

Two views on

Russian space

Bright future or...program in decay?

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A spate of Russian launch failures and fiscal mismanagement has stirred angst from the Kremlin to Congress. Is the worry warranted? Two space experts provide divergent opinions.

VIEWPOINT

TWO VIEWS

Space journalist Anatoly Zak reads the same doomsday headlines we all do about the future of Russia's space program. Zak, who was born in Moscow and is now living in the United States, doesn't think a close examination of the facts warrants such a dim view.



The case for optimism



by Anatoly Zak
agzak@russianspaceweb.com

Russia's space program in recent years has given journalists a lot of fodder for apocalyptic headlines and dire prognoses. Rockets and satellites were failing with stubborn regularity, or simply sat on the ground years behind schedule. An emblematic accident came in 2013, when the nation's workhorse Proton rocket veered off course and exploded seconds after liftoff, right in front of high-definition cameras. Turns out a poorly-trained assembly worker had installed the rocket's critical angular-velocity sensors upside down.

Not surprisingly, there is much lament inside and outside of Russia about the state of the legacy of cosmonaut Yuri Gagarin, the first human in outer space. Some pessimists see Russia's space program facing not only a deep crisis, but potential collapse. Yet it's debatable whether those concerns are justified — or just overblown. I do not believe the situation is as bleak as it seems, and even see reasons for optimism.

No question, the Russian space industry has serious quality-control problems. Those deficiencies stem from such root causes as aging or ill-trained personnel, low salaries, mismanagement and corruption. A bloated bureaucracy and obsolescent management structure inherited from the Soviet Union in many ways is still intact, while huge budgets of the former superpower are not.

First, the big picture. Money is critical for space ambitions, and Russia's space budget has been growing quite dramatically for more than a decade now, reaching 128.3 billion rubles, or \$4.2 billion, in 2013. As has been true of Russia since the time of the Mongols, some of that money likely was wasted or even stolen. But the remainder has trickled down with visible results. Renovated buildings, gleaming machinery and new uniforms offer a sharp contrast from the lean post-U.S.S.R. 1990s. The big new investments in infrastructure renovations likely will bear fruit in the coming decade.

Moreover, the Kremlin this year replaced the military leadership at Roscosmos and initiated a true and radical restructuring of the agency. Within weeks after the takeover, Roscosmos's new leadership issued a clear vision of the agency's space strategy. Officials for instance shelved the super-heavy rocket for the lunar program until better days. They instead accelerated the development of a smaller, cheaper heavy rocket that could have both commercial and human spaceflight applications.

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on Russian space

Stuck in decline

by James Oberg

jamesoberg@comcast.net



Modern spaceflight, former NASA Administrator Mike Griffin was fond of saying, is so complex that it can be pulled off only when people are performing at their absolute best. But judging by their string of spaceflight failures in recent years, the people inside Russia's space industry no longer seem to be at their peak.

The latest mishaps — booster failures, payload failures, control center-command errors and a nagging issue with solar panel deployment on two of the last four Soyuz missions — have reignited concern among Russians over unsolved, perhaps unsolvable, quality control deficiencies within the country's space program. Attempts to reverse the long post-USSR spaceflight retreat have borne little visible success. If anything, a host of new challenges, foremost among them lack of money, have exacerbated the problems.

Because many aspects of Russia's domestic space program are tightly integrated into international projects such as the space station, those concerns affect other national space programs as well.

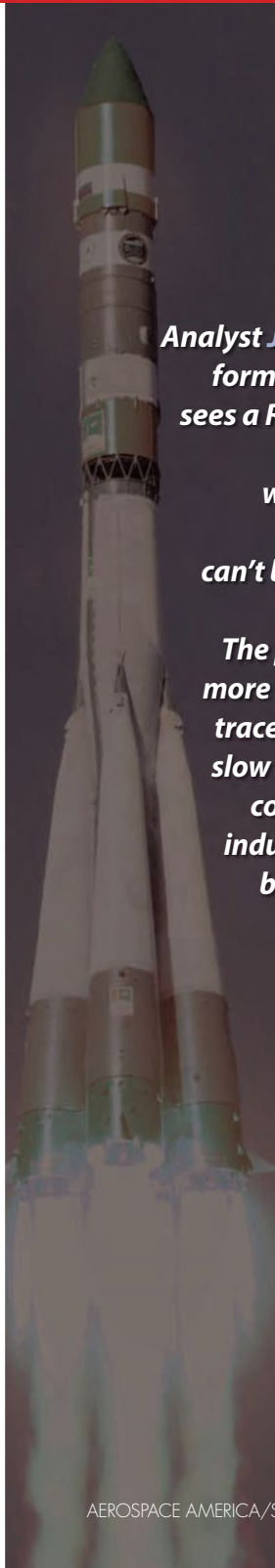
Recently, Russian Deputy Prime Minister Dmitry Rogozin, Moscow's point man for the space industry, lamented what he called corrupt management and other systemic ills within Russia.

"With such degradation in the leadership, one should not be surprised at the high accident rate," Rogozin told Russian lawmakers in a speech in May, according to news reports. Days later, a Russian watchdog agency alleged that the nation's space programs had misspent \$1.8 billion in 2014 alone.

Reforms initiated by Rogozin likely won't bear fruit for several years — assuming he gets enough money to implement them. Igor Komarov, a former auto industry executive and the fourth person in six years appointed to fix the Russian space agency Roscosmos, said a turnaround "will need profound reforms."

The Russian space industry retains a core competency that continues to operate mature space systems, perform regular upgrades, and occasionally pull off respectful leaps in capability such as the new Angara booster family, or not long ago, a 500-day ground isolation test run for a manned Mars mission. But the problem that Komarov and others have been addressing is much deeper than the highly-visible rocket explosions, spaceflight operator errors and corruption trials.

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Analyst James Oberg, formerly of NASA, sees a Russian space program whose failures and mishaps can't be chalked up to bad luck. The problems can more accurately be traced to the long, slow decline of the country's space industry after the breakup of the Soviet Union.

Optimism

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One of Russia's workhorse Proton rockets exploded seconds after liftoff in 2013, an accident traced to the faulty installation of sensors.



Roscosmos

Russia's most serious recent woes have come from the strongest segment of its space program — its rocket fleet. Those troubles for the first time are threatening Russia's leading position in the hyper-competitive field of commercial launch services.

But let's put those launch failures in proper context. Russians launch a lot of rockets, more than anybody else in the world. So far this year, Russians have made a total of 14 orbital launch attempts, two of which ended with failures. In April, a Soyuz rocket failed during the operation of its third stage, whose rapid breakup fatally damaged the Progress cargo ship moments after its separation from its booster, investigators believe. That was followed by a Proton rocket failure in May, resulting in the loss of the MexSat-1 communications satellite, also due to the third-stage failure. By comparison, Americans flew 13 missions, including the SpaceX Falcon 9 v1.1 that disintegrated in June. During the same period, Europeans launched just five rockets, and the Chinese two. Last year, Russia fired 37 missions into orbit with two failures; the United States launched 23, with one failure. China and Europe were far behind with 16 and seven successful orbital attempts, respectively.

It's worth noting that the latest failure of the Proton rocket was traced to a historical engineering flaw that had previously

The Soyuz TMA-9 spacecraft launches from the Baikonur Cosmodrome in Kazakhstan. Soyuz rockets and capsules are currently the only vehicles that can ferry crews to the International Space Station.



doomed two other vehicles. Roscosmos, the Russian space agency, says new diagnostics tools installed on the latest Proton have now pinpointed and fixed the problem once and for all.

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Decline

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The scope of the problem goes far beyond the evident troubles; it also shows in the things we don't see.

Russia has not ventured beyond Earth orbit in a quarter century. And the list of promised deep-space missions invariably seems to retreat further and further into the future.

Russia also has been unable to replace the Soviet-era full-orbit coverage communications relay satellite network — code named Luch, the equivalent of NASA's Tracking and Data Relay Satellites. This is curtailing human spaceflight operations and forcing Russia to rely on NASA's communications network.

More embarrassing is Russia's inability to produce and deliver the long-promised and years-delayed Nauka Science Module, which was supposed to host a major upgrade of Russian station-research capabilities. It's uncertain whether Nauka will ever be built, making Moscow's boasts about building its own orbital outpost ring hollow.

The litany goes on. GLONASS, Russia's answer to the American GPS network, is mired in production shortages for handsets. Fabrication of next-generation spacecraft has been seriously hampered by lack of access to Western electronic components put under embargo after President Vladimir Putin's annexation of Crimea. Thanks to breakdowns of old satellites and delays of promised replacements, Russians still must buy much of their weather and Earth imagery from abroad. The new weather-forecasting satellite is officially still undergoing acceptance testing two years after launch. Even a key rocket fuel, heptyl, is now imported from Germany.

Perhaps most dangerously in an era of growing world tensions, Russia's military officials are publicly complaining that the missile early-warning satellite network has totally collapsed. The delay of replacement satellites means Moscow must rely on ground radars to detect any missile attack, slowing detection and giving dangerously brief window to make life-or-death decisions.

All this may seem like piling on, and no major program is immune to sporadic failures. But the sheer number of technical, operational and financial woes bedeviling



NASA

Soyuz TMA-14M lifts off toward the space station in 2013 carrying a crew of three. Two of the last four Soyuz missions have been bedeviled by trouble with solar panel deployment.

Russia's once-vaunted space program is worrisome. The recent failure of a crewed Soyuz to deploy a solar array, the second in the last four flights — after 30 years of faultless performance — is a disturbing reminder of the “canary in the coal mine” metaphor, a sign of more widespread danger.

Many of the root causes, including an aging workforce, low salaries, obsolescent infrastructure and the deterioration of a culture of disciplined quality control, remain largely unresolved. Meanwhile, a spate of new problems adds to the strain on Russia's space program.

The economic embargo and boycotts following Russia's claim over the Crimean peninsula has exacerbated Russia's vulnerability stemming from its reliance on foreign avionics components. This has added to the

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By contrast, April's Soyuz rocket failure resulted from a transition to a more powerful Soyuz-2 variant, rather than any obvious shortcomings in quality control. What's more, in a display of remarkable flexibility, Roscosmos immediately switched to an older and reliable Soyuz-U, ensuring that the next ISS supply mission two months later went without a hitch. Try that, SpaceX!

Oh, I need not mention that the Soyuz spacecraft and its rocket are still the only vehicles capable of delivering crews to the space station, and probably will remain so for a few more years.

Meanwhile, the Proton's replacement — a brand-new Angara rocket that had been in development for two decades — has just made two promising inaugural flights, proof that Russia is finally replacing its Soviet heritage with 21st-century technology.

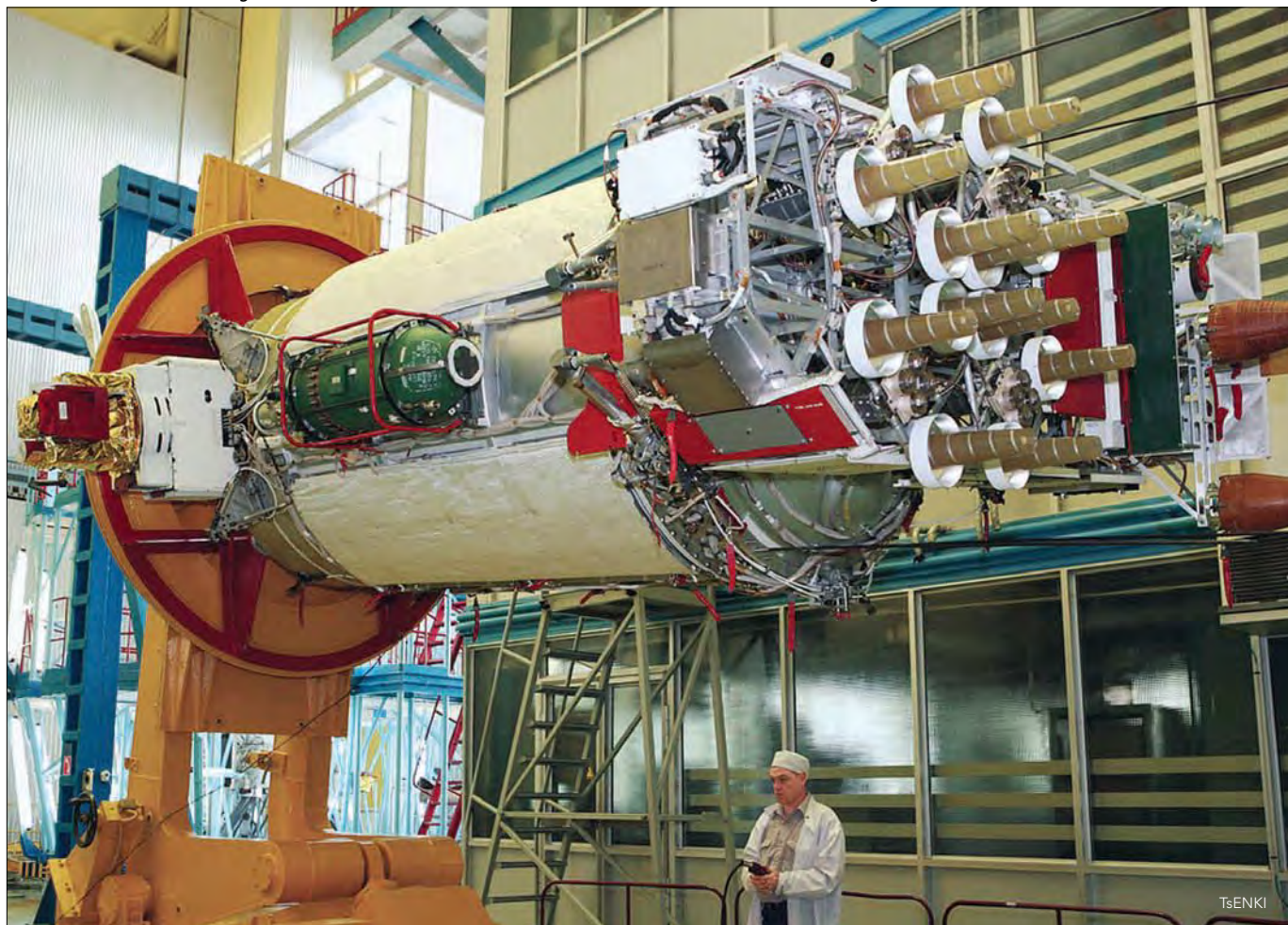
Last, but not least, Russian workers are

putting finishing touches on a monumental spaceport in the far-eastern taiga, with first launch tentatively scheduled for late December. Granted, Roscosmos's previous leadership designed the new Vostochny Cosmodrome with a launch pad for the Soyuz, the world's oldest rocket and the kind that launched Sputnik in 1957. Still, the scale and the technical potential of the Vostochny spaceport marks a truly new beginning for the entire Russian space program. Add the construction of a second launch complex for the Angara family that will start next year, and by the mid-2020s Russia should have a new spaceport, a new operational workhorse rocket and a new-generation spacecraft for human space flight.

That picture doesn't take into account perhaps the most remarkable — if least celebrated — Russian space achievement of the past decade. A decade ago, Moscow's military and civilian satellites were ap-

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The 24-satellite GLONASS navigation constellation, Russia's answer to American GPS, has been revived after facing near death in the 1990s.



Decline

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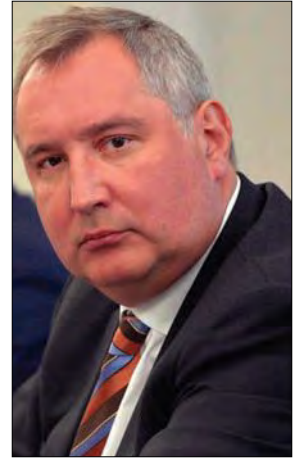
previously recognized need to develop domestic suppliers for several hundred critical aerospace products previously purchased from Ukrainian factories.

The plunge in world oil prices has slashed Russia's space budget by as much as one third less than promised. What's more, Russian policymakers have been siphoning rubles from the space program to military investments. Still more money is being diverted to dubious infrastructure projects, such as the Vostochny Cosmodrome in Siberia and refitting confiscated Ukrainian-owned space facilities in the Crimea. Even if properly managed — and it clearly has not been — this enormous construction boondoggle is sucking up a large share of the financial resources.

The entire space industry is undergoing a massive reorganization with the stated goal of eliminating redundant industrial ca-

pability and standardizing quality control processes. While touting the need to hire 10,000 college graduates per year, Rogozin has declared that 100,000 of the 250,000 current workers will lose their jobs as underused and duplicate production capacity is eliminated. The trick then is to retain enough skilled veterans who can work alongside new hires and pass on the hard-earned wisdom of their experience.

A perennial problem in Russia, graft and corruption, has resulted in more than a hundred prosecutions of middle- and upper-level officials, including Vitaly Lopota, former head of the Energiya Rocket and Space Corp., and Vladimir Nesterov, former chief of the Khrunichev State Research and Production Space Center, the two biggest enterprises in the Russian space industry. Leaders in the west should feel a chill from Putin's recent call for a return to "1930's discipline" and media nostalgia for finding "a



Russia's Deputy Prime Minister Dmitry Rogozin, Moscow's point man for the space industry, reportedly warned that corruption and mismanagement is reflected in the high rates of accidents.

Russian Presidential Press and Information Office

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Rescosmos

The mammoth Vostochny Cosmodrome under construction in Siberia could recharge Russia's space aspirations — or prove to be a costly boondoggle.

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proaching near extinction. However, in the past several years, the industry has slowly rebuilt the nation's satellite network amid several failed attempts.

The 24-satellite GLONASS navigation constellation, Russia's answer to American GPS, was fully assembled and brought to operational status. After its near collapse in the 1990s, GLONASS is now regularly replenished.

Russia also sent a new weather-forecasting satellite to a geostationary orbit after an almost two-decade hiatus. A new-generation communications satellite designed to rival most advanced western equivalents has entered orbit, as has a formidable fleet of high-resolution Earth-watching satellites.

The reinvigorated space industry also delivered to the nation's military a new generation of eyes and ears in the sky. A miniature satellite inspector made three progressively more sophisticated appearances in orbit. The point is, this again testifies to the growing engineering potential of the Russian space industry.

One major hole for Roscosmos remains space science. No Russian planetary probe has been sent beyond Earth's orbit since 1988 and only one major space observatory is currently operating. That could change with the ExoMars project that aims to deliver a European-built rover onto the Red Planet around 2018 with the help of a Russian-built lander.

If successful, Roscosmos will have, for the first time, a proven method for planetary landing. This experience could later pave the way to more ambitious projects, including a pioneering mission to return soil samples from Mars.

Albert Einstein famously said, "You never fail until you stop trying." Clearly, if the Russian space program withers, it will be not from lack of trying.



Anatoly Zak, a native of Moscow and a U.S.-based journalist, is publisher of RussianSpaceWeb.com and the author of "Russia in Space: Past Explained, Future Explored."

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new Beriya,” brutal leader of Stalin’s post-World War II Soviet nuclear program.

Top-level plans seem to focus on a relentless crash effort to make a satellite launch out of Vostochny Cosmodrome by the end of this year. However, it’s worth noting that the same construction group that rushed the Sochi Olympics to last-minute completion is in charge. But getting the launch off will not signify the achievement of operational capacity. That’s because the fixes largely come at the expense of existing resources. These schedule-driven directives have called for use of emergency utilities, the shortcutting of other infrastructure by leaving out all facilities not directly supporting the initial launch, and the temporary duty of key personnel from experienced launch teams from other launch sites. None of these ad hoc measures will ameliorate the growing weaknesses that have already been inducing an intolerably high error rate in the mainstream Russian space industry, nor will a successful but purely symbolic “on time” first launch.

That NASA officials have been downplaying Russia’s problems reflects respect for Russia’s space heritage. It also indicates a blind faith in the constancy of the odds governing catastrophic failures, which for Russia have historically been low. That faith results from a logical fallacy, and not merely because dice have no memory. In the space business, engineers like to rely on as many of the same fabrication tools, human skills and techniques as possible from mission to mission, but some change is inevitable no matter how hard they try. This means that every mission is carried with a new set of dice — and a growing number of external factors are loading each new set of dice more and more against Russian success.

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James Oberg is a former NASA Space Shuttle mission control specialist who led the orbit design team for the first International Space Station assembly mission in 1998. He is author of a dozen books on space exploration and is a former space consultant for NBC News.

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