

# Autonomous Cryogenic Propellant Depot Design

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## Description and Objectives

A propellant depot has become an integral part of most plans for providing on-orbit refueling. The effort proposed here is for an analysis of several very promising fluid storage, transfer and management techniques as well as the autonomous requirements involved with operating a cryogenic propellant depot on orbit. Based on this analysis, a conceptual design for an autonomous cryogenic fluid storage and transfer system will be generated along with a development and testing plan for Phase II. The advantages of an on-orbit propellant depot have been identified, most recently for the Orbital Express program.

*Figure 1. Magnetic Fluid Management (MFM) KC-135 Flight Experiment Using Simulant Fluid*



## Approach

The primary goal of this Phase I effort is to produce a conceptual design for a cryogenic propellant depot while addressing several of the most critical concerns associated with low gravity on-orbit storage and operation. Several of the tasks in this Phase I will benefit from the research and development that has taken place for the DARPA Orbital Express and earlier programs.

## Subcontractors/Partners

Michigan Aerospace has received a commitment from Oceaneering Space Systems (OSS) to support the requirements definition, trade studies and conceptual design of the cryogenic transfer system. A subcontract will be issued. The letter of commitment from OSS is attached to this proposal.

## Schedule and Deliverables

A six-month program is proposed, with a start date of September 1, 2001 assumed. A Final Report will be prepared that summarizes the overall feasibility, analysis and trade studies, conceptual design, recommendations, and commercialization aspects of the activities proposed in this Phase I effort.

## NASA & Commercial Applications

The development of autonomous cryogenic propellant depots potentially has a wide range of uses in both military and civil space programs. In the civil space sector, a need exists to refuel operational systems that are fuel limited but whose data is essential. With the large number of civil space systems coming on-line, the overall market potential is significant.