



MASTER THESIS

**“CAN-Bus integration in the F-Series satellite flight
software”**

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Julius-Maximilians-Universität Würzburg, 2024

CAN-Bus integration in the F-Series satellite flight software

Aparna Venugopal studied in the Elite Graduate Program “Satellite Technology” at Julius-Maximilians-Universität Würzburg. As part of her Master’s thesis, she developed and integrated CAN bus communication into the existing F-Series satellite platform flight software at Airbus Defense and Space GmbH.

Expanding communication capability for F-Series

F-Series is a highly modular and reusable satellite platform; a commercial version evolved from the University of Stuttgart’s Flying Laptop mission. It comprises of the Flexible Low Earth Orbit Platform for small satellites and the Flexible LEO Cube platform for CubeSats. The existing F-Series flight software relies solely on SpaceWire for communication with the onboard equipment. To provide greater versatility to the platform in the small satellite market, Controller Area Network (CAN) needs to be incorporated into the platform. This is especially important for CubeSat platforms where the cost and complexity of SpaceWire are not preferred.

CAN has a proven history of working effectively in the automotive industry for around 30 years now. The low power consumption and two-wire bus network may reduce expenditure for satellite manufacturers, and provide more flexibility by opening up more options for the devices to be used in the satellite.

In her master’s thesis, Aparna Venugopal implemented a way to integrate a CAN-based payload into the complete flight software architecture which runs alongside the rest of the software communicating with SpaceWire protocol.

Making CAN work with existing software architecture

The thesis involved developing a camera equipment handler and controller, and their scheduling and communication into the flight software. The flight software was designed to communicate with a device in the SpaceWire network through Remote Memory Access Protocol, which works very differently from CAN. Therefore, the task required some considerations and architectural modifications.

To test the flight software, on the simulator side, the existing standalone payload model was integrated into the rest of the Airbus in-house developed SimTG simulator, and this simulation was modified to run two instances of the camera payload in the simulator. Redundancy for the CAN-bus communication was implemented to utilize the availability of the two CAN buses of the microprocessor in case of any failures. Finally, end-to-end communication was implemented and tested with the ground segment tool achieving complete system integration.

This work can be utilized as a baseline to easily incorporate devices communicating with CAN protocol enabling the F-Series flight software to be compatible with even more satellite systems.

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