

HEDGE: Helicopters Deploy GNSS in Europe



Prototype cockpit interface for SOAP procedure

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DOCUMENT CHANGE RECORD

The following table gives the history of the successive editions of the present document.

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1 INTRODUCTION

1.1 General

This document represents D3.1 of the HEDGE project. It describes the prototype cockpit interface that has been developed for the SOAP (SBAS Offshore Approach Procedure) procedure. This interface will be used in a series of flight trials in August 2010 in order to demonstrate and trial the procedure.

It should be noted that this document describes a subset of the interface's features. The complete feature set includes those specific to the aircraft to be utilised in flight trials, and not directly related to the SOAP procedure. Although basic functionality has been described, the document is focussed upon the features most relevant to the HEDGE project.

1.2 Background

The SOAP procedure is designed to utilise the EGNOS (European Geostationary Navigation Overlay Service) for helicopter oil rig approaches. In August 2010 a series of flight trials will be undertaken to test, trial and demonstrate the SOAP procedure. In order to perform the flight trials a prototype cockpit interface has been developed, which provides an interface from EGNOS and maritime AIS (Automatic Identification Systems) receiving equipment to the pilot.

The prototype cockpit interface has been developed as a standalone application operating on a PC and connected to specific hardware for input and output. It is programmed in C++ and utilises the OpenGL graphics library for the purposes of display.

In deployment the prototype will be operated by a ruggedised Microsoft Windows PC mounted on a bespoke pallet and connected to a temporary VDU (Visual Display Unit) mounted over the aircraft's existing displays. The prototype FMS will have a read only connection to the aircraft's systems (via an ARINC429 interface) in order to obtain standard data such as attitude, velocity and altitude (barometric and radar). It will be connected to an EGNOS enabled GNSS (Global Navigation Satellite System) receiver, which will enable the SOAP procedure, and an AIS receiver which will enable marine targets to be displayed.



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2 REFERENCES

The following table shows the associated documentation referenced in this document.

#	Title	Reference	Issue	Date
[1]	EGNOS Offshore Helicopter Approach Procedure	GIANT FP6 Public deliverable D.3.1.4.3	1.4	24-01-08

Table 2–1: Associated documentation



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3 ABBREVIATIONS AND ACRONYMS

The following table shows the abbreviations and acronyms used in this document.

Acronym	Meaning
AIS	Automatic Identification Systems
EGNOS	European Geostationary Navigation Overlay Service
FAF	Final Approach Fix
FMS	Flight Management System
GNSS	Global Navigation Satellite System
IAF	Initial Approach Fix
MAPt	Missed Approach Point
NM	Nautical Mile
PFD	Primary Flight Display
SOAP	SBAS Offshore Approach Procedure
VDU	Visual Display Unit

Table 3–1: Abbreviations and Acronyms

4 FMS PROTOTYPE

4.1 Overview



Figure 4-1: FMS overview

Figure 4-1 above shows an overview picture of the cockpit interface. On the left is the PFD (Primary Flight Display) and the Navigation display is on the right.

The PFD in this example shows that the aircraft is flying straight and level at 2460ft.

The Navigation display shows that a destination has been selected and a SOAP procedure has been generated by the FMS. Two AIS targets are within 10NM of the aircraft and one is potentially encroaching on the selected track.

4.2 PFD

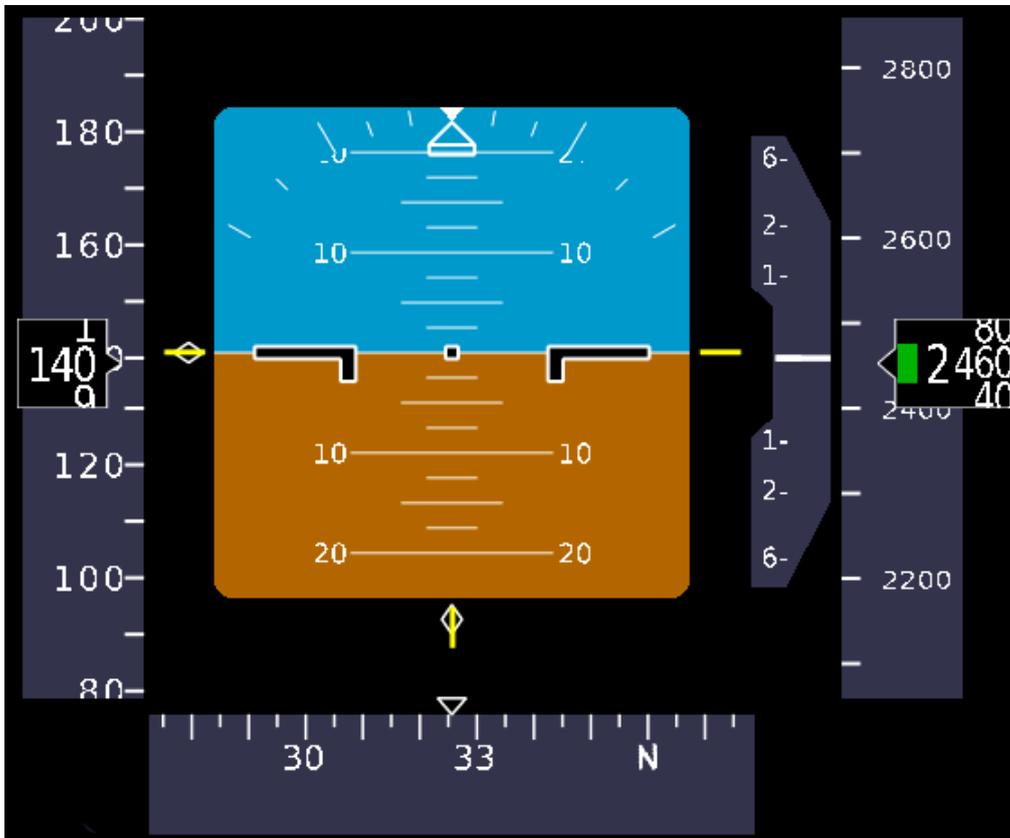


Figure 4-2: PFD screen capture

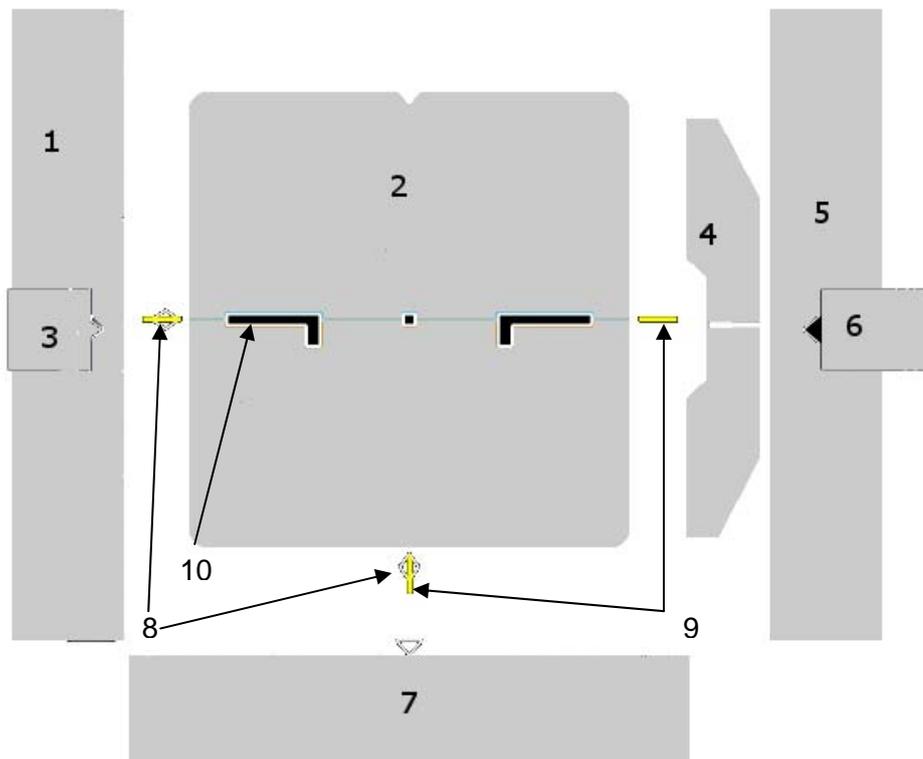


Figure 4-3: PFD diagram



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The following are descriptions of the PFD's key features as shown in Figure 4-2 and labelled in Figure 4-3.

1) Airspeed indicator tape

Description	Indicates the aircraft's airspeed, moves up and down.
Displayed	Permanently.
Colour	White on blue background.
Note	The airspeed ticker (3) also acts as the reference mark.

2) Attitude display

Description	Indicates the aircraft's attitude (pitch and roll). The scale scrolls vertically to show pitch and the background (artificial horizon) rotates to show roll.
Displayed	Permanently.
Colour	Blue above horizon, brown below horizon.

3) Airspeed ticker

Description	Indicates aircraft's airspeed. The numbers "tick" up and down as the airspeed changes.
Displayed	Permanently.
Colour	White on black background.
Note	Acts as reference point for airspeed indicator tape (1).

4) Vertical speed indicator

Description	Indicates the rate of ascent or descent of the aircraft. The central line (deflector bar) raises and lowers.
Displayed	Permanently.
Colour	White on blue background.
Note	Deflection gauge.

5) Altitude indicator tape

Description	Indicates aircraft's altitude. Moves up and down.
Displayed	Permanently.
Colour	White on blue background.
Note	Barometric and radar ground.

6) Altitude ticker

Description	Indicates aircraft's altitude. Numbers "tick" up and down as the aircraft's altitude changes.
Displayed	Permanently.
Colour	White on black background.
Note	Also acts as reference mark for altitude indicator tape (5).

7) Heading indicator tape

Description	Indicates aircraft's magnetic heading. Moves left and right as heading changes.
Displayed	Permanently
Colour	White on blue background

8) Lateral and Vertical guidance bugs display

Description	Indicates aircraft's deviation from desired flight path. The bugs move up and down (or left and right) to indicate the direction of the desired flight path. For example if the aircraft is below the desired flight path, the vertical guidance bug will move up.
Displayed	When applicable guidance from the SOAP procedure is available.
Colour	White.
Note	If the aircraft's position is deviates by more than full scale deflection arrows appear in yellow to indicate the direction of the correct flight path. Can be lateral or angular deflection depending upon phase of SOAP procedure.



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9) Reference marks

Description	Indicate the neutral (straight and level) position. For example if the artificial horizon line is aligned with the horizontal reference lines then the aircraft is flying a level path.
Displayed	Permanently
Colour	Yellow

10) Aircraft reference symbol

Description	Indicates position of the aircraft on the display scales.
Displayed	Permanently
Colour	Black with white outline

4.3 Navigation display

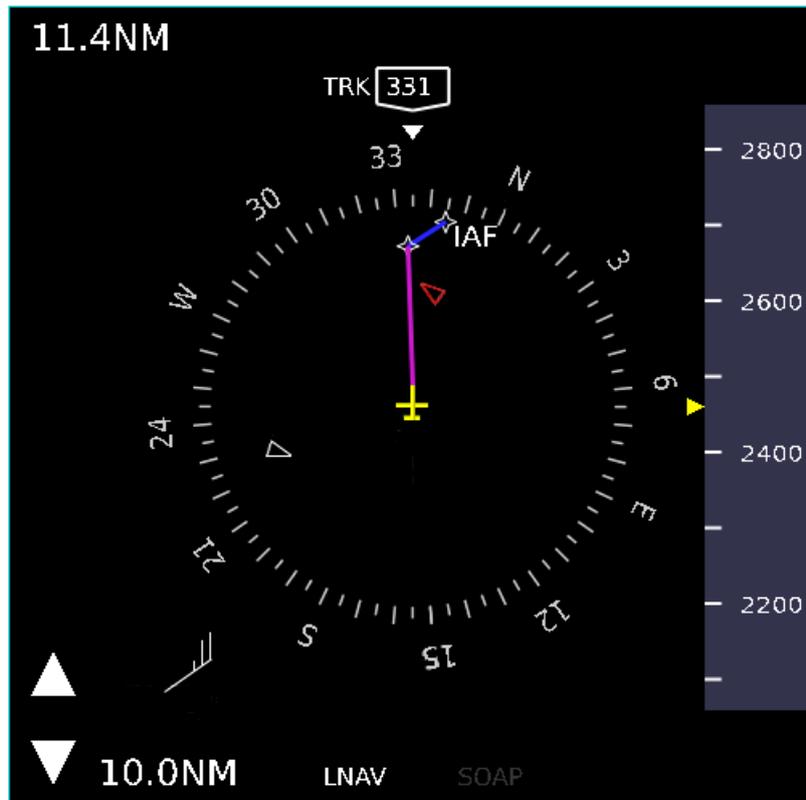


Figure 4-4: Navigation display screen capture

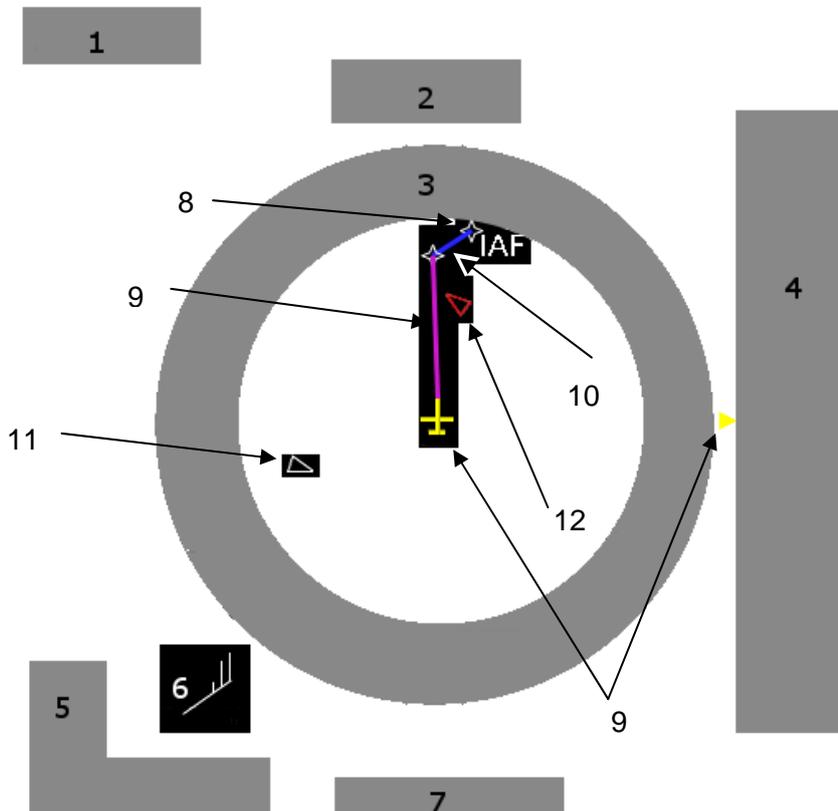


Figure 4-5: Navigation display diagram



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The following are descriptions of the Navigation Display's key features as shown in Figure 4-4 and labelled in Figure 4-5.

1) Distance marker

Description	Indicates the distance to the Missed Approach Point (MAPt).
Displayed	When target has been selected.
Colour	White.

2) Digital track indicator

Description	Digital display of the aircraft's course over ground.
Displayed	Permanently.
Colour	White.

3) Compass

Description	Indicates the magnetic heading of the aircraft. Rotates so that the current heading is at the top.
Displayed	Permanently.
Colour	White.
Note	White arrowhead at top indicates current heading.

4) Altitude indicator tape

Description	Indicates aircraft's altitude. Moves up and down.
Displayed	Permanently.
Colour	White on blue background.
Note	As altitude tape on PFD. Yellow arrowhead indicates current altitude.

5) Scale adjustment inputs and indicator

Description	Up and down arrow adjust scale of map display. Digital indicator of scale.
Displayed	Permanently.
Colour	White.
Note	Map display uses Mercator projection. Icons on the map adjust according to scale to limit cluttering. Scale indicated represents the radius of the compass.

6) Wind indicator

Description	Indicates direction and velocity of wind. Direction of main line indicates direction of wind. Additional lines indicate velocity (5kt, 10kt, 50kt respectively). If there is now wind a disc symbol is displayed.
Displayed	Permanently.
Colour	White.

7) Mode indicator

Description	Indicates the current navigation mode in operation.
Displayed	Permanently.
Colour	White for active mode, grey for inactive mode.
Note	SOAP mode activated after capture of IAF.

8) Waypoint (Labelled)

Description	Indicates the map position of a SOAP procedure waypoint.
Displayed	Permanently.
Colour	White.
Note	In the example given the waypoint is part of the SOAP procedure and is labelled.



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9) Selected track current segment

Description	Indicates the path from the aircraft to the next waypoint.
Displayed	When a track is selected.
Colour	Magenta.
Note	If the end of the segment is out beyond the range of the map display, the segment extends to the edge of the compass and a box is added. The box can be aligned with the current heading indicator.

10) Selected track future display

Description	Indicates the path between waypoints of the selected SOAP procedure.
Displayed	When a track is selected and the segment is visible on the map display.
Colour	Blue.

11) AIS target

Description	Indicates the position, heading and velocity of an AIS target (e.g. ship).
Displayed	When a target is present.
Colour	White.

12) AIS target (encroaching on selected track)

Description	Example of an AIS target considered to be potentially encroaching on the aircraft's flight path.
Displayed	When a target is present.
Colour	Red.
Note	Target is considered encroaching if it is within 1NM of any point on the selected TRACK.