Elementary Experimental Study of the Burner Used in FAA Fire Test: NexGen Burner

Yi-Huan Kao, Samir B. Tambe, John R. Hasselbeck, and San-Mou Jeng

Department of Aerospace Engineering and Engineering Mechanics

University of Cincinnati

Cincinnati, Ohio, U.S.A.

Abstract

The NexGen (Sonic) burner is the new burner developed by the Federal Aviation Administration Technical Center, FAATC, to replace old oil burners used for the required fire certification tests on powerplant related materials, as it provides the capability to control the both air and fuel flow rates. During a fire test, the burner is supposed to simulate a certain fire situation, so the flame properties should be robust and repeatable. In the presented work, the influence of the turbulator and the thermocouple size used for flame calibration was studied. Due to the increase of turbulent intensity, the modified turbulator results in a better fuel/ air mixing, as compared to the original turbulator. Additionally, the sensitivity of the burner performance to air and fuel flow rate, as measured by the temperature and heat flux for calibration purposes, was studied. The fire test results on Aluminum (AL) samples indicate that the flame is more favorable while smaller thermocouple is employed for calibration. The air flow rate has a significant impact on the fire test results on AL samples, even though it doesn't show a marked difference on calibration data. For variations in air temperature, monitoring the air mass flow rate is necessary as just monitoring the pressure gauge at the sonic choke was not enough to ensure repeatability. The effect of burner inclination was studied by mapping the temperature and heat flux and conducting fire tests on Al samples. The results show that the flame becomes stronger and burnthrough time decreased with increasing inclination for the same calibration conditions. The results obtained in this study show that the current calibration criterion of monitoring the heat flux and the thermocouples reading flame temperature may not be good enough to ensure repeatable burner performance. Therefore, monitoring the mass flow rates of fuel and air to minimize the discrepancy of fire test result is recommended in this work.