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D. Geesaman
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orig → M. Tolian
R.H → Oct 25, 2010

Fermilab

*Addendum #1*

**to the**

# Memorandum of Understanding Between

# Fermi National Accelerator Laboratory

# And

# E-906 SeaQuest Experiment

September 29, 2010

MOU-00400 REC

**Addendum/Modifications to the E-906 Memorandum of Understanding**

**E906 Target Gas Handling System**

9/29/2010

**General Remarks:**

The purpose of this addendum is to record expectations for budget estimates and work allocations for Fermilab, the funding agencies and the participating institutions in the fabrication, installation, and maintenance of the gas handling system for the E906 cryotarget. The addendum reflects an arrangement that currently is satisfactory to the parties. However, it is recognized and anticipated that changing circumstances of the evolving research program may necessitate revisions. The parties agree to modify this memorandum to reflect such required adjustments. Any actual contractual obligations will be set forth in separate documents.

The responsibilities of the E906 collaboration with regard to the cryotarget center on the efforts of the University of Maryland and the University of Michigan. Sections 5.11 and 5.12 of the MOU give a rough guide to the expectations for the collaboration's responsibilities, while Sections 6.2.7 and 6.2.8 show the expectations for Fermilab.

The following is a list of items procured/provided to date or that are otherwise known to exist at Fermilab or within the E906 collaboration:

- Three target flasks used for the E-866 experiment have been provided by Fermilab.
- Both cryocoolers (2 cold-heads, 2 compressors) have been procured and tested by the E906 collaboration.
- The cryo-absorbers and the LN2 dewars are available at Fermilab. This is not needed.
- Flow sensors for the cryocooler helium gas have been located at Fermilab.
- Vacuum pumps and two target vacuum jackets are available at Fermilab.
- Pump carts have been located at Fermilab.
- Temperature sensors for the H2/D2 flasks (CERNOX), condenser (CERNOX), and the cryo-lines (4 Platinum) have been procured by the E906 collaboration.
- Air compressors have been located and are available at Fermilab.

**MOU modifications:**

# 5 Collaboration's Responsibilities

**Original Version (Dec 12, 2008)**

### 5.11 University of Maryland

5.11.1 Maryland will participate in the development and maintenance of the DAQ system.

5.11.2 Maryland will work with the Fermilab's cryogenic target experts to develop the cryotarget control systems and participate in the integration of target assemblies and target controls.

5.11.3 Maryland will participate in the data collection and analysis.

5.11.4 Maryland is responsible for the decommissioning of the DAQ and cryotarget control systems as outlined in Sec.8.2.

**New Version (Sep 29, 2010)**

### 5.11 University of Maryland

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5.11.3 Maryland will participate in the data collection and analysis.

5.11.4 Maryland is responsible for the decommissioning of the DAQ and cryotarget control systems as outlined in Sec. 8.2.

**5.11.5 Maryland will be responsible for connecting sensors, valves, and other monitoring items that the collaboration seeks to monitor within Fermilab's area of responsibility for the target control system.**

# 6 Fermilab's Responsibilities

**Original Version (Dec 12, 2008)**

**6.2.7** Provide some support for the cryogenic targets. This includes:

- Provide existing E-866 cryogenic targets and target table assembly.
- Provide technical and safety support for the hydrogen and deuterium targets. Engineering and technical work will be done in cooperation with Michigan.
- Provide hydrogen tent, vent system and hydrogen gas alarm system for targets.

- Examine the existing targets and measure their present activation. It is expected that the present flasks can be reused. If not, Fermilab is expected to provide and test new flask assemblies.
- Provide the vacuum pumps and pump carts for the cryotargets.
- Fermilab will commission the targets, but will not provide operators on shift.
- Provide the solid targets and target supports.

**New Version (Sep 29, 2010)**

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- Provide hydrogen tent, vent system and hydrogen gas alarm system for targets.
- Examine the existing targets and measure their present activation. It is expected that the present flasks can be reused. If not, Fermilab is expected to provide and test new flask assemblies.
- **Provide vacuum systems and pump carts for the cryotargets.**
- Fermilab will commission the targets, but will not provide operators on shift.
- Provide the solid targets and target supports.
- **Provide suitable cooling water for the cryocooler compressors.**

**Original Version (Dec 12, 2008)**

6.2.8 Provide high purity (99.9%) hydrogen and (99.99%) deuterium gas for use in cryogenic targets. If Fermilab wants to recover this gas, Fermilab will provide a recovery system and be responsible for the recovery.

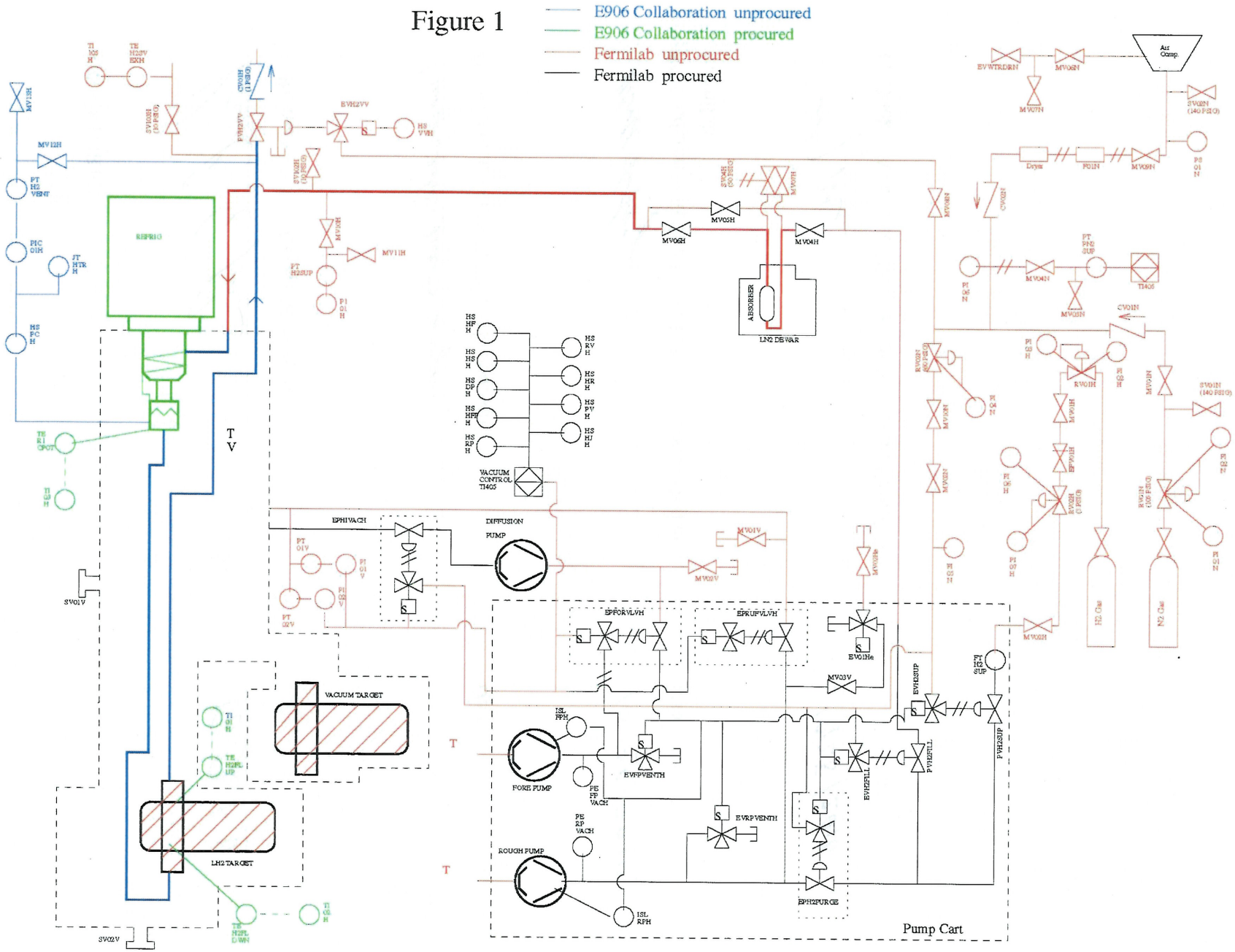
**New Version (Sep 29, 2010)**

6.2.8 **Provide high purity (99.9%) hydrogen and (99.99%) deuterium gas for use in the cryogenic target.**

- **Fermilab will provide the high purity hydrogen and deuterium cylinders, and provide the piping from the gas shed to the cryogenic target.**
- **The E906 Collaboration will provide shift personnel to monitor the gas pressure and flow.**

If Fermilab wants to recover this gas, Fermilab will provide a recovery system and be responsible for the recovery.

Figure 1


E906 Collaboration unprocured
E906 Collaboration procured
Fermilab unprocured
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REFRIG
ABSORBER
LN2 DEWAR
VACUUM CONTROL TI405
DIFFUSION PUMP
EPHIVACH
VACUUM TARGET
LH2 TARGET
FORE PUMP
ROUGH PUMP
Pump Cart
Air Comp.
Dryer
H2 Gas
N2 Gas

SIGNATURES

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|---|---|
| P. Reimer – E-906 Co-spokesperson | 18 Oct 10<br>Date |
| (unavailable due to surgery)<br>D. Geesaman – E-906 Co-spokesperson | Date |
| M. Lindgren – Acting Head, Particle Physics Division<br>Fermilab | 10/20/2010<br>Date |
| G. Bock – Associate Director for Research, Fermilab | 10/28/2010<br>Date |