

Lecture 22  
by Bob Parker

## Scientist-Astronauts and Lunar Science

*Oxygen toxicity* (cont'd from Larry's lecture last week)

Most problems are reversible, but there are some acute and irreversible problems if you breathe oxygen at a partial pressure of greater than 2 atm (e.g. lung collapse, pulmonary problems).

“Test as You Fly, Fly as You Test; Train as You Fly, Fly as You Train” presentation

Intro:

Graduated from Caltech, played a critical role in scientist-astronaut program. Finished his NASA career as manager of the flight propulsion lab.

Important to test your craft as you're flying them, and actually fly them as you test. But it's also important for operators to be very well trained at operating the machines and executing vital procedures; also, having them train at operating the machinery along the way can actually influence the design of the controls.

Showed some photos of Link Trainers, which were cockpit simulators used for flight training. Also showed images of simulated capsule cockpit; LM simulator with the computers controlling it; room with the simulated lunar surface.

The landing site model was new for each mission, of course, since it was intended to model the mission's unique intended landing site.

Joint Operating Plans (JOP): involved flicking a lot of switches to control various instruments during flight (to do things such as observe the sun at a particular time); astronauts were trained for doing even this on the ground.

Astronaut “training” trains both the astronauts and their trainers; everybody needs to become, and stay, proficient at their own jobs. For example, the guy whose job it is to monitor 5 conversations at once? That requires a lot of experience and training!

[Slides of geologists doing field work and training scientist-astronauts]. The geologists taught astronauts about what to look for and how to proceed with a geological survey in the moon buggy on the moon (this training session was its own sort of simulation).

Astronauts also trained in their spacesuits, to get used to them and figure out what they'd be able/unable to do during particular, planned procedures with that kind of encumbrance.

[Image of the lunar lander simulation vehicle.] This was a tricky vehicle; 4 flights, 4 crashes.

[Image of a trainer cockpit for the shuttle spacecraft.] Simulator is almost identical to the real thing, but you can't practice landing in it.

Required training on how to operate *everything* – including operating the particular types of cameras, etc. Needed to learn how to prepare and eat zero-gravity food, and use the spacecraft's toilet, too.

In summary, training is important because of:

Risks – being competent to handle a bad situation; being trained so as to *avoid* complications that could arise from not being familiar with a procedure

Proficiency – assuring that, on the operator side, things should go smoothly and competently

Design and Development – the astronaut's role in helping define/develop the design so that the machine is optimal for astronaut interaction and mission needs

Q&A:

Parker thought the actual scientists (e.g. the geologist) were actually useful, and should be included again if we go back to the moon.

Parker believes that we should probably go straight to Mars, rather than going back to the Moon. Doesn't believe the Moon is really necessary as a training arena for Mars; the Mohave desert, with more and more sophisticated robots doing largely autonomous tasks, would work just fine.