He Gas Recovery at the University of Florida- Gainesville

- The Physics Department at UF Gainesville maintains a helium liquefaction plant for the campus, including recovery of He gas from remote buildings.
- The plant supplies 3000-5000 liters monthly, recovering 90-95% of gas boiled off, enabled by...
- Real time, continuous inventory tracking of both liquid and gas by means of an innovative, cheap and reliable system of remote monitors of their own design and construction. This in turn allows…
- An innovative and efficient liquefaction schedule and distribution plan. This reduces costs so that...
- Customers who recover are billed *per liter used at a unit charge less than that of the raw gas cost .*

Central Campus at UF, showing He gas recovery lines

1. New physics building/ LHe liquifier
2. Health sciences
3. Old physics bldg..
4. Chemistry

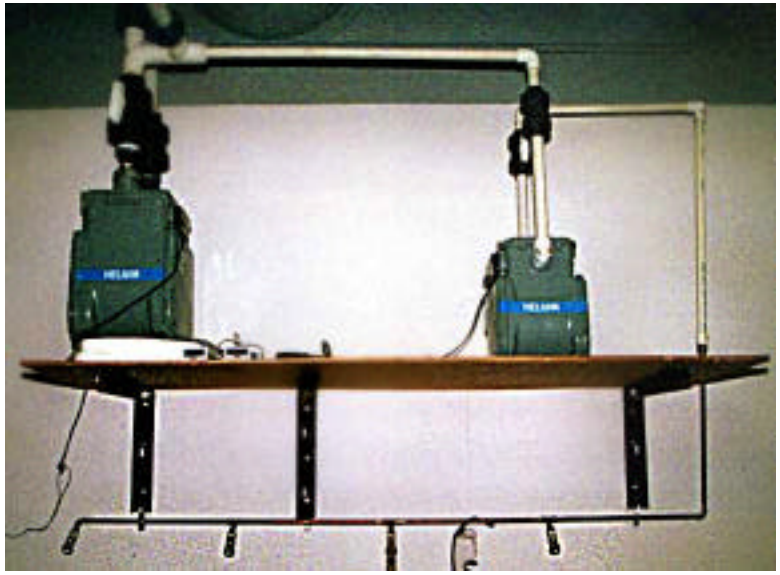
1 mi.

Recovering He in Chemistry

Ballast tank with compressors. Gas bag to right. Cost of equipment in room - approximately $5000.

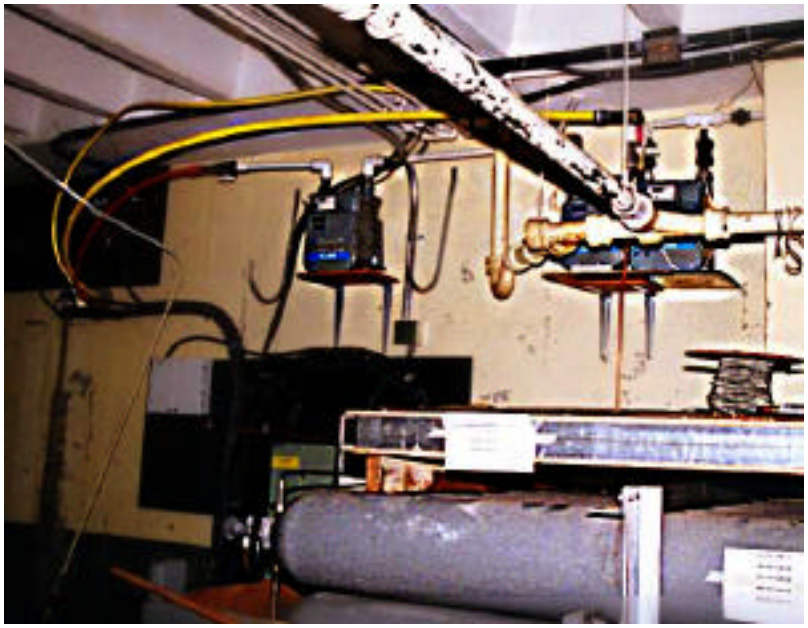
Gas boils off from magnets and flows through Cu piping in the chemistry building at 3" water, and is collected in a 200ft^3 gas bag after passing through the meters.When the bag is 1/3 full, the 4cfm pump charges the ballast to approximately 75 psi. maximum from the bag. If a high flow rate e.g. magnet refill fills the bag 1/2 full, the 11 cfm pump kicks in. A low pressure regulator vents the ballast into the main recovery system (yellow plastic pipe).

4 cfm (left) and 11 cfm (right) compressors



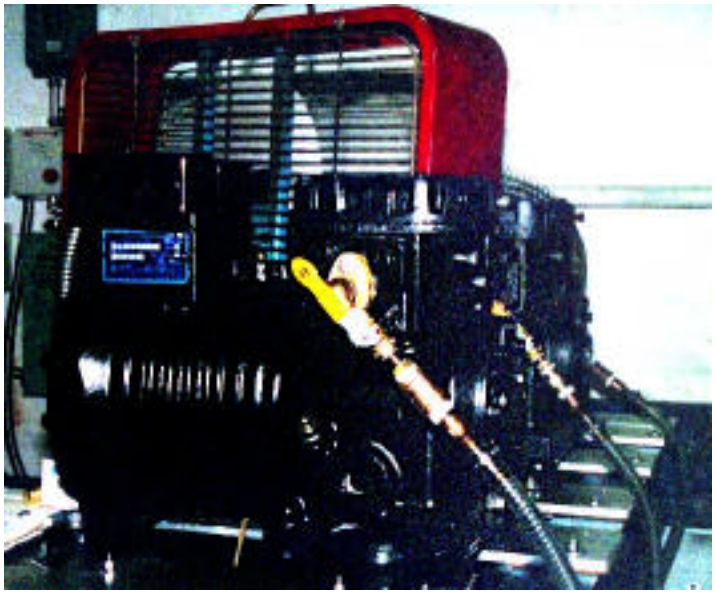
Instrumented natural gas flowmeters measure return from the magnets (left) and recovered from transport dewars (right), which sit in this room until needed, boiling off into the recovery system. Dewars are delivered into this room regularly, then taken and returned by users as needed. The CryoNet system allows users to log in electronically before removing a transport dewar. CryoNet sensors within the building talk on one RS485 string to an old PC on Ethernet in the basement.

Branches Combine at Old Physics

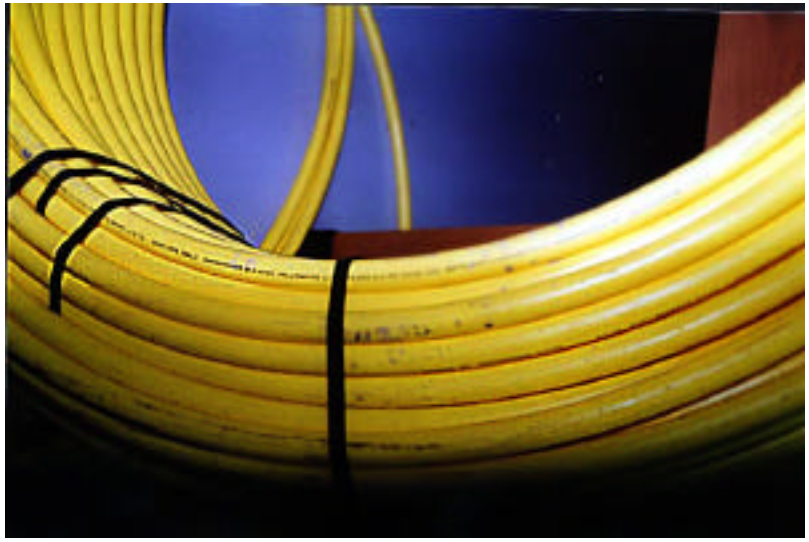


Yellow pipe from chemistry and labs in the old physics building combine at the site of the old liquifier.The pipes run between buildings in communication conduit, that installation done as part of campus network upgrades. The pipes simply “tee” together to another pipe which goes back to the new physics building. More gas meters double-check flow, allowing reliable statistics on gas as well as metrics on the metering system . The meters have random error of a few percent.

The basement of the old physics building was the previous location of the liquifier facility, and large old ballast tanks still catch boiloff from a large microkelvin experiment nearby. Three 11 cfm pumps operate in parallel to charge the ballast tanks. Again, a simple inert regulator charges the main return line from the ballast tanks.



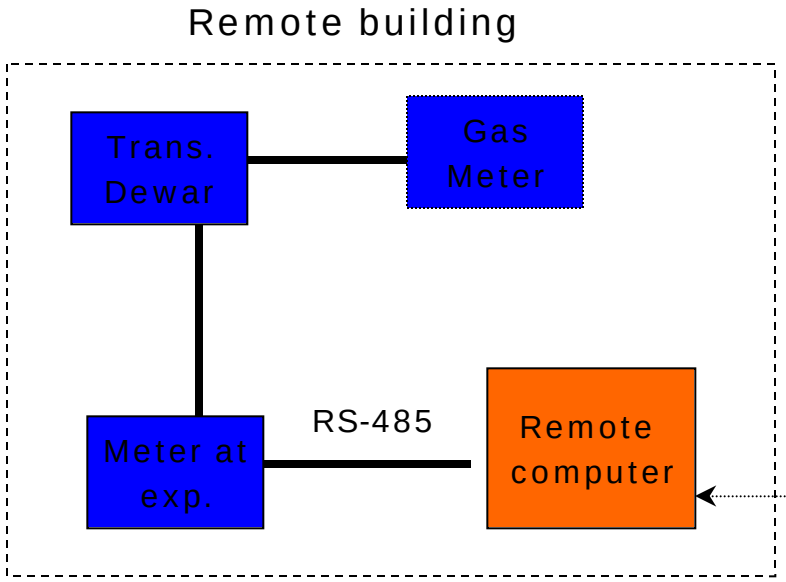
Finally Collected at the Liquifier



This is the polyethylene gas pipe used for plumbing the entire recovery system. It can be pulled through standard conduit in underground tunnels at low cost.

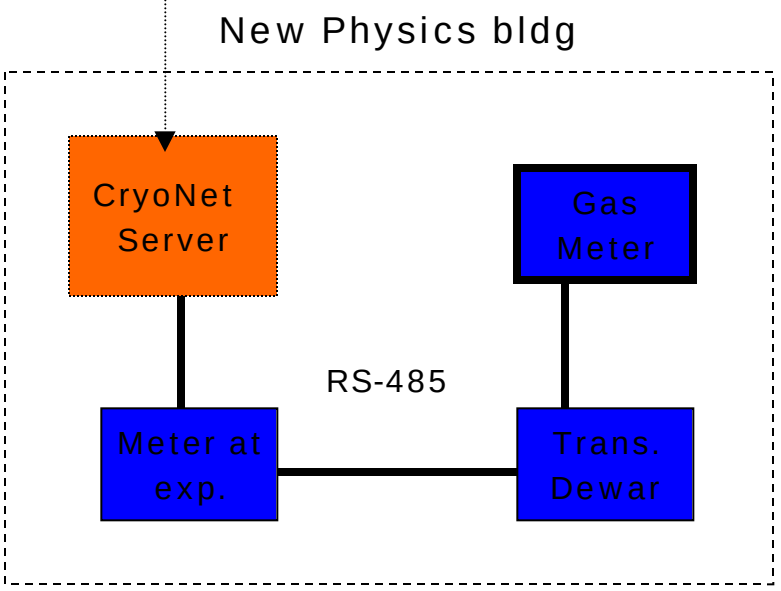
The whole recovery network collects in this 300 ft^3 bag, which in turn feeds 2 18 ft^3 high pressure compressors .

The CryoNet Inventory System at UF



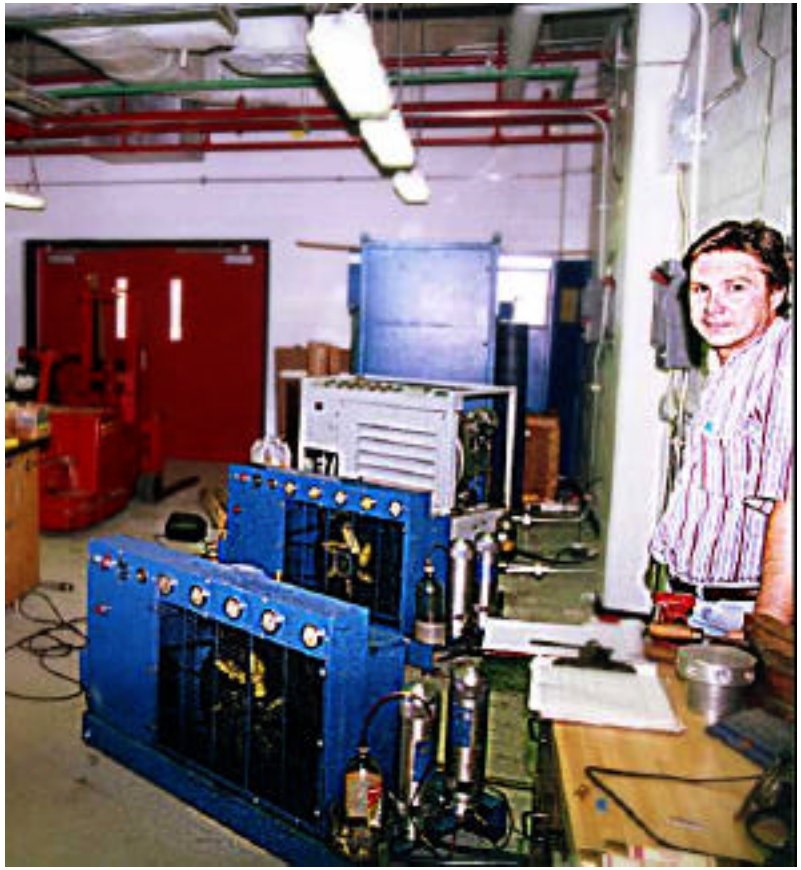
Each sensor station (blue) incorporates a Motorola CPU with memory, ADC and RS 485 communication. The RS-485 line includes power, and each transmitter box includes a rechargeable battery for up to two weeks of disconnected operation. Each transport dewar unit includes a UF designed and built level detector. Dewar and experiment units include lists of users for generating monthly bills centrally.

Campus Ethernet



The addressable serial protocol and robust design of the RS-485 allow a single string of almost any length to be run and added to in a building, alongside the recovery piping. Transmitter boxes bay be removed at any time. Simple terminal emulator programs on old, slow PCs provide communication at each building, and ftp sessions run from daemons query the system regularly over campus ftp, but could as easily use phone modems.

Greg Labbe and the High Pressure Final Compressors



The high pressure tanks fed from here feed in turn the PSI 1610A liquifier, whose own compressor is in the back.

Distribution

The recovery and inventory systems allow transport dewars to be delivered from the liquifier to intermediate storage rooms at remote sites, e.g. the chemistry recovery/dewar storage room. Users may then remove dewars and transfer LHe as their needs dictate, while the facility can supply the campus more or less on its own schedule. This represents a considerable saving of labor and time while ensuring adequate and timely supplies of liquid helium on the UF campus. Furthermore, product can be delivered in small dewars convenient for the customer at no increase in price.

Conclusion

This distribution scheme reduces the price of product to approximately $2.00/liter over the cost of He gas.The high recovered fraction of gas reduces overall raw material cost of slightly less than $0.50/liter, including LN2 needed for liquifier operation(1999 prices). This is a mature project -UF has now 13 years experience with LHe recovery and liquefaction, and this review shows components and systems which are mostly third and fourth generation. Further details are available from Greg Labbe labbe@phys.ufl.edu, and a more detailed guide will be available from the UW -Madison ASC - helium website - http://www.engr.wisc.edu/centers/asc/helium during the summer of 1999.