Seeking extraterrestrial life

NASA is not quite alone

Boston

HAVING weathered a Golden Fleece award and, last year, a cut-off of funds, the National Aeronautics and Space Administration (NASA)'s Search for Extraterrestrial Intelligence (SETI) programme is back on its feet. This spring, the centre-piece of the programme — a multichannel analyser to scan 74,000 radio channels simultaneously for evidence of non-natural signals — will go on-line. And, confident that funding will continue, NASA has a five-year research and development plan that will eventually expand that capability to eight million channels.

The programme's recent financial troubles had seemed likely to kill SETI once and for all. Senator William Proxmire (who, in 1977, had awarded SETI one of his Golden Fleece prizes for projects that represent the biggest wastes of taxpayers' money) succeeded in attaching an amendment to NASA's appropriation for fiscal year 1982 forbidding the agency to spend any of its funds on SETI. NASA spent a year shutting the programme down, only to have it revived this year after a visit from Carl Sagan apparently persuaded the senator to mute his objections. NASA will spend \$1.5 million on SETI this year.

Criticism from within the astronomical community, however, persists. The latest row was set off by a letter by Dr Frank Tipler of Tulane University that appeared in *Science* last week. Tipler takes Carl Sagan to task for having argued that the SETI radio search will have "profound implications for our view of the Universe and ourselves", whether the results are positive or negative. Tipler says that "a negative result would probably not convince supporters of SETI that extraterrestrial civilizations do not exist. They could simply argue that advanced civilizations generally abandon inefficient radio transmitters like ours after a short time . . . SETI will only become a science when its proponents tell us what observations will convince them that it is reasonable to assume we are alone".

Tipler's criticisms did not impress SETI proponents attending the American Astronomical Society meeting in Boston last week. Dr Jill Tarter of the University of California, Berkeley said, "Tipler's arguments never did have validity"; Dr Frank Drake of Cornell University called them "a lot of baloney". In fact, Drake said, "there's no way ever to prove the negative" in any scientific experiment.

SETI supporters also pointed to the National Academy of Sciences study last spring on priorities in astronomical research (the Field committee report) which endorsed a modest SETI effort and to the establishment of a committee on extraterrestrial life by the generally staid International Astronomical Union (IAU)

as evidence that they have the astronomical community behind them. Drake said that he has been "deluged with requests" from IAU members seeking to join the committee since its establishment last August.

Nonetheless, the underlying question in Tipler's recent criticism may have hit a raw nerve. SETI proponents seem painfully aware of the limitations inherent in the current research plan. Even with the full eight-million-channel real-time capacity, the analyser will cover a spectrum of only 8 MHz at one time. Each channel is 1 Hz wide in order to screen out natural astronomical phenomena, which have bandwidths of at least 1 kHz.

But even the constraints imposed by natural noise (which interferes with signals at wavelengths longer than 10 m or so) and by thermal radiation (which interferes at

wavelengths shorter than 5 cm) leave a useful listening band 1,000 times broader than the 8 MHz capability of the analyser.

Similarly, limiting candidate stars to those nearby and those similar to our Sun leaves tens of thousands to be studied.

Thus it will always be easy to argue that the lack of a positive result is due to having looked in the wrong place — and thus easy to continue on what may in fact be a wild-goose chase. Tarter maintained that "it would be hard in a single lifetime to amass a statistically significant negative result".

Another difficulty that SETI may face is some foot-dragging, even on the part of enthusiasts — particularly enthusiasts who happen to be observatory directors. As Dr Stuart Bowley of University of California, Berkeley — a SETI researcher — said, "the intrinsic problem is that you must take over a radio telescope to conduct the search", taking away limited observation time for a project that, as Bowley readily admits, has an exceedingly small chance of success.

And for all the claims that SETI has achieved respectability within the astronomical community, the general scientific community remains sceptical. The National Science Foundation has no official policy on SETI research, but refers enquiries to the NASA programme.

Stephen Budiansky

NASA astrophysics budget

Hope springs eternal

Boston

DESPITE a flurry of last-minute budget revisions ordered by President Reagan to bring down a federal deficit projected to exceed \$200,000 million, officials of the National Aeronautics and Space Administration (NASA) and other members of the astronomy community remain confident that they will fare well under the 1984 budget, due to be released on 31 January.

"I still believe that they will stand up and support the good, solid projects", Frank Martin, director of NASA's astrophysics division, said here at the American Astronomical Society meeting. Martin suggested that much of the credit for the favourable reception that astronomy is receiving at the White House belongs to the Field committee report, issued last spring, which ranked by priority various astronomical projects (see *Nature* 296, 482; 1982). It is widely viewed as reflecting the consensus of the astronomy community, and represents the sort of priority-ranking that White House science adviser George Keyworth has been urging all disciplines to establish. "If you can get the community to agree on what to do, it's a very powerful statement", Martin said.

NASA will reportedly get the go-ahead for two major projects in the 1984 budget: the Very-Long Baseline (VLB) array and the Venus radar mapper. The VLB array, to consist of 10 radio telescopes, would permit an angular resolution of 0.3 milli-seconds of arc, a hundred-fold improvement over current observational limits. The Field committee had recommended spending \$50 million on the project over the decade.

The Venus radar mapper is the scaled-down version of the VOIR (Venus Orbiting Imaging Radar), born of NASA's realization that the only hope for approval of the mission was in cutting its \$600 million cost. The Venus radar mapper will cost exactly one-half of that; it will also provide a 1-km resolution of Venus's surface, ten times degraded from the original specifications. In almost any form, though, approval of the mission would provide a much needed shot in the arm for the planetary exploration programme, whose last new project was the Galileo mission to Halley's comet.

NASA is meanwhile proceeding swiftly on the space telescope and the gamma-ray observatory and on plans for the project ranked first by the Field committee, the advanced X-Ray Astrophysical Facility (AXAF). AXAF will provide a sensitivity 100 times greater than that of the Einstein observatory (which "died" in orbit in 1981) and an on-axis resolution eight times greater. It will also fill a 10-year gap (by the

time of its launch in 1990–91) during which the United States will have had no orbiting facility at all for X-ray data.

NASA is planning to issue next month a request for proposals for the detailed design ("phase B" in NASA's lingo) of AXAF. Proposals for focal-plane instruments will be due in July. NASA is hoping to receive approval to begin construction in the 1986 budget.

Dr George Clark of Massachusetts Institute of Technology noted that before the Field committee report, the launch date for AXAF had "receded at a rate of one year per year". Now, he said, "AXAF seems firmly set in NASA's planning".

NASA also hopes to receive approval in the 1984 budget for an expansion of the Explorer satellite programme, which the Field committee ranked as top priority among "modest" new programmes. The new Explorers would include satellites for studying the extreme ultraviolet, X-ray timing and the solar corona.

Martin also expressed confidence that the new projects would not come at the expense of other parts of the new programme. He admitted that data analysis "suffered from the 1983 budget-crunch". But "without the flight projects", he said "the whole programme atrophies".

Stephen Budiansky

Blood-typing reagents

Monoclonal product on UK market

CELLTECH Ltd, the specialist British biotechnology company, has started bulk manufacture and sales of monoclonal antibody ABO blood grouping reagents made by artificially-produced hybrid cells. This is the first bulk-scale application of mammalian cell hybridization. The reagents will be cheaper than commercial products made by conventional methods, and are claimed to be more reliable.

Early development of the new reagents was carried out by a team under Dr Ed Lennox at the Medical Research Council's Laboratory of Molecular Biology at Cambridge. The Medical Research Council, which by standing agreement offers its monoclonal antibodies to Celltech for manufacture, then licensed Celltech to proceed to bulk production.

The story, like some other notable discoveries, has a fairy-tale beginning: an antibody with anti-A specificity was found unexpectedly during an experiment designed to look for tumour antibodies. The accidental product was found to be a more effective reagent for blood typing than those now in use in Britain, which are mostly extracted from blood given by selected donors. However, its properties fell short of those of other commercially produced reagents obtained from blood given by hyperimmunized volunteers. The work of the Cambridge team was then to find mouse lines and immunization schedules suitable for the production of anti-A antibodies with high avidity and correct specificity. The other reagent, anti-B, was also soon being produced, and is now claimed to be better than any other available.

Having perfected the product, the scale-up operation to bulk production — complicated by the physical fragility of the cells — was handed to Celltech, which substantially increased yields. By using automated monitoring equipment, Celltech was able to identify optimal physicochemical conditions for bulk production of the cells while maintaining high rates of antibody production. The cells are now grown in 100-litre vessels, and

a continuous-production system is being developed.

Because each is a single antibody, the new reagents have substantial advantages over products made by conventional means, which contain a variable mixture of different antibodies. Their use will also conserve supplies of blood, which is not used in the production process.

Celltech's products came through with flying colours in a large-scale study involving more than 85,000 tests co-ordinated by the National Blood Group Reference Laboratory: Celltech claims that the new reagents produce no "false positives". The tests employed were based on the exacting US Food and Drug Administration tests, and Celltech is confident that its new products will be approved and be competitive in the American market, as well as the European and Japanese markets. Deliveries to several UK blood transfusion centres have already started. According to Dr Tim Leeney, the Celltech business manager leading the project team, monoclonal antibodies will take a significant share of the world market for blood grouping reagents by the end of this decade. The Department of Industry, which recognizes a good thing once it has been pointed out, has awarded Celltech a grant for the study of continuous cell culture.

In the course of the coming year, blood-typing reagents will be supplied within the National Health Service free of charge, with financial support thought to be of the order of £100,000 from the Department of Industry. It is hoped that during the year in question, overseas markets will be opened up and that it will also be possible during that period for the Department of Health to make a realistic appraisal of the true cost of supplying conventional typing reagents.

The expertise Celltech has acquired in the large-scale use of hybridomas puts it ahead in the rush to develop other monoclonal blood grouping reagents, including rhesus-specific agents. Celltech considers that further reagents of this kind will be available within two years. **Tim Beardsley**

Acid rain research

New panel's industrial bias

Washington

THE Reagan Administration's commitment to acid rain research, already under question, has come under a new cloud. Last month when the president named to the panel overseeing federal acid rain research three new members, all three turned out to have close ties to the utility industry.

Earlier last month, the Administration provoked protests from environmental groups and several members of Congress when the Office of Management and Budget (OMB) directed the Environmental Protection Agency (EPA) to cut funding for the development of an acid rain model from \$650,000 to \$150,000. The model, to be used in assessing the effects of utility emissions control strategies on sulphur and nitrogen emission, was to have been ready for use next year. According to EPA, it will now be completed in 1986, by which time a similar model for industrial sources will also be completed.

The OMB action was considered unusual in that it effects funds already appropriated and being spent — and that it deals with a very detailed internal policy decision. OMB could not actually order a cut; what it did was to direct EPA to "reprogramme" \$500,000 from the utility model to the industrial model. But according to the Natural Resources Defense Council, EPA sources say that at most \$200,000 of the reprogrammed funds could actually be used this year on the industrial model.

Environmental groups had been eager for EPA to complete work on the utility model, which will be available for public use. Groups such as NRDC have been spending large sums on hiring consultants to run model predictions for policy analyses.

The appointments of the three new members to the Acid Precipitation Task Force has added fuel to the fire. The task force, which is made up of representatives of the 13 federal agencies involved in the 10-year research effort plus four outside members, oversees all aspects of the Federal Government's research programme on acid rain.

The new task force members, who are not subject to Senate confirmation are: Ralph Perhac, director of environmental assessment at the Electric Power Research Institute (the electric utilities' research organization); James Mahoney, vice-president of Environmental Research and Technology, a consulting firm that has many contracts with industry and the government, and Professor John McKetta, of the University of Texas at Austin, who has frequently served as an expert witness for the utility industry.

Stephen Budiansky