

# Making a List, Checking It Twice

October 14 2005

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Last month, the Desert RATS (Research and Technology Studies) team spent two weeks roaming about on a cattle field near Flagstaff, Arizona. Their objective: test out advanced technology - space suits, an automated rover, communications equipment - that may be used some day on human missions to the moon and Mars.

Dr. Dean Eppler, a geologist at the Johnson Space Center in Houston, Texas, was one of the two participants who worked with the space suits.

Near the end of the two-week period, Astrobiology Magazine's Henry Bortman interviewed Dr. Eppler about his experiences. In this, the final segment of a three-part interview, Eppler talks about working with a rover and using a helmet-mounted electronic checklist.

**Astrobiology Magazine:** This year's field tests focused on working with a semi-autonomous rover as a robotic assistant. How much of a difference does it make to have a rover along to do the "heavy lifting"?

**Dean Eppler:** Last week we were on the back side of the crater, and we weren't using the rover. We were doing a number of fairly difficult traverses. By Friday afternoon, both Keith and I were pretty well worn out. It took two days to recover completely - and these weren't even particularly long suit runs; they were like half-an-hour, 45-minute suit runs.

Today and yesterday we did suit runs with the rover that broke records for me. I was in the suit for an hour and 45 minutes. We covered more

ground; we did as much if not more; and I'm not particularly tired tonight.

The lesson, which was learned on Apollo - and I've known it intellectually but it's kind of interesting to kind of learn it viscerally - is that rovers don't necessarily buy you speed, but when you're sitting on a rover going from point A to point B, whether that's 50 miles or 50 yards, you're not using up a lot of metabolic effort and so you're not getting tired. You may have a little bit of fatigue.

But the bottom line is, if you can drive between points where you have to actually do something, get out and spend your effort doing that, whether it's science or instrument setup or whatever, then get on your rover and drive to the next spot, you save yourself so much in terms of your ability to continuously operate.

You save backpack time, too, (the suit's liquid air supply is stored in its backpack) because you're not breathing as fast and you're not needing as much cooling. So rovers just become an absolutely essential piece of any kind of exploration activity.

AM: Another technology you tried out was a helmet-mounted electronic display that let you view your procedural checklists just by looking glancing over to the side of your field of vision. How did that work out?

DE: We're trying to get to a situation where the crew member interacts with the suit and the systems onboard in a way that's very transparent. When space station crew members go out on a station EVA (extra-vehicular activity, or "space walk"), they have this arm-mounted checklist that's like the Bronx phone book.

It's got as many as 100 pages of checklists in it. It weighs a lot and you have to be able to flip through it. Last year during Desert RATS we tried

to test the idea of comparing this little helmet-mounted target reticule that you can look into and see your checklists with the traditional cuff-mounted checklists.

After the first run I threw the cuff checklists away. To be able to look at this little eyepiece and say, I want this checklist, and there it is, is so much easier than fumbling with the gloves and trying to figure out what page you're on. It's just amazing. Things like that are going to greatly improve what we do.

NASA and the crew office and the EVA guys have been trying for at least 15 years to come up with some sort of an electronic checklist and we haven't succeeded yet because it's a very difficult problem. A heads-up display is great, but you have to have the equipment mounted on your helmet to project it out in front.

Anything that's on the top of your helmet - it's like the horse that decides it wants to clean you off on the nearest tree - you can forget it's there and wreck it. I think this is the first thing I've ever seen that makes me feel like, Yeah, this is the way to do it.

In the helmet-mounted display, there's a little reticule. Both Keith and I have them. They're mounted in the helmet so that when you turn and look, there's this little screen that shows the checklist. Now in this case, I've written the checklists and put them in PowerPoint, so we just launch a PowerPoint slide show. You control it with voice commands.

Right now we just have individual PowerPoint slides. So I'll just tell it, Display PowerPoint 1; display PowerPoint 11. So when you get to a particular site and you're going to get a soil sample, you say, Give me the soil-sample procedure, and it just brings it up, and there's what I do, there's what Keith does. You don't have to memorize it, it's right there. It's a real treat to use.

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