

## Experimental Analysis of Supersonic Combustion Induced by Shock Wave at the Combustion Chamber of the 14-X Scramjet Model

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**Abstract :** The 14-X is a strategic project of the Brazil Air Force Command to develop a technological demonstrator of a hypersonic air-breathing propulsion system based on supersonic combustion programmed to flight in the Earth's atmosphere at 30 km of altitude and Mach number 10. The 14-X is under development at the Laboratory of Aerothermodynamics and Hypersonic Prof. Henry T. Nagamatsu of the Institute of Advanced Studies. The program began in 2007 and was planned to have three stages: development of the wave rider configuration, development of the scramjet configuration and finally the ground tests in the hypersonic shock tunnel T3. The install configuration of the model based in the scramjet of the 14-X in the test section of the hypersonic shock tunnel was made to proportionate and test the flight conditions in the inlet of the combustion chamber. Experimental studies with hypersonic shock tunnel require special techniques to data acquisition. To measure the pressure along the experimental model geometry tested we used 30 pressure transducers model 122A22 of PCB®. The piezoelectronic crystals of a piezoelectric transducer pressure when to suffer pressure variation produces electric current (PCB® PIEZOTRONIC, 2016). The reading of the signal of the pressure transducers was made by oscilloscope. After the studies had begun we observed that the pressure inside in the combustion chamber was lower than expected. One solution to improve the pressure inside the combustion chamber was install an obstacle to providing high temperature and pressure. To confirm if the combustion occurs was selected the spectroscopy emission technique. The region analyzed for the spectroscopy emission system is the edge of the obstacle installed inside the combustion chamber. The emission spectroscopy technique was used to observe the emission of the OH\*, confirming or not the combustion of the mixture between atmospheric air in supersonic speed and the hydrogen fuel inside of the combustion chamber of the model. This paper shows the results of experimental studies of the supersonic combustion induced by shock wave performed at the Hypersonic Shock Tunnel T3 using the scramjet 14-X model. Also, this paper provides important data about the combustion studies using the model based on the engine of 14-X (second stage of the 14-X Program). Informing the possibility of necessities corrections to be made in the next stages of the program or in other models to experimental study.

**Keywords :** 14-X, experimental study, ground tests, scramjet, supersonic combustion

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