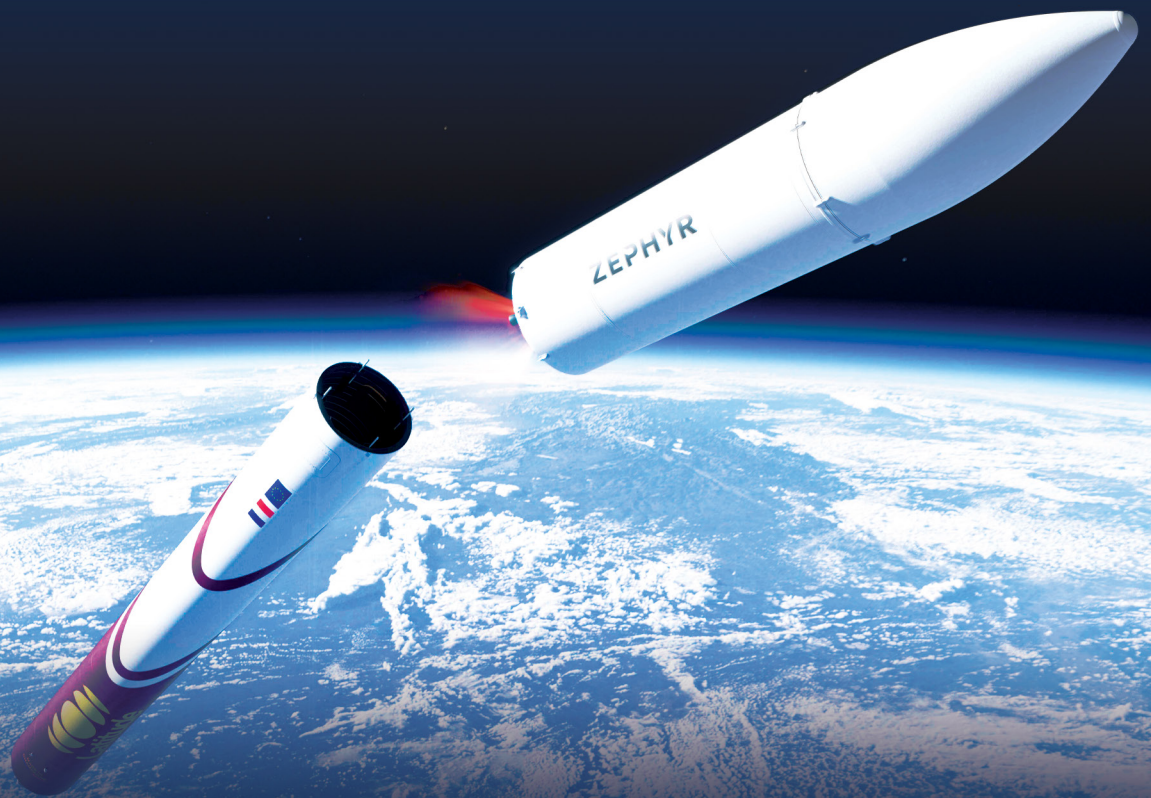# Latitude Adopts Ada and SPARK for Light Launcher Software in New Space Industry

French company leverages AdaCore's tools, training, and mentorship services to produce flight software for small satellite launchers

Executive Summary

In the competitive New Space industry, ingenuity, reliability, and cost-effectiveness are paramount factors. When Latitude embarked on creating their cutting-edge small satellite launcher, Zephyr, they recognized the importance of selecting the right programming language and development tools to support their efforts. After evaluating a number of candidates, Latitude settled on Ada and its formally verifiable SPARK subset. Ada and SPARK were judged to have the best support for sound software engineering practice, thus reducing life cycle costs, while meeting real-time embedded systems performance and predictability requirements. Based on their successful experience, Latitude plans to expand its use of Ada and SPARK on future projects and sees these technologies as key enablers.

Choosing Ada: Safety, Reliability, and Qualification

Headquartered in Reims, France, Latitude's mission is to launch small satellites (up to 100 kilograms in Low Earth Orbit) for the European space market. To fulfill this mission the company is developing from the ground up a new launcher called Zephyr. Software is a vital element in this endeavor and the company's core project involves developing and verifying the launcher flight code. The company was founded in 2019 with an engineering approach that combines a rich industrial heritage with advanced aerospace ingenuity. Their core project revolves around the flight software for the launchers, and a key decision – affecting the effort required in developing, verifying, and maintaining the code - was the choice of programming language, its supporting tools, and the tool vendor.

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- Clément Rousseau,
  embedded software engineer,
  Latitude

Among the various language technologies that Latitude investigated, Ada stood out as offering the best balance for the company's needs. Perceived benefits included improved code quality, better safety support, and reasonable qualification cost. "We were drawn to Ada for its potential to simplify certification, even though it wasn't a strict requirement when we began," said Remo Smadja, Embedded software engineer at Latitude. "We expect our software to undergo certification in the future, most probably with some of the ECSS (European Cooperation for Space Standardization) standards."

Ada and SPARK have been instrumental in helping Latitude meet its goals. "Ada's high-level features combined with its systems programming support have been incredibly

Customer:
Latitude, an innovative French aerospace startup, is revolutionizing the small satellite launch sector. With their ambitious Zephyr light launcher, they aim to cater to Europe's burgeoning smallsat market.

Challenge:
Latitude's main challenge was to develop reliable and cost-effective flight software for Zephyr, ensuring safety and precision in the demanding realm of space flight.

Solution:
After careful consideration, Latitude chose the Ada programming language and its SPARK subset for their development. These tools were selected for their robust support in engineering practices, crucial for reducing lifecycle costs and ensuring performance in embedded systems.

Result:
Latitude's adoption of Ada and SPARK has led to the successful development of high-quality, reliable flight software. This choice has positioned them well for future certification and has been instrumental in advancing their Zephyr light launcher project.

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beneficial," said Mr. Smadja. "We've made significant use of records and representation clauses, which allow us to capture the low-level register representation of microcontrollers. This flexibility is remarkable."

Latitude's decision to write its entire software in Ada reflects its trust in the language's safety, reliability, and efficiency. "We write everything in Ada, from our own device drivers to the bare-metal programming of our business logic on microcontrollers," said Clément Rousseau, embedded software engineer at Latitude.

Latitude's current software strategy prioritizes simplicity and efficiency, and leverages GNAT Pro's included real-time tasking run-time for safe concurrency. The team found particular benefits in using the Ravenscar profile, a subset of Ada's concurrency features supported by the certifiable light-tasking runtime profile. "The Ravenscar profile fits our needs perfectly at this point," said Mr. Rousseau. "Our strategy is to keep everything

as straightforward as possible." By eliminating the need for a complex operating system, Ravenscar has streamlined task analysis and boosted the team's confidence in mitigating concurrency-related issues.

AdaCore's GNAT Pro and GNAT Studio form the core of Latitude's development environment, additionally, the SPARK language and the SPARK Pro tool suite are used for critical code sections.

AdaCore's Support: Navigating the Transition to Ada

Latitude's software developers, although experienced in C, C++, and Java, were not formally trained to Ada at the outset of the project. Understanding Ada's rich set of features and knowing how to use them effectively were therefore critical skills that the team needed to acquire. To meet this goal, Latitude decided in late 2021 to invest in the training and mentoring services that AdaCore offers. AdaCore conducted classes that included hands-on workshops, which provided customized guidance on how to best use Ada's safe coding practices. After rapidly becoming proficient in Ada, the team readily made the transition to SPARK for critical code sections.

The mentorship was instrumental during Latitude's software development. Initiated while the code architecture was still being designed, AdaCore's consultation helped the team employ Ada's best practices in refining the code structure. Mentorship discussions covered topics ranging from design patterns to code analysis techniques such as stack checks. Latitude found the GNAT Pro compiler especially useful; it performs many checks that would have required the use of separate analysis tools in the case of deploying other languages.

Future Outlook: Conquering the "New Space Industry"

Looking ahead, Latitude remains keenly focused on the development of Zephyr's flight software. In addition, the company plans to continue leveraging Ada and SPARK for future projects. In the rapidly changing landscape of European space startups, companies are always looking to stand out from the crowd. For software, that means implementing innovative functionality through code that is safe, secure, reliable, efficient, and easily maintainable as requirements evolve. Latitude believes in modern programming language technology, backed by AdaCore's effective professional support, to help them meet their goals.

AdaCore

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