – Departure airport
- Arr – Arrival airport
- APU – “Yes” if APU reports messages are sent periodically, “No” otherwise.
- Eng. – “Yes” if engine status reports messages are sent periodically, “No” otherwise.

5.3.2.4 Special Information

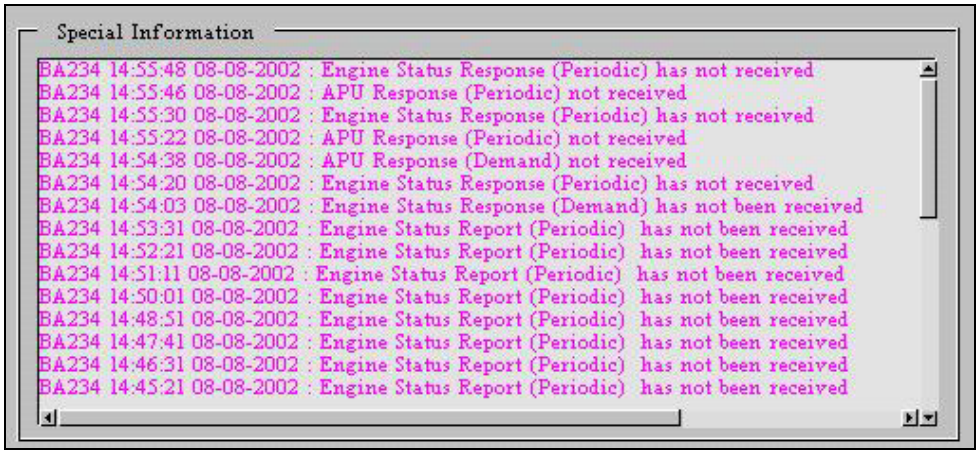


Figure 48 – Special Information

The Special Information display presents the alerts generated by the AGP system concerning aircraft maintenance data. Each alert contains a set of data fields, explained below:

- Flight Id – Flight Identifier.
- Time – Alert generation time.
- Date – Alert generation date.
- Description – Small description text of what is the reason of an alert.

5.3.2.5 Aircraft

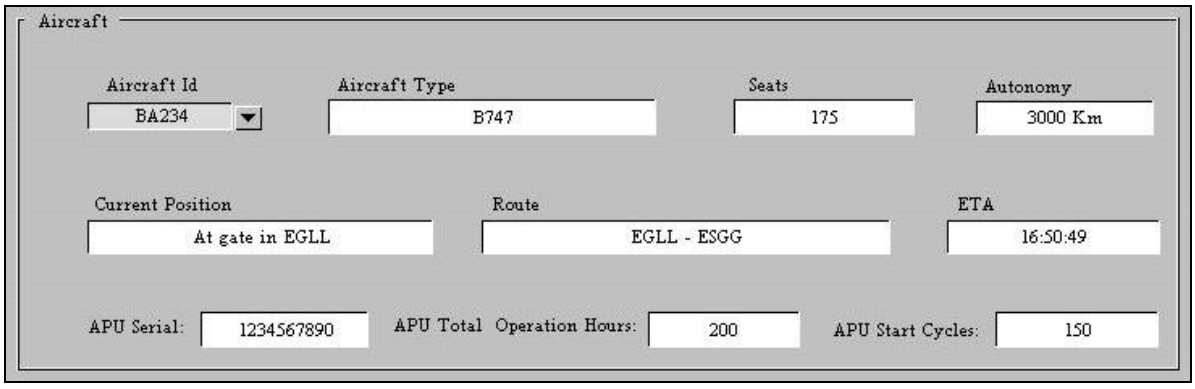


Figure 49 – Aircraft Details

The aircraft details group contains the following aircraft information:

- Aircraft Id – Flight Identifier.
- Aircraft Type – Aircraft type.

- Seats – Passengers capacity.
- Autonomy – Aircraft Range.
- Current Position – Aircraft status.
- Route – Departure and destination.
- ETA – Estimated Time of Arrival
- APU Serial – APU serial number
- APU Total Operation hours – APU total operating hours
- APU Start Cycles – Number of APU start cycles

5.3.2.6 Messages List

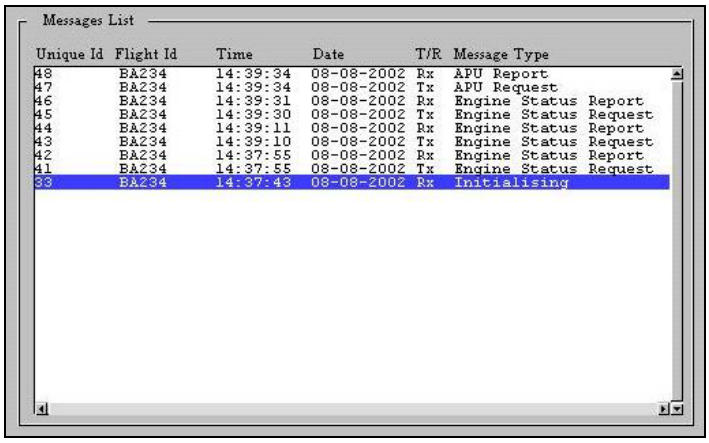


Figure 50 – Messages List

Messages List shows all maintenance related messages exchanged between the AGP and a selected Flight. The Message List contains a set of different data fields per each message displayed. Details of each data field are explained below:

- Unique Id – Message unique id.
- Flight Id – Flight Id that sent or received the message.
- Time – Time when a message is logged in AGP.
- Date – Date when a message is logged in AGP.
- T/R – “Tx” if message is a transmitted message, “Rx” if message is a received message.
- Message Type – Type of message.

5.3.2.7 Message Contents

In the bottom-right side of display, there is the message contents area. Message Contents shows the details of a selected message as described below::

- From – Message sender / transmitter.
- Message Type – Type of message.
- Sent/Received – Time and date when a message is logged in AGP.
- Message data details.

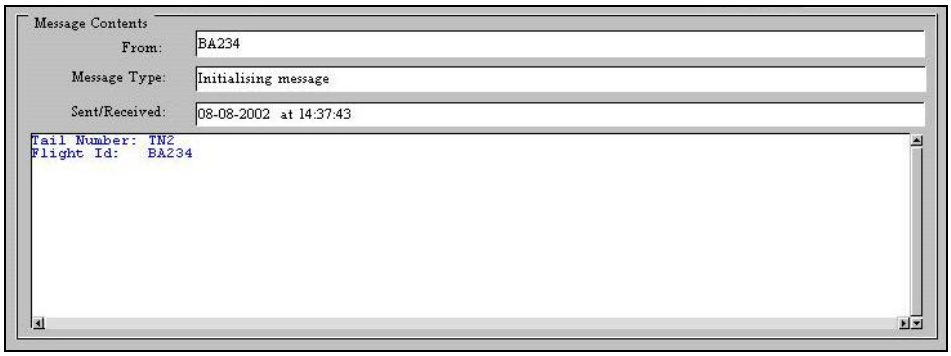


Figure 51 – Messages Contents

5.3.2.8 Engines Graph

The Engine Graph area presents graphical information concerning the behaviour of a selected aircraft engine parameters.

The engine graph area includes a graph window and the toolbar. The graph window is where the graph is actually depicted. The toolbar enables the user to change the variable that is being displayed on the graph window. The variables that are available to display are:

- N1, rotation speed of the low pressure compressor relative to maximum.
- Fuel Flow.
- EGT, engine exhaust gas temperature.
- Oil Temperature.

Please note that these graphics are only available after the reception of at least two engine status reports.

5.3.3 Processing procedures

5.3.3.1 Selecting a flight

To view messages, concerning a given flight, the operator needs to select a given flight by clicking *inside* "Registered Flights", or by clicking and selecting a flight in "Aircraft ID" combo box inside "Aircraft" group.

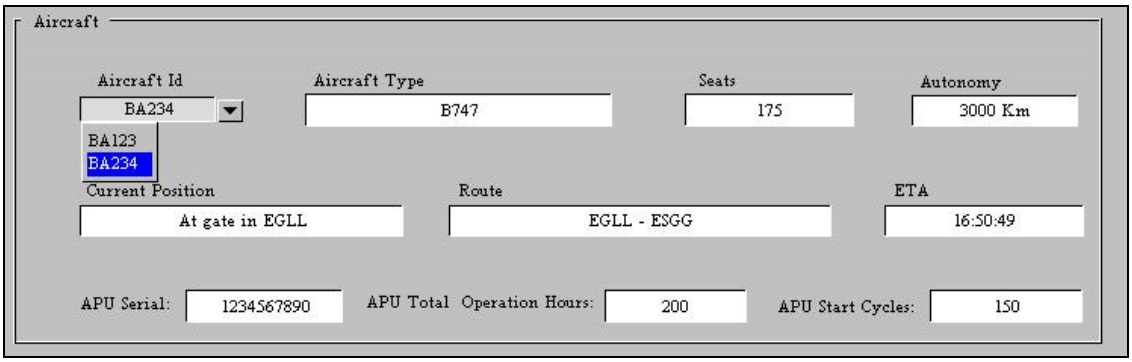


Figure 52 – Flight Selection

5.3.3.2 Sending APU requests

Pressing "APU Req." button or the "APU" entry on the Maintenance Display Requests menu shows the "APU Request" form.

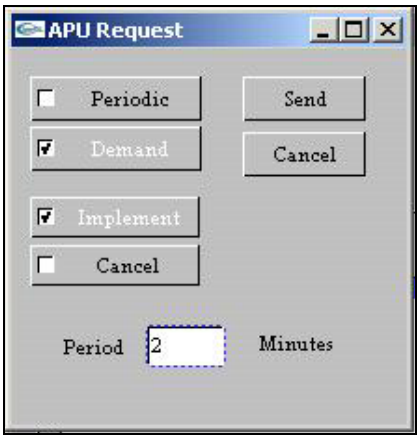


Figure 53 – APU Request Form

To send an APU Request the operator is allowed to make some choices concerning the APU request message. These options are described below. After setting up the different options the operator can send APU report requests to a selected aircraft by clicking the "Send" button; the "Cancel" button will close the APU Request form.

Periodic or Demand Reports

The operator may choose between the reception of periodic reports or single reports: click “Periodic” for receiving periodical reports, or ”Demand” for receiving a unique report.

Implement or Cancel periodic contract

The operator may choose between the implementation of a periodical contract between the AGP and a selected flight, or to cancel an existing contract. Clicking “Implement” implements a periodical contract, and clicking “Cancel” cancels an existing contract.

Periodic Rate

In periodical contracts the operator must define the sending period rate, changing “Period” text box defines a new periodical sending report rate (time unit is minutes).

5.3.3.3 Sending Engine Status requests

Pressing “Eng. Req.” button or the “Eng. Status” entry on the Maintenance Display Requests menu shows “Engine Status Request” form.

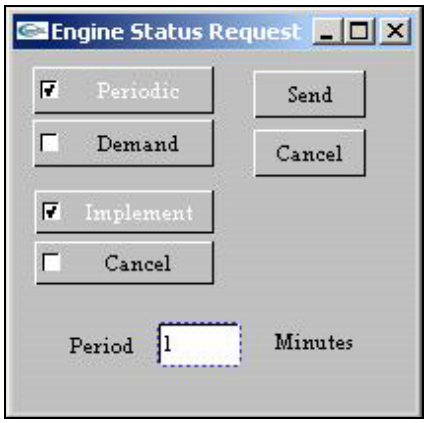


Figure 54 – Engine Status Request Form

To send a Engine Status request message the operator should make some choices concerning the Engine Status request message. These options are described below. After setting up the different options the operator can send Engine Status requests to a selected aircraft by clicking the “Send” button; the “Cancel” button will close the Engine Status Request form.

Periodic or Demand Reports

The operator may choose between the reception of periodic reports or single reports: click “Periodic” for receiving periodical reports, or ”Demand” for receiving a unique report.

Implement or Cancel periodic contract

The operator may choose between the implementation of a periodical contract between the AGP and a given flight, or to cancel an existing contract. Clicking “Implement” implements a periodical contract, and clicking “Cancel” cancels an existing contract.

Periodic Rate

In periodical contracts the operator must define the sending period rate, changing “Period” text box defines a new periodical sending report rate (time unit is minutes).

After all of the above options are set, operator can send a Engine Status request by clicking “Send” button, or “Cancel” button to close this form.

5.3.3.4 Selecting a message

Clicking a message inside “Messages List” selects a message and shows message details in the bottom-right of Maintenance display.

5.3.3.5 Showing message details

Double-Clicking a message inside “Messages List” pops-up a “Message Contents” form, and message details are shown inside “Message Contents” form.

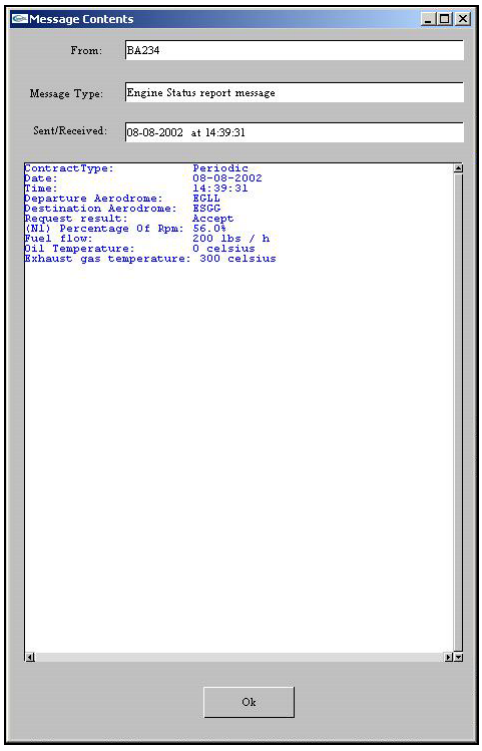


Figure 55 – Message Contents Form

5.3.3.6 Displaying N1 graph

Clicking in “N1” button displays the graphic concerning the N1 parameter. This graphic shows RPM (y-axis in percentage) by time (x-axis in minutes).

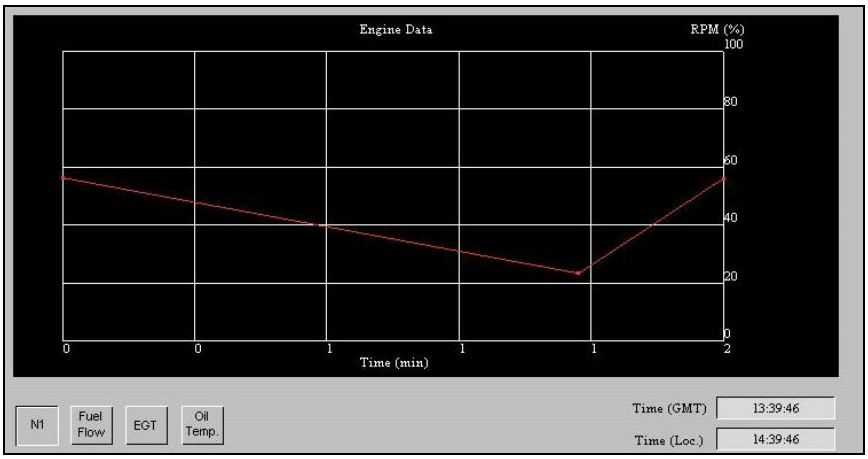


Figure 56 – N1 graphic representation.

5.3.3.7 Displaying Fuel Flow graph

Clicking in “Fuel Flow” button displays the graphic concerning the fuel flow parameter. This graphic shows the engine fuel flow (y-axis in lbs/h) by time (x-axis in minutes).

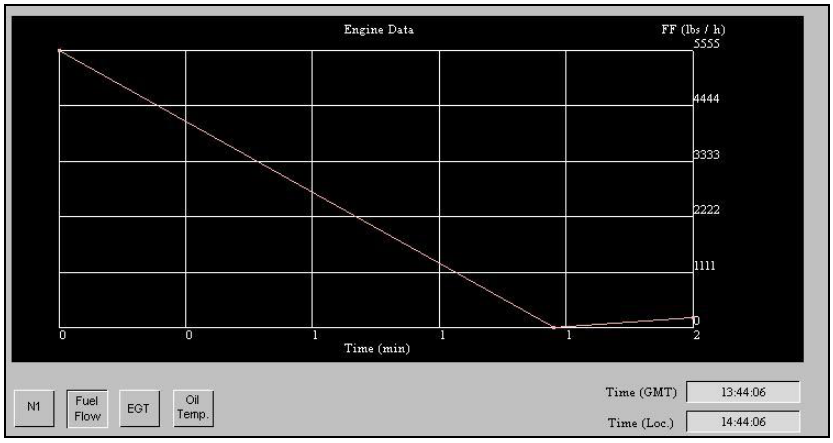


Figure 57 – Fuel Flow graphic representation.

5.3.3.8 Displaying EGT graph

Clicking in “EGT” button displays the graphic concerning the EGT parameter. This graphic shows the exhaust gas temperature (y-axis in Celsius) by time (x-axis in minutes).

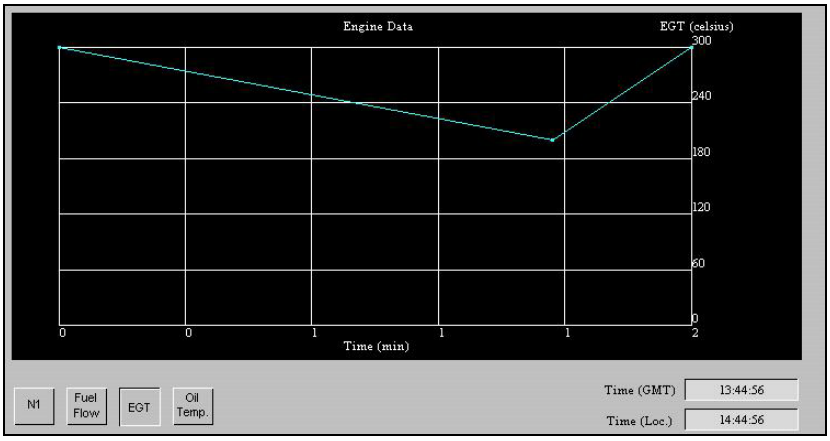


Figure 58 – EGT graphic representation.

5.3.3.9 Displaying Oil Temperature graph

Clicking in “Oil Temp.” button displays the graphic concerning the oil temperature parameter. This graphic shows the oil temperature (y-axis in Celsius) by time (x-axis in minutes).

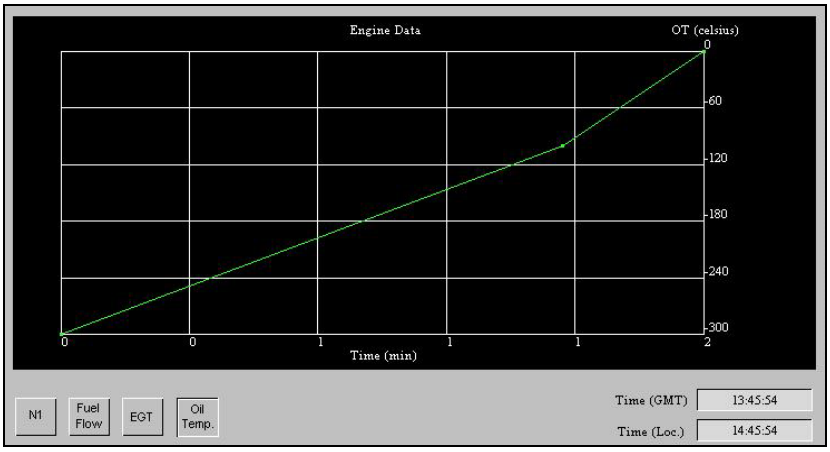


Figure 59 – Oil Temperature graphic representation.

5.4 Warnings

In order to send a message to a given flight the operator shall, first, select the intended flight (refer to *Selecting Flight* section for each display). If a non-valid flight is selected in one of the AGP displays (FPD, Maintenance, or Post-flight), the AGP application will present to the operator a warning form. Warning forms are described below:

- **Missing Selected Flight** - The AGP application shows a missing selected flight warning if a flight is not selected.

Figure 60 – Missing Selected Flight

- **Multiple Selected Flights** - If "ALL" is selected in FPD display, the AGP shows a warning because AGP can only send a message to a single flight. Broadcast messages are not allowed.

Figure 61 – Multiple Selected Flights

- I**ncorrect Flight Selected** -If "CFMU" or WHTR"" is selected, the AGP shows a non-valid selected flight since it is not possible send messages to the CFMU or to the Meteorological Office.

Figure 62 – Incorrect Selected Flight

6 FLEET SIMULATOR

6.1 Introduction

The AGP Fleet Simulator is an application that simulates a group of aircraft in communication with the AGP. The fleet simulator is capable of simulating up to 20 aircraft at a time, and each communicates with the AGP by using the Generic ATN Communications Service (GACS). The simulated aircraft are indistinguishable from real aircraft to the AGP.

6.2 Setting up the simulated aircraft

The actions of the simulated aircraft are described by input files created by the user, which are loaded into the fleet simulator. The content of these files are described below.

6.2.1 Scenario file

The scenario file is a simple text file with the extension ".sen". These files are located in the /Data directory. The first line of the scenario file gives the location (directory) of the input files for the simulated fights (described below). The subsequent lines of the file can be used to give a description of the scenario. The scenario file allows multiple scenarios to be defined, and then the required one loaded when the fleet simulator is started.

6.2.2 Simulated Flight Input File

Each flight to be simulated must have a file that specifies the actions of the flight. These files must be located in the path specified in the scenario file. The input format of the contents of the input file are described in the following sections. Note it is also permissible to add comments to the file by using // to force the rest of the line to be ignored. In the following definitions the construct [X] has been used to express optionality, meaning that X can be included or omitted, and the construct <Y|Z> to mean that one of either Y or Z can be used (<> , [] and | are not part of the definitions).

6.2.2.1 ICAO Address

This is the 24 bit ICAO address of the aircraft. This is used to open a GACS endpoint and must be unique for each aircraft. (Ensure that GACS has been configured with an ATN MO to accept this address.)

This is specified in the file by the following item:

```
ICAO_ADDRESS = XXX.YYY.ZZZ
```

XXX = 0-255, value of the first byte of the 24-bit address.

YYY = 0-255, value of the second byte of the 24-bit address.

ZZZ = 0-255, value of the third byte of the 24-bit address.

6.2.2.2 Initialising Message

This item specifies when an initialising message should be sent and what data it should contain. Note that the time is relative to the start of the simulation, and that some fields are optional, but not mutually exclusive.

```
INIT
{
TIME                                    =                                   HH:MM:SS
TAILNUMBER                                 =                                XXXXXXXX
[FLIGHTID                                    =                YYYYYYYY                ]
[DEPARTURE                                      =                AAAA                ]
[DESTINATION  = AAAA ]

}
```

HH:MM:SS = Time the initialising message should be sent after start of Fleet Simulator execution.

XXXXXXXX = Tail Number of the flight.

YYYYYYYY = Flight Id of the flight (optional)

AAAA = ICAO Address of the departure/destination airport (optional)

6.2.2.3 Loadsheet Acknowledgement

Used to specify the code that forms the acknowledgement to an uplinked loadsheet.

```
LOADSHEET_ACK_CODE = XXXX
```

XXXX = 4 character code used to acknowledge the loadsheet.

6.2.2.4 Taxi Times

Used to specify the time between the EOBT (OUT) and the take off time (OFF) (this should be the same as specified in the flight plan), and the time between landing (ON) and reaching the gate (IN).

```
TAXI_OUT_TIME = HH:MM:SS

TAXI_IN_TIME = HH:MM:SS
```

6.2.2.5 Meteo Report Requests

This item specifies the times at which a simulated aircraft requests meteorological data. More than one request can appear between the curly braces.

```
METEO_REQUEST
{
TIME  =  HH:MM:SS        TYPE  =  [SIGMET]  [TAF]  [METAR]      LOCATION  =  XXXX
……
```

```
.....
}
```

HH:MM:SS = Time after take-off the request will be sent..

SIGMET = One or more of SIGMET, TAF, METAR.
TAF
METAR If more than one is required, separate by a space.

XXXX = ICAO location of airport.

6.2.2.6 Flight Progress Reports

Used to specify whether the flight will accept flight progress requests. If set to YES then the aircraft will provide the reports requested at the required intervals. If set to NO then the aircraft will respond with a response message rejecting the request.

```
FLIGHT_PROGRESS_REPORTS
{
ACCEPT_DEMAND                                   =                                   <YES|NO>
ACCEPT_PERIODIC                                  =                                  <YES|NO>
}
```

6.2.2.7 Aircraft Meteo Reports

Used to specify whether the flight will accept a request for aircraft meteo reports. If set to YES then the aircraft will provide the reports requested at the required intervals. If set to NO then the aircraft will respond with a response message rejecting the request. The meteorological data is fixed for each report and forms part of the configuration construct below.

```
AIRCRAFT_METEO_REPORTS
{
ACCEPT_DEMAND                                   =                                   <YES|NO>
ACCEPT_PERIODIC                                  =                                  <YES|NO>
AIR_TEMPERATURE                                    =                                   [-]XX
WIND_DIRECTION                                      =                                   DDD
WIND_SPEED                                       =                                   SSS
TURBULENCE                                       =                                   TTT
}
```

XX = The air temperature that will be reported by the aircraft.
(Range –99 to 99)

DDD = The wind direction in degrees that will be reported by the aircraft.
(Range 0 to 359)

SSS = The wind speed in knots that will be reported by the aircraft.
(Range 0 to 500)

TTT = The average turbulence that will be reported by the aircraft.
(Range 0 to 255)

6.2.2.8 APU reports

Used to specify whether the flight will accept a request for APU reports. If set to YES then the aircraft will provide the reports requested at the required intervals. If set to NO then the aircraft will respond with a response message rejecting the request. The data in the report is dependant on the phase of the flight.

```
APU_REPORTS
{
ACCEPT_DEMAND                                =                                  <YES|NO>
ACCEPT_PERIODIC                               =                                 <YES|NO>
SERIAL_NUMBER                                =                                SSSSSSSSSS
TOTAL_OPERATING_HOURSGATE  =  HHHH       OUT  =  HHHH     OFF  =  HHHH     ON  =  HHHH
START_CYCLES    GATE  =  CCCC        OUT  =  CCCC      OFF  =  CCCC      ON  =  CCCC
}
```

SSSSSSSSSS = The APU serial number reported by the aircraft.

HHHH = Number of hours (Range 0 to 9999)

CCCC = Number of cycles (Range 0 to 9999)

6.2.2.9 Engine Reports

Used to specify whether the flight will accept a request for engine status reports. If set to YES then the aircraft will provide the reports requested at the required intervals. If set to NO then the aircraft will respond with a response message rejecting the request. The data in the report is dependant on the phase of the flight. A random value will be generated that falls between the minimum and maximum values for the particular flight phase.

```
ENGINE_REPORTS
{
ACCEPT_DEMAND                                =                                  <YES|NO>
ACCEPT_PERIODIC = <YES|NO>

N1GATEMIN          =          AA                          MAX          =          AA
OUT MIN          =          AA                          MAX          =          AA
OFF MIN          =          AA                          MAX          =          AA
ON MIN = AA    MAX = AA

EGTGATEMIN        =        [-]BBBB                       MAX        =        [-]BBBB
OUT MIN         =         [-]BBBB                      MAX         =         [-]BBBB
OFF MIN         =         [-]BBBB                      MAX         =         [-]BBBB
ON MIN = [-]BBBB    MAX = [-]BBBB

FUEL_FLOW
GATEMIN         =         CCCCC                        MAX         =         CCCCC
OUT MIN         =         CCCCC                        MAX         =         CCCCC
```

```
OFF MIN          =          CCCCC                              MAX          =          CCCCC
ON MIN = CCCCC    MAX = CCCCC

OIL_TEMPERATURE
GATEMIN          =          [-]DDD                             MAX          =          [-]DDD
OUT MIN          =          [-]DDD                             MAX          =          [-]DDD
OFF MIN          =          [-]DDD                             MAX          =          [-]DDD
ON MIN          =          [-]DDD                              MAX          =          [-]DDD
}
```

AA = N1 (Percentage of RPM) value. (Range 0 – 99).

BBBB = Exhaust Gas Temperature in Celsius. (Range –9999 to 9999).

CCCCC = Fuel Flow in lbs/hour. (Range 0 – 99999).

DDD = Oil Temperature in Celsius. (Range –999 to 999).

6.2.2.10 IFTM

This item allows the aircraft to be configured to accept or reject requests to perform In-Flight Traffic Management (IFTM). If set to YES then the aircraft will respond with an “accepted for negotiation” message, and then a “cleared trajectory” message, containing the same route as the uplinked constraints. If set to NO then the aircraft will respond with a “rejected for negotiation” message.

```
IFTM
{
ACCEPT                                   =                                   <YES|NO>
ATC_NEGOTIATION_TIME                              =                          HH:MM:SS
}
```

HH:MM:SS = Time between the receipt of a constraints list and the aircraft sending a cleared trajectory message.

6.2.2.11 SNAG

This item specifies times at which the simulated aircraft will report a SNAG. More than one SNAG can appear between the curly braces.

```
SNAG
{
TIME     =     HH:MM:SS                                        CODE     =     XX
…
…
}
```

HH:MM:SS = Time after take-off that the SNAG message will be sent.

XX = Two digit SNAG code.

6.2.2.12 Free-Text

This item specifies times at which the simulated aircraft will send a free-text message. More than one message can appear between the curly braces.

```
FREE_TEXT
{
TIME    =    HH:MM:SS                                    MESSAGE    =    "ABCDEFGHIJK……"
…
…
}
```

HH:MM:SS = Time after take-off that a freetext message will be sent.

ABCDEFGHIJK… = Message text (max length 255 chars).

6.3 Installation and Starting the fleet simulator

Copy the FleetSim.exe file to the same directory as the AGP executable.

Ensure GACS is started and configured to accept the peerIds that are specified in the Input Files as the 24-bit ICAO address. This is done by editing the GACS configuration files to create an ATN MO for each aircraft.

Edit the configurationData.dat file in the \Data directory and ensure that the GACS parameters are set correctly.

Double click the FleetSim.exe file.

The Fleet Simulator window will appear. To load a scenario click the load scenario button and select a .sen file. The simulation will start.

Double clicking on a flight in the flights list will bring up a list of scheduled messages and their send times, along with information about what contracts the flight is set to accept.

7 ABBREVIATIONS

A/C	Aircraft
AGP	AOC Ground Platform
AOC	Airline Operational Centre
APU	Auxiliary Power Unit
EGT	Exhaust Gas Temperature
ETA	Estimated Time of Arrival
FIR	Flight Information Region
FMS	Flight Management System
FOpsDB	Flight Operations Database
FPD	Flight Progress Display
FPDB	Flight Planning Database
GACS	Generic ATN Communications Services
GAPI	GACS Application Programming Interface
HMI	Human-Machine-Interface
MA-AFAS	More Autonomous Aircraft in the Future ATM System
MFC	Microsoft Foundation Classes
OOOI	Out, Off, On, In
Rpm	Rotation Per Minute

APPENDIX A. MESSAGES VS DISPLAY

The table below describes in which display(s) a given message is presented.

	Flight Progress Display	Maintenance Display	Post-Flight Display
Trajectory	X		X
Slot Allocation	X		X
Initialising	X	X	X
Oooi	X		X
Trajectory Request	X		X
Company Flight Plan	X		X
Free Text Message	X		X
FMS Meteo	X		X
Loadsheet	X		X
Loadsheet Ack	X		X
Aircraft Meteo Request	X		X
Aircraft Meteo Response	X		X
Aircraft Meteo Report	X		X
APU Request		X	
APU Response		X	
APU Report		X	
Engine Status Request		X	
Engine Status Response		X	
Engine Status Report		X	
Flight Progress Request	X		X
Flight Progress Response	X		X
Flight Progress Report	X		X
Constraints List	X		X
Cleared Trajectory	X		X
Meteo Report Request	X		X
Snag Report		X	
Constraints List Acceptance	X		X
TAF	X		X
METAR	X		X
SIGMET	X		X
N/A Meteo Report	X		X
Meteo Forecast	X		X
AMDAR message	X		X
CFMU Slot Allocation	X		X

APPENDIX B.AGP TEST TOOL

Description:

The AGP application can be tested without communication with real aircraft. To support the simulation of air-ground communications, Skysoft Portugal developed a simple *Aircraft Comms Emulator*. This aircraft emulator, named AGP Test Tool simulates an aircraft end system though sending and receiving messages between the AGP ground platform and the aircraft.

The AGP Test Tool was developed with the only purpose of supporting the AGP test phase; therefore it does not rely on a full ATN stack. Instead, the AGP Test Tool uses a GACS emulator developed by AIRTEL ATN to communicate with the AGP. To start-up this emulator the operator should double-click on the GACS.exe file.

Initialisation:

To start the AGP test tool the operator must first assure that the GACS emulator is already running and then execute the AGP test tool executable file (AGC.exe). Afterwards, a dialog to enter the GACS Address -Figure 63 – Test tool init form, is shown. The GACS aircraft address is needed to identify the aircraft internally in GACS Stack. Pressing OK button sets the GACS aircraft address and launches the test tool.

To run an additional test tools, thus to simulate communications with another aircraft, the operator just needs to run a new instance of AGC.exe and change the GACS Aircraft Address value inside the text box to a different value from the previous test tools that are already running.

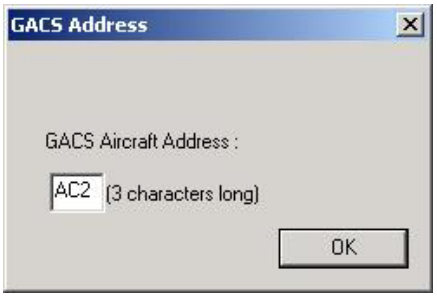


Figure 63 – Test tool init form

Functionalities:

The test tool main display (Figure 64) provides to the operator the set of possible options (i.e. messages) that the airborne AOC module is allowed to send to the ground platform (AGP).

This set of messages includes automatic messages (e.g. SNAG Report) and manual messages (e.g. Free text message).

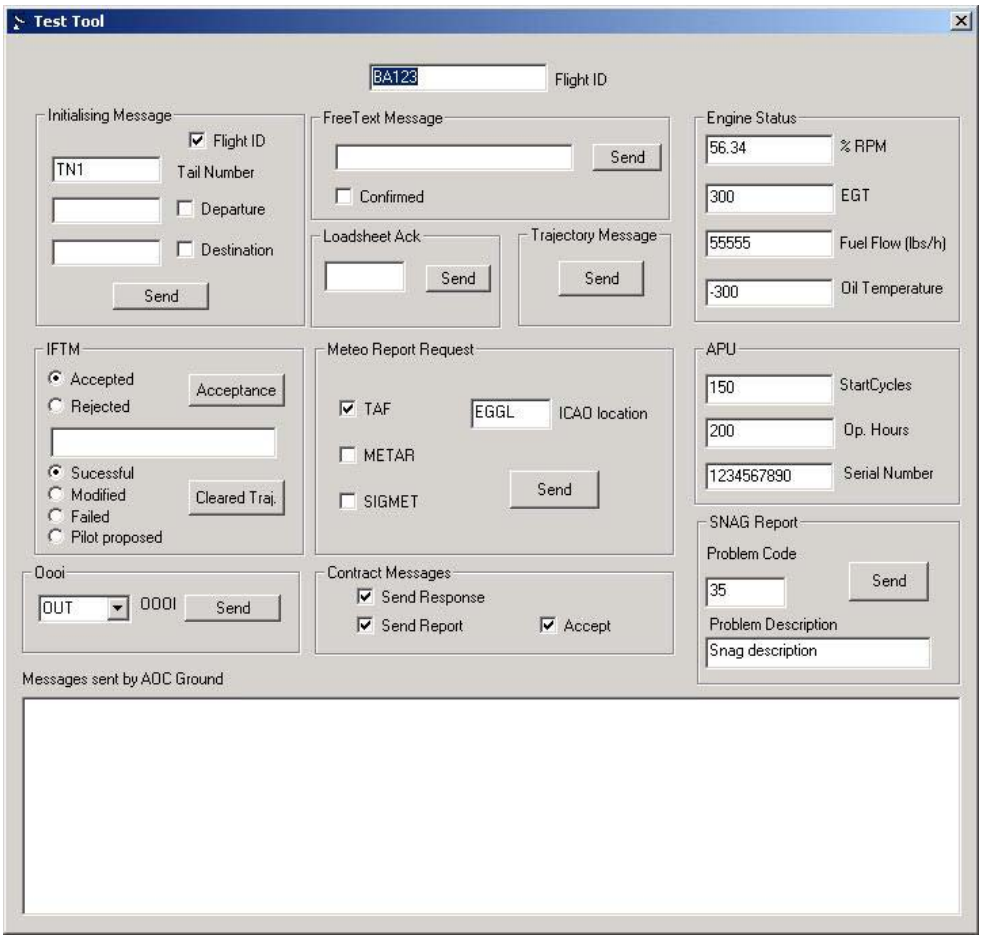


Figure 64 – Test Tool main display

APPENDIX C.INPUT DATA FILES

Flight Plan Input Files

Flight plans are pre-defined and are loaded on system start-up.

Flight Plans should be put in the \data directory with the file extension .fp

The file format is:

```
Tail Number
Flight Id
Primary or Alternate           - alternate used for IFTM
Route Identifier
Estimated Number of Passengers
Flight Rules
Type of Flight
Type of Aircraft
Wake turbulence Category
Equipment
Departure Aerodrome
Time [hh mm ss]                 -departure time
EOBT [hh mm ss]
Cruising Speed [Ground_speed]
Cruising Level [feet]            |--- used to generate levels
Rate of Climb/Descent [feet/min] |
Destination Aerodrome
Alternate Aerodrome
Second Alternate Aerodrome
Other info
Waypoint1                       --|
Waypoint2                         |
Waypoint3                         |---------- See below for format
Waypoint4                         |
      .                           |
      .                         --|
Waypoint128
```

The waypoints are specified using fixed length fields.

An example is given below.

The section up to Longitude can be obtained from http://www.asalink.net/davideg/rfquery.html
TurnType = none / before / at / arc - If not specified defaults to "before".
AirspaceType = none / TMA / MAS / FF (freeFlight) / UMAS / SID / STAR / APP - If not specified defaults to "MAS".

```
Waypoint   Not Used          Latitude    Longitude   TurnType AirspaceType     optional Notes (to EOL)
 Name          |               |           |          |      |                  |
  |            |               |           |          |      |                  |
<---><----------------><-><----------> <------------> <----> <--> <----------------->

OCK   11530    0      0   N51°18'18.00" W000°26'50.00" arc    none OCK
BOGNA        151     25   N50°42'07.00" W000°15'06.00"             BOGNA
BENBO        151     18   N50°27'05.00" E000°00'37.00"             BENBO
HAWKE        151      6   N50°22'27.00" E000°05'25.00"        UMAS HAWKE
XAMAB        151     12   N50°12'16.00" E000°15'53.00"             (MID 150/061)
VEULE        151     25   N49°51'24.00" E000°37'12.00"        STAR VEULE
BAMES        151     63   N48°58'31.00" E001°29'10.00" arc    APP  BAMES
RBT   11470  137     28   N48°39'14.00" E001°59'39.00"             RAMBOUILLET
MELEE        138     20   N48°25'00.00" E002°21'48.00"             MELEE
RETRI        156      7   N48°19'05.00" E002°26'21.00"             RETRI
RIGNI        156     86   N47°02'00.00" E003°23'48.00" at          RIGNI
MOU   11670  157     22   N46°42'24.40" E003°37'54.00"             MOULINS
```

Slot Allocations

The slotAllocations.dat file in the \data directory contains details about the slot allocation messages sent by the CFMU.

Each line of the file represents a single CFMU slot allocation message.

The file format is given below. All fields are mandatory and must appear in the given order. Each slot allocation must be on a single line. The spacing between fields is unimportant but each field must begin with a -.

```
-TITLE SAM        -ARCID BA345    -EOBT 0045    -CTOT 0100    -REGUL UZZU12     -SENDTIME 00:02

|--------|        |----------|    |--------|    |---------|    |----------|      |-------------|
    |                 |              |             |               |                    |
    |                 |              |             |               |                    |
    |                 |              |             |               |                    |
This is a fixed  The flightId   the new EOBT  the new CTOT  A reason for      The time the SA is sent
field in MAAFAS. of the a/c.    as an offset  as an offset  the delay. (this  from the CFMU, as an offset
                                from system   from system   is transmitted    from system start-up time.
                                start-up.     start-up.     in the freetext   HH:MM
                                HHMM          HHMM          field of the SA).
```

SIGMET Input Files

SIGMETs are pre-defined and are loaded on system start-up.

SIGMETs should be put in the \data directory with the file extension .sig

The file format is given below. All fields are mandatory, must appear in the given order and should be on the same line. All fields concerning date/time should be fixed length, i.e., validity period and issue day and time. Free text field must not exceed 256 characters.

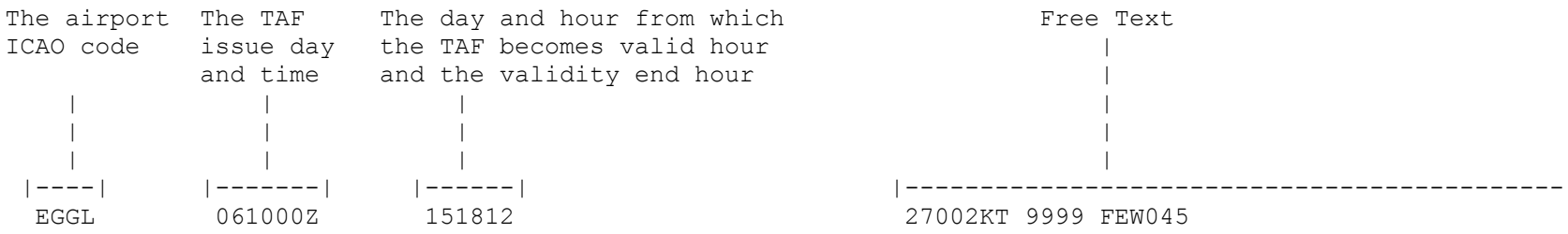
```
The issue  The SIGMET  The ICAO code    The        The       The       The days and times    Free text
centre     issue day   of the issue     SIGMET     sequence  VALID     of the SIGMET            |
ICAO code  and time    centre location  keyword    number    keyword   validity period          |
    |         |           |              |         |         |              |                   |
    |         |           |              |         |         |              |                   |
    |         |           |              |         |         |              |                   |
 |----|    |------|      |----|        |------|    |-|     |-----|    |-------------|    |------------
  EGGL      231454        LFFF          SIGMET      4       VALID      231500/231900      LFPW- UIR
FRANCE ISOL CB OBS/FCSR BLW FL360 E OF 03E AND N OF 47N MOV NE 20KT NC
```

TAF Input Files

TAFs are pre-defined and are loaded on system start-up.

TAFs should be put in the \data directory with the file extension .taf

The file format is given below. All fields are mandatory, must appear in the given order and should be on the same line. All fields concerning date/time should be fixed length, i.e., validity period and issue day and time. Free text field must not exceed 256 characters.

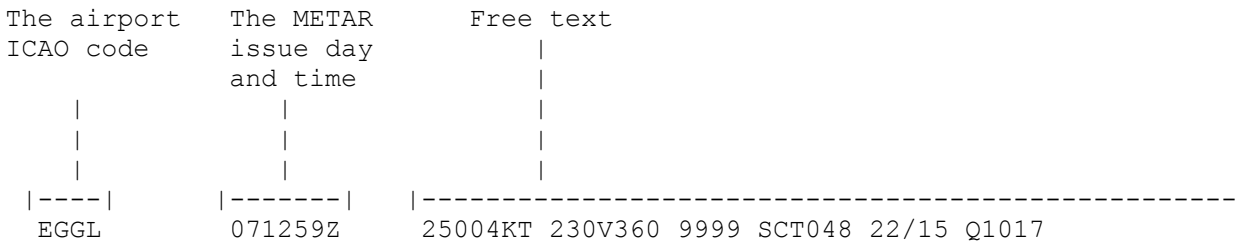


METAR Input Files

METARs are pre-defined and are loaded on system start-up.

METARs should be put in the \data directory with the file extension .met

The file format is given below. All fields are mandatory, must appear in the given order and should be on the same line. The issue day and time field should be fixed length. Free text field must not exceed 256 characters.



Meteo Forecast Input Files

Meteo forecast files are pre-defined and are loaded on system start-up.

Meteo forecast should be put in the \data directory with the file extension .mtf

The file format is:

```
Date and      Validity  Number of  Number of  Initial   Latitude   Number of
time of       date and  latitude   longitude  latitude  increment  altitude
issue.        time      values     values     value     value      levels
    |            |         |          |          |         |          |
    |            |         |          |          |         |          |
    |            |         |          |          |         |          |
|----------||----------| |--|      |--|      |----|     |---|        |-|
 6 9 2 1999  9 9 2 1999   21        15        5600       -50          8
3.64    47.81    98.82   182.89   235.74   300.65   339.99   386.62        ------> Altitude level values

meteo point 1                                                                -
meteo point 2                                                                |       Meteo data relating
meteo point 3                                                                |       to each (lat, long)
.                                                                            |       point. The meteo
.                                                                            |       points should be
.                                                                            |       grouped according
.                                                                            |       the number of
.                                                                            | ----> latitude and
.                                                                            |       longitude values.
.                                                                            |       In the example given
.                                                                            |       meteo points should
.                                                                            |       be provided in 21
.                                                                            |       groups of 15 rows.
.                                                                            |       See below for meteo
.                                                                            |       point format
meteo point n                                                                -
```

Meteo Point Format

The meteo point format is:

```
Longitude QNH                  temperature, wind direction and speed
value     value                     for each altitude level
  |         |                                |
<-->      <---> <------><-------><-------><-------><-------><-------><-------><------->
-600       109  02343018-08345032-20343039-35352040-48347037-59355055-59353057-59347055
                <><-><->
                 | |  |
       temperature |  |
                   |  |
                   |  |
       wind direction |
                      |
                      |
               wind speed
```

APPENDIX D.CONFIGURATION

The file configurationData.dat in the \data directory contains a number of configurable constants used by the AOC. The constants are listed below and can be changed by including the identifying string followed by a colon and then the value followed by a # and optionally a comment :

<Configurable Item Id String> : <Value> # <Comment>

General Configuration Constants

Configurable Item Identifier String	**Units**	**Description**	**Default**
Log Filename	n/a	Filename for logged data	deafultaocGround.log
Slot Allocation File Name	n/a	File containing slot allocations	data\slotAllocations.dat
Flight Plan Directory	n/a	directory, plus file extension	data*.fp
Meteo Forecast Directory	n/a		data*.mtf
Firs File Name	n/a		data\firs.txt
Airports File Name	n/a		data\airports.txt
Waypoints File Name	n/a		data\waypoints.txt
TAFs Directory	n/a	directory, plus file extension	data*.taf
SIGMETs Directory	n/a	directory, plus file extension	data*.sig
METARs Directory	n/a	directory, plus file extension	data*.met
Downlink Message Time Out	Seconds	time from request being made to a response being received. Applies to trajectory / contract responses / contract report tolerance	120
Data Update Rate	Milli-Seconds	Controls the rate at which the data on the HMI is updated. (A delay of 100 means the data will be updated 10 times a second).	100

Colour Configuration Constants

Configurable Item Identifier String	Units	Description	Default
Continents Colour	R.G.B	Flight Progress Display map colours. Range 0-255.	255.255.209
Oceans Colour	R.G.B	Flight Progress Display map colours. Range 0-255.	200.250.255
Aircraft Ground Colour	R.G.B	Flight Progress Display map colours. Range 0-255.	255.0.0
Aircraft Airborne Colour	R.G.B	Flight Progress Display map colours. Range 0-255.	0.255.0
Grid Colour	R.G.B	Flight Progress Display map colours. Range 0-255.	191.191.191
Wind Colour	R.G.B	Flight Progress Display map colours. Range 0-255.	0.0.0
Fir Colour	R.G.B	Flight Progress Display map colours. Range 0-255.	26.26.153
Route Colour	R.G.B	Flight Progress Display map colours. Range 0-255.	128.128.0
Grid Text Colour	R.G.B	Flight Progress Display map colours. Range 0-255.	128.128.128

Flight Planning Constants

Configurable Item Identifier String	Units	Description	Default
Registration Time Before EOBT	minutes	Specifies time before EOBT an aircraft must send it's init message to avoid an alert being generated	30
Slot ACK Time Out Before EOBT	minutes	Specifies time before EOBT that an acknowledgement must be received in response to an uplinked slot allocation	30
Flight Plan ACK Time Out Before EOBT	minutes	Specifies time before EOBT that an acknowledgement must be received in response to an uplinked flight plan	30
Loadsheet ACK Time Out Before EOBT	minutes	Specifies time before EOBT that an acknowledgement must be received in response to an unlinked loadsheet	40
Loadsheet Sent Time Out Before EOBT	minutes	Specifies time before EOBT that a loadsheet acknowledgement message must be received by	30
Fuel Burn Rate	Kg/NM	Used to generate fuel usage info in flight plan	5.5
Approach Start Height	feet	This will be the level generated for the last waypoint in a flight plan	6000

Four-D Trajectory Constants

Configurable Item Identifier String	Units	Description	Default
Max Difference Between Waypoint Lat/Long	minutes	max difference between downlinked Trajectory and previous known trajectory	2
Max Level Difference At Waypoint	feet	max difference between downlinked Trajectory and previous known trajectory	50
Max Eta Difference At Waypoint	minutes	max difference between downlinked Trajectory and previous known trajectory	5

IFTM Constants

Configurable Item Identifier String	Units	Description	Default
Time Between Constraints and Acceptance	seconds	Time from constraints list being sent to an acceptance being received	60
Time Between Acceptance and Cleared Trajectory	seconds	Time from acceptance being received to cleared trajectory being received	60

Flight Progress Constants

Configurable Item Identifier String	Units	Description	Default
Max Difference Between Reported And Expected Position	minutes	Max difference in latitude and longitude	2
Max Difference Between Reported And Expected Level	feet	Max difference in flight level.	50
Max ETA Difference at NRP	minutes	ETA tolerance for next reporting point	5
Max ETA Difference	minutes	ETA tolerance for flight	10
Max Fuel Difference	kg	Max fuel deficit from calculated usage	100
Periodic Contract Default Reporting Rate	minutes	Used if period not specified and for flight progress contract set up on the OFF message.	5

Configurable Item Identifier String	Units	Description	Default
GACS ACK Time Out	seconds	Time to wait for a GACS level ack message for messages sent using the GACS confirmed service before generating an alert.	60
GACS Message Type	integer	GACS configuration constant	23
AGP GACS Address	string	GACS address for the AGP.	MAAFAS
GACS Server	IP	IP address of the GACS server	127.0.0.1
GACS Server Port	Server Port	Port of the GACS Server	5001