COE CST Tenth Annual Technical Meeting

Interoperable Air and Space Traffic Management

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Agenda

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Team Members

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- Organization
  - **DLR German Aerospace Center**
    Institute of Flight Guidance
    Associate Member of the COE CST

Task Description

- With global growth of the commercial space industry there is a developing demand for space flight operations in and over Europe. Air Traffic Management (ATM) is playing a key role to address this challenge.
- The goal is to prepare the European ATM system to enable a safe integration of space vehicle operations (SVO) in a sustainable and efficient way. To enable global operations, interoperability of implemented technologies and procedures is an essential requirement and a specific focus of the DLR work program.

Goals

- Categorization of relevant space flight operations and assessing their impact on European airspace using the DLR Space and Air Traffic Management (SATM) testbed.
- Development of measures and procedures for enabling efficient ways to optimize airspace usage for space flight operations while minimizing airspace segregation.
- Development of concepts and prototypes for a seamless, safe and secure implementation of space flight operations into the ATM using System Wide Information Management (SWIM) and related open and standard mainstream technologies.

Results

Enhanced Controller Working Position for integrating Spaceflight into Air Traffic Management

via Master Thesis by Carmo Kluenker

Objective:
Development and validation of a concept visualizing information at the controller working position (CWP) to enable controllers to initiate appropriate measures to protect aircraft from falling debris

Results

Research question:

1. What information does an air traffic controller (ATC) need to respond appropriately to non-nominal events during space activities?

2. How can this information be effectively visualized at the controller working position (CWP) so that he/she can perform the required actions?

Results

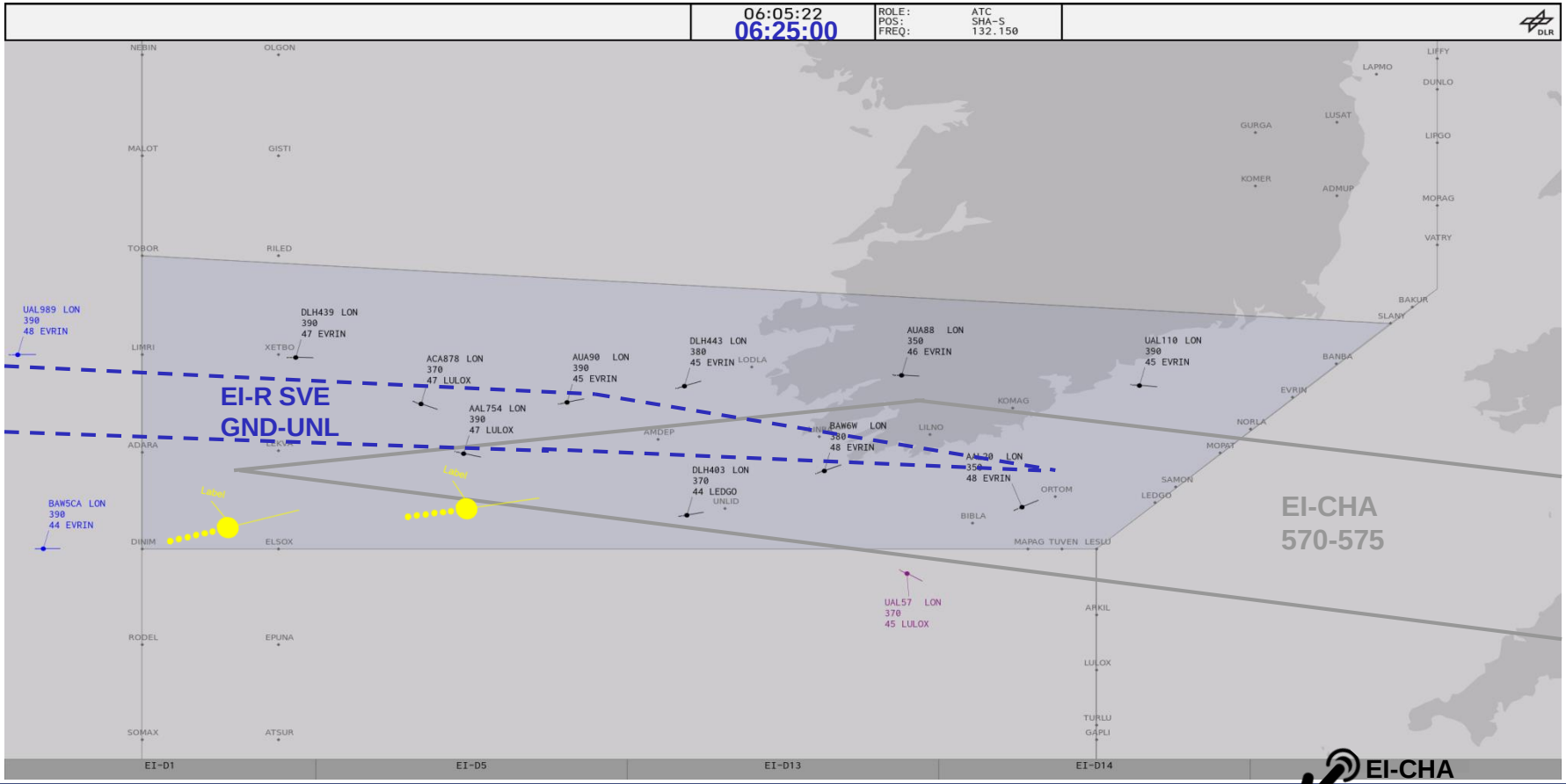
1. What information does an air traffic controller (ATC) need to respond appropriately to non-nominal events during space activities?

Information requirements
• Location of the hazard area (HA) • Period of activation of the HA • Aircraft potentially at risk

Design requirements
• No information overload • Intuitive / user-friendly • Usage of known elements → Ecological Interface Design

Results

2. How can this information be effectively visualized at the controller working position (CWP) so that he can perform the required actions?



Results

- Highlighting of affected aircraft increased awareness regarding the potential risk.
- Presentation of the HA according to other special used airspace is reasonable.
- Time representation in UTC accelerates the traffic management planning.
- Knowing about the contingency HA helped to prepare mentally and to assess the effects.

The situation was manageable!

Publications

- Kluenker, Carmo (2019), Integration von kommerziellen Raumflügen in das Luftverkehrsmanagement, Master Thesis, Technical University of Berlin / DLR Institute of Flight Guidance
- Kluenker, Carmo (exp. 2021); Enhanced Controller Working Position for integrating Spaceflight into Air Traffic Management, 12th International Conference on Applied Human Factors and Ergonomics, AHFE

Conclusion

- A concept to respond flexible and effectively to failures during launch and re-entry has been developed and evaluated.
- A Human Machine Interface (HMI) has been designed to visualize information at the controller working position.
- Operational experts evaluated the concept under the aspect that it focuses on the essential information required by controllers and avoids unnecessary complexity.
- Further research should consider the coordination processes between controllers, as this may result in new requirements for such a concept.

Future Work

- Identifying optimization potential of operational mechanisms and procedures for SVO in a Pan-European aviation system
- Applying advanced ATM concepts such as Flexible Use of Airspace, Flight Centric ATC and Dynamic Sectorization
- Enhanced functions for space flight SWIM services including all ATM planning and execution levels.