

## Title

**ECOSYSTEM Project: Evaluation of nitrogen as a replacement for halon 1301 in cargo compartments**

## Authors

Adam Chattaway, Changmin Cao, El Hassan Ridouane [Collins Aerospace]

## Abstract

ECOSYSTEM is an EU-funded Clean Sky 2 project, which started in October 2019 and was concluded in March 2022. The maximum EU funding contribution was k€699, and the project effort was scheduled to be 74 person months. To ensure industrial relevance a Topic Leader is appointed, which was Airbus in this case.

The scope of the ECOSTSTEM project was to develop an environmentally friendly and economically viable halon-free cargo hold fire suppression system demonstrator to TRL-5, and carry out tests at simulated altitude (both reduced pressure and lower temperatures) at Fraunhofer facility in Holzkirchen, Germany.

The demonstrator comprised a bank of composite cylinders for the high-rate discharge (HRD) the low-rate discharge (LRD) together with appropriate flow controller to give the required discharge rates. The design and fabrication of the demonstrator, as well as simulation of its performance was presented at the FAA Virtual Forum Meeting in April 2021. This paper will focus on the results obtained in Holzkirchen. The test facility is a large pressure vessel which contains the front half of an Airbus A310 wide body aircraft.

A total of 15 tests were performed, covering the following variables:

- Ambient cargo temperature
- Elevated cargo compartment temperature
- Reduced cargo compartment temperature
- Simulated cruise conditions
- Cruise followed by descent
- Empty cargo compartment
- 75% full cargo compartment

Key test cases were also simulated using CFD modelling to compare the distribution oxygen concentrations throughout the cargo compartment as well as pressure rises during the HRD discharge. The modelled oxygen concentrations results agreed well with the modelled results. The leakage characteristics of the older A310 cargo compartment differ from those of in-production aircraft, meaning the that the assumptions used in the CFD modelling were incorrect.

The paper will conclude with a brief discussion of the next steps.