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Why Old Blimps and Biplanes Are the Secret to Tomorrow's Drone Motherships

Almost 85 years ago, Blimps could suck in biplanes like a steampunk tractor beam. Now, the U.S. wants to create something similar — with drones and C-130s.

U.S. Navy

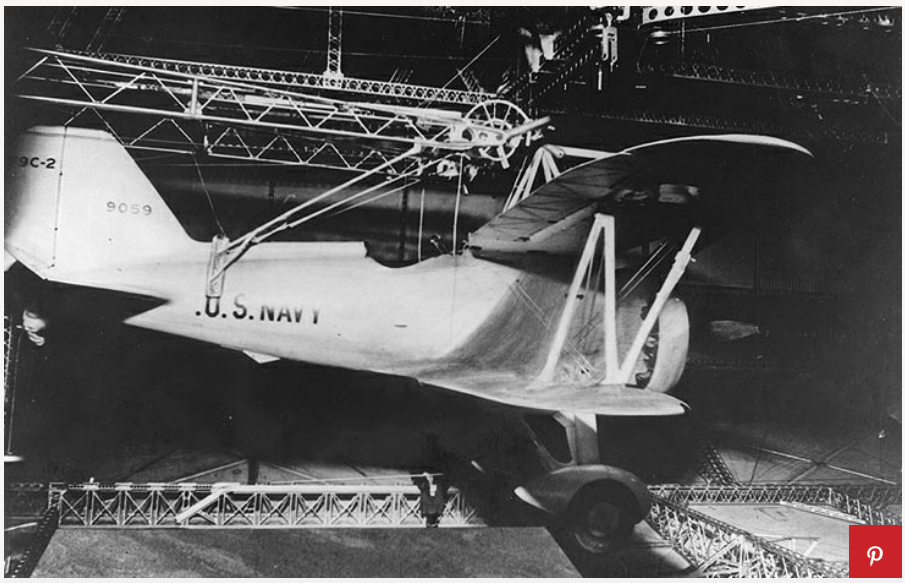

By Eric Tegler Sep 6, 2017

On a calm morning off the coast of New Jersey in May 1932, Navy Lieutenant Daniel W. Harrigan throttled back the 428-hp radial engine powering his small Curtiss F9C-2 Sparrowhawk biplane. As he looked up from the cockpit, the centerline of the massive *USS Akron* airship dominated his view.

He approached a steel arm extending from the airship with a hook on the end. Flying just above the Sparrowhawk's 60 mph stall speed, Harrigan gingerly guided the hook mounted above the his top wing into the hook on the airship arm, successfully mating with the massive *Akron* in flight. The trapeze then swung forward and up, raising the lieutenant and his biplane—its engine still running—into the belly of the airship. Minutes later, the airship took aboard another Sparrowhawk, proving its capability as an airborne mothership with the capacity to hold, launch, and recover up to four reconnaissance biplanes.

This blimp and its "parasite" fighters were a short-lived dream—the project died with the demise of the *Akron* less than a year later. Today, the same idea is being reborn nearly 85 years later. And this time, the parasites are drones.

GREMLINS IN THE MACHINE



A Sparrowhawk inside the USS Akron hangar.

U.S. Navy

Though the machines have changed, the story remains the same. The idea is that a transport aircraft like the C-130 Hercules would be the airborne aircraft carrier, and its 21st century payload is not biplane, but rather a volley of drones that could fly into a battle space to provide reconnaissance and surveillance. These drones would simultaneously communicate and swarm, confusing the enemy with their numbers and distracting its air defenses.

An entire fuel tanker being loaded into a C-130 Hercules, 1955.

Getty + Bettmann

Named for the fictitious imps that became a good luck charm for British pilots during World War II, these Gremlin drones would be small, weighing 500 to 1,000 pounds a piece, smaller than Predators and Reapers. They would carry a 60-pound payload, including various sensors, weapons, and enough fuel to fly for 300 miles, loiter over a target for an hour, and fly back to the Hercules mothership.

Why the C-130? Well, its size is a good start. With a fuselage originally designed to airdrop an M551 Sheridan tank, a Hercules could carry about 16 of the reusable drones. Once recovered, they could be ready for another mission within 24 hours. A lifespan of 20 missions would make the Gremlins competitive with expendable drones and far cheaper to make than more durable drones.

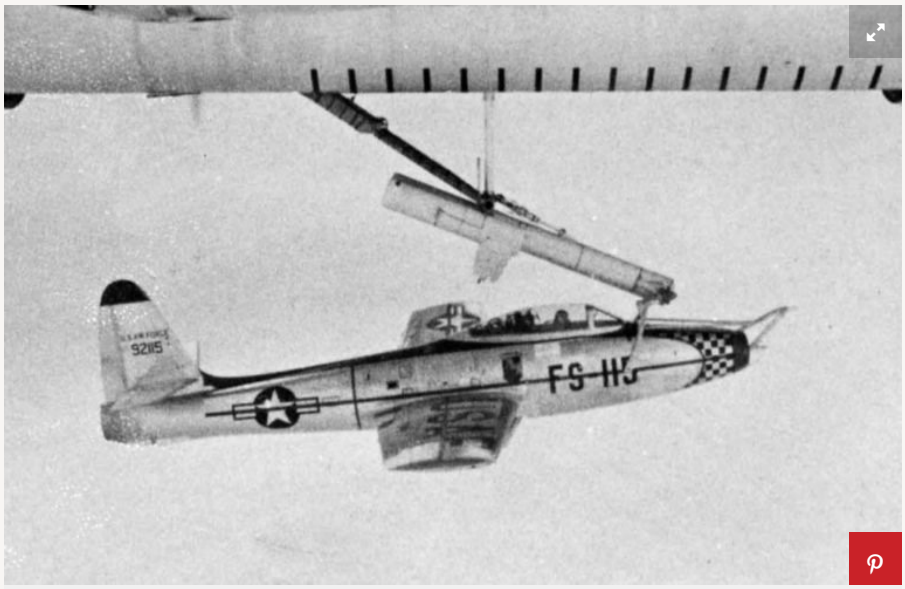
The program to build these things is sponsored by DARPA, the Pentagon's mad science department. Now on Phase 2, the Gremlins program pits contractors General Atomics and Dynetics as they try to build the winning airborne launch and recovery concept, due for a demonstration in 2019.

A concept of the future Gremlin drone.

DARPA

Although a C-130 spewing out a squadron of swarming, armed drones feels like a far future idea, Michael Atwood, General Atomics' senior director of advanced programs, is looking to the past for inspiration. "Everything we're doing has been done before," says Atwood. "We just layer on the unmanned experience that we have."

FROM EXPERIMENT TO REALITY



The F-84 parasite plane.

U.S. Air Force

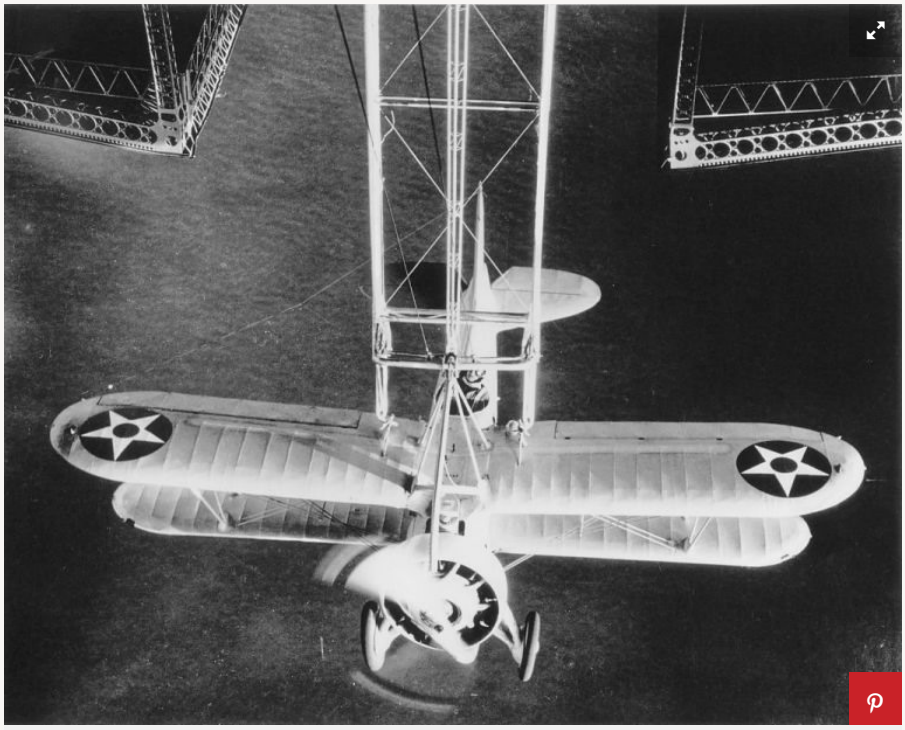
After the era of biplanes and blimps went bust, similar launch platforms popped up in the 1940s and early 50s. Back then, the U.S. Air Force successfully launched and recovered fighters from large multi-engined bombers like the B-29 and B-36. Envisioned as extended range reconnaissance aircraft and interceptors, the McDonnell XF-85 Goblin and Republic F-84 Thunderjet were both coupled to the bombers and hoisted aboard using trapeze-like mechanisms in 1948 and 1952 respectively.

Like the B-29 and B-36, a C-130 generates significant turbulence behind its wing and turboprops. Dynetics and General Atomics will have to overcome that turbulence while coupling their Gremlins to whatever UAV recovery system they dream up. But they don't need to reinvent the wheel. Building on the *Akron* and the XF-85 and F-84 experiments is a no-brainer.

"There is a great deal of merit in past work accomplished," says Dynetics' Gremlins Chief Engineer Tim Keeter, describing how his Gremlins team is relying on the *Akron* and later experiments to help build this launch-and-recover system of the future. "Prior studies provided us the opportunity to research many related efforts and technologies in order to formulate our approach to this challenging problem."

One added challenge compared to previous attempts is that the Gremlin drones won't have a pilot. Where the *Akron* and later Air Force experiments relied on a blend of engineering and human intuition, says Atwood, Gremlins will need to solve the problem by applying machine learning and relative navigation software. You can already see these tools being used to successfully refuel the autonomous X-47B while in flight.

MANY IDEAS, ONE WINNER



Sparrowhawk biplane lands on USS Akron, 1932.

Getty + US Navy/Interim Archives

Since the competition is ongoing, neither company will fully divulge its concept until DARPA awards a winner. But DARPA's Gremlins program manager, Scott Wierzbanowski, says that proposed UAV launch and recovery systems would "require minimal modifications to the host aircraft."

A reasonable guess is that an arm-like mechanism—as used with the airships and bombers — could haul the drones inside the C-130. The use of an arm is related to keeping the returning drone out of the Hercules' turbulence Atwood says. But General Atomics is exploring other options. "The way in which we solve the 'one foot problem'—getting two bodies to meet in space aerodynamically—is much more than just an arm."

General Atomics' solution could combine an arm with a reeled line which flies to the Gremlin then pulls it in. Atwood alludes to the possibility when discussing an aerial refueling technique where a pilot flies a fighter's refueling probe into a basket, or drogue, at the end of the tanker's hose.

"Imagine a hose and drogue where the hose could control itself or tell itself where it is," Wierzbanowski says.

Recovering a RQ-21A drone with a Skyhook system.

Another idea is that Gremlins could be snagged in-flight, something like what the Navy and Marines use now to recover the Scan Eagle and RQ-21 reconnaissance drones.

Of course these designs will be dependent on just how big these drones will be, and both companies say they see opportunities for drones large and small.

"While smaller gremlins would provide more quantity per host vehicle and possibly be more affordable to build, larger gremlins would have the ability to loiter longer and carry a larger sensor suite," says Wierzbanowski.

We likely won't get many answers until the Gremlins concepts are revealed in 2018. Then we'll see if the bold aerial experiments of the past will live on into the future.

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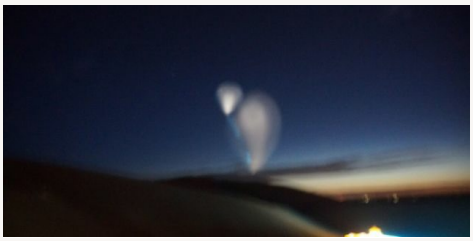

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