

Soyuz is not a trolley-bus, but Comecon flights continue

SIGMUND Jähn, the first East German cosmonaut, together with his Soviet flight-partner Valerii Bykovskii, returned to Earth last Sunday, after a week aboard the Salyut-6 orbiting station. Jähn, the third non-Soviet cosmonaut to visit Salyut, completes the first phase of "international" flights; further launches, with the participation of cosmonauts now in training from other Comecon countries are scheduled for next year.

The manned "Interkosmos" programme, in which the Soviet Union puts into orbit crew members from her Comecon allies did not at first meet with the approval of the entire Soviet scientific establishment. Academician Anatolii Aleksandrov, President of the Soviet Academy of Sciences, was reported to be against any such non-Soviet participation ("Soyuz is not a trolley-bus!"). The programme appears to have been inaugurated partly as a visible expression of fraternal solidarity, and, more practically, as a recompense for the contributions made to the Soviet space programme by the Comecon allies. (It is notable that the first three countries to be honoured by a flight were Czechoslovakia, Poland, and East Germany, whose contribution has been particularly great).

As regards Jähn's particular contribution to the joint mission, one experiment, at least, codenamed "Rech" makes use of his linguistic background. During all communication sessions, he had to repeat "Zwei hundert sechs und zwanzig", so that the parameters of his speech—tone, volume, rate, etc., could be monitored and related to his physical and psychological reaction to weightlessness. (The significance of the number 226 is not clear—nor why the experiment could not have been performed using a Russian repeating "Dvesti dvadtsat' shest'!")

Reaction to weightlessness was the underlying theme of most of the East German experiments, including tissue culture and bacteria metabolism experiments, and an investigation of the cross-linking of micro-organisms and organic polymers. This last used "a Soviet apparatus modified by GDR specialists" (essentially a complex of polythene bags).

And, as in previous "international" flights, the "Splav" furnace was used to produce semiconductor compounds—in this case lead-tellurium and bismuth-antimony compounds, the experimental capsule being renamed for the occasion "Berolina". **Vera Rich**

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Taj Mahal out of danger?

THE Indian Government is considering a report from a committee of experts, headed by the chairman of the Indian Petrochemicals Corporation, Dr S. Varadarajan, on how pollution from an oil refinery being built near Agra will affect the Taj Mahal. The committee began its investigations four years ago after fears in scientific circles and in the press that sulphur dioxide waste from the refinery at Mathura 146 km south of New Delhi, would damage the white marble of the Taj Mahal and red sandstone of other historical monuments at Agra, 40 km farther southeast.

The committee's studies revealed that the sulphur dioxide content of the air in Agra is already 15 to 20 micrograms/m³ because of two power plants, numerous small industries and a railway shunting yard there. The refinery, according to the report, would only add a further 1 to 2 micrograms/m³ in the long term, although short-term peak concentrations of 65 micrograms/m³ might be expected under the worst meteorological conditions in winter.

Meanwhile the Government also engaged an Italian firm, Techneco, which specialised in the damaging effects of pollution on marble, to study the problem. The firm in its report ruled out any potential threat to the Taj from the refinery. Another study by the Indian Meteorological Department (IMD) on the expected ground level concentrations of sulphur dioxide in the Agra region because of the refinery also sought to allay the apprehensions. None of the two reports have been made public so far.

However, some experts and technical agencies have expressed doubts about the validity of the findings of Techneco and IMD which they say are based on wind data not of Agra but of Delhi. They alleged that the mathematical models, which were developed abroad, and the constants used were not appropriate for the local weather conditions. The Archaeological Survey of India, which is responsible for the maintenance and conservation of the monuments, is of the view that the emissions from the refinery would certainly discolour and wear away the white marble of the Taj.

Further critics say the Varadarajan committee has avoided the main issue: the report does not say in unequivocal terms whether the threat does or does not exist. They point out that the terms of reference did not include the possibility of shifting the refinery to another site away from Agra. (The Minister of Petroleum and Chemicals, Mr H. N. Bahuguna, had reportedly given the assurance last year that he would reconsider the moving of the refinery to Etawah, 100 km east of Agra, if the expert committee definitely said there was potential danger to the Taj.)

Nevertheless the committee recommends some control measures: that long-term emission of sulphur dioxide from the refinery should be limited to 1 to 2 micrograms/m³ and that three monitoring stations should be set up between the refinery and Agra to keep a constant check on this. The committee also puts forward plans to reduce the overall sulphur dioxide

content in Agra by closing the power plants, switching from coal-fired locomotives to diesel in the shunting yard, moving out some of the present industries and banning from the area any new ones which might add to pollution. It also wants to set up a body to monitor the air at Agra and advise industries on how to keep within acceptable pollution limits.

The Indian Oil Corporation, which has commissioned the refinery, has also taken steps to minimise pollution. Low sulphur fuel oil and gases will be used in the furnaces, and a plant will be installed for the removal and recovery of sulphur. The height of the emission stacks will be increased from 40 metres to 80 metres to ensure better dispersal, and fixed and mobile stations will monitor the concentration of sulphur

dioxide at ground level at various distances from the refinery. These measures will, according to the corporation, limit sulphur dioxide emission from the 6 million tonne refinery to 1 tonne per hour. Installing a planned flue gas desulphurisation unit could reduce this to 0.4 tonne per hour, the Corporation believes.

Corrective action is envisaged if the emissions rise above the safety level. But, critics ask, who will give directions to the refinery each time the monitoring stations give warning that the pollution has risen above the danger level? Moreover, they point out, the recommendations are not mandatory. What is the guarantee that the measures suggested by the expert committee would be fully implemented? And even if all the safeguards are taken, a certain amount of

residual pollution will cause damage to the monuments over a long period.

The latest among the public figures to come out openly against the refinery is the noted ornithologist Dr Salim Ali. In a public statement he called for the shifting of the refinery as "there is a controversy among experts about its effects on the Taj". Dr Ali also spoke about the threat to the famous Bharatpur bird sanctuary near Agra because of refinery gases.

While the Government is yet to take a decision on the Varadarajan Committee report, more than 80 million rupees is reported to have already been spent on the refinery project. There is growing apprehension among critics that it may soon be too late to turn back. □

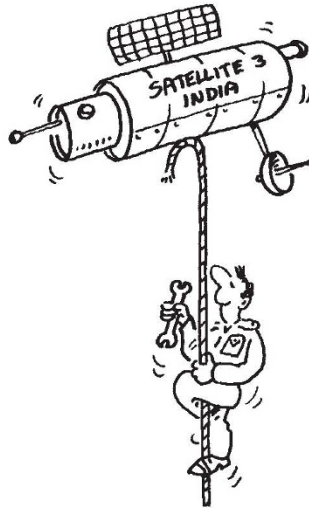
India plans to invest in tethered balloon technology

WITH the successful ascent of a 270-cubic metre tethered balloon at the Space Applications Centre (SAC), Ahmedabad, on 19 May this year, India has joined the select band of countries like the United States, Britain and France which have developed tethered balloon technology.

According to the Electronics Commission's Information, Planning and Analysis Group, India has all the expertise and indigenous materials to develop this technology on a large scale. A panel on tethered balloon technology, set up by the commission to work out the best plan given available resources and the work in progress in the country, has recommended developing balloons of all sizes—small, medium and big. The panel has also stressed the need for making possible users aware of the potential of balloons.

Research in this technology began in India when tethered balloons were seen as a substitute for the ATS-6 satellite for the continuation of the SITE programme. On the initiative of the Electronics Commission, research was taken up at SAC in April 1974. Apart from the many government and private institutes that helped in designing and testing the balloons, collaboration was sought with the Tata Institute of Fundamental Research, where work was already in progress on plastic balloons.

Two years ago, Tata launched a similar balloon to the present one from its National Balloon Facility at Hyderabad. The present balloon is of medium size, has a payload of 50 kg and can float to an altitude of 1.5 km. Except for two fireproof motors in its pressure regulation system, its components are all Indian made. It carried telemetry and telecommand equipment and batteries.



There is no doubt that tethered balloons are the poor nations' substitute for satellites. Once their technology is developed, they can be used for TV and FM broadcasting, remote sensing, ecology, oceanography, meteorology, coastline management and pollution monitoring. Because they are tethered, height can easily be varied for the study of atmospheric phenomena close to earth. A study carried out by IPAG suggests using balloons in offshore oil exploration as a temporary communication link with offshore platforms.

For communication and TV relays over hilly areas, where building earth-

bound installations is difficult and expensive, tethered balloons can also be used. The panel has said that two balloons at an altitude of 30,000 metres, one at Shillong and another at Dibrugarh, could be easily and cheaply used for a service covering most of the north-eastern hills of India.

The panel also advocates the immediate development of low technology tethered balloons—of low payload and short flight duration. For instance, a tethered balloon with a 10 kg payload, parking at an altitude of 1 km for 24 hours, could be useful to the Meteorological Department and the Institute of Oceanography. Such balloons could also be of use in the MONEX programme scheduled for the 1979 monsoon in the country. The panel has also asked for a study of hazards to the balloons, such as lightning and ultraviolet rays.

Once the technology is fully developed, it is recommended that a national agency should take over to tailor the balloons to the needs of users. How cost effective a tethered balloon can be will be apparent from one example. For a TV broadcast operation for one per cent coverage of India, the total capital investment is 40 million rupees with an annual recurring cost 4.2 million rupees. The same costs for a tethered balloon would be 6.5 million and 1.7 million rupees.

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Correction

In 'India prepares to launch Earth resources satellite' (10 August, page 526) it was incorrectly stated that the SEO satellite will be launched from the SHAR range in India. The satellite will be launched in the Soviet Union.