



ITWP
Integrated Tower Working Position

Date: December 03, 2007
Version: 031207
Status: Draft

Integrated Tower Working Position

**WP5 - FUNCTIONAL SPECIFICATIONS AND ASSOCIATED HMI
REQUIREMENTS V2**

Reference: Specifications Status: Draft Edition No: 031207 Date: 03.12.07

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1 INTRODUCTION

1.1 Document Purpose and Scope

This document is the deliverable of the ITWP project. The objectives of this document is to develop commonly agreed Functional Specifications and associated HMI requirements that cover operational, human factors to be supported by ITWP. As the development of ITWP requirements and solution is organised in two steps (i.e. baseline functionality, advanced functionality), the scope of the current version only addresses the baseline functionality.

1.2 Structure of the document

The content of this document is organised as follows:

- Section 2 addresses the description of the methodology used, identification, numbering and grouping of requirements;
- Section 3 addresses the functional and HMI requirements; these are logically organised following the methodology described in section 2.
- Section 4 addresses the transversal Human Factors requirements.

1.3 Acronyms

CWP	Controller Working Position
EEC	Eurocontrol Experimental Centre
HMI	Human Machine Interface
ITWP	Integrated Tower Working Position
TWR	ToWeR
WIMP	Windows, Icons, Menus and Pointers

1.4 Glossary

- Planning state: a flight, during its life cycle has a particular state with regard to a controller working position and the role that is allocated to that CWP. Possible planning states may include 'pending' (flights for which the current role is planned to be responsible in the near future), 'assumed' (flights for which the current role is responsible) and 'not concerned' (flights for which the current role is not responsible).
- Traffic: in this document, traffic refers to both aircraft and vehicles traffic.

2 METHODOLOGY

EEC past experience of developing Controller Working Position Interface shows that there is a need to follow a methodology to make sure that people with different skills (operational, technical, human factors, safety) share the same understanding of the issues addressed and resolved by the project.

The EEC Core project has provided a methodology to improve both the process and outcomes of activities directed at upgrading the working positions of air traffic controllers.

2.1 ITWP functional model

One ITWP objective is to initiate and support a process of HMI harmonisation at the level of HMI requirements, independently of any HMI solution (look and feel or interaction mechanism are likely to remain solution specific).

Emphasis is then required to distinguish between requirements (functional, HMI) from an HMI solution (procedures, detailed HMI objects and interactions).

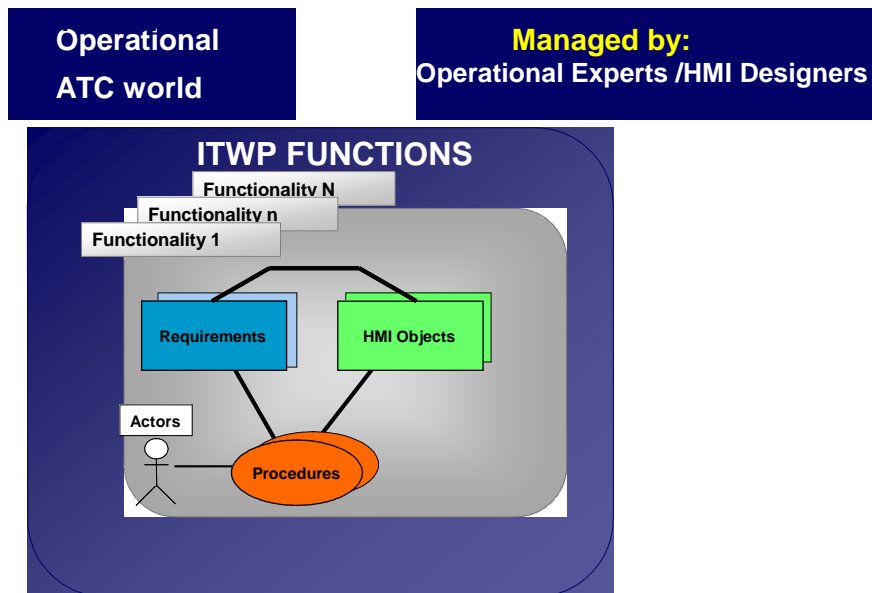


Figure 1: Overall model

According to Core model, a function is described under four basic elements:

- The **actors** that are part of the system (be they human or components of the technical environment);
- A set of **requirements** (ATM system functional and HMI requirements). These will be expressed in text format describing the requirement, each with a unique identifier.

- A set of working **procedures** (equivalent to use cases) describing the different action possibilities provided by the function and suggesting the ways in which the controller would use it. A procedure is described by its objectives, the actors involved, the triggering conditions, the necessary pre-conditions and the dialog, i.e. by the sequence of actions/consequences.
- A set of **HMI objects** which the controller needs to carry out the procedures. An object is described in terms of its objectives, when and where it is available, and how it is presented.

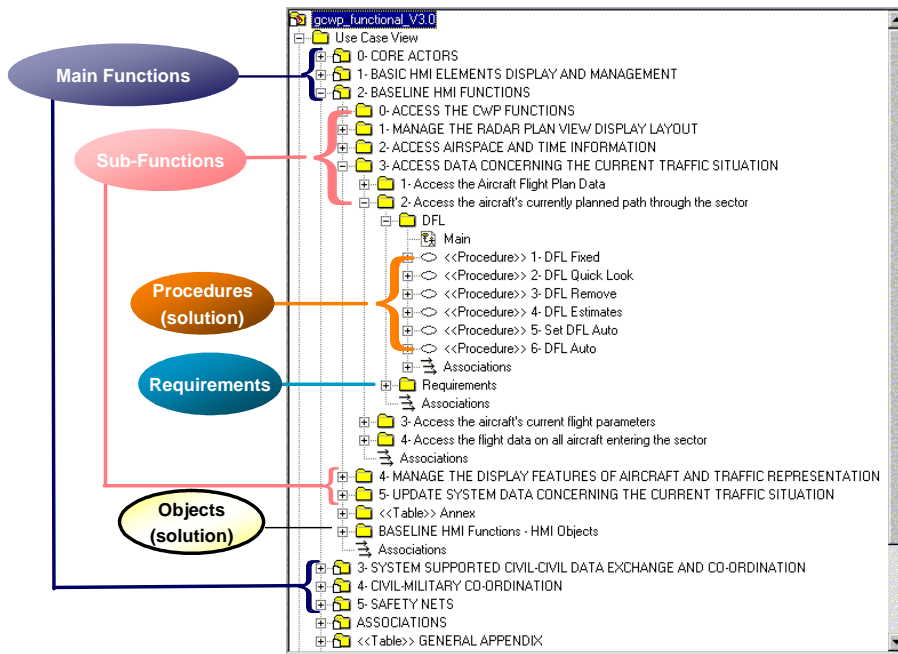


Figure 2: Overall model structure

2.2 ITWP functional decomposition

An initial task consists in building the ITWP functional decomposition (functions and sub-functions), then detailing associated requirements. This functional decomposition shall take into account existing TWR controller tasks (ground, runway, and clearance delivery) and activities, supplemented by taking into account the future services.

Requirements have been split into:

- **General ITWP HMI requirements** which are independent of function and should apply to all aspects of the ITWP interface, placed under the responsibility of human factors experts.
- **Functional and HMI requirements.** HMI requirements are specific to the individual functions generating them (see Figure 3).

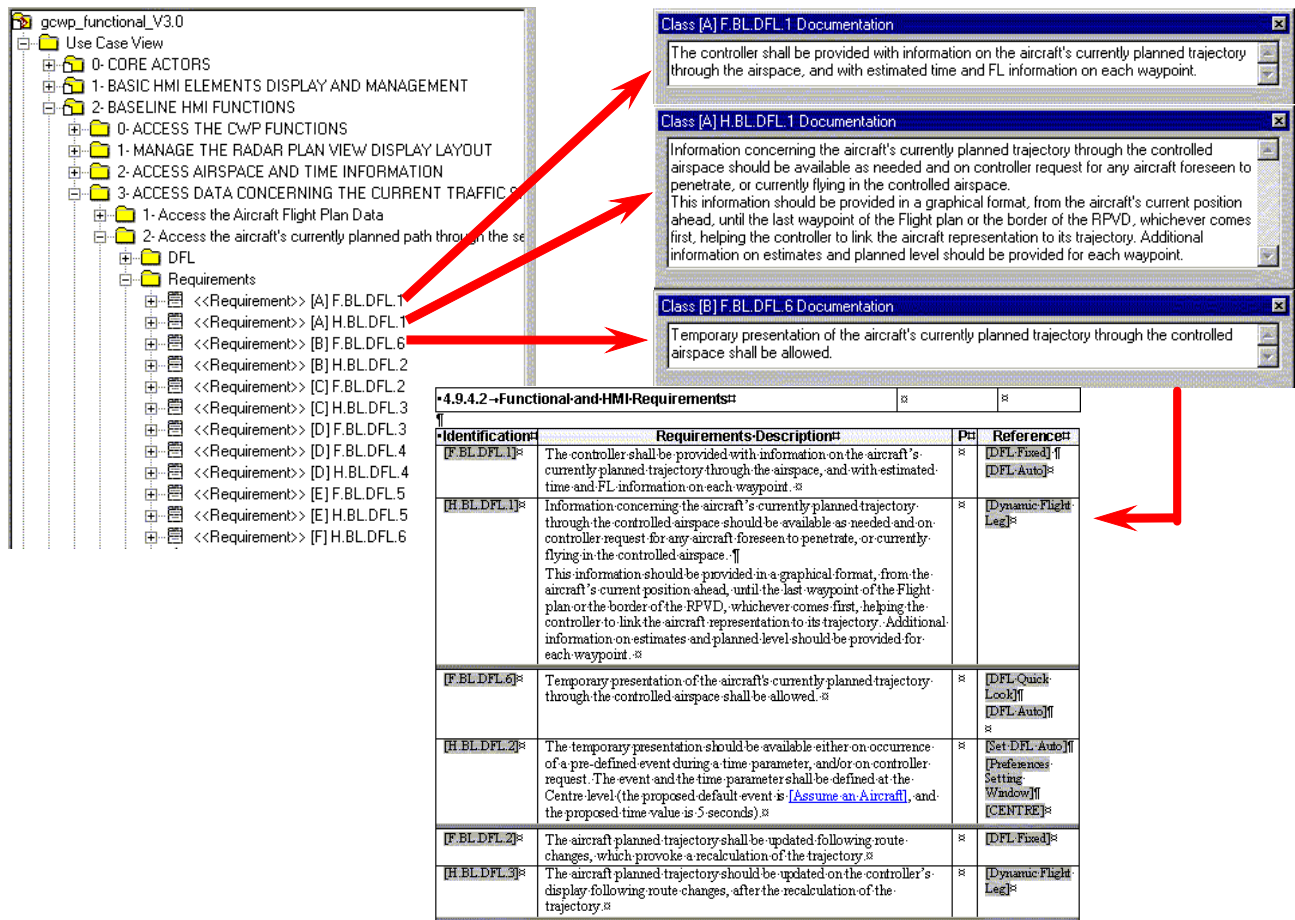


Figure 3: Functional and HMI requirements

2.3 Logical organisation of requirements

Requirements have been grouped in different logical high level functions that benefits from the Eurocontrol experience in En-Route HMI specification (Core En-Route). The main identified high-level functions are briefly presented below while associated requirements are proposed in section 3.

- Basic HMI elements display and management (section 3.1): addresses basic graphical user interface management linked to windows and menus.
- Supporting HMI functions (section 3.2): The objective is there to provide the controllers with a highly interactive interface. There are several components to the requirements for an interactive HMI. The corresponding functions are related to:
 - Access to the Controller Working Position functions (§3.2.1);
 - Manage the display layout (§3.2.2);
 - Access to air, surface and time information (§3.2.3);
 - Manage the display features of traffic representation (§3.2.4);



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- Access data concerning the current traffic situation (§3.2.5);
- Update system data concerning the current traffic situation (§3.2.6).
- System supported data exchange and communication
- Monitoring and control functions

Note: other functions such as surface routing, surface guidance, planning, pilot /controller data link communications, monitoring aids¹ will be developed during ITWP iteration 2.

2.4 Requirements format and numbering

The following skeleton is used throughout this document to describe functional requirements; in the following, ‘number’ is incremented when several requirements exist for a sub-function

F. “functionName”.”sub-functionName”.”number”	
<i>Description:</i>	Describes what the function performs.
<i>References:</i>	Where applicable, reference to official documentation.

H. “functionName”.”sub-functionName”.”number”	
<i>Description:</i>	Textual description of the HMI requirements

The current² functions and sub-functions abbreviations used in this document are:

.BL Basic HMI elements display and management

- .HMI** To manage WIMP graphical user interface
- .LOG** To access to CWP
- .SET** To set up the display and access screen setting
- .TOOL** To manage toolbars functions
- .ZOOM** To zoom, offset and modify the geographical information
- .MAP** To manage the display of surface and air information on the display
- .TIME** To access time information
- .POS** To manage the position of radar label
- .TRCK** To manage the display of radar tracks
- .VECT** To manage the display of speed vectors
- .LBL** To manage the content of radar labels

¹ To detect, regulate and report on deviations between planned data (e.g. times, trajectory) and actual or anticipated ones such as: trajectory surface conformance monitoring, CTOT compliance monitoring, etc.

² Subject to modification (addings) during ITWP phase 2



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- .WAR** To draw controller's attention to a specific a/c or vehicle
- .SEL** To select an individual aircraft or vehicle
- .TRAF** To provide controllers with available data on any individual aircraft or vehicle
- .SIL** To access data on all aircraft/vehicles entering or planning to enter a TWR sector
- .ORD** To provide support to the controller for the input of clearances given to an aircraft
- .WEA** To access to weather information
- .APT** To set up airport elements status

.FD To provide system support for data exchange and coordination between ATC units.

- .RUL** To manage the distribution of flight data on control positions.
- .TRSF** To provide system assistance for flight transfer control.

.SN To provide the controllers with alerts to potentially hazardous situations in an effective manner and with sufficient warning time for appropriate instruction to be issued by ATC to resolve the situation, allowing for appropriate avoiding action to be taken by the pilot.

- .RCA** To manage runway conflicts detection and alerting.
- .PTD** To manage protecting devices.
- .NAV** To be informed about nav aids serviceability.
- .CLR** To detect/ display inconsistent clearances.
- .LAY** To detect/ display ATCO input errors versus airport layout.
- .CNF** To detect/ display non conformance to ATC instructions.
- .MIS** To detect/ display miscellaneous detections (e.g. excessive a/c taxi speed, stationary a/c in the RWY protection area, etc.).

2.5 Link between requirements and HMI solution

The EUROCONTROL Experimental Centre ITWP project is intended to support the process of HMI harmonisation at the level of functional and HMI requirements, independently of any HMI solution. However, the look and feel or interaction mechanism will remain solution specific. For instance, if the management of flight data is a generic functionality, one solution (amongst others) would consist in the implementation of electronic flight strips in a specific format (e.g. replication of paper strip or tabular message format) and with a specific input device (e.g. mouse, touch input device or pen).

EEC HMI solution will be documented through the link between functional and HMI requirements (this document) and HMI procedures / HMI objects (future HMI solution document). An example of such link is provided below as an example (extract from Core En-Route).

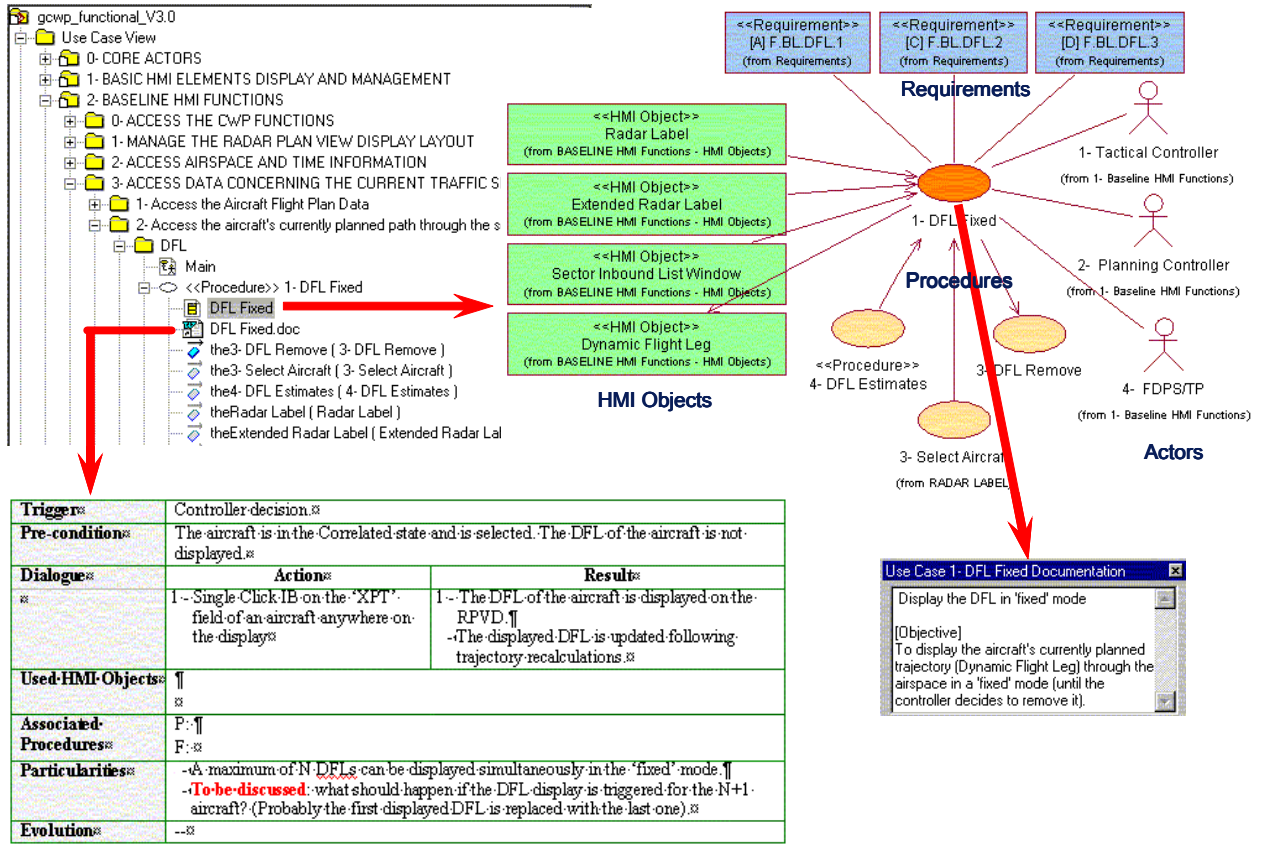


Figure 4: Link between requirements, procedures and HMI objects



3 ITWP OPERATIONAL REQUIREMENTS

3.1 Basic HMI elements and display management

The available physical and electronic display area on the controller working position is constrained by:

- The physical limitations of the controller working position
- The choice of information presentation technology
- Human characteristics, e.g.:
 - Memory and attention
 - Awareness of context
 - Management of resources
 - Navigation within the task and interface
 - Interpersonal communications, team-working,
 - Personal state, emotional arousal, fatigue, environmental conditions, etc

These limitations lead to the set of requirements presented hereafter. On the basis of these requirements recommendations are made:

- To employ a graphical user interface of the Windows, Icons, Menus, Pointers family (WIMP)
- For technical reasons, to base the WIMP on industrial standards such as the X-windows environment (with the reservation that special functions may be required which need additional development).

3.1.1 WIMP Graphical User Management

H.BL.HMI.01	
<i>Description:</i>	The limits of the space of interaction with the system shall be clearly defined.
H.BL.HMI.02	
<i>Description:</i>	The background colour and luminance of the worktop should be such as to: <ul style="list-style-type: none">• Provide good, homogenous, contrast for all task related information,• Minimise flicker effects at the available screen refresh rate.
H.BL.HMI.03	
<i>Description:</i>	There is a need to access more information than can instantaneously be presented on the surface of the display area, which can be made 'available' to a single controller.



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H.BL.HMI.04	
<i>Description:</i>	<p>The general set of information than can potentially be presented, mixes graphical and textual sources and does not conform to a unique hierarchy, hence:</p> <p>The user shall be able to navigate freely amongst the available information sources, which implies that the user shall be able to:</p> <ul style="list-style-type: none">• Visualise the sources of information available (overview requirement)• Select/deselect and prioritise the information sources which are available• Flexibly and easily re-organise information within the display, including the possibility of a temporary undisplay.
H.BL.HMI.05	
<i>Description:</i>	<p>A window size need not be identical to the field of information, which can be viewed through it. This generates the need to change the viewpoint to access all the information in the field.</p>
H.BL.HMI.06	
<i>Description:</i>	<p>The visual appearance of a window's structure should provide the controller with cues as to its behaviour and available properties.</p>
H.BL.HMI.07	
<i>Description:</i>	<p>The nature of the window content should always be clearly indicated.</p>
H.BL.HMI.08	
<i>Description:</i>	<p>The background colour of the window interior should be such as to provide good contrast for the displayed information.</p>
H.BL.HMI.09	
<i>Description:</i>	<p>At any moment, the locus of potential user actions shall be clearly indicated.</p>
H.BL.HMI.10	
<i>Description:</i>	<p>The type of system activity and the entry into a mode shall be clearly indicated.</p>
H.BL.HMI.11	
<i>Description:</i>	<p>At any moment, possible actions on the interface shall be clearly indicated.</p>
H.BL.HMI.12	
<i>Description:</i>	<p>The occurrence of events, which may lie outside of the user's current focus of attention, shall be clearly indicated.</p>
H.BL.HMI.13	
<i>Description:</i>	<p>The cursor shall always be visible and easily located.</p>



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H.BL.HMI.14	
<i>Description:</i>	The cursor movement should be smooth and track input device (e.g. mouse) movements without lags. No system activity should take priority over the cursor tracking relationship.
H.BL.HMI.15	
<i>Description:</i>	An easy and immediate access shall be provided at the HMI level to all the functions available to the controller, allowing him to perform actions and to access tools and objects containing information.
H.BL.HMI.16	
<i>Description:</i>	Buttons shall provide feedback specific to the action taken.
H.BL.HMI.17	
<i>Description:</i>	The physical appearance of the buttons shall provide the controller with information on their functions and characteristics.
H.BL.HMI.18	
<i>Description:</i>	On request, the controller shall be provided with a set of selectable items amongst which he can make a selection to perform an action. Any one of the selectable items shall be easily and quickly accessed.
H.BL.HMI.19	
<i>Description:</i>	The availability to selection, and the operational status of the presented menu items shall be clearly indicated.
H.BL.HMI.20	
<i>Description:</i>	The currently selected menu item shall always be clearly indicated.
H.BL.HMI.21	
<i>Description:</i>	The menu item that is the most probable to be selected, depending on the context, shall be very easily and quickly accessed.
H.BL.HMI.22	
<i>Description:</i>	The identity of the object that initiated the display of a menu shall be clearly indicated. Depending on the context, it could be the aircraft, the particular field indication, etc.
H.BL.HMI.23	
<i>Description:</i>	The process of making a selection shall be completed by the selection action (i.e. no supplementary action shall be necessary to close a menu).



H.BL.HMI.24

Description: It shall be possible to easily and quickly abandon any initiated menu dialogue without having made a selection.

H.BL.HMI.25

Description: The system status shall always be clearly stated and indicated to the controller.

3.2 Supporting HMI functions

3.2.1 Access the CWP functions

The objective is to provide the controllers with secured access to the CWP functions. The access to the CWP functions is provided through a logon procedure, which allows identification of each authorised user and thus ensures security and integrity of the system.

3.2.1.1 Access / Exit the CWP

F.BL.LOG.1		Log on CWP
<i>Description:</i>	It shall be possible to an authorised user to access any time the CWP functions. A mechanism to ensure that only authorised users can access the CWP functions shall be provided. This mechanism shall be mandatory for access to the CWP functions.	

F.BL.LOG.2		Log on CWP
<i>Description:</i>	Only one access to the CWP functions at a time shall be allowed for each identified user.	

H.BL.LOG.1	
<i>Description:</i>	The authorised user should be provided with an unambiguous and personalised access to the CWP functions.

H.BL.LOG.2	
<i>Description:</i>	When accessing the CWP functions, the user should have access to the identity of all the other users currently working on a CWP.

F.BL.LOG.3		Log out CWP
<i>Description:</i>	It shall be possible to a user to exit the CWP functions.	

H.BL.LOG.3	
<i>Description:</i>	The user should be provided with the possibility to exit the CWP functions.



3.2.2 Manage the display layout

The objective is to provide the controllers with an easy and rapid access to the general display layout modification functions.

The monitoring of the general display layout consists of HMI related functions allowing the controller to configure and to re-access preferred display settings, and to access functions that provide surface, airspace and traffic information.

3.2.2.1 Set-up the display and access screen settings

The objective is to allow the controllers:

- To save a preferred screen set-up so that it can be restored at any time,
- To modify certain screen settings, so that they can adapt to different user characteristics,
- To define certain global window settings, i.e. applicable globally to a type of window.

Its main purpose is to avoid an extensive re-positioning of windows and display options at the beginning of a new work session.

F.BL.SET.1		Save configuration set-up
<i>Description:</i>	It shall be possible to store the current CWP screen set-up. The information stored shall be: <ul style="list-style-type: none">• the location, size and current priority of all open windows, including hidden windows,• whether a window is (temporarily) iconified or not,• the panning and zoom values of all windows equipped with this capability,• the presence and position of any toolboxes and tools and of all settings selectable within tools.• screen and global window settings.	
F.BL.SET.2		Access configuration set-up
<i>Description:</i>	The maximum number of screen set-ups that can be stored at any one time shall be defined at the local level. The proposed default number is 3.	
F.BL.SET.3		Access configuration set-up
<i>Description:</i>	It shall be possible to access a stored screen set-up.	
F.BL.SET.4		Access configuration set-up
<i>Description:</i>	A default screen set-up shall be defined for each control position at the local level. At initialisation, the default settings should be presented, and the controller can then choose a previously stored configuration, or create a new one.	
F.BL.SET.5		Save configuration set-up
<i>Description:</i>	It shall be possible to delete a stored screen set-up, except for the default screen set-up.	



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F.BL.SET.6		Set mouse hand
<i>Description:</i>	The interaction means with the system shall be adapted to both left and right handed users.	
H.BL.SET.1		
<i>Description:</i>	At each control position, the controller should be provided with the possibility to store a pre-defined number of screen and window configuration set-ups.	
H.BL.SET.2		
<i>Description:</i>	The controller should be provided with an easy access to a previously stored screen and window configuration set-up.	
H.BL.SET.3		
<i>Description:</i>	The controller should be provided with an easy access to the default screen and window configuration set-up.	
H.BL.SET.4		
<i>Description:</i>	The controller should be provided with the possibility to delete a previously stored screen set-up, by overwriting it with a newly defined screen set-up.	
H.BL.SET.5		
<i>Description:</i>	It should not be possible to delete the default screen set-up. This impossibility should be clearly indicated.	
H.BL.SET.6		
<i>Description:</i>	The controller should have the choice of which previously stored screen set-up to delete/overwrite when the maximum number of stored screen set-ups is attained.	
H.BL.SET.7		
<i>Description:</i>	The fact that the maximum number of screen set-ups has been stored should be clearly indicated.	
H.BL.SET.8		
<i>Description:</i>	The controller should be allowed to easily and rapidly adapt the interaction means operation to his own left-handed or right-handed use.	
F.BL.SET.7		Select screen settings
<i>Description:</i>	It shall be possible to select amongst different lighting ambiance settings	



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F.BL.SET.8 Fine tune brightness and contrast	
<i>Description:</i>	It shall be possible to fine tune brightness and contrast settings.

note: fine tuning brightness and contrast might be directly available through screen .

H.BL.SET.9	
<i>Description:</i>	The controller should be provided with a rapid and easy access to configure lighting ambiance settings.

H.BL.SET.10	
<i>Description:</i>	The controller should be provided with a rapid and easy means to fine tune brightness and contrast settings.

3.2.2.2 Manage toolbar functions

The objective is to allow the controllers to easily access functions, which will permit to monitor globally the traffic display features on the situation display.

F.BL.TOOL.1 Access to display monitoring functions	
<i>Description:</i>	The HMI shall provide individual access to each of the situation display monitoring functions.

H.BL.TOOL.1	
<i>Description:</i>	A rapid and easy access should be provided to each of the TWR situation monitoring functions.

H.BL.TOOL.2	
<i>Description:</i>	It should be possible to access individually each of the TWR view display monitoring functions. The eventual grouping of the TWR view display monitoring functions should not hinder the access to each individual function.

3.2.3 Access Air, Surface and Time information

The objective is to provide the controllers with clear representation of the air, ground components of the TWR area of interest. The access to surface, air and time information consists of functions allowing the controller to focus the display on a specific area of the APP or ground view display, display different types of information and access the current UTC time.

3.2.3.1 Zoom, offset and modification of geographical orientation functions

F.BL.ZOOM.1 Perform zoom	
<i>Description:</i>	It shall be possible to change the situation display range (APP or Ground Situation Display), without changing the size of the situation display



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F.BL.ZOOM.2		Perform zoom
<i>Description:</i>	The minimum and maximum zoom ranges shall be defined at the local level.	
H.BL.ZOOM.1		
<i>Description:</i>	The controller should be provided with a composite picture which can zoom in to airport scale and out to APP/en-route scale.	
H.BL.ZOOM.2		
<i>Description:</i>	The controller should be provided with the possibility to change the situation display range (APP or Ground situation display). The minimum and maximum zoom values, if any, should be clearly indicated.	
F.BL.ZOOM.3		Store zoom
<i>Description:</i>	It shall be possible to store a particular zoom range associated with a particular map centre-point (zoom setting).	
F.BL.ZOOM.4		Store zoom
<i>Description:</i>	The maximum number of zoom settings that can be stored at any one time shall be defined at local level. The proposed default number is 3.	
H.BL.ZOOM.3		
<i>Description:</i>	The controller should be provided with the possibility to store a pre-defined number of zoom settings.	
H.BL.ZOOM.4		
<i>Description:</i>	The fact that the maximum number of zoom settings has been stored should be clearly indicated.	
F.BL.ZOOM.5		Retrieve zoom Zoom back
<i>Description:</i>	It shall be possible to access a stored zoom setting.	
H.BL.ZOOM.5		
<i>Description:</i>	The controller should be provided with the possibility to quickly and easily access a previously stored zoom setting.	
F.BL.ZOOM.6		Delete zoom
<i>Description:</i>	It shall be possible to delete a stored zoom setting.	



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H.BL.ZOOM.6

Description: The controller should be provided with the possibility to delete a previously stored zoom setting.

H.BL.ZOOM.7

Description: The controller should have the choice of which setting to delete when the maximum number of stored zoom settings is attained.

F.BL.ZOOM.6

Offset centre

Description: It shall be possible to centre the situation display on any point chosen by the controller.

H.BL.ZOOM.8

Description: The controller should be provided with the possibility to easily and rapidly re-centre the situation display on a chosen point.

3.2.3.2 Display surface information

F.BL.MAP.1

Display airport video map

Description: It shall be possible to display and remove different types of surface information on the ground situation display.

F.BL.MAP.2

Display airport video map

Description: The number of airport 2D maps and the content of each map shall be defined at local level. The proposed default display is the following:

- The taxiways,
- The runways,
- The terminals and other airport buildings,
- Aprons and gates,
- Stop bars.

H.BL.MAP.1

Description: The controller should be provided with a rapid and easy access to the surface information display or removal on the ground situation display.

F.BL.MAP.3

Display parking names | Display parking names (quick look)

Description: It shall be possible to display / remove display parking names and associated location on the ground situation display.



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H.BL.MAP.2	
<i>Description:</i>	The controller should be provided with a rapid and easy means to display / remove display parking names and associated location on the ground situation display, either permanently or temporarily.

F.BL.MAP.4 Display taxiway names Display taxiway names (quick look)	
<i>Description:</i>	It shall be possible to display / remove display taxiway names on the ground situation display, either permanently or temporarily.

H.BL.MAP.3	
<i>Description:</i>	The controller should be provided with a rapid and easy means to display / remove display taxiway names on the ground situation window, either permanently or temporarily.

F.BL.MAP.5 Display working areas	
<i>Description:</i>	If any, working areas should be automatically displayed on the ground situation window.

H.BL.MAP.4	
<i>Description:</i>	The controller should be provided with a rapid and easy means to remove display or re-display working areas on the ground situation window.

F.BL.MAP.6 Display RWYs restricted areas	
<i>Description:</i>	It shall be possible to display / remove display the limits of RWY restricted areas (RWY strips boundaries) according to LVP / non-LVP conditions.

H.BL.MAP.5	
<i>Description:</i>	The controller should be provided with a rapid and easy means to display / remove display RWY strip boundaries according to LVP or non-LVP conditions.

F.BL.MAP.7 Modify map geographical orientation	
<i>Description:</i>	It shall be possible to modify the geographical orientation of airport maps.

H.BL.MAP.6	
<i>Description:</i>	The controller should be provided with a rapid and easy means to modify the geographical orientation of airport maps.

F.BL.MAP.10 Display vehicle mask area	
<i>Description:</i>	It shall be possible to display / remove the apron mask area limit.

H.BL.MAP.8	
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<i>Description:</i>	The controller should be provided with a rapid and easy means to display / remove the apron mask area limit.
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3.2.3.3 Display airspace information

The objective is to provide the controllers with clear representation of the airspace components on the APP radar image.

F.BL.MAP.8	Display air video map
<i>Description:</i>	It shall be possible to display and remove different types of airspace information on the APP radar image.

F.BL.MAP.9	Display air video map
<i>Description:</i>	The number of airspace maps and the content of each air map shall be defined at local level. The proposed default display is the following: <ul style="list-style-type: none">• The area of the sector(s) controlled on the position• The waypoints and waypoint identifications• The airways / airway centre-lines• The military areas• The coastlines• The scale markers• The range-rings.

H.BL.MAP.7	
<i>Description:</i>	The controller should be provided with a rapid and easy access to the airspace information display or removal on the APP radar image.

3.2.3.4 Display time information

F.BL.TIME.1	Display time
<i>Description:</i>	The UTC time shall be continuously provided to the controller with the precision of 1 second.

H.BL.TIME.1	
<i>Description:</i>	The display of the UTC time should be always available.

3.2.3.5 Display additional view

F.BL.VIEW.1	Display additional sub-view
<i>Description:</i>	It shall be possible to display additional composite situation view (picture in picture) on the situation display.

F.BL.VIEW.2	Display additional sub-view
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<i>Description:</i>	The maximum number of additional sub-views that can be displayed shall be defined at the local level. The proposed default number is 2.
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H.BL.VIEW.1	
<i>Description:</i>	The controller should be provided with a rapid and easy means to display / remove display additional sub-views on the situation display.

3.2.3.6 Display and track range & bearing

F.BL.RB.1 Obtain Range and Bearing information	
<i>Description:</i>	It shall be possible to obtain range and bearing information as measured from one point of the airspace to another.

H.BL.RB.1	
<i>Description:</i>	The controller should be provided with a rapid and easy access to the Range and Bearing function allowing obtaining precise range and bearing information as measured from one point of the airspace to another.

H.BL.RB.2	
<i>Description:</i>	The controller should be provided with a rapid and easy way of leaving the Range and Bearing function.

H.BL.RB.3	
<i>Description:</i>	The controller should be provided with feedback when the Range and Bearing function is active or not.

F.BL.RB.2 Create Range and Bearing Tracker Link	
<i>Description:</i>	It shall be possible to monitor over time the change in relative range and bearing over time of two points, one or both of which are dynamic (an aircraft and a fixed point, or two aircraft).

F.BL.RB.3 Create Range and Bearing Tracker Link	
<i>Description:</i>	The maximum number of trackers linking two points that can be displayed at the same time on the Composite Situation Display shall be defined at the Centre level. The proposed default number is 5.

H.BL.RB.4	
<i>Description:</i>	The controller should be provided with a rapid and easy access to the Tracker link function allowing to monitor over time the change in relative range and bearing over time of two points, one or both of which are dynamic (an aircraft and a fixed point, or two aircraft).



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H.BL.RB.5	
<i>Description:</i>	The controller should be provided with a rapid and easy way of leaving the Tracker Link function.

H.BL.RB.6	
<i>Description:</i>	The controller should be provided with feedback when the Tracker link function is active or not.

H.BL.RB.7	
<i>Description:</i>	The fact that the maximum number of Tracker links has been displayed should be clearly indicated.

F.BL.RB.4 Cancel Range and Bearing Tracker Link	
<i>Description:</i>	It shall be possible to remove the displayed range and bearing information.

H.BL.RB.8	
<i>Description:</i>	The controller should be provided with a rapid and easy way of removing the displayed range and bearing information.

F.BL.RB.5 Obtain Range and Bearing information Create Range and Bearing Tracker Link	
<i>Description:</i>	It shall be possible to display and to monitor over time the estimated time of flight of an aircraft between its current position and a fixed point of the airspace.

H.BL.RB.9	
<i>Description:</i>	The controller should be provided with a rapid and easy access to the estimated time of flight of an aircraft to a fixed point of the airspace.

H.BL.RB.10	
<i>Description:</i>	The controller should be provided with the possibility to express the estimated time of flight of an aircraft to a fixed point of the airspace in a format best suited to his need.

3.2.4 Manage the display features of traffic representation

3.2.4.1 Manage the radar label position

The objective is to allow the controllers to manage the radar label positions, by:

- Either activating the automatic radar label anti-overlap function,
- Or taking manual control of the position of all or individual radar labels.



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Its main purpose is:

- To provide the controllers with clear representation of all the displayed traffic without overlapping, so that to keep information legible and avoid confusion,
- To avoid an extensive manual re-positioning of radar labels, taking the controller's attention away from the main control task.

F.BL.POS.1 Deconflict labels automatically Deconflict labels manually	
<i>Description:</i>	An 'on-off' automatic radar label anti-overlap function shall be provided to the controller. The automatic function shall find for each radar label (aircraft or vehicle) the optimum display position free of overlap with other radar labels or with other displayed information, taking into account a set of constraints and parameters defined at the anti-overlap algorithm configuration level.

H.BL.POS.1	
<i>Description:</i>	The controller should have the possibility to choose whether to use the automatic radar label anti-overlap function: the function should be activated and de-activated only on controller's request. The access to the activation/deactivation should be immediate, and the controller should be provided with feedback whether the automatic anti-overlap is active or not.

F.BL.POS.2 Set leader length Set leader direction	
<i>Description:</i>	It shall be possible to modify some of the algorithm configuration parameters to adapt them to the local needs. At the minimum, it should be possible: <ul style="list-style-type: none"> • To change the radar label position relative to the aircraft track symbol. • To change the length of the leader line of all the radar labels. • To set the top of the screen as reference for the orientation of the radar labels. • To set the aircraft track as reference for the orientation of the radar labels.

H.BL.POS.2	
<i>Description:</i>	The controller should have the possibility to adapt easily and quickly some of the algorithm configuration parameters to his own needs.

F.BL.POS.3 Set fixed reference Set variable reference	
<i>Description:</i>	In the manual label positioning mode, it shall be possible to choose a frame of reference for the display of all radar labels in a given orientation with respect to this reference. Proposed references are: <ul style="list-style-type: none"> • Variable reference: aircraft heading • Fixed reference: the top of the screen, providing the possibility to display the radar label with different angles relative to this fixed reference.



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H.BL.POS.3	
<i>Description:</i>	At any moment, the controller should have the possibility to choose between the proposed frames of reference for the manual monitoring of all the radar labels' position.

F.BL.POS.4 Set leader direction	
<i>Description:</i>	In the manual label positioning mode, it shall be possible to set the position of the displayed radar labels to a given orientation with respect to a specified reference.

H.BL.POS.4	
<i>Description:</i>	At any moment, the controller should have the possibility to manually set the orientation of all the displayed radar labels, within a given frame of reference.

F.BL.POS.5 Set leader length	
<i>Description:</i>	In the manual label positioning mode, it shall be possible to change the length of the displayed radar labels' leader lines.

H.BL.POS.5	
<i>Description:</i>	At any moment, the controller should have the possibility to manually set the leader line length of all the displayed radar labels. Several lengths of the leader line should be available, allowing changing the position of the labels without modifying their direction with respect to the aircraft track.

F.BL.POS.6 Move radar label	
<i>Description:</i>	It shall be possible to manually move any individual label, independently of either the automatic anti-overlap algorithm operation, or the global manual setting of label position.

H.BL.POS.6	
<i>Description:</i>	At any moment, it should be possible to move a particular radar label anywhere on the radar image. The leader line should automatically extend and reposition to maintain the link between the label and the aircraft or vehicle position symbol. The minimum length of the leader line should be long enough to avoid overlapping of the label with the position symbol. There should be no limitation of the leader line orientation or maximum length, allowing the controller to find an adequate position for the label.

F.BL.POS.7 Deconflict labels automatically	
<i>Description:</i>	A label, manually put in a certain position, should be avoided by the labels which are monitored by the automatic radar label anti-overlap function.



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F.BL.POS.8		Resume label position
<i>Description:</i>	It shall be possible to put the individually moved labels in conformance with the rules defined within the global setting of label position, or to take them off the global setting so that they stay in the controller-defined position.	

H.BL.POS.7	
<i>Description:</i>	At any moment, the controller should have the choice of including or not the individually moved labels into the global label position setting.

H.BL.POS.8	
<i>Description:</i>	Any manual global or individual positioning of labels should be easy and rapid to perform.

3.2.4.2 Manage Tracks and labels

3.2.4.2.1 Display speed vectors

The objective is to provide the controllers with information on the future horizontal evolution of aircraft by displaying speed vectors corresponding to (n) minutes of flight time.

F.BL.VECT.1		Set speed vectors value
<i>Description:</i>	It shall be possible to display (remove display) a speed vector, corresponding to a given number of minutes of flight time for all the aircraft.	

H.BL.VECT.1	
<i>Description:</i>	The controller should be provided with an easy and rapid way to configure the speed vector length for all the aircraft tracks.

F.BL.VECT.2		Set speed vectors value
<i>Description:</i>	The possible display values of the overall and individual speed vector shall be defined at local level. The proposed default values are 0, 1, 2, 3, 4, 5 minutes.	

H.BL.VECT.2	
<i>Description:</i>	The speed vector should not be 'confusable' with the leader line of the air aircraft radar label.

3.2.4.2.2 Display aircraft and vehicle representation

The objective is to provide the controllers with track representation and information on the horizontal evolution and speed of aircraft and vehicles by displaying (n) trail dots, each dot representing a position from a previous update.



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F.BL.TRCK.1	Display track symbol
<i>Description:</i>	It shall be possible to distinguish between aircraft and vehicles symbols.

H.BL.TRCK.1	
<i>Description:</i>	Aircraft and vehicles track symbols should be different so that the controller should clearly distinguish between them.

F.BL.TRCK.2	Display track symbol
<i>Description:</i>	It shall be possible to distinguish between light, medium and heavy aircraft categories on the situation display.

H.BL.TRCK.2	
<i>Description:</i>	Three sizes of dots should be displayed to the controller to represent light, medium and heavy aircraft categories

F.BL.TRCK.3	Display aircraft shape (quick look)
<i>Description:</i>	It shall be possible to display the aircraft shape in a quick look mode.

H.BL.TRCK.3	
<i>Description:</i>	The controller should be provided with the ability to enable/disable the display of aircraft shape in a quick look mode.

F.BL.TRCK.4	Set track history value
<i>Description:</i>	It shall be possible to display a given number of trail dots for all the aircraft/vehicles.

F.BL.TRCK.5	Set track history value
<i>Description:</i>	The number of trail dots that can be displayed shall be defined at local level. The proposed default number is 0, 1, 2, 3, 4, 5.

H.BL.TRCK.4	
<i>Description:</i>	The controller should be provided with an easy and rapid way to configure the number of trail dots for all the aircraft tracks.

3.2.4.2.3 Configure the radar labels

The objective is to allow the controllers to configure the content of radar labels by selecting additional information to be displayed.

F.BL.LBL.1	Configure radar labels
<i>Description:</i>	It shall be possible to configure the content of radar labels by displaying and removing additional data.



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F.BL.LBL.2		Configure radar labels
<i>Description:</i>	It shall be possible to configure independently the selected format of radar labels (aircraft and vehicles) from the minimum format, by displaying and removing additional data.	

F.BL.LBL.3		Configure radar labels
<i>Description:</i>	<p>The minimum and selected data to be displayed in the radar labels shall be defined at local level.</p> <p>The proposed default set for the <u>minimum</u> label is the following:</p> <ul style="list-style-type: none">a) for a departure aircraft: callsign, departure parking/stand, clearance limitb) for an arrival aircraft: callsign, arrival parking/stand.c) For towed aircraft: callsignd) For vehicles: callsign <p>The proposed default set for the <u>selected</u> label is the following:</p> <ul style="list-style-type: none">a) for a departure aircraft callsign, departure parking/stand, clearance limit, altitude (when airborne), true air speed (when airborne), type of aircraft, RWY, SID, CTOT, weight vortex category, departure sequence number.b) for an arrival aircraft: callsign, aircraft type, arrival parking/stand, altitude (when airborne), true air speed (when airborne), RWY, type of aircraft, weight vortex category, arrival sequence number.c) for a towed aircraft: callsign, aircraft type, departure stand, arrival stand.	

F.BL.LBL.4		Configure radar labels
<i>Description:</i>	It shall be possible to configure the content and position of fields in the radar label.	

H.BL.LBL.1	
<i>Description:</i>	The controller should be provided with a rapid and easy way to configure the content of minimum and selected radar labels by adding or removing data fields.

H.BL.LBL.2	
<i>Description:</i>	The content of radar labels should be configurable according to operator role.

H.BL.LBL.3	
<i>Description:</i>	The colours associated to arriving and departing traffic should be different. At least the callsign, symbol and the leader line should have the same colour.

3.2.4.2.4 Filter out groups of aircraft tracks

The objective is to help the controllers to focus on relevant traffic by selecting group(s) of aircraft tracks to be visualised (or not).

F.BL.FILT.1		Filter tracks
<i>Description:</i>	It shall be possible to select category(ies) of aircraft tracks to be displayed.	

F.BL.FILT.2		Filter tracks
<i>Description:</i>	The default categories of aircraft tracks to be displayed shall be defined at local level.	

H.BL.FILT.1		
<i>Description:</i>	The controller should be provided with the possibility to set/select groups of aircraft tracks to be displayed.	

3.2.4.2.5 Draw attention to a specific aircraft or vehicle

The objective is to mark an aircraft either as a local mnemonic that something should be done or monitored concerning that aircraft or vehicle on the ground, or as a means to draw attention of next controller unit to that particular aircraft or vehicle. This includes the possibility:

- To input a warning by marking on an aircraft or vehicle (input intra cwp warning procedure);
- To export an intra cwp warning on other positions (share intra cwp warning procedure);
- To remove an intra cwp warning (remove intra cwp warning procedure).

F.BL.WAR.1		Input intra cwp warning
<i>Description:</i>	It shall be possible to input an intra-sector warning marking on an aircraft or vehicle.	

H.BL.WAR.1		
<i>Description:</i>	The controller should be provided with an easy and rapid way to mark an aircraft or vehicle for herself/himself as an 'aide memoire'.	

F.BL.WAR.2		Share intra cwp warning
<i>Description:</i>	It shall be possible to share an aircraft or vehicle marking with the next cwp.	

H.BL.WAR.2		
<i>Description:</i>	The controller should be provided with an easy and rapid way to share an aircraft or vehicle marking with the next controller unit. If input, this warning should be provided even if the aircraft or vehicle is not yet visible on the controller's ground situation display.	

F.BL.WAR.3	Remove intra cwp warning
<i>Description:</i>	It shall be possible to remove an intra-cwp warning marking on an aircraft or vehicle.

H.BL.WAR.3	
<i>Description:</i>	The controller should be provided with an easy and rapid way of removing the displayed intra-cwp warning.

3.3 Access data concerning the current traffic situation

The main objective is to provide the controllers with a clear 'picture' of the actual traffic situation, and with all the necessary traffic data to assist them in their control tasks.

Different sets of traffic data are provided in order to assist the controllers in different types of tasks (e.g. updating of data, planning of actions, surface conflict detection and monitoring). These sets of data are presented in either textual or graphical format.

- Traffic position and trajectory are provided in graphical format to help the controller to easily locate each aircraft or vehicle and visualise its evolution.
- Textual data can be provided in several formats:
 - a) Isolated sets of data related to each aircraft or vehicle. Access to the current flight parameters is provided through interaction with any aircraft or vehicle representation.
 - b) Lists of data allowing comparisons to help the controller to detect conflicts and to prioritise the planning of actions.

3.3.1 Select an aircraft or vehicle

The notion of selection relates to the intention to interact with the traffic label and/or with the associated symbol and trajectory, and/or its representation through traffic data. The interface supports the notion of the currently selected traffic whose data the controller is currently examining or modifying.

F.BL.SEL.1	Select an individual aircraft or vehicle Deselect an individual aircraft or vehicle
<i>Description:</i>	It shall be possible to select or deselect an individual aircraft or vehicle.

H.BL.SEL.1	
<i>Description:</i>	The controller should be able to select an aircraft or vehicle by placing the cursor on its representation. It is proposed that aircraft or vehicle representation would be accessed <ol style="list-style-type: none"> a) either through its label or on its track. b) or traffic data representation.



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H.BL.SEL.2

Description: Only one aircraft or vehicle should be possible to select at any instant within the interface of a single controller.

H.BL.SEL.3

Description: Selecting an aircraft or vehicle should:

- a) Highlight all the available representations of that traffic wherever such information appears, allowing for an easy location of the traffic information.
- b) Show the radar label in the appropriate selected format.

H.BL.SEL.4

Description: De-selecting an aircraft or vehicle should:

- a) Deselect the previously highlighted traffic representation.
- b) Revert the radar label to its minimum form

H.BL.SEL.5

Description: Selection is a necessary pre-condition for interaction with an aircraft or a vehicle or its data. Only interactive fields should be highlighted when accessed with the input/output device.

F.BL.SEL.2 **Hide vehicles on the apron | Show vehicles on the apron**

Description: It shall be possible to hide / show all vehicles on the apron.

H.BL.SEL.6

Description: The controller should be able to easily hide or show all vehicles on the apron. Only previously selected vehicles should be highlighted. By default, all vehicles will be hidden.

F.BL.SEL.3 **Display initial route**

Description: It shall be possible to visualise initial trajectory for assumed mobile.

H.BL.SEL.7

Description: The controller should be able to easily visualise the planned trajectory for a mobile. Only trajectories for assumed mobiles should be highlighted.

F.BL.SEL.4 **Modify initial route**

Description: It shall be possible to modify the initial trajectory of assumed mobile.

H.BL.SEL.8

Description: The controller should be able to easily modify planned trajectory or to input a new route for a mobile. Only trajectories for assumed mobiles should be possible to modify.



3.3.2 Display traffic representation

The objective is to provide the controllers with any of the available data on any individual aircraft or vehicle.

F.BL.TRAF.1 Display aircraft representation Display vehicle representation	
<i>Description:</i>	The controller shall be provided with a clear representation of the traffic (i.e. aircraft and vehicles) helping the controller to easily <u>locate and identify</u> aircraft and vehicles and to have a direct access to essential information.

F.BL.TRAF.2 Display aircraft representation Display vehicle representation	
<i>Description:</i>	The traffic representation shall be updated following: a) Updates of the surveillance system b) Controller or system initiated update of data.

H.BL.TRAF.1	
<i>Description:</i>	Aircraft and vehicle representation should be provided in a format helping the controller to easily <u>locate and identify</u> the traffic and to have direct access to essential information. The relation between traffic representation and information concerning that traffic should be unambiguous.

H.BL.TRAF.2	
<i>Description:</i>	To avoid screen congestion and minimise overlap of displayed information, the permanently displayed traffic data should be only the <u>minimum</u> information needed by the controller. Minimum traffic information data shall be defined at local level.

F.BL.TRAF.3 Display aircraft representation Display vehicle representation	
<i>Description:</i>	The controller shall be provided with a clear indication that a traffic is: a) Entering her/his area of responsibility; b) Being under her/his responsibility; c) Leaving her/his area of responsibility

H.BL.TRAF.3	
<i>Description:</i>	The planning state of the aircraft should be clearly indicated.

H.BL.TRAF.4	
<i>Description:</i>	Temporary ('quick look') presentation of any of the additional traffic data should be allowed.



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H.BL.TRAF.5

<i>Description:</i>	The traffic representation should be updated <u>on the controller's display</u> following: a) updates of the surveillance system b) controller <u>or</u> system initiated update of traffic data.
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F.BL.TRAF.4

Display aircraft cooperative status

<i>Description:</i>	The cooperative status of aircraft shall be displayed on the aircraft representation.
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H.BL.TRAF.6

<i>Description:</i>	The controller should be provided with a clear and visible indication of aircraft cooperative status.
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3.3.2.1 Access all traffic entering or planning to enter a sector

The objective is to provide the controllers with data on all traffic entering or planning to enter a controller area of responsibility.

F.BL.SIL.1

Display Traffic Data List

<i>Description:</i>	Traffic data related to aircraft and vehicles entering or planned to enter controller's area of responsibility shall be presented to the controller.
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F.BL.SIL.2

Display Traffic Data List

<i>Description:</i>	<u>Traffic Data Items</u> shall be grouped in one or several <u>Traffic Data Lists</u> . Displayed Traffic Data Items displayed at each working position shall include: a) Traffic that will become under control responsibility in the near future, and b) Traffic under responsibility control for that position.
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H.BL.SIL.1

<i>Description:</i>	All Traffic Data Items pertinent to a controller should be presented in a clear and pre-defined format(s) that help her/him to prioritise planning and control actions. Depending on operational needs, traffic data shall be highly configurable with regard to layout, size, shape, fonts, colours and interaction capability.
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H.BL.SIL.2

<i>Description:</i>	Traffic under the control area responsibility of a controller at a particular working position should be clearly distinguished from traffic which is not under her/his control responsibility.
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F.BL.SIL.3		Configure Traffic Data Items
<i>Description:</i>	Traffic Data Items shall be represented in minimum format or extended format based on controllers' choice. It shall be possible to configure independently the <u>extended</u> format of Traffic Data Items from the <u>minimum</u> format, by displaying and removing additional data.	

F.BL.SIL.4		Configure Traffic Data Items
<i>Description:</i>	Traffic Data Items fields to be displayed in <u>minimum</u> format shall be defined at local level. The proposed default sub-set is the following: a) <u>for an arrival flight:</u> <ul style="list-style-type: none">- ELDT (i.e. Estimated LanDing Time, when estimated) or ALDT (Actual Landing Time)- Aircraft callsign- Aircraft type- Wake Vortex category- Stand identification + Waiting time indication (if the stand is occupied)- IFR or VFR flight indicator- Time to touchdown- Indication of last clearance / instruction- Runway- Runway sequence number b) <u>for a departure flight:</u> <ul style="list-style-type: none">- TTOT (Target Take-Off Time) or ATOT (Actual Take Off Time)- Aircraft callsign- Aircraft type- Wake vortex category- Stand- SID or VFR indicator- CTOT (Calculated Take Off Time) and Ready Message indicator- Indication of last clearance / instruction- Runway- Runway sequence number	

F.BL.SIL.5		Configure Traffic Data Items
<i>Description:</i>	Traffic Data Items fields to be displayed in <u>extended</u> format shall be defined at local level. The proposed default sub-set is the following: a) <u>for an arrival flight:</u> <ul style="list-style-type: none">- EIBT (Estimated In-Block Time) or AIBT (Actual In-Block Time)- Airline name- SSR code- Aerodrome of departure- QNH- Remarks	



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	<p>b) <u>for a departure flight:</u></p> <ul style="list-style-type: none"> - EOBT or TOBT or AOBT (Estimated or Target or Actual Off Block Time) - Airline name - SSR code - Aerodrome of destination - QNH - Remarks
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F.BL.SIL.6 Expand Traffic data item	
<i>Description:</i>	The controller shall be able to expand the format of a displayed Traffic Data Item to access additional data. By default, Traffic Data Items should be presented under normal (minimum) format.

H.BL.SIL.3	
<i>Description:</i>	Extended Traffic Data Item information should be available on controller request. The presentation format should be fixed, allowing the controller to easily find an information. Access to additional information should be simple and rapid.

F.BL.SIL.7 Sort Traffic Data Items	
<i>Description:</i>	It shall be possible for the controller to sort displayed Traffic Data Items either manually or in a semi-automatic mode according to criteria. The proposed criteria are chronological and alphabetic (callsign).

H.BL.SIL.4	
<i>Description:</i>	The controller should be provided with an easy means to sort out Traffic Data Items displayed in a Traffic Data List, either manually or according to configurable criteria. By default, Traffic Data Items should be sorted chronologically.

F.BL.SIL.8 Move Traffic data item	
<i>Description:</i>	The movement of traffic data items from one position to another one in the same Traffic List or to a different traffic list on the same control position shall be exclusively triggered on a controller action.

F.BL.SIL.9 Create New Traffic Data Item	
<i>Description:</i>	It should be possible to create a new traffic data item.

H.BL.SIL.5	
<i>Description:</i>	<p>The controller should be assisted to create a new traffic data item</p> <ul style="list-style-type: none"> a) either by selecting a pre-defined model (departure, arrival, towed, vehicle model), or b) by copying an existing one and modify subsequent data



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F.BL.SIL.10		Archive Traffic Data Item
<i>Description:</i>	It shall be possible to archive Traffic Data Items, either a) on controller decision, or b) automatically after AIBT (for arrivals) or after ATOT (for departures);	

F.BL.SIL.11		Display Archived Traffic Data Items
<i>Description:</i>	It shall be possible to display all archived traffic data items either in a fixed or quick look mode.	

3.4 Access weather/advisory information

F.BL.WEA.1	
<i>Description:</i>	It shall be possible to access to weather information, minimum and additional. a) The proposed minimum information includes surface wind direction (touch down) and strength (graphical and text), QNH (mb), ATIS code, temperature and dew point b) Additional information should be defined at local level and can include information such as surface wind (Touch Down and Stop End) , visibility, current weather, cloud ceiling, QNH and QFE (mb and inches), weather forecast information, RVR conditions and a remarks section.

H.BL.WEA.1	
<i>Description:</i>	Minimum weather information should always be displayed and available to the controller and includes (per runway): surface wind direction (touch down) and strength (graphical and text), QNH (mb), ATIS code, temperature and dew point

H.BL.WEA.2	
<i>Description:</i>	The controller should be provided with an easy means to access to <u>additional</u> weather information that should include surface wind (Touch Down and Stop End) , visibility, current weather, cloud ceiling, QNH and QFE (mb and inches), weather forecast information, RVR conditions and a remarks section. The display should be provided either on controller request or automatically triggered on specific events defined at local level.

3.5 Set up the airport layout

Note: This functionality permits to input the status of the airport elements (RWY and taxiways).

F.BL.APT.1	
<i>Description:</i>	It shall be possible to input the status of the runways and taxiways.



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H.BL.APT.1

Description: The controller should be provided with an easy means to access / modify the status of the RWY and taxiways (active / closed).

3.6 Update system data concerning the current traffic situation

3.6.1 Update the system data according to controller clearances

Note : F.BL.ORD.1 and H.BL.ORD.1 requirements (regarding the “continue approach” instruction) have been removed (June 2007).

F.BL.ORD.2		Input cleared to land
<i>Description:</i>	It shall be possible to input a “cleared to land” instruction.	

H.BL.ORD.2	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a cleared to land instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.3		Input go around
<i>Description:</i>	It shall be possible to input a go-around instruction for an aircraft.	

H.BL.ORD.3	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a go-around instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.4		Input vacate
<i>Description:</i>	It shall be possible to input a “vacate” instruction	

H.BL.ORD.4	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a vacate instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.5		Input cross active runway
<i>Description:</i>	It shall be possible to input a “cross active runway” instruction	

H.BL.ORD.5	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a cross active runway for an aircraft. The aircraft representation should account for this instruction.



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F.BL.ORD.6 Input taxi	
<i>Description:</i>	It shall be possible to input a “taxi” instruction.

H.BL.ORD.6	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a taxi instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.7 Input start up	
<i>Description:</i>	It shall be possible to input a “start up engines” instruction

H.BL.ORD.7	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a start-up instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.8 Input pushback	
<i>Description:</i>	It shall be possible to input a “pushback” instruction

H.BL.ORD.8	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a pushback instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.9 Input hold	
<i>Description:</i>	It shall be possible to input a “hold” instruction

H.BL.ORD.9	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a hold instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.10 Input line-up	
<i>Description:</i>	It shall be possible to input a “line-up” instruction.

H.BL.ORD.10	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a line-up instruction for an aircraft. The aircraft representation should account for this instruction.



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F.BL.ORD.11 Input conditional line-up	
<i>Description:</i>	It shall be possible to input a “conditional line up” instruction

H.BL.ORD.11	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a conditional line up instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.12 Input cleared for take off	
<i>Description:</i>	It shall be possible to input a “cleared for take off” instruction

H.BL.ORD.12	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a cleared for take-off instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.13 Input abort take-off	
<i>Description:</i>	It shall be possible to input an “abort take-off “ instruction.

H.BL.ORD.13	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input an abort take-off instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.14 Input En-route Clearance	
<i>Description:</i>	It shall be possible to input an “En-route clearance“ instruction.

H.BL.ORD.14	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input an en-route clearance instruction for an aircraft. The aircraft representation should account for this instruction.

F.BL.ORD.15 Input Tow Clearance	
<i>Description:</i>	It shall be possible to input a “Tow “ instruction for a towed aircraft.

H.BL.ORD.15	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a tow clearance instruction for a towed aircraft. The aircraft representation should account for this instruction.



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F.BL.ORD.16		Input Release Clearance
<i>Description:</i>	It shall be possible to input a “REL “ instruction for a vehicle / towed aircraft.	

H.BL.ORD.16	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a release clearance instruction for a vehicle / towed aircraft.

F.BL.ORD.17		Input enter runway protected area
<i>Description:</i>	It shall be possible to input an “enter runway protected area” instruction	

H.BL.ORD.17	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input an enter clearance instruction for a vehicle / towed aircraft.

H.BL.ORD.18	
<i>Description:</i>	When the controller gives ‘cross’ or ‘enter’ instruction to a vehicle / towed aircraft, the controller should have visual indication of the issued clearance on the runway until the ‘vacate’ order is given or ‘release’.

F.BL.ORD.18		Cancel the last inputed order
<i>Description:</i>	It shall be possible to cancel the last given order / instruction to an aircraft or vehicle /towed aircraft.	

H.BL.ORD.19	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to cancel the last given instruction to an aircraft, vehicle and towed aircraft.

3.6.2 Update the system data according to traffic data modifications

Depending on access rights, the controller shall be able to interact with fields of a traffic data item to enter new information or modify existing information. Traffic data item fields shall be pre-defined so that selecting a field may initiate one or more of the following actions: no action, open a dialogue window, open a pop-up sub-menu, issue a clearance, transfer a traffic data item from a traffic List to another Traffic List or another controller role, acknowledge a pilot request.



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F.BL.UPD.1		Modify Traffic Data Item Field
<i>Description:</i>	It shall be possible to modify traffic data items fields. Only the controller role having a traffic under control responsibility shall be able to access to modifiable fields.	

H.BL.UPD.1	
<i>Description:</i>	Traffic data item fields that can be subject to interaction by the controller should be clearly indicated.

H.BL.UPD.2	
<i>Description:</i>	Only available options for interaction should be displayed. Such options depend on the flight planning state and previously issued clearances for the flight

H.BL.UPD.3	
<i>Description:</i>	The controller shall be provided with a visible indication when modifications are made to a displayed traffic data item.

H.BL.UPD.4	
<i>Description:</i>	A visible indication shall be provided on a traffic data item when a flight has been cancelled or delayed.

H.BL.UPD.5	
<i>Description:</i>	Modification of traffic data on one control position shall lead to update this information wherever it is available.

F.BL.UPD.2		Modify Traffic Data Item Field
<i>Description:</i>	Depending on traffic responsibility, it shall be possible to modify traffic data item fields: a) Departure RWY, Departure parking /stand, SID and aircraft type (departure flight) b) Arrival Runway, Arrival parking/stand and aircraft type (arrival flight) c) Arrival and departure parking / stands (towed aircraft)	

F.BL.UPD.3		Log Times
<i>Description:</i>	It shall be possible to log the actual times of arrival or departure for each aircraft under responsibility.	

H.BL.UPD.6	
<i>Description:</i>	The controller should be provided with an easy means to log departure and arrival times of traffic under responsibility either manually (controller action) or automatically (detection of take-off or landing event).



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F.BL.UPD.4		Input remark
<i>Description:</i>	It shall be possible for the controller to input or modify a free remark ('remarks' field) on a traffic data item when a traffic is under her/his responsibility.	

H.BL.UPD.7	
<i>Description:</i>	The controller should be provided with visual indication that a remark has been input for a traffic by the preceding control position.

H.BL.UPD.8	
<i>Description:</i>	The controller should be provided with an easy way to input free text.

F.BL.UPD.5		Display remark
<i>Description:</i>	It shall be possible for the controller to display a remark on a traffic data item.	

3.7 Flight Plan Edition

This section provides the specification of the HMI elements related to the flight plan edition functions.

3.7.1 Create a new flight plan

F.BL.FPL.1		Create new flight plan
<i>Description:</i>	It shall be possible to manually create a new flight plan	

H.BL.FPL.1	
<i>Description:</i>	The controller should be provided with an easy and simple means to manually create a new flight plan

H.BL.FPL.2	
<i>Description:</i>	At any stage of a new flight plan creation the controller should be assisted by the system by indication of data to be input, data available for input, erroneous data, possible actions, forbidden actions.

F.BL.FPL.2		Copy flight plan
<i>Description:</i>	The controller should have the possibility to create a flight plan from a copy of an existing flight plan and subsequent modification of the data.	

H.BL.FPL.3	
<i>Description:</i>	The controller should be provided with an easy and simple means to copy an existing traffic data item



F.BL.FPL.3	Delete flight plan
<i>Description:</i>	The controller should have the possibility to correct or delete a previously saved flight plan

H.BL.FPL.4	
<i>Description:</i>	Flight plans that have been saved by the controller and can be deleted or corrected should be clearly identified.

H.BL.FPL.5	
<i>Description:</i>	The deletion of a saved flight plan should be confirmed by the controller.

3.7.2 Modify a flight plan

F.BL.FPL.4	Display flight plan data
<i>Description:</i>	The controller shall have the possibility to display the flight plan data of any existing flight plan

H.BL.FPL.6	
<i>Description:</i>	The controller should be provided with an easy and simple access to the display a flight plan.

F.BL.FPL.5	Modify flight plan data
<i>Description:</i>	The controller shall have the possibility to manually modify flight plan elements

H.BL.FPL.7	
<i>Description:</i>	Flight plan elements that can be modified by the controller should be clearly indicated

3.8 System Supported Data Exchange and Co-ordination

The data exchange between control positions in the tower requires system support aimed at assisting the controllers in the tasks associated with the different components.

The objective is to propose a system support, which would provide benefits in terms of alleviation of controller workload and reduction of inter-unit communication and co-ordination, through the system supported distribution of flight data and co-ordination between Control positions.

3.8.1 Traffic data distribution between control positions

The objective is to provide full flight information to the controllers. The purpose of the availability of this information is to reduce the need for controller-to-controller verbal co-ordination. It consists of the distribution of flight data information before a flight enters the area of interest of the concerned unit.



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F.FD.RUL.1		Display Pending Traffic
<i>Description:</i>	Arrival traffic data shall be displayed on the RWY arrival control position at a time parameter before expected landing time (ELDT). The proposed time parameter should be defined at local level.	

F.FD.RUL.2		Display Pending Traffic
<i>Description:</i>	Based on local decision, Arrival traffic data shall be displayed on concerned GND control position(s) either at a time parameter before expected landing time or based on an identified runway controller action/clearance for that flight. The proposed time parameter should be defined at local level.	

F.FD.RUL.3		Display Pending Traffic
<i>Description:</i>	Based on local decision, Departure traffic data item shall be displayed on concerned GND position(s) either at a time parameter before expected off block time (EOBT) time or based on an identified controller action/clearance for that flight. The proposed time parameter should be defined at local level.	

3.8.2 Transfer of control responsibility

The objective is to provide controllers with system assistance for the access to minimum facilities for transfer of control, allowing them to inform their colleagues from the next/previous ATC units.

F.FD.TRSF.1		Modify control responsibility Transfer control responsibility
<i>Description:</i>	It shall be possible to modify the control responsibility for an aircraft or vehicle, and transfer control responsibility to other operator roles in the system	

H.FD.TRSF.1	
<i>Description:</i>	The controller should be provided with easy means to modify or transfer the control responsibility for an aircraft to other operator roles. Transfer of control responsibility should be possible through any representation of the aircraft.

F.FD.TRSF.2		Transfer Traffic Assume Traffic
<i>Description:</i>	Transfer of control responsibility shall consist of two actions: transfer (to transfer traffic to default next operator role) and assume (to assume traffic).	

H.FD.TRSF.2	
<i>Description:</i>	The controller should be provided with an easy and visible way to indicate that transfer of control responsibility has been initiated on both giving and receiving control positions.

F.FD.TRSF.3		Direct Transfer Traffic
<i>Description:</i>	It shall be possible to transfer a flight to another controller role than planned in the pre-defined sequence.	



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H.FD.TRSF.3

<i>Description:</i>	The controller should be provided with an easy means to transfer control responsibility of any traffic to a control position different from the pre-defined one
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F.FD.TRSF.4

Transfer Traffic | Assume Traffic

<i>Description:</i>	After successful transfer of a flight or vehicle to another controller role, it shall remain under control of the former controller until the latter assumes it, that completes the transfer.
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H.FD.TRSF.4

<i>Description:</i>	When transferred by another operator role, the controller should be provided with an easy way to assume an aircraft or vehicle.
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H.FD.TRSF.5

<i>Description:</i>	Visible indication of completion of a flight or vehicle transfer/assume control responsibility shall be provided on both assuming and transferring operator roles.
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3.9 Monitoring and Control Functions

3.9.1 Surface Conflict Detection and Alerting

The surface conflict detection and alerting function is responsible for automatic detection and alerting of possible conflicts on the surface. It should be able to detect the following conflicts (ICAO-9830, section 3.4.5.7): runway conflicts, taxiway conflicts and stand/gate/apron conflicts. Only Runway conflict detection and alerting is detailed in this initial document.

When a conflict situation is detected, the A-SMGCS safety net will provide the controller with two types of alert, named ‘information’ and ‘alarm’:

- **Information:** When receiving an ‘information alert’, this means that a potential dangerous situation may occur. The controller will use his skill and backgrounds to decide if, with remaining possible actions, the situation can be saved without using a too restrictive procedure (e.g. go around). If successful, there will be no alarm; if not successful the alarm will be activated and be presented on the surveillance display.
- **Alarm:** When receiving an “alarm”, it is said that a critical situation is developing and that an immediate action should be performed.



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3.9.1.1 Runway conflicts detection and alerting

F.SN.RCA.1 Display RWY conflict (step 1 alert) Display RWY conflict (step 2 alert)	
<i>Description:</i>	It shall be possible to detect and display: a) Conflicts / infringements on runway caused by aircraft or vehicles; b) Restricted areas incursions caused by aircraft (i.e incursions on a closed taxiway or runway).
<i>References:</i>	<i>EUROCONTROL Operational Concepts and Requirements for A-SMGCS Implementation Level II, V1.0, 30/09/2003 (§2.2)</i>

F.SN.RCA.2 Display RWY conflict (step 1 alert) Display RWY conflict (step 2 alert)	
<i>Description:</i>	The controller shall be provided with clear and visible indication of a runway conflict alert as soon as the alert exists. Different levels of severity for alert situations should be distinguished. To each level of severity may correspond a different alert stage: <ul style="list-style-type: none">• Stage 1 alert is used to inform the controller that a situation which is potentially dangerous may occur, and he/she needs to be made aware of. According to the situation, the controller receiving a stage 1 alert may take a specific action to resolve the alert if needed. This is called the 'information' step.• Stage 2 alert is used to inform the controller that a critical situation is developing which needs immediate action. This is called 'alarm' step.
<i>References:</i>	<i>EUROCONTROL Functional Specification for A-SMGCS Level II, v1.0 (17.05.2004), §5.3.1</i>



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F.SN.RCA.3	Display RWY conflict (step 1 alert) Display RWY conflict (step 2 alert)																														
<i>Description:</i>	<p>A runway conflict monitoring alert shall be automatically triggered when an arriving or departing aircraft proceeds with moving traffic to/on <u>converging or intersecting runways</u>.</p> <p>The following cases shall be considered:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Ref. aircraft</th> <th style="text-align: center;">Conflicting aircraft</th> <th style="text-align: center;">Stage 1 alert</th> <th style="text-align: center;">Stage 2 alert</th> </tr> </thead> <tbody> <tr> <td rowspan="3" style="text-align: center; vertical-align: middle;">No reference aircraft</td> <td>Unidentified vehicle on the runway protection area</td> <td style="text-align: center;">No</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td>Aircraft proceeding to a closed runway</td> <td style="text-align: center;">Aircraft on runway protection area surface</td> <td style="text-align: center;">Departing aircraft lining-up or taking-off or arriving aircraft (< T1 from threshold)</td> </tr> <tr> <td>Aircraft departing on the runway in the wrong direction</td> <td style="text-align: center;">No</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td rowspan="3" style="text-align: center; vertical-align: middle;">Arriving aircraft</td> <td>An aircraft or vehicle is on the runway protection area surface</td> <td style="text-align: center;">Arriving aircraft < T1 from threshold</td> <td style="text-align: center;">the arriving aircraft < T2 from threshold, until the arriving aircraft has passed the a/c or vehicle (a/c or vehicle behind the arriving aircraft)</td> </tr> <tr> <td>A slower preceding departing aircraft which has not crossed the end of the runway-in-use or has not started a turn</td> <td style="text-align: center;">Arriving aircraft < T1 from threshold</td> <td style="text-align: center;">Arriving aircraft < T2 from threshold</td> </tr> <tr> <td>A preceding arriving aircraft which has not cleared the protection area</td> <td style="text-align: center;">Arriving aircraft < T1 from threshold</td> <td style="text-align: center;">Arriving aircraft < T2 from threshold</td> </tr> <tr> <td style="text-align: center; vertical-align: middle;">Departing aircraft</td> <td>a mobile (aircraft or vehicle) is on the runway protection area surface and not behind the departing aircraft</td> <td style="text-align: center;">departing aircraft is not yet taking-off (speed < 50 knots)</td> <td style="text-align: center;">departing aircraft is taking-off (speed > 50 knots)</td> </tr> </tbody> </table> <p>Note : The air boundary is defined as a flight time to threshold : Non-LVP conditions : T1 = 30'', T2 = 15'', LVP conditions : T1 = 45'', T2 = 30'</p>			Ref. aircraft	Conflicting aircraft	Stage 1 alert	Stage 2 alert	No reference aircraft	Unidentified vehicle on the runway protection area	No	Yes	Aircraft proceeding to a closed runway	Aircraft on runway protection area surface	Departing aircraft lining-up or taking-off or arriving aircraft (< T1 from threshold)	Aircraft departing on the runway in the wrong direction	No	Yes	Arriving aircraft	An aircraft or vehicle is on the runway protection area surface	Arriving aircraft < T1 from threshold	the arriving aircraft < T2 from threshold, until the arriving aircraft has passed the a/c or vehicle (a/c or vehicle behind the arriving aircraft)	A slower preceding departing aircraft which has not crossed the end of the runway-in-use or has not started a turn	Arriving aircraft < T1 from threshold	Arriving aircraft < T2 from threshold	A preceding arriving aircraft which has not cleared the protection area	Arriving aircraft < T1 from threshold	Arriving aircraft < T2 from threshold	Departing aircraft	a mobile (aircraft or vehicle) is on the runway protection area surface and not behind the departing aircraft	departing aircraft is not yet taking-off (speed < 50 knots)	departing aircraft is taking-off (speed > 50 knots)
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<i>References:</i>	<p><i>EUROCONTROL Functional Specification for A-SMGCS Implementation Level II, v1.0 (17/05/04), Annex B; EUROCONTROL Operational Concepts and Requirements for A-SMGCS Implementation Level II, V1.0, 30/09/03, Annex A.</i></p>																														



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F.SN.RCA.6 Display RWY conflict (step 2 alert)	
<i>Description:</i>	A runway incursion alert should always be clearly distinguished and shall never be hidden by any other alert or information display.

F.SN.RCA.7 Display RWY conflict (step 2 alert)	
<i>Description:</i>	The indication of a runway incursion alert shall have higher priority than any other alert or information display.

3.9.1.2 Protecting devices and runway lighting

F.SN.PTD.1 Display stop bars status	
<i>Description:</i>	It shall be possible to display the stop bars status

F.SN.PTD.2 Manually switch protection devices	
<i>Description:</i>	It shall be possible to manually switch (i.e. activate or de-activate) protection devices such as stop bars or anti-intrusion system.

H.SN.PTD.1	
<i>Description:</i>	The controller should be provided with an easy means to manually activate or de-activate stop bars.

H.SN.PTD.2	
<i>Description:</i>	The status of stop bars (i.e. activated, de-activated, failure) should be clearly and visually indicated to the controller.

F.SN.PTD.3 Display lighting status	
<i>Description:</i>	It shall be possible to display the APP and runway lighting status

F.SN.PTD.4 Switch lighting	
<i>Description:</i>	It shall be possible to manually switch APP and runway lighting

H.SN.PTD.3	
<i>Description:</i>	The controller should be provided with an easy means to manually switch-on or switch off APP and runway lighting

H.SN.PTD.4	
<i>Description:</i>	The status of runway lighting should be clearly and visually indicated to the controller.



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F.SN.PTD.5 Automatically switch protection devices	
<i>Description:</i>	Switching (i.e. activate or de-activate) status of stop bars should be changed automatically according to ATCO clearances and a/c position.

H.SN.PTD.5	
<i>Description:</i>	Stop bars colours and status should switch when ATCO clearance is given and return to its original colour and status when aircraft position is a distance parameter after stop bar position. The distance parameter should be defined at local level.

3.9.1.3 Nav aids serviceability

F.SN.NAV.1 Display NAVAIDS serviceability	
<i>Description:</i>	It shall be possible to display the status of any airport NAVAIDS equipment.

H.SN.NAV.1	
<i>Description:</i>	The controller should be provided with an easy means to display on request the status of airport NAVAIDS equipment.

H.SN.NAV.2	
<i>Description:</i>	The controller should be warned automatically in case of modification of airport NAVAIDS equipment serviceability.

3.9.1.4 Detection of inconsistent clearances

F.SN.CLR.1 Display inconsistent clearance input	
<i>Description:</i>	It shall be possible to detect and display inconsistent clearances manual inputs.

H.SN.CLR.1	
<i>Description:</i>	The controller shall be provided with clear and visible indication of inconsistent clearances manual inputs as soon as they exist.



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H.SN.CLR.2

Description: A step 2 alert shall be automatically triggered when inconsistent clearances input occur.
Triggering conditions are as follows:

a/c ₂ \ a/c ₁	Line-up	Cross/Enter	Take-Off	Landing
Line-up			Yes if ac2* is in front of ac1	Yes
Cross/Enter			Yes if a/c ₂ ^(*) is in front of a/c ₁	Yes ^(*)
Take-off	Yes if a/c ₁ is in front of a/c ₂	Yes if a/c ₁ ^(*) is in front of a/c ₂	Yes	Yes
Landing	Yes	Yes ^(*)	Yes	Yes

(*) applies to aircraft and vehicle

3.9.1.5 Detection of ATCO input errors with respect to airport layout

F.SN.LAY.1 Display ATCO input errors w.r.t airport layout

Description: It shall be possible to detect and display ATCO input errors with respect to airport layout.

H.SN.LAY.1

Description: The controller shall be provided with clear and visible indication of input errors with respect to airport layout.

H.SN.LAY.2

Description: Step 1 alerts shall be automatically triggered when ATCO input errors with respect to airport layout occur.

- a) For a flight, when a selected runway is either closed or inactive.
- b) For a flight, when a selected runway is inappropriate/unsuitable w.r.t the aircraft type, i.e. runway is too short.
- c) For a flight, when the input taxi route is inappropriate/unsuitable, i.e. at least one taxiway in the planned route is closed, or at least one taxiway in the planned route is not compatible with the aircraft type.



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3.9.1.6 Detection of non conformance to ATC instructions

F.SN.CNF.1 Display non conformance to ATC instructions	
<i>Description:</i>	It shall be possible to detect and display non conformance to ATC instructions.

H.SN.CNF.1	
<i>Description:</i>	The controller shall be provided with clear and visible indication of non conformance to ATC instructions as soon as they exist.

H.SN.CNF.2	
<i>Description:</i>	An alert shall be automatically triggered when non conformance to ATC instructions is detected, when: <ul style="list-style-type: none">a) An aircraft deviates from cleared route on a taxiway (step 1 alert)b) An aircraft does not stop at clearance limit; if the clearance limit is the runway holding point, a step 2 alert shall be triggered; in other clearance limit cases, a step 1 alert shall be triggered.c) An aircraft stays stationary a time parameter after take-off, line up or cross given clearances (step 2 alert). The proposed time parameter should be defined at local level.

3.9.1.7 Miscellaneous detections

F.SN.MISC.1 Display excessive aircraft taxi speed	
<i>Description:</i>	It shall be possible to detect and display if an aircraft taxis with speed exceeding 40 knots.

H.SN.MISC.1	
<i>Description:</i>	The controller shall be provided with clear and visible indication when an aircraft is taxiing at a speed > 40 knots.

H.SN.MISC.2	
<i>Description:</i>	An alert step 1 shall be automatically triggered when excessive aircraft taxi speed is detected.

F.SN.MISC.2 Display stationary arrival aircraft in the RWY protection area	
<i>Description:</i>	It shall be possible to detect and display if an aircraft is stationary in the RWY protection area.



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H.SN.MISC.3

Description: The controller shall be provided with clear and visible indication when an arrival aircraft is stationary (i.e. stops for more than a time parameter) in the RWY protection area. The proposed time parameter should be defined at local level.

H.SN.MISC.4

Description: An alert step 2 shall be automatically triggered when an arrival stationary aircraft is detected in the runway protection area.

F.SN.MISC.3

Display wrong a/c or vehicle behaviour

Description: It shall be possible to detect and display if an aircraft or a vehicle is entering a runway without clearance.

H.SN.MISC.5

Description: The controller shall be provided with clear and visible indication when an aircraft or vehicle is entering a runway without clearance.

H.SN.MISC.6

Description: An alert step 2 shall be automatically triggered when an aircraft or vehicle is entering a runway without clearance.

F.SN.MISC.4

Display a/c "clear to land" omission

Description: It shall be possible to detect and display if an aircraft on short final has not been cleared to land after it passes a certain point.

H.SN.MISC.7

Description: The controller shall be provided with clear and visible indication when an arrival aircraft on short final has not been cleared to land after it passes a certain point (distance/altitude from runway threshold).

H.SN.MISC.8

Description: An alert step 2 shall be automatically triggered when an arrival aircraft on short final has not been cleared to land after it passes a certain point (distance/altitude from runway threshold).



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F.SN.MISC.5		Display wrong a/c landing runway
<i>Description:</i>	It shall be possible to detect and display if an arrival aircraft is not lined up on final for assigned landing runway.	

H.SN.MISC.9	
<i>Description:</i>	The controller shall be provided with clear and visible indication when an arrival aircraft is not lined up on final for assigned landing runway.

H.SN.MISC.10	
<i>Description:</i>	An alert step 2 shall be automatically triggered when an arrival aircraft is not lined up on final for assigned landing runway



4 ITWP HUMAN FACTORS REQUIREMENTS

Transversal Human Factors requirements (XHF) are requirements or guidelines that potentially apply to all aspects of the ITWP interface. They relate to the general approach that the interface will adopt to interaction and are thus potentially applicable to any new function that would be added. They can be contrasted with HMI requirements that derive directly from the functionality being introduced. If, for example, a runway conflict detection and alerting is integrated, there could be an HF Requirement to *‘provide the controller with a clear and visible indication as soon as the alert exists’*. This requirement derives directly from the functionality of the Runway Conflict Alert. However the detailed choice of presentation should take into account the general approach to alerts defined transversally across the whole HMI, so that the presentation mechanism eventually chosen will be consistent with other functions and have an appropriate priority in relation to any other alerts deriving from other function

In this document, transversal requirements are often integrated and expressed in terms of policies or conventions, e.g. the policy for use of colour, for management of errors, for highlighting, for selection, etc. Distinction has been made between requirements (X.HF.Rx) and guidelines (X.HF.Gx) to categorise between mandatory and desirable aspects. Some of them have been extracted from Eurocontrol Core Style Guide.

4.1 Processes of interaction

4.1.1 Behavioural consistency

Rationale: the system behaviour therefore has to be predictable, which in turn implies that its behaviour should be consistent, i.e. the same event, applied to the same object in the same context, provokes the same response.

X.HF.G1		Minimize Training
<i>Description:</i>	Systems and equipment should be capable of being maintained, operated, and repaired in the planned operational and maintenance environment with minimal training.	
<i>Source:</i>	MIL-STD-1472F, 1999	

X.HF.G2		Predictable results
<i>Description:</i>	Systems and equipment should be designed so that basic system functions are obvious to the user.	
<i>Source:</i>	Martin & Dong, 1999	

X.HF.G3		Standardize hardware and software
<i>Description:</i>	Hardware and software designs should be standardized to the degree practical and compatible with system functions and purposes.	
<i>Source:</i>	MIL-STD-1472F, 1999	

X.HF.G4		Maintain identical interfaces for identical functions
<i>Description:</i>	Equipment with identical functions should employ identical or similar interfaces	
<i>Source:</i>	MIL-STD-1472F, 1999	



X.HF.G5 Make controls, displays, marking, coding, labelling, and arrangement uniform	
<i>Description:</i>	Controls, displays, marking, coding, labelling, and arrangement schemes should be uniform for common functions of all equipment
<i>Source:</i>	MIL-STD-1472F, 1999

4.1.2 Level of user awareness

Rationale: the user should only be ‘thinking’ in terms of the task activities and never in terms of the mechanics of the interface. The user should be thinking in terms of operational actions and consequences. This is critically dependent on the intuitiveness and ease of use of the interface.

X.HF.G6 Use familiar terms and images	
<i>Description:</i>	Systems and equipment should use terms and images familiar to the user
<i>Source:</i>	Martin & Dong, 1999

4.1.3 Explicit Design to support resource management and monitoring

Rationale: the rules and limitations should be built into the procedures rather than being ‘hard-wired’ into the interface code. There should be some separation of operational procedures and the mechanisms of the interface

X.HF.G7 Design for simplicity	
<i>Description:</i>	The system or equipment design should be as simple as possible, consistent with the desired human-machine system functions, and compatible with the expected maintenance and operational concepts
<i>Source:</i>	MIL-STD-1472F, 1999

4.1.4 Flexibility in the use of the interface: multiple paths and expert use

Rationale: the design must be flexible and tolerant because, at the detailed level, we do not know all the ways in which the expert may make use of it.

X.HF.G8 Provide enough flexibility for different user skill levels	
<i>Description:</i>	Systems and equipment should be flexible enough to accommodate the interaction styles of users with differing skill and experience levels
<i>Source:</i>	Ameritech, 1998

4.1.5 Minimum cognitive effort

X.HF.G9 Be consistent with user mental model	
<i>Description:</i>	To decrease learning or training times, systems should be designed to be consistent with the mental model of the users
<i>Source:</i>	CTA, 1996



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4.1.6 Feedback on action

X.HF.G10		Routine feedback
<i>Description:</i>	The system should provide users with consistent, routine feedback regarding such activities as control entries, computer processing, and print requests	
<i>Source:</i>	MIL-STD-1801, 1987	

X.HF.G11		Timely and informative feedback
<i>Description:</i>	Systems and equipment should provide timely and informative feedback to user actions to keep the users informed about what is happening	
<i>Source:</i>	Apple Computer Incorporated, 1995	

X.HF.G12		Predictable results
<i>Description:</i>	For the feedback to be effective an appropriate response time should be defined for each selectable object. In absence of definition ≤ 125 milliseconds is assumed.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.G13		Predictable results
<i>Description:</i>	User actions should cause predictable results.	
<i>Source:</i>	Martin & Dong, 1999	

4.2 Inputs

4.2.1 Input Basics

X.HF.R1		Highlighting principle
<i>Description:</i>	By default any field or object that is selectable shall provide a feedback (highlight) to show selection acquisition and an 'inverse' feedback to show de-selection.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R2		Highlighting activation
<i>Description:</i>	An object shall become selected only when the acquisition boundary of (an instance ³ of) the object has been crossed by the cursor. (The area within the acquisition boundary is called the acquisition area).	
<i>Source:</i>	Eurocontrol Echoes, 2003	

³ There are cases in the HMI where selection of one instance of an object results in the cross highlighting of all other instances (e.g. selecting an aircraft in a list highlights the label).



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X.HF.R3		Highlighting de-activation
<i>Description:</i>	The object shall cease to be highlighted only when the cursor crosses the retention boundary, or when the presentation of the object changes as the result of an input action. (The area within the retention boundary can be called the retention area).	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.G14		Highlighting latency
<i>Description:</i>	There should be a latency parameter associated with highlighting such that the object highlights only when the cursor lies within the two boundaries for more than a certain time, i.e. the value of the latency parameter.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R4		Boundary definition
<i>Description:</i>	Acquisition and retention boundaries shall be defined as attributes, for each selectable object. (The boundaries are defined in millimetres ⁴ relative to the visible boundaries of the object).	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R5		Boundary default
<i>Description:</i>	If unspecified, the default assumption shall be that all boundaries correspond to the visible boundary.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

4.2.2 The accessibility of selectable objects

X.HF.R6		Target access
<i>Description:</i>	To be selectable a screen object shall be visible to the user (i.e. not completely overlapped by other screen objects).	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R7		Target availability
<i>Description:</i>	If a screen object is visible, its availability for input shall be clearly indicated to the user either through a convention or a specific encoding.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R8		Target size
<i>Description:</i>	Selectable objects shall be at least 4.00mm across the shortest axis along which they will be acquired. Applies to both text and non-text selectable objects.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

⁴ Of course it is the visual angle presented which is important.



4.2.3 Response times

X.HF.G15		Priority response
<i>Description:</i>	An initial response to user input - indicating recognition that an input has been made - should take priority over any other activity at the interface.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.G16		Feedback response time
<i>Description:</i>	For good interface engagement a minimum feedback response to an explicit user input should be provided in ≤ 125 milliseconds (perception of immediate response).	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R9		Feedback response consistency
<i>Description:</i>	Consistency of response time shall be more important than the absolute time of response.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

4.2.4 Temporary versus Permanent Information Display

X.HF.R10		Access quick look
<i>Description:</i>	The interface shall provide the capability to display objects or information temporarily, removing it after the controller has obtained the desired information, with no further intentional action on the controller's part.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R11		Access sustained
<i>Description:</i>	The interface shall provide the capability to display objects or information which remains displayed on screen for successive use by the controller, and is removed only as a consequence of a subsequent, specific controller action.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

4.2.5 Policy on default selections

X.HF.G17		Menu defaults
<i>Description:</i>	Where defaults are deemed necessary, care should be taken to: (a) limit their tendency to impede non-standard inputs (they should never block them) and (b) ensure that consistency of interaction is maintained.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R12		Menu defaults
<i>Description:</i>	The use of menu defaults shall not lead to inconsistency in menu presentation or in the rules for user interaction with menus.	
<i>Source:</i>	Eurocontrol Echoes, 2003	



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X.HF.R13		Menu defaults
<i>Description:</i>	The order of menu items ⁵ shall not be modified in menus for the input of operational parameters or actions. If the menu should open on a specific selection, the opening menu shall be displaced vertically to put the appropriate value under the cursor which shall not move from the point of last user action.	
<i>Source:</i>	Eurocontrol Echoes, 2003 (modified)	
X.HF.G18		Menu defaults
<i>Description:</i>	In cases where a parameter selection menu defaults to a value, there should be a method or coding which allows recognition of the currently assigned parameter value.	
<i>Source:</i>	Eurocontrol Echoes, 2003	
X.HF.R14		Pop-up menu
<i>Description:</i>	When displayed, a pop-up menu shall appear in a location that is coordinated with the location of the pointer.	
<i>Source:</i>	Eurocontrol Echoes, 2003	
X.HF.R15		Menu options
<i>Description:</i>	A menu shall display explicitly and completely all options available to a user at the current step in a transaction sequence.	
<i>Source:</i>	Eurocontrol Echoes, 2003	
X.HF.G19		Menu activation
<i>Description:</i>	A menu should be activated by a click and shall require another click or action (moving of the object) to be deactivated.	
<i>Source:</i>	Eurocontrol Echoes, 2003 (modified)	
X.HF.R16		Groups of options
<i>Description:</i>	Groups of options in a menu shall be ordered according to user's logic.	
<i>Source:</i>	Eurocontrol Echoes, 2003	
X.HF.G20		Number of options
<i>Description:</i>	The number of options in a menu should not be more than ten or less than three.	
<i>Source:</i>	Eurocontrol Echoes, 2003	
X.HF.R17		Number of options
<i>Description:</i>	A menu shall display explicitly and completely all options available to a user at the current step in a transaction sequence.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

⁵ Generally the contents of menus are fixed. Items not available in a certain context will be present but 'greyed-out'.



4.2.6 Input Devices and Input Events

4.2.6.1 Mouse

X.HF.R18		Mouse buttons hand
<i>Description:</i>	Definition of mouse buttons, assignement of actions and results should be consistent throughtout the overall interface.	
<i>Source:</i>	ITWP, 2007	

X.HF.R19		Mouse buttons hand
<i>Description:</i>	The buttons mouse functions shall be interchangeable as an option for left-handed subjects.	
<i>Source:</i>	Eurocontrol Echoes, 2003 (modified)	

4.2.6.2 Keyboard

X.HF.G21		When to use
<i>Description:</i>	If applicable, keyboards should be provided for the entry of alphabetic, numeric, and other special characters into the system.	
<i>Source:</i>	Department of Defence, (MIL-STD-1472D), 1989	

X.HF.G22		Include a numeric keypad for entering numeric data
<i>Description:</i>	If an application requires substantial and repetitive input of numeric data, the keyboard should include a numeric keypad	
<i>Source:</i>	MIL-STD-1472D, 1989; Department of Defence (MIL-STD-1801), 1987	

X.HF.R20		Frequently used commands
<i>Description:</i>	Function keys shall be provided for frequently used commands, and shall be clearly labelled to indicate their function	
<i>Source:</i>	ATC (FAA) HF Checklist, 7.4.3	

X.HF.R21		Keyboard location
<i>Description:</i>	The main keyboard shall be located directly in front of and below the associated visual display, at a comfortable distance from the seated controller's position	
<i>Source:</i>	ATC (FAA) HF Checklist, 7.4.3	

X.HF.G23		Accidental activation
<i>Description:</i>	Guards should be in place for any key that would present a problem if inadvertently activated	
<i>Source:</i>	ATC (FAA) HF Checklist, 7.4.3	

4.2.6.3 Touch screen

X.HF.G24		Use
<i>Description:</i>	A touch panel or screen should be used to provide an overlaying control function to a display device (e.g., a CRT, an electro luminescent display, or a programmable indicator) if direct visual reference access and optimum direct control access are desired	
<i>Source:</i>	MIL-STD-1472D, 1989; DOE-HFAC1, 1992	



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X.HF.G25		Luminance transmission
<i>Description:</i>	Touch panels should have sufficient luminance transmission to allow the display to be clearly readable in the intended environment	
<i>Source:</i>	MIL-STD-1472D, 1989; DOE-HFAC1, 1992	

X.HF.G26		Minimal parallax
<i>Description:</i>	Touch-interactive devices should be selected and mounted to minimize parallax problems	
<i>Source:</i>	Avery & Bowser (DOE HFDG ATCCS V2.0), 1992	

X.HF.G27		Minimal specular glare
<i>Description:</i>	Touch-interactive devices should be selected and mounted to minimize specular glare	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

4.2.6.4 Menus and Pop-Up menus

4.2.6.4.1 General use

X.HF.G28		Use
<i>Description:</i>	Menus should be used for selecting values and choosing from a set of related options.	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G29		Selecting a mutually exclusive option
<i>Description:</i>	When users need to choose one option from a number of mutually exclusive options, a) radio buttons should be used for up to 6 options, b) a menu should be used for up to 10 options, and c) a scrolling menu should be used for more than 10 options.	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G30		Menus distinct from other displayed information
<i>Description:</i>	Menus should be distinct from the other objects or information on the screen	
<i>Source:</i>	MIL-HDBK-761A, 1989; DOE HFDG ATCCS V2.0, 1992; MIL-STD-1801, 1987; DOD HCISG V2.0, 1992	

X.HF.G31		Consistent style
<i>Description:</i>	Menus throughout an application should conform to a single style of interface	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

X.HF.G32		Consistent menus and options
<i>Description:</i>	When the same menu or option appears in different displays within an application, it should be consistent in wording, grammatical structure and organization.	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992 (modified)	

X.HF.G33		Menu titles
<i>Description:</i>	Menu titles and menu options should be easily distinguishable	
<i>Source:</i>	Ameritech Services Inc., 1996	



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X.HF.G34		Distinguishing menu titles
<i>Description:</i>	Menu titles should be easily distinguished from the options	
<i>Source:</i>	Ameritech Services Inc., 1996	

X.HF.G35		Numbering menu titles
<i>Description:</i>	Menu titles should not be numbered	
<i>Source:</i>	MIL-HDBK-761A, 1989; Defence Information Systems Agency, 1995	

X.HF.G36		Menu titles as options
<i>Description:</i>	The menu title should not appear as an option in the menu	
<i>Source:</i>	MIL-HDBK-761A, 1989	

4.2.6.4.2 Menu options

X.HF.G37		Highlighting menu options
<i>Description:</i>	A menu option should be highlighted when the pointer is on the menu option	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992	

X.HF.G38		Number of options
<i>Description:</i>	The number of options in a menu should not be more than 10	
<i>Source:</i>	MIL-HDBK-761A, 1989 (modified)	

X.HF.G39		Distinguishing unavailable options
<i>Description:</i>	When a menu contains options that are temporarily unavailable, the unavailable options should be displayed but clearly distinguishable from available options	
<i>Source:</i>	MIL-HDBK-761A, 1989	

X.HF.G40		Menus with no available options
<i>Description:</i>	When all the options on a menu are unavailable, then the menu title and all the options should be disabled (greyed out)	
<i>Source:</i>	Ameritech Services Inc., 1996	

4.2.6.4.3 Options organisation

X.HF.G41		Alignment of options
<i>Description:</i>	With the exception of a menu bar, the options in a menu should be presented in a single vertical column, aligned and left justified	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992; MIL-HDBK-761A, 1989; MIL-STD-1801,1987	

X.HF.G42		Ordering a number of options
<i>Description:</i>	When a group of options or a menu contains a number of options, the options should be ordered logically according to the requirement of the user.	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992 (modified)	



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X.HF.G43		Default option
<i>Description:</i>	The most likely selection in a menu list should be made the default option	
<i>Source:</i>	CTA, 1996	

4.2.6.4.4 Menu bars

X.HF.G44		Number of options
<i>Description:</i>	Menu bars should contain no more than 10 options plus Help	
<i>Source:</i>	DON UISNCCS, 1992] HFDS 2003 Chapter 8 Computer human interface, 8-77	

X.HF.G45		Placement of options
<i>Description:</i>	The options should begin at the left margin and extend to the right with Help located consistently, with enough space between them so that they can be read easily and accommodate the longest options in the pull-down menus	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G46		Names of menu bar options
<i>Description:</i>	Each menu that appears as an option in a menu bar should have a title that is unique in the application	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G47		Same menu bar in different windows
<i>Description:</i>	When the same menu occurs in different windows, it should have the same title in each	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G48		Menu bar activation
<i>Description:</i>	A menu bar should be activated b a single click and shall require another click or action (moving of the object) to be deactivated)	
<i>Source:</i>	ITWP, 2007	

4.2.6.4.5 Scrolling menus

X.HF.G49		When to use
<i>Description:</i>	Scrolling capability should be provided for menus used in data entry that are too long to display in their entirety (for example, lists of retrievable files or acceptable entries for a filed)	
<i>Source:</i>	Apple Computer Inc., 1992	

X.HF.G50		Scroll-bar
<i>Description:</i>	The scroll-bar should be placed at the right of the displayed options	
<i>Source:</i>	DON UISNCCS, 1992	



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X.HF.G51		Option display
<i>Description:</i>	The displayed options in a scrolling menu should be arranged vertically with one option per line	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G52		Order of options
<i>Description:</i>	The options in a scrolling menus should be ordered in a way that minimizes user navigation	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G53		Alphabetical arrangement
<i>Description:</i>	When ordering by expected frequency of use or in chronological or other sequential order is not appropriate, options should be ordered alphabetically	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G54		Display of all options in a scrolling menu
<i>Description:</i>	All the options in a scrolling menu should be available for explicit and complete display through scrolling.	
<i>Source:</i>	Apple Computer Inc.,1992	

4.2.6.4.6 Pop-up menus

Pop-up menus are menus that only appear on user demand. They are often associated with a particular object on a display, (for example, a pop-up menu listing acceptable command options close to the immediate work area). Because they are not displayed all of the time, they do not take up valuable screen space. They provide an efficient way to access commands because they eliminate the need for the user to navigate to a menu bar or control bar. A pop-up menu typically contains 5 to 10 options presented in a vertical listing. Pop-up menus can be very useful in data entry. They can present to a user the permissible entries for a field, thus eliminating the need for the user to remember the entries, preventing invalid entries, and eliminating potential typing errors. A pop-up menu resembles a pull-down menu, but it is not associated with the top level menu listed in the menu bar. [*source: CTA, 1996*].

X.HF.G55		Pop-up menus
<i>Description:</i>	Pop-up menus should follow the rules for standard pull-down menus and should be titled when required	
<i>Source:</i>	Microsoft Corp., 1992 (modified)	

X.HF.G56		Distinguishing the pop-up menu
<i>Description:</i>	The pop-up menu should be made distinct from the screen background by giving it a contrasting yet complementary background or by giving it a solid-line border	
<i>Source:</i>	CTA, 1996	

X.HF.G57		Pop-up menu location
<i>Description:</i>	A pop-up menu should be placed directly below the pointer used to select it and near the object or higher-level menu that is being manipulated	



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Source:	CTA, 1996
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X.HF.G58	Indication of pop-up menu
Description:	An indication or cue should be provided to the existence of a pop-up menu
Source:	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992

X.HF.G59	Selecting an option using a pointing device
Description:	A user should be able to select an option on a pop-up menu by moving the pointer onto the desired option and clicking the appropriate button
Source:	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992

X.HF.G60	Selection highlighting
Description:	When an option in a pop-up menu remains on display after it has been selected, it should remain highlighted
Source:	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992

X.HF.G61	Pop-up menus leading to cascading menus
Description:	When an option in a pop-up menu leads to a cascading menu, a right pointing triangle (▶) should be placed after the option label.
Source:	CTA, 1996

X.HF.G62	Options leading to cascading menus
Description:	Selected options that lead to a cascading menu should remain highlighted and serve as the title for the cascading menu.
Source:	CTA, 1996

4.2.7 Input Error Management Policy

X.HF.G63	Flexible "go back" for error correction
Description:	A system or application should allow a user to go back easily to previous steps in a transaction sequence in order to correct an error or make any other desired change.
Source:	DOE HFDG ATCCS V2.0, 1992

4.3 Visual presentation rules and conventions

4.3.1 Display hardware

4.3.1.1 General

X.HF.G64	Make displays legible under all conditions
Description:	Visual displays should be legible under all anticipated viewing conditions, and should maintain good image quality even at the dimmest possible setting
Source:	MIL-STD-1472F, 1999



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4.3.1.2 Glare

X.HF.G65		Glare Control
<i>Description:</i>	Glare should be eliminated or minimized	
<i>Source:</i>	ANSI, 1988; MIL-STD-1472F, 1999	

4.3.2 Principles for the presentation of data

4.3.2.1 General Principles

X.HF.G66		Simplicity
<i>Description:</i>	Information should be presented simply and in a well-organized manner. Ways to achieve simplicity include the following: <ol style="list-style-type: none"> a. The screen should appear to be orderly and clutter-free. b. Information should be presented in consistent, predictable locations. c. The language used should be plain and simple. d. The means for moving around the screen and to related screens should be simple. e. Interrelationships should be indicated clearly. 	
<i>Source:</i>	Avery & Bowser (DOE HFDG ATCCS V2.0), 1992; Avery & Bowser (DOD HCISG V2.0), 1992	

X.HF.G67		Minimizing the user's short-term memory load
<i>Description:</i>	A single window should contain all relevant information and should allow a user to complete the task without having to refer to additional information	
<i>Source:</i>	Department of the Navy (DON UISNCCS, 1992), 1992	

4.3.2.2 Organisation of information

X.HF.G68		Priority of displayed information
<i>Description:</i>	Information should be prioritized so that the most important or critical information is displayed all the time and less important or critical information can be displayed upon a user's request	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992	

X.HF.G69		Grouped information
<i>Description:</i>	Groups of data items should be separated by a blank space, lines, colour-coding, or other visually distinctive means	
<i>Source:</i>	MIL-HDBK-761A, 1989	



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X.HF.G70		Primary viewing area
<i>Description:</i>	Information that is particularly important or that requires immediate user response should be displayed in the user's primary viewing area	
<i>Source:</i>	DOD HCISG V2.0, 1992	

X.HF.G71		Task-critical information
<i>Description:</i>	When a window contains task-critical information, that information should be displayed in a way that users can identify easily, (for example, separating it from other information by a blank space)	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G72		Ordering of information
<i>Description:</i>	When displayed information is to be used in some spatial or chronological order, its arrangement on the screen should preserve that order. When ordering displayed information by sequence, function, frequency, or importance is not appropriate, some other method such as alphabetical or chronological should be followed.	
<i>Source:</i>	DOD HCISG V2.0, 1992	

X.HF.G73		Minimal visual competition
<i>Description:</i>	Information on a display screen should be organized so that visual competition among distinct items of information is minimized.	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992	

X.HF.G74		Matching layout to task
<i>Description:</i>	Application designers should design the screen layout so that users can move quickly and easily among items and can manipulate objects in ways that support task performance	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G75		Removal of Information from the screen
<i>Description:</i>	Information that the controller needs should not disappear from the screen without being deleted or suppressed by the controller	
<i>Source:</i>	ATC (FAA) HF Checklist	

X.HF.G76		Highlighting
<i>Description:</i>	When a user is performing an operation on a selected object in a display, that object should be highlighted	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; MIL-HDBK-761A, 1989	

X.HF.G77		Display Consistency
<i>Description:</i>	There should be a high level of consistency between screen structures, screen elements, display formats, and location of instructions and prompts	
<i>Source:</i>	MIL-HDBK-761A, 1989	

4.3.2.3 Text properties



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4.3.2.3.1 Fonts and sizes

X.HF.G78		Number of different fonts
<i>Description:</i>	There should be a limit of two different fonts displayed on any one screen	
<i>Source:</i>	National Air Traffic Services, 1999]	

X.HF.G79		Text size and style
<i>Description:</i>	Variations in the size and style within a font should be used to categorize the information into different levels	
<i>Source:</i>	National Air Traffic Services, 1999	

4.3.2.3.2 Vocabulary and abbreviations

X.HF.G80		Vocabulary
<i>Description:</i>	The words used in all non-editable text should be task-oriented and familiar to users	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G81		Consistent wording and structure
<i>Description:</i>	The wording and grammatical structure of displayed data and labels should be consistent throughout an application and related applications	
<i>Source:</i>	MIL-HDBK-761A, 1989	

X.HF.G82		Use of abbreviations
<i>Description:</i>	When a system or application uses abbreviations in its user-computer interface, the abbreviations should be unique, distinct, and unambiguous so as not confuse users	
<i>Source:</i>	MIL-HDBK-761A, 1989; Department of Defence (MILSTD-12D), 1981	

X.HF.G83		Acronyms
<i>Description:</i>	Acronyms should be used only if they will be seen more than once, are significantly shorter than the term they represent, and the users will commonly understand them	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G84		Acronym format
<i>Description:</i>	Acronyms should be displayed in all upper-case letters	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G85		Consistent abbreviation use
<i>Description:</i>	When used, abbreviations should be used consistently throughout an application or set of related applications	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992	

4.3.2.3.3 Style and layout

X.HF.G86		Contrast
<i>Description:</i>	Text should be displayed as black characters on a white or light background. The contrast between text and its background should be sufficiently high to ensure readability of the text	
<i>Source:</i>	DON UISNCCS, 1992	



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X.HF.G87 Suitability/appropriateness of bold coding	
<i>Description:</i>	Bold coding should be used for strong emphasis. No more than three levels of bold coding should be used
<i>Source:</i>	National Air Traffic Services, 1999

4.3.2.4 Viewing distances

X.HF.G88 Range for viewing distance	
<i>Description:</i>	Minimum and maximum viewing distances for displays should be determined by the legibility of the displayed information
<i>Source:</i>	MIL-STD-1472F, 1999 (modified)

4.3.2.5 Radar Labels

X.HF.G89 Aircraft information	
<i>Description:</i>	The presented aircraft information should clearly indicate if the aircraft status or evolution requires a controller action.
<i>Source:</i>	Eurocontrol Echoes, 2007

X.HF.G90 Aircraft parametre	
<i>Description:</i>	Information concerning the aircraft's current flight parameters should be available on controller request, in an easy and rapid way.
<i>Source:</i>	Eurocontrol Echoes, 2007

X.HF.G91 Aircraft flight data avialibility	
<i>Description:</i>	The controller receiving the aircraft should be informed of the availability of the aircraft flight data on reception of the flight notification.
<i>Source:</i>	Eurocontrol Echoes, 2007 (modified)

X.HF.G92 Aircraft flight data update	
<i>Description:</i>	The controller in the sending Unit should be informed that flight activation has been performed on the aircraft. The controller in the receiving Unit should be informed of the availability of the updated aircraft flight data on reception of the flight activation.
<i>Source:</i>	Eurocontrol Echoes, 2007 (modified)

X.HF.G93 Inactive label	
<i>Description:</i>	After having successfully sent the transfer of communication or the release of an aircraft, the transferring controller should no more have the capability to input any order (clearance) on that aircraft.
<i>Source:</i>	Eurocontrol Echoes, 2007 (modified)

X.HF.G94 Notification of an aircraft	
<i>Description:</i>	The controller in the receiving Unit should be informed of the availability of the aircraft flight data on reception of the flight notification. The controller in the receiving Unit should be provided with adequate (ease of use, consistency,



	predictability - see the Style Guide) means to access the aircraft flight data.
Source:	Eurocontrol Echoes, 2007 (modified)

X.HF.G95		Transfer of an aircraft
Description:	The reception of the transfer of communication or of the release of an aircraft by the accepting Unit should enable the controller to assume the control of that aircraft.	
Source:	Eurocontrol Echoes, 2007	

4.3.2.6 Check boxes (i.e. on EFS)

Check boxes (also known as nonexclusive buttons) are single, two-state choices. For example, a check box can be on, (checked) or off (not checked). A check box group is a collection of two-state choices, all of which apply to the same selected object. Check boxes can be grouped.

X.HF.G96		Selecting check boxes
Description:	Users should be able to toggle selected and unselected states on a check box using either a pointing device or the keyboard	
Source:	DON UISNCCS, 1992	

X.HF.G97		Check box states
Description:	Check boxes should have two states, selected and unselected.	
Source:	DON UISNCCS, 1992	

X.HF.G98		Labelling check boxes
Description:	Labels should be provided for each set of check boxes	
Source:	CTA, 1996	

X.HF.G99		Check box height and width
Description:	When grouping check boxes, the boxes should be equal in height and width	
Source:	CTA, 1996	

4.3.2.7 Cursors

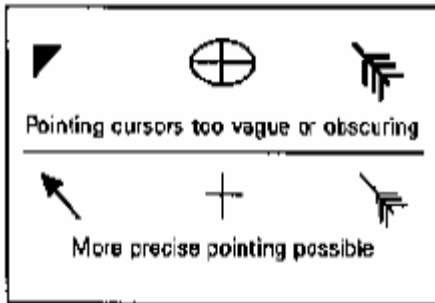
X.HF.G100		Cursor movement
Description:	When entering and editing text, users should be able to move the cursor freely within a displayed page to specify items for change and to make changes directly in the text	
Source:	MIL-HDBK-761A, 1989	

X.HF.G101		Size
Description:	Position or pointing cursors should maintain their size across all screen locations during movement	
Source:	Ameritech Services Inc., 1996	

X.HF.G102		Rate of movement
<i>Description:</i>	Position or pointing cursors should move rapidly in response to the pointing device (less than 100msec).	
<i>Source:</i>	Ameritech Services Inc., 1996	

X.HF.G103		Pointer location
<i>Description:</i>	The pointer should be easy to locate on the screen of the user.	
<i>Source:</i>	ITWP, 2007	

X.HF.G104		Cursor active point
<i>Description:</i>	A pointer should have an active point to indicate the precise location where an operation will occur. These points are specified for a variety of pointer shapes	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992 (modified)	



4.3.2.8 Maps and Tactical Displays

4.3.2.8.1 Characteristics

X.HF.G105		Intensity
<i>Description:</i>	The intensity of the map should be controllable to allow the map to be dimmed without losing all the map features	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

X.HF.G106		Map as background
<i>Description:</i>	When an application uses one map intensively, it is recommended that the map be used as the background or base screen, which should be the maximum display size possible to promote readability	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

X.HF.G107		Map size
<i>Description:</i>	Map displays should be large enough to permit the simultaneous presentation and visual integration required by users	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

X.HF.G108		Coverage
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<i>Description:</i>	Maps should cover the areas and display all the essential features and details users need to perform their tasks
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992

X.HF.G109	Situation displays as overlays
<i>Description:</i>	Situation displays (additional view windows) should be provided to their related maps
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992 (modified)

X.HF.G110	Map orientation
<i>Description:</i>	Users should have a possibility to orient the map in order to perform their task
<i>Source:</i>	ITWP, 2007

X.HF.G111	Areas of special interest
<i>Description:</i>	Map areas of special interest should be differentiated by colour or shading
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992 (modified)

X.HF.G112	Reading a map
<i>Description:</i>	Users should be provided with a means or easily determining distance and bearing between any two points on a map
<i>Source:</i>	DON UISNCCS, 1992

X.HF.G113	Labelling features
<i>Description:</i>	To the extent possible without cluttering the display, all significant features should be labelled
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992

X.HF.G114	Consistent label position
<i>Description:</i>	Map labels should be positioned consistently with respect to the feature they identify, for example, to the left of or below the feature, but without obscuring important information
<i>Source:</i>	DON UISNCCS, 1992

X.HF.G115	Label legibility
<i>Description:</i>	Labels should remain legible at all display resolutions
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992

X.HF.G116	Association of symbols with map features
<i>Description:</i>	A symbol should be placed accurately with respect to the map feature with which it is associated, or connected to the feature with an arrow, line, or other pointing device so that the association between feature and symbol is clear
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992

X.HF.G117	Reducing clutter
<i>Description:</i>	Users should be provided with a means for reducing clutter without losing essential information, such as the use of filters
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992



4.3.2.8.2 Graphic display manipulation

X.HF.G118		User control of map appearance
<i>Description:</i>	Users should be able to customize a map to conform to the task being performed. Methods include: pan and zoom, return to initial appearance, define a home position and return to this position easily, move a map window, define the map appearance (for example, assign colours to areas), and select the objects that appear on the map and change the appearance of critical information	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G119		Map manipulation
<i>Description:</i>	The system should provide users with all appropriate tools for moving easily around a map, including zooming and panning as well as insets, registration, and keys for scale	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

X.HF.G120		Return to start
<i>Description:</i>	When panning is provided, users should have the ability to return to the starting configuration quickly and easily	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

X.HF.G121		Zooming and legibility
<i>Description:</i>	Zooming in and out should not interfere with the ability of users to read symbols, labels, and other map features	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

X.HF.G122		Discrete vs. continuous zooming
<i>Description:</i>	The method of zooming provided, discrete or continuous, should be acceptable to the users	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

4.3.2.8.3 Dynamic information update

X.HF.G123		Alphanumeric data
<i>Description:</i>	Alphanumeric data that users are required to read reliably and accurately should not be updated more often than once a second	
<i>Source:</i>	MIL-HDBK-761A, 1989	

4.3.3 Alarms and critical information

X.HF.G124		Display of alarms
<i>Description:</i>	Alarms or critical information that a controller must read quickly should never blink or flash.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R22		Alerts causes
<i>Description:</i>	Alerting and warning systems shall be unambiguous, with a clear indication of the cause for the alert.	
<i>Source:</i>	Eurocontrol Echoes, 2003	



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X.HF.G125		Use of alarms
<i>Description:</i>	Alarms should <ol style="list-style-type: none"> a. alert the user to the fact that a problem exists, b. inform the user of the priority and nature of the problem, c. guide the user's initial responses, and d. confirm in a timely manner whether the user's response corrected the problem. 	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R23		Visual and Auditory Alarm
<i>Description:</i>	When used in conjunction with a visual display, an audio signal shall be supplementary or supportive, alerting and directing the user's attention to the appropriate visual display.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

X.HF.R24		Priority between alerts
<i>Description:</i>	When two or more incidents or malfunctions occur simultaneously, the one generating a message of higher priority shall be presented first. After presentation of the highest priority message, remaining messages shall be presented in descending order of priority.	
<i>Source:</i>	Eurocontrol Echoes, 2003	

4.3.4 Visual alerts

4.3.4.1 General

X.HF.R25		Alert Location
<i>Description:</i>	High-priority and other critical information shall be located within the central display areas (the central 15 degrees of the area where the controller normally looks, given the normal viewing position). If alert is displayed should not be hidden by other windows and objects.	
<i>Source:</i>	ATC (FAA) HF Checklist, 9.3.4, 7.2.11 (modified)	

X.HF.G126		Reducing False Alarms
<i>Description:</i>	Alerts should have a low incidence of false alarms	
<i>Source:</i>	ATC (FAA) HF Checklist, 7.2.11	

X.HF.G127		Coding
<i>Description:</i>	Coding should be used to differentiate items of information, call a user's attention to important information; unusual situations, or potential problems that require user action; or indicate changes in the state of a system	
<i>Source:</i>	MIL-HDBK-761A, 1989	

X.HF.G128		Attention
<i>Description:</i>	A user's attention should be drawn to critical or abnormal information by highlighting, inverse video, colour-coding, or other means. Coding techniques that have strong attention-getting qualities (for example, colour and flashing) should be used sparingly and judiciously	
<i>Source:</i>	National Air Traffic Services, 1999	



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X.HF.G129		Misuse of Visual Coding
<i>Description:</i>	Visual coding should be used for functional, not decorative, purposes	
<i>Source:</i>	National Air Traffic Services, 1999	

X.HF.G130		Consistency
<i>Description:</i>	Coding should be consistent throughout an application and related applications	
<i>Source:</i>	MIL-HDBK-761A, 1989	

4.3.4.2 Icons, buttons and controls

X.HF.G131		Design of symbols
<i>Description:</i>	To the extent possible, a symbol should be an analogy of the object it represents in general use and well known to the users or based on established standards or conventional meanings	
<i>Source:</i>	MIL-HDBK-761A, 1989	

X.HF.G132		Minimum selectable area
<i>Description:</i>	The selectable area or hotspot outside of the area of the icon should be at least 4 millimetres	
<i>Source:</i>	Ameritech Services Inc., 1996	

X.HF.G133		Creating icons
<i>Description:</i>	When existing icons are not satisfactory, the user should create drawings that are meaningful representations to users, easily recognizable, and visually distinct from each other	
<i>Source:</i>	CTA, 1996	

4.3.4.3 Use of colours principles

X.HF.G134		Use of Colour
<i>Description:</i>	Colour should be used: <ol style="list-style-type: none"> a. to augment a user's understanding of the information being presented, b. to attach specific meaning to a portion of text or a symbol, c. to direct a user's attention to something (highlighting critical elements), d. to reduce clutter, e. to identify and classify information, f. to indicate changes in status, g. As a formatting aid, and to enhance legibility. 	
<i>Source:</i>	DOD HCISG V2.0, 1992; National Air Traffic Services, 1999	

X.HF.G135		Reserved meanings
<i>Description:</i>	Cultural colour conventions should not be violated. Colour-coding should conform to the following reserved meanings consistent with conventional associations for particular colours: <ol style="list-style-type: none"> a) Red should indicate conditions such as no-go, error, failure, or malfunction. b) Flashing red should be used only to indicate emergency conditions requiring immediate user action to avert personnel injury or equipment damage. c) Yellow should indicate marginal conditions, alert users to situations where caution or rechecking is necessary, or notify users of an unexpected delay. 	



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<i>Source:</i>	MILHDBK- 761A, 1989 (modified)
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X.HF.G136 Colour coding strategy	
<i>Description:</i>	The same colour coding strategy should be applied to every display used by the same controller, and colours should be used consistently within a screen, within an application, and across a set of applications
<i>Source:</i>	DON UISNCCS, 1992

X.HF.G137 Data categories	
<i>Description:</i>	When colour is used to identify data categories, its use should not conflict with other colour-coding conventions
<i>Source:</i>	MIL-HDBK-761A, 1989

X.HF.G138 Redundant use	
<i>Description:</i>	The use of colour should not reduce screen readability
<i>Source:</i>	DOD HCISG V2.0, 1992

X.HF.G139 Small areas	
<i>Description:</i>	Users should not have to discriminate among colours in small areas
<i>Source:</i>	DOD HCISG V2.0, 1992

X.HF.G140 Drawing attention	
<i>Description:</i>	Brighter or more saturated colours should be used to draw a user's attention to critical data
<i>Source:</i>	MIL-HDBK-761A, 1989

X.HF.G141 Colours for action and status	
<i>Description:</i>	Longer wavelength colours (for example, red and orange) should be used to suggest action or a demand for a response
<i>Source:</i>	DOD HCISG V2.0, 1992

X.HF.G142 Relative colour	
<i>Description:</i>	The colour of other figures and the background relative to a particular item should be considered in order to provide the appropriate colour contrast and emphasis to the colour-coding of a particular item.
<i>Source:</i>	MIL-HDBK-761A, 1989

X.HF.G143 Colour pairs	
<i>Description:</i>	The following colour pairs should be avoided: saturated red and blue, saturated red and green, saturated blue and green, saturated yellow and green, yellow on purple, green on white, yellow on green, blue on black, magenta on green, red on black, magenta on black, yellow on white.
<i>Source:</i>	CTA, 1996



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X.HF.G144		Test colours
<i>Description:</i>	Selected colours should be tested with users to verify that the colours can be easily discriminated from each other	
<i>Source:</i>	CTA, 1996	

X.HF.G145		Varying lightness
<i>Description:</i>	Colour combinations that are similar in lightness should be avoided (for example, navy blue on black, yellow on white).	
<i>Source:</i>	CTA, 1996	

X.HF.G146		Foreground and background contrast
<i>Description:</i>	The foreground colour should contrast highly with the background	
<i>Source:</i>	DOD HCISG V2.0, 1992	

4.3.4.4 Brightness / intensity coding

X.HF.G147		High brightness
<i>Description:</i>	High brightness should be used to call attention to errors in data-entry fields and to highlight answer fields on question and answer screens	
<i>Source:</i>	CTA, 1996	

X.HF.G148		Highlighting during operations
<i>Description:</i>	When a user is performing an operation on a selected object in a display, that object should be highlighted	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; MILHDBK-761A, 1989	

X.HF.G149		Highlighting on dark backgrounds
<i>Description:</i>	When the background is dark, white highlighting should be used with dark letters to draw attention to particular data or portions of the screen	
<i>Source:</i>	DOD HCISG V2.0, 1992	

X.HF.G150		Highlighting on light backgrounds
<i>Description:</i>	When the background is light, dark highlighting should be used with white letters to draw attention to particular data or portions of the screen	
<i>Source:</i>	DOD HCISG V2.0, 1992	

X.HF.G151		Size and number of areas highlighted
<i>Description:</i>	The size and number of areas highlighted should be minimized	
<i>Source:</i>	DOD HCISG V2.0, 1992	

4.3.4.5 Flashing

X.HF.G152		Flash rate for Error Messages
<i>Description:</i>	Information that the controller must read and understand quickly, such as alarms or critical error messages, should never blink or flash rapidly (greater than 3Hz).	
<i>Source:</i>	ATC (FAA) HF Checklist	



4.3.5 Auditory alerts

X.HF.G153		Use
<i>Description:</i>	Auditory alerts should be used only as necessary, to alert the controller of any impending danger or critical change in the system or equipment status and to alert him of any actions that need to be taken. They can also be used to supplement visual signals and to present information in situations in which visual presentation is not feasible and to provide feedback for control actuation, data entry or the completion of timing cycles and sequences.	
<i>Source:</i>	MIL-HDBK-761A, 1989	

X.HF.G154		Application
<i>Description:</i>	An audio signal should be provided when the information to be processed is short, simple, and transitory and requires immediate or time-based response. The criticality of a response to a visual signal makes supplementary or redundant alerting desirable. It is desirable to warn, alert, or cue the user for subsequent or additional responses and when voice communication is necessary or desirable	
<i>Source:</i>	MIL-STD-1472F, 1999	

X.HF.G155		Annoyance factors
<i>Description:</i>	Alerts should not annoy or antagonize the controller	
<i>Source:</i>	ATC (FAA) HF Checklist 7.3.5, 7.3.6	

X.HF.G156		Alarms for normal conditions
<i>Description:</i>	Auditory alarms should not be used to indicate normal conditions	
<i>Source:</i>	Wiener, 1988	

4.3.5.1 Differentiation of signals

X.HF.G157		Differentiating signals
<i>Description:</i>	Auditory signals that require different user responses should be easily distinguishable from one another	
<i>Source:</i>	MIL-STD-1472F, 1999	

X.HF.G158		Multiple audio signals
<i>Description:</i>	When several different audio signals will be used to alert a user to different conditions, the signals should be distinctive in intensity, pitch, or use of beats and harmonics	
<i>Source:</i>	MIL-STD-1472F, 1999	

4.3.5.2 Signals meaning

X.HF.G159		Consistent signals and meanings
<i>Description:</i>	The meaning of audio warning signals selected for a particular function in a system should be consistent with warning signal meanings already established for that function	
<i>Source:</i>	MIL-STD-1472F, 1999	



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4.3.5.3 Duration

X.HF.G160		Signal termination
<i>Description:</i>	Completion of a corrective action by the user or by other means should automatically terminate the signal	
<i>Source:</i>	MIL-STD-1472F, 1999	

Intensity (loudness)

X.HF.G161		Environmental compatibility
<i>Description:</i>	The intensity, duration, and source location of an auditory signal should be compatible with the acoustic environment of the intended receiver as well as with the requirements of other personnel within acoustic range of the signal	
<i>Source:</i>	MIL-HDBK-761A, 1989	

X.HF.G162		Volume limits
<i>Description:</i>	Volume control movement should be restricted to prevent reducing the volume to an inaudible level or increasing it to an unacceptably high level	
<i>Source:</i>	MIL-STD-1472F, 1999	

4.3.5.4 Acknowledging signals

X.HF.G163		Acknowledging and terminating alarms
<i>Description:</i>	A system or application should provide users with a means of acknowledging alarms and of turning off alarm signals once the alarms have been acknowledged or the condition generating the alarm has been corrected	
<i>Source:</i>	MIL-STD-1801, 1987	

X.HF.G164		Automatic reset
<i>Description:</i>	An automatic reset function for audio signals should be provided, whether the signals are designed to terminate automatically, manually, or both. The automatic reset function should be controlled by a sensing mechanism that recycles the signal system to a specified condition as a function of time or the state of the signalling system so that the warning device can sound again if the condition reappears	
<i>Source:</i>	MIL-STD-1472F, 1999	

4.3.6 Designing windows

4.3.6.1 General

Windows can be either modal or modeless. A modal window is a window with which a user must interact before being able to interact with any other windows. That is, a user cannot interact with other windows as long as the modal window is displayed. When a window is modeless, a user can interact with other windows.

X.HF.G165		User-specified windows
<i>Description:</i>	When there is a need to view several different types of data simultaneously, the user should be able to display and select separate windows on a single CRT screen	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	



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X.HF.G166		Number of allowable open windows
<i>Description:</i>	The number of allowable open windows should not compromise system response time	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

X.HF.G167		Window size
<i>Description:</i>	Windows should be large enough to: present all relevant information for the task, not obscure important information, not cause crowding or visual confusion, and minimize the need for scrolling. The default size of the window should be less than the full size of the entire screen. When possible, the initial size of a window should permit the display of all its contents	
<i>Source:</i>	National Air Traffic Services, 1999	

X.HF.G168		Window Resizing
<i>Description:</i>	Where applicable, the application should provide a resize operation that enables a user to change the size of a window	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G169		Moved or resized windows
<i>Description:</i>	When a window has been moved or resized or both and is then closed and reopened during an application session, it should reappear in the size and location it had when it was closed	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G170		Default location for moved or resized windows
<i>Description:</i>	When a window has been moved or resized in the current session, it should appear in its default location at the next application session	
<i>Source:</i>	DON UISNCCS, 1992	

4.3.6.2 Window states

X.HF.G171		Window movement limits
<i>Description:</i>	The user should never be able to move a window off the display so that it cannot be seen, although it may be completely hidden by one or more other windows	
<i>Source:</i>	Ameritech Services Inc., 1996	

4.3.6.3 Window organisation

X.HF.G172		Window default location
<i>Description:</i>	Each window should have a default location at which the window appears when it is first opened. The initial placement of a window should be based on the importance of the information (critical information should be placed in the centre of the user's field of view), information already displayed that should not be obscured, the distance from the current pointer location (pointer movement should be minimized), and when applicable, information already displayed that is relevant to the window	
<i>Source:</i>	DON UISNCCS, 1992	



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4.3.6.4 Window components

4.3.6.4.1 Title bar

X.HF.G173		Use
<i>Description:</i>	A title bar should appear as a rectangular area at the top of a window inside the window border and with the title of the window in the centre	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.G174		Capitalization in window titles
<i>Description:</i>	Significant words in the title (except user-defined words) should be capitalized	
<i>Source:</i>	Ameritech Services Inc., 1996	

4.3.7 System response time

X.HF.G175		Appropriate system response time
<i>Description:</i>	The response time of a system to a user action should be appropriate to the type of transaction, the time constraints of the task, and any specific data processing requirements	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; MILHDBK-761A, 1989	

5 ANNEX : HUMAN FACTOR RECOMMENDATIONS FOR THE SYSTEM DESIGN

Annex gathers the HF requirements assessed to be HMI recommendations for the ITWP design. Distinction has been made between requirements (X.HF.ARx), guidelines (X.HF.AGx) to categorise between mandatory and desirable aspects.

5.1 Inputs

5.1.1 Input Devices and Input Events

5.1.1.1 Touch screen

X.HF.AG1		Positive indication
<i>Description:</i>	A positive indication of touch-panel activation should be provided to acknowledge the system response to the control action	
<i>Source:</i>	MIL-STD-1472D, 1989; DOE-HFAC1, 1992	

X.HF.AG2		Display feedback
<i>Description:</i>	Display of user command or action feedback for touch panels should not exceed 0.25 seconds	
<i>Source:</i>	MIL-STD-1472D, 1989	

5.1.1.2 Menus and Pop-Up menus

5.1.1.2.1 Options organisation

X.HF.AG3		Placing destructive command options
<i>Description:</i>	When menu organization is based on such principles as frequency of use, the designer should place destructive commands (Delete, Exit) at the bottom of the menu.	
<i>Source:</i>	CTA, 1996	

5.1.1.2.2 Menu bars

X.HF.AG4		When to use
<i>Description:</i>	A menu bar should only be used if the display screen size and resolution permit fast and accurate movement of the cursor onto the options	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992	

5.1.1.2.3 Pull down menus

X.HF.AG5		When to use
<i>Description:</i>	Pull-down menus should be used rather than pop-up menus if the position of the cursor on the screen is not important for information or option retrieval	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; DOD HCISG V2.0, 1992	



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X.HF.AG6		Consistent location
<i>Description:</i>	Pull-down menus should always appear immediately below the option whose selection leads to their appearance	
<i>Source:</i>	MIL-HDBK-761A, 1989	

X.HF.AG7		Titles
<i>Description:</i>	The title of a pull-down menu should be the option on the menu bar with which the pull-down menu is associated	
<i>Source:</i>	DON UISNCCS, 1992, HFDS 2003 Chapter 8 Computer human interface	

X.HF.AG8		Unique title
<i>Description:</i>	The title of a pull-down menu should be unique in the menu bar and, to the extent possible, describe or identify the options in the pull-down menu	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.AG9		Outlining
<i>Description:</i>	Pull-down menus should be outlined with a border or drop shadow.	
<i>Source:</i>	CTA, 1996	

X.HF.AG10		Cascading pull-down
<i>Description:</i>	When a pull-down option leads to a second-level cascading pull-down, the option label should be followed with a right-pointing arrow	
<i>Source:</i>	CTA, 1996	

X.HF.AG11		Separators to divide groups of options
<i>Description:</i>	The number of options in a pull down menu should not be more than 10 or less than 3	
<i>Source:</i>	DON UISNCCS, 1992	

X.HF.AG12		Minimize scrolling
<i>Description:</i>	To the extent possible, all options should be present to minimize scrolling	
<i>Source:</i>	CTA, 1996	

X.HF.AG13		Option selection
<i>Description:</i>	A user should be able to select an option on a pull-down menu by moving the pointer onto the desired item and selecting it	
<i>Source:</i>	Ameritech Services Inc., 1996	

5.1.1.2.4 Cascading menus

A **cascading menu** is a type of hierarchical menu in which a submenu is attached to the right side of a menu item. Cascading menus can be added to drop-down menus, pop-up menus, or even other cascading menus (source: Microsoft Corp., 1992, HFDS 2003 Chapter 8 Computer human interface 8-83).

X.HF.AG14		When to use
<i>Description:</i>	Cascaded menus should be considered when the menu bar is crowded and the grouping of options is obvious to the user	



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<i>Source:</i>	Ameritech Services Inc., 1996
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X.HF.AG15	Cascading menus
<i>Description:</i>	Cascading menus should follow the same rules as hierarchical menus
<i>Source:</i>	Microsoft Corp., 1992

X.HF.AG16	Cascade indicator
<i>Description:</i>	Every cascaded menu item that leads to cascading menus should be marked with a cascade indicator after the menu item name
<i>Source:</i>	Ameritech Services Inc., 1996

X.HF.AG17	Number of levels
<i>Description:</i>	Because cascaded menus require the user to remember where options are located or buried (the original menu may be partially hidden by the new cascaded menu), the number of levels should be limited to one
<i>Source:</i>	Ameritech Services Inc., 1996

5.1.2 Input Error Management Policy

X.HF.AR1	Provision of Error messages
<i>Description:</i>	Error messages shall be provided whenever needed (upon questionable data entries) and provide and briefly summarize the specific problem and propose a specific solution
<i>Source:</i>	ATC (FAA) HF Checklist, 7.5.5, 7.5.6, 7.5.8

X.HF.AG18	Format
<i>Description:</i>	Error messages should be direct, precise, and not redundant
<i>Source:</i>	ATC (FAA) HF Checklist, 7.2.14, 7.5.6

X.HF.AR2	Presentation time
<i>Description:</i>	Error messages shall be presented immediately after an error's occurrence
<i>Source:</i>	ATC (FAA) HF Checklist, 7.5.7

X.HF.AG19	Error recovery
<i>Description:</i>	All conditions and information relevant for user recovery from an error should be displayed to the user
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992; MIL-STD-1801, 1987



5.2 Visual presentation rules and conventions

5.2.1 Principles for the presentation of data

5.2.1.1 General Principles

X.HF.AG20		Group task-related displays together
<i>Description:</i>	All displays necessary to support a user's activities or sequence of activities should be grouped together.	
<i>Source:</i>	MIL-STD-1472F, 1999	

5.2.1.1.1 Style and layout

X.HF.AG21		Distinctive appearance
<i>Description:</i>	Text entered by a user should be clearly distinguishable from system-supplied text that also appears on the screen.	
<i>Source:</i>	MIL-HDBK-761A, 1989	

X.HF.AG22		Text Fields
<i>Description:</i>	When a user must be able to type input from the keyboard, a text field should be provided	
<i>Source:</i>	DON UISNCCS, 1992	

5.2.1.2 Cursors

X.HF.AG23		Blink
<i>Description:</i>	Position or pointing cursors should not blink	
<i>Source:</i>	Ameritech Services Inc., 1996	

X.HF.AG24		Pointer visibility
<i>Description:</i>	The pointer should disappear when a user begins typing and reappear when the user stops typing or when he or she moves the pointing device.	
<i>Source:</i>	Add reff	

X.HF.AG25		Movement
<i>Description:</i>	Position or pointing cursors should not move without input of the user	
<i>Source:</i>	Ameritech Services Inc., 1996	

5.2.1.3 Maps and Tactical Displays

5.2.1.3.1 Characteristics

X.HF.AG26		Connecting text to features
<i>Description:</i>	When the text is offset from the feature to which it refers, it should be connected to the feature with a line or arrow	
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992	

X.HF.AG27		Determining coordinates
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<i>Description:</i>	Users should be able to obtain the exact map coordinates of any symbol or map feature
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992

5.2.1.3.2 Graphic display manipulation

X.HF.AG28	Grid overlay
<i>Description:</i>	Users should be able to display and remove a grid overlay on a map
<i>Source:</i>	DOE HFDG ATCCS V2.0, 1992

5.2.1.4 Radar Labels

X.HF.AG29	Mark in label
<i>Description:</i>	Where a dialogue requires a response from the accepting Unit, the controller in the transferring Unit should be provided with support for remembering the content and tracking the co-ordination process.
<i>Source:</i>	Eurocontrol Echoes, 2007

5.2.2 Visual alerts

5.2.2.1 Use of colours principles

X.HF.AG30	Colour legends
<i>Description:</i>	Colour should not be used to substitute for written legends
<i>Source:</i>	National Air Traffic Services, 1999

X.HF.AG31	Colour brightness
<i>Description:</i>	When colour is used to emphasize information, the brightest colour should be used for the most important information
<i>Source:</i>	DOD HCISG V2.0, 1992

X.HF.AG32	Number of levels on coloured displays
<i>Description:</i>	Due to the relationship between brightness and colour, a maximum of two luminance levels should be used for coding on coloured displays
<i>Source:</i>	National Air Traffic Services, 1999

5.2.2.2 Brightness / intensity coding

X.HF.AG33	More than one brightness level
<i>Description:</i>	When two brightness levels are used to code information, the higher brightness should apply to the more critical information, and the lower brightness to the less critical information
<i>Source:</i>	National Air Traffic Services, 1999

X.HF.AG34	Reverse video
<i>Description:</i>	Reverse video (for example, brightness inversion) should be used to highlight critical items requiring user attention, and return to a normal brightness when the user has responded
<i>Source:</i>	CTA, 1996

X.HF.AG35	Validation
<i>Description:</i>	Before the appropriate auditory signals are incorporated into the system, they should be tested and evaluated for usability and suitability from an operating point of view
<i>Source:</i>	Ameritech Services Inc., 1996



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5.2.3 Auditory alerts

X.HF.AG36 Avoid negative consequences	
<i>Description:</i>	Auditory signals should not result in user or operator confusion, errors, or inefficiencies in response
<i>Source:</i>	Ameritech Services, Inc., 1996

X.HF.AG37 Compatible with environment	
<i>Description:</i>	Auditory signals should also be compatible with the acoustical environment of the controller
<i>Source:</i>	MIL-STD-1472F, 1999

X.HF.AG38 Validation	
<i>Description:</i>	Before the appropriate auditory signals are incorporated into the system, they should be tested and evaluated for usability and suitability from an operating point of view
<i>Source:</i>	Ameritech Services Inc., 1996

5.2.3.1 Number of signals

X.HF.AG39 Number of audio signals for absolute identification	
<i>Description:</i>	When absolute identification is required, the number of signals to be identified should not exceed four
<i>Source:</i>	MIL-STD-1472F, 1999

5.2.3.2 Differentiation of signals

X.HF.AG40 Differentiation from routine signals	
<i>Description:</i>	Audio alarms intended to attract the user's attention to a malfunction or failure should be different from routine signals such as bells, buzzers, random noises generated by air conditioning and other equipment and normal operation noises
<i>Source:</i>	MIL-STD-1472F, 1999

5.2.3.3 Signals meaning

X.HF.AG41 Established signals	
<i>Description:</i>	Established signals should be used provided they are compatible with the acoustic environment and voice communication systems
<i>Source:</i>	MIL-STD-1472F, 1999

5.2.3.4 Periodicity

X.HF.AG42 Intermittence	
<i>Description:</i>	Auditory signals should be intermittent rather than continuous
<i>Source:</i>	MIL-HDBK-761A, 1989

5.2.3.5 Frequency

X.HF.AG43 Frequency range	
<i>Description:</i>	The frequency range of a warning signal should be between 200 and 5,000 Hz, preferably



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	between 500 and 3,000 Hz
Source:	MIL-STD-1472F, 1999

5.2.3.6 Intensity (loudness)

X.HF.AG44 Exceeding ambient noise	
Description:	Auditory signals should exceed the prevailing ambient noise level by at least 10 dB(A) or any maximum sound level with a duration of 30 seconds by at least 5 dB(A), whichever is louder, without exceeding 115 dB(A) for emergency signals or 90 dB(A) for other signals
Source:	MIL-STD-1472F, 1999; NUREG-0700, 1981

X.HF.AG45 Maximum intensity	
Description:	The intensity of evacuation and emergency signals should not exceed 115 dB(A). The intensity of other signals should not exceed 90 dB(A)
Source:	MIL-STD-1472F, 1999; NUREG-0700, 1981

5.2.3.7 Acknowledging signals

X.HF.AG46 Automatic and manual shutoff	
Description:	If an audio signal is designed to persist as long as it contributes useful information, a shutoff switch controllable by the user, the sensing mechanism, or both, should be provided consistent with the operational situation and personnel safety
Source:	MIL-STD-1472F, 1999

5.2.4 Designing windows

5.2.4.1 General

X.HF.AG47 Obscuring critical information	
Description:	Critical information should not be obscured during window resizing
Source:	CTA, 1996

X.HF.AG48 Standard management of windows	
Description:	The management of a window, open, close, minimize, maximize, restore, move, resizing as well as should be consistent with the standard window management.
Source:	DON UISNCCS, 1992 (modified) ; ATC (FAA) HF Checklist

5.2.4.2 Window states

X.HF.AG49 Controller Operations	
Description:	The controller must be able to open, close, minimize, maximize, restore, move and icon-ify windows).
Source:	ATC (FAA) HF Checklist

X.HF.AG50 Open Windows	
Description:	An open window should be capable of receiving input from the system or user, and should be completely visible on the screen at the time it is opened and when it is active
Source:	UISNCCS, 1992



ITWP
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Date: December 03, 2007
Version: 031207
Status: Draft

5.2.4.3 Window component

X.HF.AG51		Standard window component
<i>Description:</i>	Definition of a scrolling bar (use, management) in a window, type of windows should be consistent with the standards windows component.	
<i>Source:</i>	ITWP, 2007	

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