



**ITWP**  
**Integrated Tower Working Position**

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**Integrated Tower Working Position**

**ITWP FUNCTIONAL REQUIREMENTS**

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## 1 INTRODUCTION

### 1.1 Document Purpose and Scope

This document is the deliverable D1 of the ITWP Requirements and Validation project. The objective of this document is to develop commonly agreed functional specifications and associated HMI requirements that cover the operational and human factors aspects to be supported by ITWP. The document covers both the basic and advanced (e.g. safety support tools, routing, data link, vehicle management) functionalities identified during the development of ITWP.


### 1.2 Structure of the document

The content of this document is organised as follows:

- Section 2 describes the methodology used, including the identification, numbering and grouping of requirements;
- Section 3 addresses the functional and HMI requirements; organised following the methodology described in section 2.
- Section 4 addresses the transversal human factors requirements.
- Section 5 (annex) lists the human factors recommendations for the system design.

### 1.3 Acronyms

APP	APProach
A-SMGCS	Advanced Surface Movement Guidance & Control System
ATC	Air Traffic Control
ATCO	Air Traffic COntroller
ATM	Air Traffic Management
CWP	Controller Working Position
EEC	Eurocontrol Experimental Centre
HMI	Human Machine Interface
ICAO	International Civil Aviation Organisation
IFR	Instrumental Flight Rules
ITWP	Integrated Tower Working Position
PANS-ATM	Procedures for Air Navigation Services - Air Traffic Management
TWR	ToWeR
UTC	Universal Time Coordinate

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WIMP                      Windows, Icons, Menus and Pointers

## 1.4 Definitions

- **Alert:** an indication of an existing or pending situation during aerodrome operations, or a indication of abnormal A-SMGCS operation, that requires attention/action [*ICAO-A-SMGCS definition*]
- **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.
- **Aerodrome control tower:** “*Aerodrome control towers shall issue information and clearances to aircraft under their control to achieve a safe, orderly and expeditious flow of air traffic on and in the vicinity of an aerodrome with the object of preventing collision(s) between:*
  - a) *aircraft flying within the designated area of responsibility of the control tower, including the aerodrome traffic circuits;*
  - b) *aircraft operating on the manoeuvring area;*
  - c) *aircraft landing and taking off;*
  - d) *aircraft and vehicles operating on the manoeuvring area;*
  - e) *aircraft on the manoeuvring area and obstructions on that area.”*

Reference: [ICAO PANS-ATM] ( §7.1.1.3)

- **RWY controller in ITWP:** a tower controller, normally responsible for operations on the runway and aircraft flying within the area of responsibility of the aerodrome control tower [ICAO PANS-ATM] ( §7.1.1.3)]
- **GND controller in ITWP:** a ground controller, normally responsible for traffic on the manoeuvring area with the exception of runways [ICAO PANS-ATM] ( §7.1.1.3 3)
- **CLD controller in ITWP:** a clearance delivery position, normally responsible for delivery of start-up and ATC clearances to departing IFR flights [ICAO PANS-ATM] ( §7.1.1.3)

## 1.5 Reference documents

Note: includes the reference documents applicable to annex.

[AMERITECH]	Ameritech, 1998
[AMERITECH Inc]	Ameritech Services Inc., 1996
[Apple Computer Incorporated]	Apple Computer Incorporated, 1995





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[ATC (FAA) HF Checklist]	ATC (FAA) HF Checklist
[Cardosi & Murhpy]	Cardosi & Murhpy, 1995
[CTA 1996]	Common Task For Assessment, Human And Social Sciences 1996
[Def Stan]	Def Stan 00-25, Human factors for designers of equipment
[DIS AGENCY]	Defence Information Systems Agency, 1995
[DOD HCISG]	Human-Computer Interface Style Guide (Version 2.0), Department of Defense, also known as DOD HCISG V2, Avery & Bowser, 1992.
[DOE HFAC1]	Department of Energy, Human Factor AC1, 1992
[DOE HFDG ATCCS]	Human Factors Design Guidance, (DOE HFDG ATCCS V2.0), Avery & Bowser, 1992
[DON UISNCCS]	DON UISNCCS, Department of the Navy, 1992
[EPISODE 3 WP2 D2.1]	SESAR - Episode 3 WP2 D2.1. , EUROCONTROL, 2008
[ECHOES 2003]	EUROCONTROL Consolidation of HMI for Operations, Evaluations and Simulations, 2003
[ECHOES 2007]	EUROCONTROL Consolidation of HMI for Operations, Evaluations and Simulations, 2007
[FS A-SMGCS LEVEL II]	EUROCONTROL Functional Specification for A-SMGCS Level II, v1.0 (17.05.2004)V1.0, EUROCONTROL 30/09/2003
[ICAO PANS-ATM]	ICAO Procedures for Air Navigation Services - Air Traffic Management, Doc 4444
[ICAO Doc 9830]	Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual, First Edition, ICAO, 2004
[ITWP FS&HMI 2007]	ITWP Functional specifications and associated HMI requirements V2 (3 <sup>rd</sup> Dec. 2007, Draft), EUROCONTROL, 2007
[Martin & Dong]	Martin & Dong, 1999
[Microsoft Corp.]	HFDS 2003 Chapter 8 Computer human interface 8-83, Microsoft Corp., 1992
[Merideth & Edworthy]	<i>Human</i> Factors in Alarm Design, Merideth & Edworthy, 1994
[MIL-HDBK-761A]	Department Of Defense, Handbook Human Engineering Guidelines For Management Information Systems. MIL-HDBK-761A, dated 30 September 1989



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[MIL-STD-1472D]	Human engineering design criteria for military systems, equipment, and facilities (superseding mil-std-1472c) (s/s by mil-std-1472e), Military Specifications and Standards, Department Of Defense, 14-Mar-1989
[MIL-STD-1472F]	Design Criteria Standard Human Engineering, Department Of Defense Design Criteria Standard, MIL-STD-1472F 1999
[MIL-STD-1801]	Human Engineering Requirements for User/Computer Interface, Department Of Defense , MIL-STD-1801, 1987
[MIL-STD-12D]	Abbreviations for Use on Drawings, and in Specifications, Standards and Technical Documents, Department of Defence, 29 May 1981
[NATS]	National Air Traffic Services, 1999
[NUREG-0700]	Guidelines for control room design reviews, NUREG-0700, United States Nuclear Regulatory Commission, 1981
[OC&R AIRPORT SAFETY NETS]	EUROCONTROL Operational Concept & Requirements for Airport Surface Safety Nets, P1002 DO14 OpsCon, EUROCONTROL , 2008
[OC&R A-SMGCS IMP LEVEL II]	EUROCONTROL Operational Concepts and Requirements for A-SMGCS Implementation Level II, V1.0, 30/09/2003

## 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).

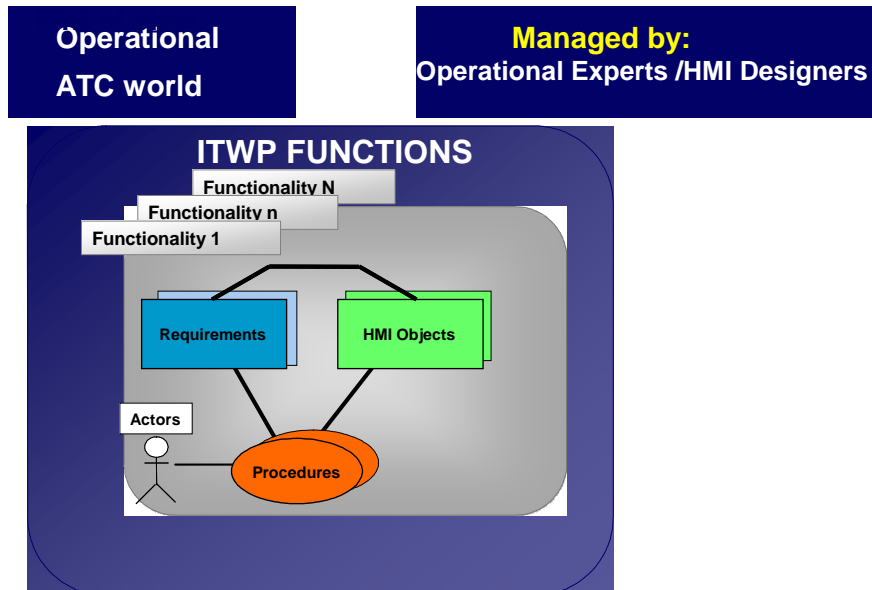
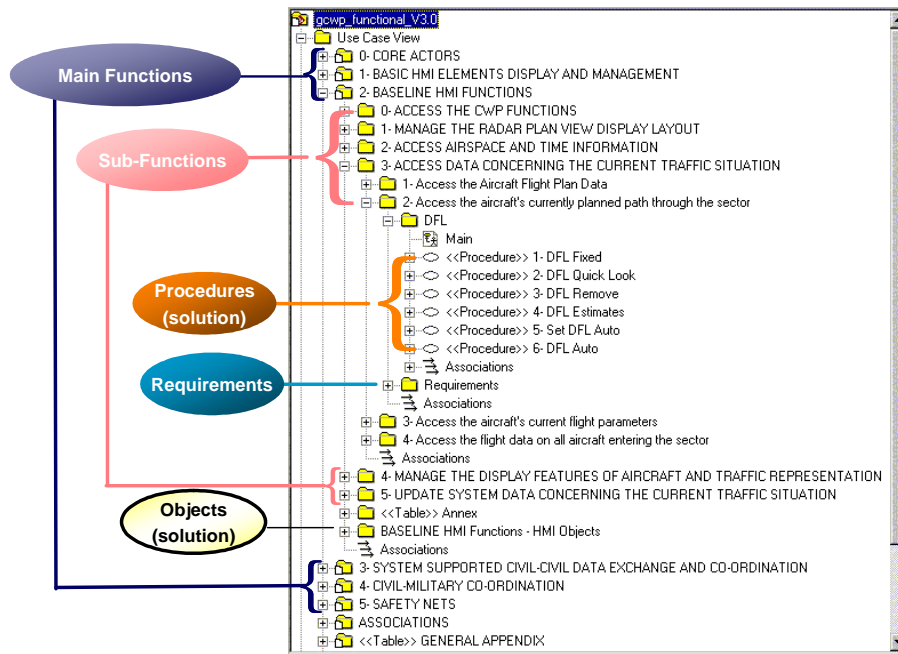


Figure 1: Overall model

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.



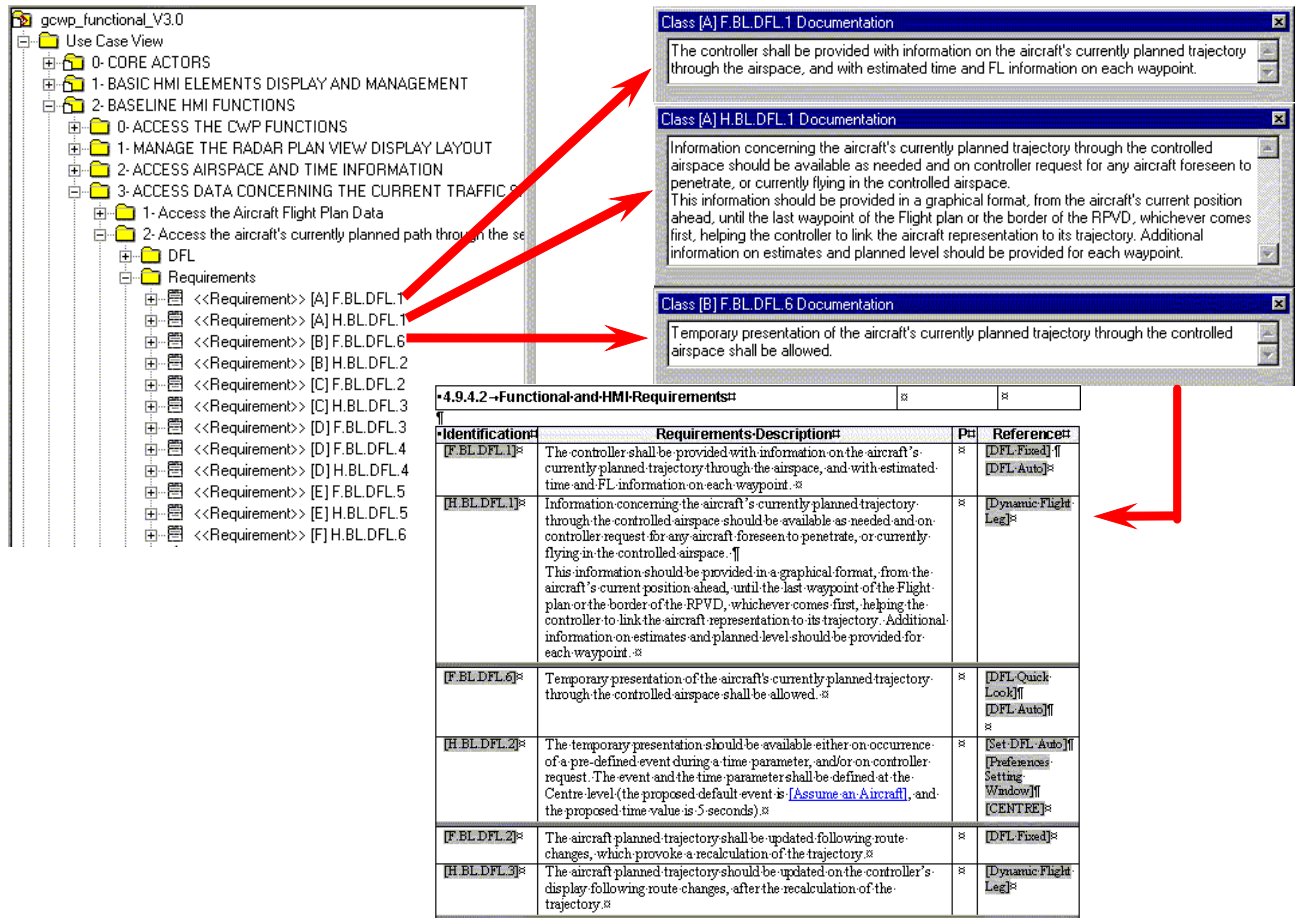
**Figure 2: Overall model structure**

## 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 benefit from the Eurocontrol experience in En-Route HMI specification (Core En-Route). The main high-level functions identified 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: The objective there is to provide the controllers with a highly interactive interface. There are several components of the requirements for an interactive HMI. The corresponding functions are related to:
  - Access to the Controller Working Position (§3.2.1);
  - Management of the display layout (§3.2.2);
  - Access to air, surface and time information (§3.2.3);
  - Management of the display features of traffic representation (§3.2.4).



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- Access to data concerning the current traffic situation (§3.3);
- Access to weather /advisory information (§3.4);
- Setting up of the airport layout (§3.5).
- Update of the system data concerning the current traffic situation (§3.6);
- System supported data exchange and co-ordination (§3.8);
- Vehicle management (§3.9);
- Monitoring and control (§3.10);
- Management of the mobile routing (§3.11);
- Air-ground data link communication (§3.12).

*Note: other functions such as planning and monitoring aids\* will be developed during future ITWP phases.*

## 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

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

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

The current<sup>†</sup> 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

\* 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.

<sup>†</sup> Subject to modification (addings) during future ITWP phases



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- .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
- .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.

- .GEN** General requirements regarding the alerts.
- .PROC** To detect / display non conformance to ATC instructions / procedures (former CNF category and MISC category)
- .CLRS** To detect / display conflicting ATC clearances (former CLR category)
- .AREA** To detect / display infringement of restricted / closed areas (merge of the former RCA category – runway conflicts detection and alerting and LAY category – Controllers input errors versus airport layout).
- ....RWY** To manage mobiles on the runway (crossing / entering).
- .PTD** To manage protecting devices.
- .NAV** To be informed about nav aids serviceability.

**.ROUTE** To provide support to the controllers regarding routing functions (i.e. effective modifications of routes initially assigned to a mobile).

- .DIS** To provide support to the controller to display an assigned / cleared route to a mobile
- .CLR** To provide support to the controller to validate / clear the initially assigned route
- .CHG** To provide support to the controller to manage the modification of a route given to a mobile

**.VEH** To provide support to the controllers to manage vehicles and towed aircraft

- .DIS** To display vehicle traffic
- .ORD** To manage vehicles by controlling their behaviour

**.SEQ** To manage arriving and departing traffic

- .DEP** To manage departing traffic
- .ARR** To manage arriving traffic.



- .DL** To provide system support for air-ground communication between pilots and ATC unit controllers.
- .IDF** To provide the controllers with information about data link equipped aircraft

## 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).

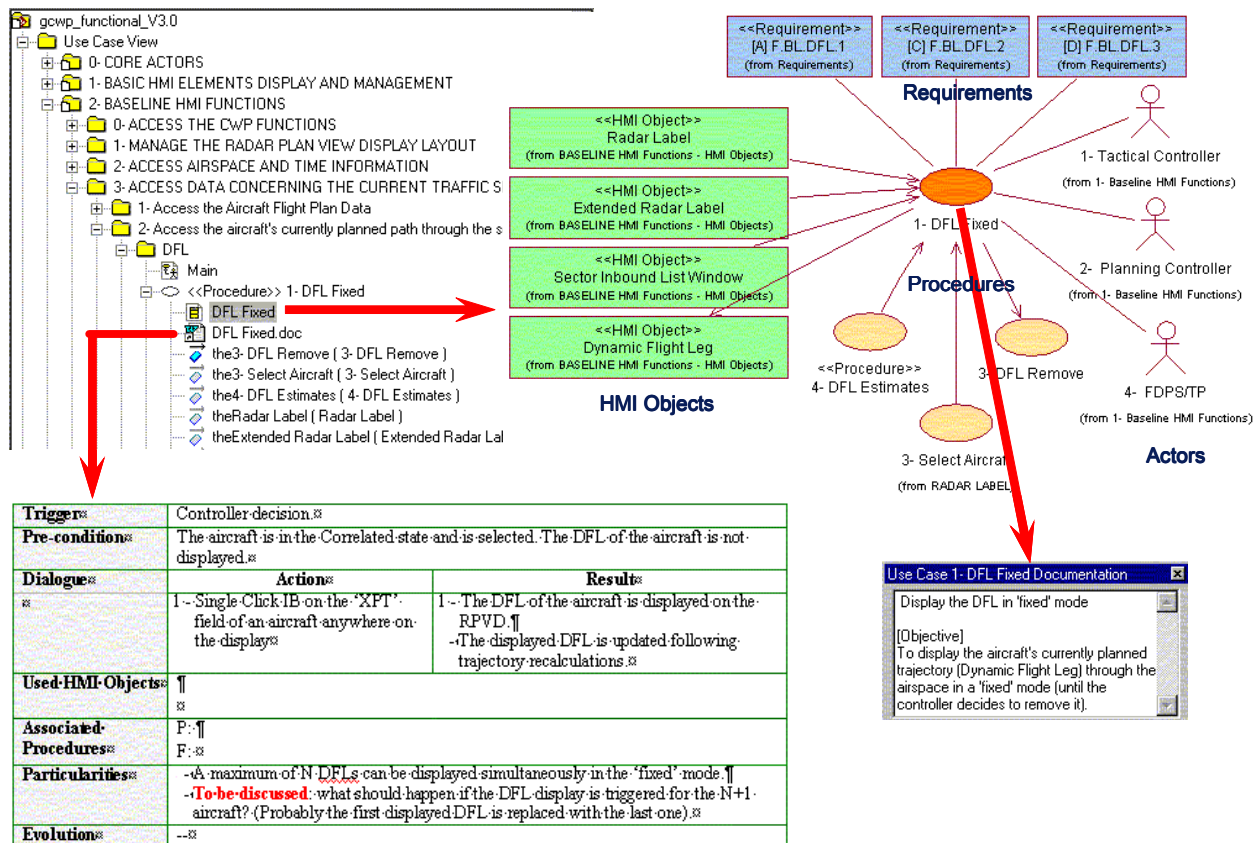


Figure 4: Link between requirements, procedures and HMI objects



### 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

<b>H.BL.HMI.01</b>	
<i>Description:</i>	The limits of the space of interaction with the system shall be clearly defined.
<b>H.BL.HMI.02</b>	
<i>Description:</i>	The background colour and luminance of the worktop should be such as to: <ul style="list-style-type: none"> <li>• Provide good, homogenous, contrast for all task related information,</li> <li>• Minimise flicker effects at the available screen refresh rate.</li> </ul>
<b>H.BL.HMI.03</b>	
<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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<b>H.BL.HMI.04</b>	
<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"><li>• Visualise the sources of information available (overview requirement)</li><li>• Select/deselect and prioritise the information sources which are available</li><li>• Flexibly and easily re-organise information within the display, including the possibility of a temporary undisplay.</li></ul>
<b>H.BL.HMI.05</b>	
<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>
<b>H.BL.HMI.06</b>	
<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>
<b>H.BL.HMI.07</b>	
<i>Description:</i>	<p>The nature of the window content should always be clearly indicated.</p>
<b>H.BL.HMI.08</b>	
<i>Description:</i>	<p>The background colour of the window interior should be such as to provide good contrast for the displayed information.</p>
<b>H.BL.HMI.09</b>	
<i>Description:</i>	<p>At any moment, the locus of potential user actions shall be clearly indicated.</p>
<b>H.BL.HMI.10</b>	
<i>Description:</i>	<p>The type of system activity and the entry into a mode shall be clearly indicated.</p>
<b>H.BL.HMI.11</b>	
<i>Description:</i>	<p>At any moment, possible actions on the interface shall be clearly indicated.</p>
<b>H.BL.HMI.12</b>	
<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>
<b>H.BL.HMI.13</b>	
<i>Description:</i>	<p>The cursor shall always be visible and easily located.</p>



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<b>H.BL.HMI.14</b>	
<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.
<b>H.BL.HMI.15</b>	
<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.
<b>H.BL.HMI.16</b>	
<i>Description:</i>	Buttons shall provide feedback specific to the action taken.
<b>H.BL.HMI.17</b>	
<i>Description:</i>	The physical appearance of the buttons shall provide the controller with information on their functions and characteristics.
<b>H.BL.HMI.18</b>	
<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.
<b>H.BL.HMI.19</b>	
<i>Description:</i>	The availability to selection, and the operational status of the presented menu items shall be clearly indicated.
<b>H.BL.HMI.20</b>	
<i>Description:</i>	The currently selected menu item shall always be clearly indicated.
<b>H.BL.HMI.21</b>	
<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.
<b>H.BL.HMI.22</b>	
<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.
<b>H.BL.HMI.23</b>	
<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).



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<b>H.BL.HMI.24</b>	
<i>Description:</i>	It shall be possible to easily and quickly abandon any initiated menu dialogue without having made a selection.

<b>H.BL.HMI.25</b>	
<i>Description:</i>	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

<b>F.BL.LOG.1</b>		<b>Log on CWP</b>
<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.	

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

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

<b>H.BL.LOG.2</b>	
<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.

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

<b>H.BL.LOG.3</b>	
<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.

<b>F.BL.SET.1</b>		<b>Save configuration set-up</b>
<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"><li>• the location, size and current priority of all open windows, including hidden windows,</li><li>• whether a window is (temporarily) iconified or not,</li><li>• the panning and zoom values of all windows equipped with this capability,</li><li>• the presence and position of any toolboxes and tools and of all settings selectable within tools.</li><li>• screen and global window settings.</li></ul>	
<b>F.BL.SET.2</b>		<b>Access configuration set-up</b>
<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.	
<b>F.BL.SET.3</b>		<b>Access configuration set-up</b>
<i>Description:</i>	It shall be possible to access a stored screen set-up.	
<b>F.BL.SET.4</b>		<b>Access configuration set-up</b>
<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.	
<b>F.BL.SET.5</b>		<b>Save configuration set-up</b>
<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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<b>F.BL.SET.6</b>		<b>Set mouse hand</b>
<i>Description:</i>	The interaction means with the system shall be adapted to both left and right handed users.	
<b>H.BL.SET.1</b>		
<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.	
<b>H.BL.SET.2</b>		
<i>Description:</i>	The controller should be provided with an easy access to a previously stored screen and window configuration set-up.	
<b>H.BL.SET.3</b>		
<i>Description:</i>	The controller should be provided with an easy access to the default screen and window configuration set-up.	
<b>H.BL.SET.4</b>		
<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.	
<b>H.BL.SET.5</b>		
<i>Description:</i>	It should not be possible to delete the default screen set-up. This impossibility should be clearly indicated.	
<b>H.BL.SET.6</b>		
<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.	
<b>H.BL.SET.7</b>		
<i>Description:</i>	The fact that the maximum number of screen set-ups has been stored should be clearly indicated.	
<b>H.BL.SET.8</b>		
<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.	
<b>F.BL.SET.7</b>		<b>Select screen settings</b>
<i>Description:</i>	It shall be possible to select amongst different lighting ambiance settings	



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<b>F.BL.SET.8</b> <span style="float: right;"><b>Fine tune brightness and contrast</b></span>	
<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 .*

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

<b>H.BL.SET.10</b>	
<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.

<b>F.BL.TOOL.1</b> <span style="float: right;"><b>Access to display monitoring functions</b></span>	
<i>Description:</i>	The HMI shall provide individual access to each of the situation display monitoring functions.

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

<b>H.BL.TOOL.2</b>	
<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

<b>F.BL.ZOOM.1</b> <span style="float: right;"><b>Perform zoom</b></span>	
<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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<b>F.BL.ZOOM.2</b>		<b>Perform zoom</b>
<i>Description:</i>	The minimum and maximum zoom ranges shall be defined at the local level.	
<b>H.BL.ZOOM.1</b>		
<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.	
<b>H.BL.ZOOM.2</b>		
<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.	
<b>F.BL.ZOOM.3</b>		<b>Store zoom</b>
<i>Description:</i>	It shall be possible to store a particular zoom range associated with a particular map centre-point (zoom setting).	
<b>F.BL.ZOOM.4</b>		<b>Store zoom</b>
<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.	
<b>H.BL.ZOOM.3</b>		
<i>Description:</i>	The controller should be provided with the possibility to store a pre-defined number of zoom settings.	
<b>H.BL.ZOOM.4</b>		
<i>Description:</i>	The fact that the maximum number of zoom settings has been stored should be clearly indicated.	
<b>F.BL.ZOOM.5</b>		<b>Retrieve zoom   Zoom back</b>
<i>Description:</i>	It shall be possible to access a stored zoom setting.	
<b>H.BL.ZOOM.5</b>		
<i>Description:</i>	The controller should be provided with the possibility to quickly and easily access a previously stored zoom setting.	
<b>F.BL.ZOOM.6</b>		<b>Delete zoom</b>
<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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<b>H.BL.MAP.2</b>	
<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.
<b>F.BL.MAP.4</b> <b>Display taxiway names   Display taxiway names (quick look)</b>	
<i>Description:</i>	It shall be possible to display / remove display taxiway names on the ground situation display, either permanently or temporarily.
<b>H.BL.MAP.3</b>	
<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.
<b>F.BL.MAP.5</b> <b>Display working areas</b>	
<i>Description:</i>	If any, working areas should be automatically displayed on the ground situation window.
<b>H.BL.MAP.4</b>	
<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.
<b>F.BL.MAP.6</b> <b>Display RWYs restricted areas</b>	
<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.
<b>H.BL.MAP.5</b>	
<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.
<b>F.BL.MAP.7</b> <b>Modify map geographical orientation</b>	
<i>Description:</i>	It shall be possible to modify the geographical orientation of airport maps.
<b>H.BL.MAP.6</b>	
<i>Description:</i>	The controller should be provided with a rapid and easy means to modify the geographical orientation of airport maps.

### 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.



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

<b>F.BL.MAP.9</b>		<b>Display air video map</b>
<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"><li>• The area of the sector(s) controlled on the position</li><li>• The waypoints and waypoint identifications</li><li>• The airways / airway centre-lines</li><li>• The military areas</li><li>• The coastlines</li><li>• The scale markers</li><li>• The range-rings.</li></ul>	

<b>H.BL.MAP.7</b>	
<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

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

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

### 3.2.3.5 Display additional view

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

<b>F.BL.VIEW.2</b>		<b>Display additional sub-view</b>
<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.	

<b>H.BL.VIEW.1</b>	
<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.



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**3.2.3.6 Display and track range & bearing**

<b>F.BL.RB.1 Obtain Range and Bearing information</b>	
<i>Description:</i>	It shall be possible to obtain range and bearing information as measured from one point of the airspace to another.
<b>H.BL.RB.1</b>	
<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.
<b>H.BL.RB.2</b>	
<i>Description:</i>	The controller should be provided with a rapid and easy way of leaving the Range and Bearing function.
<b>H.BL.RB.3</b>	
<i>Description:</i>	The controller should be provided with feedback when the Range and Bearing function is active or not.
<b>F.BL.RB.2 Create Range and Bearing Tracker Link</b>	
<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).
<b>F.BL.RB.3 Create Range and Bearing Tracker Link</b>	
<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.
<b>H.BL.RB.4</b>	
<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).
<b>H.BL.RB.5</b>	
<i>Description:</i>	The controller should be provided with a rapid and easy way of leaving the Tracker Link function.



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

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

<b>F.BL.RB.4</b> <span style="float: right;"><b>Cancel Range and Bearing Tracker Link</b></span>	
<i>Description:</i>	It shall be possible to remove the displayed range and bearing information.

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

<b>F.BL.RB.5</b> <span style="float: right;"><b>Obtain Range and Bearing information   Create Range and Bearing Tracker Link</b></span>	
<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.

<b>H.BL.RB.9</b>	
<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.

<b>H.BL.RB.10</b>	
<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.

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.



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<b>F.BL.POS.1 Deconflict labels automatically   Deconflict labels manually</b>	
<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.

<b>H.BL.POS.1</b>	
<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.

<b>F.BL.POS.2 Set leader length   Set leader direction</b>	
<i>Description:</i>	<p>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:</p> <ul style="list-style-type: none"><li>• To change the radar label position relative to the aircraft track symbol.</li><li>• To change the length of the leader line of all the radar labels.</li><li>• To set the top of the screen as reference for the orientation of the radar labels.</li><li>• To set the aircraft track as reference for the orientation of the radar labels.</li></ul>

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

<b>F.BL.POS.3 Set fixed reference   Set variable reference</b>	
<i>Description:</i>	<p>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:</p> <ul style="list-style-type: none"><li>• Variable reference: aircraft heading</li><li>• Fixed reference: the top of the screen, providing the possibility to display the radar label with different angles relative to this fixed reference.</li></ul>

<b>H.BL.POS.3</b>	
<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.



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<b>F.BL.POS.4</b> <span style="float: right;"><b>Set leader direction</b></span>	
<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.

<b>H.BL.POS.4</b>	
<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.

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

<b>H.BL.POS.5</b>	
<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.

<b>F.BL.POS.6</b> <span style="float: right;"><b>Move radar label</b></span>	
<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.

<b>H.BL.POS.6</b>	
<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.

<b>F.BL.POS.7</b> <span style="float: right;"><b>Deconflict labels automatically</b></span>	
<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.

<b>F.BL.POS.8</b> <span style="float: right;"><b>Resume label position</b></span>	
<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.
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#### H.BL.POS.8

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

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

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

<b>F.BL.TRCK.3</b> <span style="float: right;"><b>Display aircraft shape (quick look)</b></span>	
<i>Description:</i>	It shall be possible to display the aircraft shape in a quick look mode.

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

<b>F.BL.TRCK.4</b> <span style="float: right;"><b>Set track history value</b></span>	
<i>Description:</i>	It shall be possible to display a given number of trail dots for all the aircraft

<b>F.BL.TRCK.5</b> <span style="float: right;"><b>Set track history value</b></span>	
<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.

<b>H.BL.TRCK.4</b>	
<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.

<b>F.BL.LBL.1</b> <span style="float: right;"><b>Configure radar labels</b></span>	
<i>Description:</i>	It shall be possible to configure the content of radar labels by displaying and removing additional data.



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<b>F.BL.LBL.2</b>		<b>Configure radar labels</b>
<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.	

<b>F.BL.LBL.3</b>		<b>Configure radar labels</b>
<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"><li>a) for a departure aircraft: callsign, departure parking/stand, clearance limit</li><li>b) for an arrival aircraft: callsign, arrival parking/stand.</li><li>c) For a towed aircraft: callsign</li><li>d) For a vehicle: callsign</li></ul> <p>The proposed default set for the <u>selected</u> label is the following:</p> <ul style="list-style-type: none"><li>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.</li><li>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.</li><li>c) for a towed aircraft: callsign, aircraft type, departure stand, arrival stand.</li><li>d) For a vehicle: callsign, operational role and ground route</li></ul>	

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

<b>H.BL.LBL.1</b>	
<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.

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



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**H.BL.LBL.3**

*Description:* 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.

**H.BL.LBL.4**

*Description:* The colours associated to vehicles should be different from the associated to the arriving and departing traffic.

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**

*Description:* It shall be possible to select the category(ies) of aircraft tracks to be displayed.

**F.BL.FILT.2**

**Filter tracks**

*Description:* The default categories of aircraft tracks to be displayed shall be defined at local level.

**H.BL.FILT.1**

*Description:* The controller should be provided with the possibility to set/select groups of aircraft tracks to be displayed.

3.2.4.2.5 Draw the 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**

*Description:* It shall be possible to input an intra-sector warning marking on an aircraft or vehicle.

**H.BL.WAR.1**

*Description:* The controller should be provided with an easy and rapid way to mark an aircraft or vehicle for herself/himself as an 'aide memoire'.

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

<b>H.BL.WAR.2</b>	
<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.

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

<b>H.BL.WAR.3</b>	
<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.

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



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**H.BL.SEL.1**

*Description:* 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

- a) either through its label or on its track.
- b) or traffic data representation.

**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.

### 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**

*Description:* The controller shall be provided with a clear representation of the traffic (i.e. aircraft and vehicles) helping the controller to easily locate and identify aircraft and vehicles and to have a direct access to essential information.





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<b>F.BL.TRAF.4 Display traffic cooperative status</b>	
<i>Description:</i>	The cooperative status of traffic shall be displayed on the traffic representation.

<b>H.BL.TRAF.6</b>	
<i>Description:</i>	The controller should be provided with a clear and visible indication of traffic cooperative status.

### 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.

<b>F.BL.SIL.1 Display Traffic Data List</b>	
<i>Description:</i>	Traffic data related to aircraft and towed aircraft entering or planned to enter controller's area of responsibility shall be presented to the controller.

<b>F.BL.SIL.2 Display Traffic Data List</b>	
<i>Description:</i>	<p><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:</p> <ul style="list-style-type: none"><li>a) Traffic that will become under control responsibility in the near future, and</li><li>b) Traffic under responsibility control for that position.</li></ul>

<b>H.BL.SIL.1</b>	
<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.

<b>H.BL.SIL.2</b>	
<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.

<b>F.BL.SIL.3 Configure Traffic Data Items</b>	
<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.



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**F.BL.SIL.4**

**Configure Traffic Data Items**

*Description:*

Traffic Data Items fields to be displayed in minimum format shall be defined at local level.

The proposed default sub-set is the following:

a) for an arrival flight:

- 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) for a departure flight:

- 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

c) for a towed aircraft:

- Aircraft callsign
- Aircraft type
- Stand
- Runway
- Estimated Start Taxi Time





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<b>F.BL.SIL.5</b>		<b>Configure Traffic Data Items</b>
<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"><li>- EIBT (Estimated In-Block Time) or AIBT (Actual In-Block Time)</li><li>- Airline name</li><li>- SSR code</li><li>- Aerodrome of departure</li><li>- QNH</li><li>- Remarks</li></ul> b) <u>for a departure flight</u> : <ul style="list-style-type: none"><li>- EOBT or TOBT or AOBT (Estimated or Target or Actual Off Block Time)</li><li>- Airline name</li><li>- SSR code</li><li>- Aerodrome of destination</li><li>- QNH</li><li>- Remarks</li></ul> c) <u>for a towed aircraft</u> : <ul style="list-style-type: none"><li>- Aircraft callsign</li><li>- Aircraft type</li><li>- Stand</li><li>- Runway</li><li>- Estimated Start Taxi Time</li></ul>	
<b>F.BL.SIL.6</b>		<b>Expand Traffic data item</b>
<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.	
<b>H.BL.SIL.3</b>		
<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.	
<b>F.BL.SIL.7</b>		<b>Sort Traffic Data Items</b>
<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).	



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**H.BL.SIL.4**

*Description:* 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**

*Description:* 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**

*Description:* It should be possible to create a new traffic data item.

**H.BL.SIL.5**

*Description:* The controller should be assisted to create a new traffic data item

- a) either by selecting a pre-defined model (departure, arrival, towed, vehicle model), or
- b) by copying an existing one and modify subsequent data

**F.BL.SIL.10**

**Archive Traffic Data Item**

*Description:* 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**

*Description:* 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. <ul style="list-style-type: none"><li>a) The proposed minimum information includes surface wind direction (touch down) and strength (graphical and text), QNH (mb), ATIS code, temperature and dew point</li><li>b) Additional information should be defined at local level and can include information such as surface wind (Touch Down and Stop End) , visiblity, current weather, cloud ceiling, QNH and QFE (mb and inches), weather forecast information, RVR conditions and a remarks section.</li></ul>

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) , visiblity, 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		Runway taxiway status
<i>Description:</i>	It shall be possible to input the status of the runways and taxiways.	

H.BL.APT.1	
<i>Description:</i>	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).



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<b>F.BL.ORD.2</b>		<b>Input cleared to land</b>
<i>Description:</i>	It shall be possible to input a “cleared to land” instruction.	
<b>H.BL.ORD.2</b>		
<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.	
<b>F.BL.ORD.3</b>		<b>Input go around</b>
<i>Description:</i>	It shall be possible to input a go-around instruction for an aircraft.	
<b>H.BL.ORD.3</b>		
<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.	
<b>F.BL.ORD.4</b>		<b>Input vacate</b>
<i>Description:</i>	It shall be possible to input a “vacate” instruction	
<b>H.BL.ORD.4</b>		
<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 or vehicle. The aircraft/vehicle representation should account for this instruction.	
<b>F.BL.ORD.5</b>		<b>Input cross active runway</b>
<i>Description:</i>	Deleted in this chapter and moved in §3.10.4. (Dec. 2008)	
<b>H.BL.ORD.5</b>		
<i>Description:</i>	Deleted in this chapter and moved in §3.10.4. (Dec. 2008)	
<b>F.BL.ORD.6</b>		<b>Input taxi</b>
<i>Description:</i>	It shall be possible to input a “taxi” instruction.	
<b>H.BL.ORD.6</b>		
<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 or vehicle. The aircraft / vehicle representation should account for this instruction.	
<b>F.BL.ORD.7</b>		<b>Input start up</b>
<i>Description:</i>	It shall be possible to input a “start up engines” instruction	



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<b>H.BL.ORD.7</b>	
<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.

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

<b>H.BL.ORD.8</b>	
<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.

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

<b>H.BL.ORD.9</b>	
<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 a mobile. The mobile representation should account for this instruction.

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

<b>H.BL.ORD.10</b>	
<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.

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

<b>H.BL.ORD.11</b>	
<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.

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



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**H.BL.ORD.12**

*Description:* 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**

*Description:* It shall be possible to input an “abort take-off “ instruction.

**H.BL.ORD.13**

*Description:* 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**

*Description:* It shall be possible to input an “En-route clearance“ instruction.

**H.BL.ORD.14**

*Description:* 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**

**Cancel the latest inputted order**

*Description:* It shall be possible to cancel the latest given order / instruction to an aircraft.

**H.BL.ORD.15**

*Description:* 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.

**F.BL.ORD.16**

**Input hold at**

*Description:* It shall be possible to input a “hold at” instruction

*Note:* The objective is to implement a function that enables the controller to clear an arrival aircraft, after landing, to taxi until a certain point. For the CDG airport layout, the instruction “hold at” is used. For other airports, another instruction could be associated to this function.

**H.BL.ORD.16**

*Description:* Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a “hold at” instruction for an aircraft. The aircraft representation should account for this instruction.



### 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.

<b>F.BL.UPD.1</b>		<b>Modify Traffic Data Item Field</b>
<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.	

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

<b>H.BL.UPD.2</b>	
<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

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

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

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



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<b>F.BL.UPD.2</b>		<b>Modify Traffic Data Item Field</b>
<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)	

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

<b>H.BL.UPD.6</b>	
<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).

<b>F.BL.UPD.4</b>		<b>Input remark</b>
<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.	

<b>H.BL.UPD.7</b>	
<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.

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

<b>F.BL.UPD.5</b>		<b>Display remark</b>
<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

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

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





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**H.BL.FPL.2**

*Description:* 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, and forbidden actions.

**F.BL.FPL.2**

**Copy flight plan**

*Description:* 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**

*Description:* 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**

*Description:* The controller should have the possibility to correct or delete a previously saved flight plan

**H.BL.FPL.4**

*Description:* Flight plans that have been saved by the controller and can be deleted or corrected should be clearly identified.

**H.BL.FPL.5**

*Description:* 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**

*Description:* The controller shall have the possibility to display the flight plan data of any existing flight plan

**H.BL.FPL.6**

*Description:* 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**

*Description:* The controller shall have the possibility to manually modify flight plan elements

**H.BL.FPL.7**

*Description:* 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.

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

<b>F.FD.RUL.2</b>		<b>Display Pending Traffic</b>
<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 the estimated landing time (ELDT) or based on an identified runway controller action / clearance for that flight. The proposed time parameter should be defined at local level.	

<b>F.FD.RUL.3</b>		<b>Display Pending Traffic</b>
<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 the estimated or target off block time (EOBT / TOBT) 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.

<b>F.FD.TRSF.1</b>		<b>Modify control responsibility   Transfer control responsibility</b>
<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	



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**H.FD.TRSF.1**

*Description:* The controller should be provided with easy means to modify or transfer the control responsibility for an aircraft or vehicle to other operator roles. Transfer of control responsibility should be possible through any representation of the aircraft / vehicle.

**F.FD.TRSF.2**

**Transfer Traffic | Assume Traffic**

*Description:* 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**

*Description:* 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**

*Description:* It shall be possible to transfer a flight to another controller role than planned in the pre-defined sequence.

**H.FD.TRSF.3**

*Description:* 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

**F.FD.TRSF.4**

**Transfer Traffic | Assume Traffic**

*Description:* 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.

**H.FD.TRSF.4**

*Description:* When transferred by another operator role, the controller should be provided with an easy way to assume an aircraft or vehicle.

**H.FD.TRSF.5**

*Description:* Visible indication of completion of a flight or vehicle transfer/assume control responsibility shall be provided on both assuming and transferring operator roles.

### 3.9 Vehicle management<sup>‡</sup>

The Vehicle management comprises management of vehicles and towed aircraft (aircraft taxiing from one parking position to another). The objectives are to:

- display vehicles and towed aircraft to the controller so that he/she could easily distinguish this traffic from departing and arriving traffic. The colour coding of this traffic is different from the other traffic that has already been specified in §3.2.4.;
- filter the visibility of vehicles on the movement area;
- allow the controller to access data concerning the current traffic situation, aircraft and vehicles (see §3.3).
- allow the controller, when and where appropriate, to have a vehicle driver on frequency (assume / non assume and realise planning state) to provide information;
- give instructions to a vehicle driver or towed aircraft to ensure safe and efficient realisation of the traffic.
- transfer a vehicle to another controller (e.g. the GND controller could transfer a runway inspection vehicle to the RWY controller). The transfer of responsibility for a vehicle is described in §3.8.2.

#### 3.9.1 Display / hide vehicles

The objective is to handle the visibility of vehicles on the apron using a filter. The filter is a mask area that corresponds to those parts of the movement area that are exclusively dedicated to the movements of vehicles (including passive and empty stands), the **apron mask area**.

<b>F.VEH.DIS.1</b>		<b>Display vehicle mask area</b>
<i>Description:</i>	It shall be possible to display / remove the apron mask area limit.	

<b>H.VEH.DIS.1</b>	
<i>Description:</i>	The controller should be provided with a rapid and easy means to display / remove the apron mask area limit.

<sup>‡</sup> Vehicle management includes management of a towed aircraft



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<b>F.VEH.DIS.2</b> <span style="float: right;"><b>Hide vehicles on the apron   Show vehicles on the apron</b></span>	
<i>Description:</i>	It shall be possible to hide / show all the vehicles on the apron.

<b>H.VEH.DIS.2</b>	
<i>Description:</i>	The controller should be able to easily hide or show all the vehicles on the apron. Only previously selected vehicles should be highlighted. By default, all the vehicles shall be hidden.

### 3.9.2 Instructions to vehicle

<b>F.VEH.ORD.1</b> <span style="float: right;"><b>Assume vehicle</b></span>	
<i>Description:</i>	It shall be possible for the controller to assume a vehicle and to have it on the frequency.

The controller's instructions to a vehicle are such as: 'taxi', 'vacate', 'hold', 'holdat' (see § 3.6). For a towed aircraft, the instructions are such as: 'vacate', 'hold', 'holdat' The instructions to cross or enter an active runway is given in § 3.6.1

Following instructions are specific to vehicles and towed aircraft.

<b>F.VEH.ORD.2</b> <span style="float: right;"><b>Input Tow Clearance</b></span>	
<i>Description:</i>	It shall be possible to input a "Tow " instruction for a towed aircraft.

<b>H.VEH.ORD.1</b>	
<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.

<b>F.VEH.ORD.3</b> <span style="float: right;"><b>Input Release Clearance</b></span>	
<i>Description:</i>	It shall be possible to input a "REL " instruction for a vehicle / towed aircraft.

<b>H.VEH.ORD.2</b>	
<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.

## 3.10 Monitoring and Control Functions

### 3.10.1 Surface hazardous situations detection and alerting

The objective of the detection of hazardous situations on the surface and alerting function is to automatically detect and alert when a possible hazard may come out on the surface.

#### 3.10.1.1 Introduction to hazardous situations in the surface management

Besides the detection of conflicts on the runway protection area, the detection of hazardous situations on the apron and taxiways (see [EPISODE 3 WP2 D2.1], §4.3, Apron & Taxiways Management Support to De-conflict and Separate traffic (A3.3)) helps the controller to de-conflict and safely separate traffic. The following alerting functions are implemented in the ITWP:

- Runway conflicts;
- Inconsistent (conflicting) clearances;
- Controllers input error with respect to airport layout;
- Non conformance to ATC instructions;
- Miscellaneous detections (any situation that could not be classified under previous ones).

To be in line with the Operational Concept & Requirements for Airport Surface Safety Nets [OC&R AIRPORT SAFETY NETS], all the detections and alerts have been split into three categories (see [OC&R AIRPORT SAFETY NETS], §4.1):

- **Category 1: Non-conformance to ATC instructions/procedures** (Non conformance to ATC instructions and miscellaneous detections);
- **Category 2: Conflicting ATC clearances** (inconsistent controllers' clearances);
- **Category 3: Infringement of restricted/closed areas** (covering the detection of input errors with respect to airport layout and runway conflicts);

When a hazardous situation is detected, the Advanced Surface Movement Guidance and Control Systems (A-SMGCS) will provide the controller with two types of alerts, named 'INFORMATION' and 'ALARM' (see [OC&R A-SMGCS IMP LEVEL II]).

- **INFORMATION:** When receiving an 'information alert', this means that a potential hazardous situation may occur. The tower 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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<b>F.SN.GEN.1</b>		<b>Display of alert</b>
<i>Description:</i>	An alert associated with a <u>detected</u> conflict should be provided with an adequate time and brought to the attention of the controller (ALARM coding). An alert associated with a <u>predicted</u> conflict (INFORMATION coding) should also be provided.	
<i>Reference:</i>	ICAO Document 9830, §3.4.5.8	

<b>F.SN.GEN.2</b>		<b>Visual display of alerts</b>
<i>Description:</i>	A visual display of an alert associated with a <u>detected</u> or <u>predicted</u> hazardous situation should be provided to the controller .	

<b>H.SN.GEN.1</b>	
<i>Description:</i>	Alerting and warning systems shall be unambiguous, with a clear indication of the cause of the alert.
<i>References:</i>	[ECHOES 2003]

<b>H.SN.GEN.2</b>	
<i>Description:</i>	The controller should be provided with a consistent visual display of alerts on the interface. The display of alert should be given in the radar label, on the e-strip, on the A-SMGCS display and around the track symbol.

<b>F.SN.GEN.3</b>		<b>Use of audio signal</b>
<i>Description:</i>	Auditory signals in conjunction with alerts should only be used when immediate action is required, with auditory alerts only competing when it is absolutely necessary	
<i>References:</i>	[Cardosi & Murhpy] ,(1995, A14, 7.3.8; pp 16 & 339)	

<b>H.SN.GEN.3</b>	
<i>Description:</i>	The controller should be provided with an audio signal to support identification of alarms.

<b>F.SN.GEN.4</b>		<b>Display of alert messages</b>
<i>Description:</i>	The controller on the GND and RWY position shall be provided with all alert messages and auditory signal when they are triggered.	

<b>H.SN.GEN.4</b>	
<i>Description:</i>	The controller should be provided with the same visual and audio coding of the alerts on the GND and RWY position.

<b>F.SN.GEN.5</b>		<b>Acknowledgement button</b>
<i>Description:</i>	Only the controller responsible for handling the potential hazardous situation should be able to acknowledge the alert on his position.	



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**H.SN.GEN.5**

*Description:* The controller shall be provided with means to easily acknowledge perception of visual and sound alert messages. The acknowledgment of alerts should not impact the safety situation.

**H.SN.GEN.6**

*Description:* The controller shall not be allowed to cancel an alarm (i.e. remove the display of the alarm on the screen before it has been resolved).

**F.SN.GEN.6**

**End alert display**

*Description:* The end of an alert shall be automatically triggered when the corresponding triggering conditions are no more fulfilled.

**H.SN.GEN.7**

*Description:* The controller shall be provided with clear and visible information about the end of the alert as soon as the alert ends.

**H.SN.GEN.8**

**Timely display of alerts**

*Description:* An alert associated with a detected conflict should be provided with an adequate time and brought to the attention of the controller (alarm coding). An alert associated with a predicted conflict (information coding) should also be provided.





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### 3.10.1.2 Detection of non conformance to ATC instructions / procedures (PROC<sup>§</sup>)

The objective is to detect deviations from the given ATC instructions (e.g. route conformance, clearance conformance...); for example, if an aircraft deviates from the assigned route or if a mobile enters the runway without clearance.

The control function of an A-SMGCS should be able to handle the behaviour of the movements of aircraft and / or vehicles. The movement of mobiles is monitored to check if they do what they are intended to. The conflict monitoring function permanently looks for deviations from the instruction. The surveillance function of the A-SMGCS contributes to situational awareness and enables a continuous monitoring and assessment of conformance with the intended movements.

<b>F.SN.PROC.1</b> <b>(F.SN.CNF.1)</b>		<b>Display non conformance to ATC instructions</b>
<i>Description:</i>	It shall be possible to detect and display non conformance to ATC instructions.	
<i>Reference:</i>	[ICAO Doc 9830] §3.4.5	

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

<b>H.SN.PROC.2</b> <b>(H.SN.CNF.2)</b>	
<i>Description:</i>	An alert shall be automatically triggered in case a non conformance to ATC instructions is detected, when:  a) An aircraft deviates from a cleared route on a taxiway (INFORMATION alert) b) An aircraft does not stop at clearance limit; if the clearance limit is the runway holding point, an ALARM alert shall be triggered; in other clearance limit cases, an INFORMATION alert shall be triggered. c) An aircraft stays stationary a time parameter after take-off, line up or cross given clearances (INFORMATION / ALARM alert). The proposed time parameter should be defined at local level.
<i>Reference:</i>	[ICAO Doc 9830] §3.4.5

<sup>§</sup> Airport Safety Nets, Alerts Category 1: Non-conformance to ATC instructions/procedures



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**H.SN.PROC. 3**

**(H.SN.CNF.3)**

<i>Description:</i>	An alert shall be automatically triggered in case non conformance to ATC instructions is detected, when:  a) An assumed vehicle deviates from cleared route on a taxiway (INFORMATION) b) An assumed vehicle does not stop at clearance limit. ; c) An assumed vehicle stays stationary in the runway protected area
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The detections described under the “Miscellaneous detections” section in the previous versions of the ITWP functional requirements, [ITWP FS&HMI 2007] , are enclosed in the category PROC – detections of non conformance to ATC instructions / procedures.

**F.SN.PROC.2**

**Display alert for excessive aircraft taxi speed**

**(F.SN.CNF.2)**

<i>Description:</i>	It shall be possible to detect and display if an aircraft taxiies with excessive speed <sup>**</sup>
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**H.SN.PROC.4**

**(H.SN.CNF.4)**

<i>Description:</i>	The controller shall be provided with clear and visible indication when an aircraft is taxiing at speed > X knots.
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**H.SN.PROC.5**

**(H.SN.CNF.5)**

<i>Description:</i>	An INFORMATION alert shall be automatically triggered when an excessive aircraft taxi speed is detected (speed > X knots).
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**H.SN.PROC.6**

**(H.SN.CNF.6)**

<i>Description:</i>	An ALARM alert shall be automatically triggered when an excessive aircraft taxi speed is detected (speed > Y knots, X>Y).
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**F.SN.PROC.3**

**Display stationary aircraft in the RWY protection area**

**(F.SN.CNF.3)**

<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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\*\* an excessive speed is a parametre to be defined at a local level



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**H.SN.PROC.7**

**(H.SN.CNF.7)**

*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 a local level.

**H.SN.PROC.8**

**(H.SN.CNF.8)**

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

**H.SN.PROC.9**

**(H.SN.CNF.9)**

*Description:* An alert INFORMATION shall be automatically triggered when a stationary mobile is detected in the runway protection area without interaction with a surrounding traffic.

**F.SN.PROC.4**

**Display wrong a/c or vehicle behaviour**

**(F.SN.CNF.4)**

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

**H.SN.PROC.10**

**(H.SN.CNF.10)**

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

**H.SN.PROC.11**

**(H.SN.CNF.11)**

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

**F.SN.PROC.5**

**Display a/c "clear to land" omission**

**(F.SN.CNF.5)**

*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.PROC.12**

**(H.SN.CNF.12)**

*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).



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**H.SN.PROC.13**

**(H.SN.CNF.13)**

*Description:* An alert ALARM 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).

**F.SN.PROC.6**

**Display red stop bar crossed**

**(F.SN.CNF.6)**

*Description:* It shall be possible to detect when an aircraft crosses the red stop bar.

**H.SN.PROC.14**

**(H.SN.CNF.14)**

*Description:* The controller shall be provided with clear and visible indication when an aircraft crosses a red stop bar.

**H.SN.PROC.15**

**(H.SN.CNF.15)**

*Description:* An alert ALARM shall be automatically triggered when an aircraft crosses a red stop bar.

**F.SN.PROC.7**

**Display a/c taking off without clearance**

**(F.SN.CNF.7)**

*Description:* It shall be possible to detect and display if an aircraft takes-off without clearance.

**H.SN.PROC.16**

**(H.SN.CNF.16)**

*Description:* The controller shall be provided with clear and visible indication when an aircraft is taking-off without clearance.

**H.SN.PROC.17**

**(H.SN.CNF.17)**

*Description:* An alert INFORMATION shall be automatically triggered when an aircraft is taking off without clearance and there is no implication with the surrounding traffic.

**H.SN.PROC.18**

**(H.SN.CNF.18)**

*Description:* An alert ALARM shall be automatically triggered when an aircraft is taking off without clearance and a mobile is on the RPA (crossing or entering the same runway).



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**F.SN.PROC.8**

**Display wrong a/c landing runway**

**(F.SN.CNF.8)**

*Description:* It shall be possible to detect and display if an arrival aircraft is not lined up on final on assigned landing runway.

**H.SN.PROC.19**

**(H.SN.CNF.19)**

*Description:* The controller shall be provided with clear and visible indication when an arrival aircraft is not lined up on final on the assigned landing runway.

**H.SN.PROC.20**

**(H.SN.CNF.20)**

*Description:* An alert ALARM shall be automatically triggered when an arrival aircraft is not lined up on final on the assigned landing runway



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**3.10.1.3 Detection of conflicting ATC clearances (CLRS<sup>††</sup>)**

In order to align the categorisation of detections of the surface potential hazardous situations with the Airport Safety Nets categorisation, the detection of inconsistent clearances are included in the category of alerts related to the conflicting ATC clearances.

*Note: the former requirements referenced F.SN.CLR.YY and H.SN.CLR.YY have been replaced respectively with F.SN.CLRS.YY and H.SN.CLRS.YY.*

The input clearances via e-strip allows the system to cross check the given clearances (A-SMGCS services beyond levels 1&2). The objective of the ITWP alerting function, which is in line with the Episode 3, is to check the set of clearances provided at the same time on an airport, to ensure that the set of instructions is consistent.

The clearances should represent the normal set of clearance a controller normally gives to an aircraft such as: 'cleared to land', 'go-around', 'vacate', 'cross', taxi', 'stop at', 'start-up', 'push-back', 'hold', 'line-up', 'conditional line-up', 'take-off', 'abort take-off' etc...

<b>F.SN.CLR.1</b>	
<b>F.SN.CLRS.1</b>	<b>Display conflicting ATC clearances</b>
<i>Description:</i>	It shall be possible to detect and display manual inputs of inconsistent clearances.
<i>References:</i>	[EPISODE 3 WP2 D2.1]; [OC&R AIRPORT SAFETY NETS]

<b>H.SN.CLR.1</b>	
<b>H.SN.CLRS.1</b>	
<i>Description:</i>	The controller shall be provided with clear and visible indication of inconsistency between manually input clearances as soon as they exist.

<sup>††</sup> Airport Safety Nets, Alerts Category 2: Conflicting ATC clearances



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**H.SN.CLR.2**  
**H.SN.CLRS.2**

*Description:*

An ALARM shall be automatically triggered when input of inconsistent clearances occurs.

The triggering conditions are described in the following table:

a/c <sub>2</sub> \ a/c <sub>1</sub>	Line-up	Cross/Enter	Take-Off	Landing
Line-up	Yes if a/c are LUP from the same or adjacent holding points on the same runway (if the multiple line-up is forbidden).  In case of authorised multiple line-up, if the sequence order displayed on the EFPS is different from the actual sequence of aircraft with LUP CLR (already lined-up or not) then INFORMATION (5), (8)		Yes if ac2* is in front of ac1	Yes (6)
Cross/Enter	Aircraft with CROSS/LUP but another aircraft on final within T1+15"	(8)	Yes if a/c <sub>2</sub> <sup>(*)</sup> is in front of a/c <sub>1</sub>	Yes <sup>(*)</sup> (6)
Take-off	Yes if a/c <sub>1</sub> is in front of a/c <sub>2</sub>	Yes if a/c <sub>1</sub> <sup>(*)</sup> is in front of a/c <sub>2</sub>	Yes (1), (2), (5)	Yes (6)
Landing	Yes	Yes <sup>(*)</sup>	Yes (4), (5)	Yes (3)

<sup>(\*)</sup> applies to aircraft and vehicle

- (1) if converging runways and converging trajectories then TOF vs. TOF => ALARM
- (2) if intersecting runways and converging trajectories then TOF vs. TOF => ALARM
- (3) if intersecting runways and converging trajectories then LND vs. LND => ALARM
- (4) if intersecting runways and converging trajectories then TOF vs. LND => ALARM
- (5) LUP/LUP, TOF/TOF and LND/LND shall trigger an ALARM if two aircraft are cleared on two opposite runway directions (on the same runway but on the opposite threshold) => ALARM.
- (6) if an aircraft is cleared to CROSS/LUP/TOF and the other aircraft is cleared to LND on the opposite direction on the same runway => ALARM
- (7) if an aircraft is cleared to TOF and another aircraft is cleared to TOF/CROSS/ENTER/LUP on the same runway => ALARM
- (8) CROSS/LUP vs. CROSS/LUP: if on taxiways in opposite direction => ALARM







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<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="width: 15%;">Ref. aircraft</th> <th style="width: 35%;">Conflicting aircraft</th> <th style="width: 20%;">Step 1 alert</th> <th style="width: 30%;">Step 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 (&lt; 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 &lt; T1 from threshold</td> <td style="text-align: center;">the arriving aircraft &lt; 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 &lt; T1 from threshold</td> <td style="text-align: center;">Arriving aircraft &lt; 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 &lt; T1 from threshold</td> <td style="text-align: center;">Arriving aircraft &lt; 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 &lt; 50 knots)</td> <td style="text-align: center;">departing aircraft is taking-off (speed &gt; 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> <p><i>Note: LUP/LUP, TOF/TOF and LND/LND shall trigger an ALARM if two aircraft are cleared on the same runway but on the opposite thresholds.</i></p>			Ref. aircraft	Conflicting aircraft	Step 1 alert	Step 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)
Ref. aircraft	Conflicting aircraft	Step 1 alert	Step 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)																												
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	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)																												
<i>References:</i>	[FS A-SMGCS LEVEL II], Annex B; [OC&R A-SMGCS IMP LEVEL II], Annex A.																														



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<b>H.SN.RCA.1</b>	
<b>H.SN.AREA.1</b>	
<i>Description:</i>	<p>Conflict information should be unambiguously presented to the controller using visual and sound processes:</p> <p>a) Visual process consists in the provision of alert situation information: the provided information should include the type and location of alert situation, and identification of the conflicting traffic.</p> <p>b) Sound process consists in a sound alert issued when the alert situation necessitates an immediate action. A sound process shall always be associated with a visual process in order to provide the controller with the information he needs to understand the situation.</p> <p>This information should be always available to the controller.</p>
<i>References:</i>	[OC&R A-SMGCS IMP LEVEL II] (§3.2.1)
<b>H.SN.RCA.2</b>	
<b>H.SN.AREA.2</b>	
<i>Description:</i>	An alert associated with a <u>detected</u> conflict should be provided with an adequate time and brought to the attention of the controller (alarm coding). An alert associated with a <u>predicted</u> conflict (information coding) should also be provided.
<i>References:</i>	[ICAO Doc 9830] (§3.4.5.8)
<b>F.SN.RCA.4</b>	
<b>F.SN.AREA 4</b> <span style="float: right;"><b>Display RWY conflict (step 1 alert)   Display RWY conflict (step 2 alert)  End RWY conflict alert</b></span>	
<i>Description:</i>	Conflict information should be displayed <u>continuously</u> while the conflict is present. It should not be possible to manually de-activate a runway conflict alert.
<i>References:</i>	[ICAO Doc 9830] (§3.4.5.14)
<b>H.SN.RCA.3</b>	
<b>H.SN.AREA.3</b>	
<i>Description:</i>	The controller shall not be allowed to cancel a runway conflict alert.
<b>F.SN.RCA.5</b>	
<b>F.SN.AREA.5</b> <span style="float: right;"><b>End RWY conflict alert</b></span>	
<i>Description:</i>	The end of a runway conflict alert shall be automatically triggered when the corresponding triggering conditions are no more fulfilled.



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<b>H.SN.RCA.4</b>	
<b>H.SN.AREA.4</b>	
<i>Description:</i>	The controller shall be provided with clear and visible information about the end of the runway conflict alert as soon as the alert ends.

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

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

#### 3.10.1.4.2 Detection of ATC controllers input errors with respect to airport layout

The objective is to detect input errors of the controllers, like assigning a closed runway to an aircraft. The control function of the A-SMGCS which is implemented in ITWP is able to handle events that impose operational changes (e.g. runway changes, taxiway closed for maintenance etc.).

*Note: the former requirements referenced F.SN.LAY.YY and H.SN.LAY.YY have been replaced with F.SN.AREA.YY and H.SN.AREA.YY respectively.*

<b>F.SN.LAY.1</b>	
<b>F.SN.AREA.8</b>	<b>Display ATCO input error w.r.t airport layout</b>
<i>Description:</i>	It shall be possible to detect and display ATCO input error with respect to airport layout (i.e. a/c arriving to or departing on a closed runway; aircraft cleared to taxi via closed taxiway)
<i>Reference:</i>	ICAO Document 9830 (§3.4.5)

<b>H.SN.LAY.1</b>	
<b>H.SN.AREA.5</b>	
<i>Description:</i>	The controller shall be provided with clear and visible indication of an input error with respect to the airport layout.



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**H.SN.LAY.2**

**H.SN.AREA.6**

<i>Description:</i>	<p>An INFORMATION alert shall be automatically triggered when ATCO input error with respect to the airport layout occur:</p> <p>a) For a flight, when a selected runway is either closed or inactive.</p> <p>b) For a flight, when a selected runway is inappropriate/unsuitable w.r.t the aircraft type, i.e. runway is too short.</p> <p>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.</p>
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**H.SN.LAY.3**

**H.SN.AREA.7**

<i>Description:</i>	<p>An ALARM alert shall be automatically triggered when the situation, input error with respect to airport layout, is not resolved and the system detect mobile entering the unauthorised area:</p> <p>a) For a flight, when an aircraft is entering either closed or inactive runway.</p> <p>b) For a flight, when an aircraft is taxiing on the closed taxiway.</p>
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**3.10.2 Protecting devices and runway lighting**

One of basic requirements of the A-SMGCS guidance function (see ICAO Doc 9830, f) in §2.5.3) is that it should allow monitoring of the operational status of all guidance aids.

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

<b>F.SN.PTD.2</b>	<b>Manually switch protection devices</b>
<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.

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

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

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



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

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

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

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

<b>H.SN.PTD.5</b>		
<i>Description:</i>	Red stop bars should switch off when a line up or take-off clearance is given to an aircraft. They should return to red (activated) when the aircraft has crossed the stop bar. The parameter to switch the stop bars on could be time or distance based. This parameter should be defined at a local level. <i>Note: in the future, the activation of the stop bar will be refined. The change of the red stop bar status might be linked to the conflicting ATC clearances detections.</i>	

### 3.10.3 Nav aids serviceability

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

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

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



### 3.10.4 Management of mobiles on the runway (cross & enter)

The objectives are to:

- raise situational awareness of the controller when the runway is occupied (e.g. highlight the runway when a mobile is authorised to cross or enter);
- inform the system that the controller has cleared a mobile to ‘cross’ or ‘enter’ an active runway (e.g. allows the system to detect when an aircraft is cleared to take off and another aircraft is cleared to cross the active runway).

<b>F.SN.RWY.1</b> <b>Input ‘enter’ runway protected area</b>	
<i>Description:</i>	It shall be possible for the controller to input an “enter runway protected area” instruction

<b>F.SN.RWY.2</b> <b>Input ‘cross’ runway</b>	
<i>Description:</i>	It shall be possible to input a “cross runway” instruction (see §3.6.1)

<b>H.SN.RWY.1</b>	
<i>Description:</i>	The controller should be provided with an easy means to input a “cross” clearance instruction

<b>H.SN.RWY.2</b>	
<i>Description:</i>	When the controller gives a ‘cross’ or ‘enter’ instruction to a mobile, the controller should have visual indication of the runway occupancy until the ‘vacate’ or ‘release’ order is given (e.g. runway e-strip).
<i>Reference:</i>	ICAO Document 9830 (§3.4.5.7 a) point 5 & 6)

<b>F.SN.RWY.3</b> <b>Runway occupied</b>	
<i>Description:</i>	It shall be possible to display when a runway is occupied by an aircraft or a vehicle which is on the frequency with the controller.

<b>H.SN.RWY.3</b>	
<i>Description:</i>	The controller should be provided with a clear identification of runway occupancy.

<b>F.SN.RWY.4</b> <b>End Runway occupancy</b>	
<i>Description:</i>	It shall be possible to display when the end of a runway is not occupied anymore.

<b>H.SN.RWY.4</b>	
<i>Description:</i>	The controller should be provided with a clear visual identification when the runway is not occupied any more.



### 3.10.5 Management of traffic queues – sequencing traffic

This chapter gives basic specifications and requirements for the management of departure and arrival sequences separately (supposing that the sequencing tools do not communicate). In the future phases of ITWP, the sequencing tools (AMAN and DMAN) should be interconnected.

#### 3.10.5.1 Departure management

The objective is to provide GND and CLD controllers with:

- A runway sequence of departing aircraft;
- A Target Start Up Time (TSAT) for every departing aircraft;
- A Target Take Off Time (TTOT) for every departing aircraft.

<b>F.SEQ.DEP.1</b>		<b>Display TSAT</b>
<i>Description:</i>	It shall be possible to display the Target Start Up Time of a departing aircraft.	

<b>H.SEQ.DEP.1</b>	
<i>Description:</i>	The controller should be provided with a clear display of the Target Start Up Time for a departing aircraft. The time should be displayed on the EFS and in the radar label.

<b>F.SEQ.DEP.2</b>		<b>Display TTOT</b>
<i>Description:</i>	It shall be possible to display the Target Take Off Time of a departing aircraft.	

<b>H.SEQ.DEP.2</b>	
<i>Description:</i>	The controller should be provided with a clear display of the Target Take Off Time for a departing aircraft. The time should be displayed on the EFS and on the radar label.

<b>F.SEQ.DEP.3</b>		<b>Display RWY sequence number</b>
<i>Description:</i>	It shall be possible to display the flight position number in the runway sequence at the runway.	

<b>H.SEQ.DEP.3</b>	
<i>Description:</i>	The controller should be provided with clear display of the flight position number in the departure sequence at the runway. The number should be available on the EFS and on the radar label (extended radar label and selected field in the EFS).

### 3.10.5.2 Arrival management

The objective is to provide RWY controllers with the estimated landing time of an aircraft and the arrival runway sequence number.

<b>F.SEQ.ARR.1</b>		<b>Display ELDT</b>
<i>Description:</i>	It shall be possible to display the Estimated LanDing Time of an arriving aircraft.	

<b>H.SEQ.ARR.1</b>	
<i>Description:</i>	The controller should be provided with a clear display of the Estimated LanDing Time for an arriving aircraft.

<b>F.SEQ.ARR.2</b>		<b>Display RWY sequence number</b>
<i>Description:</i>	It shall be possible to display flight position number in the arrival sequence at the runway.	

<b>H.SEQ.ARR.</b>	
<i>Description:</i>	The controller should be provided with clear display of the flight position number in the arrival sequence at the runway. The number should be available on the EFS and on the radar label (extended radar label and selected field in the EFS).

## 3.11 Mobile Routing Management

The objective is to provide a routing information to the controller regarding the aircraft and vehicles on the movement area. The objective is also to provide support to the controllers in order to efficiently modify routes initially allocated to a mobile.

The routing function allows the controller to assign and change the route and destination of any aircraft or vehicle within the movement area<sup>§§</sup> at any time. The conformance monitoring of a cleared mobile route is described in §3.10.1.2.

The routing function should provide a means to validate a part or the totality of an assigned route ([ICAO Doc 9830] , §2.5.2.4. f.).

<sup>§§</sup> The part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area and apron. For A-SMGCS, it does not include passive stands, empty stands and those areas of the apron that are exclusively designed to vehicle movements.





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### 3.11.1 Display planned route

<b>F.ROUTE.DIS.1</b>		<b>Display initial route</b>
<i>Description:</i>	It shall be possible to provide routing information (i.e. visualise the trajectory) for an aircraft and an assumed vehicle.	
<i>Reference:</i>	ICAO Document 9830 (§3.4.2.2)	

<b>H.ROUTE.DIS.1</b>	
<i>Description:</i>	The controller should be able to easily visualise the planned trajectory of a mobile. Only the trajectories of the assumed mobiles should be highlighted.

### 3.11.2 Validate assigned route and display cleared route

*Note:* in this context, “validate” means to clear the route initially assigned to an assumed mobile. The objective is to provide this information to the system and to the pilot.

<b>F.ROUTE.CLR.1</b>		<b>Validate assigned route</b>
<i>Description:</i>	It shall be possible to validate a part or the totality of the route assigned to an assumed mobile.	
<i>References:</i>	[ICAO Doc 9830] (§2.5.2.40)	

<b>H.ROUTE.CLR.1</b>	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to validate the route assigned to a mobile. The mobile representation should account for this validation.

<b>F.ROUTE.DIS.2</b>		<b>Display cleared / not cleared route</b>
<i>Description:</i>	It shall be possible to visualise a cleared / not cleared portion of the trajectory of an assumed mobile.	

<b>H.ROUTE.DIS.2</b>	
<i>Description:</i>	The controller should be able to easily visualise portions of the cleared route for a mobile



### 3.11.3 Input “Stop at” instruction

<b>F.ROUTE.ORD.1</b>		<b>Input stop at</b>
<i>Description:</i>	It shall be possible to input a “stop at” instruction	

<b>H.ROUTE.ORD.1</b>	
<i>Description:</i>	Depending on the controller role and flight control responsibility, the controller should be provided with an easy means to input a “stop at” instruction for an aircraft. The aircraft representation should account for this instruction.

### 3.11.4 Input route modification

<b>F.ROUTE.CHG.1</b>		<b>Change initial route</b>
<i>Description:</i>	It shall be possible for the controller to change the initial trajectory of an assumed mobile.	
<i>References:</i>	[ICAO Doc 9830] , §2.5.2.1	

<b>F.ROUTE.CHG.2</b>		<b>Cancel / Change initial route</b>
<i>Description:</i>	By human-initiated means, it should be possible to immediately cancel or change an existing and used route.	
<i>References:</i>	[ICAO Doc 9830] , §3.4.2.7	

<b>F.ROUTE.CHG.3</b>		<b>Input new route</b>
<i>Description:</i>	When the existing and used route of a mobile has been cancelled, the controller should be able to input a new route.	
<i>Reference</i>	[ICAO Doc 9830] , §3.4.2.7	

<b>F.ROUTE.CHG.4</b>		<b>Propose new route</b>
<i>Description:</i>	When the existing and used route is modified, the system should propose a new route to reach the initial destination.	

<b>H.ROUTE.CHG.1</b>		<b>Change / Input route</b>
<i>Description:</i>	The controller should be provided with an easy means to change a planned trajectory or to input a new route for a mobile. Only the trajectories of the assumed mobiles should be modifiable.	



### 3.12 Air-Ground Data Communication : Data link Functions

The objective is to display the aircraft that are equipped for data link communications (information exchange between the air and the ground without voice communication). The capability of the equipment is called DLIC – Data link Initiation Capability. This capability sometimes referred to as logging on, provides the mechanism for exchanging and forwarding information between aircraft and ground systems, in support of CPDLC, ADS, and CM communications.

*Note: the data link function and related requirements will be defined and implemented in the future phases of the ITWP developements, .*

<b>F.DL.IDF.1 Aircraft equipped for data link communication</b>	
<i>Description:</i>	It shall be possible to identify an aircraft equipped with data link.

<b>H.DL.IDF.1</b>	
<i>Description:</i>	The controller should be provided with visual representation for aircraft equipped for data link communications in the radar label, on the EFS and everywhere else the callsign of the aircraft is displayed.



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## 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.

<b>X.HF.G1</b> <span style="float: right;"><b>Minimize Training</b></span>	
<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]

<b>X.HF.G2</b> <span style="float: right;"><b>Predictable results</b></span>	
<i>Description:</i>	Systems and equipment should be designed so that basic system functions are obvious to the user.
<i>Source:</i>	[Martin & Dong]

<b>X.HF.G3</b> <span style="float: right;"><b>Standardize hardware and software</b></span>	
<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]

<b>X.HF.G4</b> <span style="float: right;"><b>Maintain identical interfaces for identical functions</b></span>	
<i>Description:</i>	Equipment with identical functions should employ identical or similar interfaces
<i>Source:</i>	[MIL-STD-1472F]



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<b>X.HF.G5 Make controls, displays, marking, coding, labelling, and arrangement uniform</b>	
<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]

#### 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.

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

#### 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

<b>X.HF.G7 Design for simplicity</b>	
<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]

#### 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.

<b>X.HF.G8 Provide enough flexibility for different user skill levels</b>	
<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]

#### 4.1.5 Minimum cognitive effort

<b>X.HF.G9 Be consistent with user mental model</b>	
<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]



#### 4.1.6 Feedback on action

<b>X.HF.G10</b>		<b>Routine feedback</b>
<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]	

<b>X.HF.G11</b>		<b>Timely and informative feedback</b>
<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]	

<b>X.HF.G12</b>		<b>Predictable results</b>
<i>Description:</i>	For the feedback to be effective an appropriate response time should be defined for each selectable object. In absence of definition $\leq 125$ milliseconds is assumed.	
<i>Source:</i>	[ECHOES 2003]	

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

## 4.2 Inputs

### 4.2.1 Input Basics

<b>X.HF.R1</b>		<b>Highlighting principle</b>
<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>	[ECHOES 2003]	

<b>X.HF.R2</b>		<b>Highlighting activation</b>
<i>Description:</i>	An object shall become selected only when the acquisition boundary of (an instance <sup>***</sup> of) the object has been crossed by the cursor. (The area within the acquisition boundary is called the acquisition area).	
<i>Source:</i>	[ECHOES 2003]	

\*\*\* 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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<b>X.HF.R3</b>		<b>Highlighting de-activation</b>
<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>	[ECHOES 2003]	

<b>X.HF.G14</b>		<b>Highlighting latency</b>
<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>	[ECHOES 2003]	

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

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

#### 4.2.2 The accessibility of selectable objects

<b>X.HF.R6</b>		<b>Target access</b>
<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>	[ECHOES 2003]	

<b>X.HF.R7</b>		<b>Target availability</b>
<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>	[ECHOES 2003]	

<b>X.HF.R8</b>		<b>Target size</b>
<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>	[ECHOES 2003]	

<sup>†††</sup> Of course it is the visual angle presented which is important.



### 4.2.3 Response times

<b>X.HF.G15</b>		<b>Priority response</b>
<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>	[ECHOES 2003]	

<b>X.HF.G16</b>		<b>Feedback response time</b>
<i>Description:</i>	For good interface engagement a minimum feedback response to an explicit user input should be provided in $\leq 125$ milliseconds (perception of immediate response).	
<i>Source:</i>	[ECHOES 2003]	

<b>X.HF.R9</b>		<b>Feedback response consistency</b>
<i>Description:</i>	Consistency of response time shall be more important than the absolute time of response.	
<i>Source:</i>	[ECHOES 2003]	

### 4.2.4 Temporary versus Permanent Information Display

<b>X.HF.R10</b>		<b>Access quick look</b>
<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>	[ECHOES 2003]	

<b>X.HF.R11</b>		<b>Access sustained</b>
<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>	[ECHOES 2003]	

### 4.2.5 Policy on default selections

<b>X.HF.G17</b>		<b>Menu defaults</b>
<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>	[ECHOES 2003]	

<b>X.HF.R12</b>		<b>Menu defaults</b>
<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>	[ECHOES 2003]	





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<b>X.HF.R13</b>		<b>Menu defaults</b>
<i>Description:</i>	The order of menu items <sup>+++</sup> 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>	[ECHOES 2003] (modified)	
<b>X.HF.G18</b>		<b>Menu defaults</b>
<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>	[ECHOES 2003]	
<b>X.HF.R14</b>		<b>Pop-up menu</b>
<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>	[ECHOES 2003]	
<b>X.HF.R15</b>		<b>Menu options</b>
<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>	[ECHOES 2003]	
<b>X.HF.G19</b>		<b>Menu activation</b>
<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>	[ECHOES 2003] (modified)	
<b>X.HF.R16</b>		<b>Groups of options</b>
<i>Description:</i>	Groups of options in a menu shall be ordered according to user's logic.	
<i>Source:</i>	[ECHOES 2003]	
<b>X.HF.G20</b>		<b>Number of options</b>
<i>Description:</i>	The number of options in a menu should not be more than ten or less than three.	
<i>Source:</i>	[ECHOES 2003]	
<b>X.HF.R17</b>		<b>Number of options</b>
<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>	[ECHOES 2003]	

<sup>+++</sup> 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

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

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

### 4.2.6.2 Keyboard

<b>X.HF.G21</b>		<b>When to use</b>
<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>	[MIL-STD-1472D]	

<b>X.HF.G22</b>		<b>Include a numeric keypad for entering numeric data</b>
<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]; [MIL-STD-1801]	

<b>X.HF.R20</b>		<b>Frequently used commands</b>
<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	

<b>X.HF.R21</b>		<b>Keyboard location</b>
<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	

<b>X.HF.G23</b>		<b>Accidental activation</b>
<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

<b>X.HF.G24</b>		<b>Use</b>
<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]; [DOE HFAC1]	



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<b>X.HF.G25</b>		<b>Luminance transmission</b>
<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]; [DOE HFAC1]	

<b>X.HF.G26</b>		<b>Minimal parallax</b>
<i>Description:</i>	Touch-interactive devices should be selected and mounted to minimize parallax problems	
<i>Source:</i>	[DOE HFDG ATCCS]	

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

**4.2.6.4 Menus and Pop-Up menus**

4.2.6.4.1 General use

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

<b>X.HF.G29</b>		<b>Selecting a mutually exclusive option</b>
<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]	

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

<b>X.HF.G31</b>		<b>Consistent style</b>
<i>Description:</i>	Menus throughout an application should conform to a single style of interface	
<i>Source:</i>	[DOE HFDG ATCCS]	

<b>X.HF.G32</b>		<b>Consistent menus and options</b>
<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]; [DOD HCISG] (modified)	

<b>X.HF.G33</b>		<b>Menu titles</b>
<i>Description:</i>	Menu titles and menu options should be easily distinguishable	
<i>Source:</i>	[AMERITECH Inc]	



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<b>X.HF.G34</b>		<b>Distinguishing menu titles</b>
<i>Description:</i>	Menu titles should be easily distinguished from the options	
<i>Source:</i>	[AMERITECH Inc]	

<b>X.HF.G35</b>		<b>Numbering menu titles</b>
<i>Description:</i>	Menu titles should not be numbered	
<i>Source:</i>	[MIL-HDBK-761A]; [DIS AGENCY]	

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

4.2.6.4.2 Menu options

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

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

<b>X.HF.G39</b>		<b>Distinguishing unavailable options</b>
<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]	

<b>X.HF.G40</b>		<b>Menus with no available options</b>
<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 Inc]	

4.2.6.4.3 Options organisation

<b>X.HF.G41</b>		<b>Alignment of options</b>
<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]; [DOD HCISG] ; [MIL-HDBK-761A]; [MIL-STD-1801]	

<b>X.HF.G42</b>		<b>Ordering a number of options</b>
<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]; [DOD HCISG] (modified)	



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<b>X.HF.G43</b>		<b>Default option</b>
<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

<b>X.HF.G44</b>		<b>Number of options</b>
<i>Description:</i>	Menu bars should contain no more than 10 options plus Help	
<i>Source:</i>	[DON UISNCCS]; [Microsoft Corp.], 8-77	

<b>X.HF.G45</b>		<b>Placement of options</b>
<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]	

<b>X.HF.G46</b>		<b>Names of menu bar options</b>
<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]	

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

<b>X.HF.G48</b>		<b>Menu bar activation</b>
<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

<b>X.HF.G49</b>		<b>When to use</b>
<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 Incorporated]	
<b>X.HF.G50</b>		<b>Scroll-bar</b>
<i>Description:</i>	The scroll-bar should be placed at the right of the displayed options	
<i>Source:</i>	[DON UISNCCS]	



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

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

<b>X.HF.G53</b>		<b>Alphabetical arrangement</b>
<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]	

<b>X.HF.G54</b>		<b>Display of all options in a scrolling menu</b>
<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 Incorporated]	

#### 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 (*see* [CTA 1996] ).

<b>X.HF.G55</b>		<b>Pop-up menus</b>
<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)	

<b>X.HF.G56</b>		<b>Distinguishing the pop-up menu</b>
<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]	



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<b>X.HF.G57</b>		<b>Pop-up menu location</b>
<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	
<i>Source:</i>	[CTA 1996]	

<b>X.HF.G58</b>		<b>Indication of pop-up menu</b>
<i>Description:</i>	An indication or cue should be provided to the existence of a pop-up menu	
<i>Source:</i>	[DOE HFDG ATCCS]; [DOD HCISG]	

<b>X.HF.G59</b>		<b>Selecting an option using a pointing device</b>
<i>Description:</i>	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	
<i>Source:</i>	[DOE HFDG ATCCS]; [DOD HCISG]	

<b>X.HF.G60</b>		<b>Selection highlighting</b>
<i>Description:</i>	When an option in a pop-up menu remains on display after it has been selected, it should remain highlighted	
<i>Source:</i>	[DOE HFDG ATCCS]; [DOD HCISG]	

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

<b>X.HF.G62</b>		<b>Options leading to cascading menus</b>
<i>Description:</i>	Selected options that lead to a cascading menu should remain highlighted and serve as the title for the cascading menu.	
<i>Source:</i>	[CTA 1996]	

#### 4.2.7 Input Error Management Policy

<b>X.HF.G63</b>		<b>Flexible "go back" for error correction</b>
<i>Description:</i>	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.	
<i>Source:</i>	[DOE HFDG ATCCS]	



### 4.3 Visual presentation rules and conventions

#### 4.3.1 Display hardware

##### 4.3.1.1 General

<b>X.HF.G64</b> <span style="float: right;"><b>Make displays legible under all conditions</b></span>	
<i>Description:</i>	Visual displays should be legible under all anticipated viewing conditions, and should maintain good image quality even at the dimmest possible setting
<i>Source:</i>	[MIL-STD-1472F]

##### 4.3.1.2 Glare

<b>X.HF.G65</b> <span style="float: right;"><b>Glare Control</b></span>	
<i>Description:</i>	Glare should be eliminated or minimized
<i>Source:</i>	ANSI, 1988; [MIL-STD-1472F]

#### 4.3.2 Principles for the presentation of data

##### 4.3.2.1 General Principles

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

<b>X.HF.G67</b> <span style="float: right;"><b>Minimizing the user's short-term memory load</b></span>	
<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>	[DON UISNCCS]

##### 4.3.2.2 Organisation of information

<b>X.HF.G68</b> <span style="float: right;"><b>Priority of displayed information</b></span>	
<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]; [DOD HCISG]

<b>X.HF.G69</b> <span style="float: right;"><b>Grouped information</b></span>	
<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]





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<b>X.HF.G70</b>		<b>Primary viewing area</b>
<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]	

<b>X.HF.G71</b>		<b>Task-critical information</b>
<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]	

<b>X.HF.G72</b>		<b>Ordering of information</b>
<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]	

<b>X.HF.G73</b>		<b>Minimal visual competition</b>
<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]; [DOD HCISG]	

<b>X.HF.G74</b>		<b>Matching layout to task</b>
<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]	

<b>X.HF.G75</b>		<b>Removal of Information from the screen</b>
<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]	

<b>X.HF.G76</b>		<b>Highlighting</b>
<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]; [MIL-HDBK-761A]	

<b>X.HF.G77</b>		<b>Display Consistency</b>
<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]	



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### 4.3.2.3 Text properties

#### 4.3.2.3.1 Fonts and sizes

<b>X.HF.G78</b>		<b>Number of different fonts</b>
<i>Description:</i>	There should be a limit of two different fonts displayed on any one screen	
<i>Source:</i>	[NATS]	

<b>X.HF.G79</b>		<b>Text size and style</b>
<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>	[NATS]	

#### 4.3.2.3.2 Vocabulary and abbreviations

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

<b>X.HF.G81</b>		<b>Consistent wording and structure</b>
<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]	

<b>X.HF.G82</b>		<b>Use of abbreviations</b>
<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]; [MIL-STD-12D]	

<b>X.HF.G83</b>		<b>Acronyms</b>
<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]	

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

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



#### 4.3.2.3.3 Style and layout

<b>X.HF.G86</b>		<b>Contrast</b>
<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]	

<b>X.HF.G87</b>		<b>Suitability/appropriateness of bold coding</b>
<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>	[NATS]	

#### 4.3.2.4 Viewing distances

<b>X.HF.G88</b>		<b>Range for viewing distance</b>
<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] (modified)	

#### 4.3.2.5 Radar Labels

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

<b>X.HF.G90</b>		<b>Aircraft parametre</b>
<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>	[ECHOES 2007]	

<b>X.HF.G91</b>		<b>Aircraft flight data avialibility</b>
<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>	[ECHOES 2007] (modified)	

<b>X.HF.G92</b>		<b>Aircraft flight data update</b>
<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>	[ECHOES 2007] (modified)	

<b>X.HF.G93</b>		<b>Inactive label</b>
<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>	[ECHOES 2007] (modified)	



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<b>X.HF.G94</b>		<b>Notification of an aircraft</b>
<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.	
<i>Source:</i>	[ECHOES 2007] (modified)	

<b>X.HF.G95</b>		<b>Transfer of an aircraft</b>
<i>Description:</i>	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.	
<i>Source:</i>	[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.

<b>X.HF.G96</b>		<b>Selecting check boxes</b>
<i>Description:</i>	Users should be able to toggle selected and unselected states on a check box using either a pointing device or the keyboard	
<i>Source:</i>	[DON UISNCCS]	

<b>X.HF.G97</b>		<b>Check box states</b>
<i>Description:</i>	Check boxes should have two states, selected and unselected.	
<i>Source:</i>	[DON UISNCCS]	

<b>X.HF.G98</b>		<b>Labelling check boxes</b>
<i>Description:</i>	Labels should be provided for each set of check boxes	
<i>Source:</i>	[CTA 1996]	

<b>X.HF.G99</b>		<b>Check box height and width</b>
<i>Description:</i>	When grouping check boxes, the boxes should be equal in height and width	
<i>Source:</i>	[CTA 1996]	

#### 4.3.2.7 Cursors

<b>X.HF.G100</b>		<b>Cursor movement</b>
<i>Description:</i>	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	
<i>Source:</i>	[MIL-HDBK-761A]	



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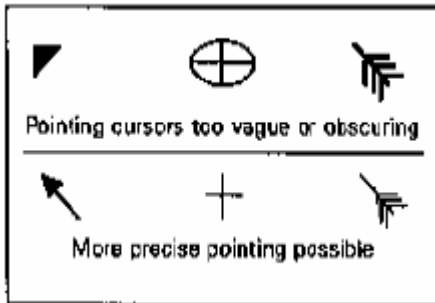
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<b>X.HF.G101</b>		<b>Size</b>
<i>Description:</i>	Position or pointing cursors should maintain their size across all screen locations during movement	
<i>Source:</i>	[AMERITECH Inc]	

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

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

<b>X.HF.G104</b>		<b>Cursor active point</b>
<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](modified)	



#### 4.3.2.8 Maps and Tactical Displays

##### 4.3.2.8.1 Characteristics

<b>X.HF.G105</b>		<b>Intensity</b>
<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]	

<b>X.HF.G106</b>		<b>Map as background</b>
<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]	



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<b>X.HF.G107</b>		<b>Map size</b>
<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]	
<b>X.HF.G108</b>		<b>Coverage</b>
<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]	
<b>X.HF.G109</b>		<b>Situation displays as overlays</b>
<i>Description:</i>	Situation displays (additional view windows) should be provided to their related maps	
<i>Source:</i>	[DOE HFDG ATCCS] (modified)	
<b>X.HF.G110</b>		<b>Map orientation</b>
<i>Description:</i>	Users should have a possibility to orient the map in order to perform their task	
<i>Source:</i>	ITWP, 2007	
<b>X.HF.G111</b>		<b>Areas of special interest</b>
<i>Description:</i>	Map areas of special interest should be differentiated by colour or shading	
<i>Source:</i>	[DOE HFDG ATCCS] (modified)	
<b>X.HF.G112</b>		<b>Reading a map</b>
<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]	
<b>X.HF.G113</b>		<b>Labelling features</b>
<i>Description:</i>	To the extent possible without cluttering the display, all significant features should be labelled	
<i>Source:</i>	[DOE HFDG ATCCS]	
<b>X.HF.G114</b>		<b>Consistent label position</b>
<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]	
<b>X.HF.G115</b>		<b>Label legibility</b>
<i>Description:</i>	Labels should remain legible at all display resolutions	
<i>Source:</i>	[DOE HFDG ATCCS]	
<b>X.HF.G116</b>		<b>Association of symbols with map features</b>
<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]	



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<b>X.HF.G117</b>		<b>Reducing clutter</b>
<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]	

#### 4.3.2.8.2 Graphic display manipulation

<b>X.HF.G118</b>		<b>User control of map appearance</b>
<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]	

<b>X.HF.G119</b>		<b>Map manipulation</b>
<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]	

<b>X.HF.G120</b>		<b>Return to start</b>
<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]	

<b>X.HF.G121</b>		<b>Zooming and legibility</b>
<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]	

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

#### 4.3.2.8.3 Dynamic information update

<b>X.HF.G123</b>		<b>Alphanumeric data</b>
<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]	

### 4.3.3 Alarms and critical information

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



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

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

<b>X.HF.R23</b>		<b>Visual and Auditory Alarm</b>
<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>	[ECHOES 2003]	

<b>X.HF.R24</b>		<b>Priority between alerts</b>
<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>	[ECHOES 2003]	

#### 4.3.4 Visual alerts

##### 4.3.4.1 General

<b>X.HF.R25</b>		<b>Alert Location</b>
<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)	

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

<b>X.HF.G127</b>		<b>Coding</b>
<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]	

<b>X.HF.G128</b>		<b>Attention</b>
<i>Description:</i>	A user's attention should be drawn to critical or abnormal information by highlighting,	





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	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>	[NATS]

<b>X.HF.G129</b>	<b>Misuse of Visual Coding</b>
<i>Description:</i>	Visual coding should be used for functional, not decorative, purposes
<i>Source:</i>	[NATS]

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

#### 4.3.4.2 Icons, buttons and controls

<b>X.HF.G131</b>	<b>Design of symbols</b>
<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]

<b>X.HF.G132</b>	<b>Minimum selectable area</b>
<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 Inc]

<b>X.HF.G133</b>	<b>Creating icons</b>
<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

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



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<b>X.HF.G135</b>		<b>Reserved meanings</b>
<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: <ul style="list-style-type: none"> <li>a) Red should indicate conditions such as no-go, error, failure, or malfunction.</li> <li>b) Flashing red should be used only to indicate emergency conditions requiring immediate user action to avert personnel injury or equipment damage.</li> <li>c) Yellow should indicate marginal conditions, alert users to situations where caution or rechecking is necessary, or notify users of an unexpected delay.</li> </ul>	
<i>Source:</i>	[MIL-HDBK-761A] (modified)	
<b>X.HF.G136</b>		<b>Colour coding strategy</b>
<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]	
<b>X.HF.G137</b>		<b>Data categories</b>
<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]	
<b>X.HF.G138</b>		<b>Redundant use</b>
<i>Description:</i>	The use of colour should not reduce screen readability	
<i>Source:</i>	[DOD HCISG]	
<b>X.HF.G139</b>		<b>Small areas</b>
<i>Description:</i>	Users should not have to discriminate among colours in small areas	
<i>Source:</i>	[DOD HCISG]	
<b>X.HF.G140</b>		<b>Drawing attention</b>
<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]	
<b>X.HF.G141</b>		<b>Colours for action and status</b>
<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]	
<b>X.HF.G142</b>		<b>Relative colour</b>
<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]	



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<b>X.HF.G143</b>		<b>Colour pairs</b>
<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]	

<b>X.HF.G144</b>		<b>Test colours</b>
<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]	

<b>X.HF.G145</b>		<b>Varying lightness</b>
<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]	

<b>X.HF.G146</b>		<b>Foreground and background contrast</b>
<i>Description:</i>	The foreground colour should contrast highly with the background	
<i>Source:</i>	[DOD HCISG]	

#### 4.3.4.4 Brightness / intensity coding

<b>X.HF.G147</b>		<b>High brightness</b>
<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]	

<b>X.HF.G148</b>		<b>Highlighting during operations</b>
<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]; [MIL-HDBK-761A]	

<b>X.HF.G149</b>		<b>Highlighting on dark backgrounds</b>
<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]	

<b>X.HF.G150</b>		<b>Highlighting on light backgrounds</b>
<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]	

<b>X.HF.G151</b>		<b>Size and number of areas highlighted</b>
<i>Description:</i>	The size and number of areas highlighted should be minimized	
<i>Source:</i>	[DOD HCISG]	



#### 4.3.4.5 Flashing

<b>X.HF.G152</b>		<b>Flash rate for Error Messages</b>
<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

<b>X.HF.G153</b>		<b>Use</b>
<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, present information in situations in which visual presentation is not feasible and provide feedback for control actuation, data entry or the completion of timing cycles and sequences.	
<i>Source:</i>	[MIL-HDBK-761A]	

<b>X.HF.G154</b>		<b>Application</b>
<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]	

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

<b>X.HF.G156</b>		<b>Alarms for normal conditions</b>
<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

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

<b>X.HF.G158</b>		<b>Multiple audio signals</b>
<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]	



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#### 4.3.5.2 Signals meaning

<b>X.HF.G159</b>		<b>Consistent signals and meanings</b>
<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]	

#### 4.3.5.3 Duration

<b>X.HF.G160</b>		<b>Signal termination</b>
<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]	

#### Intensity (loudness)

<b>X.HF.G161</b>		<b>Environmental compatibility</b>
<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]	

<b>X.HF.G162</b>		<b>Volume limits</b>
<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]	

#### 4.3.5.4 Acknowledging signals

<b>X.HF.G163</b>		<b>Acknowledging and terminating alarms</b>
<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]	

<b>X.HF.G164</b>		<b>Automatic reset</b>
<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]	

### 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



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as long as the modal window is displayed. When a window is modeless, a user can interact with other windows.

<b>X.HF.G165</b>		<b>User-specified windows</b>
<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]	

<b>X.HF.G166</b>		<b>Number of allowable open windows</b>
<i>Description:</i>	The number of allowable open windows should not compromise system response time	
<i>Source:</i>	[DOE HFDG ATCCS]	

<b>X.HF.G167</b>		<b>Window size</b>
<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>	[NATS]	

<b>X.HF.G168</b>		<b>Window Resizing</b>
<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]	

<b>X.HF.G169</b>		<b>Moved or resized windows</b>
<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]	

<b>X.HF.G170</b>		<b>Default location for moved or resized windows</b>
<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]	

#### 4.3.6.2 Window states

<b>X.HF.G171</b>		<b>Window movement limits</b>
<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 Inc]	

#### 4.3.6.3 Window organisation

<b>X.HF.G172</b>		<b>Window default location</b>
<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),	



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	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
Source:	[DON UISNCCS]

#### 4.3.6.4 Window component – Title bar

<b>X.HF.G173</b>		<b>Use</b>
Description:	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	
Source:	[DON UISNCCS]	

<b>X.HF.G174</b>		<b>Capitalization in window titles</b>
Description:	Significant words in the title (except user-defined words) should be capitalized	
Source:	[AMERITECH Inc]	

#### 4.3.7 System response time

<b>X.HF.G175</b>		<b>Appropriate system response time</b>
Description:	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	
Source:	[DOE HFDG ATCCS]; [MIL-HDBK-761A]	



## 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

<b>X.HF.AG1</b>		<b>Positive indication</b>
<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]; [DOE HFAC1]	

<b>X.HF.AG2</b>		<b>Display feedback</b>
<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]	

##### 5.1.1.2 Menus and Pop-Up menus

###### 5.1.1.2.1 Options organisation

<b>X.HF.AG3</b>		<b>Placing destructive command options</b>
<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

<b>X.HF.AG4</b>		<b>When to use</b>
<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]; [DOD HCISG]	

###### 5.1.1.2.3 Pull down menus

<b>X.HF.AG5</b>		<b>When to use</b>
<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]; [DOD HCISG]	





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<b>X.HF.AG6</b>		<b>Consistent location</b>
<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]	
<b>X.HF.AG7</b>		<b>Titles</b>
<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], [Microsoft Corp.]	
<b>X.HF.AG8</b>		<b>Unique title</b>
<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]	
<b>X.HF.AG9</b>		<b>Outlining</b>
<i>Description:</i>	Pull-down menus should be outlined with a border or drop shadow.	
<i>Source:</i>	[CTA 1996]	
<b>X.HF.AG10</b>		<b>Cascading pull-down</b>
<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]	
<b>X.HF.AG11</b>		<b>Separators to divide groups of options</b>
<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]	
<b>X.HF.AG12</b>		<b>Minimize scrolling</b>
<i>Description:</i>	To the extent possible, all options should be present to minimize scrolling	
<i>Source:</i>	[CTA 1996]	
<b>X.HF.AG13</b>		<b>Option selection</b>
<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 Inc]	

#### 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).



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

<b>X.HF.AG15</b>		<b>Cascading menus</b>
<i>Description:</i>	Cascading menus should follow the same rules as hierarchical menus	
<i>Source:</i>	[Microsoft Corp.]	

<b>X.HF.AG16</b>		<b>Cascade indicator</b>
<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 Inc]	

<b>X.HF.AG17</b>		<b>Number of levels</b>
<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 Inc]	

### 5.1.2 Input Error Management Policy

<b>X.HF.AR1</b>		<b>Provision of Error messages</b>
<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	

<b>X.HF.AG18</b>		<b>Format</b>
<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	

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

<b>X.HF.AG19</b>		<b>Error recovery</b>
<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]; [MIL-STD-1801]	



## 5.2 Visual presentation rules and conventions

### 5.2.1 Principles for the presentation of data

#### 5.2.1.1 General Principles

<b>X.HF.AG20</b>		<b>Group task-related displays together</b>
<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]	

##### 5.2.1.1.1 Style and layout

<b>X.HF.AG21</b>		<b>Distinctive appearance</b>
<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]	

<b>X.HF.AG22</b>		<b>Text Fields</b>
<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]	

#### 5.2.1.2 Cursors

<b>X.HF.AG23</b>		<b>Blink</b>
<i>Description:</i>	Position or pointing cursors should not blink	
<i>Source:</i>	[AMERITECH Inc]	

<b>X.HF.AG24</b>		<b>Pointer visibility</b>
<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>		

<b>X.HF.AG25</b>		<b>Movement</b>
<i>Description:</i>	Position or pointing cursors should not move without input of the user	
<i>Source:</i>	[AMERITECH Inc]	

#### 5.2.1.3 Maps and Tactical Displays

##### 5.2.1.3.1 Characteristics

<b>X.HF.AG26</b>		<b>Connecting text to features</b>
<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]	



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<b>X.HF.AG27</b>		<b>Determining coordinates</b>
<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]	

5.2.1.3.2 Graphic display manipulation

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

**5.2.1.4 Radar Labels**

<b>X.HF.AG29</b>		<b>Mark in label</b>
<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>	[ECHOES 2007]	

**5.2.2 Visual alerts**

**5.2.2.1 Use of colours principles**

<b>X.HF.AG30</b>		<b>Colour legends</b>
<i>Description:</i>	Colour should not be used to substitute for written legends	
<i>Source:</i>	[NATS]	

<b>X.HF.AG31</b>		<b>Colour brightness</b>
<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]	

<b>X.HF.AG32</b>		<b>Number of levels on coloured displays</b>
<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>	[NATS]	

**5.2.2.2 Brightness / intensity coding**

<b>X.HF.AG33</b>		<b>More than one brightness level</b>
<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>	[NATS]	

<b>X.HF.AG34</b>		<b>Reverse video</b>
<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]	

**5.2.3 Auditory alerts**

<b>X.HF.AG35</b>		<b>Relation to visual displays</b>
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<i>Description:</i>	When used in conjunction with the visual displays, audio warning devices shall be supplementary or supportive. The audio signal shall be used to alert and direct operator attention to the appropriate visual display
<i>Source:</i>	[MIL-STD-1472F] ,5.3.2.4, pp44

<b>X.HF.AG36</b>	<b>Intrusiveness</b>
<i>Description:</i>	An auditory alert should not nag, or otherwise annoy the controller
<i>Source:</i>	[Cardosi & Murhpy], A5, 7.3.5; pp15

<b>X.HF.AG37</b>	<b>Avoid negative consequences</b>
<i>Description:</i>	Auditory signals should not result in user or operator confusion, errors, or inefficiencies in response
<i>Source:</i>	[AMERITECH Inc]

<b>X.HF.AG38</b>	<b>Compatible with environment</b>
<i>Description:</i>	Auditory signals should also be compatible with the acoustical environment of the controller
<i>Source:</i>	[MIL-STD-1472F]

<b>X.HF.AG39</b>	<b>Validation</b>
<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 Inc]

### 5.2.3.1 Number of signals

<b>X.HF.AG40</b>	<b>Number of audio signals for absolute identification</b>
<i>Description:</i>	When absolute identification is required, the number of signals to be identified should not exceed four. Research shows that between 4 to 7 alarms can be acquired reasonably quickly, performance decreases dramatically for additional alarms. The meanings associated with up to nine alarms can be retained if the alarms are presented regularly.
<i>Source:</i>	[MIL-STD-1472F] ; Patterson, 1982; Stanton & Edworthy, 1994

<b>X.HF.AG41</b>	<b>Number of audio signals for relative identification</b>
<i>Description:</i>	When relative discrimination is required, the number of alarm signals should not exceed 12.
<i>Source:</i>	Stanton & Edworthy, 1994

<b>X.HF.AG42</b>	<b>Single audio signal</b>
<i>Description:</i>	A single audio signal should be used in conjunction with multiple visual displays only if immediate identification of the appropriate visual display is not critical to personnel safety or system performance
<i>Source:</i>	[MIL-STD-1472F]



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### 5.2.3.2 Differentiation of signals

<b>X.HF.AG43</b> <span style="float: right;"><b>Differentiation from routine signals</b></span>	
<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]

<b>X.HF.AG44</b> <span style="float: right;"><b>Unsuitable auditory signals</b></span>	
<i>Description:</i>	Auditory signals should not be used if they resemble sounds that can occur in the actual operational setting.
<i>Source:</i>	[NATS]

### 5.2.3.3 Signals meaning

<b>X.HF.AG45</b> <span style="float: right;"><b>Established signals</b></span>	
<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]

<b>X.HF.AG46</b> <span style="float: right;"><b>Consistent signals</b></span>	
<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]

### 5.2.3.4 Periodicity

<b>X.HF.AG47</b> <span style="float: right;"><b>Intermittence</b></span>	
<i>Description:</i>	Auditory signals should be intermittent rather than continuous. Continuous tones are the most easily confused signals, even if they vary considerably in pitch. Furthermore, the human auditory system quickly adapts to continuous auditory stimulation.
<i>Source:</i>	[MIL-HDBK-761A], [Merideth & Edworthy]

### 5.2.3.5 Frequency

<b>X.HF.AG48</b> <span style="float: right;"><b>Frequency range</b></span>	
<i>Description:</i>	(1)The frequency range of a warning signal should be between 200 and 5,000 Hz, preferably between 500 and 3,000 Hz (2)Auditory signals should be based on frequencies in the range 300Hz to 3kHz. These are well within the band of frequencies that the human is most sensitive to.
<i>Source:</i>	(1): [MIL-STD-1472F] (2): [Cardosi & Murhpy];7.3.8, pp17; [NUREG-0700], Vol 2; [Def Stan] , part 8, pp8; Kincade & Anders, 1984, pp. 187



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**5.2.3.6 Intensity (loudness)**

<b>X.HF.AG49 Exceeding ambient noise</b>	
<i>Description:</i>	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
<i>Source:</i>	[MIL-STD-1472F] ; [NUREG-0700]

<b>X.HF.AG50 Minimum sound level</b>	
<i>Description:</i>	Depending on the frequencies present in the signal and noise, the minimum sound level for an auditory alert or warning signal presented in quiet (less than 50 dBA) conditions shall be 65 dBA or between 5 to 15 dBA more intense than the ambient noise. For equipment to be used silently at night the sensors may designate a single value of 60 dBA at the ear under an earphone. In this case person should be monitored regularly for good hearing and the earphones should be tested.
<i>Source:</i>	[Def Stan] , Part 8, 12.4, pp 10; [Cardosi & Murhpy]; A6;7.3.38, 4.1.3; pp15, 18 & 338; Parson, 1995, pp281 Ergonomics of Physical Environments in Applied Ergonomics 1995, Vol. 26

<b>X.HF.AG51 Maximum intensity</b>	
<i>Description:</i>	The intensity of evacuation and emergency signals should not exceed 115 dB(A). The intensity of other signals should not exceed 90 dB(A)
<i>Source:</i>	[MIL-STD-1472F] ; [NUREG-0700]

<b>X.HF.AG52 Appropriate use</b>	
<i>Description:</i>	Auditory coding should be used a. to alert users to critical conditions or operations; b. to supplement visual signals; c. to present information in situations in which visual presentation is not feasible; and d. to provide feedback for control actuation, data entry, or the completion of timing cycles and sequences.
<i>Source:</i>	[MIL-HDBK-761A]

<b>X.HF.AG53 Inappropriate use</b>	
<i>Description:</i>	Auditory coding should not be used when ambient noise prevents effective listening
<i>Source:</i>	[NATS]

<b>X.HF.AG54 Manual Disable</b>	
<i>Description:</i>	Manual disable of auditory signal intensity (loudness) should be avoided. A volume control mechanism should prevent the controller from reducing any audio display to an inaudible level (especially warnings)
<i>Source:</i>	[Cardosi & Murhpy] 9.5.3, 4.1.3; pp 524



### 5.2.3.7 Acknowledging signals

<b>X.HF.AG55</b>		<b>Automatic and manual shutoff</b>
<i>Description:</i>	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	
<i>Source:</i>	[MIL-STD-1472F]	

<b>X.HF.AG56</b>		<b>Alarm reset</b>
<i>Description:</i>	A system or application shall provide users with a simple means for turning off non-critical auditory alarms without erasing any displayed message that accompanies the auditory signal.	
<i>Source:</i>	[DOE HFDG ATCCS]; [MIL-HDBK-761A]; [MIL-STD-1801]	

## 5.2.4 Designing windows

### 5.2.4.1 General

<b>X.HF.AG57</b>		<b>Obscuring critical information</b>
<i>Description:</i>	Critical information should not be obscured during window resizing	
<i>Source:</i>	[CTA 1996]	

<b>X.HF.AG58</b>		<b>Standard management of windows</b>
<i>Description:</i>	The management of a window, open, close, minimize, maximize, restore, move, resizing as well as should be consistent with the standard window management.	
<i>Source:</i>	[DON UISNCCS](modified) ; [ATC (FAA) HF Checklist]	

### 5.2.4.2 Window states

<b>X.HF.AG59</b>		<b>Controller Operations</b>
<i>Description:</i>	The controller must be able to open, close, minimize, maximize, restore, move and icon-ify windows).	
<i>Source:</i>	[ATC (FAA) HF Checklist]	

<b>X.HF.AG60</b>		<b>Open Windows</b>
<i>Description:</i>	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	
<i>Source:</i>	[DON UISNCCS]	

### 5.2.4.3 Window component

<b>X.HF.AG61</b>		<b>Standard window component</b>
<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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