

Design and testing of a new high pressure chamber with optical access (BOHP).

G.Martins, C.Verplancke

In the framework of the Research and Technology program, the Space Engines Division of SAFRAN Snecma develops new injection technologies for advanced liquid engine gas generators. This program aims at drastically reducing the costs associated with the fabrication and the integration of injection elements in the injection head of gas generators. The solution was to reduce the number of injection elements and therefore increase the mass flow rate per element, which becomes possible with the development of the tricoaxial injection technology.

Because of the high flow rates involved, tricoaxial injectors cannot be tested in the Mascotte test bench at ONERA. These injectors are typically tested at DLR P8 test bench, a co-ownership between Astrium, DLR, CNES and Snecma. A single injection element test chamber without optical access is used:

- To characterize the performance of the tested injection element, particularly the thermal stratification at specified axial positions,
- To measure injection pressure losses
- To characterize LF (Low Frequency) and HF (High Frequency) combustion stability of the injection element.

Flame and reaction zones visualizations were deemed necessary in order to better validate advanced CFD combustion models for transcritical combustion. Consequently, it was decided to design a new test chamber capable of providing optical (BOHP) access to the flames of tricoaxial injection elements covering present and future Gas Generator development needs. These needs were then translated in the specification of extreme operating conditions up to 200 bar chamber pressure and H₂/O₂ mixture ratio up to 1.

This paper provides a synthesis of the specifications used in the early stage of the project (2007), as well as an overview of the design and fabrication phases that took place in 2008. Finally, the results of the 2009 acceptance testing campaign are summarized.