DESIGN AND ANALYSIS OF THE FAA NEXT GENERATION FIRE TEST BURNER

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The United States Federal Aviation Administration makes use of threat-based fire test methods for the certification of aircraft cabin materials to enhance the level of safety in the event of an in-flight or post-crash fire on a transport airplane. The global nature of the aviation industry results in these test methods being performed at hundreds of laboratories around the world; in some cases testing identical materials at multiple labs but yielding different results at each lab. Maintenance of this standard for an elevated level of safety requires that the test methods be as well defined as possible, necessitating a comprehensive understanding of critical test method parameters. The tests have evolved from simple Bunsen burner material tests to larger, more complicated apparatuses, requiring greater understanding of the apparatus for proper application. The FAA specifies a modified home heating oil burner to simulate the effects of large, intense fires for testing of aircraft seat cushions, cargo compartment liners, power plant components, and thermal acoustic insulation. Recently, the FAA has developed a Next Generation (NexGen) Fire Test burner to replace the original oil burner that has become commercially unavailable. The NexGen burner design was based on the original oil burner but with more precise control of the air and fuel flow rates with the addition of a sonic nozzle and a pressurized fuel system. Knowledge of the fundamental flow properties created by various burner configurations was desired to develop an updated and standardized burner configuration for use around the world for aircraft materials fire testing and airplane certification. To that end, the NexGen fire test burner was analyzed with Particle Image Velocimetry (PIV) to resolve the non-reacting exit flow field and determine the influence of the configuration of burner components. The correlation between the measured flow fields and the standard burner performance metrics of flame temperature and burnthrough time was studied. Potential design improvements were also evaluated that would simplify burner set up and operation.