GEOSYSTEMS
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Hexagon Diamond Authorized Reseller

Creating situational awareness for space missions

GEOSYSTEMS GmbH | *Germany*

Space travel is instrumental not only for communication and military objectives, but also in tackling global environmental and climate issues. It facilitates numerous digital services, new business models and technological advancements.

The worldwide commercialization of space — referred to as New Space — presents significant opportunities, evidenced by an increase in orbital launches. In 2022, the number of global orbital space launches reached 174, marking the highest count since the onset of the Space Race in 1957.

Preview image of the rocket launch visualization (Photo credit (c) Harren Group)

Presently, 16 countries, along with private companies and individuals, are actively engaged in space exploration. To boost New Space activities, many countries like Germany, which lack space centers on the ground, are looking for alternatives like floating spaceports in the sea equipped with micro launchers. To run them safely, operators must guarantee the safety of the operation and ensure other stakeholders in the launch area are not impaired.

Hexagon partner GEOSYSTEMS GmbH has developed a customized 4D real-time application for such critical missions as an internal proof of concept using Hexagon's Luciad portfolio. The demonstrator app covers all phases of a mission: planning, mission control and post-mission analysis.

Strong foundation in space missions

GEOSYSTEMS GmbH is a subsidiary of OHB SE and operates within the OHB Digital division. OHB SE, based in Bremen, Germany, develops high-tech solutions for various space missions. Its products include satellite systems for Earth observation, navigation, telecommunications and reconnaissance, as well as human space flight equipment. OHB and GEOSYSTEMS have been collaborating with Hexagon for more than a decade.

The demo system from GEOSYSTEMS has proven to be exceptionally beneficial for us. It allows us to optimally visualize our highly innovative projects in the space industry. The seamless integration of diverse data sources, the incredibly fast and agile execution by the GEOSYSTEMS team and the exceptional performance of Luciad have truly impressed us."

Manuel Wilhelm
System Engineer
OHB Digital Connect

Data integration delivers location intelligence

OHB aimed to demonstrate its capability to plan, simulate, visualize and monitor a rocket launch from an offshore platform in the North Sea.

By simulating a rocket's flight path, it defines buffer and impact zones with the option to share this information with other stakeholders like authorities, airlines, air traffic control, vessels and infrastructure owners.

To support the mission across all three phases, a real-time 3D application was necessary. This application needed to be capable of displaying various features, such as a rocket's movement within an environment that incorporates real-time data from ships and aircraft movements. Additionally, 4D functionality was required, featuring a timeline view with "replay" and "live" modes to monitor both current and past events.

To oversee such a complex operation in the mission control phase, it is essential to review data from multiple external sources to manage all activities in the area. Hexagon's Luciad technology was crucial in developing the GEOSYSTEMS solution, offering real-time location intelligence and situational awareness. It connects to any database via its SDK and supports over 200 data formats, including domain-specific real-time data. The high performance of LuciadRIA, coupled with the efficient and agile implementation by GEOSYSTEMS, facilitated seamless integration of AIS data containing vessel position information provided by OHB Luxspace, ADS-B data for flight tracking, IoT data, OSPAR data for offshore natural areas and all other necessary data for a safe operation.

Buffer zones can be created around a rocket launch area and communicated for the safety of air traffic and marine vessels.

4D control center

The 4D real-time solution leverages GPU power for high accuracy and provides 4D visualization with an intuitive, interactive map-centric view. The fusion of multisource content into an intelligent digital reality was realized by GEOSYSTEMS in a very short time frame. All aspects were prepared for an offshore rocket launch, including actual ship and aircraft movements. The proof-of-concept solution aids all phases of mission planning in the control center with “replay” and “live” modes to monitor both current and past events.

Users can view bathymetric data, live tracking of ships and planes, real trajectories and impact and buffer zones that define critical areas during a launch. Red boxes indicate potential conflicts with crossing planes and ships during the operation, allowing for warning alerts. Heat maps display maritime and air traffic hotspots, helping identify suitable areas and detect potential conflicts with aircraft.

In the post-mission phase, replay functionality allows a deep analysis to check if the buffer zones were adequate, if any conflicts occurred and how communication can be improved.

This demonstrator application can be integrated into a superordinate mission operating tool both before and during a launch. It can monitor potential intruders entering the buffer zone and initiate alarm procedures in the mission control center.

Looking ahead

The internal proof of concept was completed in June 2024. The next step is to become operational once the legal and political framework related to the offshore spaceport has been developed. The solution enables engineers to adequately visualize and monitor the upcoming launch of the first rocket. The 4D demonstrator helped OHB promote its innovative project of an offshore spaceport internally and externally.

Once the 4D sample application becomes operational, it will streamline the rocket launch planning process and address safety concerns related to interactions with ships or aircraft, as well as the protection of natural environments and infrastructure. Today’s demo system is a visualization tool only. In the future, it is foreseen to implement also decision-support workflows and customized processes.