

Unmanned Wingmen For Japan's Piloted Force Planned For 2030s

Japan lays out a plan for pilotless combat aircraft to help fighters

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Air-combat maneuvers will be far more challenging than strike missions for artificial intelligence, so countries planning autonomous warplanes are generally looking at trying air-to-ground first.

But to many Japanese ears, unmanned strike sounds too offensive—in both senses of the word. Probably for that reason, the country's defense planners are proposing to leap directly into air-to-air automation. Limiting the challenge, they propose high-performance robotic aircraft that would fly as helpers for manned fighters; a pilot would issue commands. And at first the aircraft, called Combat Support Unmanned Aircraft or unmanned wingmen, would fly ahead as sensor carriers, only later taking on the role of shooting.

This family will appear in the 2030s, according to a technology road map for pilotless aircraft published by the defense ministry's purchasing office, the Acquisition, Technology and Logistics Agency (ATLA). The ministry previously discussed concepts for unmanned wingmen but has now advanced its plans. The road map will also include a ballistic-missile defense (BMD) type that would go into service in the 2030s.

The plan divides unmanned aircraft into five types, including the two simplest—small, portable ones and those that operate with line-of-sight communications—which Japan already has in service. A third category, which the country is still working on, are those that need relay communications by satellite, such as types the U.S. has relied on for years, like the General Atomics MQ-1 and MQ-9 and the Northrop Grumman Q-4 in various versions. Then there are pilotless combat aircraft and, lastly, aerostats and solar-powered airplanes, both for extremely long endurance.

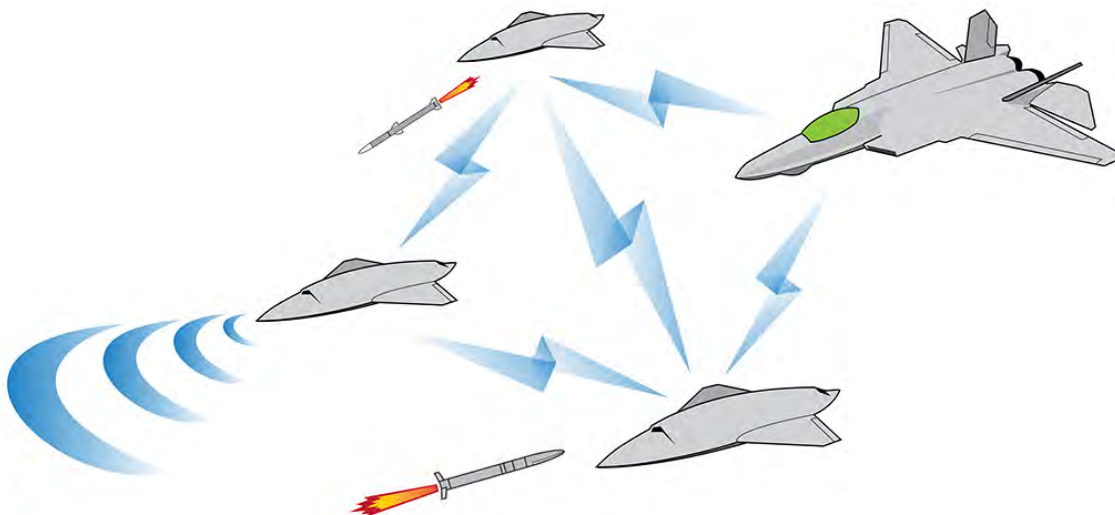
ATLA says resources will be directed toward the third category, for ballistic missile defense, and the fourth, for air combat, meaning that they have priority.

The agency makes no mention of the BMD aircraft carrying weapons. Instead, the type seems to be envisaged as a sensor carrier, presumably using an infrared detector descended from the Airboss system that was tested in 2007. A simple concept design in ATLA's road map document shows that it would be of a conventional configuration for high-altitude, long-endurance operation, with an extremely slender wing and what appears to be a twin pusher propeller-engine installation, similar to the Boeing Condor of the late 1980s. The sensor is shown in a turret in the upper nose (see concept, page 21).

The ministry's Technical Research and Development Institute (TRDI) first discussed the concept of the unmanned wingmen at least six years ago. It then conceived of such aircraft entering into service in the 2040s and working with a suitably upgraded version of the country's proposed next fighter, the F-3. The first version of the F-3 is expected to enter service around 2030.

ATLA now says Japan will "acquire high-autonomy technology to realize an unmanned wingman for the F-3 in 15 to 20 years." Entry into service before 2035 is probably not intended, since the agency proposes that technology be demonstrated in fiscal 2029–33. In that case, the F-3 would still get an upgrade to make it compatible with unmanned wingmen, but the modified version would appear sooner than was previously planned.

The first type of unmanned wingman to appear would be a sensor aircraft. ATLA's concept drawing shows three flying ahead of a fighter with which they would have a data link. This is the concept that would be achieved in 15-20 years.



The Japanese defense ministry envisages unmanned wingmen firing missiles, searching for targets and luring and defeating missile attack. Source: Japanese Defense Ministry

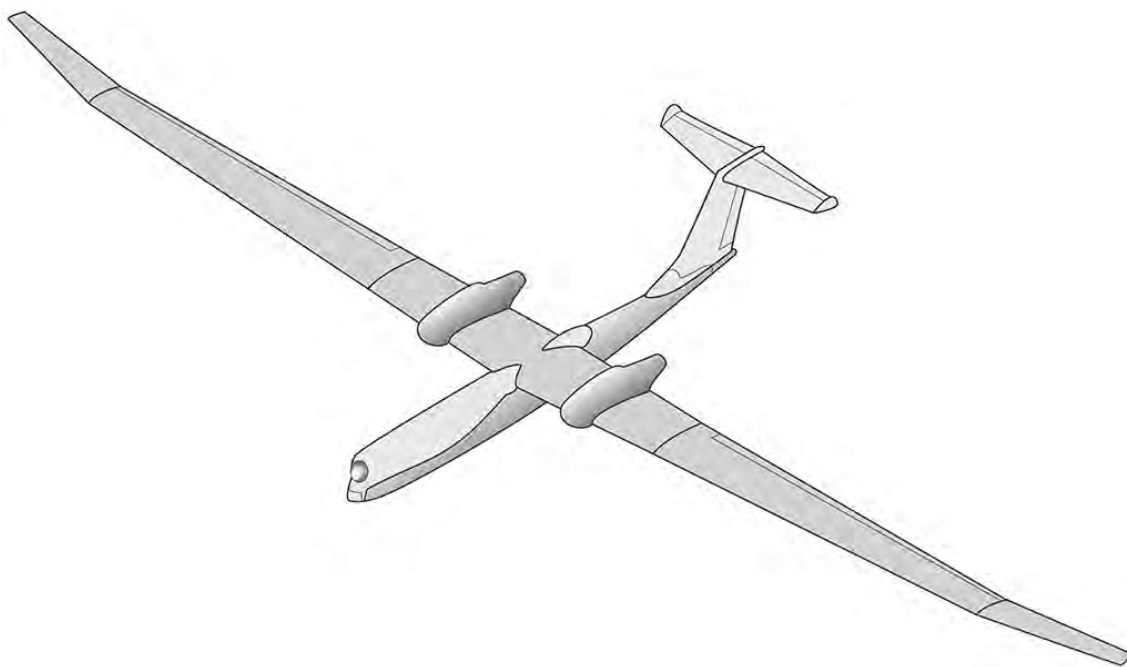
More than 20 years from now, there would be a second type—or perhaps a second version, using the same airframe and engine as the first. It would fire weapons. Also after 20 years, the sensor type or version would take on the role of a missile sponge. Since the sensor-carrying wingman would have to cost much more than missiles fired at it, and could not possibly accept hits, ATLA must expect it to routinely defeat attacks in the sponge role, using maneuver and electromagnetic countermeasures.

ATLA shows two concept designs for the unmanned wingman in low-resolution pictures that may or may not bear some resemblance to what is eventually deployed. One has a broad body, blended into a stubby wing that has perhaps 45-50 deg. of backward sweep on the

leading edge and moderate forward sweep on the trailing edge (see concept, above). The design is shown operating in all three roles. The other concept design, with a longer, skinnier body, has about 60 deg. of sweep on the leading edge and a conventionally aft-swept trailing edge. It looks fast, except it has the draggy and unstealthy feature of a large underslung pod extending almost to the nose, presumably carrying a radar. This design is shown only as a sensor aircraft.

The unmanned wingman would be under the control of the F-3 pilot but would devise its own tactical maneuvers, reporting back its planned moves. That suggests that the pilot would give general instructions, such as where to search or what to attack, and the drone would work out how best to execute them. It would do things that a piloted aircraft could not, the agency says, probably meaning it would pull maneuvers that a human could not withstand. That would contribute to surviving enemy missile volleys.

The progression from only searching to attacking and dodging is consistent with expectations outside Japan on the likely evolution of artificial intelligence and its capacity to choose maneuvers.



A Japanese unmanned aircraft for detecting ballistic missiles is anticipated in the 2030s. Source: Japanese Defense Ministry

Saab, for example, has published a technology sequence in which an optionally manned Gripen E/F would progress from the current capability of automatically holding altitude and navigating by waypoints to performing “basic air traffic maneuvers” and takeoffs and landings. Later the fighter would be autonomously capable of basic maneuvers needed for maintaining a relative position with a flight leader—presumably, a manned fighter. That looks like the level that the Japanese unmanned wingman needs for the sensor role.

For the next degree of difficulty, Saab lists aerobatics, such as rolling and looping, and then tactical turns executed in relation to the flight leader. Last, and hardest, are maneuvers for beyond-visual-range combat, such as cranking and pumping. That is probably something like what the Japanese believe they need for an unmanned wingman that attacks the enemy or attracts and dodges missiles.

Power and propulsion studies for the unmanned wingmen are to begin in fiscal 2019. The technologies Japan must develop are high agility, meta-materials (with properties not found in nature) for stealth, morphing structure and bistatic radar.

With that radar technology, a transmitter is separate from the receiver, but the acquisition agency does not say which aircraft will do what. One possibility is that the sensor wingman will transmit and the shooter wingman will receive. But it would also be possible for the manned fighter to be the silent receiver, or for it to transmit safely in the rear of the drones while they silently close in for the kill.

The F-3 is likely to have much greater range than the unmanned wingmen. The sensor drones could be of moderate size, however, so they could conceivably be carried near to the combat zone and air launched. ATLA says that in 2011 Japan completed development of a jet-powered reconnaissance drone that can be launched in the air and then land on a runway. An F-15J can carry two, each weighing 750 kg (1,650 lb.).

Alternatives would be to use inflight-refueling—which could be repeated often on each mission, since there would be no tired pilot aboard—or perhaps to accept that many unmanned aircraft must be built to support frequent shuttling to and from the combat zone where on-station time would be short.

The latest concept for the F-3, devised in 2014, envisages a fighter with great endurance and armament at the expense of maneuverability.

The unmanned recon drone launched by an F-15 was a product of Fuji Heavy Industries, Japan's specialist in unmanned aircraft. The company is presumably well placed to build the unmanned wingman, too, although rival Mitsubishi Heavy Industries is the national specialist in combat aircraft.