RIGHT International, 13 March 1975

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AVING completed a successful 30-day manned flight. Russia is preparing a new space station capable of carrying several cosmonauts. Work has been under
way for the last ten years on a new super-booster at least equivalent to America's Saturn V and launch preparations are now finalised. The projects are directly related to each other and point to a new era of manned space activity, giving a clearer view of future Russian plans for orbital flight.
There are indications that the Soyuz spacecraft was originally designed for circumlunar flights, an ambition reduced to irrelevancy by the successful Moon-orbit flight of Apollo 8 in December 1968. Only when Apollo activities reached a peak did Russia take positive steps to adapt Soyuz for a space-station ferry role, thereby providing the basis for a significant manned spaceflight programme during the 1970s. The early Soyuz craft, represented by-vehicles 1 to 9 (and launched between 1967 and 1970). carried sufficient propellant for a flight to the Moon, re-connaissance in orbit around it, and the return journey. Later models dispensed with the performance needed for Moon flights. From 1967, when Soyuz first appeared. Russia was clearly aiming at a lunar reconnaissance pro-gramme, but the death of cosmonaut Komarov in April of that year set back preparations severely and by 1971 the second-generation Soyuz had emerged.

Just as Nasa used redundant Apollo spacecraft to mount long-duration space-station missions in the Skylab programme, so the Russians introduced the Soyuz for space-station ferry flights. Unlike America. Russia has, in Salyut, invested in the development of a more permanent orbital station and has thus acquired an asset with rather greater potential than the one-off Sky-lab. However, this comparison is not strictly valid, for at the time Russia was developing its space-station plans Nasa was expecting to launch Skylab stations at the rate of at least one a year. In several respects Russia is follow-ing a similar plan to that originally advanced by the American space agency. Western political indifference seems to have stifled the very policy that Russia is now so effectively exploiting.

Multi-role spacecraft

Analysis of the Salyut design shows evidence of a desire to meet both civilian and military objectives within the same spacecraft, so standardising production and launch operations and avoiding costly duplication of de-velopment effort. Salyut 1 was launched on April 19, 1971, into a 200km-222km orbit to await the three-man Soyuz 10 crew who arrived four days later. This 48hr flight cleared the way for the long-duration attempt which began with the launch of Sovuz 11 on June 6. By June 30 the three cosmonauts were on their way home after a 22-day stay in Salyut, but a loss of pressure in the Soyuz ferry vehicle caused their death before entry into the atmosphere. Sub-sequent modifications and the incorporation of a new life-support system reduced the crew-carrying capacity to two persons.

Not until April 3, 1973, did Russia resume space-station operations, with the launch of Salyut 2 into a 215km-260km orbit. Next day the path was raised to 239km-261km and again, on April 8, to 261km-286km. Speculation concerning the fate of Salyut 2 heightened when rumours began circulating of a possible break-up in orbit, but the

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Russians countered these suspicions with statements claiming a planned pressure test which had resulted in the destruction of the vehicle. If Soviet engineers had de-cided to stage a full test of the environmental control system, a test to destruction may have been deemed neces-sary to the proving of the design. If this was the case it is puzzling that the Russians designated the flight Salyut 2 rather than disguising it as a Cosmos mission. But no-manned launch was made and on May 11 Cosmos 557 was placed into a 218km-266km orbit. A student of Russian space policy, Sven Grahn. points out the similarity of the transmitter frequencies used to those of Salyut 1, con-firming the launch as that of a Salyut station. This seems to indicate a serious accident to Salyut 2, necessitating a disguised follow-up test in space. Cosmos 557 re-entered and fell into the Indian Ocean eleven days after its launch. The post-Soyuz 11 spacecraft was man-rated in Septem-ber and December 1973 when vehicles 12 and 13 carried two-man crews on short-duration missions. An unmanned Soyuz (Cosmos 573) had been flown in June of that year. The way was now clear for a resumption of space-station operations and towards this end Salyut 3 was placed in a 219km-277km orbit. Soyuz 14 docked with it on July 5 and returned to Earth 14 days later. Soyuz 15 flew to dock with Salvut 3 on August 26 for a brief, two-dav exercise.

Countdown for new

Russian space-station?

Unmanned operations with Salyut 3 continued through an orbital change on October 24 to December 25, 1974. The station re-entered the Earth's atmosphere and was destroyed following retro-fire on January 24.
Examination of the Salyut 1, 2 and 3 flights, plus that
of the unmanned space-station flown under the guise of Cosmos 557. reveals two distinct types of mission. Salyut 1 and Cosmos 557 (orbited in April 1971 and May 1973 respectively) were apparently engaged in scientific re-search covering astrophysics, Earth-survey and biomedical tasks. Salyut 2 and 3 (launched in April 1973 and June 1974) appear to have been part of a military surveillance operation in which the second of the two vehicles con-ducted an extensive reconnaissance programme before its re-entry into the atmosphere. In this respect US and Soviet space objectives are similar. Nasa was made re-sponsible for civilian space-station activity, Skylab that is, while the Defence Department was assigned the Manned Orbital Laboratory (MOL) project with which to meet its military requirements. The cancellation of MOL in 1969 pre-vented simultaneous development of the two designs but the Russians arc obviously pursuing a similar approach by combining the two functions in one vehicle. The military Salyut carries an advanced multi-sensor package which is returned intact to Earth while the science and technology vehicle incorporates astrophysical instruments in the same location. Salyut 3's reconnaissance package was returned to Earth automatically on September 23, 1974, less than a month after the Soyuz 15 visit. Salyut 3 is therefore the first successful flight of the military version, since Salyut 2 apparently failed to meet its objectives.

The only successful civilian flight was demonstrated
by Salyut 1, occupied bv the Soyuz 10 and 11 cosmonauts. Cosmos 557, although a civilian design, did not support manned activity. Then, on December 26 last year, Salyut 4 was launched to act as a base for the 30-day flight of Soyuz 17. The two-man crew flew to rendezvous with the space-station on January 11 and returned on February 9. From an initial orbit of 219km-270km the unmanned sta-tion was boosted to a height of 250km four days before the cosmonauts arrived. This shows a significant increase in performance over previous Salyut flights; the long-dura-tion orbits now possible will greatly extend the useful lives of future Salyuts. Russia is obviously interested in building up the number of endurance flights devoted to