Notes from the NASA/GSFC Meeting at Precision Cryogenics

Held on 00/09/28

Attending: Benford, Dipirro, Jackson, Shafer (GSFC); Gummer (PC)

Issues:

1. Frame requires bolts/pins before cryostat welded inside (page 60 of CoADR handout). Frame has three square plates with circular holes; cryostat cylinder will be welded to those three plates. Vacuum weld at the two ends; flange weld at central plate to fillet but not to seal. O-ring grooves in either end, sealing to cryostat end flanges (circular). Frame is symmetric top-to-bottom. Angled pieces at each corner will require pins on one side of each of the three plates, screws on both sides. Screw threads to be helicoiled.

2. Dewar will have a snout with a window to mate to telescope. Coupling to be built by NASA. More on the cryostat attachment of this snout later. The snout will have to accommodate 4K, 77K, and 300K extensions, with bolt patterns accessible such that assembly from the outside is easy. PC to deliver cryostat with blanked ports.

3. This is the "test cryostat" for SAFIRE. Perhaps one year from now, we will order a similar "flight cryostat" which will be nearly the same. At that time, we may ask for the telescope interface structure be manufactured by PC. Also, the flight cryostat will require materials certifications, inspected welds, and may require nut plates for critical screws.

4. Some sort of relief/burst disc required on cryostat vacuum. FAA requires this in the event that one of the cryogen tanks fails into the vacuum space. Type TBD by NASA. Could be single-use bursts, replaceable bursts, Cryolab relief-in-valve, large quench relief valves, English latching relief. Remember that the pressure for relief must be smaller than that required to blow the cryostat window which forms the pressure window for the airplane.

5. Valve could be the Cryolab type with the better actuator. PC will deliver a Cryolab type valve with the relief fitting welded to a K40 flange.

6. Dewar window should have flanges on 300K, 77K, 4K sides for attachment of "top hat" snout for lens outside dewar cylinder. (As in #2)

7. Fiberglass should be low enough conductance to maintain >4day hold time on all cryogen tanks. Layed-up fiberglass preferred to rolled+riveted fiberglass. Relieve fiberglass as much as possible maintaining stiffness. Diameters may have to be changed slightly to accommodate available fiberglass sizes.

8. Fill tubes must be long enough so that dewar can rotate ±25° around the window axis without pouring out liquids. NASA to figure out what REAL range is! Note from Dominic 00/09/29: Telescope range is +15 to +70° ZA, as near as I can figure out. Nominal mounting at 40°, so range for dewar is –25° to +30°. Note from Dominic 00/10/11: From Sean Casey, it appears that the usable range is only ±20° around the vertical mounting point at 40°, so if the dewar can survive **±20°** without spilling, this should pass by the FAA.

9. NASA to determine what the maximum fill tube length can be. Note from Dominic 00/09/29: Maximum height of dewar + cart is 60". Dewar frame is ~48", so this won't allow much room for tubes! Further note from Dominic 00/09/30: Absolute MAX servicing height is 110" from the "WL231" axis. Currently, the SAFIRE cryostat top plate is 41" above this, leaving 70" servicing height. The dewar depth is 35" below this point. Therefore the fill tubes cannot extend above the cryostat by more than x, where the transfer tube length is $(35+x)$ and where $70–(35+x)=0$ is the servicing limit. This allows 35" of fill tube extension, clearly more than we need. I therefore submit: the fill tubes shall extend **6"** above the top plate, and the transfer tube shall have a length of 44".

10. Cold plate to have a final cut to be flat. Pattern is 6-32 on a 1/2" grid, tapped for helicoils. Helicoils to be added on demand by NASA. Cold plate to be gold plated if possible. NASA to find out if gold plating possible.

11. Ring bolted onto Helium can for passthrough of wiring. We later decided that the "ring" is the height of the helium shield, so that no additional shield other than the lid is necessary. The ring shall have angles cut such that all joints have dog-legs to prevent stray light.

12. Thermal model to be handled by NASA and PC together. Requirement is that the hold time of the system with no electrical dissipation MUST BE >48 hours. Note from Dominic 00/10/10: from our discussions with Sean Casey, **60** hours hold time is needed.

13. MLI placed on G10 tubes as well as all metal surfaces. >10 wraps at 77K, ~5 wraps at 4K. Wrap along G10 at 77K will spiral or step upward from 77K to 300K.

14. PC to determine how to assemble all the parts. This specifies the sizes of certain portions of the 4K and 77K assembly, such that the cryostat can be dismantled easily. The ADR Insert must be easy to install into the assembled cryostat.

15. Fill tubes to be 1/2" diam; removable fill port flanges. Jam nut at top plate seal to be stainless. Terminate in KF16.

16. Holes in square top plate *and* bottom plate for eye bolts (4 each plate). This will allow the cryostat to be hoisted in either orientation.

17. Connectors on top: 55pin and 2x26pin. Bolted straight onto top flange. Location to be chosen by PC, agreed to be NASA.

18. Helium level sensor to be installed with cryogenic feedthrough. Nitrogen can be bought as 1/4" diameter capacitive sensor down fill tube.

19. Vacuum port to be a K40, welded onto top flange. Two ports required. Location to be chosen by PC, agreed to be NASA. As shipped, cryostat to have one port blanked, one with a Cryolab-type valve w/relief. (see #5)

20. Dewar to be painted some bluish-purplish color. NASA will choose prior to assembly.

21. NASA to provide PC with dimension from cold plate surface to centerline of window.

22. NASA to determine clocking of insert with its cabling with respect to optical window.

23. NASA to provide dimensions for the window. Distance to cold plate is crucial, since there is a "ring" at the cold plate level. What if the shield is **all** ring? This sounds like a good idea (Thanks Mike!) (see #11). The decision was made to use only a single piece cylindrical helium shield with a flat circular lid, bolted onto the helium shield cylinder.

24. For connectors, put the fly-cut flanges every 90° on each of 77K and 4K shield. (4 per shield). One of these will be the window/snout flange (see #6, #2). Diameter of these flanges to be determined by NASA.

25. Mike Jackson to compile drawings into Pro-E to verify compliance with all interfaces. PC to provide drawings to Mike as they become available.

26. Note tilt direction and angle. Have to set fill tubes correctly! (see #8)

27. Space above dewar for transfer tube? Settled in #9.

28. Mike & Dick discussed dewar / ADR insert interface.

29. Cryogen tanks to total 60l. More LN2 may be required by thermal models (#12). Change of tank diameters may be needed to accommodate changed volume or assembly requirements (#14).

30. Total height of cold work volume? Dominic calculated that 2.5" or so was the maximum extension of the original 25cm spec. This will be verified by NASA using the latest optical models (Mike Jackson and Cathy Marx to handle this portion).

31. Fitting at 4K/77K interfaces of cryostat and ADR Insert must be tight, but not too tight. Light tightness at 4K interface is crucial.