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JETSCREEN Program - Impact of fuel composition on aeronautic emissions: Combustor rig test

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Introduction

Aviation is actually one of the strongest growing transport sectors, and this trend is predicted to continue. Therefore, there is a big concern linked to the impact of aviation emissions both in climate and air quality. Among the different options available, the aviation industry has identified the development of new fuels as one of the major tools to tackle its emissions. Currently there are five biofuel production pathways technically certified and 16 more certifications are in preparation (Mawhood et al. 2016). In this frame, The JETSCREEN project aims to develop an optimization platform enabling the integration of distributed design tools and experimental based validations to assess the risks and benefits of alternative fuels. The proposed platform will contribute to optimize alternative fuels in terms of achieving the maximal energy density and lowest pollutant emissions.

Methods

During JETSCREEN project, tests at different scales, from laboratory to combustor rig, will be performed. In this work we present the test done at ONERA combustor rig M1.



Figure 1. M1 test facility

In this test, we have studied 4 different fuels, including standard JetA-1, Alcohol to Jet (AtJ), AtJ/JetA-1 blends and desulfurized JetA-1.

We have used the measurement line depicted in Fig. 2 to characterize the emissions from different fuels. This line was exactly the same that the one used in previous laboratory tests using a CAST generator especially designed to burn liquid fuel. In this way, we have been able to compare the results obtained with the CAST generator and the combustor rig for the four fuels studied in this test.

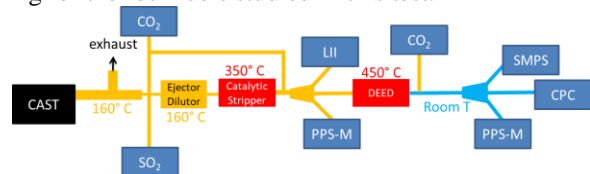


Figure 2. Scheme of the sampling line for Jetscreen tests

We have measured CO₂ and SO₂ concentrations. CO₂ was used as well to calculate the dilution done along the line. We have measure soot mass by means of Laser Induced Incandescence (LII, Artium Inc.), particle number was measured using a Pegasor Particle Sensor type M (PPS-M, Pegasor Oy.) and a Condensation Particle Counter (CPC, Grimm GmbH.). Finally, particle size distribution was measured using a Scanning Mobility Particle Sizer (SMPS) using either a CPC or a Faraday Cup Electrometer as detector (Grimm GmbH). For each fuel, we have studied different engine regimes. Including some of the regimes included in the LTO-cycle, but also some additional regimes such like a cruise regime.

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Mawhood, R., et al., (2016) *Biofuels, Bioprod. Bioref.* 10, 462-484.