

# US Space Station needs another redesign

■ Maintenance too heavy a burden

■ Station essential for NASA's survival?

**Washington**

ONLY six months after a comprehensive restructuring of the US Space Station programme unleashed a torrent of criticism from Congress and from the project's international partners, more redesign work is on the cards. NASA (National Aeronautics and Space Administration) last week announced a review of plans for the \$30,000-million craft in response to an internal report which concluded that routine maintenance of the space station would require 2,300 astronaut-hours of 'space-walking' every year. In the 30-year history of the US space programme, astronauts have spent only 400 hours outside their craft.

The study, by astronaut William Fisher and NASA engineer Charles Price, surveyed the NASA contractors who are building the 5,578 parts that will reside on the outside the space station, and found that repairs and replacement of light bulbs, thermal blankets, electromechanical devices and batteries aboard the space station will require, on average, some external maintenance every day. Spacewalks, known in NASA parlance as 'extravehicular activity' (EVA), are considered risky because of danger from radiation and micrometeorites.

Fisher and Price asked the contractors to estimate a "mean time between failures" for each part. Then, calculating how long it would take to repair each part and allowing for a certain amount of overhead, the team arrived at an estimate of 2,284 hours of EVA time a year. That amount is based on an assumption of about one failure a day in a critical part on the outside of the station.

The estimated repair time for these failures at present stands at nearly four times the level NASA officials have set as their goal, a discrepancy Fisher and Price found "ominous".

If the maintenance requirements are not reduced, they conclude, space station astronauts would have to switch from construction to repair by the time the project was only 60-70 per cent complete. "That's unacceptable", Fisher said.

Responding to the results of the study at a meeting in Washington last week, NASA's associate director for space flight, William Lenoir, said that maintenance "has always been an issue lurking right beneath the surface. Now we're designing real hardware, not paper, and it was time to put in real numbers." But Lenoir played down the severity of the problem.

Saying that the estimates were "a snapshot in the middle of our study", he added "it's business as usual". Officials from NASA headquarters openly disputed the reliability of the Fisher-Price study, which came from the Johnson Space Center in Houston, Texas. At a press conference last Friday Lenoir characterized the study as a "worst case scenario" whose numbers were "not credible". But Fisher asserted



that the work was "a conservative estimate" and released a statement criticizing NASA for diminishing the study "simply because the results are unpopular." Whatever the magnitude of the problem, NASA said it would waste no time in finding a solution. Space station officials said that they would concentrate initially on finding the parts that are expected to consume the most EVA time and then either redesign them for greater reliability or relocate them so that they are accessible from within the pressurized crew compartments. "We're willing to spend money to make [a] part more reliable, or to bring [it] inside", said Lenoir: "we will probably

find that 80 per cent of the effort is allocated to 20 per cent of the items. We want to concentrate on those items." Another option is to use the station's two robots to make more of the repairs. But without costly upgrading, the robots as now configured are unlikely to be able to take over more than a quarter of the repair task. And adapting external parts to be more "friendly" to robotic manipulation will cost money as well, Fisher said.

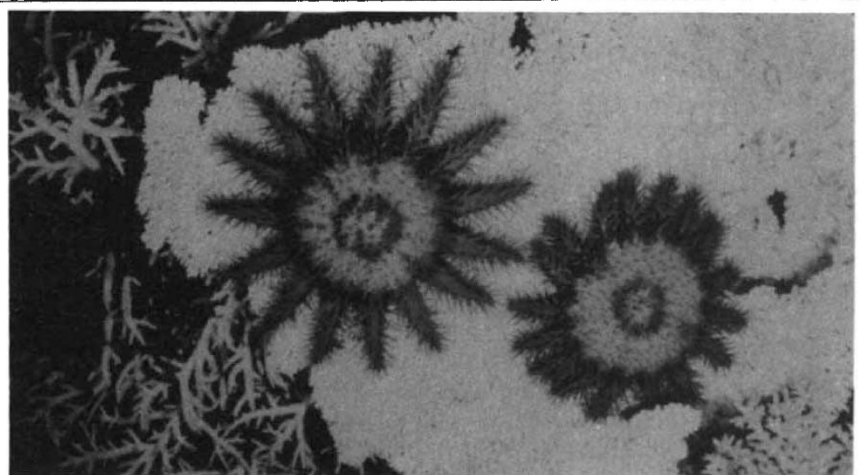
Nevertheless, Fisher said that robot technology is likely to improve far faster than spacewalking skills over the station's 30-year lifetime. Although "we may have to bite the bullet early on" by shifting emphasis to expensive and potentially troublesome robots, "the learning curve is steeper" for the machines, he said.

NASA administrators insist that the project's overall cost will not rise because of the changes. Lenoir said that the space station's current budget allows for some redesign. The preliminary final design is expected to be completed by the end of the year, although it is not known if the unexpected EVA problem will change the timetable. First in-space assembly of the station is scheduled to begin in 1995.

Another concern for NASA is how Congress will react to this latest problem with the space station. The congressional appropriations process is approaching its critical months and early responses from key legislators suggested that one solution might be to cut the space station's 1991 funding while NASA sorts out the problem. Three congressional hearings are scheduled this week on the EVA issue.

But analysts believe that although cutbacks are possible, cancellation of the entire project is probably not. "It's not the end of the line", says John Pike, a space analyst for the Federation of American Scientists. "I'm fairly confident that they can wrestle this problem to the ground. They'll have to; [the space station] is essential to NASA's institutional survival."

**G. Christopher Anderson**



Has the Great Barrier Reef survived the onslaught of the Crown of Thorns starfish? News from Australia, page 370.