Subject: Scholes cabin 5: Rust bucket

19 February 2090 0700 UTM -47.8000, 3.4815

Dear Stirling,

The Agulhas is thirty years old, but you would not believe it. She is being replaced not because she is falling apart, but because the needs have changed, and technology has moved on. One of the reasons she still looks so good is because she is very well looked after. On the long voyages between Cape Town and Antarctica the crew are always busy: scrubbing, scraping and painting. Nearly every bit of the ship, inside and out, has been painted since we have been on board. The ocean is such a corrosive environment that every metal part must be repeatedly covered in paint to keep it from rusting. The moving parts get a big dollop of grease instead. No wonder the captain gets grumpy when our lab is not as tidy as his ship, and he is quite right.

You would think they might make ships out of something that does not rust, like stainless steel. Well, they could, but it would be very expensive, and stainless steel has some properties which are less desirable than ordinary mild steel - it tends to be brittle, and is hard to weld. Most grades of stainless steel are not completely immune to corrosion, just resistant. Some fancy ships, where cost is no barrier, are built out of aluminium or even titanium. It is practical to build smaller vessels out of fibreglass or carbon-fibre reinforced plastic resins, but I have never heard of a ship this big being built that way. I am not sure how it would cope with ramming through ice. Of course, in the old days ships were built of wood, and there are still people (me included) who love wooden boats, but that is even more high-maintenance than steel, and there aren't that many big trees left in the world. So in the long run, ordinary mild steel is still the best material. That means scraping off any rust that develops, then painting it; and doing so again and again.Mixing different metals is a bad idea. When the junction is wetted with salt water it forms a battery that gobbles up the metal even faster. That is called 'galvanic corrosion', and sometimes you can use it to your advantage. Do you remember when we visited the aircraft carrier in Corpus Christi? They had rigged up a lump of metal in the water next to it, and applied an electrical charge between the lump and the ship. That way, the lump will corrode rather than the ship. Our UCTD probe has a similar arrangement, only in miniature, called a sacrificial anode. Galvanised iron works the same way. It consists of a thin layer of zinc plated onto the steel. The electrochemistry favours corroding the zinc before the iron, but zinc has a nice property of forming an oxide when it corrodes which acts as a barrier to further corrosion.

So when we get back to Cape Town, the ship will be shiny and bright in its white and red colours. We will look a bit scruffy. Beards and wild hair are almost compulsory in Antarctica, for men anyway.

Love,

Dad