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**SIMULATIONS OF FUEL TANK TEMPERATURES WITHIN U.S. AIR FORCE
CARGO AIRCRAFT AS PART OF A JP-8 REPLACEMENT STUDY**

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Jet A fuel currently offers cost advantages over JP-8 jet fuel. If Jet A could be used to replace JP-8 in cargo aircraft, the U.S. Air Force could potentially realize significant cost savings. Jet A has a higher specification freeze point than does JP-8. Thus, it is necessary to study cargo aircraft and assess the impact of Jet A use on safety and operability. Simulations of the heat transfer within critical fuel tanks were performed using computational fluid dynamics (CFD) and a zero-dimensional model. For model development, the aircraft manufacturers provided information on tank configurations, fuel flow rates, electrical loads, wing characteristics, and thermal properties. In addition, flight tests were performed for model validation. It is challenging to use CFD to calculate the transient temperatures within large fuel tanks for long missions. During tank draining, the use of a relatively large grid with sufficient resolution required small time steps (~0.001 s to 0.04 s) for numerical stability. In spite of complexities, the CFD models provided details of the temperature and flow velocity spatial variation not available with the zero-dimensional model. In contrast, simulations involving the zero-dimensional model required calculation times of only minutes rather than days or weeks as needed for the CFD models. Bulk temperatures calculated by the two methods agreed well with each other. Lastly, the presence of foam in a fuel tank complicates the understanding of the fuel temperature behavior and was difficult to accurately represent in the models.