

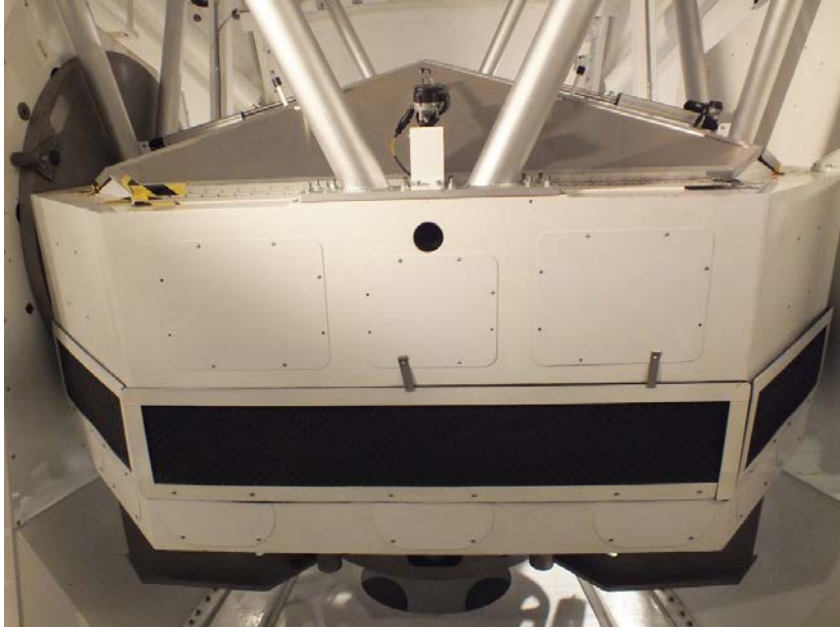
Automated Planet Finder Primary Mirror Cleaning

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7/11/12

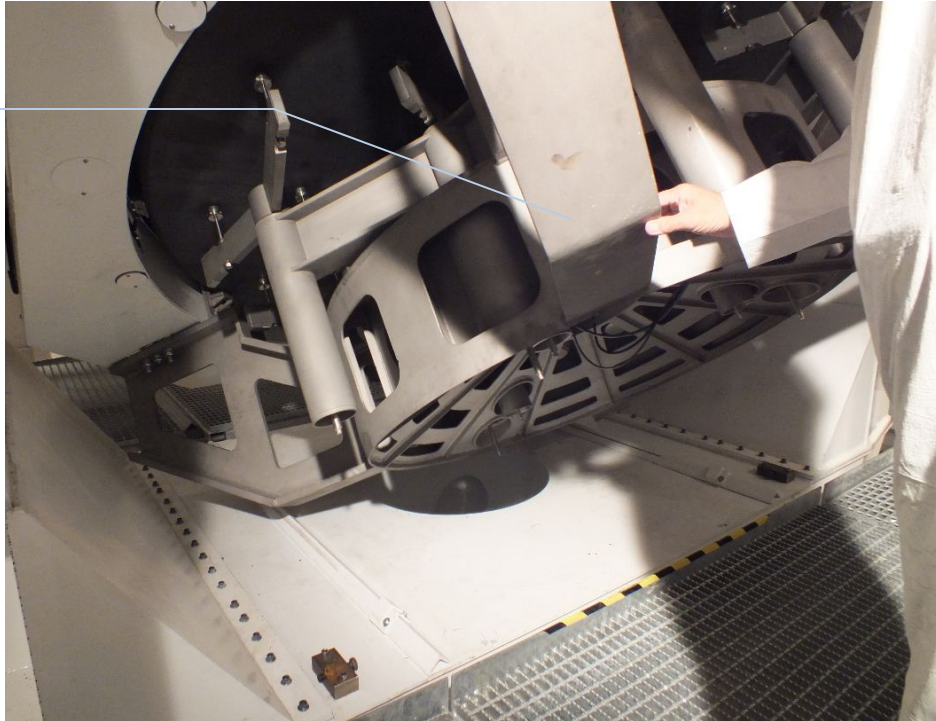
Automated Planet Finder

The main purpose of this trip was to clean the primary mirror of the APF. The instrument shop had recently modified a large-diameter hose to use as a trough to catch any run-off from the cleaning process and we wanted to test-fit it for possible use. As it turned out Dave had recently used a cleaning technique on the ADC prisms in Hawaii that didn't generate very much liquid runoff and he elected to clean the APF primary using a similar method, so we didn't use the trough. When we arrived the mirror was in its normal rest state, pointed up at the closed dome shutter.



We called Kostas and Bob, told them we had arrived, and that we needed instructions on pointing the telescope horizontal, so that the primary would be accessible. We also requested they bring a tank of dry nitrogen and a de-ionizing gun to deliver it. After the phone call the telescope moved freely to the horizontal position and Jim pinned it in place for the duration of the cleaning operation. I don't know whether Jim was instructed to un-pin the telescope somehow to get it to move.

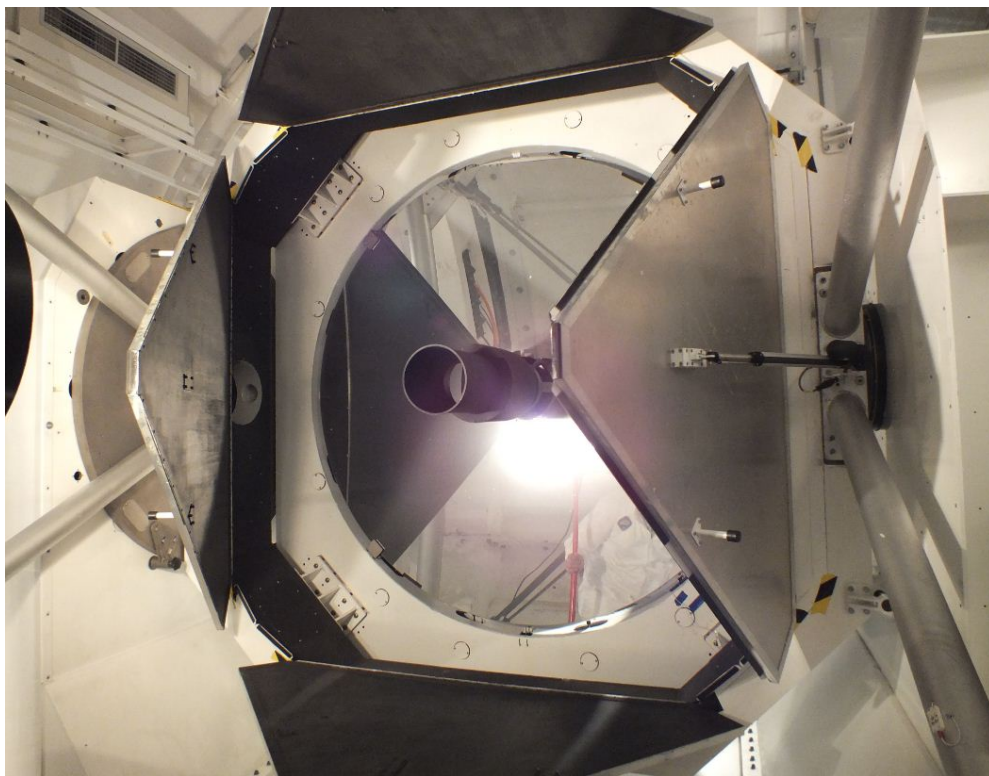
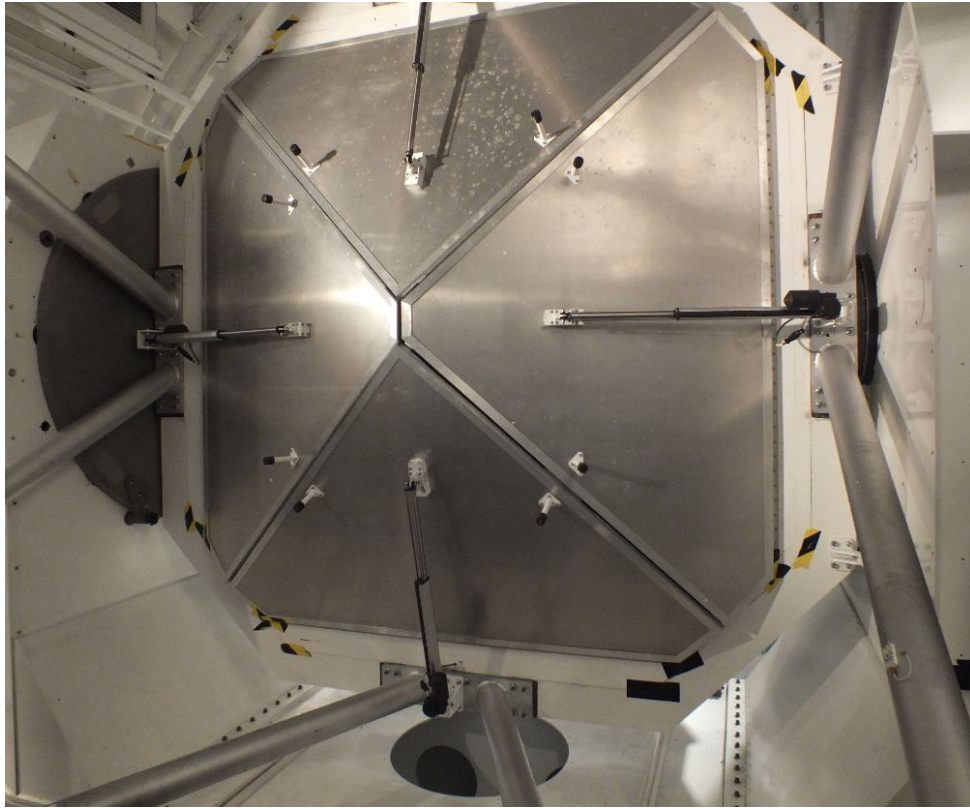
Tilting the telescope down from the back side



Pinning the telescope in horizontal position



Another phone call was made to Will Deich to request he open the covers remotely, which he did. I am unclear on what our options would have been to open the covers had Will been unavailable.



Before beginning the cleaning operation we test-fit the trough for future use, noting where the mirror mounting brackets and other things would require the trough to be modified in order to fit snugly to the mirror.



Dave cleaned the secondary and tertiary mirrors while we waited for the dry nitrogen to be set up (the N2 hose had to be fed through a small hole between the floors of the dome). These photos show those two mirrors after cleaning. The secondary had several scratches near the center and one particularly bad coating blemish that had progressed to about 3/8" diameter.



Surface scratches

Center alignment crosshair



The tertiary mirror still had a film after cleaning, and several spots 1/4" – 3/8" diameter that were not on the surface but in the coating.



Once the dry nitrogen and its de-ionizing gun were set up Dave blew the primary off, starting at the top and working his way down, while Brian kept the hose away from the mirror. The pressure was limited to 50 PSI, where-as 80 PSI would have been preferable.



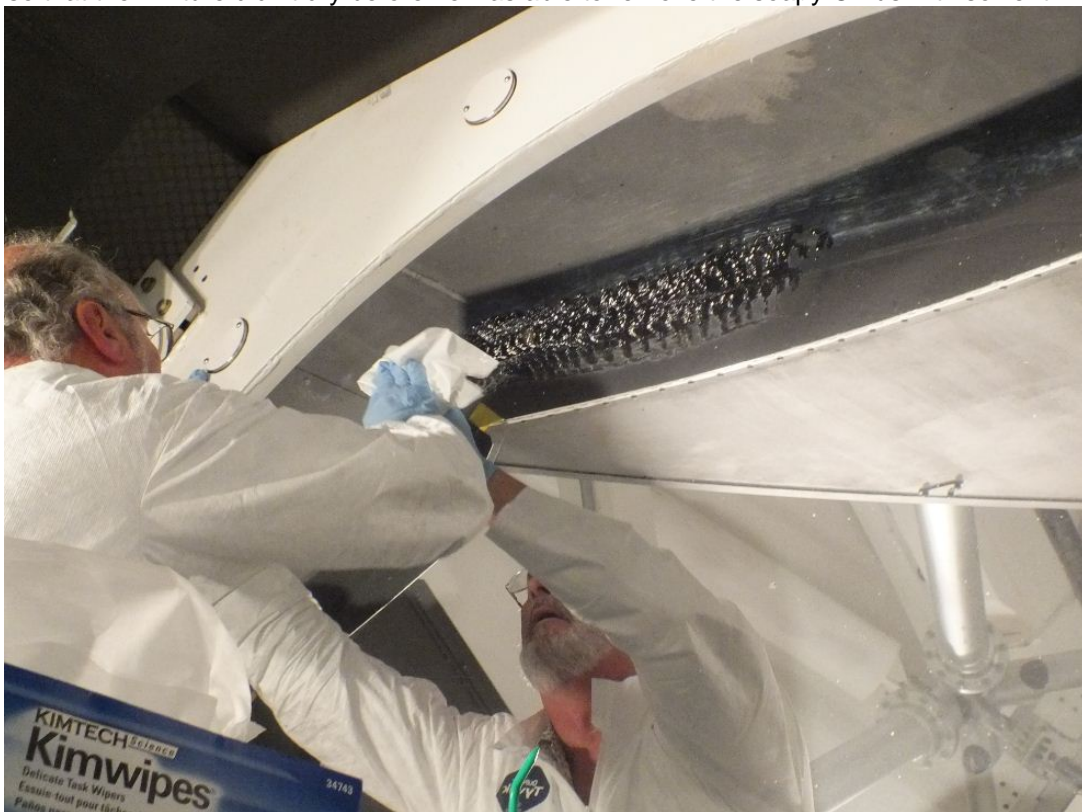
The primary mirror was fairly uniformly dirty. We measured 83% reflectivity with the blue filter and 90% with the red (not absolute, but compared to the reference mirror).





Particularly
dirty
quadrant

Dave's cleaning technique was to pat the surface with an Orvus/Acetone/H₂O mix, occasionally applying extra water from a spray bottle of distilled, de-ionized water. He worked an area of a couple square feet at a time, so that the mixture didn't dry before he was able to remove the soapy Orvus with solvent.



He removed the Orvus/acetone/H2O mix with pure acetone.



In this picture he had already cleaned the top 12" or so all the way across and another 9" – 12" on the left side.

Clean / dirty
dividing line

Temporary
soap buildup



Uncleanable
older and
water spots



After working his way down the left side of the mirror he did the same for the right half, then followed up with a final overall acetone wipe-down. There were some spots that were permanent (at least until it gets its first recoating); they were caused by a dome leak during the mirror installation phase.

CONCLUSION

Once the cleaning operation was complete we re-measured the reflectivity and found it to be 92% with the blue filter and 94% with the red. This represented an improvement of 9% in the blue and 4% in the red.