HoliDes newsletter

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Intro

Emergency Response Control Rooms handle unplanned events that require an immediate response. Examples are Control Rooms of the fire department, of emergency call services (e.g., “112”, “911”, …), of energy network monitoring and of border security organizations. Control Room is one of the four application domains considered by project HoliDes (Holistic Human Factors and System Design of Adaptive Cooperative Human-Machine Systems).
In this number, we present the HoliDes Control Room AdCoS (Adaptive Cooperative Human-Machine Systems): a border security control room AdCoS and an energy network control room AdCoS. They both consist of surveillance operators who cooperate with distributed human and machine agents to monitor the safety-critical resource (being it a protected area or an energy network) and to launch and perform inspections. Adaptation is needed in order to tailor the tasks associated to the control room operators according to their current status of workload, to their position, skills, experience and profile, as well as to situational dynamics.
Besides our Control Room demonstrators, we here introduce also one of the initiatives started by the project to foster the integration of Human Factors issues solutions in System Engineering: the creation of the Human Factors OSLC User Group.

Enjoy the reading!

In this issue:

The Border Security Control Room AdCoS

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The Border Security Control Room AdCoS employs the combination of novel proximity-based interaction technologies and adaptive support functionalities in order to increase the effectiveness and efficiency of emergency response operations.

Work in border security control rooms is characterized by phases with high activity followed by longer phases with little or no activity. They are organized to allow a 24/7 operation. The educational level of operators is often medium to low, and border security organizations may experience a high operator turnover. Border security is organized hierarchically. The control room sites are usually located close to the border and may be subject to assaults. The situation in other command and control (C2) or emergency response organizations has similar characteristics.

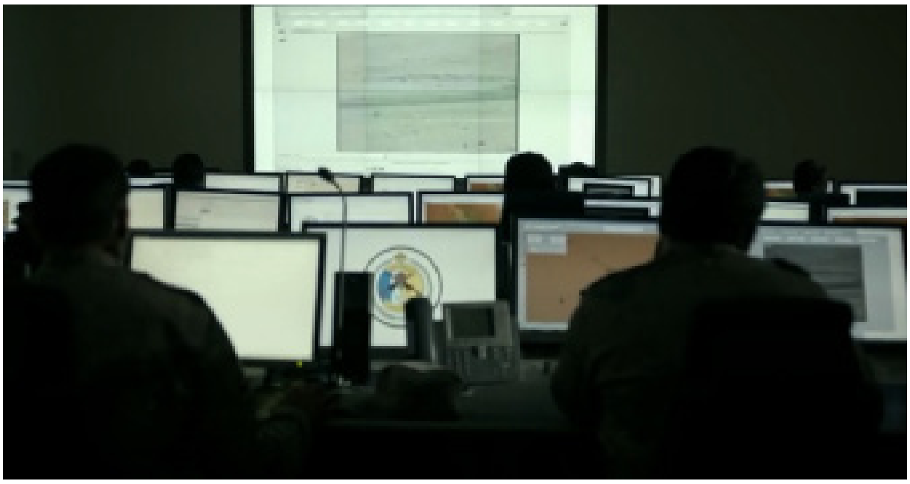

Figure 1. Workplaces in a Border Security Control Room

Currently, no mechanisms exist that ensure that operators are present at their workstations when the situation requires it. Neither are there adaptive and automatic functionalities for increasing the Control Room's effectiveness by (semi-) automatic workload handover. Given the status quo, the AdCoS adaptation aims at increasing the emergency response organization's effectiveness and security by implementing new adaptation functionalities. The AdCoS focuses on the operators' physical and mental states, ensuring that they are present and effective when needed. Secondly, the organization's effectiveness can be increased by optimizing the workload of each operator.

Five use cases for the Border Security Control Room AdCoS have been implemented at the time of writing:

1

Operator presence / absence

In longer periods of inactivity, operators may be tempted to spend longer times away from their workstations. In the case of an emergency, they may not be immediately available, thereby increasing the Control Room's response times to the emergency. The AdCoS uses infrared sensors in a Microsoft Kinect device to establish reliably whether an operator is present at his workstation or not. If his absence exceeds the permitted length of time (or in case of an incoming urgent case to deal with) the system will alert him discreetly by a vibration alert of his smartwatch to "nudge" him to return to his station.

2

Operator idle / asleep

The AdCoS adaptation recognizes sleeping operators. If an operator has been identified as sleeping, the system will again activate an actuator to wake him up discreetly without anybody else noticing. This functionality is also realized with the help of the Kinect IR sensor and the smartwatch actuator device.

3

Operator tired at his workplace

The level of fatigue of an operator is captured by means of an eye-tracker system. The sensors observe the movements of the operator's eyelid and interpret specific eyelid behaviours as indicators of fatigue (PERCLOS parameter). The position of the operator's head is measured by the Microsoft Kinect's optical camera to provide the system with the information, at which times the operator is facing the screens.

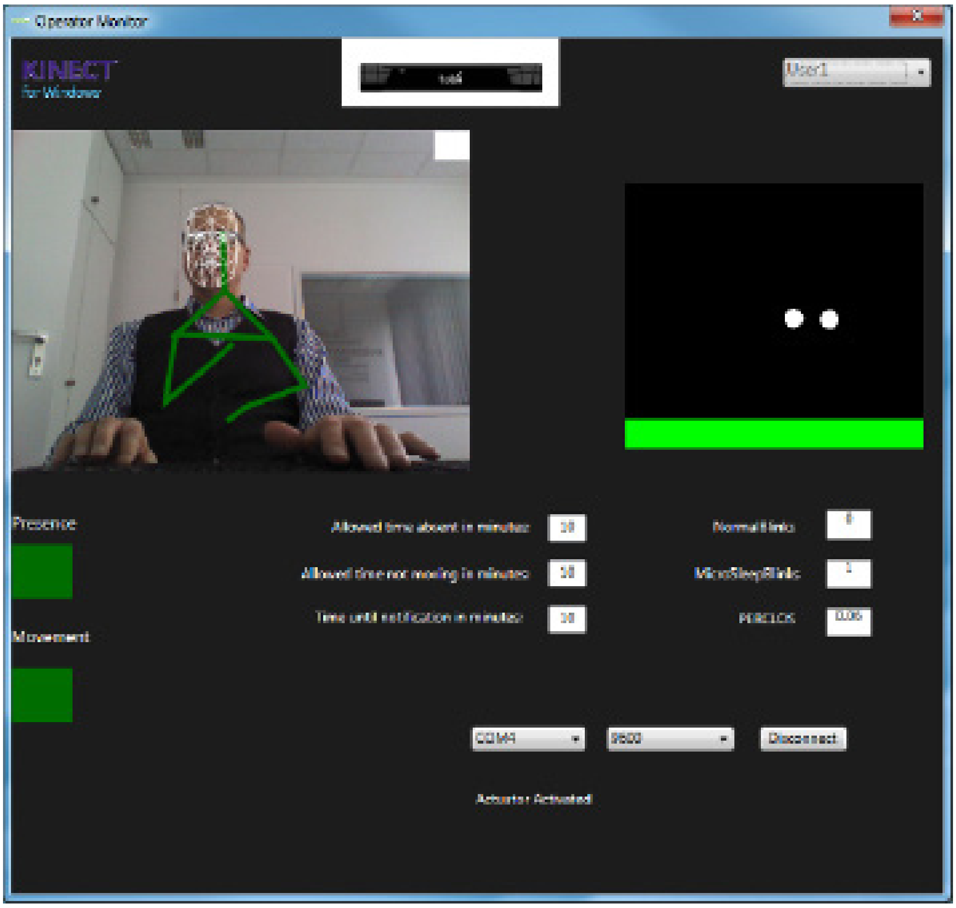

Figure 2. The Border Security Control Room AdCoS
Interplay of optical camera and eye-tracking system (maintenance mode)

4 Registration of unusual behaviour pattern

Regular and observable behaviour patterns can be exploited by perpetrators for scheduling illegal activities. For example, they observe that the operators always sit outside of the station playing cards at two o'clock in the morning and exploit this knowledge. The automatic recognition of such exploitable behaviour patterns can support the C2 Control Room management in identifying training needs for operators, focusing on behaviours that help maintaining the Control Room's security.

5 Load balancing at operator level

One way of improving the effectiveness of a C2 Control Room is the optimum distribution of workloads among operators. To just consider "objective" parameters such as number of cases to be dealt with is not sufficient, as parameters related to the individual operator such as level of expertise, level of fatigue and level of stress also affect the workload experienced by an operator at a given time. The AdCoS monitors the workload of each operator at any moment, visualizes the workloads to the supervisor, and pro-actively suggests the handover of individual cases from one operator to another if this improves the effectiveness of the operation as a whole.

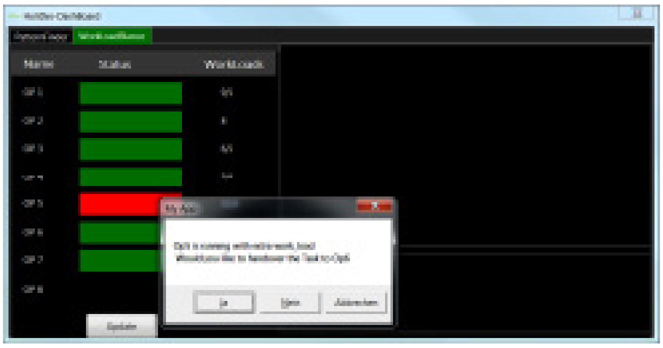

Figure 3. The Border Security Control Room AdCoS suggests a workload handover

At the present stage of the project, verification and validation activities are ongoing. Dedicated evaluation activities are focused on the acceptance of the proposed solution by emergency response operators. This will be addressed with focus group sessions and questionnaire studies.

The Energy Network Control Room AdCoS

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The Control Room of Iren, established in Parma (Italy), has been recently built as a modern 'control tower' of the services provided by the Iren Group: as shown in Figure 4, on the wall of giant monitors - directly derived from the aeronautics domain - the real-time data of gas distribution, heat, water and electricity is represented. In case of fault, alarms are triggered on the screens with the specific portion of network involved in the fault. The Control Room guarantees a prompt H24 service.

Figure 4. The Energy Control Room of IRN

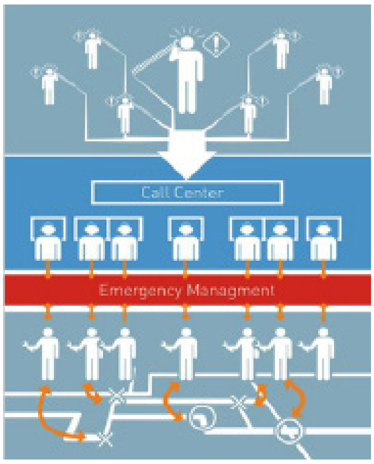


Figure 5. Schematic Representation of the Communications and Roles in the Control Room of IRN

The Control Room receives either calls from customers who report network failures, or signals from the controlled network segments, with the relevant data being subsequently being displayed on the synoptic system on the giant monitors as well as the monitors of the operators.
The communication between the customers and the Control Room is managed by a specific group of the Control Room operators (Call Center), which is assigned to the collection of the information of each emergency call.
Once the information is stored, operators in the Control Room apply a first level of intervention (remote intervention) on the network, to fix the problem. In case this is neither decisive nor possible (e.g., in case of a burst pipe), the operators are formally requested to assign the intervention to the technicians in the field (as represented in Figure 5).

Before HoliDes, IRN did not use any adaptive system to allocate tasks to available operational teams in the field, and the communication between the Control Room operators and the operative teams took place only via phone calls (very time-demanding) and the allocation of tasks and responsibilities was based on the senior experience of Control Room operators.
The AdCoS developed in HoliDes focused on the communication between the operator and the operational teams in the field, and this specific use case has been selected because we expect it to get the most benefit from the adaptation of the communication strategy and the inclusion of Human Factors in the development process since the very beginning.

The AdCoS includes three macro elements:

- a Server with the **Decision Algorithm** for the automatic selection of the most appropriate technician for each intervention
- an **Android app for the technicians in the field**, installed on several mobile devices (tablets/mobile phones)
- an **HMI application for the Control Room operators**

The Android app for the technicians (Figure 6) lets them accept the assignment of an intervention and access the corresponding data (type of intervention, address, etc.).
The HMI application for the Control Room operators (Figure 7) is a web-based application that lets them access the list of interventions, assign an intervention to a specific technician (according to the priority list provided by the Decision Algorithm) and see which technician is in charge of which interventions. We designed a web-based interface to be easily accessible on different devices because the operators of the Control Room use different applications and operating systems (mainly Windows and UNIX).

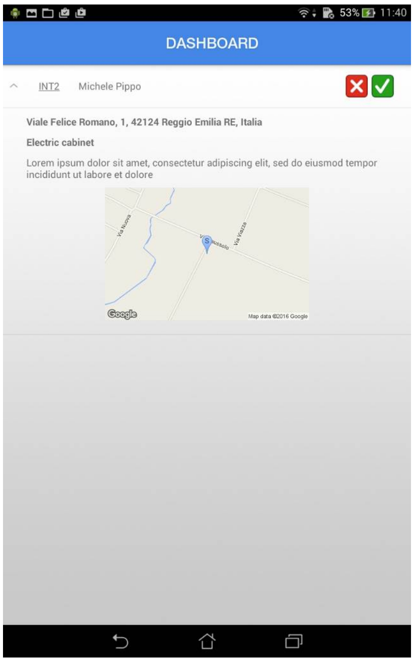
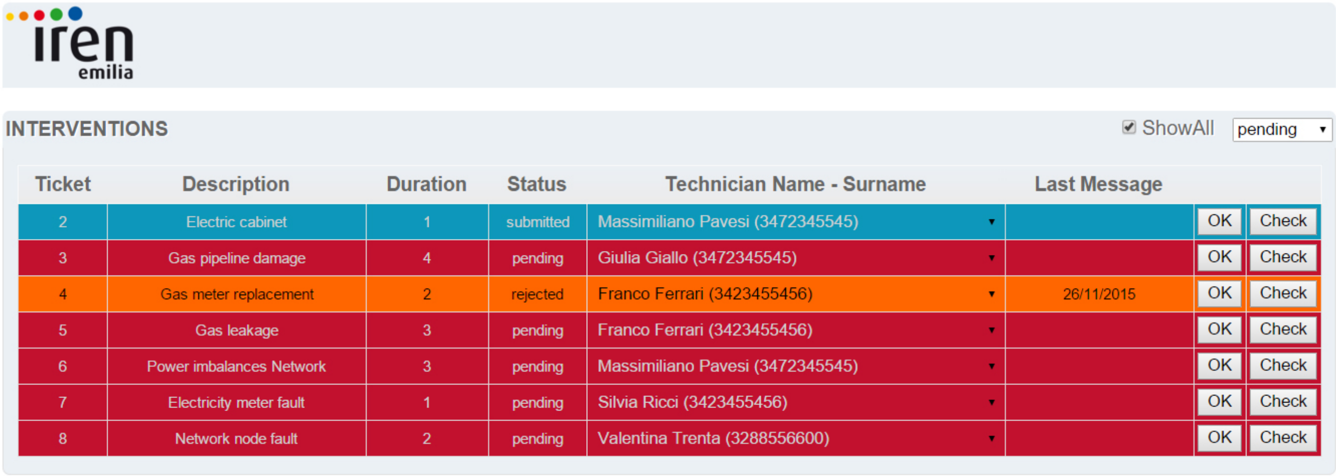


Figure 6 - Additional Information Associated with the Intervention



Ticket	Description	Duration	Status	Technician Name - Surname	Last Message		
2	Electric cabinet	1	submitted	Massimiliano Pavesi (3472345545)		OK	Check
3	Gas pipeline damage	4	pending	Giulia Giallo (3472345545)		OK	Check
4	Gas meter replacement	2	rejected	Franco Ferrari (3423455456)	26/11/2015	OK	Check
5	Gas leakage	3	pending	Franco Ferrari (3423455456)		OK	Check
6	Power imbalances Network	3	pending	Massimiliano Pavesi (3472345545)		OK	Check
7	Electricity meter fault	1	pending	Silvia Ricci (3423455456)		OK	Check
8	Network node fault	2	pending	Valentina Trenta (3288556600)		OK	Check

Figure 7 - Desktop Interface for the Operators

Using the **Task Analysis** techniques, we designed the applications by mainly focusing on the automation to optimize the allocation of the technicians in the field. However, the operators of the Control Room raised concerns about their trust in the automation (“How can I trust the decision-making process of the system?”)

Therefore, during the design phased, by taking stock of the comments of the operators, the HMI concept has been improved by including features that cope with the **sharing of authority issue**, to share knowledge and increase trust in automation. In particular, the “Check button” has been introduced, as well as the representation of the Decision Algorithm steps to clearly and intuitively show how it works.

The Human Factors OSLC User Group

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At the start of the year, approval was given for the creation of a Human Factors OSLC User Group.
The charter that was submitted defined the need for better human factor tools integration. Human Factors is of course not a new topic but its digital integration into the lifecycle is still quite immature compared to other domains. Often, human factors work is heavily text and paper based making use of questionnaires, surveys and studies.
Of course, these documents can be digitised but simply having a digital copy of document does not demonstrate traceability with the architectural models they support which comes about with a mature integration.

At this point, it is prudent to point out that the topic of Human Factors is vast and not all Human Factors tools which can be integrated are lifecycle based. This distinction is important since OSLC is concerned with life cycle collaboration hence the name "Open services for lifecycle collaboration". To illustrate the difference, a non-lifecycle tool is typically associated with a process performed at some point in the development of a system. A lifecycle tool or service provides information which is generally consumed at multiple points throughout the development.
For example, a set of requirements, test cases or a change requests can be used and referred to throughout the lifecycle. Non-lifecycle services and tools are generally used at a specific point in a project to do a specific job. For example an eye tracking sensor used during trials would not be considered lifecycle since the trial is conducted at a single phase in development. The same could be said of a simulation tool.

OSLC does not seek to harmonise integration of non-lifecycle tools since OSLC utilises linked data over a REST architecture and there are more suited standards for simulation and eye tracking.
OSLC seeks to apply the principles that made the Internet so successful and apply them to lifecycle integration. It has done this with some success in many areas such as requirement management, change management, quality management and many more. These domains either have or are working towards a specification to describe the concepts for integration in their respective areas. Previously, there was nothing for human factors until the user group was created by the HoliDes project partners at the start of the year.

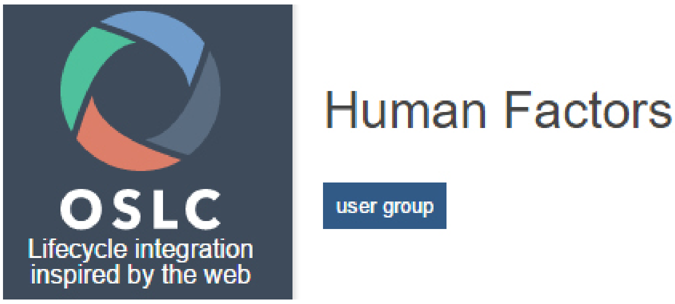
The OSLC approach lends itself to lifecycle collaboration since it is scalable and lightweight. Ultimately, you're sharing services over REST using XML. The services include the creation, reading updating and deleting of resources. So long as a tool uses these same tried and tested internet protocols the resulting tool chain will be scalable, open and easy to implement.

The purpose of the Human Factors user group is not to develop a fully-fledged set of specifications, but to define a set of scenarios and concepts which could be used to drive a specification in the future after HoliDes. (Developing a fully-fledged set of specification documents requires membership and participation with the OASIS community and this is beyond the scope of HoliDes.)

Having an OSLC working group gives you a number of facilities become available including a wiki and a mailing list. It also gives you visibility on the main OSLC website: **http://open-services.net/workgroups/**

The OSLC working group on Human Factors is open for everyone. We hope for further contributions from Human Factor experts and all other interested parties. If you know of someone beyond HoliDes who could add some valuable input to developing human factor scenarios, please get in touch with Ian Giblett (ian.giblett@airbus.com). Alternatively, feel free to visit the wiki at http://open-services.net/wiki/human-factors/ and contribute what you think our integration scenarios should be.

A first integration scenario has already been defined. It is based around evaluation and applies 3 concepts. We are specifically interested in contributions of lifecycle integration scenarios for Human Factors. Contribution is easy: just create an account and log into the wiki to join in with the collaboration.



2nd Annual Project Review meeting

Hosted by Philips Healthcare, Best (NE), November 2015

NOV 2015

The second Annual Project Review (APR) meeting was held in Best at the Philips Healthcare headquarter from November 24 to November 26. The results of the second year of the project were shown by providing presentations, posters, and practical demonstrations in all the four application domains (Health, Aeronautics, Control Room and Automotive).

Visit the web gallery of the posters at:
www.holides.eu

Figure 8. 2nd year APR – Philips Healthcare headquarter in Best (NE)

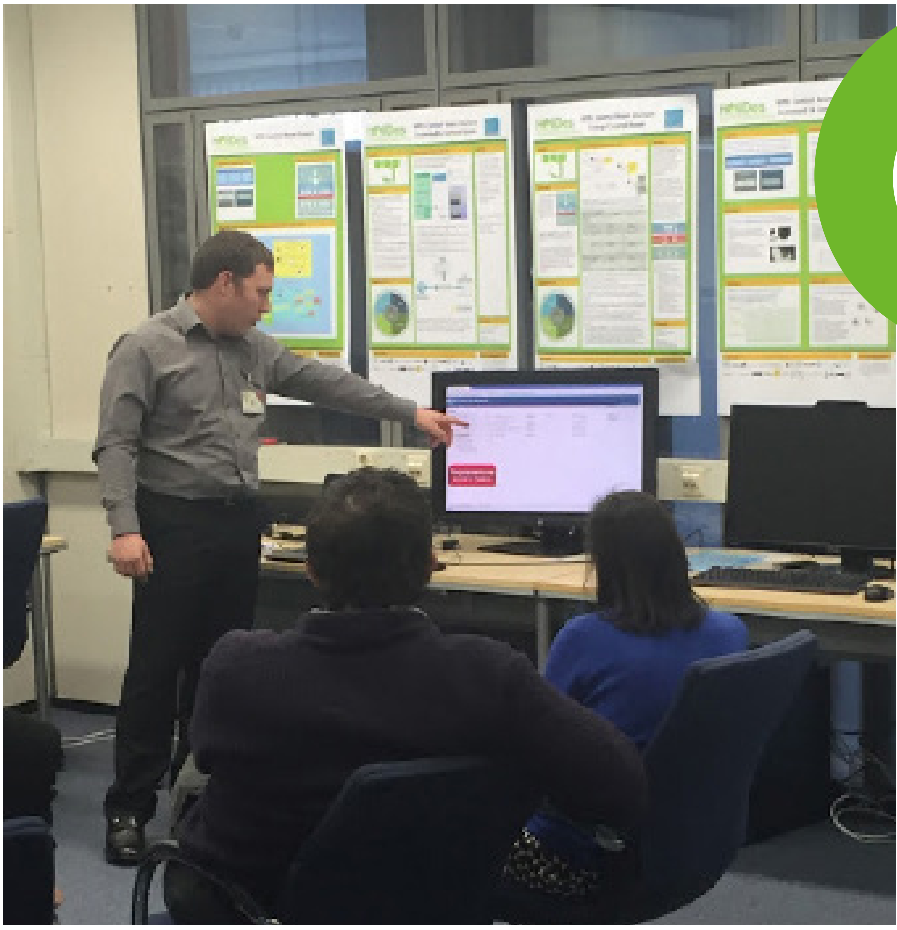


Figure 9. 2nd year APR – Presentation of the border security AdCoS (Control Room)

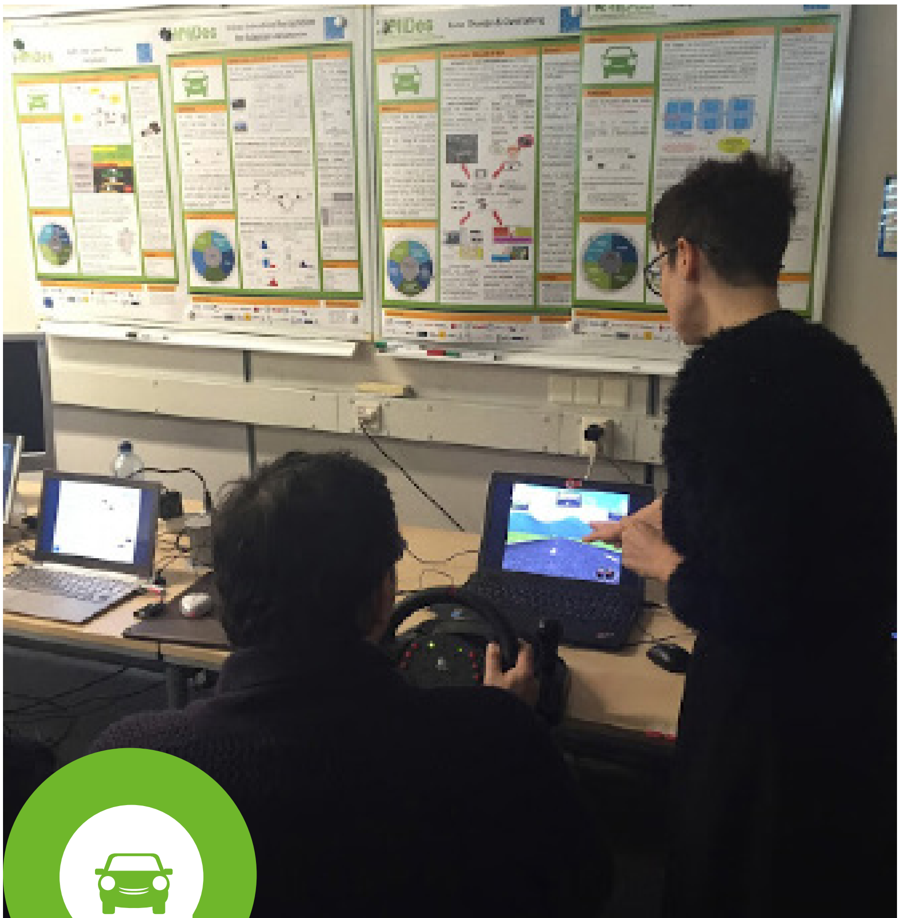


Figure 10. 2nd year APR – First results of the CRF Lane Change Assistance AdCoS shown with a driving simulator (Automotive)

Figure 11. 2nd year APR – The Ibeo vehicle for the Automated Adaptation AdCoS (Automotive)

Figure 12. 2nd year APR – Philips AdCoS for the guided patient positioning (Health)

Figure 13. 2nd year APR – Diversion Assistance AdCoS in action (Aeronautics)

HoliDes technical and dissemination project meeting

Hosted by Tecnalia, Bilbao (ES), October 2015

OCT 2015

Tecnalia – Research and Innovation hosted a technical and dissemination meeting for the HoliDes project on October 14th 2015 at Parque Científico y Tecnológico de Bizkaia in Bilbao.

The meeting was organized to meet people from other EU projects concerning **Human Factors modeling and integration in Systems Engineering**, in order to introduce them the HoliDes Human Factors Reference Technology Platform (HF-RTP) and discuss with them our project approach.

Three other projects joined the events:

CRYSTAL

CRYSTAL (http://www.crystal-artemis.eu/) – Critical System Engineering Acceleration. Crystal is an ARTEMIS Joint Undertaking project taking up the challenge to establish and push forward an **Interoperability Specification** (IOS) and a **Reference Technology Platform (RTP)** as a European standard for safety-critical systems.

CP-SETIS (http://cp-setis.eu/) – Towards Cyber-Physical Systems Engineering Tools Interoperability Standardization. CP-SETIS is a H2020 project supporting **IOS Standardization** by defining a concrete model for sustainable IOS Standardization

SeaHorse (http://www.seahorseproject.eu/) - Safety Enhancements in transport by Achieving Human Orientated Resilient Shipping Environment. SeaHorse is a Seventh Framework Programme project aimed at improving shipping safety through technology transfer from air transport to **marine transport focusing on human factors** problems in an innovative, integrated and multidisciplinary manner.

The identified shared goals includes Human Factor Modeling and Interoperability. The **HoliDes Common Meta Model** and **Human Factor Ontology** were presented. In particular, the HF ontology has been identified and proposed as the common vocabulary to be used when exchanging information between MTTs related to Human Factors.

As to the RTP issues, the Bilbao meeting established a important link towards the alignment with the other projects dealing with IOS.

Figure 14. HoliDes technical and dissemination meeting with other EU projects

next

HoliDes final event – September 29th, 2016
Hosted by Airbus, Friedrichshafen (DE)

We are going to invite you to join our final event in Friedrichshafen to guide you through the demonstrators of our results… *Save the date!*

HoliDes
final event
Friedrichshafen, September 29 2016