

Jan 16th, 11:00 AM - 12:30 PM

NAS Integration: CST and Air Traffic Insertion The Way Ahead

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Drescher, Juergen; Kaltenhäuser, Sven; and Schmitt, Dirk-Roger, "NAS Integration: CST and Air Traffic Insertion The Way Ahead" (2018). *Space Traffic Management Conference*. 21.
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NAS Integration - CST and Air Traffic Insertion The Way Ahead

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Knowledge for Tomorrow



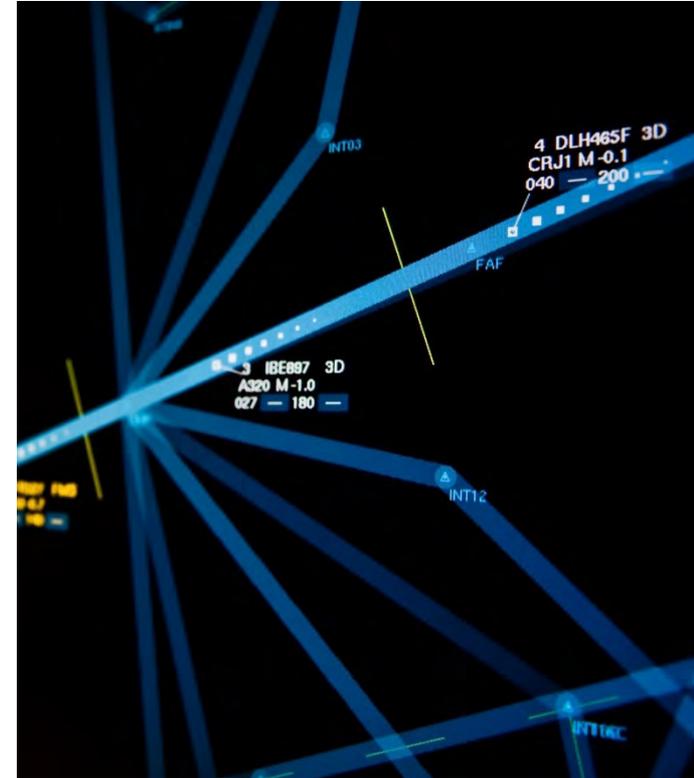
Differences in handling aircraft vs. spacecraft in ATM

Space Vehicles - current situation

- do not file a flight plan,
- trajectories are predictable but far away from 4D-contracts,
- provide limited capabilities to avoid other traffic, therefore **spacecraft have to be prioritized**, therefore need restricted airspace,
- often have to delay launch / landing operations,
- will operate internationally - e.g. launch at KSC and land in Europe,

are not (yet) fully integrated into ATS !

International Intraoperability is required !

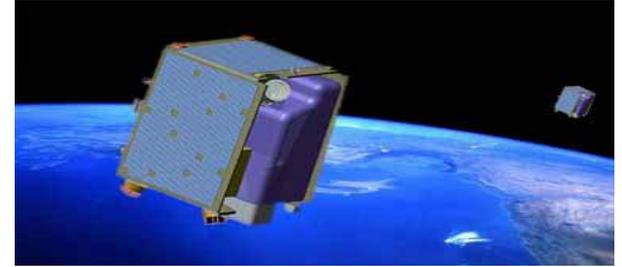


One day's air traffic – meet the challenges together



Challenges for CST

- **Backlog of more than 4 years for satellite launches**
 - slowing commercial development
- **High demand in launch capacity for small satellites**
 - faster production times,
 - cheaper build,
 - serial production,
 - pre-manufactured building blocks
- **New and innovative launch concepts**
 - Reduction in launch cost
 - Faster reaction times
 - Reduced requirements on launch sites
- **Commercial suborbital flights will become available**
 - Alternative to parabolic flights, longer microgravity phase
 - Industry, Research, Tourism customers



ATM & STM Integration =

1. Low Cost Launches
2. Increase in Demand
3. More Frequent Launches

Future Development Trends in Space Transportation



-Airlaunch



-Advanced Partial-Reusable Rocket



-Reusable Space Vehicle



BOOST IMAGINATION

- We are enabling the small sat revolution
- Air Launch to orbit of 300 kg to 500 km SSO
- Your concierge service to space: when you want it, where you want it



CST Integration in Airspace

- Integration based on international intraoperability
- SESAR - Single European Sky
- NextGen US National Airspace System NAS



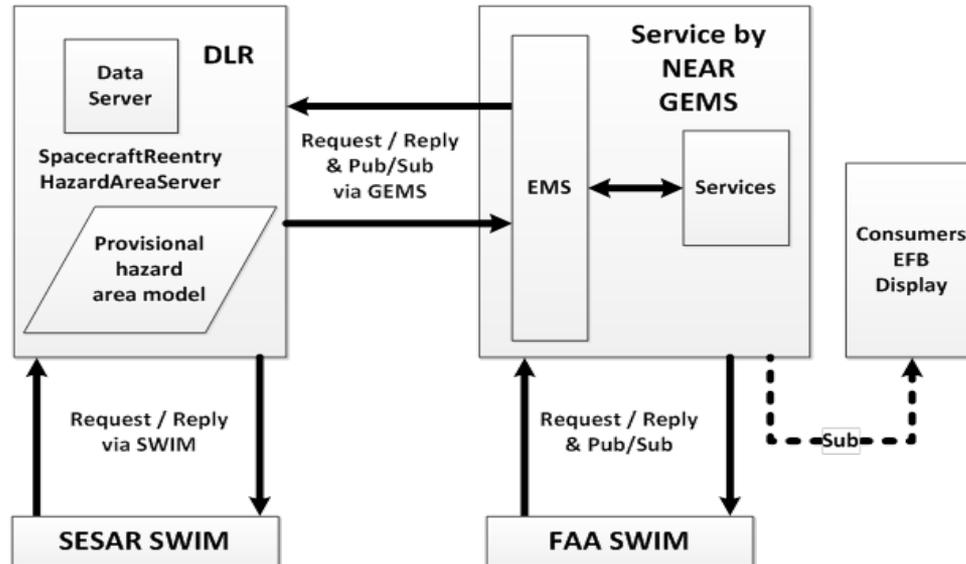


.. imaging Spaceports in Germany / Europe e.g. Commercial CRS to ISS



ERAU and DLR Collaboration - to be extended

- 2015 SWIM Masterclass Competition: DLR and ERAU worked together on International Harmonization efforts conducting an Information Exchange using FAA SWIM and SESAR SWIM systems



EUROCONTROL - Network Manager



DLR partners with EUROCONTROL - The Network Manager Connecting the Network to deliver Improved Performance



FLOW MANAGEMENT SINCE 1995

FLIGHT EFFICIENCY INITIATIVE

LAUNCHED IN 2013



EUROCONTROL

DLR / ESA and EUROCONTROL

Interactive Support of Commercial Space Operations

- Memorandum of Cooperation w/ ESA (European Space Agency)
- Flow management
 - Controlled and uncontrolled re-entries
 - Protect traffic flows
- Airspace management
 - Flexible use of airspace
 - Developments to ensure dynamic procedures supporting commercial space operations
- European Aviation Crisis Coordination Cell (EACCC)
 - coordinate the response to those network crisis situations which impact adversely on aviation, in close cooperation with corresponding structures in States.
- Support development of STM - ATM interfaces from a network perspective;
- Key contributor to ICAO-UNOOSA working arrangement (ICAO SLG, various panels)



DLR Remote Tower solutions for Spaceports

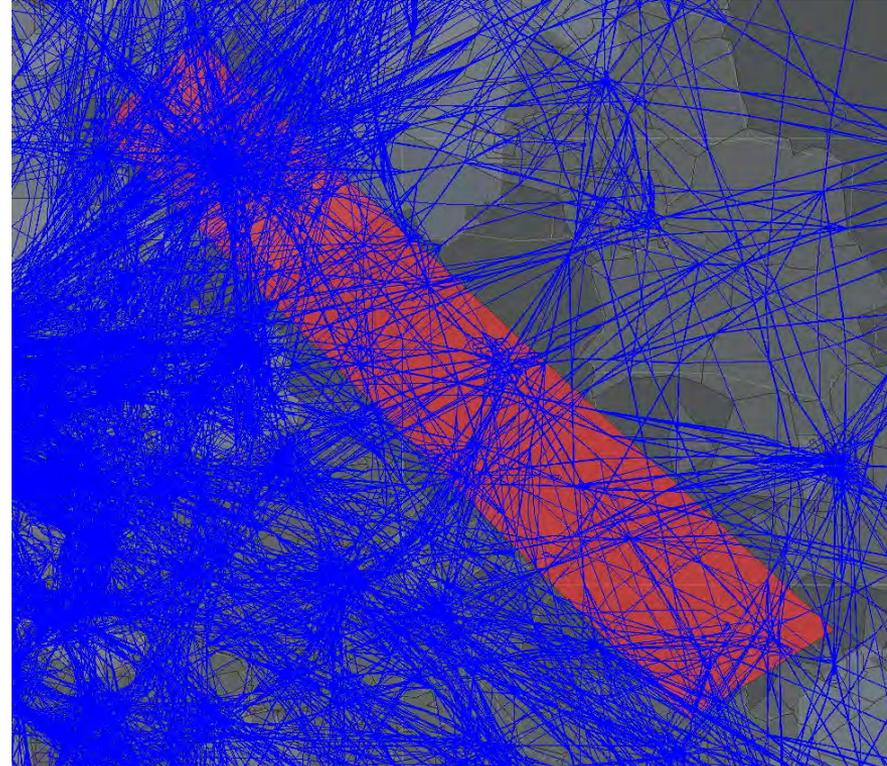
- Operating and landing internationally
- Remote Control of Launch and Landing sites
- Contingency and Continuity Operations
- Additional experts surveillance from home base
- Information of clients/press at home base
- **EUROCONTROL SWIM Registry
Aerodrome Remote Tower Service**
(as of 31 July 2013)



ATM Integration of Space Vehicles in Europe / Germany

Seamless and efficient integration of air traffic and spaceflight operations

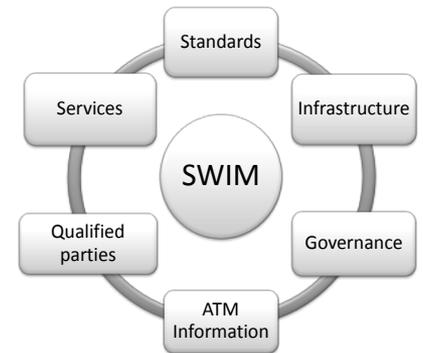
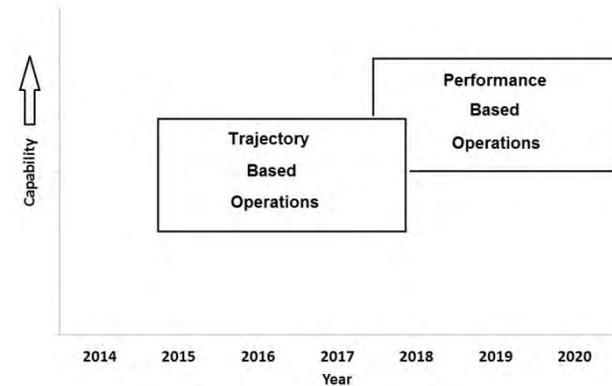
- Efficiency of the air traffic system while incorporating Space Vehicles as additional class of vehicles
- Utilizing ERAU / DLR / EUROCONTROL air traffic analysis and evaluation tools and capabilities
- Analysis and optimization of SVO scenarios and concepts regarding air traffic impacts
- Improved ATC procedure design



SESAR Requirements & SWIM

Single European Sky ATM Research Programme SESAR

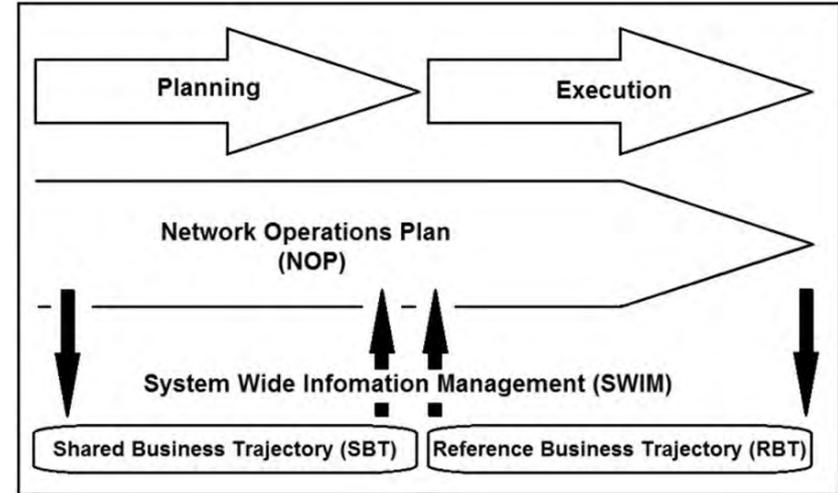
- From Business trajectory to Performance based trajectory
- **System Wide Information Management SWIM**
 - Integration also Controller-Pilot Data Link Communication (CPDLC)
 - Pilots, Airport Operations Centers, Airline Operations Centers, Air Navigation Service Providers, Meteorology Service Providers, Military Operations Centers



SWIM in SESAR

From Planning to Sharing to Execution

- Business Development Trajectory BDT
- Shared Business Trajectory SBT
- Reference Business Trajectory

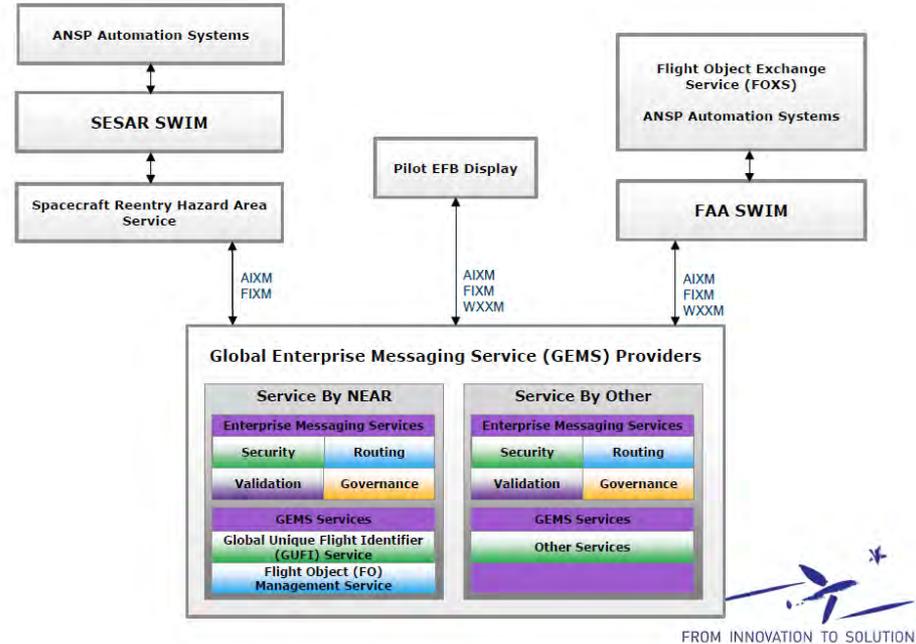


SESAR SWIM "Intranet for ATM" concept requests all the future air traffic participants acting as communicating sub-systems!



Spacecraft Flight Planning and Execution

1. Checking potential hazard areas by making the IFPS Validation System a SpacecraftReentryHazardAreaServer consumer
2. ANSP Automation Systems consume the SpacecraftReentry-HazardAreaServer, Air traffic controller issuing associated voice commands to other aircraft
3. Standard http requests for pre-formatted web charts to a chart web server
4. EFB software as a GEMS subscriber or an AMQP subscriber to the gate way server



DLR and its partners are committed to support
the integration of CST into ATM



The Future is now!!

Thank You For Your Attention

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