

Russia Hopes To Launch Reusable Spacecraft In 2012

It does not sound likely that Russia will employ a reusable spacecraft in 2012 - but it is. On Friday, February 3, the Russian Space Agency is due to announce the developer of a new Russian reusable spacecraft, reports RIA Novosti.

The shortlist includes Energia Rocket and Space Corporation, Khrunichev Space Center, and Molniya Science and Production Association. As manned space flight capability has been put on top of the national agenda, the winner will have every incentive to deliver on its offers. Moreover, foreign players might join in if the project proves successful. Director General of the European Space Agency, Jean Jacques Dordain, has repeatedly made it clear that his organization is watching the project closely.

To move with the times, we certainly need new spacecraft designs that can take people to the Moon (and help sustain a human colony there) and eventually to Mars.

To calculate single-use launch costs - necessary to complete such a formidable effort - is already a challenging task; frequency of orbiting will be as crucial as the sheer total payload. Without reliable figures, the question arises: will reusable technology be commercially viable?

The answer is yes, but only if the frequency of its use is high enough. The calculation that states single-use systems withstand cost competition against reusable technology at five launches per year includes such collateral costs as alienation of the land, exposed to the fall of jettisoned parts (under five launches per year, it may only be temporary, with local population, cattle, and vehicles having to be evacuated from the riskiest areas).

Alienation has never really been a factor in Russia, because, until recently, decision-makers just did not have to bother about evacuations, let alone full alienation and corresponding economic pressure. In the modern world, however, these costs are real, and have to be taken into account.

In short, reusable systems win the race at a minimum of 75 launches within a 15-year program, and save even more as the frequency of launches grows.

With reusable systems under your belt, you need not produce a new rocket each time you have a heavy load to orbit. In comparable space programs, reusable technology requires five times fewer rocket stages, 50 times fewer central hulls, and nine times fewer liquid-propellant second-stage engines, thus probably saving one full single-use rocket's cost on a program with a reusable launch vehicle.

The bulk of post-flight and turnaround MRO calculations for reusable spacecraft made back in Soviet times was based on bench and flight tests of the Buran orbiter airframe, with special heat protection coatings, strategic bombers, and reusable liquid-propelled engines of the RD-170/RD-0120 class. According to the research, turnaround costs were about 70% lower than the cost of a new single-use rocket.

Who's on top?

The clear frontrunner is Energia, with decade-long Soviet expertise and the Mir orbital station and the Energia-Buran orbiting system on its record. The Kliper space shuttle, its own original design, not only offers an interplanetary capability but can also make the backbone of a new - conceptually new - reusable space transport network. Energia's president Nikolai Sevastyanov promised a Kliper maiden flight as early as 2012.

If Energia wins the tender, he said, after a three-year "full flight qualification," the new shuttle will become the basic carrier for all manned space missions. He noted low operational costs and health-friendliness among key requirements, as the shuttle would carry two professional space pilots - one responsible for orbital operations, the other for landing - and four non-professionals, researchers or space tourists.

Normal landing, Sevastyanov said, would be possible at the Russian Baikonur Space Center and French Kourou Launch Site; emergency landing will be safe enough at many operational airports. The Kliper concept includes the prospect of developing Energia's huge tourism program, which offers a week at the International Space Station and a flight around the Moon.

The first full-scale mockup of the new Russian space shuttle was exhibited at the MAKS 2005 air show, near Moscow. The first impression was that the 10m/20cu m shuttle offered much more space than the Soyuz, the Russian space research mainstay for decades. The shuttle doubles the weight of the seven-ton Soyuz and has a payload capacity of 500kg.

Energia also proposes another project developed by its subsidiary Space Regatta Consortium. Its main advantage, Space Regatta CEO Vladimir Syromyatnikov said, is that the design does not use heat resistant tiles, like those responsible for destroying the last U.S. Space Shuttle.

"We are currently working on a new spacecraft. It is going to be reusable, a hybrid of capsule Soyuz-class and winged Buran-class vehicles. The new design should ensure safer and more reliable space flights," the executive said.

The idea is that the new spacecraft acts most of the time as a conventional Soyuz-class capsule, with wings folded, and protected, by a heat-resistant sabot. As the descent vehicle heads back to Earth, the sabot is discarded, the wings are unfolded, and the vehicle lands like an aircraft.

The convergence between the Soyuz and the Buran is going to give the new vehicle compactness and interoperability, with rescue systems along with advanced flight characteristics. A lighter version is going to weigh no more than seven tons, which will make the new spacecraft compatible with Soyuz launch vehicles. Meanwhile, its heat resistance capability, unlike conventional winged space vehicles, will be based on an alloy coating, rather than tiling.

"This is a key advantage of the project. With a need for in-flight, as well as turnaround retiling, tiles are expensive and risky. What we need is a breakthrough that will allow us to discard them altogether," Syromyatnikov said.

"The spacecraft is going to be orbited like a capsule, while the landing procedure will be the same as for a fixed-wing aircraft. This enables re-entry at an earth escape velocity and safe landing after an interplanetary mission," he added.

The project is at the technology proposal stage.

Who is who on the shortlist

Energia Rocket and Space Corporation, a national space technology pioneer, named after the first Soviet spacecraft designer Sergei Korolyov, was set up on August 26, 1946 and since then has contributed to almost all domains of rocketry and space. Energia's record includes the first-ever Soviet R-1 (SS-1A Scunner) and R-2 (SS-2 Sibbling) ballistic missiles, the first nuclear-capable design R-5 (SS-5 Shyster), and the legendary R-7 (SS-6 Sapwood) intercontinental missile from which civilian-use launch vehicles were later derived. Energia played a key part in the launch of the first-ever built satellite in 1957 and the first Gagarin manned space mission in 1961.

The first space station, Salyut 1, was also an Energia project. The corporation contributed to national (Voskhod, Vostok, Kosmos, Soyuz) and international U.S.-Soviet (Soyuz-Apollo) manned space programs and automatic research missions to the Moon, Venus, and Mars.

Energia developed the Proton and Zenit final stages, Yamal advanced telecommunications satellites, and tested the Energia-Buran concept. The corporation made dozens of manned Soyuz and cargo Progress spacecraft and was a key developer of the Mir orbital station, which worked for 15 years, and gave Russia volumes of knowledge on long-term space flights.

Currently Energia is a contributor to the Sea Launch international space effort, and still makes the Soyuzes and Progresses, which are currently the only gateway to the ISS.

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The Khrunichev Space Center, an important player on the modern space technology market, was set up on June 7, 1993, as a convergence of aircraft and space production facilities, Khrunichev Engineering Plant and Salyut design bureau. The two institutions had been responsible for the UR-100 and UR-200 ballistic missiles, all Salyut orbital stations, and all the Mir modules.

Currently Khrunichev specializes in heavy (Proton-K and Proton-M) and light (Rokot) launch vehicles, and the Briz-M and Briz-KM final stages. It is also the key contractor for the Russian segment of the ISS, currently consisting of the Zarya and Zvezda modules. One of its latest developments is the Yakhta concept, a general-purpose compact space platform, and Monitor, an Earth remote sensing spacecraft.

Khrunichev is a member of the modular launch vehicle Angara program.

Molniya is a leading aircraft research and production company set up in 1976, under the Buran project that led to the single flight in November 1988.

Since the 1980s, Molniya has embarked on the "flying space launch site" effort, and has developed the Molniya and Gerakl heavy-lift carrier aircraft.

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