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D1.2.9: TRAINING OPPORTUNITIES REPORT



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Related Documents

DELIVERABLE No	Name	Responsible Partner	Description
D1.1.1	Initial survey of HILAS knowledge management requirements and specification of KMS1	Trinity College Dublin	Initial survey of HILAS knowledge management requirements and specification of KMS1
D1.1.3	KMS1 Implementation and training guides	Trinity College Dublin	Guidelines for implementation and training of KMS1
D1.1.5	Evaluation results	Trinity College Dublin	Evaluation results of technology used to develop KMS1
D1.2.3	Theoretical workshop review and evaluation	Trinity College Dublin	Evaluation results of theoretical workshop
D1.2.5	Lecture series evaluation	National Aerospace Laboratory NLR	Evaluation results of lecture series
D1.3.1	Implementation requirements - knowledge management	Trinity College Dublin	Requirements of KMS
D1.3.2	Implementation requirements - organisational learning	Trinity College Dublin	Key issues regarding organisational learning in and through HILAS
D1.3.3	Implementation requirements - innovation	Trinity College Dublin	Evaluation of HILAS as system of innovation
D1.3.4	Implementation requirements for operations management - the lean-safe-green agenda	Trinity College Dublin	Integrated approach to lean-safe-green operations for aviation enterprises
D1.3.5	Implementation requirements - safety management	Trinity College Dublin	Identification of implementation requirements for safety and risk management
D1.3.6	Experiences of Dédale implementing a safety model and risk-based decision aid approach in past projects	Dédale Paris	Enquiry into Dédale's experiences implementing new safety management technique
---	HILAS integration workshop 2007 review and evaluation	Trinity College Dublin	Evaluation results of integration workshop



Table of Contents

Executive Summary	6
1. Introduction	8
2. Methodology	9
3. Analysis of Lecture Series Evaluative Survey	10
3.1 Lecture Series	10
3.2 Evaluative Survey	10
3.3 Results	11
3.4 Conclusions	14
4. Analysis of KI Deliverables D1.3.1 – 1.3.6	16
4.1 Knowledge Management (D1.3.1)	16
4.2 Organisational Learning (D1.3.2)	18
4.3 Innovation (D1.3.3)	20
4.4 The Lean-Safe-Green Agenda (D1.3.4)	21
4.5 Safety Management (D1.3.5)	23
4.6 Dédale Experiences of Implementing a Safety Model and Risk-Based Decision Aid Approach (D1.3.6)	27
5. Identification of Training Needs and Opportunities within FO, FDT, MX and KI Strands	29
5.1 Methodology	29
5.2 Results of the Survey	30
5.3 Conclusions	37
6. Training Platforms	39
6.1 Introduction	39
6.2 Available Training Platforms	39
6.3 Liaison with Stakeholders	41
6.4 Future Steps	42
7. Conclusions: Overview of Training Opportunities	43
References	46
Appendix 1: List of Acronyms	47
Appendix 2: Lecture Series Evaluative Survey	48
Appendix 3: Training Requirements Questions	56

Executive Summary

The HILAS (Human Integration in the Life-cycle of Aviation Systems) project is a large, integrated European project which aims to improve safety in the civil air transport sector through the integration of human factors across the life-cycle, while simultaneously generating improved operational efficiencies. The Knowledge Integration strand plays an active role in ensuring that integration takes place across the HILAS project. It initiates activities such as integration workshops, newsletters, HUFAG, dissemination events and lecture series to ensure effective communications both within and external to the consortium.

The current report represents a deliverable associated with the dissemination, training and knowledge support activities of the KI strand (WP1.2); more specifically deliverable D1.2.9: Training Opportunities Report. The objective of this deliverable is to identify the training opportunities from HILAS consortium outputs.

Several methods are used to identify the training development opportunities arising from HILAS outputs: first, the evaluation of the lecture series 2007; then, the evaluation of WP1.3 deliverables D1.3.1 – 1.3.6; and finally, the interaction with the different HILAS strands (through questionnaires). Together, these complementing evaluations should result in the identification of interesting and relevant training development opportunities arising from HILAS consortium outputs. The evaluation of the lecture series 2007 was described in chapter 3. Results of this evaluation showed that participants were moderately interested in receiving training in the use of the specific tools and/or measures, especially concerning eye tracking and CRIA. Nonetheless, participants appreciated being briefed about the tools and/or measures through the lecture series. The tools and/or measures presented were believed to be useful, relevant and important for the HILAS project, especially with regard to the psychophysiological measures and Pamela.

The competence requirements evaluated in WP1.3 deliverables D1.3.1 – 1.3.6 add valuable information to the process of identifying training opportunities. The implementation requirements listed in the deliverables D1.3.1 – D1.3.6 were summarized and, from these, competence/training requirements needed in HILAS organizations were extensively formulated in chapter 4. These competence requirements and the results of the evaluation of the lecture series 2007 together formed the basis for the strand leaders' questionnaire used for the interaction with the different strands.

Interaction with the strands (described in chapter 5) was necessary to identify the specific training opportunities for the different domains. The questions revealed rather diverse results and therefore, it seems difficult to present an all comprising conclusion with respect to the specific training opportunities. Nevertheless, partners have already provided different interesting and relevant training opportunities to implement. Of course, these opportunities often lie within the



expertise of the different partners/strands; i.e. opportunities for training that could be developed from the expertise that exists already in the consortium and that is likely to develop as the project progresses.

The training platforms that are currently available within the possibilities and constraints of the HILAS project are described in chapter 6. These are lectures series, workshops and the Knowledge Management System. These activities can actually be implemented to acquire knowledge, skills and competencies; in other words to train. It is necessary to extent the use of the available training platforms to the outside world. The development of on-line training via KMS2 and the use of tailored courses are two great examples of this. In addition, lecture series and workshops can be (re-)designed for external stakeholders. The dissemination and integration of knowledge – using these training platforms – is vital to the success of HILAS products beyond the project.

1. Introduction

The HILAS (Human Integration in the Life-cycle of Aviation Systems) project is a large, integrated European project which aims to improve safety in the civil air transport sector through the integration of Human Factors (HF) across the life-cycle, while simultaneously generating improved operational efficiencies. The HILAS project contains four strands of work: the integration and management of HF knowledge (Knowledge Integration KI strand); flight operations processes and performance (Flight Operations FO strand); the evaluation of new flight deck technologies (Flight Deck Technologies FDT strand); and the monitoring and assessment of maintenance operations (Maintenance MX strand).

The KI strand plays an active role in ensuring that integration takes place across the project – both with respect to its role in technical integration and the integration of research expertise into the implementation and evaluation activities of the strands. In order to do so, its information, knowledge and tools should be relevant and usable by its customers, the industries involved. It is therefore not sufficient to gain new knowledge in an academic sense, but also to initiate action to exploit the acquired knowledge and tools. The KI strand aims to increase the accessibility of the HF knowledge gained in the project and to manage the process of acquisition and dissemination by initiating activities such as integration workshops, newsletters, HUFAG, dissemination events and lecture series. A Knowledge Management System (KMS) linking all strands facilitates the use of the project's knowledge.

The current report represents a deliverable associated with the dissemination, training and knowledge support activities of the KI strand (WP1.2); more specifically deliverable D1.2.9: Training Opportunities Report. The objective of this deliverable is to identify the training opportunities¹ from HILAS consortium outputs.

¹ Training refers to the acquisition of knowledge, skills and competencies. Opportunity stands for a chance for advancement, progress or profit.

2. Methodology

Several methods are used to identify training development opportunities arising from HILAS outputs: first, the evaluation of the lecture series 2007; then, the evaluation of WP1.3 deliverables D1.3.1 – 1.3.6; and finally, the interaction with the different strands. The evaluation of the lecture series (held in Cheltenham, June 2007) begins to inform the future training strategy, mainly within the HILAS consortium. The competence requirements evaluated in WP1.3 deliverables D1.3.1 – 1.3.6 add valuable information to the process of identifying training opportunities. However, this will only identify training opportunities from the generic topics that the KI strand has been working on. This needs to be complemented by the evaluation of the other strands; i.e. interaction with the FO, FDT and MX strands is required to identify specific training opportunities that are valuable for the end-users. The KI strand also needs to be included in this, as it has its own specific training needs.

The underlying report begins by outlining the evaluation of the three methods in chapters 3, 4 and 5. The analysis of the lecture series evaluative survey is described in chapter 3. This section focuses on one narrow dimension of training; i.e. the lecture series. Chapter 4 summarizes the implementation requirements listed in deliverables D1.3.1 – D1.3.6 and, from these, identifies and formulates competence/training requirements needed in the HILAS consortium. These training requirements form the basis for the data-gathering interaction with the strand leaders (through questionnaires). Herewith, chapter 5 identifies the specific training opportunities for the different end-users. Together, these complementing evaluations should reveal interesting and relevant training development opportunities arising from HILAS consortium outputs.

Chapter 6 presents an overview of the training platforms within the possibilities and constraints of the HILAS project. This section should propose innovative ideas for training solutions. Finally, in chapter 7, the report concludes with an overview of the relevant training opportunities identified in the previous chapters; i.e. opportunities for training within HILAS and opportunities for training beyond the project.

3. Analysis of Lecture Series Evaluative Survey

3.1 Lecture Series

The HILAS project aims to integrate information on human performance, abilities, opportunities and limitations into industry designs and operations; i.e. the life-cycle. The annual lecture series are one means for realising this goal². Two series were already held within the HILAS project. The first lectures series (held in Dublin, June 2006) provided a common starting point for the strands³. The second series (held in Cheltenham, June 2007) represented an important training forum for the HILAS consortium. The lecture series 2007 focused on the topic of HF tools and presented a detailed picture of many of the tools being developed within the HILAS network. In addition, it was valuable to have demonstrators of many of the tools on display so that participants could see and try the tools at first hand.

The current report specifically represents the deliverable D1.2.9 associated with the dissemination, training and knowledge support activities; i.e. WP1.2 of the KI strand. The objective of D1.2.9 is to identify the training opportunities from HILAS consortium outputs. Therefore, the lecture series 2007 were evaluated. In addition to identifying training opportunities, the survey possibly helps to improve future lectures. The results of the evaluative survey are being analysed in the current chapter.

3.2 Evaluative Survey

Six lectures were held in Cheltenham, 2007:

1. Introduction and EU HUFAG by Prof. Peter Jorna.
2. Using psychophysiological measures on the flight deck by Dr. Dick de Waard.
3. Eye tracking in HF research at the NLR by Rolf Zon.
4. HF software tools developed by the HFI-DTC for system design by Prof. Neville Stanton (guest speaker).
5. Pamela by Prof. Peter Jorna.
6. CRIA's simulation applicability process by Ms. Chiara Santamaria Maurizio.

² The PowerPoint presentations of both lecture series are accessible via KMS, located at the HILAS website <http://www.hilas.info/mambo>.

³ For the evaluation report of the first lecture series, see D1.2.5: Lecture series evaluation.

All delegates were handed out a survey and they were asked to complete the survey after the lectures and hand them in at the end of the day. In addition, delegates who did not finish the survey directly after the lectures received an email the next week asking them to complete the survey. All responses were voluntary and are kept confidential.

Per lecture about eight questions were asked to the participants. Some general questions completed the survey. For most questions the answers could be provided in a 5-point scale (see Table 3.1). Using this scale, participants could point out if they disagreed strongly or agreed strongly with the given statement. Also, participants were free to explain their answers (in writing) or add further suggestions. See Appendix 2 for the complete lecture series evaluative survey.

Table 3.1 5-point scale

1	2	3	4	5
Disagree strongly	Disagree	Without opinion	Agree	Agree strongly

3.3 Results

The survey contained both questions trying to identify possible training opportunities and questions to improve future lectures. The results are presented according to this distinction.

The survey was evaluated descriptively; means (M) and standard deviations (SD) were calculated per question for each lecture separately and for all lectures together.

The attendance level of the lecture series 2007 was very successful: 58 delegates participated in the event. However, of these 58 delegates only 16 participants completed the evaluative survey. The low response rate can not be explained. This means that we have to be careful when interpreting and generalizing the presented results.

Training opportunities

With regard to each topic in the lecture series, four relevant questions were asked per lecture, namely:

1. The lecture was useful and relevant.
2. The lecture helped me clarify or find solutions to my specific issues and questions.
3. I think the role of this topic in the HILAS project is important.
4. I would like training in using these tools and/or measures.

The results (M and SD) of these questions per specific lecture are presented below in Figure 1. Concerning the first lecture by Prof. Peter Jorna, the question about training needs was not relevant and therefore, not part of the survey. Remarkable about the results is that the need for training in the presented tools and/or measures appears to be relatively small, especially concerning eye tracking and CRIA. One respondent pointed out that *“the eye tracking lecture was not directly relevant to my job, but the lecture was really interesting to attend. It is nice to see what is being done in HILAS”*. Also, participants did not really speak out (*“without opinion”*) when it comes to the second statement *“the lecture helped me clarify or find solutions to my specific issues and questions”*. Regarding the psychophysiological measures and Pamela, participants agreed that they are useful, relevant and important for the HILAS project.

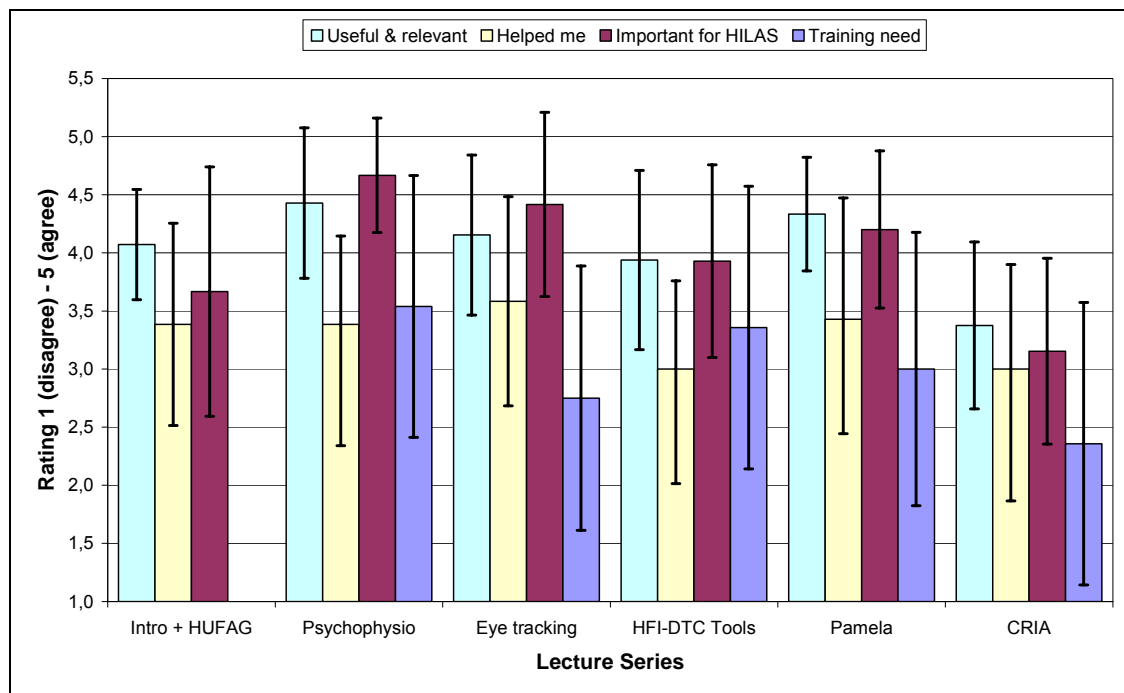


Figure 3.1 Rating of training opportunities per lecture (M and SD)

Additional general questions (not specifically related to a certain lecture) concerning training opportunities were asked. The answers to these questions supplement those presented in Figure 3.1. The statement *“training should be provided through the HILAS project”* scored M 3,94 (SD 0,93). To the question *“do you believe the lecture series is a good training mechanism within HILAS?”* 9 out of 16 participants replied with *“yes”* and only 1 with *“no”* (leaving 6 blank replies). One respondent added that *“it is a good way for the different strands and outsiders to see HILAS and its many facets”*. The question *“what forms of training would you prefer?”* showed the preference for the lecture series format (7

replies) and courses tailored to the organization (7 replies). On-line training via HILAS KMS (3 replies) and workshops (3 replies) were also opted.

Future lectures

Input for the improvement of future lectures was gained through seven relevant questions, four of which were asked per lecture, namely:

1. The length of the lecture was appropriate.
2. The quality of the lecture was good.
3. I understand the content of the lecture.
4. The lecture met my expectations.

The results (M and SD) of these four questions per specific lecture were averaged and presented below in Figure 3.2. The majority of the respondents implied that they were “without opinion” or “agreed” with regard to the four statements.

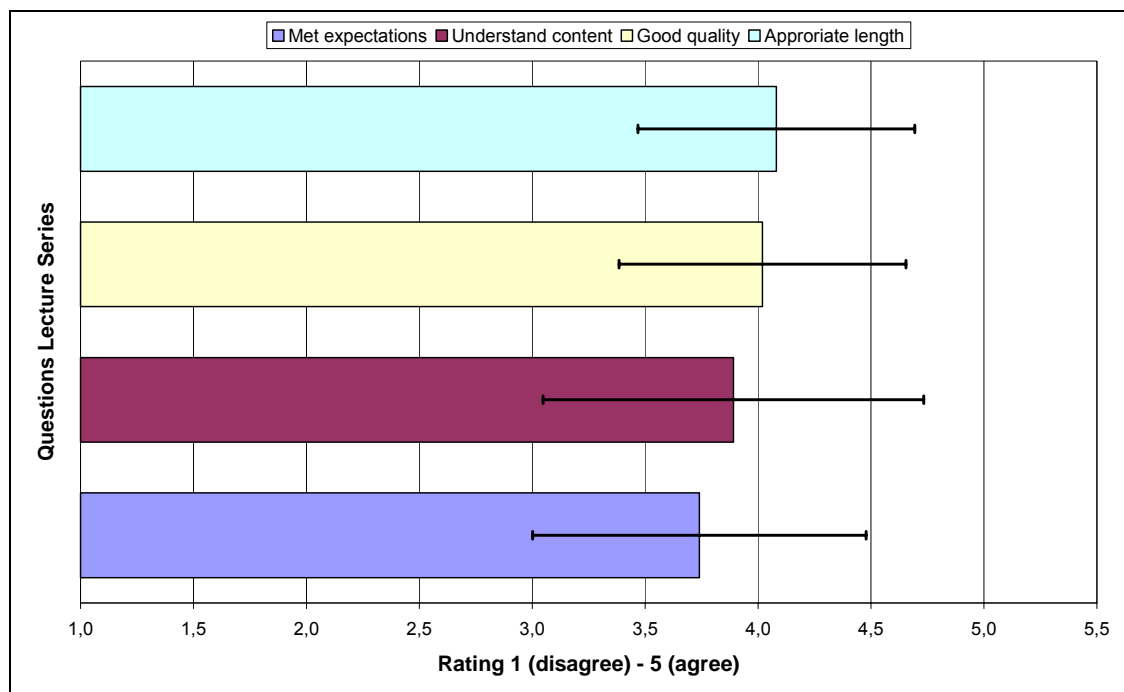


Figure 3.2 Rating of future lectures per question (M and SD)

The remaining three relevant questions (not specifically related to a certain lecture) are:

5. I liked listening to someone from outside the HILAS project (guest speaker).
6. The number of lectures was appropriate.
7. The topics and objectives were clear.

The results of these three questions are presented below in Figure 3.3. Participants generally “agreed” with way the lecture series 2007 were set-up. The guest speaker was specifically appreciated.

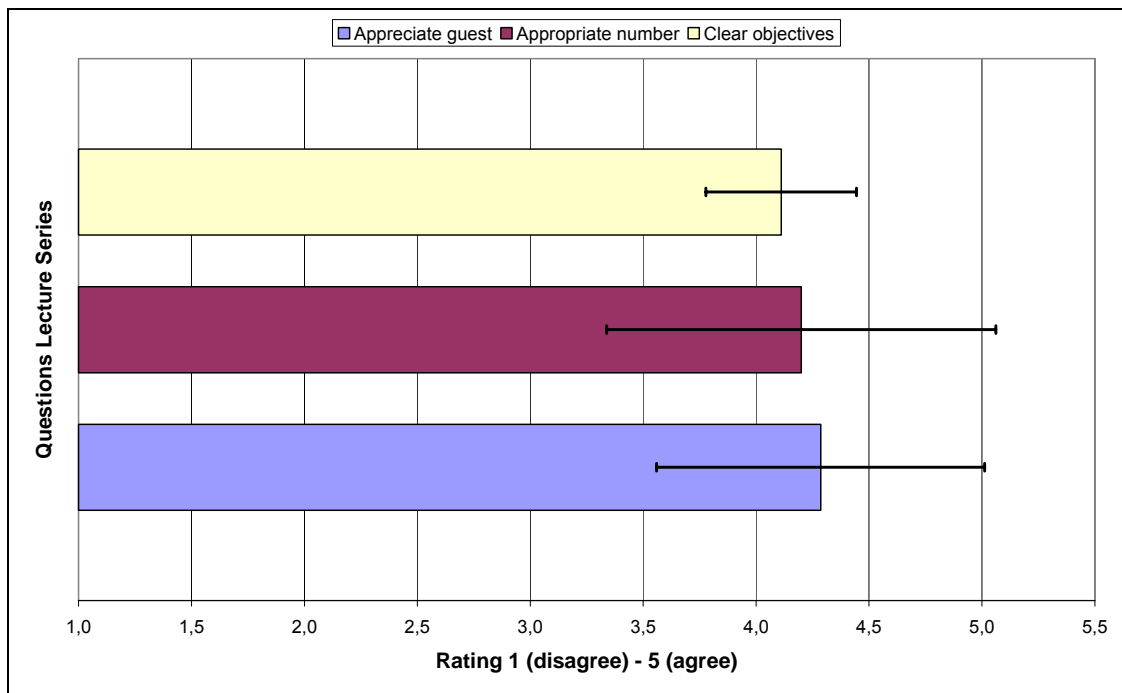


Figure 3.3 Rating of future lectures per question (M and SD)

Finally, a general suggestion concerning future lectures was made by a respondent. He or she urged to put the lectures into the context of the certain strand. Also, the progression (status) within this strand should be pointed out.

3.4 Conclusions

Within the HILAS project, the KI strand plays an active role in ensuring that integration takes place across the project. Activities such as the lecture series are organized to fulfil this role. The lecture series 2007 were evaluated to identify possible training opportunities and to improve future lectures.

Although the attendance levels of the second lecture series were very successful (58 delegates participated), only 16 participants completed the evaluative survey. This low level of response has to be taken into consideration when interpreting the results. It compromises the generalizability of conclusions to be drawn.



With regard to the potential for exploiting future training opportunities, participants were only moderately interested in receiving training in the use of the specific tools and/or measures; i.e. the need for training appeared to be relatively small, especially concerning eye tracking and CRIA. This is perhaps understandable given the fact that people's roles in the HILAS project may not require the use of these tools and/or measures. The result that "*the lecture did not really help me clarify or find solutions to my specific issues and questions*" supports this deduction since these specific issues and questions may not relate at all to the use of the presented tools and/or measures.

Nonetheless, participants appreciated being briefed about the tools and/or measures through the lecture series. The tools and/or measures presented were believed to be useful, relevant and important for the HILAS project, especially with regard to the psychophysiological measures and Pamela.

Participants recognised the importance of the lecture series as a training mechanism within the HILAS consortium. It is suggested by the participants to supplement the lecture series with courses tailored to the organization, on-line training via HILAS KMS and workshops.

Concerning the topic future lectures, attendees seem to be very pleased with the way the lecture series 2007 were organized. This concerns the presented topics, the number (and length) of the lectures, the presence of a guest speaker and the quality of the presentations. The lectures met the expectations of the attendees; they found the lecture series to be interesting and enjoyable.

Given these positive results no recommendations can be provided for future lecture series, except that it should be organized in a similar manner to those held in Cheltenham, 2007. The success of this event gives the KI strand the confidence and motivation to proceed with planning the next lecture series.

The evaluation of the lecture series 2007 described in the current chapter clearly begins to inform the future training strategy. The next section will focus more on the training needs of the end-users that will implement the HILAS output.

4. Analysis of KI Deliverables D1.3.1 – 1.3.6

The aim of this chapter is to identify and summarize the competence/training requirements that can be extracted from the KI deliverables D1.3.1 – D1.3.6. This research from the KI strand will provide training solutions potentially. The competence/training requirements found will serve as inputs with regard to training development opportunities in organizations involved in the HILAS project.

4.1 Knowledge Management (D1.3.1)

Deliverable D1.3.1 'Implementation Requirements – Knowledge Management' was written by Desiree Hoving at Delft University with the objective to improve the key knowledge processes within HILAS by providing a number of user requirements for a suitable KMS for HILAS. The deliverable also reports on a survey performed to see how the organizations within the HILAS network are using knowledge management to enhance innovation.

Knowledge sharing and cooperation represent a significant challenge for the project. There is a considerable need for robust mechanisms for communication, the facilitation of information and knowledge sharing, the transfer of best practice and the stimulation of innovation.

Summary of important issues related to knowledge management

Today, in order to be successful, companies need to strategically leverage internal and external sources of ideas and take them to market. Therefore, companies are searching for new and advanced ways to enhance creativity, innovativeness and productivity of their work processes. Knowledge processes are one of the key factors for companies to become innovative (Andriessen, 2006).

The deliverable D1.3.1 forwards two strategies that can be distinguished for managing knowledge processes; codification strategies and personalization strategies. Codification has to do with explicating knowledge and storing these explications in ICT-based repositories. Knowledge is transferred into documents to be stored, retrieved and distributed in a systematic way. Codified knowledge can often be found in manuals, specifications, papers and books. There are three main problems with codifying knowledge: (i) often difficult to codify all relevant knowledge in practice, (ii) hard to predict what knowledge will be relevant for whom and in what format in the future and (iii) systems are often developed as search engines rather than systems that fit the daily work processes of knowledge working employees.

The personalization strategy emphasizes the communication flow between people in order to support (tacit) knowledge sharing. The delivery forwards

perspectives from researchers saying that organisations should focus much more on informal knowledge sharing and informal ways of working, in order to be innovative (Brown & Duguid, 2000). Possibilities for this can be provided through meetings, knowledge officers, master apprentice relationships and Communities of Practice. Also, for the transfer of skills, competencies and insights, it is important to have social networks with other people (Wenger, McDermott, & Snyder, 2002).

Nowadays, many companies develop a balanced integration of interpersonal exchange of knowledge and codification in systems (Jashapara, 2004). The deliverable D1.3.1 forwards that both codification and personalization efforts need to be supported by a sub set of systems in order to be effective. A KMS refers to a class of information systems applied to managing individual and organizational knowledge processes and flows (Carlsson, 2003).

Conclusions and recommendations

The deliverable D1.3.1 concludes that for the purpose of HILAS a suitable KMS should have the following two main functionalities: (i) document management to enable the storage and retrieval of HILAS documentation and (ii) group support to enable collaboration between members.

Competence/training requirements:

- The success of document management systems is influenced by organisational challenges, such as privacy and security issues, but also keeping the list of documents up to date and complete and the ability of employees to search and find the right documents within the system. It is vital to both qualify and classify the information.
- Group support systems can support five basic group processes: communication, knowledge sharing and learning, cooperation, coordination and social interaction. For these group processes to be successful, knowledge and understanding about social interaction and collaboration, types of leadership in different situations, etc. is vital.
- It is important that a KMS fits with the organizational context in which such a system is used. Some situations would require a system that incorporates the management of documents and supports decisions, whereas another situation would call for more emphasis on workflow management and group support.

4.2 Organisational Learning (D1.3.2)

The deliverable 'Implementation Requirements – Organisational Learning' (D1.3.2) was written by Floor Koornneef and Elena Beauchamp at Delft University. The aim of the deliverable was to explore key issues regarding organisational learning in and through HILAS. The approach applied is rooted in systems theory and therefore, draws attention to interactions between actors in the system in focus. The deliverable D1.3.2 summarises high-level implementation requirements for the HILAS system from an organisational learning viewpoint that has been summarized in D.1.4.1.1. It starts from the notion that organisational learning implies processes in which data needs to be understood in context and then transformed into "lessons" to be implemented in operations in order to become "learned". Organisations learn indirectly and therefore, they must organise their learning and assure that organisational memory is in place, functioning and accessible.

Summary of important issues related to organisational learning

The deliverable forwards that learning is a process that starts with detection of a potential problem; analysis and assessment of the problem to identify feasible options for solving the problem, and to select an adequate subset of these options and ending with implementing these in relevant operations. The efficacy of these solutions will be revealed by the absence of critical experiences that occurred before. The deliverable states that learning by organisations cannot be taken for granted, because organisations can only learn through people. It is emphasised that learning should be embedded in the whole organisation as a part of its normal operation and not to be an add-on extra. This means, in terms of safety, that there must be an intimate link between the risk assessment process, which specifies the hazard scenarios, the management process, which establishes control strategies and practices for them, the operational process, which carries them out and the learning process, which evaluates, improves and fine tunes these controls. Basic resources are knowledge, technology and equipment, organisational structures, norms and rules, as well as the people, who deploy these resources in working processes to realise the organisations' objectives.

Triggers for learning come from operational processes as signals detected through performance monitoring. For organisational learning to take place, the individual must notify a relevant learning agency. Such a learning agency consists of members, who come from the relevant shop floor processes, and therefore, is in a good position to assess whether and how a potential lesson can be learned most adequately. The learning agency needs to be linked with relevant management that is empowered to make decisions that can change the conditions, goals or resources of the work process.

Eligible lessons need to be communicated for implementation with a relevant process owner in order to close a learning loop. These lessons are implemented into the work process and need to be stored in some form of organisational memory together with added-value data, e.g. on effectiveness or underlying organisational factors. The organisational memory is indispensable for capturing lessons in a way that allow retrieval for reuse. Conklin (1997) demonstrates that one cannot create a useful organisational memory by just capturing lots of information. The data must be structured somehow in ways that preserve coherence and search ability. An organisation does not learn, unless it organises the learning and captures lessons learned in an organisational memory. It is vital that the organisational memory is accessible for retrieving contents. An interested party needs to know that such a lesson has been captured and can be retrieved from an organisational memory. Nowadays, people have no or very limited time to find out proactively whether a potentially useful information source contains new relevant actual information. Thus, we need to find a way of alerting potential users about relevant content changes that call for their attention. Obstacles to reporting vital information (e.g. incidents) include fear of blame, undue administrative burden in addition to job workload, and experiences of hearing nothing from previous notifications.

Conclusions and recommendations

Competence/training requirements:

- Learning should be embedded in the whole organisation, which means e.g. that intimate links exist between risk assessment, risk management, operational and learning processes.
- Organisational learning requires detachment and awareness of the learning from individual members, on the one hand by assigning people to the task of learning for the organisation, and on the other hand, implementing a learning agency consisting of people that have adequate factual and tacit knowledge about current processes and their operational contexts.
- Organisational learning requires an organisational memory that can exist in many forms, but in order to function, this memory must be accessible on demand by relevant parties, e.g. operators like pilots, maintenance personnel or line management, work scheduling department, engineers and quality assurance personnel.
- Awareness and knowledge about the general operational context as potentially relevant business units or departments will interpret incoming data within their own normative framework, area of competence and operational settings. Good communication is vital and the deliverable forwards the notion that language is a modelling tool and we cannot take it for granted that different people assign the same meaning to a specific word, because each of these persons associates this word with a situational context that is unique. Therefore, when it matters, we need to provide context information that

describes how a specific word is being interpreted, so that other persons can translate the original meaning within their own operational context.

- It is vital that the organisation has knowledge about the importance of promoting reporting of incidents and operational anomalies and to reduce the fear of blame when reporting.

4.3 Innovation (D1.3.3)

The deliverable 'Implementation Requirements – Innovation' (D1.3.3) was written by David Jacobson and Bernard Musyck at FIT, Nicosia. The deliverable presents various examples of innovations that were identified during fieldwork in different companies. Collaborations are important factors in any innovation process. Among many things, the deliverable reviews for each company the existence of collaborative links with other actors (including institutions). The picture that emerges is the limited range of direct collaboration between companies regarding operational matters, the important role played by airline associations, the limited role played by airline alliances and the fact that information related to safety seem to spread more easily than information that could have an impact on the competitive capacity of the company.

The deliverable D1.3.3 concludes that there are a number of reasons for the slow spread of innovation in the sector. First, there is the nature of the industry itself. Technologies and processes are relatively generic in aviation operations. Flying aircraft and transporting passengers is not "rocket science". A second factor is historical. For decades the legacy carriers have been isolated and protected in their respective domestic markets. There was no real pressure to survive other than convincing politicians to continue subsidising the airline. Thirdly, indications show so far, that the sector is rather compartmentalised with very little horizontal involvement such as joint ventures or collaborative product development initiatives.

The authors define innovation as not being strictly technological innovations, but also encompassing technological innovation, process innovations and product innovations, especially in relation to HF.

Summary of important issues related to innovation

The deliverable forwards that some of the visited companies in the fieldwork seem to suffer from "path dependency" in which a type of inertia seems to impede the introduction of technological – or other kinds of – change. There are also problems of regulation that prevent innovations from being implemented. Cost pressure is another factor that can negatively impact on innovation.

Some legacy carriers suffer from a lack of pro-active or strategic management and decisions regarding new technologies, processes and products are not taken when they should. The companies may not realise that "no decision" often lead to

a bad decision from the strategic point of view. These companies that operate under “deficient guidance” often suffer from frequent changes in senior management or bloated administration inherited from the past.

Technical factors can also play a role as in one company the fleet of aircraft did not seem to be compatible with the adoption of certain new communication technologies. This also reflects technological path dependency, mentioned earlier.

Sometimes the implementation of innovations in a company is the result of the effort of one person. It is not clear whether these companies would have innovated without the initiative of these individuals. It is also true; however, that certain organisation structures facilitate and perhaps even encourage individual innovative initiative. Closely related to this is the opposite, where there is resistance to change at all levels, for example because of organisational structure and culture.

Conclusions and recommendations

Competence/training requirements:

- It follows that, in terms of innovation, there is a variety of types, or a continuum of organisations, from less to more innovative, within HILAS. While in some cases organisations appear to lack the necessary competences, in many cases all or most of the competences required for innovation are present, but organisational and regulatory impediments continue to exist.
- The HILAS system is itself an innovation – or set of innovations – that aims to transcend individual organisations. There is therefore a potential for HILAS to provide a solution to at least two of the impediments to innovation – competence and intra-organisational blockage – and to at least ameliorate aspects of the third impediment, regulation.
- Prisoners’ dilemma impediments arise, for example, where the costs of an innovation are born by a single company, but the advantages then become shared by all companies involved. The end result for the innovator is that because of extra cost it loses competitive advantage. By jointly developing the innovation and/or providing for the sharing of the costs of the innovation, HILAS removes this impediment.

4.4 The Lean-Safe-Green Agenda (D1.3.4)

The deliverable ‘Implementation Requirements for Operations Management – the Lean-Safe-Green Agenda’ (D1.3.4), was written by Yvonne Ward at Trinity College Dublin and Marisa de Brito at Delft University.

Summary of important issues related to the lean-safe-green agenda

Given the HILAS objective of improving both safety and efficiency through HF integration, this deliverable D1.3.4 emphasises the combination of lean operations and HF. It is argued that a combination of lean (process-oriented approach) and HF (human-oriented approach) could provide aviation stakeholders with an operations management approach (lean-safe operations management), which would achieve the dual objectives of operational effectiveness and flight safety.

The deliverable states that the principle of lean operations has been heavily promoted and successfully implemented in the aerospace manufacturing sector. However, it has not yet been widely adopted within the airline and maintenance arenas. There is therefore a significant opportunity to improve the efficiency of these elements of the overall aviation system. However, given the nature of the airline and maintenance businesses, it is important to simultaneously achieve both safety and operational objectives. Another challenge facing the industry is that of sustainability and green issues. This is likely to have operational and HF implications for the aviation sector for the future and is rapidly becoming a priority. Therefore, the deliverable advocates an integrated approach to lean-safe-green operations for aviation enterprises.

In the deliverable, the US Lean Enterprise Model (MIT, 1996; Murman et al, 2002) was adapted to include an explicit focus on safety and HF, resulting in a proposed Lean-Safe Aviation Enterprise Model (LeSAM). In order to integrate sustainability and environmental aspects to the equation, this model was further extended to become a Lean-Safe-Sustainable Aviation Enterprise Model (LeSSAM). This includes lean-safe-green principles and practices and provides companies with a foundation for addressing the sustainability agenda in a visible and pro-active way.

In addition, a range of lean tools are presented and the links to HF and safety issues are identified. These include 5S, kaizen/continuous improvement, value stream mapping, seven wastes, workplace design and supply chain management, among others. Additional practices related to environmental impact and assessment, waste management, green design and stakeholder engagement are included. Tools that can be used to implement green policies are also described.

In the deliverable the lean-safe-green principles which are high-level enterprise goals, are summarised as follows:

- Waste, pollution, and error minimisation/sustainable value creation.
- Accident and incident prevention and reduction (environmental + human).
- Responsiveness to change and risks (including environmental risks).
- Right thing, from the right source, at the right place, at the right time, and in the right quantity.
- Effective relationships within the value stream (including the environment).
- Continuous productivity, safety, green and social improvement.
- Quality, safety and greening from cradle to grave.

Conclusions and recommendations

Competence/learning requirements:

The deliverable lists a number of competences that needs to be developed within organisations for the successful adoption of lean-safe-green operation. Included in this list are:

- HF, lean and sustainability awareness, knowledge and expertise and the ability to align these in order to deliver organisational benefits and improved performance.
- The ability to develop training programmes that will embed the lean-safe-green message throughout the organisation and its processes and activities. Employees will need to receive awareness training and also specific training in individual tools and methods.
- The capacity to incorporate the lean-safe-green agenda into the overall enterprise-level strategy in order to drive future growth, innovation, business opportunities and competitive advantage.
- The capability of implementing, sustaining and managing lean-safe-green operations in practice. This will require numerous skills including an in-depth understanding of lean-safe-green tools and the relationships between them, a “big picture” mentality which enables the use of tools to be considered as part of an enterprise-level change programme, and excellent people management skills.
- The ability to create a system to measure lean-safe-green business dimensions or develop a Balanced Scorecard that includes appropriate measures.
- Sophisticated communication mechanisms to ensure that the lean-safe-green approach is widely promoted throughout the organisation and to illustrate to employees how it relates to their individuals jobs.
- The capability to coach and mentor employees as they become involved in continuous improvement activities.
- Supply chain management skills which take HF and green issues into consideration.

4.5 Safety Management (D1.3.5)

Deliverable D1.3.5 ‘Implementation Requirements – Safety Management’ was written by Åsa Ek and Roland Akselsson at Lund University. The aim of the deliverable D1.3.5 was to provide (a first version of) a list of general implementation requirements for safety management to be used by HILAS partners when preparing implementations. The deliverable also discusses factors that drive and work against change and forwards obstacles that have to be

overcome or seriously taken into consideration for the change in an organisation to be successful.

Summary, conclusions and recommendations of important issues related to safety management

The competence/training requirements are divided into four areas which addresses the integrated operator management systems (under development in HILAS), the implementation of KMS, general safety management requirements, and general change management requirements:

Safety management requirements for implementation of the integrated operator management systems

- State-of-the art HF knowledge should be used in the design phase of systems to be developed. This requirement also comprises the following four items.
- The human system interfaces have to have good affordance, visibility, mapping and feedback. This will minimize human errors and support the efficiency of the human system interaction. Do not overload the human-in-the-loop with information not needed!
- The usability of the system has to be good. This means that relevance, efficiency, attitudes and “easy to learn” are important characteristics.
- Users should be involved early in the design process for better solutions and for commitment to help in the implementation phase.
- Build in flexibility in the design process and in the system. The system being designed will be used in an envisioned world, not like the one today and may be a world the system itself changes.

Safety management requirements for implementation of the KMS

- The KMS should facilitate the sharing of warning signals (free lessons as information about unsafe acts, occurrences and incidents) so that risk and system weaknesses will be disclosed faster for individual operators, making it possible for them to take steps earlier and thus decreasing risks. Prerequisites for that are good reporting (quality, quantity), good and fast analysis and fast spread of results to the right persons. Quality requires knowledge, thus training for operators as well as for KMS personnel may be necessary. Quantity requires commitment and trust that the delivered information will not hurt the sending person or organisation.
- The KMS should facilitate the sharing of experience, good or bad, from other safety measures (e.g. implementation of a safety management system or pieces of it). In addition to information in electronic documents in KMS, personal contacts may be very effective. Routines for efficient personal communication over organisational borders facilitated by KMS are also a requirement. A user group served by good electronic conferencing facilities may be a good ground for this kind of communication. This group could also

have the task to suggest improvements of KMS as a part of a continuous improvement strategy.

- The KMS should facilitate the use of relevant knowledge and experiences from other sectors (e.g. published from major EU-projects such as ARAMIS and SAMRAIL).

General safety management and change management requirements

- Applying systematic safety supervision and performance monitoring aimed at assessing safety performance and reducing or eliminating emerging problem areas.
- Good senior management commitment to the management of safety. The safety culture therefore becomes an important denominator as it constitutes the underlying perceptions and attitudes of the employees as well as behaviours on all levels in an organisation.
- Awareness of safety culture maturity levels. Organisations in the early stages of developing a safety culture are likely to require different improvement techniques from those with well-established safety cultures. Organisations progress sequentially through different maturity levels, by building on the strengths and removing the weaknesses of the previous level.
- A vision is to obtain a common safety culture across the whole aviation sector. Meanwhile, organisations should take effective measures to mediate conflicts between different subcultures.
- Application of a system view for safety. Several levels of culture in the aviation branch have relevance to safety management initiatives. Rasmussen's (1997) system perspective, stresses that a socio-technical system (e.g. the aviation system) has hierarchical levels and that these levels need to have well functioning coordination for safety if the entire (aviation) system is to cope and adapt to various sources of stress.
- Safety promotion is a key issue closely linked to management commitment, communication, training, and participation.
- Awareness of conflicting goals. Conflicting goals can be found on three levels: individual level; group level, where group goals are conflicting with organisational goals; and organisational level, where a conflict between production and safety goals can emerge.
- Searching for latent conditions (or systemic causal factors). The causes for accidents and incidents can be characterized as built-in latent conditions that may be present for many years in a system. There is a need to understand and identify these types of factors through audits, inspection, incident investigation, etc. in order to modify the operations through design and barrier/control measures.
- Well-functioning learning in an organisation is associated with having a proactive approach to safety. It is vital to implement efficient learning cycles that incorporate collecting, monitoring, and analysing relevant information on safety and health, and implementing improvements. This should also result in

an organisation having updated knowledge about how work and safety are functioning. Learned lessons should be saved in an organisational memory, which should be efficiently maintained and used.

- Sharing safety lessons learned and best practices through the active exchange of safety information (among companies and States).
- Utilization of a reporting system to collect, analyse and share safety-related data arising from normal operations. Quick feedback with meaningful information to the reporter is emphasized.
- Competent investigation of accidents and serious incidents identifying systemic safety deficiencies (rather than just targets for blame).
- Hazard identification by experts and application of scientifically-based risk management methods.
- Fostering good communication between individuals, workgroups and hierarchical levels in the organisation. Conflicts of opinion and misunderstandings between subcultures and individuals can often be precursors to accidents and incidents. Good communication can prevent errors and also trap and mitigate errors.

General requirements for successful change management

- Start the preparatory phase of the change process in time, since change processes have to take time.
- Implement participation of users for better results and for commitment.
- Acknowledging resistance. Literature shows that resistance to change in an organisation has been identified as resulting from one, or a combination of the following factors: substantive change in job, reduction in economic security or job displacement, psychological threat, disruption of social arrangements, and lowering of status.
- Acknowledging the importance of communication. Communication should be managed more strategically as a corporate process.
- Training programmes. Due to continuous change in business competition (globalisation), technology development, organisational and economical structures, workforce changes and the emergence of new occupations, there is an important need for continuous training and requirement of new skills. Above all, this concerns the training needed when new safety management systems and procedures are going to be introduced and applied. As also said above, training opportunities educate the users of a system, but they also send a signal to the staff that the management is willing to invest in them.
- Enlightened change leadership. Leaders attend mostly only to content, but people's behaviour, skills and actions are also changed and need to be managed in a best way. In order to lead the changes, leaders need to understand the forces in a change process that are driving the people, the communication and the culture.

4.6 *Dédale Experiences of Implementing a Safety Model and Risk-Based Decision Aid Approach (D1.3.6)*

Deliverable D1.3.6 'Experiences of Dédale Implementing a Safety Model and Risk-Based Decision Aid Approach in Past Projects' was written by Kyla Steele and Jean Pariès at Dédale Paris. The technique that is referred to is SaMBA (Safety Model Based Analysis), which is an approach for incident reporting and risk management developed for the aviation industry. This reflects an attempt to address the shortcomings of some of the more prevalent safety analysis tools, in particular methods for making sense of incident data. The deliverable D1.3.6 describes an enquiry into these experiences and attempts to extract general lessons which could help facilitate the smooth implementation of the new tools and techniques being developed in HILAS. The deliverable discusses the factors which appeared to facilitate or hinder the success of implementing the SaMBA safety analysis method into the industrial workplace.

Summary of important issues appearing to facilitate or hinder the implementation of SaMBA

The issue of organisational size and maturity has multiple implications in relation to organisational changes. While on the one hand there may be more resources available, it is also clear that to make changes in a large, mature organisation which has a pre-existing system of safety management is extremely costly. It can also be a challenge of creating an effective interdisciplinary working group within a large organisation as cooperation and communication can be inhibited due to cultural and political barriers.

The deliverable forwards the notion that in aviation, although it is an industry associated with research and innovation and a proactive approach is espoused, resistance to change is high compared with many other industries. This is explained by Amalberti (2006) who says that as a technology matures it becomes inflexible and its capacity to advance and improve is curbed due to its large size, standardisation, consumer expectations, and liability issues.

Important issues relating to the (SaMBA) technique itself can be considered according to three different categories: the content, structure, and execution. Content refers to the actual substance and ideas behind the technique, and Dédale identified a problematic area; i.e. the issue of conflicting safety paradigms and the implications of applying an approach without the appropriate shift in mindset. Structure refers to the physical format of the technique (such as software tools, procedures, etc.). In the SaMBA case, if there is an existing safety department, they will no longer act as the main conduit for certain types of safety information. They must transfer some of their responsibility and decision-making capacity to other departments, and as a result their role will be redefined. This does not imply that safety managers, risk analysts, or incident investigators are less important or out of a job, quite the contrary: as a major safety initiative it is

imperative that these groups take on principal roles. Execution means how the project was planned and managed.

Dédale identified three issues during their enquiry that specifically addressed the characteristics of safety management in aviation at the industry level: (i) the legal and legislative framework discourages organisations from exceeding the minimum safety requirements; (ii) professional and national culture may inhibit understanding and cooperation; (iii) the fragmented structure of the industry means that some safety needs are structurally separate from the means to fulfil them, and the ambiguous commercial value of safety does not naturally yield a supply-demand paradigm in response.

Although organisations may be crying out for a more sensitive tool, this may be seen as a liability and may be a reason for hesitation to embrace new safety management techniques without the support and guarantees of authorities.

Conclusions and recommendations

Competence/training requirements:

- It is critical to have a dedicated process-owner, who not only understands and believes in the new approach, but also can act as a mediator, explaining and promoting it where required from the emic perspective of an insider. Ideally this would be an individual or group, who is reflexive enough to recognise the implications of any mismatch in paradigms, but who has also the benefit of being an insider and can therefore present the solution in a way that makes it relevant to the specific organisational context.
- A safety manager, or someone spear-heading these kinds of initiatives, needs to be an effective organisational change agent (Swuste & Arnoldy, 2003). Management skills are possibly as important as domain knowledge, since to succeed requires the ability to negotiate internal politics and mediate new and challenging company-wide partnerships.
- Regardless of the structure of the technique, there will be others in the company who will either provide input or make use of the output. The quality of these interactions depends as much on the understanding of the underlying principles as on the knowledge of how to physically use the tool. Unless there are people working as intermediaries at every stage, this poses a significant challenge and could imply the need for training. There may be a large gap between the backgrounds of potential users and the level of understanding required to interface with the approach, however the required HF and safety training should align with the new ideas, and with some creativity it should be possible to integrate the training in this way, to avoid a large additional burden.

The current section has provided a generic view on the training requirements needed in the HILAS consortium. The next section complements this by interacting with the different strands to identify the specific training opportunities that are valuable for the end-users.

5. Identification of Training Needs and Opportunities within FO, FDT, MX and KI Strands

A questionnaire survey was conducted with the purpose to assess HILAS strands' needs concerning competence/training in a number of areas such as knowledge management, organisational learning, innovation, the lean-safe-green agenda, safety management and change management. The purpose was also to assess in what areas a certain strand can offer competence/training to other HILAS strands and partners. The results and conclusions of this survey are presented in this chapter.

5.1 Methodology

A questionnaire was created containing 11 items based on the results from the analysis of the KI deliverables D1.3.1 – 1.3.6 (chapter 3) and the analysis of the lecture series evaluative survey (chapter 2). The questionnaire is presented in Appendix 3. The specific items in the questionnaire are also presented in Table 5.2.

Each item in the questionnaire was to be answered in three parts. First, the respondent was asked to rate, according to the 5-point scale in Table 5.1, the extent of knowledge/competence/ability of the strand in relation to the subject that the item was referring to.

Table 5.1 5-point scale

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all
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Thereafter, the respondent was asked to list the subjects/issues relating to the item, in which the strand partners require competence/training: "What does your strand need with respect to training, knowledge, experience and tools?". For each subject the respondent was also asked to rate the need for competence/training according to the scale 4=very great, 3=great, 2=moderate, 1=limited and 0=not at all.

Finally, the respondent was asked to list the competence/training that the strand partners can offer to other HILAS strand partners in any subjects related to the item: "What can your strand offer (to other HILAS partners, but also to the outside world)?".

The questionnaire was sent to strand leaders and deputy strand leaders for each of the four strands FO, FDT, MX and KI. Four questionnaires were completed, one each from the FO, FDT, MX and KI strands.

5.2 Results of the Survey

The general results of the survey (the ratings of the four respondents) are presented in Table 5.2. The respondents from the four strands also described a number of issues in relation to the questionnaire items, which will be presented below.

Knowledge management

Successful management of documentation

Concerning the FO strand's general ability and skill to transfer knowledge into documents (e.g. the process of storing, retrieving and distributing knowledge in a systematic way) a comment was given that the HILAS website was not used sufficiently for uploading and sharing documents. A great need for more knowledge about this is considered necessary in the FO strand (rating = 3). What the FO strand can offer to other HILAS partners concerning transfer of knowledge is that the involved airlines can outline their current knowledge transfer processes to other partners within the strand (rating = 2). Also, technical partners can train other HILAS partners in certain technical areas (rating = 3).

In the FDT strand, improvements concerning transfer of knowledge are possible, but generally people already seem to understand what the others are doing. Further, the HILAS KMS2 is supposed to provide the explicit platform where documents and deliverables may be exchanged. Possibly more relevant information besides HILAS deliverables may be made available via that system (rating = 2). The FDT strand can provide competence/training to other HILAS partners regarding the structured and synchronised way they store data that follows from HF experiments in the simulator.

The MX strand finds that some members could require more competence regarding uploading documents onto the HILAS website, as well as regarding the use of document sharing systems like Google Docs (rating = 4). Other members in the strand, however, can offer training in the use of Google Docs and Zoho. The strand also forwarded the important issue of dissemination of information. Today, people mostly use power point presentations for writing documents in an easily accessible, short and understandable way, (which is fine) but not good for reporting or dissemination in peer reviewed journals or major dissemination forums. Therefore, more competence regarding writing these types of reports was found to be required in the strand (rating = 4).

Table 5.2 FO, FDT, MX and KI strands' ratings concerning the extent of knowledge/ competence/ability the strand has in relation to item subject

To what extent?	To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all
Do you believe your strand has the general ability and skills to transfer knowledge into documents (i.e. the process of storing, retrieving and distributing knowledge in a systematic way)?		FO, FDT, MX, KI			
Does your strand have knowledge about how to support the communication flow between people in order to support tacit knowledge sharing?	FO	KI	FDT, MX		
Do you believe your strand has the competence to implement and maintain well-functioning learning processes (to learn from incident/accident and performance monitoring)?		FO, FDT		MX	
Does your strand have the competence about the process of capturing and structuring lessons learned and put the data in a searchable organisational memory?			FDT, KI	FO, MX	
Does your strand have knowledge about organisational characteristics that supports/enhances innovation?	FDT	FO, KI		MX	
Does your strand have knowledge about lean principles and practices and their underpinning of operational improvements?	FO	MX	KI	FDT	
Does your strand have the ability to align HF, lean and sustainability knowledge in order to deliver organisational benefits and improved performance?	FDT	FO, MX	KI		
Does your strand have knowledge about how to search for and identify systemic causal factors (e.g. latent conditions) for potential accidents/incidents?		MX, KI	FO	FDT	
Does your strand have HF knowledge for design of technical systems, including interfaces?	FO, FDT	MX		KI	
Does your strand have the knowledge about how to create a safety culture and an environment that fosters effective incident/accident reporting?		KI	FO, MX	FDT	
Does your strand have knowledge about management skills for leading effective change processes?		MX, KI	FO, FDT		

The KI strand has created the KMS as a mechanism for storing, retrieving and distributing knowledge. This is primarily explicit knowledge contained in documents, both from the KI strand and also from all of the other strands. The majority of the KI strand members are researchers and therefore, are well used to transferring knowledge into conference presentations, journal papers, etc. However, best practice in knowledge management (with respect to both explicit

and tacit knowledge) should underpin all of the work of the KI strand and therefore, it would be useful for non-experts to have some training in the area. Competence/training need in the KI strand in this matter is therefore rated as moderate (rating = 2). Delft University is leading the knowledge management work in the KI strand and therefore, may be in a position to provide training in the field of knowledge management to the rest of the project partners. With regard to technical document/content management methods, Trinity College Dublin is the responsible partner.

Organisational support for informal knowledge sharing

The FO strand forwarded that an efficient process to share knowledge between all HILAS partners (e.g. cooperation, coordination, social interaction) has been a difficult task to establish. The KI strand needs to dedicate certain KI partners to become experts in each strand. This means that KI partners can then hold a monthly meeting whereby they can discuss ways of improving knowledge sharing and integration between FO, FDT and MX strands. This need was considered very great (rating = 4).

The competences/training that the FO strand can offer in relation to the communication flow between people in order to support tacit knowledge sharing was technical expertise, airline process analysis and HF issues related to current airline processes.

The FDT strand comprises partners whose core research objects are quite some distance away from knowledge sharing methodologies. Their core competence is in engineering, aviation, HF research, etc. So, it was regarded that most of the FDT partners would not know what tacit knowledge sharing comprises exactly. On the one hand, FDT partners do probably not feel a strong urge for these types of training, but, on the other hand, it is possible that partners do not know how well performance may improve when they put more effort into organisational support for informal knowledge sharing (rating = 1).

The FDT strand forwards that the tacit experience that they have contains a great deal of experience with calibrating the eye tracking system and measuring heart rate; i.e. more than just what is written in the manual. In theory therefore, FDT can train others to do calibrations and heart rate measurements. The same goes for the HEADS debriefing procedure. In order to perform this debriefing in a good manner, a great deal of tacit knowledge (concerning tasks of the pilot, the simulator and scenarios) is needed in order to get the most out of the interviews.

The MX strand forwards that across the strand help would be needed on getting people to communicate what they are doing, when they are doing it and the status of different activities, e.g. each partner should be requested to submit regular reports on the status of their activity. The strand could provide templates for such reporting from those used in Six Sigma or other initiatives.

The KI strand has a knowledge management expert within the strand, to support both explicit and tacit knowledge sharing. However, the remainder of the strand partners is not necessarily aware of best practice in this field and therefore, some training may be appropriate, especially as all KI partners are expected to support

and facilitate communication flow and the transfer of tacit knowledge among the consortium partners (rating = 2). Delft University should be able to provide training in this area.

Organisational learning

Reporting systems and learning processes

Concerning the FO strand's competence to implement and maintain well-functioning learning processes, it was found that HF partners need to investigate how Tool C will work in order to query data and detect new trends which will enable HF partners and airline personnel to learn from capturing performance monitoring data. The need was considered very great (rating = 4). What the FO strand can offer to other HILAS partners related is technical expertise in relation to the current technologies that could possibly be used to develop Tool C.

Concerning competence to implement and maintain well-functioning learning processes, FDT rated their need for more such competence and training as moderate (rating = 2). The strand has learned a great deal from the previous experiment and is currently implementing this in the new experiment. The FDT strand can offer sharing the experience described above; i.e. lessons identified from the previous experiment.

The MX strand have knowledge about how to implement and maintain well-functioning learning processes, but also forwards that this is a huge task that is not to be underestimated, and therefore any help would be appreciated. They are also reliant on KI partners to support in this activity. In SRT, they are in a process of trying to implement a learning process which will serve as a model for the other MX partners. So (following the Phase 1 trail), SRT should be in a position to hand this over to the other partners for their development / adapting to their company.

The competence/training issue is not so relevant for the KI strand, apart from easyJet (which is involved in both the FO and KI strands). Naturally, it is important for universities to have well-functioning learning processes. In addition, it is important that researchers are in a position to create generic learning from large projects such as HILAS. However, the learning will not be related directly to incident/accident reporting and performance monitoring. Therefore, the KI strand is not believed to require training in this area. Delft University has competences in this field.

Organisational memory

Organisational memory has to do with the process of capturing and structuring lessons learned and put the data in a searchable organisational memory. It was found that the FO strand has the capability of achieving this task, but due to other priorities and limited resources, it was not an essential task to be achieved (rating = 1). The strand can offer technical expertise to other partners concerning the matter.

The FDT strand forwards that their deliverables, minutes of meetings and data that were collected during experiments are their searchable memory. They believe that there are possibly more effective ways of storing that data. The FDT strand rated the need for competence/training as great (rating = 3). What the strand can offer to other HILAS partners is the documentation described above. Especially, the collected data from simulator experiments (in a synchronised and structured way), which is not easy to do.

SRT, in the MX strand, has an informal review system for capturing lessons learnt. It reviews what has happened and what went well and what did not, what might be improved and so on.

Through Delft University, the KI strand has competence with respect to organisational memory. In addition, the KMS represents a mechanism for creating inter-organisational/industrial memory, because it has the ability to capture and store lessons learned from many individual organisations. Again, while not all the strand partners have expertise in this field, training would be more relevant to industrial partners in other strands (rating = 1).

Innovation

The item on innovation concerned the extent in which the strand has knowledge about organisational characteristics that supports/enhances innovation. What the FO strand can offer in competence/training to other HILAS partners concerns the link of Tool D related to Tool A and C.

The FDT strand forwards that innovation is what this project is all about. The people working in the strand are true innovation specialists. Possibly the organisational characteristics may be “sharpened” a bit. Competence needs was rated as moderate (rating = 2).

Many of the KI strand partners have competences linked to innovation, particularly FIT. Therefore, while there may be some need for training related to innovation for those not familiar with this field, it is not believed that it is a priority (rating = 1-2).

The lean-safe-green agenda

The FO strand was found to have good knowledge about lean principles and practices and only limited training was found to be required (rating = 1). What the FO strand can offer to other HILAS partners is lean process analysis and HF issues related to current airline processes.

The FDT strand forwards that they are aware of the existence of lean principles, but do not use them explicitly in their work. However, the need for competence/training concerning these issues was rated as great (rating = 3). Furthermore, the FDT strand aims at introducing HF in the design and certification of technologies in the life-cycle of an aircraft. That is something that the strand masters very well and therefore, the competence need was rated as limited (rating = 1). The strand can show what they do, in power point presentations and demonstrations, and in theory, the FDT strand can also teach others how to do it.

In the MX strand, SRT is working on an improvement project which takes into consideration the philosophy, tools and techniques from HILAS, lean and Six Sigma.

The KI strand has developed the lean-safe-green concept (Yvonne Ward, Trinity College Dublin, and Marisa de Brito, Delft University). While others in the KI strand may benefit from being aware of these ideas (e.g. Lund University and Dédale), it is more relevant for the industrial partners in the FO and MX strands. Training in this topic is not a priority for the KI strand (rating = 1-2).

Safety management

Given the question to what extent the FO strand have knowledge about how to search for and identify systemic causal factors (e.g. latent conditions) for potential accidents/incidents, the FO response was that HF partners have struggled to define Tool C. This will have the capability of searching and detecting trends that can identify systematic causal factors for potential accidents/incidents (rating = 4). FO partners do not require competence/training (rating = 1) concerning HF knowledge for design of technical systems (including interfaces) and FO technical partners can offer other HILAS partners technical training.

The FDT strand forwards that due to the type of work they are conducting they are not very experienced with how to search and identify systematic causal factors. They rate their competence need as moderate, but on the other hand, the strand would probably not be able to fully exploit such competence. FDT partners do not require competence/training concerning HF knowledge for design of technical systems as design and evaluation of interfaces is what they are good at (rating = 1).

The FDT strand can offer competence/training to other HILAS partners. There are many specialists within the strand with design and evaluation expertise, so it is possible to provide training in the entire chain from design to evaluation with respect to HF in the process of FDT design.

The KI strand has a number of researchers that are experienced in the HF field, safety and risk management. However, given the fact that the HILAS project focuses on HF, safety and risk management, it is believed that a number of other KI partners would benefit from training in those areas. It would enable them to contribute more effectively in the project and gain some personal learning in the process (rating = 3-4). With respect to all of the areas mentioned, there are partners within the strand who could provide this training to others in the strand. In addition, training could be provided by specialists in other strands.

There is very limited technical expertise in the KI strand. Susan Reilly, Trinity College Dublin, is one of the few technical persons within the strand. She has expertise in web design (including interfaces), but not from a HF perspective as such. While the KMS development process will require an input from HF specialists, this is not something that the wider KI membership requires training in (rating = 1).

Safety culture: trust and commitment in reporting accidents/incidents

Regarding the issue of creating trust and commitment in reporting accidents/incidents, the FO strand forwards that HF partners have struggled to define Tool C which will have the capability of detecting trends which should ultimately reduce risk and increase safety. The strand rated the need for competence/training as very great (rating = 4). From the FO strand easyJet can offer training on risk modelling to other partners.

The FDT strand conveys regarding the issue of creating and improving a safety culture that the strand could discuss with customers whether the design of technologies could be adjusted in such a way that it reduces incident or accident likelihood to occur. It was believed that it was here where the different HILAS strands come together. FDT partners may provide that kind of support that might follow from information in the ABCD Tool. How this can be accomplished precisely needs to be discussed in more detail between strands.

As ICAO regulations for a just culture is coming into effect in Jan 09, the MX strand state they have knowledge about environments fostering effective incident/accident reporting. But the strand and SRT could do with further assistance to transfer a company policy stating we have a 'just' culture into a good reporting culture.

In the KI strand, the partners that are not expert in the HF fields, safety and culture may require additional knowledge in these areas. However, this is a lower priority for KI partners. University La Laguna, who specialise in culture generally, may need some support regarding safety culture specifically. However, this would need to be discussed with them on a one-to-one basis (rating = 1-2). Lund University, Delft University and University La Laguna all have expertise to offer in this area.

Change leadership – changes need to be managed in a best way (content, behaviour, attitudes)

The FDT strand forwards that the need for knowledge about how to lead effective change processes are limited as there are no change processes taking place within the strand. The products that the strand provides are built into the cockpit and, if necessary, adjustments to procedures or training are provided to the cockpit. However, that does not take place within the strand. In the FDT strand the work is focused on design of the tools themselves, the change processes that might follow after introduction of technology and tools from the strand are guided by other people.

KI strand partners are unlikely to require expertise in this area, apart from easyJet and therefore, the competence need was rated as limited (rating =1). On the other hand, most of the KI partners possess expertise to support effective change management, including FIT, University La Laguna, Delft University, Lund University and Trinity College Dublin.

5.3 Conclusions

The results from the questionnaire survey were rather diverse and therefore, it is difficult to give an all comprising conclusion. But some competence/training issues can be brought forward.

The KI strand has created the KMS as a mechanism for storing, retrieving and distributing knowledge. The FO and MX strands commented that the HILAS website was not used sufficiently for uploading and sharing documents and a need for more knowledge about this was considered required in the strand. The FDT strand forwarded that, possibly, other relevant information besides the HILAS deliverables may be made available via the system. Generally, the survey results showed that it would be useful for the FO, FDT and MX strands to have some training in the area of knowledge management, and the KI strand may be in a position to provide this.

The FO strand forwarded that an efficient process for informal (tacit) knowledge sharing between all HILAS partners has been a difficult task to establish, but can offer competences/training to support tacit knowledge sharing in the form of technical expertise, airline process analysis, and HF issues related to current airline processes. The FDT strand found that it was possible that partners did not realize how well performance may indeed improve, if they put more effort into organisational support for informal knowledge sharing. The FDT strand partners have tacit knowledge on a number of subjects. Examples are eye tracker calibrations, the HEADS debriefing procedure, heart rate measurements, etc. At the moment, FDT partners train each other in order to optimally use this tacit knowledge in the upcoming experiment.

Concerning the implementation of well-functioning learning processes, what the FO strand has to offer other HILAS partners, is mainly technical expertise of current technologies that could possibly be used to develop Tool C. The FDT strand could benefit from some training in how to create good learning processes in relation to their new experiment. In the MX strand, SRT is in the process of trying to implement a learning process which will serve as a model for the other MX partners.

The FO strand has the capability of capturing and structuring lessons learned and put the data in a searchable organisational memory, and can offer technical expertise to other HILAS partners concerning the matter. The FDT strand forwards that their deliverables, minutes of meetings and data that are collected during experiments are their searchable memory. They believe that there are possibly more effective ways of storing that data and therefore, could gain getting more knowledge about this.

The FO strand was found to have good knowledge about lean principles and practices and can offer lean process analysis and HF issues related to current airline processes to other HILAS partners. The FDT strand aims at introducing HF in the design and certification of technologies in the life-cycle of an aircraft. A great deal of methodologies for design and evaluation are available and



mastered by the FDT partners. The strand is very good at this and can present and demonstrate (and also teach) other HILAS partners how to do this. The KI strand has developed the lean-safe-green concept and can therefore offer training in this matter.

Regarding the HF knowledge for design of technical systems (including interfaces), the FO technical partners can offer other HILAS partners technical training. The FDT strand can also offer competence/training as there are many specialists within the strand with design and evaluation expertise. From the FO strand, easyJet can offer training on risk modelling to other partners.

6. Training Platforms

6.1 Introduction

The KI strand initiates activities such as integration workshops, newsletters, HUFAG, dissemination events and lecture series to ensure effective communications both within and external to the consortium. In addition, the KMS linking all strands facilitates the use of the project's knowledge. The current chapter specifically describes the training platforms currently available within the possibilities and constraints of the HILAS project; i.e. the lectures series, workshops and KMS. These activities can be implemented to acquire knowledge, skills and competencies; in other words to train. The other mentioned activities can not directly be considered as training: the newsletters may be used as a marketing vehicle but can not be interpreted as training and the HUFAG meetings and dissemination events are a means of knowledge dissemination. A specific point of attention when discussing the available training platforms concerns the question whether the platforms are only suitable within the HILAS consortium or can be used for external training as well.

6.2 Available Training Platforms

Lecture series

The lecture series are an interesting means for realising the KI training goals. The series represent an important training forum, mainly for within the HILAS consortium. Chapter 3 within this deliverable specifically focuses on the lecture series.

As already discussed in chapter 3, participants of the lecture series 2007 recognised the importance of the lecture series as a training mechanism within the HILAS consortium. Results of the lecture series evaluative survey showed that attendees were very pleased with the way the lecture series 2007 were organized.

Workshops

The workshops may provide another valuable training forum within HILAS. Until now the (integration) workshops are mainly used for the presentation of research findings, the validation of findings by the industrial partners and the discussion of new ideas⁴. Nevertheless, workshops can also be implemented to interactively

⁴ Evaluations of the workshops are available in:
- D1.2.3: Theoretical workshop review and evaluation.

train HILAS members certain HILAS outputs in which they are interested. Members could subscribe to these when interested.

Knowledge Management System

One of the key outputs from the KI strand is a prototypical KMS2 for HF at the European level. It is envisaged that KMS2 will comprise a number of modules including a public access website, an on-line community, a HF library, a HF tools registry and a HF data exchange – in essence, the foundations for a one-stop-shop for HF data, information and knowledge in Europe. The first phase of development (KMS1, see Figure 6.1) established the basis for the public access website, on-line community and HF library⁵. The second phase of development (KMS2, under construction) is focusing on the HF tools registry and data exchange modules.

On-line training should be one of the supported activities by KMS2. The ability to acquire knowledge, skills and competencies through the use of KMS2 offers an enormous training platform within the HILAS consortium, but also to the outside world. Per strand more than one on-line training module can be presented via KMS2.

The training through KMS2 offers a few different options such as: free of charge or for expense; accessible for anyone or for members only; always available or on request only; with online access to experts or without; etc.

Other training activities

It is likely that other training activities arise during (and possibly after) the course of the HILAS project. Participants of the lecture series evaluative survey (see chapter 3) suggested supplementing the lecture series with courses tailored to the organization, on-line training via HILAS KMS and workshops. The possibility of the on-line training via KMS2 is already discussed above, as are the workshops.

Courses that are tailored to the customer indeed seem an interesting addition to the training activities offered. Here, the training activities can be put together in close consideration with the customer. The training can be held “in the field” (e.g. training in an airport hangar on the use of a newly developed maintenance tool). Alternatively, the training can possibly be organised using the facilities of the HILAS partners.

- HILAS integration workshop 2007 review and evaluation.

⁵ Relevant deliverables concerning KMS are:

- D1.1.1: Initial survey of HILAS knowledge management requirements/specification of KMS1.
- D1.1.3: KMS1 implementation and training guides.
- D1.1.5: Evaluation results.

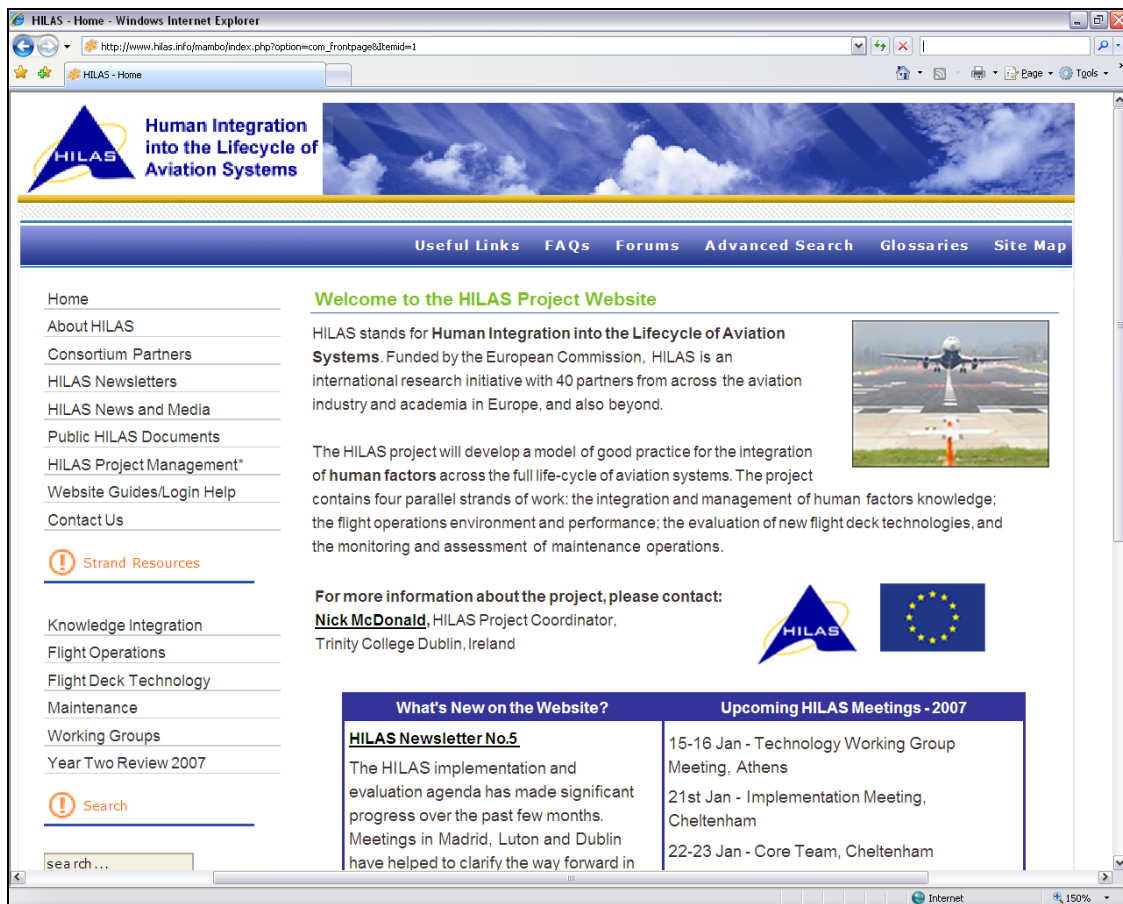


Figure 6.1 Home-page of KMS1

6.3 Liaison with Stakeholders

Internal stakeholders

An important role of the KI strand is to promote the exchange of knowledge between the FO, FDT and MX strands. The aim is to encourage the use of the knowledge from one domain in another domain (e.g. by training). This requires a practical pro-active approach to knowledge sharing and the facilitation of events that engage representatives from all HILAS strands. At a basic level, it is important that all HILAS consortium members have an understanding of the work that is being undertaken within the HILAS project, not simply within their own strands but in all strands. With respect to some topics, HILAS members may find the need to be trained herein. To some extent this is facilitated by events such as workshops and lectures series. In fact, now that it is becoming clearer for each individual strand what their output will be, more and more workshops are organised between strands. Strands actively inform each other what they have



identified so far, and use these experiences to train each other, resulting in a more integrated output of the project. Additionally, the HILAS website (i.e. KMS1) enables internal interaction by providing mechanisms such as expert pages and discussion boards. The development of KMS2 must further support the integration of knowledge between the different strands by implementing the possibility of on-line training.

External stakeholders

It is critical that HILAS develops relationships across the aviation and aerospace sectors and within HF communities, both within Europe and around the world. This includes making connections with regulators, HF groups, aviation and aerospace trade organisations, and other relevant committees and organisations. KMS2 has the potential of presenting (and training) the project's output to a greater public. This comprehensive KMS2 for HF publicly shares the HILAS know-how.

Although mainly focused at first on stakeholders from within the HILAS network, the lecture series and workshops can also form an interesting training platform for external stakeholders, e.g. by inviting speakers/experts from outside the HILAS project.

In addition, training course tailored to the customer can substantially contribute to the distribution of HILAS outputs to the outside world.

6.4 Future Steps

This chapter has presented the training platforms currently available within the HILAS context. The HILAS project can only be judged as successful if the research outputs and findings have an impact on the wider aviation industry, not simply those industrial partners involved in the HILAS consortium. The training activities lay the groundwork for the development of robust business development plans for the exploitation of HILAS products and the creation of valuable associated services. They should generate interest among external stakeholders in implementing the HILAS outputs, systems and tools within their own organisations. Therefore, it is necessary to extend the use of the available training platforms to the outside world. The development of on-line training via KMS2 and the use of tailored courses are two great examples of this. In addition, lecture series and workshops can be (re-)designed for external stakeholders. The dissemination and integration of knowledge – using these training platforms – is vital to the success of HILAS products beyond the project.

7. Conclusions: Overview of Training Opportunities

The KI strand plays an active role in ensuring that integration takes place across the project. The current report represents the deliverable D1.2.9: Training Opportunities Report; i.e. a deliverable associated with the dissemination, training and knowledge support activities of the KI strand (WP1.2). The objective of this deliverable is to identify the training opportunities from HILAS consortium outputs.

Several methods are used to identify training development opportunities arising from HILAS outputs. These methods are the analysis of the lecture series evaluative survey, the analysis of the deliverables D1.3.1 – 1.3.6 and the interaction with the FO, FDT, MX and KI strands. The evaluation of these methods is described in chapters 3, 4 and 5 of the current report. Together, these complementing evaluations should result in the identification of some interesting and relevant training development opportunities arising from HILAS consortium outputs.

The evaluation of the lecture series 2007 begins to inform the future training strategy. Concerning training opportunities, participants showed to be only moderately interested in receiving training in the use of the specific tools and/or measures; i.e. the need for training appears to be relatively small, especially concerning eye tracking and CRIA. As discussed in chapter 3, this is perhaps understandable given the fact that people's roles in the HILAS project may not (always) require the direct use of these tools and/or measures. Nonetheless, participants appreciated being briefed about the tools and/or measures through the lecture series. The tools and/or measures presented were believed to be useful, relevant and important for the HILAS project, especially with regard to the psychophysiological measures and Pamela.

The competence requirements evaluated in WP1.3 deliverables D1.3.1 – 1.3.6 add valuable information to the process of identifying training opportunities. The implementation requirements listed in deliverables D1.3.1 – D1.3.6 were summarized and, from these, competence/training requirements needed in HILAS organizations were formulated. These competence requirements formed (together with the results of the evaluation of the lecture series 2007) the basis for the questionnaire that was put together (see Appendix 3) to interact with the different strand leaders.

Given the results of the methods described above, a remarkable finding is that the need for training within the HILAS consortium appears to be relatively small. Partners are not always aware of (or are not willing to see) the possible profit certain training of HILAS outputs has to offer. However, some competence/training issues can be brought forward. For example, the survey results showed that it would be useful to provide some training in the area of knowledge management; i.e. the use of KMS within HILAS. KMS is a mechanism for storing, retrieving and distributing knowledge, and is supposed to provide the

explicit platform where documents and deliverables may be exchanged. Possibly more relevant information besides the HILAS deliverables may be made available via that system.

Training opportunities

Interaction with the strands was necessary to identify the specific training opportunities for the different domains. The questionnaire contained three parts, the last part specifically referring to the competence training that the involved strand has to offer; i.e. training opportunities for other HILAS partners and for stakeholders outside HILAS. The results from the questionnaire turned out to be rather diverse and therefore, it seems difficult to present an all comprising conclusion with respect to the specific training opportunities. Nevertheless, partners have already provided different interesting and relevant training opportunities to implement. Of course, these opportunities often lie within the expertise of the different partners/strands; i.e. opportunities for training that could be developed from the expertise that exists already in the consortium and that is likely to develop as the project progresses.

The objective of this deliverable D1.2.9 was to identify the training opportunities from HILAS consortium outputs. The identified areas for training opportunities are described below:

- Training in the area of knowledge management.
- Training to support tacit knowledge sharing (in the form of technical expertise, airline process analysis and HF issues related to current airline processes).
- Training of technological expertise with respect to current technologies used to develop Tool C.
- Training of technological aspects of capturing and structuring lessons learned (searchable organisational memory).
- Training to perform eye tracker calibration.
- Training to execute the HEADS debriefing procedure.
- Training to perform heart rate measurements.
- Training in expertise with respect to HF, safety and risk management.
- Training in lean process analysis and HF issues related to current airline processes.
- Training in expertise with respect to the lean-safe-green concept.
- Training in HF knowledge for design and certification of technologies in the life-cycle of an aircraft.
- Training in technological expertise with respect to HF knowledge for design of technical systems (including interfaces).
- Training in expertise with respect to risk modelling.

Surprisingly, at this point of time in the course of the HILAS project, only few concrete training opportunities directly arising from HILAS consortium outputs have been identified by the strand leaders. For example, the ABCD Tools (that can be considered as the major HILAS output) has moderately been mentioned, and only implicitly as a training opportunity. This can be explained by the fact



that, at this point, the none of the tools is finished and therefore, can not yet be considered as an output of HILAS. Nevertheless, being the major output, HILAS still has to identify the ABCD Tools as the most important training opportunity. Finally, the HILAS project can only be judged as successful if the research outputs and findings have an impact on the wider aviation industry, not simply those industrial partners involved in the HILAS consortium. The training activities lay the groundwork for the development of robust business development plans for the exploitation of HILAS products and the creation of valuable associated services. They should generate interest among external stakeholders in implementing the HILAS outputs, systems and tools within their own organisations. Therefore, it is necessary to extent the use of the available training platforms to the outside world. The development of on-line training via KMS2 and the use of tailored courses are two great examples of this, but also lecture series and workshops have to be (re-)designed for external stakeholders. The dissemination and integration of knowledge – using these training platforms – is vital to the success of HILAS products beyond the project.

References

- Amalberti, R. (2006). Optimum System Safety and Optimum System Resilience: Agonistic or Antagonistic Concepts? In: Hollnagel, E., Woods, D.D., & Leveson, N., (eds.), *Resilience Engineering: Concepts and Precepts*. Aldershot, UK: Ashgate Publishing Ltd.
- Andriessen, J.H.E. (2006). Chapter 14: Managing knowledge processes. In: Verburg, R.M., Ortt, R.J., & Dicke, W.M. (eds.), *Managing Technology and Innovation: An Introduction* (pp. 263-285). London, UK: Routledge.
- Brown, J.S., & Duguid, P. (2000). *The Social Life of Information*. Boston, USA: Harvard Business School Press.
- Carlsson, S.A. (2003). Knowledge managing and knowledge management systems in inter-organizational networks. *Knowledge and Process Management*, 10(3), 194-206.
- Conklin, J. (1997, 2001). Designing organizational memory: preserving intellectual assets in a knowledge economy. CogNexus Institute, 1-41.
- Jashapara, A. (2004). *Knowledge Management: An Integrated Approach*. Harlow, Essex: FT Prentice Hall.
- MIT (1996). US Lean Aerospace Initiative and US Lean Enterprise Model [accessible at <http://lean.mit.edu>].
- Murman, E., Allen, T., Bozdogan, K., Cutcher-Gershenfeld, J., McManus, H., Nightingale, D., Rebentisch, E., Shields, T., Stahl, F., Walton, M., Warmkessel, J., Weiss, S., & Widnall, S. (2002). *Lean Enterprise Value*. Hampshire, UK: Palgrave.
- Rasmussen, J. (1997). Risk management in a dynamic society: a modelling problem. *Safety Science*, 27(2-3), 183-213.
- Swuste, P., & Arnoldy, F. (2003). The safety adviser/manager as agent of organisational change: a new challenge to expert training. *Safety Science*, 41, 15-27.
- Wenger, E., McDermott, R., & Snyder, W.M. (2002). *Cultivating Communities of Practice. Boston: A Guide to Managing Knowledge*. Boston, USA: Harvard Business School Press.



Appendix 1: List of Acronyms

ACRONYMS	MEANING
CRIA	CRITICAL Interaction Analysis
D	Deliverable
FDT	Flight Deck Technologies
FO	Flight Operations
HEADS	Human factors Expert Administered Debriefing Survey
HF	Human Factor(s)
HILAS	Human Integration into the Life-cycle of Aviation Systems
HUFAG	Human Factors Advisory Group
ICT	Information & Communication Technology
KI	Knowledge Integration
KMS	Knowledge Management System
KMS1	Knowledge Management System – Version 1
KMS2	Knowledge Management System – Version 2
M	Mean
MX	Maintenance
SaMBA	Safety Model Based Analysis
SD	Standard Deviation
WP	Work Package



Appendix 2: Lecture Series Evaluative Survey

Welcome to the lecture series. You are going to listen to six lectures. We hope they are informative and relevant to you. We would like to evaluate this by means of a survey after each lecture. Also we want to use this to improve our future lectures!

We ask you to fill in the relevant survey after each lecture. All responses are voluntary and will be kept confidential. You can hand them in at the end of the day with someone from the NLR or the general organization.

Thank you for your time!



1. Introduction + EU HUFAG – Prof. Peter Jorna

1	2	3	4	5
Disagree strongly	Disagree	Without opinion	Agree	Agree strongly

1. The lecture was useful and relevant..... **1** **2** **3** **4** **5**
- If agreed, please indicate to what field (more ticks allowed):
- In general*
 - To my specific HILAS activities*
 - Other:*
2. The lecture helped me clarify or find solutions to my specific issues and questions.....
3. The lecture met my expectations.....
4. I understand the content of the lecture.....
5. I think the role of this topic in the HILAS project is important.....
6. The quality of this lecture was good.....
7. The length of the lecture was appropriate.....

Do you have suggestions were the HUFAG should talk or think about?



2. Using psychophysiological measures on the flight deck – Dr. Dick de Waard

1	2	3	4	5
Disagree strongly	Disagree	Without opinion	Agree	Agree strongly

1. The lecture was useful and relevant..... **1** **2** **3** **4** **5**
- If agreed, please indicate to what field (more ticks allowed):
- In general*
 - To my specific HILAS activities*
 - Other:*
2. The lecture helped me clarify or find solutions to my specific issues and questions.....
3. The lecture met my expectations.....
4. I understand the function of the presented psycho-physiological measures.....
5. I think the role of these measures in the HILAS project is useful.....
6. I would like training in using these measures.....
7. The quality of the lecture was good.....
8. The length of the lecture was appropriate.....

Feel free to explain your answers or write down further suggestions:



3. Eye tracking in HF research at the NLR – Rolf Zon

1	2	3	4	5
Disagree strongly	Disagree	Without opinion	Agree	Agree strongly

1. The lecture was useful and relevant..... **1** **2** **3** **4** **5**
- If agreed, please indicate to what field (more ticks allowed):
- In general*
 - To my specific HILAS activities*
 - Other:*
2. The lecture helped me clarify or find solutions to my specific issues and questions.....
3. The lecture met my expectations.....
4. I understand the function of the presented eye tracker.....
5. I think the role of the eye tracker in the HILAS project is useful.
6. I would like training in using the eye tracker.....
7. The quality of the lecture was good.....
8. The length of the lecture was appropriate.....

Feel free to explain your answers or write down further suggestions:



4. Human Factors Software Tools Developed by the HFI-DTC for System Design – Prof. Neville Stanton (guest speaker)

1	2	3	4	5
Disagree strongly	Disagree	Without opinion	Agree	Agree strongly

1. The lecture was useful and relevant..... **1** **2** **3** **4** **5**
- If agreed, please indicate to what field (more ticks allowed):
- In general*
 - To my specific HILAS activities*
 - Other:*
2. The lecture helped me clarify or find solutions to my specific issues and questions.....
3. The lecture met my expectations.....
4. I understand the function of the presented DTC tools.....
5. I think the role of these tools in the HILAS project is useful.....
6. I would like training in using these specific tools.....
7. The quality of the lecture was good.....
8. The length of the lecture was appropriate.....
9. I liked listening to someone from outside the HILAS project.....
10. I think the input of a guest speaker (outside the HILAS project) is valuable.....

Feel free to explain your answers or write down further suggestions:



5. Pamela – Prof. Peter Jorna

1	2	3	4	5
Disagree strongly	Disagree	Without opinion	Agree	Agree strongly

1. The lecture was useful and relevant..... **1** **2** **3** **4** **5**
- If agreed, please indicate to what field (more ticks allowed):
- In general*
 - To my specific HILAS activities*
 - Other:*
2. The lecture helped me clarify or find solutions to my specific issues and questions.....
3. The lecture met my expectations.....
4. I understand the function of Pamela.....
5. I think the role of Pamela in the HILAS project is useful.....
6. I would like training in using Pamela.....
7. The quality of the lecture was good.....
8. The length of the lecture was appropriate.....

Feel free to explain your answers or write down further suggestions:



6. CRIA's simulation applicability process – Ms. Chiara Santamaria Maurizio

1	2	3	4	5
Disagree strongly	Disagree	Without opinion	Agree	Agree strongly

1. The lecture was useful and relevant..... 1 2 3 4 5
 If agreed, please indicate to what field (more ticks allowed):
 In general
 To my specific HILAS activities
 Other:
2. The lecture helped me clarify or find solutions to my specific issues and questions.....
3. The lecture met my expectations.....
4. I understand the function of CRIA.....
5. I think the role of CRIA in the HILAS project is useful.....
6. I would like training in using CRIA.....
7. The quality of the lecture was good.....
8. The length of the lecture was appropriate.....

Feel free to explain your answers or write down further suggestions:



Some last general questions

1	2	3	4	5
Disagree strongly	Disagree	Without opinion	Agree	Agree strongly

- 1. The number of lectures was appropriate.....
- 2. The topics and objectives were clear.....
- 3. Do you believe the lecture series is a good training mechanism within HILAS?

Yes No If yes, why? If not, why? Explain below.

- 4. Training should be provided through the HILAS project.....
- 5. What topics would you most like training?

- 6. What forms of training would you prefer?
 - Lecture series format
 - On-line training via the HILAS knowledge management system
 - Courses tailored to my organization and held on-site
 - Other (please specify):

- 7. If a future lecture series is to be held, what topics would you like to see included?

Feel free to explain your answers further or write down other suggestions:



Appendix 3: Training Requirements Questions

Dear HILAS strand leaders and assistant strand leaders,

In order to identify the competence/training needs and opportunities in HILAS, we need to collect information from all strand leaders and assistant strand leaders. Therefore, we want to assess HILAS strands' needs concerning competence/training in a number of areas, but also to assess in what areas your strand can offer competence/training to other HILAS partners/strands.

Below is a questionnaire which we would like you to fill in and send back electronically. The questionnaire contains general questions in the areas of knowledge management, organisational learning, innovation, the lean-safe-green agenda, safety management and change management. It is also possible to add other areas of competence/training that you would like to forward.

Thank you all very much in advance.

This work is collaboration between the HILAS partners NLR and Lund University.

Dear all,

This is a reminder for filling in the questionnaire concerning HILAS Training needs and opportunities that was sent to you earlier. There are two core questions we want you to answer:

1. What does your strand need with respect to training, knowledge, experience, tools?
2. What can your strand offer (to other HILAS partners, but also the outside world)?

If there are any issues/subjects/needs, etc. that you do not see fit with the items in the questionnaire you are very much welcomed to add them at the end of the document.

We would greatly appreciate if you could send back the filled in questionnaire!



HILAS – Training needs and opportunities

Questionnaire to be filled in by strand leaders and assistant strand leaders

The purpose of this survey is to assess HILAS strands’ needs concerning competence/training in a number of areas stated below. The purpose is also to assess in what areas your strand can offer competence/training to other HILAS partners/strands.

For every question below, please mark your answer with an X in the shaded area and, thereafter, list the competence/training issues your strand needs, as well as what competence/training you can offer.

If you have any other comments, please state them too.

Knowledge management

Successful management of documentation

1. To what extent do you believe your strand has the general ability and skills to transfer knowledge into documents (i.e. the process of storing, retrieving and distributing knowledge in a systematic way)?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all

→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

###

Organisational support for informal knowledge sharing (e.g. cooperation, coordination, social interaction)

2. To what extent does your strand have knowledge about how to support the communication flow between people in order to support tacit knowledge sharing?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all



→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

###

Organisational learning

Reporting systems

3. To what extent do you believe your strand has the competence to implement and maintain well-functioning learning processes (to learn from incident/accident and performance monitoring)?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all

→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

###

Organisational memory

4. To what extent does your strand have the competence about the process of capturing and structuring lessons learned and put the data in a searchable organisational memory?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all

→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

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Innovation

5. To what extent does your strand have knowledge about organisational characteristics that supports/enhances innovation?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all
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→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

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The Lean-Safe-Green Agenda

6. To what extent does your strand have knowledge about lean principles and practices and their underpinning of operational improvements?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all
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→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

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7. To what extent does your strand have the ability to align human factors, lean and sustainability knowledge in order to deliver organisational benefits and improved performance?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all
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→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

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Safety management

8. To what extent does your strand have knowledge about how to search for and identify systemic causal factors (e.g. latent conditions) for potential accidents/incidents?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all

→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

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9. To what extent does your strand have human factors knowledge for design of technical systems, including interfaces?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all

→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

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Safety culture: Trust and commitment in reporting accidents/incidents

10. To what extent does your strand have the knowledge about how to create a safety culture and an environment that fosters effective incident/accident reporting?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all

→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

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Implementing new safety models and techniques, etc.

Change leadership - changes need to be managed in a best way (content, behaviour, attitudes)

11. To what extent does your strand have knowledge about management skills for leading effective change processes?

To a very great extent	To a great extent	To a moderate extent	To a limited extent	Not at all
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→ Please list the issues/subjects relating to the question, in which your strand/individual strand members require competence/training. For each issue/subject, please rate the need: 4=very great, 3=great, 2=moderate, 1=limited.

→ Please list the competence/training your strand can offer to other HILAS partners in any issues/subjects related to the question.

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