

April 12, 2006

## **Improving the Supply of Liquid Nitrogen to the NASA National Transonic Facility**

On February 27, 2006, NASA provided Congressional staff with information regarding Langley Research Center's (LaRC) Request for Information (RFI) to solicit ideas for solutions to meet the projected Liquid Nitrogen (LN<sub>2</sub>) requirement for the NASA National Transonic Facility (NTF) located at LaRC. Concurrent with the RFI, NASA also conducted an internal, independent assessment of potential options to supply the required LN<sub>2</sub>.

On April 13, 2006, after evaluating the responses to the RFI and the findings of the independent assessment, LaRC will post a synopsis of a Request for Proposals (RFP) related to improving the supply of LN<sub>2</sub> to the Center's NTF via a Government-Owned Contractor Operated Liquid Nitrogen plant to supply the facility.

### **Background:**

- The NTF at NASA's LaRC is a unique wind tunnel that operates at cryogenic temperatures (down to -250° F) in order to duplicate actual flight conditions for testing aircraft models at subsonic and transonic speeds.
- To match actual flight conditions, LN<sub>2</sub> is used to cool the facility.
- In October 2005, NASA's Aeronautics Research Mission Directorate (ARMD) initiated the reshaping of its aeronautics programs to focus more on fundamental research. Based on the reshaped program, as well as the anticipated needs of industry and other Government partners, NASA determined an improved supply of LN<sub>2</sub> is required.
- LaRC determined that it could substantially reduce its cost, and satisfy an increased demand for LN<sub>2</sub>, if the Government had a contractor build and operate a LN<sub>2</sub> plant. Currently, LaRC purchases LN<sub>2</sub> via a pipeline from Praxair, Inc., a private, sole source supplier that operates a commercial plant near LaRC with approximately four employees.
- NASA Headquarters conducted an internal evaluation in conjunction with the RFI, on the merits of transitioning to a Government-Owned Contractor-Operated (GOCO) plant to meet the NTF's LN<sub>2</sub> requirements.
- Because no government personnel would be involved in building and operating the new LN<sub>2</sub> plant, OMB Circular A-76 does not apply.

### **Objectives of NASA's Internal Study**

- The internal study provided an independent assessment of the various options available to NASA for meeting the LN<sub>2</sub> needs for the NTF, given LN<sub>2</sub> requirements for the NTF, and given current Agency priorities and strategies. The four objectives of the study were as follows:
  - Validate the LN<sub>2</sub> requirements;
  - Evaluate the various options for supplying LN<sub>2</sub> to the NTF;
  - Perform an independent assessment of the Net Present Value cost analysis of the options; and,
  - Incorporate the results of the RFI related to potential sources and alternatives.

**Key Study Findings**

- The LaRC assessment that the NTF requires 50,000 tons/year of LN<sub>2</sub> for planned operations, and that there needs to be a supply of up to 370 tons/day when the wind tunnel is operating, are reasonable assessments of the LN<sub>2</sub> requirements.
- LaRC had analyzed all practical options for acquiring LN<sub>2</sub>.
- The four most feasible options considered for improving the supply of LN<sub>2</sub> are as follows:
  - Existing Praxair plant with supplemental truck supply;
  - Existing Praxair plant with new supplemental plant on-site;
  - All truck supply; and,
  - New commercial GOCO plant.
- NASA has analyzed the four most feasible options for LN<sub>2</sub> supply, and in accordance with OMB Circular A-94, “Guideline and Discount Rates for Benefit-Cost Analysis of Federal Programs,” conducted an independent cost comparison that found the GOCO approach to be the most cost-effective and to have the lowest Net Present Value.

Options	LN2 Unit Cost \$/ton	Total Yearly Cost (\$) for 50,000 tons/yr	CoF Funding Capital (\$)	NPV (\$)	Payback Period
<b>1. Praxair with trucks</b>	<b>81/83</b>	<b>4,080,250</b>	<b>0</b>	<b>73,218,789</b>	<b>N/A</b>
<b>2. Praxair with plant</b>	<b>81/40</b>	<b>3,618,083</b>	<b>6,000,000</b>	<b>70,178,908</b>	<b>14 yrs</b>
<b>3. All truck delivery</b>	<b>83</b>	<b>4,300,000</b>	<b>0</b>	<b>77,162,133</b>	<b>N/A</b>
<b>4. On-site GOCO plant</b>	<b>40</b>	<b>1,997,000</b>	<b>18,000,000</b>	<b>51,596,106</b>	<b>8.6 yrs</b>

- Given the uncertainties associated with several of the variables used in the cost analysis, a sensitivity study was run that included variations in yearly LN<sub>2</sub> requirements and variations in the truck delivery price. It was found that the GOCO approach is the most cost-effective solution even when accounting for such uncertainties.
- Three companies responded to the RFI. Two of the three companies proposed a GOCO plant in response to the RFI, with one of those companies stating that the GOCO plant was “the only approach that makes long-term commercial and economic sense.”
  - Both companies that responded to the RFI by proposing to build a new LN<sub>2</sub> plant indicated that the plant could be built for less than \$20 million and, once operational, could supply LN<sub>2</sub> for less than \$40/ton.
  - The third company proposed that the current Praxair facility be augmented with additional storage tanks. However, the proposal to increase LN<sub>2</sub> storage capacity was not viable due to technical issues and safety concerns associated with more storage. Furthermore, the size of the additional tanks would have to be extremely large in order to accommodate the required cycle time.
- In addition to being the most cost-effective, long-term option, the GOCO protects NASA against future price increases, allows maximum flexibility given the cyclic nature of cryogenic testing, and makes the NTF more attractive to users by controlling the price of supplies and increasing the efficiency of testing.

**Recommended Course of Action**

- After reviewing the results of the internal study, NASA decided to proceed with posting a synopsis related to procuring a LN<sub>2</sub> GOCO plant for NTF in anticipation of releasing the RFP 15 days later to procure the LN<sub>2</sub> plant that will produce 50,000 tons/year and a minimum of 370 tons/day.