

Lockheed Martin's Skunk Works division has become a model for DOD acquisition.



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Lockheed Martin's supersecret "Skunk Works" advanced development organization—producer of the U-2 and SR-71 spyplanes and the F-117 stealth jet aircraft, among a host of other highly classified projects—is starting to break its traditional silence. This is driven in part by plaudits from top Pentagon acquisition leaders and partly by a desire to be better understood by the public.

The special projects unit is at work on a flurry of next generation concepts, some of them discussed by leaders during a recent *Air Force Magazine* visit to the Skunk Works facility at Air Force Plant 42 in Palmdale, Calif.

Top Pentagon acquisition officials—Deputy Defense Secretary Robert O. Work and acquisition, technology, and logistics chief Frank Kendall, to name two—have made it a staple of recent speeches that industry and government alike should emulate the Skunk Works model. It's unusual praise from officials who ordinarily must be strictly agnostic in their comments about industry vendors.

Kendall started calling Skunk Works to the front of the class in his 2013 rollout of "Better Buying Power 2.0," the second installment of his improved guidelines for Pentagon procurement managers. In covering commentary, Kendall said

acquisition reformers "have advocated a lean and less burdensome approach to managing programs and to making major acquisition decisions. One ... is the 'Skunk Works' approach, which dates to the 1960s. This approach involves small, highly competent government

Top: The most recent Skunk Works project to come out of the black was the RQ-170 Sentinel. Internet photos have shown it in Afghanistan, on Guam, and refueling from a tanker. Bottom: The Skunk Works facility in Palmdale, Calif. Two of its more famous successes—the P-80 jet fighter and F-117 attack jet—sit on poles outside the main building.

Internet photo

itions DESERT

By John A. Tirpak, Editorial Director

and industry teams working together on a new product development.”

In speeches this year, Kendall and Work have further touted the Skunk Works method as a smart template for preserving the US military edge during a period of flat budgets, as adversaries close the technology gap. In their view, it will be crucial to rapidly prototype new systems and accelerate the pace that technology is refreshed on existing platforms. Speed, Kendall said, can be gained by reducing “non-value-added” oversight from the Pentagon and Congress, by clearly defining projects and desired outcomes, by keeping work groups small, and by using mature but not yet fielded technologies.

Today, Skunk Works is working on hypersonics, directed energy, a sixth generation fighter, future spyplanes, and various classified programs.

“We’re being a little more public,” said Rob Weiss, Skunk Works vice president and general manager, because “we think it’s important that the nation recognizes that we’re very relevant to ... the nation’s defense needs ... and how we have the right model and culture to develop capability that’s critical, and to develop it quickly and affordably.”

Speaking in a reception and meeting area clearly geared to high-level visitors—access to work areas is tightly controlled—Weiss said the Skunk Works model can be summed up as “getting the requirements right up front, having a small number of requirements that you’re really designing to, and holding those requirements through the development process.” In addition, it’s important to get “the right people on the government side, getting the right people on the industry side” with the right talents, establishing “trust between government

Photo by Paul Weatherman



A-12s—secret CIA spyplanes that were forerunners of the SR-71—under construction when Skunk Works was located in Burbank, Calif.

and industry, [and making] sure we're not adding people to the equation that don't really add any value. Small empowered teams [are] one of the keys to success" at Skunk Works.

Third, Weiss said the unit's success "is really having your arms around the risk side of the equation." Besides client and contractor both having a clear understanding of risk, Weiss said Skunk Works looks to drive it lower by "looking for a lot of reuse," such as hardware components and software already shown to work on other platforms. The Have Blue, for example—Skunk Works' proof-of-concept aircraft that led to the F-117—used engines, instruments, and an ejection seat from the F-5 fighter; landing gear from an A-10 attack airplane; and an F-16's fly-by-wire flight control system. The big innovation of the aircraft was its low radar cross section.

Skunk Works' founder, the legendary Clarence L. "Kelly" Johnson, once said the key to success was limiting invention to "one miracle" per project.

The list of the division's achievements is long, ranging from the P-80—the first practical US jet fighter—to the F-104, the U-2, the C-130, the SR-71 and its many variants, Have Blue and the F-117, and in later days, the F-22 and F-35 fighters.

Skunk Works developed the Navy Sea Shadow stealth ship—whose lessons now echo in the slab-sided designs of modern Navy vessels—and the RQ-170 Sentinel, about which Lockheed Martin will add nothing to the Air Force's terse description that it is a stealthy remotely piloted vehicle, one having famously crashed in Iran.

Books have been written detailing other Skunk Works projects, not all having progressed to a fielded product, and not all successful.

The Skunk Works facility comprises several buildings at Palmdale. One houses the offices where analyses and design are done. Another serves as the home of programmed depot maintenance on the U-2. Still another is a large "clean room" housing an advanced tape-laying machine that can rapidly produce large complex aerodynamic shapes to extraordinary tolerances. On display are pieces of Skunk Works' "Polecat" stealth RPA demonstrator and the tooling used to make it.

The largest building on the site used to be the factory for the commercial L-1011 widebody tri-jet, Lockheed's last civilian airliner. It is now divided between two efforts. One is the giant P-791 Hybrid

Airship, a proof-of-concept vehicle aimed at a future airlifter. It combines traditional lighter-than-air technology with an aerodynamic shape that will generate about 20 percent of the craft's lift when under power. Big as it is, the envisioned final version would be many times larger and deliver heavy payloads directly to the front, eliminating the need to move extremely heavy cargo by sea to ports and then transshipping it to forward areas by truck or rail.

Next to the airship is "The Great Wall," as employees call it. Undecorated and dozens of feet tall, it blocks a view of whatever secret projects Skunk Works is working on. Power tools as well as less-sophisticated saws and hammers can be heard on the other side. (It's worth noting that the original F-117 mock-up was made of wood.)

Weiss said much of the Skunk Works effort is in analysis. The division is always looking for business, trying to anticipate what the services will need before they know it themselves. During lean years, former Skunk Works general manager Ben Rich pitched the Air Force a significant upgrade to the U-2, with new engines, sensor payloads, and other improvements

that resulted in almost an all-new aircraft. Those aircraft, though modified many times since, are still in use today and are expected to serve at least until 2020.

Weiss offered observations on some of the futuristic technologies where Skunk Works is heading.

SIXTH GENERATION FIGHTER

Skunk Works is spending the time to “fully understand the requirements” of what will be necessary to “maintain quantitative advantage over our adversaries” and secure future air dominance when the F-22 and F-35 fighters are no longer considered state-of-the-art. The Air Force is already inside the typical development time line to begin work on what would ultimately become a sixth generation fighter.

Understanding of the requirements is needed to avoid sending industry “down a bunch of paths that are ultimately not what the nation needs. We are willing to make substantial investments over a period of time, but we don’t want to make those investments in the wrong areas.”

Toward that understanding, Weiss said his shop is studying the capabilities now deployed and the best way to fully exploit them by making “air, surface, subsurface” truly collaborative.

Next will be an analysis of the modernization paths for all existing platforms, not just Lockheed’s. Weiss said Lockheed Martin might compete for upgrades on “competitor airplanes” but the analysis is really meant to discover “where are the ... gaps” in capability 20 years hence—“And you can’t do that unless you look across all the systems out there.”

Last comes “where do you need to insert a new capability,” and “what is the range of [specific] solutions” needed to fill that gap? There’s “definitely a possibility that there could be a new platform in the equation,” he said, noting that Kendall has already “identified ... X-plane concepts that he wants to initiate ... and there are certain technologies you’re going to want to mature.” Those include “broad areas of survivability.”

THE U-2

“We’ve been asked about unmanned versions of the U-2 and we’ve responded accordingly,” Weiss said, but although “technologically, it’s very achievable,”

Through the Have Blue demonstrator program, Skunk Works proved modern stealth technology worked, leading directly to the F-117. Both photos were taken in the 1970s and '80s.

he wonders if this is “something the Air Force and the nation really would want.”

There are “reasonable roadmaps”—both on the Skunk Works side and the Air Force side—to add capability that would keep the U-2 “very viable” for many years to come. The U-2’s high operating altitude has given it sanctuary from threats in all but a few heavily defended areas. However, Weiss characterized the U-2 and RQ-4 Global Hawk as intelligence, surveillance, and reconnaissance platforms useful only for the “uncontested environment.”

ISR AND HYPERSONICS

Asked if the Air Force needs to go back to a high-speed ISR platform in the class of the SR-71—something survivable in the densest area-denial situations that would be more responsive than a satellite—Weiss said, “Those are all analyses that we are currently doing.”

Speed, he said, “has always been a key part of the survivability equation, as well as enabling timely collection and dissemination of information. So we are analyzing the real value of that speed.”

However, the cost of speed is a big factor in how useful such an approach can be, he said. Hypersonic technology—the ability to fly at more than five times the speed of sound—is not yet mature enough for the company “to say that’s an absolute requirement that the Air Force ought to sign up” for, Weiss said.

Nevertheless, “we’re pretty optimistic about it, we think it could be a real game changer, but it’s going to be a ways in the future before we would propose that as a direction we think is absolutely critical to the nation.”

THE VALUE OF STEALTH

Speed is “one way to achieve survivability,” Weiss said, but effective passive signature management—stealth—makes it possible to safely obtain intelligence in other ways that are “more persistent.” If an aircraft can loiter, undetected, near an area of interest, it can soak up valuable information for an extended period.

Weiss stridently disagrees with some senior Navy officials who have discounted the value of stealth. “No question, stealth will continue to be foundational for [combat] airplane design,” he asserted. “At the same time, there are other techniques that we’re adding to the equation that will continue to make platforms and vehicles survivable into the future against advanced threats. But all these designs start with basic passive signature capability. And there’s a lot that can be done to passive signature



Lockheed Martin photo

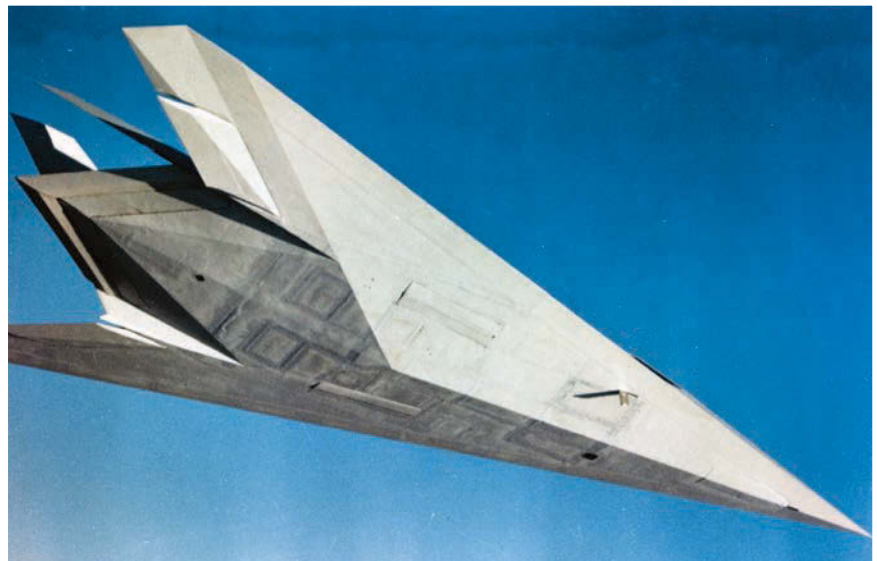


Photo via USAF



today, both on new vehicles and existing vehicles.”

DIRECTED ENERGY

“We are getting a lot closer” to having directed energy weapons with kinetic effects, Weiss said. Lockheed Martin is bringing together its Space Systems & Missions Systems with Skunk Works to develop near-term capabilities, to “mature [and] demonstrate” the feasibility of DE weapons—known in general parlance as lasers.

Weiss noted a requirement from Air Force Special Operations Command to put a directed energy weapon on a C-130 “in the 2017 time frame ... with an actual airborne demonstration.”

The size of the required host platform has shrunk from a 747 to a C-130, “and now the goal is to get it to a tactical capability that could be on the roadmap to F-35 upgrades in the future.”

A directed energy capability is not yet in the official list of planned upgrades for the F-35 fighter.

LONG-RANGE STRIKE BOMBER

Lockheed Martin’s partnership with Boeing on the Long-Range Strike Bomber (LRS-B) is “extremely effective,” Weiss said, a “complementary arrangement” with each company bringing “inherent capability [that], ... when packaged together, provides tremendous capability” for the Air Force.

“We’re not redundant, we’re not fighting about who gets what work, it’s just a very naturally occurring team that, frankly, you wouldn’t recognize what facility you’re at or what badge anybody’s wearing as the team operates.”

Top: The P-791, shown here at its 2005 rollout, is a development platform for a potential future airlifter that would be many times larger. Called a Hybrid Airship, it’s a lighter-than-air craft that also derives lift from its shape. Left: Skunk Works Executive Vice President and General Manager Rob Weiss.

He said the teaming arrangement is no different from working with another Lockheed Martin division.

Weiss declined to comment on how Skunk Works can cooperate with Boeing on the LRS-B but keep its best tricks for itself, given that the two will compete for future projects.

FUTURE NUMBERS

The Air Force facilitated to build 132 B-2s but ultimately only bought 20. It created a factory to make 750 F-22s but only got 187. Is the future of combat aircraft in short production runs segueing rapidly into successor systems?

“I think there’ll be a combination” of high-volume systems as well as short-run projects, Weiss predicted. In cases where there will be “substantial investments made by government and industry” in developing platforms with “a long-term payoff,” amenable to “a series of upgrades that occur over the life cycle of the ... system, ... I think you’ll definitely see some long-run production.”

At the same time, he sees a need for “systems that have a rapid cycle time associated with it. It can be developed quickly, fielded quickly, and produced over a relatively short period of time and then we move on to the next one. So I don’t think ... it’s an either-or answer. I think it’s going to be a combination of both. And we need to get better at both,” in industry and in government.

Weiss said he’s optimistic that can happen, especially given the push among the current DOD leadership to bring industry into capabilities talks early. “Having more frequent, more candid conversations, ... more sharing of common views of where industry’s going, where government wants us to go, ... those are all things that are going to build the trust and success as we chart a path forward,” he said.

Air Force Secretary Deborah Lee James has talked about the need to radically shrink the cost of new systems, and Weiss said, “We’ve been on a path to reduce the cost of manufacturing for decades,” with some “recent breakthroughs” that he said were proprietary.

But Lockheed Martin has also made cost breakthroughs “in partnership—I’ll just leave it at that—with other industry members,” Weiss said. Skunk Works may be the highest-profile example of its kind, but other companies have rapid prototyping arms of their own, such as Boeing’s Phantom Works. The Air Force need for faster, lower-cost solutions means a bright future for small teams making big advancements. ★

