RQ15-20

1. **Research Title:** Weather Data Assimilation Techniques
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Electrical Engineering, Digital Signal Processing, Stochastic Modeling and Analysis, (M.S. or Ph.D. level)
4. **Objectives:** Research and develop a probabilistic model for low altitude winds based on both forecast data and observed insitu data. Identify volumes within the atmospheric cube with minimal variation and high predictability. Compare and contrast data assimilation techniques, for these data inputs and assess applicability to the airdrop mission. Airdrop logistics prevent the use of real-time wind profiles. The last observation will be a few minutes old at the time of the drop. Conduct a characterization of the drop zone wind model and the wind profile sensor model, and then identify which parameters could improve the drop. Determine the kind of models of wind profile sensors that AFRL needs to generate to improve the estimate. Design a method for modeling the wind vectors, then rapidly updating the model with observed sensor information in near real time. Establish whether there is a benefit to reporting multiple observations in addition to the most recent one, and if so, how many, and over what time frame. Examine solutions that can reduce processing time to tens of seconds or less. Calculate the difference in accuracy when using observation-only data vs mixed observation/forecast data.
5. **Description:** In the area of airdrop, the Air Force uses the AF Weather Agency (AFWA) forecast along with local observations to produce a Computed Air Release Point (CARP) at which to drop materiel to troops on the ground. Currently, this procedure is accomplished in the Consolidated Airdrop Tool used by the transport flight crew, but changes in the available data are impending. The CARP needs to consider both the forecasted data and measured insitu data, particularly if the some of the insitu data is taken close to but not exactly at the desired drop location.

   AFWA is starting to generate ensemble forecasts from multiple weather models. Secondly, AFRL is developing wind profile sensors to provide near real-time updates to the weather observation at the drop zone. The current tools for aggregating this data are not as up-to-date as the systems generating it. Given ensemble weather models and what is known today about the wind profilers, generate an estimator for the airdrop wind profile at the DZ at release time. A small stipend will be provided to cover costs incurred for travel and coordination with stakeholders.
6. **Research Classification/Restrictions:** Unclassified
7. **Eligible Research Institutions:** Place an X in all that apply.

☒ Universities (DAGSI) ☒ AFIT (only) ☒ USAFA