1 Introduction

1.1 In August 2004 the Human Factors (HF) Case was first launched by Eurocontrol and since then it has been applied to lots of Eurocontrol projects. This paper will explain and review the concept of a Human Factors Case. The HF Case concept will be compared to the current policies from the IFATCA Manual and if required new policy or recommendations will be added.

1.2 According to Eurocontrol the HF Case is a management tool to provide a process to address HF issues for a project. It’s about identifying and mitigating HF issues as early as possible in the project life circle.

2 Discussion

2.1 Human factors are the key

2.1.1 There is a wide agreement in the aviation world about human factors being a key enabler for increasing safety, system performance, efficiency and management of support costs. There is also a common strongly held view that the development and deployment of human factors knowledge, guidelines, methods and tools towards improved error management and human centred technology developments and operational training, is and will remain a key enabler and key business success criterion for ATM. ¹ Human issues will have to be accounted for in each phase of the definition, development, and deployment.

2.1.2 However, many ANSPs and primarily national regulators have not yet built sufficient human factors expertise in their work environments that can promote and apply human factors in day-to-day operations. Sometimes due to the ongoing shortage of controllers there is little availability of operational staff to

¹ SESAR, WP1.7.1 D1
ensure early involvement and commitment in the development of new procedures, automated tools and systems.  

2.1.3 The analysis of the current status of European ATM has identified that Human Factors are not yet sufficiently integrated as it is theoretically required in accordance with European regulations, guidelines and recommendations. This analysis was only done in Europe, but PLC is sure the results can be applied worldwide.

2.2 Human Factors in the IFATCA Manual

2.2.1 The IFATCA Manual does not define nor describe human factors. There is a risk when defining the HF concept that it might be too narrow, that’s why PLC would like to add only a broad description of HF in the Manual.

The aviation industry, with a few exceptions, is staffed with people, who play no small part in the safety and effectiveness of the operation. An understanding of the human role in aircraft operations is therefore an essential ingredient of the total story. To protect the personnel they must be carefully selected and trained and their equipment must match the capabilities and limitations of human performance. These matters demand the attention of the applied human sciences. When temporary breakdowns in skilled performances occur in many cases this is due to system designers and managers having paid insufficient attention to human characteristics and skills. The discipline of human factors attempts to address this issue systematically in order to attain both the well-being of everyone involved and the maximum effectiveness of the planned operation.

PLC describes human factors as “the human aspects of the working environment”. PLC proposes to add this description in the Manual in W.C. 7.3.

2.3 Human Factors involvement as early as possible

2.3.1 Human operators and human factors expertise both in the air and on the ground have to be involved and considered as early as possible in the various phases of every ATM project. The basis is that the aviation system as a whole should be designed to reduce error possibility, to optimize error detection and error recovery. In the last decades a lot of resources have been invested in technology developments. PLC believes it is necessary to invest time and money in human capital, in the HF research, development and deployment as key enablers and success factors for the aviation system. From experience there is clear evidence that human factor interventions can only be successful if they start as early as possible in the lifecycle of technical and operational ATM developments. The graph below clearly indicates the risk and cost consequences associated with not integrating HF as early as possible.

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2 idem  
3 idem  
5 idem  
6 Graphic from ICAO Doc 9758
2.4 Human Factors Case

2.4.1 Human Factors is the discipline that applies our knowledge of human capabilities and limitations to the design of technological systems. It’s about applying the knowledge about people to the functional relationships between people, tasks, technologies and the working environment, in order to produce safe and efficient human performance.

2.4.2 The HF Case is a management tool to provide a process to address HF issues for a project. It’s about identifying and mitigating HF issues as early as possible in the project life cycle.

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Figure 1-1. Cost scenarios of three different life-cycle strategies

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7 Eurocontrol; The Human Factors Case: Guidance for Human Factors Integration, 12-02-2007
2.4.3 Benefits of HF Case

- **Structured process**: The HF Case provides a simple and straightforward approach to HF integration and helps to ensure that the total system meets its performance objectives.

- **Early awareness**: The HF Case focuses attention at the earliest possible stage of the project life-cycle to planning, training and staffing issues, to help ensure that competencies and resources (e.g. training) are available for the timely implementation of new systems.

- **Delay reduction**: Past experience has demonstrated that many planning and staffing issues are not considered until too close to the promised implementation dates, leading to costly delays.

- **Tangible results**: As the HF Case process clearly defines the deliverables and outputs from each stage of the HF Case, it clarifies the return from investing in HF for the Project Manager and indicates how the results will be incorporated into other project activities.

- **Group-based approach**: The HF Case encourages a group-based approach to capture HF inputs from SMEs (subject matter expert) in the project by providing a structure to enable end-user input.

- **Flexible process**: The HF Case process is flexible and can be adapted to meet different types of project needs at various stages of the project life-cycle.

- **Economical benefits**: Implementing an HF Case as early as possible in the design and implementation of any new or existing procedure/system will lower the costs of detecting and resolving human performance issues in the operational life cycle (see figure 1-1).

2.4.4 The HF Case should not be seen as a quantitative measurement tool, but intends to be the HF **element of a Safety Case**. However, addressing the six categories from the HF Pie may lead to the identification of safety-relevant issues that can be used to inform a Safety Case.

The focus of the HF Case is on the HF impacts upon human performance, e.g. augmenting human strengths and compensating for human limitations to improve total system performance. It can answer questions such as:

- Will the operators accept and trust the new/changed system or tool?
- Will they be motivated to use it?
- Will there be excessive training and re-training costs?
- Will a different type of profile be needed to select candidates?
- Will the system fit in with conventional job roles and, if not, have new roles been considered?
- Will the operators have the right skills, and has training been planned?
- Will the operators still be able to take over if/when the system fails or starts to generate bad data?
- Will there be sufficient operators available?

The HF Case looks to optimize the human input into the system with safety and efficiency considerations. Safety relevant HF issues can be identified after an in-depth examination of human error (particularly via human error-

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8 Eurocontrol; The Human Factors Case: Guidance for Human Factors Integration, 12-02-2007
prediction methods), threat and error management, human recovery from system failures, fatigue, workload, etc.

Key **outputs** from the HF Case are:

- HF Action Plan;
- HF findings which can feed back into all aspects of ATM system design, implementation and operations;
- HF Issues to feed into other HF and Safety assessment processes.

### 2.5 IFATCA Manual on Human Factors

#### 2.5.1

The concept of Human Factors is covered in several locations in the IFATCA Manual:

- **3 2 1 10; AAS. 1.5. Air-Ground Datalink** – human factors are mentioned, but not taken into account in this policy.

- **3 2 2 14; ADME 2.10. The application of cockpit display of traffic information (CDTI) in advanced surface movement guidance system (A-SMGCS) operations** - this paragraph only states that with the development human factors need to be addressed.

- **4 1 2 6; WC.2.3. Working Environments & 2.4. ATC Systems** – IFATCA policy is that: existing knowledge of human factors should be incorporated in design for new operational rooms and new ATC working positions and in modernization of existing facilities. Member Associations should take positive steps to ensure their participation in all new ATC-related projects to be undertaken at both local and national level. This participation should commence at the purchase/planning stage through to implementation to ensure that all their concerns, not only regarding technical aspects, but especially regarding human factors, are taken into consideration. – this is a good example of where and when HF should be used.

- **4 1 2 7; WC.2.5. Automation / Human Factors** – IFATCA policy is that: The Human Factors aspects of Automation must be fully considered when developing automated systems. – this is also a good example of taking into consideration HF.

- **4 1 2 10; WC.2.9. Co-operative Separation** – IFATCA policy is that: From a Human Factors aspect IFATCA has strong concerns over the transfer of control responsibility to the cockpit for the following reasons:

  1) If separation functions are transferred to the cockpit the situation awareness and skills base of the ATCO will be degraded to the point where intervention will not be possible. 2) Aircrew workload will increase by fulfilling additional tasks, which are currently carried out by ATC. This might lead to overload situations in cockpit workload when other, higher priority, tasks have to be taken care of by the crew. Responsibility for the control function cannot simply be handed back to the controller. – HF is this case is an area of concern. It does not state how and when HF should be addressed when such a procedure is put into effect.
2.6 HF Case in IFATCA Manual

2.6.1 Although the IFATCA Manual covers HF at several locations (see 2.5.1) it mainly does this for specific subjects. Introducing the general concept of the HF Case in the Manual would be a valuable addition. This new paragraph will focus especially on the early involvement of Controllers and HF in general and the HF Case in specific. Being involved from the outset with new technologies, improves the likelihood of a safer and more efficient systems.

2.6.2 PLC proposes to add a new paragraph for the HF Case and the consideration of Human Factors in general in the IFATCA Manual. The addition will be made in W.C. 7.3 of the IFATCA Manual.

The following paragraphs cover the need for HF and a HF Case in the Manual;

"The Human Factor Case is a tool to provide a process to address HF issues for a project. It’s function is to identify and mitigate HF issues as early as possible in the project life cycle."

"Human Factor issues shall be accounted for in each phase of the definition, development, and deployment of new and existing ATM systems and into operational training. Human Factors should be integrated into Safety Management Systems (SMS). Controllers should be involved as early as possible.

3 Conclusions

3.1 The HF Case is a management tool that means the HF Case should be applied through management, in the same way a Safety Case is applied. It could be stated that if a Safety Case (IFATCA Manual ATS 3.14) is done correctly, than human factors is part of the Case. Sadly, it is a fact that not in
all Safety Cases human factors are sufficiently dealt with. As a result the HF Case is designed, to make sure that every technical and operational ATM development goes through a human factor ‘check’. However, even when there is a HF Case, controllers are not always a part if it. To make sure that not only technicians and scientists decide what the impact on human factors is, it is very important that controllers are involved from an early stage of a new development.

3.2 After looking at the HF Case and the current policies in the IFATCA Manual, it can be concluded that the HF Case is a valuable tool in the design and planning of all new and even current processes, systems, tools, procedures, etc. ATCOs work with. Although the IFATCA Manual covers HF at several locations it mainly does this for specific subjects. Introducing the general concept in the Manual would be a valuable addition. Especially focusing on the early involvement of HF in general and the HF Case in specific can make a difference to controllers. Being involved from the outset with new technologies, improves the likelihood of a safer and more efficient systems. Adding new policy about the HF Case together with early involvement will not make current policy superfluous.

3.3 The IFATCA Manual deals with Human Factors (see par. 2.5), but as yet does not state clearly any description of human factors, nor the concept of a HF Case nor the early involvement of controllers. PLC proposes to add policy about the HF Case in the IFATCA Manual, see par. 4 (draft recommendations). PLC does not see the need to change current policy as a result of implementation of the HF Case.

4 Draft Recommendations

4.1 To be added in WC.7.3. Safety Management Systems
A new paragraph called Human Factors Case shall be created, featuring the following subsections.

4.1.1 “Human Factors are described as the human aspects of the working environment”.

4.1.2 “The Human Factor Case is a tool to provide a process to address HF issues for a project. It’s function is to identify and mitigate HF issues as early as possible in the project life cycle.

4.1.3 “Human Factor issues shall be accounted for in each phase of the definition, development, and deployment of new and existing ATM systems and into operational training. Human Factors should be integrated into Safety Management Systems (SMS). Controllers should be involved as early as possible.
References

- EUROCONTROL Proactive Aviation Change and Transition (ProACT) Compendium; version 0.6, edition date 24 September 2008
- The Human Factors Case: Guidance for Human Factors Integration; EATM guideline, version 1.4, edition date 12.02.2007
- The EUROCONTROL Manual for the ProACT Method; version 0.6, edition date 23.09.2008
- SESAR Consortium\textsuperscript{9} publications:
  SESAR, WP1.7.1 D1 provides an overview of the current human factors’ contribution to the performance of the aviation industry. It highlights HF contributions to the ATM performance targets, current strengths and weaknesses, and gives an overview of current and planned activities that can be regarded as short term improvements for the SESAR definition phase.
  SESAR, WP1.7.1 D2 describes the possible role of the human in the future ATM system and provides a high level analysis of the human contribution to the overall performance of the aviation industry expressed in the 11 ICAO Key Performance Areas. Finally it describes a selection of successful current human factors practices that can help to quickly overcome a number of blocking points in the current ATM system.
- Extra information can be found at Eurocontrol's Skybrary:
  Operators Guide to Human Factors in Aviation
  \url{http://www.skybrary.aero/index.php/Portal:OGHFA}

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