CLRC

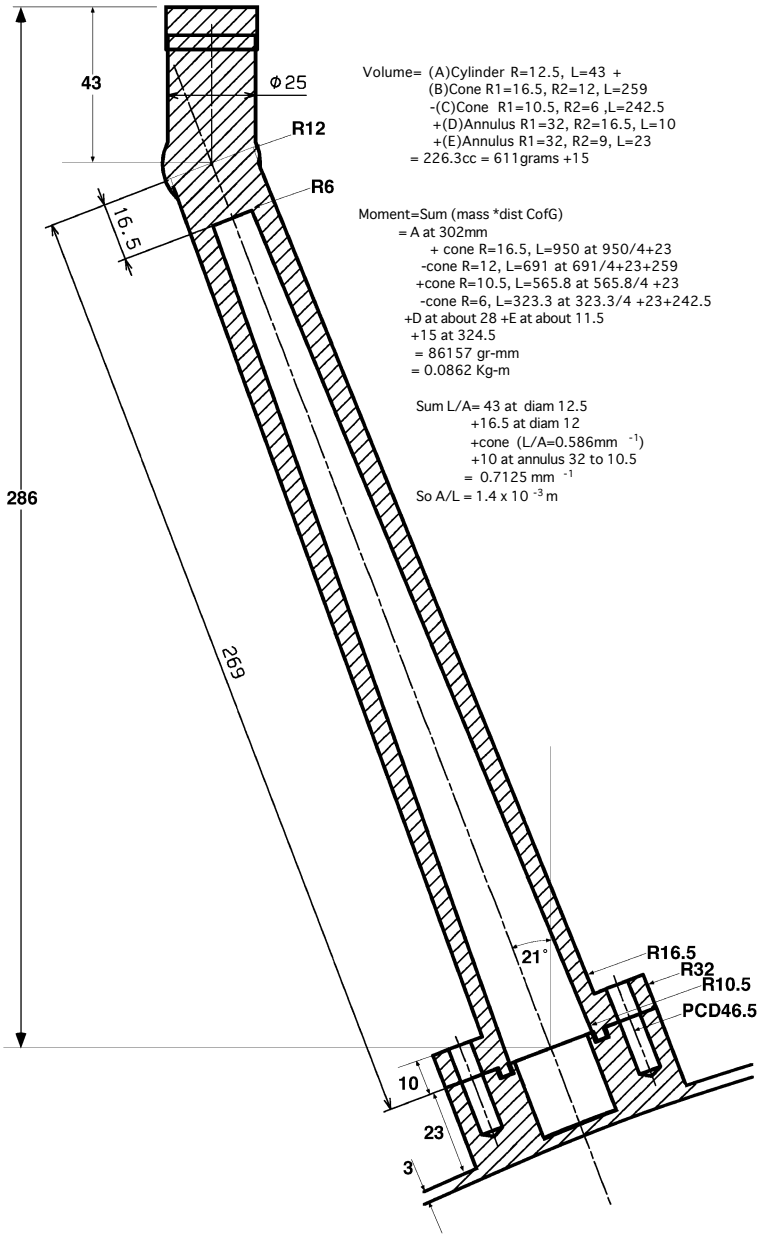
10th April 2003
SPIRE-RAL-NOT-001594

To: Chris Jewel
From: John Delderfield
cc: Horst Faas, Anne-Sophie Goizel, Lionel, Matt, Bruce, Doug, M. Langfermann, Jeurgen Kroeker.

re:SPIRE Cooling Cone

At last Friday's meeting Astrium was "trying as hard as possible" to transfer heat to Spire, using an outline design to set the specification. Cone size was limited by the load capacity of the 3mm tank wall.

The SPIRE cone was of the below form and there was flexible attached to the top of it. Taking half our estimate of the mass of the flexible as 15 grams (right on the top of the cone to be conservative), back of envelope calculations give a mass of 626grams and a moment arm of 0.086Kg-m.



In terms of our agreement that Air Liquide should try equally hard with the real design, please could you ask them to work to just within these numbers (after you've checked them if necessary!).

P.S. I thought I'd do a little basic thermal analysis. I make the A/L of the tank wall plus boss to be 0.113 m and that of the attached extended cone 0.014 m.

Because the wall and boss are made of 5083 with conductivity at 1.7K of 1.23 W/m-K (see next page), their conductance is a paltry 139 mW/K. Unless my conductivity data are wrong, this wall/boss alone renders the present scheme for the closed "ports" all but unusable.

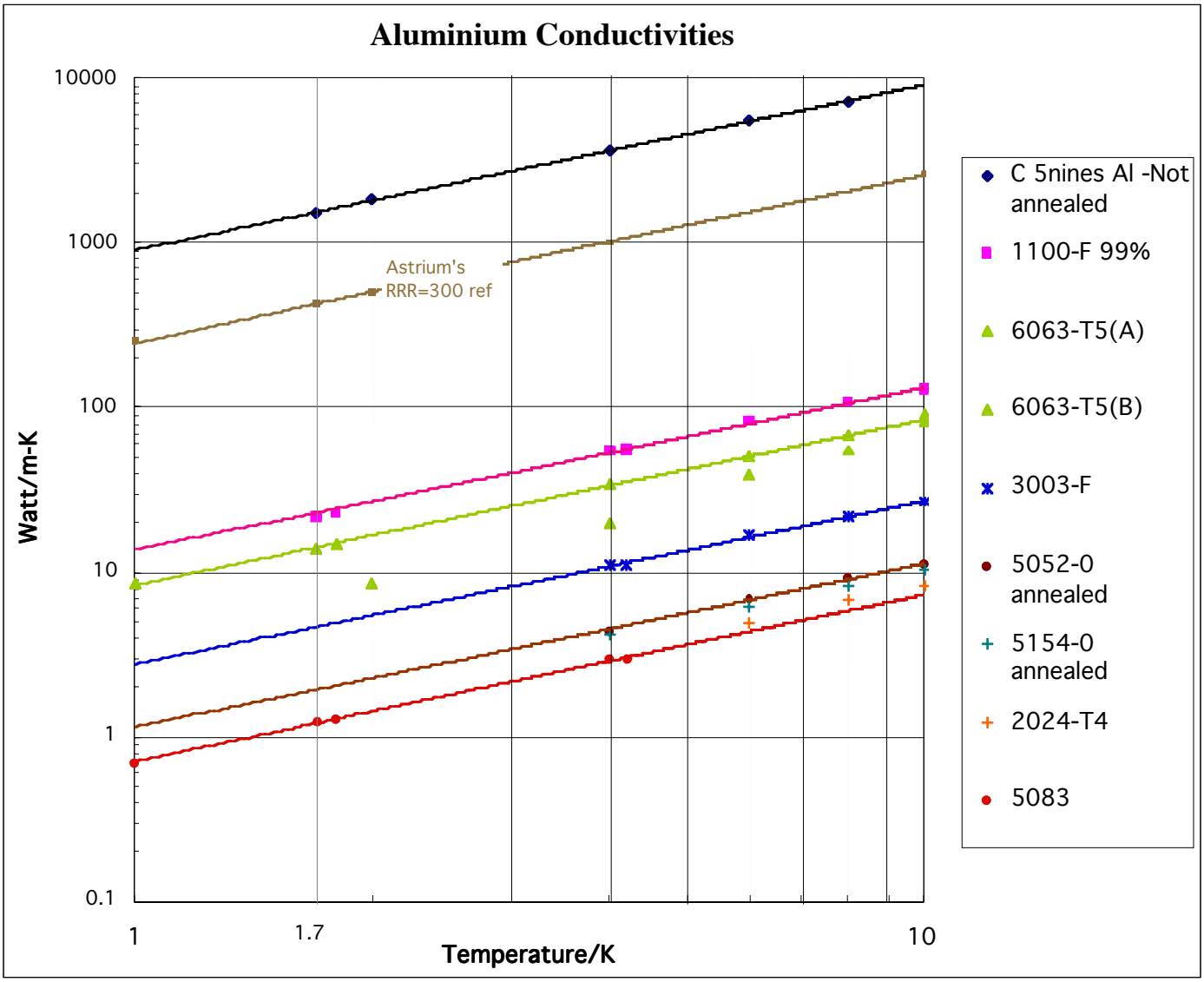
The cone itself, again at 1.7K, is sensitive to material selection for conductivity:

- 5nines Al is 1550 W/m-K conservatively unannealed and handled.
- 1050 commercial >99.5% Al can be as low as 20 W/m-K

the latter being approximately **77** times the worse.

So taking values of conductivity of 1500 and 20 W/m-K, the conductance of this design of cone could range between 2170 & 28 mW/K.

I conclude detailed work and some tests may be needed to achieve the meeting's value and considerably more to meet the 300mW/K that we may still need from this section including instrument I/F conductance.



Possible improvement for closed ports, requiring hand tapping, although it's not really a fix: