

US space programme

NASA plans a space station. . .*Washington*

THE National Aeronautics and Space Administration (NASA) is urging the United States to take its next historic step in space — the construction of a permanent manned space station that could become the centre of a space-based manufacturing industry as well as the jumping-off point for manned trips to the Moon and Mars.

Under the guise of a "modest" planning exercise, NASA has lobbied assiduously to make the space station the centrepiece of its activities to the end of the century and beyond. The agency has told the White House that a space station is the logical sequel to the shuttle and offers the best prospects for maintaining American leadership in space. It seems likely that President Reagan will agree.

Space stations have come and gone from NASA drawing boards for more than two decades. In the 1960s, plans for a space station were pushed aside by the Apollo Moon programme and in 1970 lack of political support forced NASA to drop the concept of a space station in favour of the shuttle. The agency's administrator, James Beggs, now wants an all-out effort to launch the first elements of a space station by 1991, which he estimates could cost less than £9,000 million.

Until recently, much of NASA's planning effort has been devoted to finding potential users for the space station, but in recent months agency officials have become less coy about the technical details. What has emerged is not a single large space facility but a network of manned and unmanned platforms, laboratories and satellites linked by a new generation of orbital transfer vehicles.

The vanguard of the space station in 1991 would consist of a main base at an orbital inclination of 28.5°. With a crew of six to eight, the base would include two or three pressurized modules for research and development, with a volume of about 120 cubic metres. A separate unmanned platform would be placed in polar orbit. By the end of the century, the space station would be expanded to provide space for a crew of 12 to 18 and the polar station might be turned into a manned facility.

These plans are so tentative, however, that NASA only recently lifted a self-denying ordinance banning the publication of drawings of the proposed station. A NASA official told Congress last week that at the end of meetings with foreign countries interested in the space station, all doodles had been carefully destroyed.

The ostensible reason for NASA's reluctance to define its plans is that it wants to be sure that it has the best possible design before it is committed to specific pieces of hardware. Another reason, not publicly stated, is that the agency expects to find it easier to win political friends for the space

station while the station's capabilities and uses are still somewhat vague.

The Department of Defense (DOD), for example, has so far refused to enthuse about the military uses of a space station. Richard DeLauer, Under Secretary for Defense for Research and Engineering, told a recent NASA symposium that the Pentagon had been unable to identify a single military function that could be done better by a space station than by an unmanned spacecraft. DOD is nevertheless deeply involved in hypothetical discussions about the station's design, enabling NASA to argue that a space station could make great contributions to national security.

According to Beggs, the space station could ultimately evolve into a command post or operations centre for DOD, as well as a storage facility and a base from which military satellites could be serviced. Later, Beggs adds, there would "probably" be two stations, one in polar orbit primarily for DOD use and one in equatorial orbit (the 28.5° main base) primarily for NASA.

NASA is using a similar manoeuvre to overcome the scepticism of the US space science community. The National Academy of Science's space science board has been drawn into the space station planning process and asked to consider how space scientists could exploit a space station if one were to be built. The board has not, however, been asked (by NASA) whether it believes there is a scientific justification for investing in a space station in the first place. If it were to be asked, the answer would almost certainly be no. Although it has so far observed a prudent

public silence, the board has been working on a policy statement spelling out its belief that money for space science could be better spent. The draft statement complains that current budget levels support only a small fraction of existing mission possibilities for space science and that "few" disciplines in the life sciences and none in the physical sciences need a manned space station at present. In the long run, the statement concludes, a space station could provide a "significant opportunity" for some disciplines, but space science is still just beginning to learn how to use the capabilities of the shuttle.

The National Academy of Science's space applications board has been less hostile, but also fears that by committing itself to an enormous engineering project like the space station, NASA will be forced to divert money from applications to pay for the inevitable cost overruns in development.

Despite the scepticism of some groups, Beggs believes that the White House will give the project its blessing within the next 6 to 12 months. The senior interagency group responsible for space policy is expected to receive a recommendation from its space station working group by November. Chaired by NASA, the space station group is likely to argue that without a single big engineering project like the station, NASA will be unable to maintain its preeminence in space. The Soviet Union, NASA has been pointing out, has already developed an entirely automated resupply unit for its Soyuz 7 vehicle, and recently attached a propulsion unit that will be able to move the craft into new orbits.

It will not be entirely plain sailing, however. The president's science adviser, George Keyworth, has maintained a

. . . Soviet union almost there?

In pressing for a space station, the US space agency is following the path taken by the Soviet Union. The Soviet space programme has long been committed to the idea of establishing a permanently staffed orbital station, and in 1976, a leading space-planner, Academician Georgii Petrov, talked about a staff of 100 people, with some twenty or thirty cosmonauts on board at any one time.

The new Soviet space "tug" launched on 27 June as *Cosmos-1443*, and now operating as part of a manned orbital complex with *Salyut-7* and *Soyuz-T*, marked an important step in the Soviet programme.

The new craft, with a length of 13 m, maximum diameter more than 4 m and mass (including return module) of 20 tonnes, is the largest cargo spacecraft ever launched to rendezvous with a *Salyut* station. It has more than 2.5 times the cargo space of its forerunner, *Progress*, and, unlike *Progress*, has its own power source — a solar cell of area 40 m². The return module allows up to 500 kg of

"useful cargo" — photographic film, semiconductor materials produced in space, equipment for reuse in ground-level control experiments — to be sent back.

The early recovery of film will be of particular importance to the Earth resources survey, which, a *Pravda* article stressed last week, makes a major contribution to the "practical character" of the manned orbital programme. Any suggestion that it could also be useful for military reconnaissance would, of course, be hotly denied by the Soviets who consistently contrast the "peaceful" aims of their space programme with the "military" aspects of the US space shuttle.

Not everyone abroad, however, accepts the Soviet assurances. The *Cosmos-1267* craft, used to supply and enlarge the *Salyut-6* station, and subsequently used to effect a re-entry burn when the complex had finished its useful life, was believed by a number of US analysts to have been armed with anti-satellite homing devices.

Vera Rich

carefully ambiguous public attitude. In a delphic speech in Seattle recently, Keyworth hinted that it would be a mistake to plunge into a space station project without spelling out precisely what the next step in space would be. Significantly, he dismissed the argument that Soviet achievements with Soyuz had stolen a march on the United States.

The two most significant deciding factors will be the White House's perception of the military use of the space station and the significance it assigns to private sector interest in space-based ventures. DOD's lukewarm position on the space station will be taken with more than a pinch of salt: the Pentagon learned with the shuttle that by appearing to be unimpressed it could gain access to an attractive space asset without having to pay for its development out of its own budget.

As for the private sector, NASA has spared no effort to persuade industry that a space station could lead to real manufacturing possibilities. The private management consultants, Booz, Allen and Hamilton, said last week that under a contract from NASA they had determined that there was enough economic potential in space to persuade a significant number of companies to invest in the space station. The most promising opportunities were in biological processing, production of high-performance catalysts, a fee-for-service laboratory in orbit and the production of high purity iridium crucibles for making gallium arsenide.

Peter Wright Wood, Booz Allen's senior vice president, warned, however, that several important obstacles had to be surmounted before many companies would invest in the project. Most companies complained that NASA's commercial procedures were too cumbersome and insisted that some way must be found to protect intellectual property that would be acquired by an investment in space.

NASA has also begun extensive talks with foreign governments interested in becoming users of a space station. Canada, France, Germany and Japan, as well as the European Space Agency, have carried out their own studies of missions that could be mounted from NASA's space station. Until the project is formally approved, however, NASA will not talk to foreign governments about collaboration in the station's planning and construction.

Even if the White House agrees to approve the space station, NASA will still have to deal with the sceptics in Congress. Some committees have already indicated that an unmanned space station using refinements of existing hardware offers a cheap way to achieve many of NASA's goals. But most congressmen are enthusiastic. In a recent survey by the Political Action Committee for space 26 senators and representatives favoured a space station, 3 expressed opposition and 13 were undecided.

Peter David

Cell astrobiology

Shuttle separation of islet cells

St Louis

ON the eighth space shuttle flight, due to be launched on 30 August, the McDonnell Douglas Corporation will be using continuous-flow electrophoresis to try to separate insulin-producing beta cells from the other cells of the pancreas. The procedure could have potential as a way of obtaining cells for transplantation into human diabetics. On board the shuttle *Challenger* will be dog pancreatic cells provided by Drs David Scharp and Paul Lacy,



researchers at Washington University Medical School, St Louis. They are interested in separating pure beta cells for transplantation experiments from the 98 per cent of other cells in the pancreas.

Whether they will need zero gravity in space to get the purity at which they aim is not yet known, but the absence of gravity allows electrophoresis to be done without the usual Earth-bound constraints. In space, high voltages can be used without setting up convection currents that disrupt the separation, and the concentration of the sample is limited only by the solubility

of the sample, not by the density of the buffer used.

Many questions remain to be answered about how to handle the cells before, during and after the flight — such as what kind of buffers to use and whether to use fresh or frozen tissue. This first attempt at separating beta cells in space will be used to work out the handling and separation procedures. The cells harvested from the continuous-flow electrophoresis will be tested for viability on their return.

McDonnell Douglas started working in 1977 on continuous-flow electrophoresis for separating materials in space. It has joined with the Ortho Pharmaceutical Corporation to use the procedure for drug purification.

The company plans three phases of work in space. First, it will perform separations on board the shuttle. Then it plans to launch free-flying satellites that contain automatic equipment for the separations. These satellites will be serviced by the shuttle, which will be used to load raw materials and recover finished products. By the turn of the century, McDonnell Douglas hopes to use the facilities of an orbiting space station for the work.

Much remains to be done before purified human pancreatic beta cells could be transplanted into diabetics. Even if purifying the required number of cells turns out to be feasible, the details of transplantation remain to be worked out. In any case, a procedure that works for purifying beta cells could probably be adapted to other cell types that are difficult to purify.

Karen Freeman

Yellow rain

More toxin victims claimed

Washington

MORE evidence in support of the US State Department's contention that toxin weapons are being used in South-East Asia was forwarded to the United Nations last week, bringing to 20 the number of supposed victims found to have fungal toxins in their blood. The trichothecene mycotoxins T-2 (which the State Department says is the major toxin used in "yellow rain") and HT-2 (a metabolite of T-2) were detected in the blood of four subjects, 5 days to 2½ months after allegedly being attacked on different occasions between November 1981 and March 1983 in Laos and Kampuchea. By contrast, no toxins were detected in five control subjects of similar background who did not claim to have been attacked. While the use of control samples in this latest set of data appears to buttress the State Department's claims, no explanation is offered for the failure to detect toxins in at least seven other subjects who reported

being victims of three of the four attacks.

At a briefing last week for reporters, Robert Dean of the State Department dismissed criticism that focuses on the scientific data, saying that sceptics such as Matthew Meselson of Harvard are "working from a very limited body of data" that does not include intelligence information which "has really convinced us beyond a shadow of a doubt" of the Soviet use of toxin weapons in the region. The State Department, citing security reasons, has refused to make public any of this intelligence information.

One bizarre note was interjected into the latest scientific data by the State Department's assertion that the 6 November 1981 victim, described as a Lao resistance fighter, had been attacked with a "toxic agent grenade". The victim was the only witness to the incident. Previous reports have referred to aircraft-delivered sprays or artillery shells.

Stephen Budiansky