Sensor Squadron

Part one of a two-part series

Written by: Jan Tegler on December 25, 2010
Categories: Aerospace, Programs & Tech
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One of Northrop Grumman's BAC 1-11s in flight over Maryland. Photo courtesy of Northrop Grumman.

Catch a flight at BWI International Thurgood-Marshall Airport and you'll taxi out among the familiar tall tails of airliners that ply the world's airways. Most passengers glancing at the surrounding traffic on the tarmac from their window seat won't notice anything out of the ordinary.

But if you're a bit of an aviation enthusiast you might wonder where that funny-looking DC-9 with the weird nose and wacky bulge on its port side is headed. Or, who owns that anonymously liveried 737 cruising down the opposing taxi-way?

The answers are; one, that's not a DC-9. Two, you're not really supposed to have a clue where the funny-looking airliners are headed. And three, they belong to Northrop Grumman (NG). They are part of the company's Electronic Systems division (ES3), headquartered in Linthicum, Md. just a couple miles from the runways of BWI.

Based at ES3's Flight Test facility on the northwest side of airport, the aircraft represent just two of the types in Northrop Grumman's remarkable "sensor squadron." More impressive than the airframes themselves is the historic and uniquely capable organization that has been flying them from BWI for over half a century.

The unit is deeply involved in the biggest aerospace-defense programs around today, developing highly advanced sensors for platforms ranging from the Joint Strike Fighter and F-22 to F-16, B-1B, a variety of UAVs and several programs they *can't* talk about. Suffice it to say, that while the story of NG's sensor squadron has rarely been told, the work they perform in the skies over Maryland and other locales is fascinating.

That they quietly carry out the majority of their unusual flying from a heavily populated, highly-trafficked area in comparative secrecy is a point of pride for the small, vastly experienced group.

"Quiet" is a relative term, however. Weekly sorties from the flight test facility by any one of the company's trio of specially-configured BAC 1-11s are hard to miss for those near the airport. The type's Rolls-Royce Spey twin turbofans produce a fighter jet-like thunder, a sound from a bygone era of commercial aviation complete with a long, flat smoky climb out. The roar is unmistakable, signaling the start of yet another sensor-development mission for ES3's flying laboratory.

But the BAC 1-11s are hardly the first aircraft to make aural and visual impact launching from BWI. Strangely modified test aircraft have been a feature of the field since its construction in 1952 (as "Friendship Airport") when Westinghouse Electric Corporation chose to base its Avionics and Electronic Systems Flight Department (AESFD) at the site. Westinghouse had the foresight to realize that developmental flight testing of its products in-house would help reduce the risks associated with pioneering new radar/sensor systems and computers the

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development cycle. It's a philosophy NG has taken to heart since acquiring Westinghouse in 1996.

In the era before Northrop Grumman, AESFD undertook sensor development with an amazing range of aircraft, utilizing a combination of civilian airplanes and platforms "bailed" to Westinghouse directly from the military inventory. The company's first test aircraft, a DC-3, aided in development of a series of early radar systems and acted as a flying television relay station. Equipped with a folding TV antenna, the "Gooney Bird" sent live broadcast signals over a five-state radius for the Midwest Program on Airborne Television.

In all, more than 20 different test bed aircraft have been based at the flight test facility since the early 1950s. The interesting variety that sortied from BWI included an A-3 Skywarrior, B-29 Superfortress, B-47 Stratojet, B-66 Destroyer, Beech Queenair, DC-3, DC-6, F2H Banshee, F3D Skynight, F4D Skyray, F-100 Super Sabre, F-8 Crusader and UH-1 Huey, as well as several F-4 Phantoms and F-16s.

One of Northrop Grumman ES3's Sabreliners being used for radar testing. Photo courtesy of Northrop Grumman.

One more aircraft employed and specially modified under Westinghouse was the Martin B-57 Canberra. During the Vietnam War, the company converted 19 B-57Bs, fitting them with new engines, foam-filled fuel tanks, armor plating, a low-light TV/infrared system, forward-looking terrain avoidance radar and a laser range finder. The Canberras were re-designated B-57Gs, becoming the first self contained laser-guided bomb vehicles and one of the earliest platforms to field precision-guided munitions. They made three successful tours in Southeast Asia.

The heart of the modifications made to the B-57s was the sensor package, developed in the skies over Maryland by AESFD and the man who heads up NG's flight test facility today, John Fendley. An ex-Navy fighter pilot and graduate of the Naval Test Pilot School, Fendley joined Westinghouse in 1967. Since then he's flown just about every test bed aircraft the flight department has utilized (including extensive B-57 test flying) and has been the manager of the flight test facility for many years.

"I love my job," Fendley says enthusiastically. "We've got the best group of people in the company here at flight test. All of the pilots had a successful career before they came here to work. They do their jobs perfectly and they love it too. The engineers love it here because they get to go ply their trade with these airplanes. The mechanics here love it. They actually work on airplanes and figure out how to fix them when they break as opposed to just plugging in new parts as is done in most aviation today. Everyone here has the preeminent job in aviation for their discipline."

It's the high level of experience, ingenuity and esprit de corps within this small (48 personnel) special department within NG that has kept the flight test facility and its aircraft relevant. Today, ES3's sensor squadron flies four types of test bed aircraft. Together with its three modified BAC-1-11s (three among just nine to twelve still airworthy globally), the unit flies two modified Sabreliners, a modified (BN-2T-4R) Britten-Norman Islander and a modified Boeing 737-200.

The suitability and flexibility of these aircraft for the sensor development role is complimented by ES3's willingness to fly them dynamically, maximize the flight testing resources available in the local area, send them on the road when expedient and develop creative tools for flight testing in-house.

"Just about eighty percent of our testing is done VFR just off [the local] the airways," Fendley explains. "When we're testing in the air to ground regime, especially if we have maneuvering to do or when we're going to be changing altitudes a lot, diving on a target for instance, we go into the "Pax" (NAS Patuxent River) restricted area and do our work there."

As Fendley indicates, most of the flight department's test flights take place in civilian airspace. Company test pilots visit frequently with the FAA, keep the agency updated about the flight profiles they wish to fly and work collaboratively to make sure their work has little to no impact on civilian and commercial aviation. In turn, NG pilots use tracking from the FAA on all flights, receiving flight-following data while staying in continuous contact with controllers.

During our late November visit to the ES3 facility at BWI, one of the flight department's BAC 1-11s (N62W) was deployed, flying seven hour days in the Los Angeles area for special development purposes. Flight test facility aircraft have demonstrated sensor system capabilities as far afield as Norway (for the 1990s APG-66 mid-life upgrade for F-16).

In 2009, an ES3 BAC 1-11 became the first civilian contractor aircraft ever to participate in a live exercise when it was integrated into "Northern Edge 2009". Carrying NG's AN/APG-81 (the heart of the F-35's sensor suite), the aircraft demonstrated the electronic protection capabilities of the AESA radar, flying against more than a dozen U.S. fighter and bomber types and a complete USN carrier strike group in the huge electronic warfare exercise.

"Once we complete our flight test/development program here we often go to another facility, deploying to demonstrate the capability of a sensor, or to take advantage of a government test that's under way," Fendley says. "Often we won't know

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A Northrop Grumman ES3 Sabreliner with its nosecone removed, revealing the advanced AESA radar being tested aboard the vintage aircraft. Photo courtesy of Northrop Grumman.

about the characteristics of certain targets on the ground. The government puts those things together in different places and they'll have many folks who'll come out and fly against those targets to use that setup as their database. We try to participate in all of those events that we can."

Flight test facility aircraft also travel to Edwards and Eglin AFBs, make use of instrumented ranges at Fort A.P. Hill, Va., and use the warning areas off the Atlantic coast. ES3 has invested in test facilities close to home as well. At lightly-used Sussex County Airport in nearby southern Delaware, Northrop Grumman has placed a variety of radar reflectors around the field to test various radar systems (side-looking, etc) flying aboard the BAC 1-11s and Sabreliners. High resolution ground mapping with targets of various sizes is one application.

The company also has a transponder located in the tower at Sussex, allowing it to relay real-time flight data from a sophisticated moving-map tool called "Nuggets." Developed by ES3 test pilot Mike Eide, Nuggets is used by all of the sensor squadron aircraft. The moving map display allows Northrop Grumman pilots to identify and track airborne, ground and maritime targets for more efficient sensor development, saving time, fuel and money.

"In the old days we'd be flight testing systems and be in airspace 30 miles away from another [target] aircraft and make a pass nose to nose," Eide remembers. "The airplane would go by before you knew it and you'd finish up your test run, and then have to go looking for them. We don't do that anymore. We know right where our target aircraft are with this tool and we can begin runs immediately from any relative position and conduct them anywhere in the world."

Nuggets provides a "God's eye view" of the primary test-bed aircraft integrated with target aircraft, ships or ground vehicles, all overlaid on a detailed moving map. The system helps flight crews visualize their aircraft's position, predicting their turn radius relative to targets, depicting a track of where their aircraft will be in seconds or minutes and where targets are tracking. Aspect angles to other aircraft/targets are also displayed as well as their bearing, true airspeed, altitude and latitude/longitude. Nuggets will tell pilots how long it will take to turn around and begin another run and can be played back to analyze a test flight.

The system even integrates AIS (automated identification system), the marine vessel tracking system required by the International Maritime Organization for ships of 300 or more gross tons and all passenger vessels. By simply clicking on a given vessel in the Nuggets display, pilots can know immediately the speed, direction, size, name and destination of any ship. The system has proven invaluable for development of ship detection capabilities in the NG sensors used aboard the B-1B Lancer.

"We used to have to identify ship targets after test runs, say 100 miles away, by flying to them, dropping down to low level and reading the ship's name from its hull," Mike Eide affirms.

"I flew around here [Maryland and environs] for 30 years thinking I knew where I was," Fendley adds. "Now, I know exactly where I am. We can set up a 100-mile run and we never have to look at the radar and wonder if we have the right target."

In fact, Fendley doesn't even have to be aboard any of the sensor squadron aircraft to see a test flight's progress in real time. The transponder at Sussex County Airport lets him see the same Nuggets display his pilots are seeing in the cockpit via the Internet at his desk at BWI.

The system is just one example of the unit's resourcefulness. From keeping their 737-200 flying despite the FAA-mandated grounding of similar vintage 737s (via a fix engineered in-house) to conducting their own refresher/type qualification for the BAC 1-11 in-house and pioneering modifications for their aircraft, flight test facility staff maximize efficiency and promote risk reduction.

In part two of our story on NG Flight Test we break down recent sensor development programs and those currently under way down by the sensor squadron.

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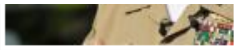


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