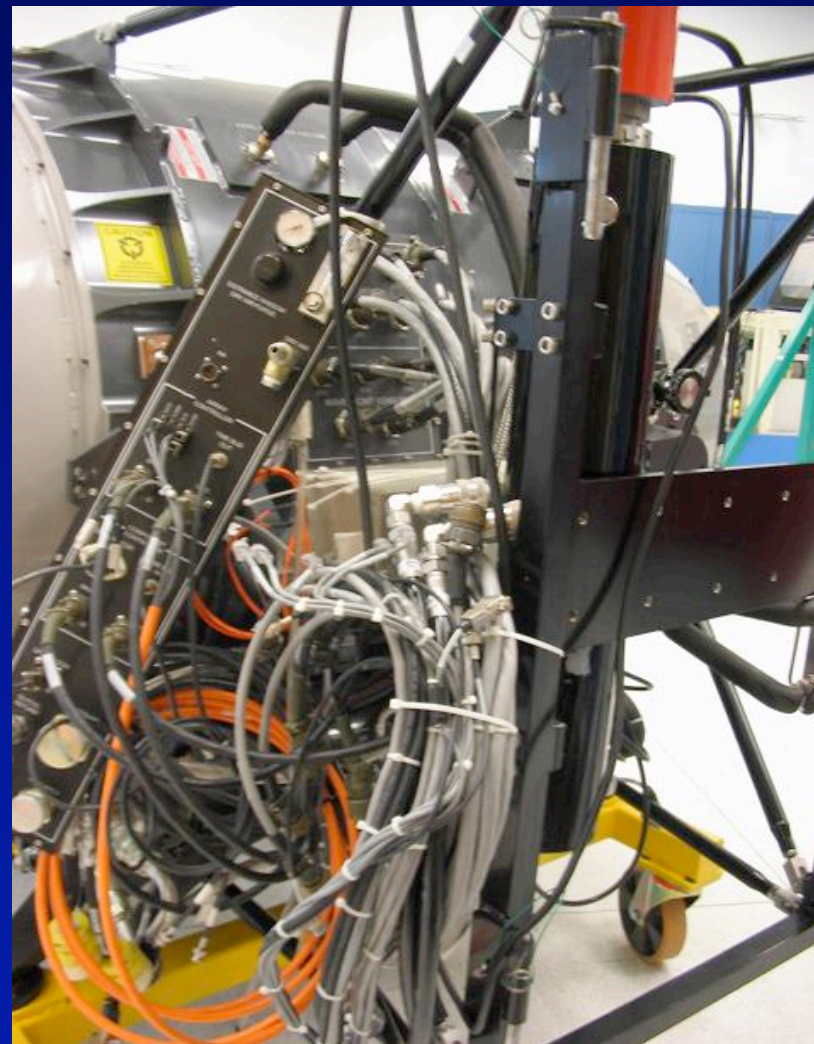


Recovering from the GNIRS Overheating

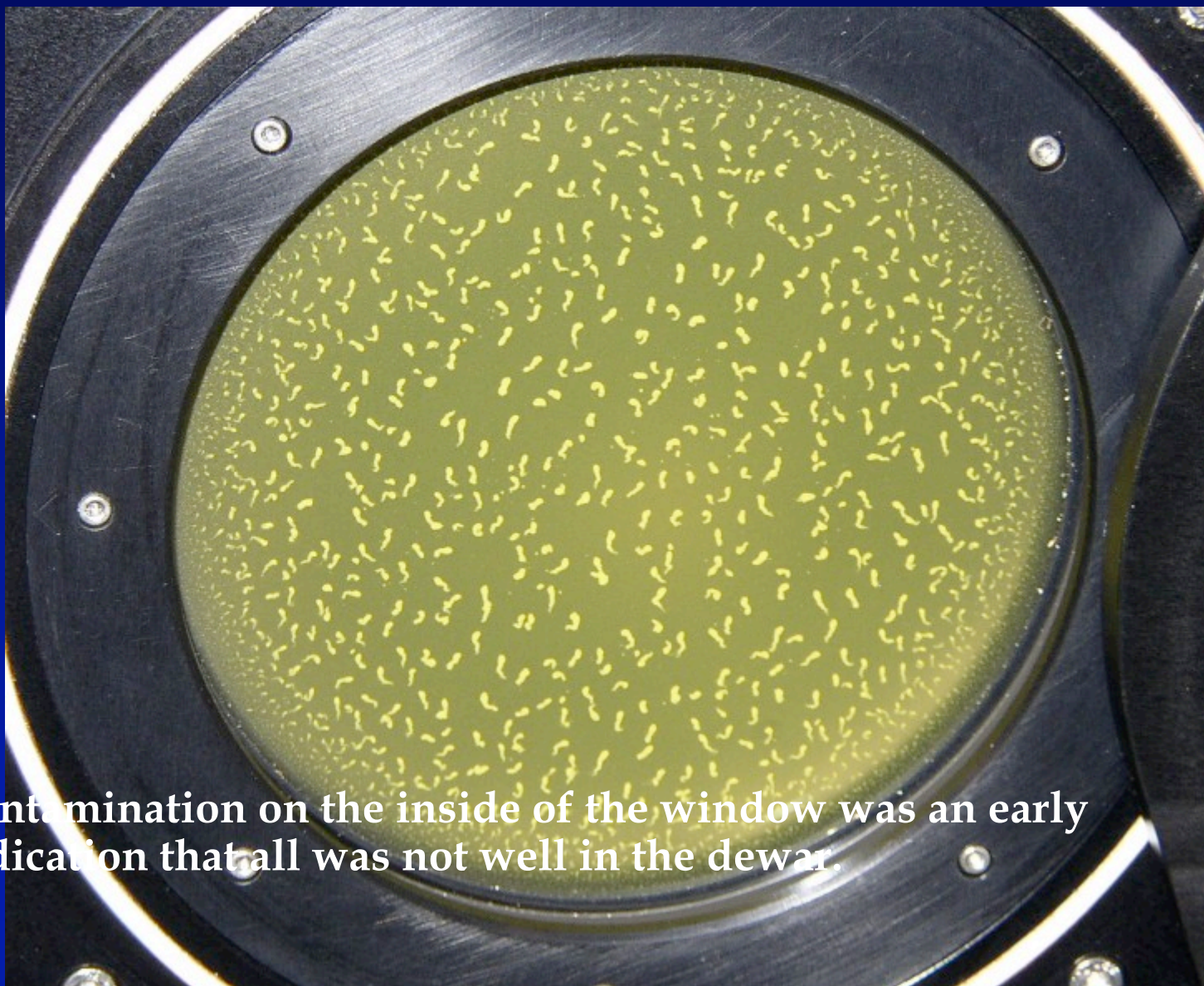
✧ At the end of April, GNIRS was warmed up for routine cold head service. In the process of servicing the cold heads, the fast warm-up system and vacuum pumps were left on over the weekend (which is normal operating procedure).



GNIRS in the lab for cold head service

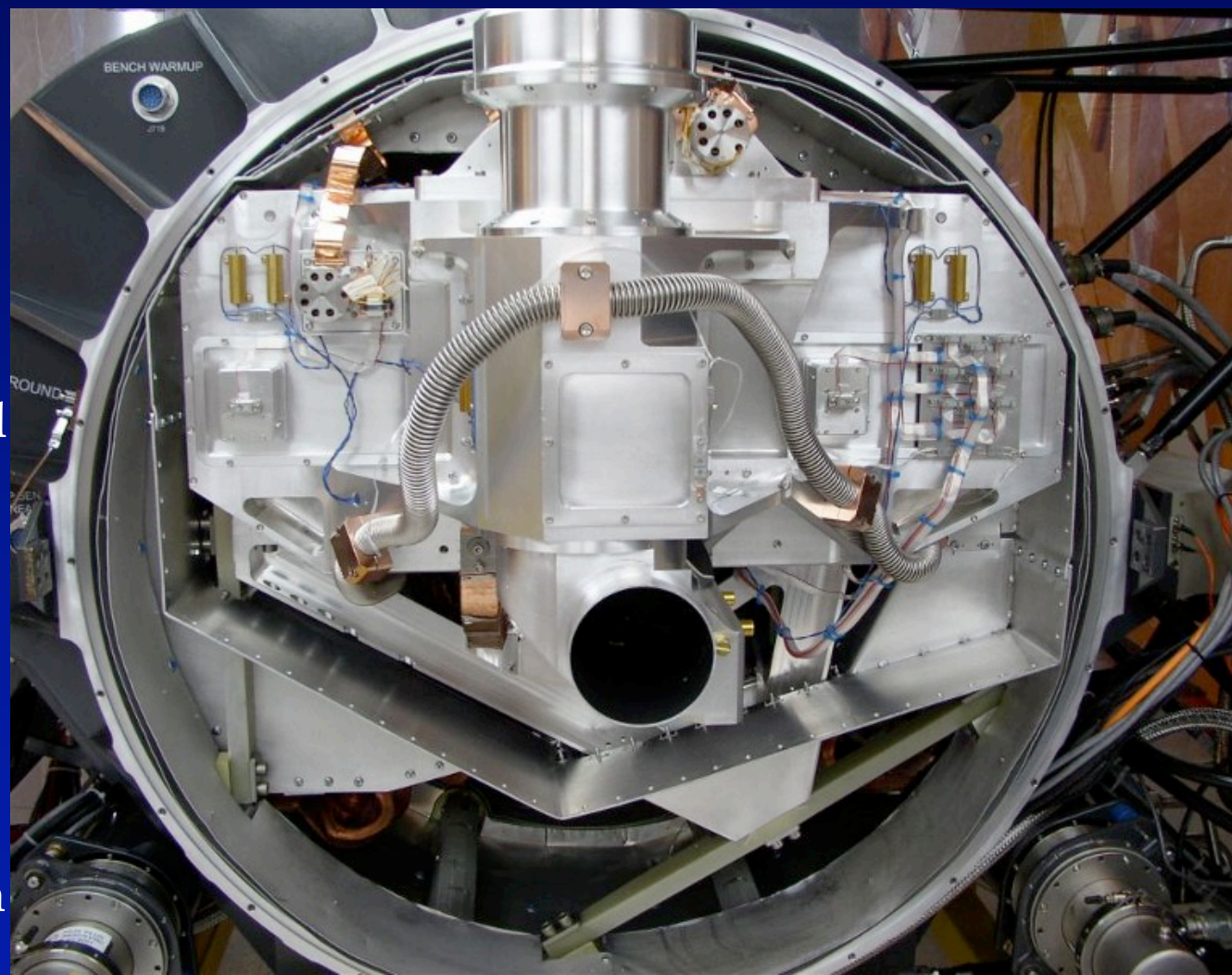
The GNIRS fast warm-up system has been used about a dozen times without incident. The system has a completely independent controller that shuts off power to the heater resistors when a set point is reached. It is independent of all other Gemini and GNIRS software. For some reason the controller failed, continuously heating GNIRS until it reached temperatures near 200° C for an unknown period of time. The fast warm-up system did not have thermal fuses or circuit breakers.

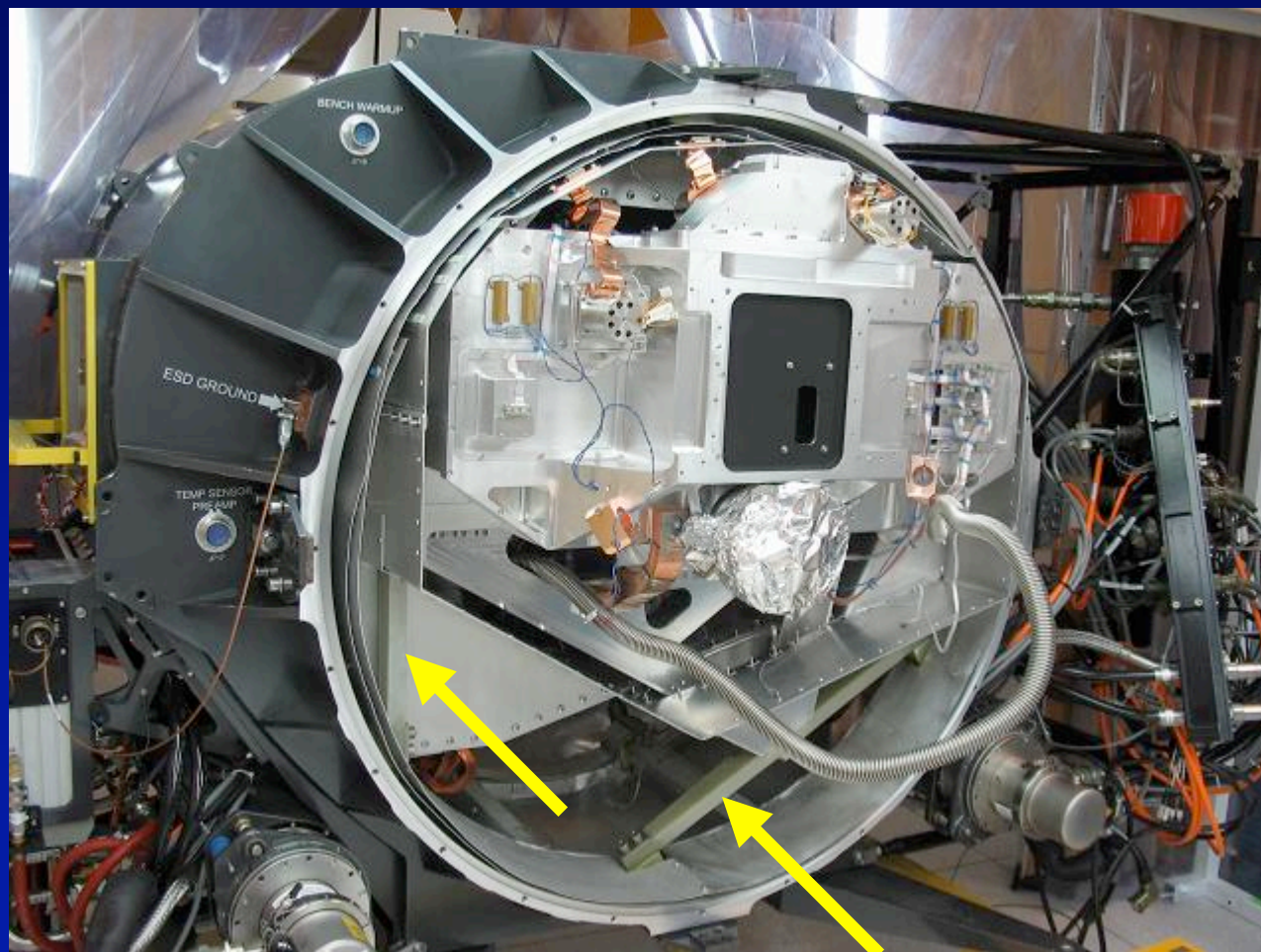
*** When Gemini staff arrived on Monday, they recognized there was a problem and shut the heaters off. They then allowed GNIRS to passively cool for several days with the pumps running. After it had cooled, the dewar was opened and the main components inspected by a team of Gemini engineers and scientists. The “Phase 1” assessment was carefully planned with input from the NOAO staff that built GNIRS.**



Contamination on the inside of the window was an early indication that all was not well in the dewar.

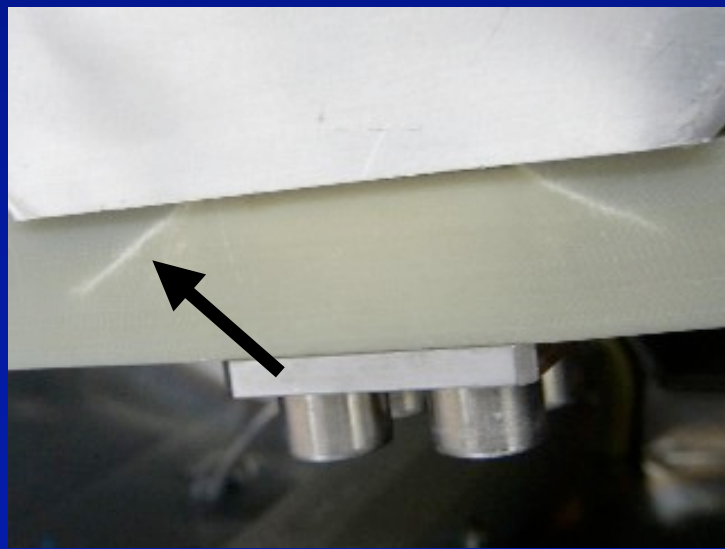
After the initial inspection, it was obvious that some components were damaged, but many are clearly fine. Interestingly, vaporized plastic and resin condensed on the window, the outer vacuum jacket and radiation shields, which were the coolest parts (near ambient temperatures). Much of the interior was relatively clean.





GNIRS suffered some structural damage to the G10 fiberglass struts that support the full weight of the optical bench.

The fiberglass resin did not survive the baking and some of the struts cracked or broke.

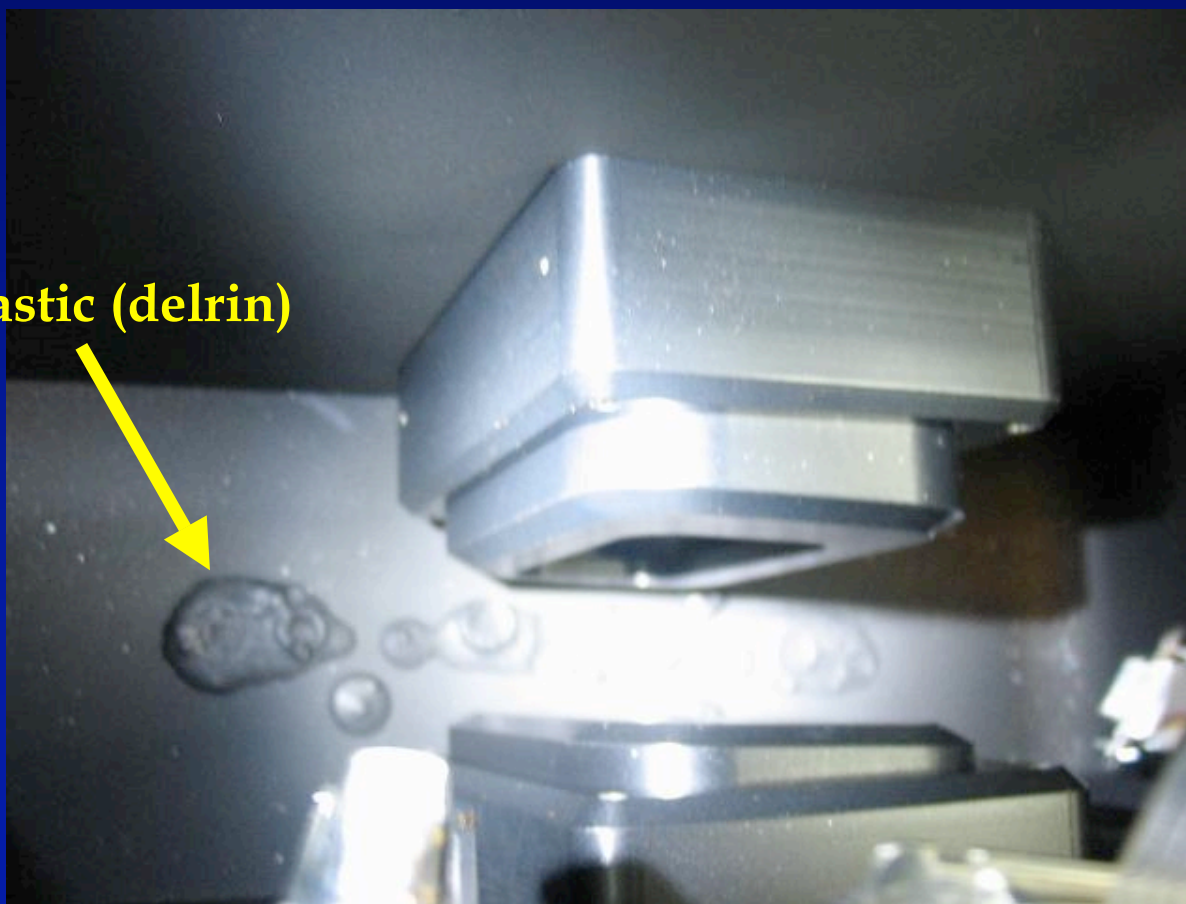


As the engineers looked deeper, the full extent of the damage started to become apparent.



Everything with a low melting point melted.

Melted plastic (delrin)

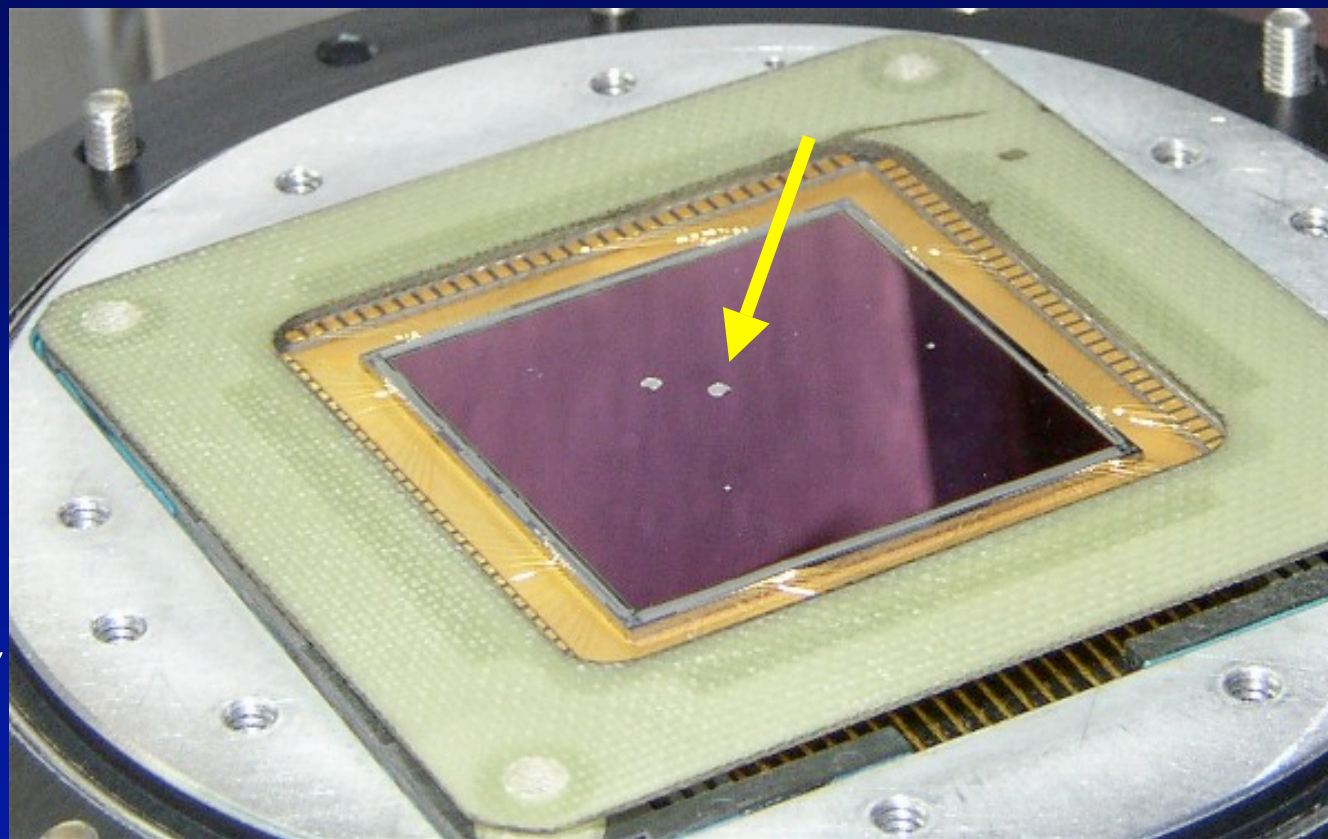




In particular, the delrin plastic spacers used in filter wheels and lens assemblies melted, and will need to be replaced.

The filters and possibly some other optics may need to be cleaned or re-polished and re-coated, or replaced if necessary.

Unfortunately, the science detector was lost. Note the holes in the InSb Aladdin 3 detector – a close inspection shows the bump bonds and MUX underneath. Indium has a low melting point (120°C), and the array was damaged beyond repair.



Indium is used to bump-bond the InSb detector to the underlying Si multiplexer. It is also used as an electrical insulator connecting the cold strap to the detector mount.



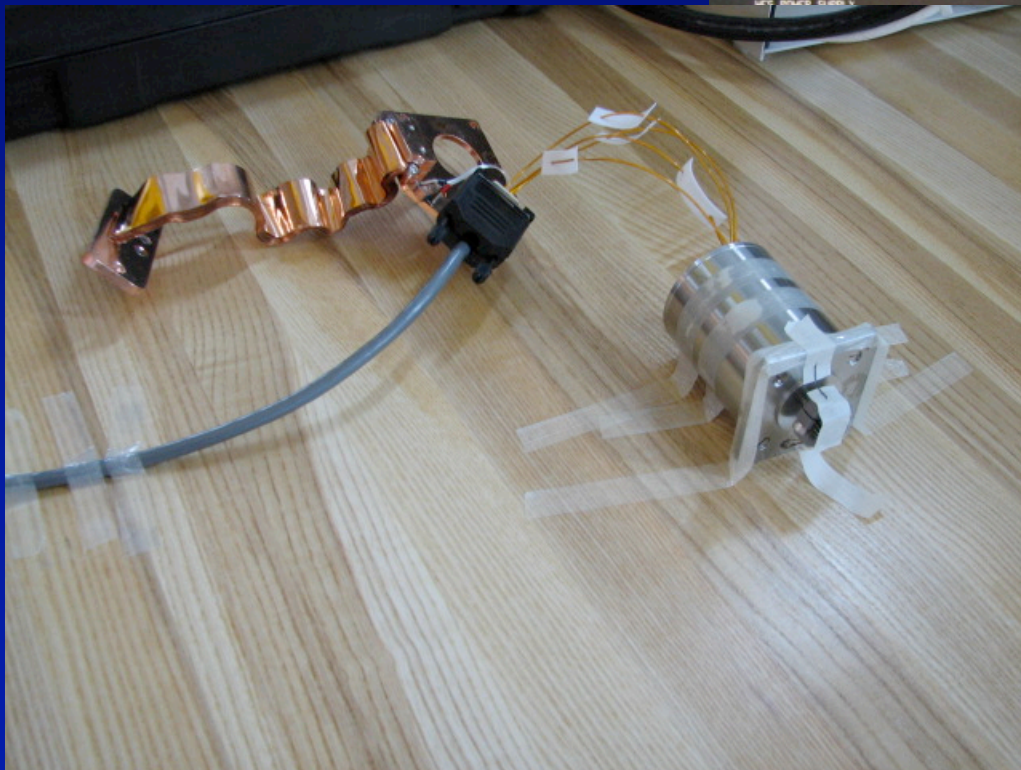
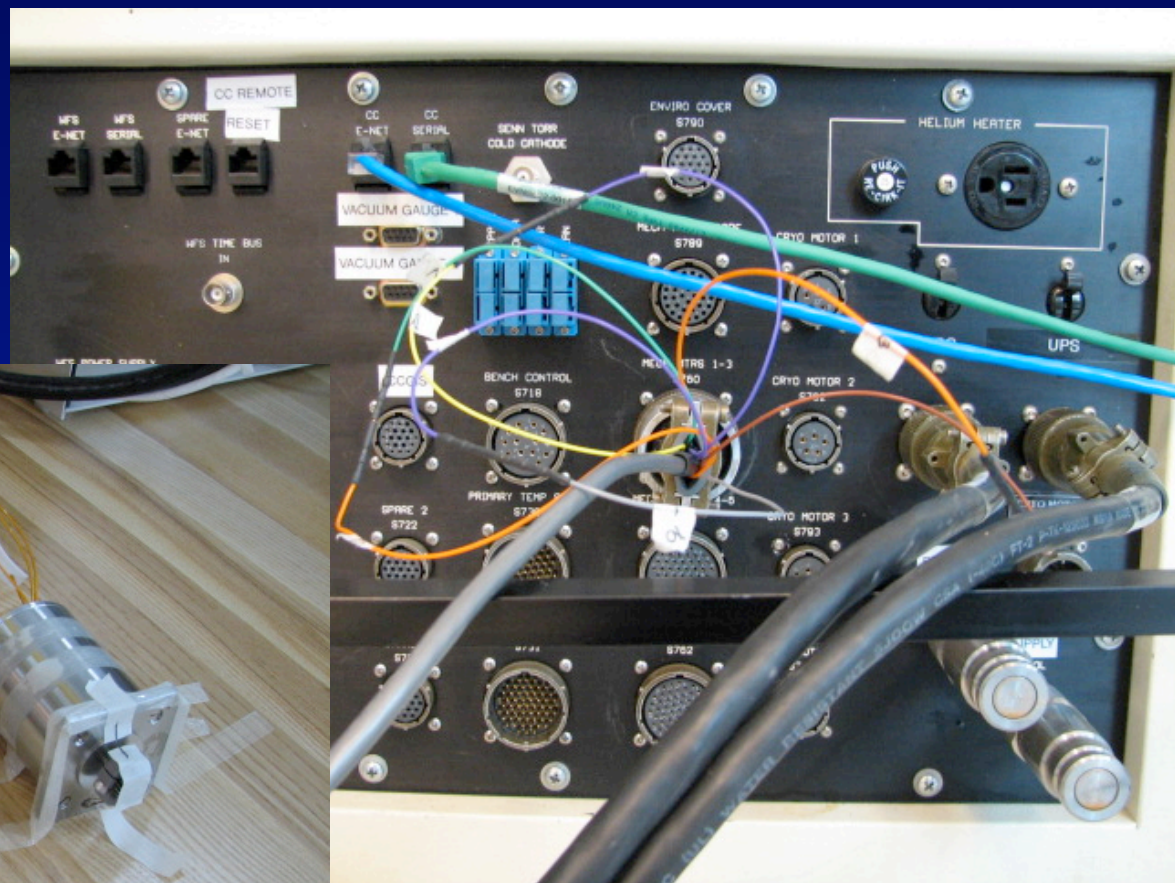
The wiring, connectors, and insulation all appear to have survived.

In summary, the science detector, the detector mount*, the OIWFS detector*, the fiberglass struts, the plastic delrin spacers, the filters*, the window*, the copper cold straps, and some sensor diodes were damaged (we have spares for those marked with an asterisk).

The dewar and optical bench, most mechanisms, the wiring, the motors and electronics appear to be OK. As of May 11, we are still uncertain about the status of the gratings, the optical coatings and surfaces of the diamond turned mirrors, the cold head displacers, and the slit mechanism (delrin). These will be inspected in detail shortly.

- ✦ We are now starting the second phase of damage assessment, including testing all the motors and wiring. We are also testing possible techniques for cleaning the optics and other surfaces. The composition of the residue is being identified at a lab. We are carefully examining everything in greater detail and looking into procuring replacements parts, including a new Aladdin array. To help us with the full assessment, Jay Elias (the GNIRS PI, NOAO) and John White (Gemini-North instrumentation engineer) are on Cerro Pachón working with the Gemini-South team of engineers.

Testing
sensors, motors
and wiring



- ✦ Once we have a full assessment of the damage, we will know what work needs to be done to bring GNIRS back to full functionality. At that point we will decide where to perform the work, and who's help will be needed to do it. It is worth emphasizing that GNIRS is *not* lost—the vast majority of its parts are fine. The work to fix GNIRS will be significant, though, and it will take several months. At a minimum, we will need to rebuild the G10 fiberglass supports and reassemble the instrument. We will need to inspect and rebuild the cooling systems. Some of the optics will need to be cleaned, and some may require re-polishing and re-coating. All the optics will have to be realigned and the mechanisms tested. A new array will be installed, tested, and characterized. Finally, we will recommission GNIRS on the telescope.

Gemini's multi-instrument queue provides flexibility in dealing with the temporary loss of GNIRS. An agreement with NOAO to leave Phoenix at Gemini for the rest of 2007 is being negotiated. A special call for proposals [<link>](#) was issued inviting proposals for additional bright-time programs using GMOS, T-ReCS and Phoenix. NICI commissioning is under way now, and the NICI campaign may begin in 2007B when NICI commissioning is complete. These will all be important steps to insure that the full scientific potential of the telescope is met while this unfortunate setback with GNIRS is fixed. GNIRS is one of our most important facility instruments, and we are optimistic about getting it back on line as soon as practical.