FREQUENTIS

researchBULLETIN

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Research is of key importance at Frequentis

New ideas are constantly evaluated and developed to market maturity using a business case approach. The main aim of our research activities is not only to keep Frequentis systems and solutions at the forefront of new technology, but also to drive technological progress, help shape the technological future and set global standards in relevant areas.

Each year, Frequentis invests 12% of its operating performance in R&D activities. A large percentage of the current R&D effort is dedicated to **internal project development**, but our company is also active in a range of **international research projects**. Our Corporate Research unit, whose origins date back to 1998, is working on various topics of relevance to the future and covering all areas of the company. The goal is to **anticipate new developments** on the market und prepare our teams for these changes.

We at Frequentis want to identify these topics as early as possible and develop the associated technologies, themes and processes on an ongoing basis, so **our customers can benefit** from their application **in future-oriented systems** and solutions. Frequentis Corporate Research actively shapes the future through its own research studies, participation in external research projects, direct support for new contracts and proposals, and management of technical training.

We invite you to enjoy some insights on our current research and development activities with this "Frequentis Research Bulletin". Our staff would be more than pleased to discuss any of the topics presented in this issue with you and your expert teams. Please feel free to contact us if you come across an article that is of particular interest to you.

HANNES BARDACH, CEO
http://www.frequentis.com/en/at/service-links/contact/#main

Contents

Antares

AUTHOR: Saadan Ansari, Corporate Research

FREQUENTIS: FIRST ON THE MARKET WITH A "CERTIFIED SATELLITE-ENHANCED COMMUNICATION SYSTEM"

In early 2004, the Council of Ministers and the European Parliament adopted the Single European Sky (SES) regulatory package prepared by the European Commission for the reform of air traffic management. The technological implementation of the SES package was launched in 2006 under the title "SESAR", and is being carried out by the SESAR Joint Undertaking (SJU). One fundamental goal of the SESAR ATM master plan is the provision of digital data links to cockpit crews with parallel satellite (SATCOM) and terrestrial communication. The aim is to grant more bandwidth for new data link applications and provide better coverage in continental and oceanic airspace. To this end, the European Space Agency (ESA) has launched the ANTARES project within the framework of the ARTES-10 Programme. The aim is to develop a certified data and voice communication system for ATM.

Frequentis Corporate Research is an ESA partner in the ANTARES project and has (since 2009) been jointly responsible for the implementation of data and voice communication systems, particularly at the application, transport and network layers. Frequentis has many years of experience in the ATM communication field and this will ensure the ANTARES project achieves its objectives. Frequentis AG's status as the global leader in ATM communication systems is reinforced by this involvement in ANTARES and the company's position as the first supplier to offer a "certified satellite-enhanced communication system".

Single link - Double link - Multilink

AUTHOR: Miodrag Sajatovic, Corporate Research

In the SJU operational concept, the data link is an essential component of the future air-ground communication infrastructure (FCI) and should become the primary air-ground communication medium. In some cases, safety and performance requirements for new data link services will be significantly higher than those for initial data link services. Additionally, voice ATC systems will no longer be able to provide backup for complex new data link services (e.g. those for trajectory management). As a result, increased availability and service continuity targets must be achieved entirely within the data link part of the FCI. Another safety-related concern is fulfilling the stringent latency and data integrity requirements expected of new operational services. Redundancy can always be increased by doubling air-ground links. The so-called "multilink" concept involves parallel use of heterogeneous data link technologies like SATCOM and terrestrial LDACS data links. This concept would further increase the FCI's robustness and provide increased protection against intentional interference (jamming). Frequentis Corporate Research is an active member of SJU project 15.2.4, contributing both to the development of the multilink operational concept and to the identification and development of the FCI mechanisms needed to support the management and operational use of different kinds of air-ground data links.

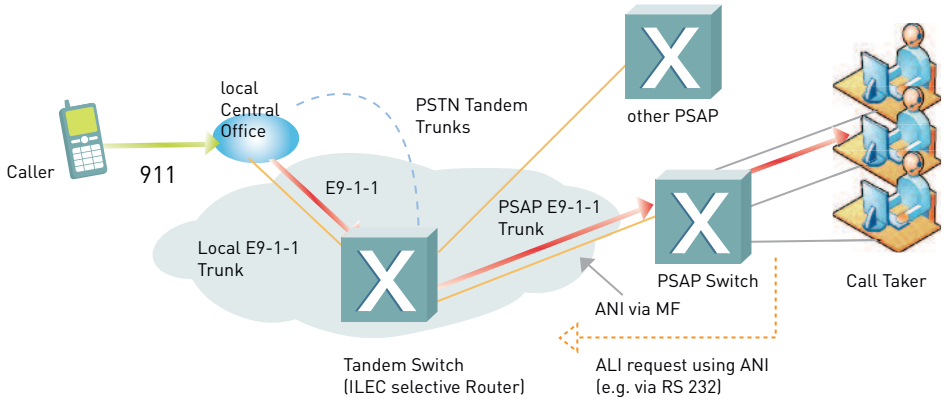
Next Generation 9-1-1

AUTHOR: Wolfgang Kampichler, Corporate Research

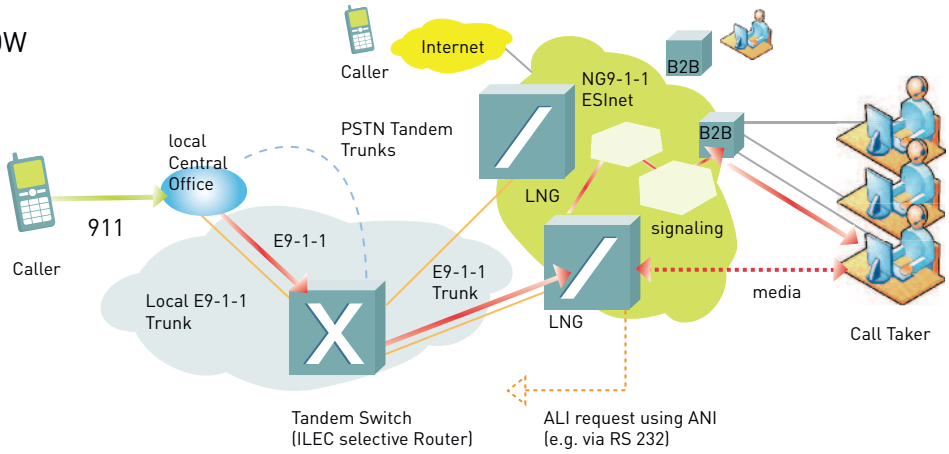
The underlying systems for today's 911 calls rely almost exclusively on analogue technology using legacy circuits and switches. Generally speaking, such systems are unable to accommodate the latest advances in telecommunications technology, such as those made possible through the Internet Protocol (IP). Today, expectations of what constitutes an accurate and timely response to 911 calls are based on the advanced features available on most communication devices. However, these are features that analogue systems cannot support, such as text, video or location information. Major features envisioned in the Next Generation (NG) 9-1-1 system include access to better and more useful information from any networked communications device, as well as location-independent call access, transfer, backup facilities and in particular geolocation of a call. The base architecture supporting an NG system is best described as three major blocks: concentration points (access to the local exchange carrier or LEC), the IP network hosting call routing services, and the site taking the calls. Call routing, based on SIP and maintained by certain functional elements, allows a clear separation of signalling and media transport. Media is always delivered end-to-end, meaning there is no intermediate element for processing audio. Frequentis developed PROTECT to help this convergence, bridge the technology gaps and thus empower NG9-1-1 systems.

TRANSITION TO NG9-1-1

TODAY



TOMORROW



Prototype Digital Radio Transmitter solution for L-DACS1

AUTHOR: Bernhard Haindl, Corporate Research

Over the past 8 years, Frequentis has been continuously involved in the conceptual development and detailed design of digital radio communication solutions for the future aeronautical data link. It all started in 2003 with B-VHF, an FP6 research project about a new, multi-carrier based, wideband communication system planned as an overlay system in the VHF COM band. B-VHF has been selected for the Future Communications Study shortlist by the AP17 partners (FAA and EUROCONTROL) and cited as one of the most promising candidates. The AP17 partners also concluded that the new terrestrial technology should preferably operate in the L-band. EUROCONTROL has therefore funded research into a B-VHF-like system in the aeronautical L-Band (960-1164 MHz). The generic name for such a system is L-band Digital Aeronautical Communication System (L-DACS). Two L-DACS options have been identified: L-DACS1 is a broadband system employing OFDM as a modulation scheme and frequency-division duplex, while L-DACS2 is a narrowband single-carrier system utilising time-division duplex. Frequentis started to build an L-DACS1 transmitter prototype in 2011, consisting of signal processing units for the Tx baseband and an RF frontend. The interface between those stages consists of analogue Tx signals on an intermediate frequency of 70 MHz upconverted to the L-band and amplified by the frontend to a power of 42 dBm. The main goal of the prototype is to be able to perform initial measurements of compatibility between L-DACS1 and legacy L-band systems in SESAR project 15.2.4.

SESAR 15.2.6

AUTHOR: German-Ignacio Meyer, Corporate Research

FUTURE SATELLITE COMMUNICATIONS FOR EUROPEAN AIR TRAFFIC MANAGEMENT

The future communications infrastructure of the Single European Sky envisages a highly-reliable satellite link to provide data and voice communications. This satellite system is being designed and developed within the framework of the European Space Agency's Iris (ARTES-10) Programme, with 15.2.6 as the project which links this programme to SESAR. The main purpose of this project is to allow the space agency to exploit the expertise of the different players in the aeronautical field and to keep it informed of these same players' expectations, for example by defining the operational concept and mission requirements. The company's participation in this project puts Frequentis in a key position to influence the design of the future system, and gain first-hand knowledge of the technologies involved.

SESAR B4.3 T5 – Service-Oriented Architecture in SESAR

The SESAR programme is a complex one, involving over 300 projects. A key issue is ensuring the work done always reflects the high-level objectives set out by the European Commission. The European ATM Enterprise Architecture was devised with this in mind and is a framework to ensure the overall coherence of the programme. Project B4.3 T5 is involved in giving the high-level architecture of SESAR a service-oriented architecture (SOA) approach. We define the processes necessary to ensure that access to information by all stakeholders is optimised and that full advantage is taken of automation opportunities, all of which are key points for ATM services.

Standardisation of VoIP for ATM

AUTHOR: Bernhard Haindl, Corporate Research

In 2004, EUROCAE set up Working Group 67 (WG-67 'Voice over IP for ATM'). The working group's members include European ANSPs, suppliers of VCS equipment and ground-based radio systems for ATM, the FAA, EUROCONTROL and telecom equipment suppliers. Its aim is to achieve interoperability of VoIP-based communication systems in ATM. Frequentis has been a leading contributor to the work of the WG for over six years and we are currently leading two of the four subgroups. The first major milestone was reached in 2009 with publication of the first official release of the three EUROCAE WG-67 documents. The ED-136, ED-137 and ED-138 documents are vital components of the global standardisation process for IP-based ATM voice communication systems. Inputs from the FAA were included and released in the 2010 update to the ED-137 Part 1 and Part 2 specifications. ICAO is finalising edition 2.0 of its 'Manual for the ATN using IPS Standards and Protocols DOC 9896', which will include references to the EUROCAE VoIP in ATM specification. Interoperability between different supplier solutions is continually being tested in dedicated interoperability tests performed at ETSI in Sophia Antipolis. Tests were completed, for example, in April 2008, March 2009, March 2010 and most recently in June 2011. The FAA also held a VoIP Interoperability Event in May 2011 in Arlington (Virginia). A new update to ED-137 was due to appear at the time of writing to account for the results from the latest tests and trials.

Frequentis at Control Room Conferences

AUTHOR: Reinard van Loo, Corporate Research
http://www.frequentis.com/en/at/service-links/contact/#main

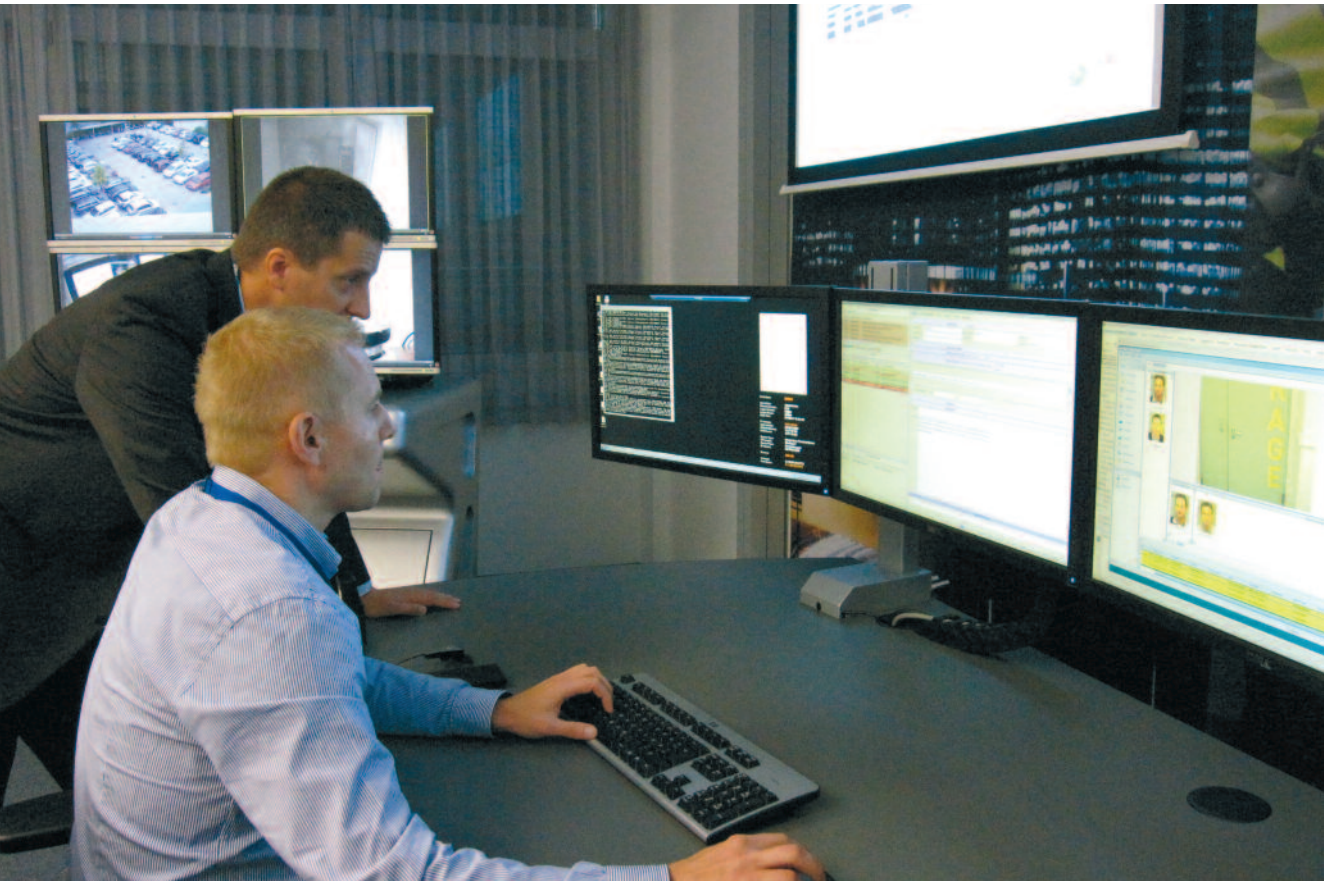
Frequentis's experience in providing solutions for control room environments was showcased at a few recent conferences. Peter Prater (Frequentis UK Office) together with Reinard van Loo (Frequentis Corporate Research) held seminars and contributed to panel discussions on the following topics:

2010: IIR Control Room Communications. We held a one-day seminar on how to effectively integrate diverse IT systems in the control room, focussing on benefits management and the importance of end-to-end solution usability for capturing these benefits.

2011: IIR Tetra World Congress. We held a workshop on multi-agency working, where we talked about the consequences for control room IT design in general. The focus was on collaboration rather than interoperability, and we presented some practical Frequentis solutions that support agencies collaborating with each other. We also discussed barriers to multi-agency collaboration.

2011: IIR Control Communications. Here we focussed on how technology can both help and hinder a customer's control room operations. The presentation and panel discussion centred on how technological change goes hand in hand with operational change: the two need to be managed together in order for this change to be successful. Technology can optimise operations, but will actually hinder operations if not applied correctly.

To learn more about any of these presentations and workshops, please get in touch.



Integrated Controller Working Position

AUTHOR: Theodor Zeh, Director Human Factors

THROUGH COMMITMENT AND INNOVATION, FREQUENTIS HAS BECOME THE UNDISPUTED iCWP LEADER IN SESAR

In recent years, Frequentis has invested even more time and resources in user interface innovation and quality. This process began 15 years ago with the establishment of our User Interface Centre. Today, we also operate a Human Factors Lab and are focused on the usability of the complete controller working position – the iCWP.
In the last few years, a key factor in the drive to reach today's level of quality has surely been the Electronic Flight Data (EFD) project: "the world's largest electronic flight strips system". This will be deployed later this year at the NATS en-route centre in Prestwick and is based on Frequentis smartStrips. EFD gets flight information from NAS, a legacy NATS Flight Data Processing System (FDPS), and provides important workflow support features that exceed those possible with current paper strip operation.

The Frequentis philosophy for the iCWP is "open platform". Building blocks from different vendors must be seamlessly integrated into one harmonious frontend. To demonstrate the feasibility of this concept, a prototype was built that integrates the EFD version of smartStrips with Indra's iTEC FDP system. Interoperability has also been established with other FDP vendors.

The pinnacle of iCWP development, however, is the iCWP prototype built together with DFS for SESAR. An ED133-based open platform hosts building blocks (Apps) from Frequentis and DFS that communicate via a Flight Object Server. The open platform is built to host any App from any supplier fulfilling the necessary quality and safety requirements.

Through commitment and innovation, Frequentis has become the undisputed iCWP leader in SESAR. Anyone interested in the future controller working position (iCWP) is invited to attend one of the workshops held three times a year at the Frequentis premises. Their original purpose was to coordinate SESAR iCWP activities, but the workshops have since grown to cover non-SESAR topics, too.

VKT-GÖPL

AUTHOR: Christian Flachberger, Corporate Research
http://www.kiras.at (NB: in German)

COMMON SITUATION AWARENESS FOR PUBLIC-PRIVATE SECURITY COLLABORATIONS

Vital infrastructural services – such as energy supply, telecommunication, transport, public health care or the food & water supply – are today run mainly by private companies. These services are absolutely critical for the continued functioning of the state and survival of the people in a major crisis situation. Collaboration between public authorities and private infrastructure companies is therefore essential for ensuring public safety and security. Through the VKT-GÖPL research project, Frequentis is contributing to the development of new collaboration tools and processes for this public-private security partnership. VKT-GÖPL creates a secure virtual information space that hosts a new kind of online collaborative tool. This tool supports both common situation awareness and collaborative decision processes within the public-private partnership. The core of the tool is the collaborative, virtual chart room: contributors meet (virtually) around the chart table to analyse different or specific crisis scenarios, and then develop possible strategic decisions options. Basic questions are used as the starting point for the subsequent collaborative process. For example, what would be the effect on people, vital infrastructure and the economy? Are there any special hazards involved? What resources would be available to cope with the crisis scenario? The project is partially funded by KIRAS, the Austrian security research programme.


SECURITY

The Flight Object Server

AUTHOR: Hubert Künig, Corporate Research

WHAT IS IT ALL ABOUT?

The Flight Object (FO) is a concept that supports the sharing of consistent flight data between different stakeholders, such as civil and military air traffic control, flow management systems, airport operators and aircraft operators. The idea is that a single logical entity - the FO - is kept up-to-date by all parties wishing to share information about a flight. Support comes from a network of Flight Object Servers (FOS), where individual servers may play different roles for individual flights, e.g. as a Flight Data Manager/Publisher (FDMP), Flight Data Contributor (FDC) or Flight Data User (FDU). In the long run, the FOS concept will be the preferred support approach for synchronising and coordinating flight information between stakeholders. An initial formal definition of the FO model was published in 2006 by EUROCONTROL in the Flight Object Interoperability Proposed Standard (FOIPS) study. The EUROCAE "Flight Object Interoperability Specification" (ED-133) of 2009 defines the interface between different instances of Flight Object Servers, in support of en-route and terminal ATC operations. The first implementation of ED-133 in Europe by Thales/Selex/Indra mainly supports flight coordination and transfer operations. Further work on FO modelling is therefore currently being performed within SESAR project 08.01.03 in order to support other aspects of ATC, such as flow management and tower operations. Frequentis is currently using the Flight Object concept for data exchange within an Advanced integrated Controller Working Position (AiCWP) prototype we developed with DFS within the scope of SESAR project 12.05.04. Flight Objects are also used in an electronic flight strips customer project. We are building up basic services for FDC, FDU and FDMP roles, with the potential to implement the nucleus of a future Flight Object Server.

ICAO GANIS

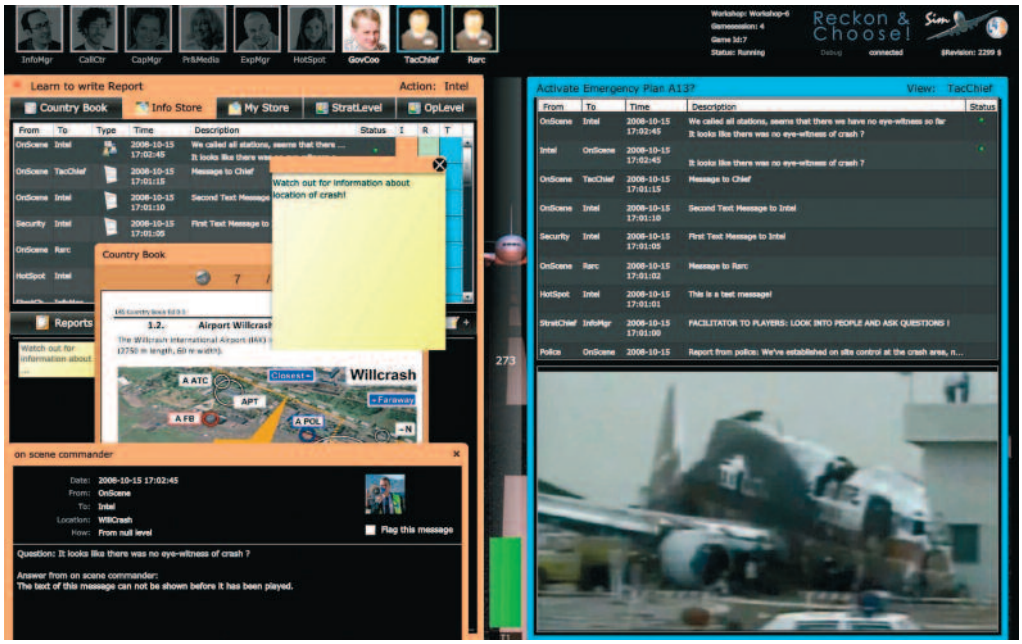
AUTHOR: German-Ignacio Meyer, Corporate Research
http://www.icao.int/Meetings/Pages/default.aspx

TOWARDS A HARMONISED FUTURE FOR GLOBAL ATM

In light of the Global Air Navigation Industry Symposium (GANIS) taking place this year, the International Civil Aviation Organization (ICAO - a UN agency) is pursuing a platform for fostering interoperability and harmonisation between the various ATM modernisation programmes (SESAR, NextGen and others). To this end, ICAO has proposed a global operational concept for incremental ATM upgrades which could provide a framework for the future of ATM on a global scale. As a member of SESAR, Frequentis is involved in determining how the programme can align with ICAO, so both can work together towards this harmonised global ATM concept.

L4S – Learning for Security

AUTHOR: Christian Flachberger, Corporate Research



PERFORMANCE AND USABILITY FOR MAJOR EMERGENCIES AND CRISIS SITUATIONS

Air traffic management, fire services, the police…all typical users of the control centre solutions delivered by Frequentis. All these users perform safety and mission-critical tasks on a daily basis, and all may suddenly be confronted with a major emergency or crisis situation. That's when the technical systems they use must prove their worth in terms of performance and usability. And that is why Frequentis invests so much into research on the human factors involved in crisis management. "Learning for Security" (L4S http://l4s.fvaweb.eu/site/info.html) is one such research project, conducted in collaboration with the Austrian Research Institute for Artificial Intelligence and a number of partners from various EU member states. The project has resulted in the development of technology-enhanced learning experiences that take the form of computer games. These allow users to experience the dynamics of collaboration in crisis management. The trainee is assigned a specific role and is obliged to collaborate with others in managing a developing crisis situation. Professional briefing, debriefing and zoom-in sessions help to transfer the – often very emotional – experiences into insights and improved skills that can then be applied in real crisis situations. Frequentis participates in such research projects to study the human factors involved with crisis management in the context of technical communication and information systems. The knowledge gained is used to continually improve the user interface design of the company's control centre solutions. This is why the performance and usability of technical solutions from Frequentis have proven their worth again and again, especially during crisis situations. The L4S project is partially funded by the European Union.

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