Gray Flannel Spacesuits:

Do We Have Any Business in Space?

BY GREG BEAR

THE SPACE SHUTTLE is expensive and complex, designed not only to withstand liftoff but to orbit in space and survive atmospheric re-entry. After it glides back to Earth, it will be carefully checked out and used again. It will never take off on its own power or make a powered landing, so it has none of the cocky independence and simple durability of the DC-3. But the space-shuttle may very will usher in the age of commercial spaceflight.

Big business, universities and even private individuals have shown interest in renting space aboard the shuttle. And smaller companies are already planning to provide competition for the shuttle in the near future. The emphasis of space travel is being subtly shifted . . . and that's exactly what NASA wants.

Spaceflight has allegedly passed through its romantic phase. Now the time has come, many say, to make it pay for itself. In numerous ways it already has, and not just through technological spin-offs: Landsat pictures are invaluable to geologists and other investigators of Earth's natural resources; navigation satellites become more essential to oceanic trade every year; meteorological satellites have saved billions of dollars and hundreds of lives. Communications satellites are a major part of the much-touted electronics revolution.

But with the space shuttle, not only can new enterprises be undertaken with less expense, but old enterprises — many of the satellites mentioned above — can be rescued and repaired. The savings? Almost incalculable.

It all brings to mind a *Mad* Magazine jape of almost two decades ago with a nonchalant blue-collar repairman presenting his bill to Telstar management: *"Nine Billion Dollars?!"* "I hadda take it into the shop."

Most experts believe that space has tremendous potential. Some regard it as the ultimate salvation of humanity. Others think it will serve us best as a kind of extension of the Earth environment. It's obvious that even in the most starry-eyed scheme of things, the Earth-extension view will predominate in the beginning.

To that end, NASA and the European Space Agency (ESA) have joined hands to launch an orbiting research laboratory in the space shuttle. Spacelab is an adaptable sysem of pressurized aluminum modules and unpressurized pallets. Scientists working in the shuttle and modules direct experiments in conditions of relative comfort; they need not be rigorously trained astronauts, just reasonably healthy experts. They will not quite approach the dream of Everyman in space, but they're a step in that direction.

ESA is building two Spacelabs, one of which they will donate to NASA in return for experiment space. The second Spacelab will be sold to NASA for about $160,000,000. Considering that Spacelab development has cost the Europeans about $7.9 billion, with West Germany footing about half the bill, that's a bargain. In fact, a 1984 West German Spacelab flight aboard the shuttle has become so expensive — NASA rents shuttle space at the going rate after the first Spacelab — that Germany is actively investigating the possibility of sharing costs with Japan.

Cooperation between NASA and ESA has been shaken by Reagan budget cuts — which have eliminated American participation in a joint Solar Polar mission, almost castrating the project — and by launch schedule rearrangements. For now, the first Spacelab is scheduled to be launched in the shuttle in June of 1982. Spacelab 1 will carry seventy-two experiments in one long pressurized module and two pallets open to space. The flight will last seven days. Among the scheduled research will be experiments in materials processing, plasma physics, and the physics of Earth's upper atmosphere. Medical, biological and astronomical studies will be made, as well as the ubiquitous observations of Earth's surface from space.

At least three major American corporations have made plans for using the shuttle as a tool for research in space. McDonnell Douglas, in association with Ortho Pharmaceuticals (a subsidiary of Johnson & Johnson) has developed equipment to separate medically useful substances in space. McDonnell Douglas, because of its extensive aerospace work, has an expert space medicine division on hand already. In this joint venture with NASA, McDonnell Douglas will provide an EOS (Electrophoresis Operations in Space) package to be placed in the crew quarters of the fourth shuttle, which will be launched in mid-1982. Electrophoresis is the process of separating electrically charged chemicals in a fluid medium. Because gravity can interfere with such separations and affect the purity of the substances, the cooperating companies hope to establish that weightless conditions will allow greater efficiency. One of the experiments will concentrate on the separation of live beta cells from human pancreatic material. Pure beta cells could be used to help diabetics, perhaps even cure them.

If commercial applications are found, McDonnell Douglas hopes to have future shuttle flights place robot pharmaceutical laboratories in orbit, where they will manufacture pure substances to be picked up at regular intervals. Should solar power stations be placed in orbit, McDonnell Douglas believes their medical labs could be attached to them, drawing power from the sun and providing heretofore unavailable drugs for Earth's medical needs.

John Deere Company of Moline, Illinois, long known for its manufacture of tractors, has a heavy commitment to cast iron. Thirty percent of its products, on the average, consist of cast iron. So Deere Company is interested in finding new, improved methods of casting iron, and feels that space offers a useful environment for such research. In space under weightless conditions there are no convection currents in molten metal. When a metal solidifies without convection currents, interesting new properties might be discovered. Deere is hoping to find methods of casting iron so that it will be stronger and more durable. Deere Company is not committed to space manufacturing, however, and would be just as happy to conduct its research in space, learn more about cast iron, and carry on totally earthbound operations. Their agreement with NASA is much like McDonnell-Douglas's — they provide equipment, NASA will supply weightless conditions. No money changes hands. Deere will benefit from the knowledge obtained with a one-year lead-time before any competitors have access to what has been discovered.

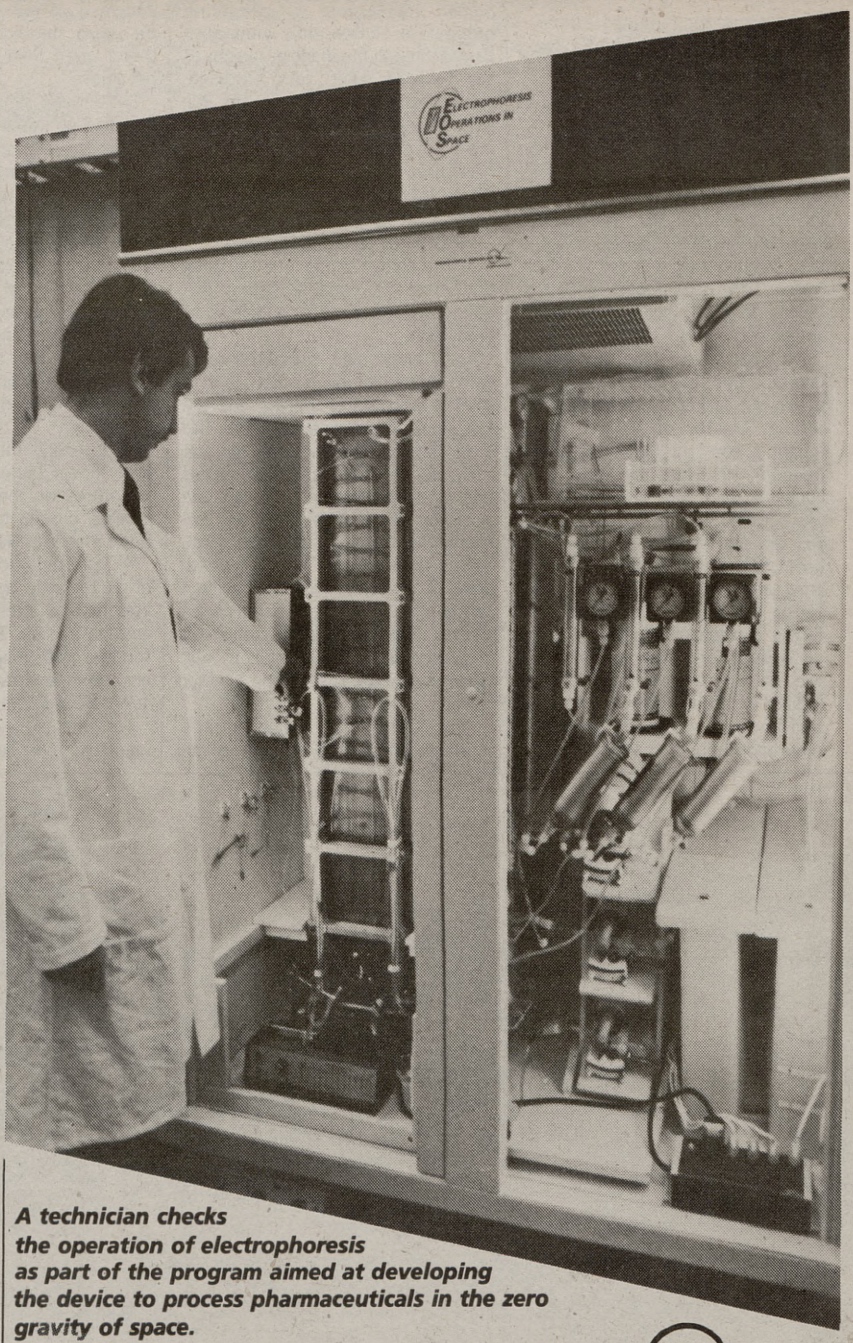
Materials processing in space has been both hyped and criticized, but several major American companies feel that the potential is worth investigating. And for those who condemn the effort by making present-day analyses based on current knowledge, there's always the prospect of space research revealing things we haven't yet imagined. Consequences from important new knowledge cannot be encompassed by cost-benefit ratios.

Not only can corporations and scientific agencies contract for space aboard the shuttle, but you can, too. The cost is not small, unless you compare it with the cost of space research before the shuttle. For $10,000 you can buy five cubic feet of space and fill it with equipment weighing up to two hundred pounds. For half the cost, you get half the volume and half the weight.

At least seventy-five universities and colleges and half a dozen high schools across the country plan to rent space for experiments aboard the shuttle. Stan Eilenberg, at the Jet Propulsion Laboratory's Table Mountain Observatory in Wrightwood, California, is the NASA liaison for school projects.

And in Japan, the newspaper *Asahi Shimbun* asked for suggestions from its readers for an experiment to be launched aboard the shuttle. The winners, two high school students, are preparing an experiment for the manufacture of pure snow crystals. The paper is renting a $10,000 compartment.

From cast iron to the purest of snowflakes; from hard industry to pure research; from life-saving to life-enhancing. In less than a century, historians may look back with wonder on a time when the potential of human business in space was ever doubted.



A technician checks the operation of electrophoresis as part of the program aimed at developing the device to process pharmaceuticals in the zero gravity of space.

Greg Bear is a novelist and occasional science journalist as well as a free lance teacher; he has taught courses in the history of science (ancient technology), Celtic culture, Greek and Roman life and science fiction writing. His latest of four novels is Strength of Stones *(published by Ace), and the February 1982* Omni *includes one of his short stories.*