Space vehicles

British HOTOL closes in on French Hermes

BRITAIN's horizontal take-off and landing space plane, HOTOL, could be in space by 1998, according to the director of the British National Space Centre (BNSC), Roy Gibson. A bid to make it a European project will be made at the next (October) council meeting of the European Space Agency (ESA). HOTOL, which was little more than a gleam in a British Aerospace designer's eye a couple of years ago, thus seems to be racing ahead. With its launch date brought forward, what once seemed almost science fiction is now in direct conflict with the more conventional French project Hermes, in which a mini-shuttle could be launched on top of a cryogenic Ariane-5 rocket around 1995.

But will HOTOL work? According to British Aerospace, the design incorporates a "breakthrough" in air-breathing engine technology which makes it possible to move ahead with off-the-shelf technology rather than the completely new engineering needed for the US National Aeronautics and Space Administration's "National Aerospace plane" (NASP) programme. The NASP programme is aimed at pushing ahead with research in high temperature materials and computational hypersonic fluid dynamics to enable, early next century, the creation of a whole class of vehicles from long-range airliners to spacecraft capable of air-breathing propulsion at speeds of Mach 5–12. By comparison with HOTOL, NASP is "technology driven" according to the British Aerospace Launch Vehicles Project Manager, Bob Parkinson. "HOTOL is a conceptual, not a technological breakthrough", Parkinson claims.

According to Parkinson, "we saw a way of doing the propulsion system that noone else has spotted... . We took the engine concept to Rolls-Royce" and HOTOL began to roll. That was a couple of years ago. But the "breakthrough" is still classified. Commentators have suggested the engine might precool inlet air with its liquid hydrogen fuel, to increase the density of the air and allow the production of a more compact engine. A Rolls-Royce spokesman said that the same engine, once the vehicle reached Mach 5, would be switched to liquid oxygen oxidant to complete the push into space.

Professor J.E. Ffowcs Williams, of the Department of Engineering at the University of Cambridge, many of whose staff work on Rolls-Royce contracts, said that though he knew little about the project he believed it would benefit from publicity at this stage. Arthur C. Clarke, the science fiction writer, said from Colombo last week that he invented the idea of the air-breathing engine for space vehicles "40 years ago". But Clarke could not speculate on the British Aerospace design because "I don't know anything about engines and aerodynamics".

Meanwhile, Gibson and others backing the British space effort have the task of raising money from abroad for what is estimated as a $4,500-million project to produce two flying HOTOL vehicles by 1998, without the freedom to expose the HOTOL "breakthrough". Nevertheless, says Gibson, BNSC has made "progress" in getting HOTOL declassified, as the classification was much more commerical than military. "We've been able to lift the veil enough to make a tour round Europe", seeking participants.

According to Gibson there remain a few technological "hoops", but all should be clear a year or so from now. The British plane is to present ESA members in October with a proposal for a four-year, $400-million HOTOL feasibility study; but this will clash, politically at least, with the simultaneous effort being made by the French to win participants in a cheaper, $48-million study of their Hermes space shuttle. Hermes is ahead on the political timetable, as ESA passed an "enabling resolution" approving the study in June (only the money is yet to be found); and it is also ahead on the engineering timetable (as the French space agency CNES has been working on Hermes far longer than the British on HOTOL). But Germany has been hesitating to give full support to Hermes, and according to a Bonn research ministry spokesman, HOTOL has already won the heart of his minister, Heinz Reisenhuber.

France has said it will go it alone with Hermes if it cannot raise European support. Britain, however, is sounding equally bullish about HOTOL. According to Gibson, whose first British space plan will go to ministers this week, participation of the French in the HOTOL programme would not be essential.

There is no French technology that can ot be found or developed elsewhere, ac ording to Gibson, and even French money may not be essential. It is not inconceivable, therefore, that HOTOL will go ahead like Concorde, the Anglo–French supersonic airliner, as a bi-national project, though this time the nations involved may be Britain and West Germany.

Robert Walgate

Indian science

Making the numbers count

Bangalore

THE gulf between the industrialized nations of both East and West and developing countries such as India is dramatically illustrated in the latest batch of statistics from the Indian Department of Science and Technology. In one year, India's spending on research and development amounts to just US$1.52 per head of population, compared to $361.22 in Switzerland, the country at the top of the league. The United States spends $303.9, Sweden $242.26 and Japan US$231.1. With India at the lower end of the scale are the Philippines ($1.65) and Pakistan ($0.49).

The pattern is similar when research spending is seen as a percentage of gross national product (see table) or when the science enterprise is assessed in terms of the number of scientists and technologists per head of population. Compared with nearly 140 per thousand of population in the United States, for instance, India boasts a mere 2.63 per thousand. Yet in a country as big as India this means there were 2.47 million scientist and technologists in 1985, up from 1.95 million ion 1980.

Expenditure on research and development as percentage of gross national product (1982)

Sweden	4.9
Hungary	3.3
Czechoslovakia	3.8
United States	2.5
Japan	2.4
West Germany	2.4
India	**0.85**
Greece	0.2
Pakistan	0.2
Philippines	0.2

It is this two-million-plus science workforce that Prime Minister Mr Rajiv Gandhi sees as the key to India's welfare in the twenty-first century. His new science policy identifies three levels of projects: "missions", where scientists will need to put proven technology to work to solve specific problems; "thrust areas"; and "blue-sky" basic research. The emphasis in each area, is to be on the possible benefits for the "common man", most particularly India's rural population.

Five of the "missions" have already been selected — improving drinking water, campaigning against illiteracy, telecommunications, a vaccination programme for children and in agriculture a major effort to improve oil seeds. The "thrust areas" so far proposed are computer technology and biotechnology — frontier disciplines requiring major investment but with the potential to give immediate results.

Radhakrishna Rao