

## Thermal Modeling and Analysis of the Hurricane Imaging Radiometer (HIRad)

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### Abstract

The Hurricane Imaging Radiometer (HIRad) is a payload carried by an unmanned aerial vehicle (UAV) at altitudes up to 60,000 ft with the purpose of measuring ocean surface wind speeds and near ocean surface rain rates in hurricanes. The payload includes several components that must maintain steady temperatures throughout the flight. Minimizing the temperature drift of these components allows for accurate data collection and conclusions to be drawn concerning the behavior of hurricanes. HIRad has flown on several different UAVs over the past two years during the fall hurricane season. Based on the data from the 2011 flight, a Thermal Desktop model was created to simulate the payload and reproduce the temperatures. Using this model, recommendations were made to reduce the temperature drift through the use of heaters controlled by resistance temperature detector (RTD) sensors. The suggestions made were implemented for the 2012 hurricane season and further data was collected. The implementation of the heaters reduced the temperature drift for a portion of the flight, but after a period of time, the temperatures rose. With this new flight data, the thermal model was updated and correlated. Detailed analysis was conducted to determine a more effective way to reduce the temperature drift. The final recommendations made were to adjust the set temperatures of the heaters for 2013 flights and implement hardware changes for flights beyond 2013.