

Oxygen Fire in an EMS helicopter

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On 2 May 1997 the Brisbane office of the then BASI was advised of an accident involving an ultralight aircraft at a place called Tartrus Station. This turned out to be about 100 km north of Rockhampton, off the old road to Sarina. We elected not to attend this accident as the occupants were not fatally injured, and we would be able to obtain reports from them in due course.

After some time word came through that a helicopter had caught fire at Tartrus Station. Was this the same accident, or had the rescue helicopter come to grief? Confusion reigned for a while, until we were able to establish that the helicopter had not crashed, but had caught fire after landing. We then decided to go to the accident site and investigate both accidents.

Witnesses told us that the pilot had been the only one near the helicopter, and all the other people were some distance away with the light aircraft. They heard a loud bang like a rifle shot, then the helicopter was seen to be on fire. The pilot had been blown backwards and laid flat on the ground. He was temporarily deaf and suffered bruising to his chest. Because there was no fire fighting equipment available, the helicopter was completely burned. Its fuel tanks had contained some hundreds of pounds of fuel.

When we arrived at the site it was obvious that the fire had destroyed the helicopter. This said, we needed some evidence as to what the source of the fire had been. One item that was unusual was the length of braided hose that had a gauge at one end but seemed to be burned at the other, and did not appear to be connected to anything. The other end of that hose was later found at the regulator. A length of that hose was missing. It was therefore looking as though an oxygen fire had been the problem. That night I tried to contact people who might be able to assist in investigating an oxygen fire. A Department of Mines inspector was not available, so I tried the Police, who made a scientific officer from Brisbane available. He came on site for an initial inspection and we decided what items to keep for further investigation.

Back in Brisbane further attempts to gain expert assistance were made through the oxygen manufacturer, the Queensland Government Mines people, and SIMTARS (Safety in Mines Testing and Research Station). No one was able to assist with an examination of the pieces and a determination of the cause of the fire. The Police scientific officer had done some research for me, and had taken some scrapings from the insides of pipes so that he could identify the materials in the oxygen system. Ultimately, we went to the Defence Science and Technology Organisation in Melbourne, where staff had experience in a number of military oxygen fires. Simon Barter proved to be of excellent assistance.

Prior to this time my only experience with precautions relating to oxygen was that you don't go near it with grease, or oily rags. I soon learned that there are at least ten ways to start an oxygen fire, but most of them are avoided by proper precautions at the design stage. All the parts were examined and checked for oxygen compatibility. This resulted in a comprehensive report that later became a significant part of the Bureau's public report.

Reports were obtained from all the people involved with the design and installation of the oxygen system in the helicopter. It appeared that all involved had been working to the best of their abilities, and had not been negligent in any way. The big problem was that some information was wrong, or people did not know enough. Information was also obtained on the instructions issued by aviation regulators in Australia – military and civil – and the USA. It became clear that the Australian civil requirements were lacking and did not place sufficient emphasis on the design of the medical oxygen systems. A copy of an STC from an American manufacturer was also obtained so that I could compare the instructions issued for this helicopter with those issued by another approved manufacturer.

Through Simon Barter I was also put in contact with an engineer at Queensland University, named Ted Steinberg. He had close associations with NASA and the American Society of Testing and Materials, of which he was a member. It was clear that no adequate process had been involved in the design of this oxygen system.



The helicopter was extensively burned. Rivulets of different metals began running down the slope near the rotor blade.



The end of a braided hose was melted. The rest of the hose was missing.



The beginning of the hose was attached to the regulator of the large bottle. A second bottle and regulator were the portable system, which had also had oxygen burning from it.



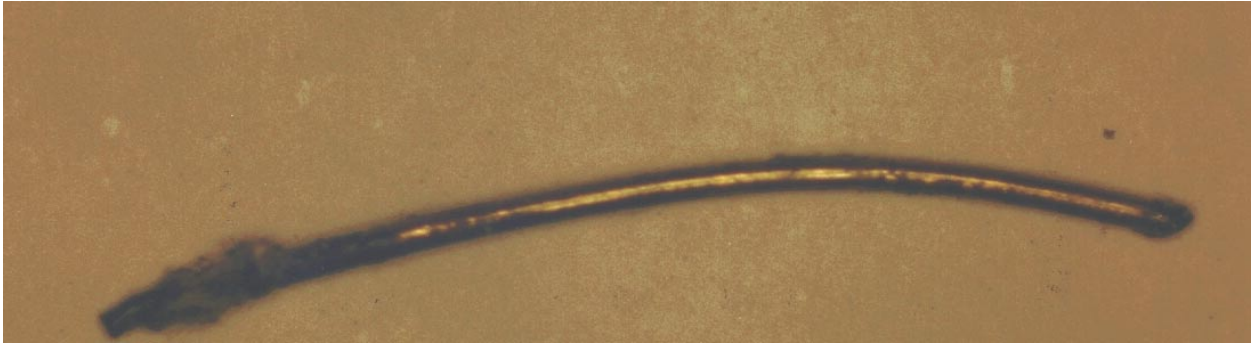
It was necessary to gain an understanding of the installation before the fire. This one was similar, but this one had two bottles permanently fixed. Note the loops of hose visible where the cover has been removed.



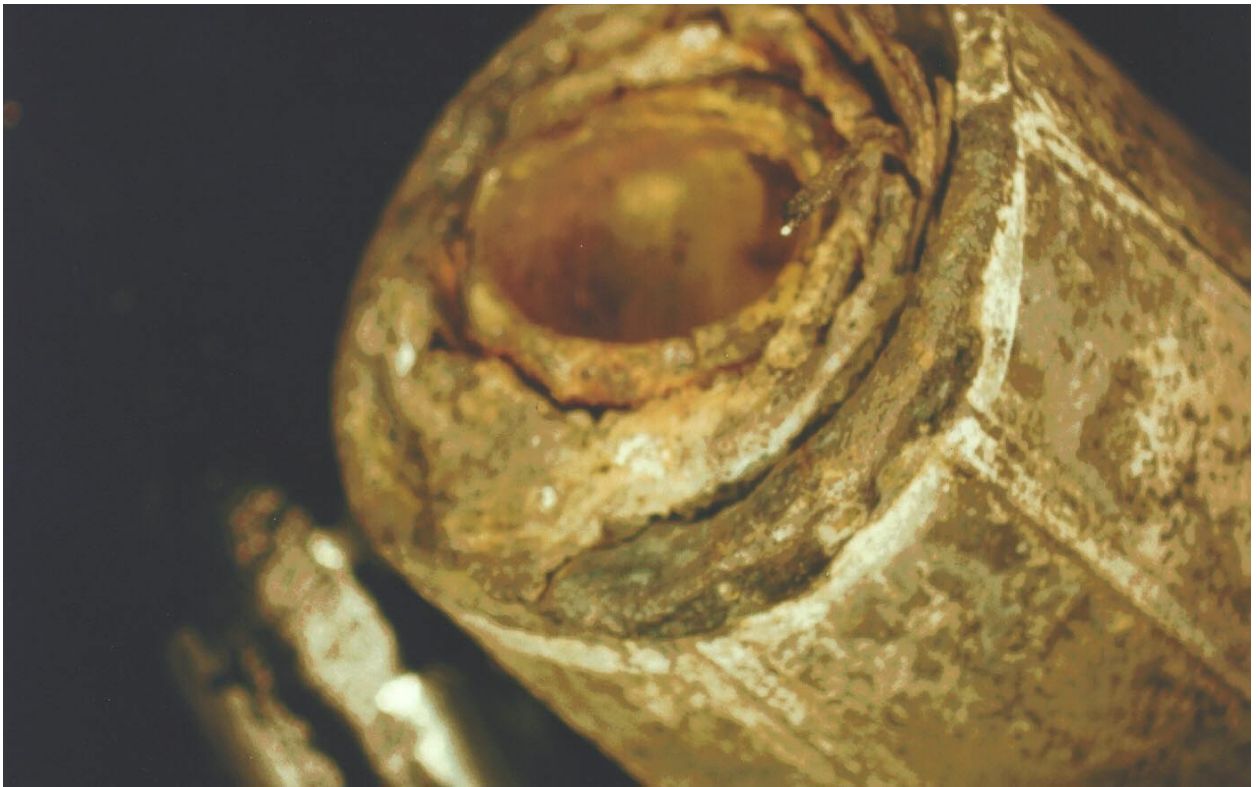
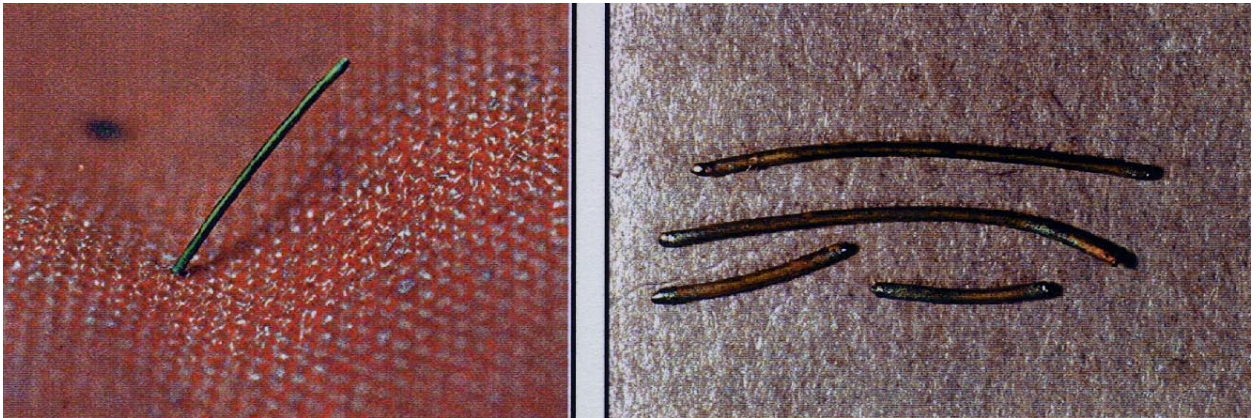
A fixed wing aircraft was found with an unsafe installation of oxygen bottles and hoses in the nose locker. There was no way to turn these bottles off from inside the aircraft.



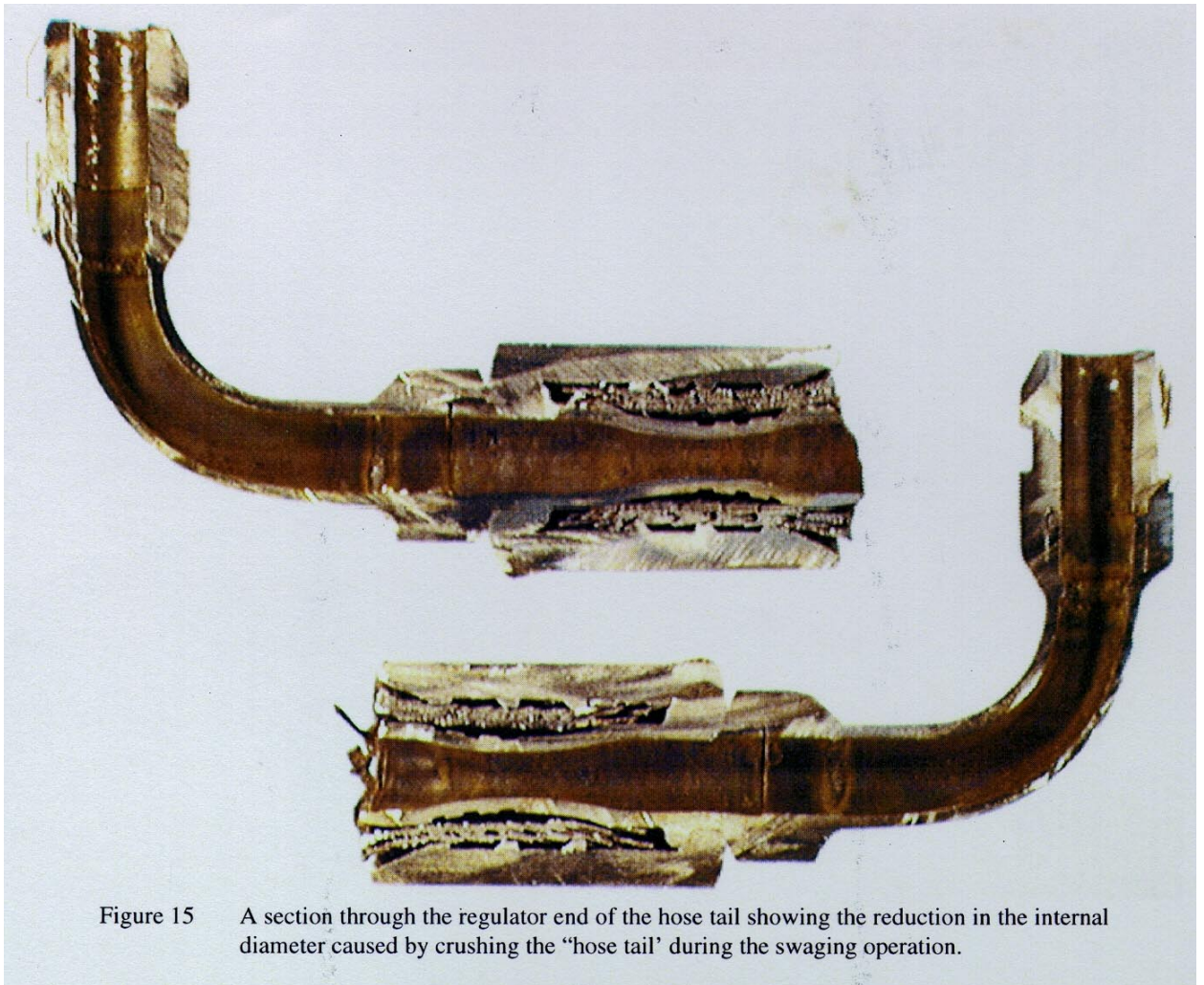
The hose running into the cabin was not restrained, nor protected from chafing, or cutting.



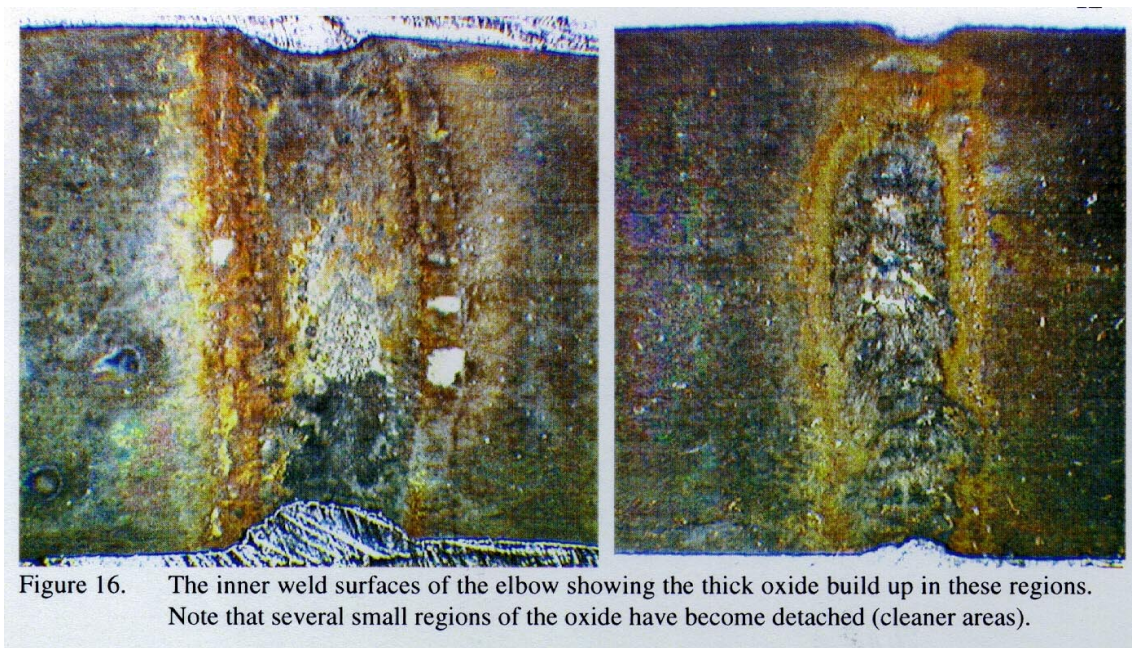
Pieces of wire braid were extracted from the pilot's flying suit and neck. The ends of the steel wire had melted.



The hose fitting at the regulator was solid enough to stop the oxygen fire before the regulator. Some melting took place. Remember that all of the oxygen fire occurred in about 0.3 seconds.



The crimped fittings had been over-crimped, creating venturis to accelerate particles in the gas flow.



Welding flux broke off the inside of the welded fittings, which were industrial, not aircraft quality.

