

# Survey on State-of-the-Art Operating Systems in Avionics, Targeting Open-Source Operating Systems

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## 1 Introduction

This paper surveys the use of open source operating systems in aerospace, with a particular focus on Linux, historically and up to the state-of-the-art.

Our scope includes systems using Linux exclusively as well as systems using Linux in combination with other Open- and Closed-Source software. Our scope also covers both air and space, and flight- and ground support systems. We do not limit our consideration to systems that require regulated standards (e.g. DO-178C/DO-278C, ED-12C/ED-109A, NASA NPR 7150.2, MIL-STD0882). We consider systems not only where Linux itself is supporting safety-critical functions but also where it is present in non-safety-critical aspects. For example, the provision of an ARINC 653 environment can isolate a partition containing Linux at a lower criticality level from other partitions at higher criticality levels.

The main contribution addressed by the paper is what open-source operating systems and tools exist that open up for a more common and extensible platform, starting with commercial (closed-source) RTOS and what they deliver in terms of regulated environments, safety criticality and real-time. Linux as an open-source operating system has evolved over the years towards real-time schedulers, strengthened security, safety and a stream-lined and a stringent development process. Therefore, it seems a feasible candidate for a regulated environment, at least for low-DAL applications as it may allow easier accessibility, a more open, large community, wider compatibility, preclude prototyping, a larger scale of collaborative development (independence factor of quality and always more output over time), source access for security as well as bug-fix and further supporting options.

The outline of the paper is as follows: Section XXX will (...)

## 2 Background

The Aerospace Working Group (AWG) [ELI25a] under the ELISA<sup>1</sup> foundation [ELI25b] develops use cases to inform and influence Linux architecture and related tools also working to derive technical requirements for avionics operating systems. It seeks to enhance and expand avionics software life-cycle processes, practices, and tools to enable use of Linux in avionics systems that are certified for high design assurance levels. One of AWG's special interests is to provide a common platform / kernel to support such developments.

The goal of AWG's special interest group Space Grade Linux (SGL) [SGL25] is to advance space technology innovation and competitiveness by developing a common Linux distribution that can be used in space applications, e.g., deep space, long lifespan missions. The nature of not only flight- but also space-missions brings many challenges, from development to deployment. SGL seeks to create an ecosystem of supported platforms and an open source community to drive collaboration.

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<sup>1</sup>ELISA stands for: Enabling Linux in Safety Critical Applications

## References

- [ELI25a] ELISA Aero WG Community. *ELISA Aerospace Working Group*. Accessed: 04-06-2025. 2025. URL: <https://github.com/elisa-tech/wg-aerospace>.
- [ELI25b] ELISA Community. *ELISA - Enabling Linux in Safety Critical Applications*. Accessed: 04-06-2025. 2025. URL: <https://elisa.tech/>.
- [SGL25] SGL Community. *Space Grade Linux (SGL)*. Accessed: 04-06-2025. 2025. URL: <https://github.com/containers/space-grade-linux/>.