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RD-180: Learning to let go

Growing concerns over U.S. dependence on Russia's RD-180 engine for launching Atlas 5 rockets led to the recently released "Mitchell Report," named for the chairman of the panel that studied the issue. Marc Selinger explains the report's recommendations and looks behind the scenes at the long-simmering controversy.

When the U.S. signed an agreement in 1994 to import RD-180 rocket engines built by Russia's NPO Energomash, many defense officials figured the U.S. would one day get around to doing what a panel of experts chaired by retired Air Force Maj. Gen. H.J. "Mitch" Mitchell now recommends it should do: figure out how to propel the first stage of the Atlas 5 without relying cooperation with Russia. Specifically, the Mitchell report recommends a domestically produced engine.

No one through the years was clairvoyant enough to predict that a Russian deputy prime minister would tweet a threat to cut off the supply of RD-180s because of tensions over Ukraine. But U.S. defense and intelligence officials were not unaware of the risk they were taking. Some inside the Pentagon argued that Boeing-built Delta 4 rockets could back up the Atlas 5 rockets if the inventory of RD-180s at a United Launch Alliance manufacturing plant in Decatur, Ill., ran out. Mitchell recommends making sure payloads are also compatible with Delta 4s, but cautions there is no option that would fully replace the RD-180s through fiscal 2017.

Most recently, in 2007, then-Pentagon acquisition chief John Young penned an "ac-

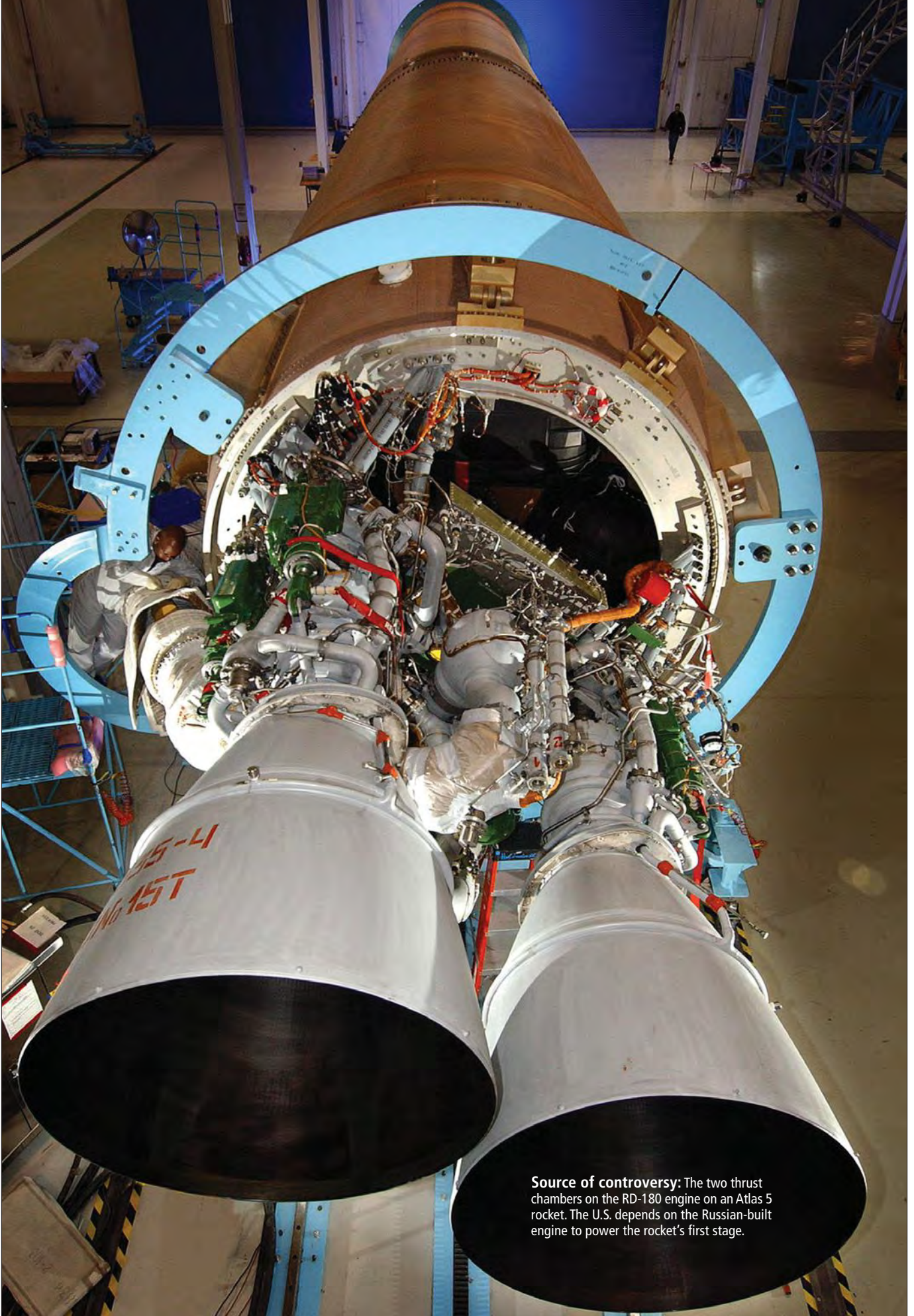
quisition decision memorandum" — or ADM — directing the Air Force to develop an equivalent to the RD-180 on its own or become a co-producer of the engine, meaning a second nation to build RD-180s — not that it would build them jointly with Russia.

"I am deeply troubled by dependence on Russian-produced RD-180s for its space lift," Young wrote in cursive at the bottom of the one-page document. "I want to see a robust, aggressive, fully funded plan to develop a new engine, co-produce RD-180s, or both!"

Young tells Aerospace America that in light of the "long history of roller-coaster relations" between the United States and Russia, it was too risky to rely on Russian engines for vital space launches. That concern is reflected in his memorandum, which tells the Air Force to "maintain a sufficient RD-180 inventory to ensure access to space in the event of a disruption in the supply of Russian engines. This inventory is intended to allow for the smooth transition to a new engine for Atlas 5 or for the orderly transfer of payloads to the Delta 4 system."

As a Georgia Tech-educated aerospace engineer, Young also strongly believed that the U.S. military could — and should — use American-made engines.

"I saw it as a matter of national pride," recalls Young. "In a nation that created the



Source of controversy: The two thrust chambers on the RD-180 engine on an Atlas 5 rocket. The U.S. depends on the Russian-built engine to power the rocket's first stage.

aerospace industry — or the vast majority of it — we were using Russian engines. That was never a satisfying condition for me.”

Despite Young’s effort, Air Force funding for a new or co-produced engine never materialized, and Young says the issue fell by the wayside when he left office in 2009.

“It just got buried in the Pentagon budget process,” Young says.

The Air Force, in a prepared statement, said it “did continue R&D efforts to ‘improve understanding’ [of the RD-180] as directed by the ADM. Those efforts continue to inform the ongoing review of the issue and any decisions that may be made.”

U.S. lawmakers are also concerned about continued reliance on Russian engines. The House Appropriations Committee has proposed spending \$220 million in fiscal year 2015 to begin developing a new U.S.-made engine.

Starting anew?

The Mitchell panel estimates it would take six years to develop a new engine, which is typical, even aggressive, for a new rocket engine program, industry officials say. The program would begin with two years of technical risk-reduction efforts, followed by four years of full-scale development.

The risk reduction phase would cover standard issues for a new engine, including pre-burner and main-chamber combustion stability, the injector and turbo-pump designs, and metallurgy technology.

U.S. rocket experts say developing a new engine would be preferable to learning to make the RD-180 in the U.S. Domestic production of the RD-180 would save little time or money and would use a 40-year-old design, these industry officials say. One problem is that Russian engineers protect metals parts inside the RD-180s by applying coatings. The U.S., by contrast, would prefer the newer approach

Standby: A Boeing Delta 4 lifts off. Some in the Pentagon have argued that if the RD-180 engine became unavailable, this heavy-lift rocket could fill in for the Atlas 5.



Boeing



United Launch Alliance

Blasting off: An Atlas 5 launch at Vandenberg Air Force Base. An angry tweet by a Russian official during the Ukraine crisis threatened to cut off the supply of RD-180 engines that power the rocket’s first stage.

of utilizing alloys that can withstand an oxygen-rich combustion environment like that inside the RD-180 — an environment that can burn parts absent the right engineering solution.

“There are not many things you would start with 40-year-old technology, and rocket engines are no exception,” one industry official says.

Also, an agreement allowing the U.S. to co-produce the RD-180 expires in 2022, and there is no guarantee Russia would approve renewing that agreement, especially with U.S.-Russian relations tense over Ukraine.

On the other hand, developing a new engine would create its own set of challenges.

The 46 Atlas 5 launches powered by the RD-180 have gone well. “If we do a new engine, there will be no track record,” Young says. “We’re going to have to start over and we’re going to be taking some risk. But I believe...the U.S. should have the capability and the national will to have a rocket engine industrial base that can launch any payload we need to launch.” ▲