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A Collaborative High Alitude Flow Facility (CHAFF): University Facility for Studies of High Altitude Propulsion Plumes, Liquids and Gas Releases, and Interactions

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Abstract: Interest in realistic simulation of the space environment as applied to the study of contamination and thruster plumes has led to the development of the **CHAFF**-4 facility. A multi-fin cryogenically cooled array (approx. 20K) completely envelops the interior of the **CHAFF**-4 chamber, providing an available condensing surface area of 590 m2. It is anticipated that the equivalent altitudes that can be simulated for various electric propulsion systems vary between 150-350 km (depending on type). The effective pumping speed is predicted to be about 9x106 liters/sec. The facility is designed to accommodate thruster power levels up to 3500 W without the use of supplementary liquid helium, although infrastructure permitting its use is available. Provisions for the simulation of high-speed LEO flow environments have been incorporated in the design, and the corresponding pumping requirements are well within the capabilities of **CHAFF**-4. Developmental considerations and design issues are discussed based on the requirements of plume testing, in order to ensure the validity of phenomena that are observed in the facility. The construction of the **CHAFF**-4 facility required a period of about 12 months. It is now complete and preliminary leak checking has been accomplished. Performance testing and more sensitive leak checking in order to bring the facility to operational status will require about six months from the date of this report.

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