Flight Test NEWS

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APRIL 1970

See in-flight refueling as providing assist in speeding F-14 test-flight cycle

In-flight refueling hardly rates as something that has just come down the aircraft pike. Oldtimers speak of a primitive refueling method, a pilot reaching up out of his cockpit to snare a swinging hose line lowered from a plane above, and putting it in his fuel tank so the tanker could supply the gasoline. That tricky and dangerous maneuver of barnstorming pilots lives in memory today; new, more reliable methods are in vogue—and the **why** of in-air refueling has changed, too.

To extend the in-flight time of a plane was and is the underlying rationale of mid-air refueling. Initially, the target was simply to break an existing flight-distance mark, say, flying coast to coast without intermediate landings. Then came the need of the military to flight-patrol over battle zones (or to fight or bomb), continuously, for critical time was lost when an aircraft touched down: not only would the plane be refueled but it would go through a time-consuming point-by-point inspection.

Now there is another need for in-flight refueling—to shave flight testing time so that a new aircraft can be on the line and ready for action a lot sooner than ever before.

That's what's planned in the F-14 program. Joe Burke, A-6A Project pilot, says that A-6s used as tankers are "airborne gas stations. Instead of having an F-14 take just a long, single afterburner run, there'll be two A-6 tankers—one at each end of the high-speed flight corridor—that'll service the F-14. So, one flight can do what it used to take three flights to accomplish."

Time saver

This "shortcut" has been proved in a series of EA-6B flights using A-6 tankers. These flights show that in-flight refueling triples the time that a pilot can spend in the air on a single flight.

"The savings in both time and money are dramatic when you do flight testing this way," says Frank Finnerty, assistant manager of Vehicle Flight Test. "You can do in one day what used to take a week."

Another assist

It's not only in-flight refueling, all by itself, that holds the key to getting the air superiority fighter F-14 in the Fleet quickly. A lot of other things are essential, such as the $12 million telemetry station at Plant 7. "The station has a three-path capability," explains Frank Edwards, director of Flight Acceptance Dept. "It can get data from three different planes or three different types of data from one aircraft. The data links cover both the plane in flight and the ground stations, and information is read out in real time."

So each ground monitoring station and each pilot knows how the plane is doing every flight-step of the way. And looking at this, and tieing it in with the time and cost savings of in-flight refueling, the question pops up: Why not cut even further by refueling more than twice? The answer comes from Test Pilot Don King:

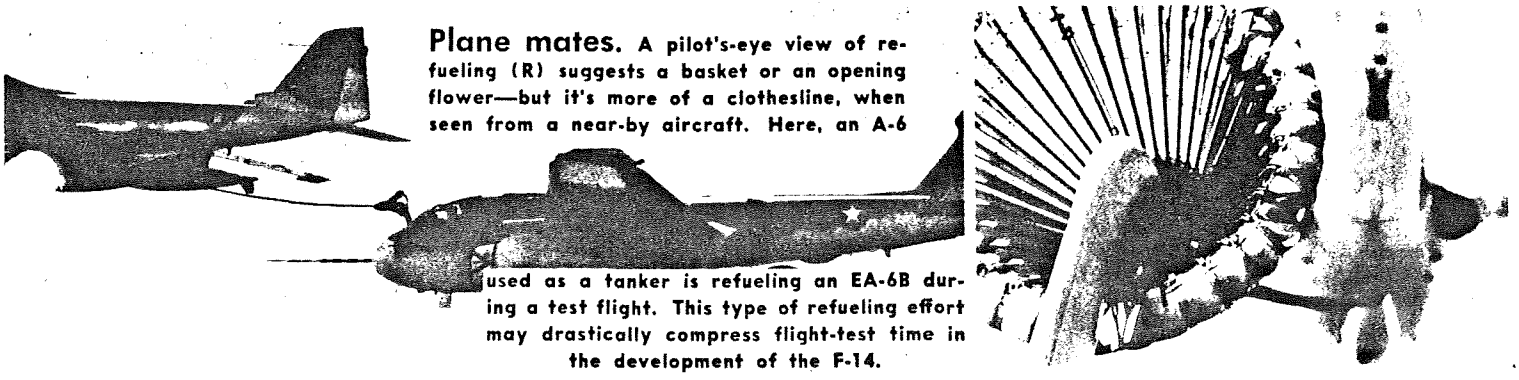
"When you're flight-testing an airplane, you do it in daylight. The pilot has to see and the chase plane has to see. They must have visual contact. In addition, there's the question of pilot fatigue, of how long a pilot can perform all of the tests demanded of him when he's got a new and very complex bird to handle. I don't know what the fatigue limit is. I doubt that anyone knows . . . there are so many variables."

At this point, the fatigue question may be academic. Getting planes flight tested in half the time it once required is the cardinal consideration.

You can add up what that means in a number of ways:

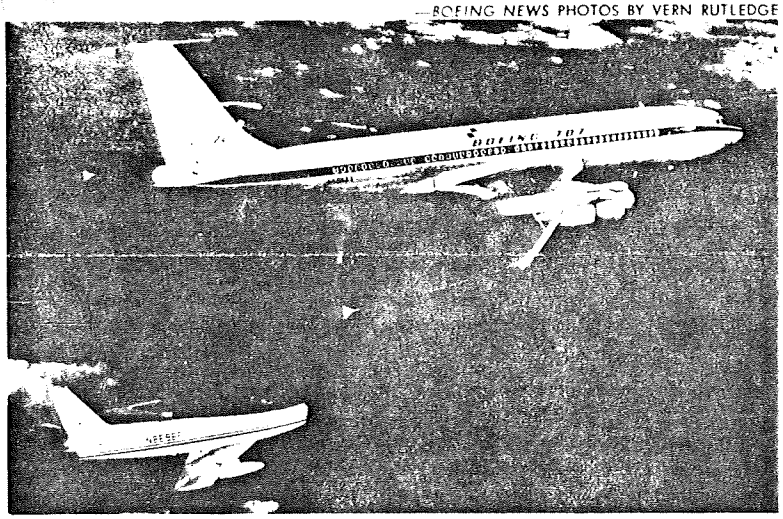
- One flight series can run for more than five and a half hours as compared with the single run average of 1.7 hours
- About 300 flight tests of the F-14 will be eliminated because of the in-flight refueling plan
- The Navy will have a plane to check out for flight readiness after 17 months from start instead of the 33 or 34 months it normally takes

In other words, a pattern of two in-flight refuelings per day gets a plane on station faster than ever before.



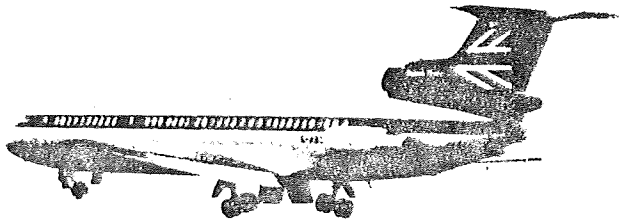
Plane mates. **A pilot's-eye view of refueling (R) suggests a basket or an opening flower—but it's more of a clothesline, when seen from a near-by aircraft. Here, an A-6 used as a tanker is refueling an EA-6B during a test flight. This type of refueling effort may drastically compress flight-test time in the development of the F-14.**

—BOEING NEWS PHOTOS BY VERN RUTLEDGE



A Boeing 707, extends drogue for approaching F-86 to refuel by using probe. The Boeing-owned 707 is undergoing experimental tests as a tanker on extended missions.

Maiden flight



The first Hawker Siddeley Trident Three — one of an order of 26 for BEA — has made an almost three-hour maiden flight from Hawker Siddeley Aviation, Hatfield.

Flown by Mr. John Cunningham, Executive Director and Chief Test Pilot at Hatfield, the Trident took off at 12.35 p.m. and landed at 3.23 p.m. "The whole flight went well. This aircraft has the benefit of all the experience gained in previous Tridents," said Mr Cunningham.

The HS Trident Three is the largest in the Trident series, capable of carrying up to 170 passengers. It is powered by three Rolls-Royce Spey Turbo-Fans and a Rolls-Royce R.B. 162 boost engine which gives an extra 15% more thrust for take-off and climb. The boost engine was not installed for the first flight.

Test pilot tells what it's all about

Don Evans is a rather slightly-built man, quiet and unassuming, perhaps exhibiting intensity and a trace of nervous energy. You might expect to see him on a ' course or a tennis or handball court. You might k of him as a bridge player (and you'd be right, he's very good). But you wouldn't cast him as, say, a center or a bruising fullback. Too small for such a hazardous profession, you'd say, and he might agree.

Yet Evans is in a very hazardous job and has been for years. And for a time, his avocation was also hazard-riddled. For Evans has been a test pilot for years and one of his hobbies (until his wife coaxed him away from it) was automobile racing. The memory of those racing days, from 1962 through 1967, is so bright it appears as though a matter of the moment: mention auto racing and he smiles and his eyes light up, and he says "It was a lotta fun. . . ."

Fun? The timid among us—and there must be millions upon millions of us—blanch a bit. Don just smiles.

His attitude toward test flying is similar, and he talks of spins, rolls, stalls, yaws—and even getting shot down over Korea while flying an F-80—with apparent unconcern, in the level tone of a statistician reporting the day's activities to his wife. The drive and fierce interest in flying comes out almost explosively, however, when he gets talking of individual planes, differences in mission-purpose, and the day-to-day work of an engineering test pilot.

No plane for all reasons

"No single plane is capable of carrying out all the types of missions that have to be performed," Don says. "There have to be compromises, and there's no way out of it." He cites the U-2 (which he flew for three years), the A-6A, and the F-14 as examples:

"The U-2 was a very light aircraft designed to fly at very high altitudes over very long distances. That's all it could do. The A-6A, which I'm flying now, can't go as high or fly for as long distances, **but** it can pierce the blackness of night and pinpoint an obscured target, and then either bomb the target precisely or d a fleet of F-4s to the target. The F-14 is something e again—an air superiority fighter designed to over- helm any other fighter in the world. It has to be faster and more maneuverable than an A-6; that's its reason for being, fighting enemy aircraft."

But for all of the logical and imperative differences of missions that lead to corresponding differences in aircraft design, there is, underneath it all, a set of test considerations that apply to all. Evans outlined four: structural tests, flying qualities, performance, and carrier suitability. (Because he has an Air Force background, he thought it inappropriate to talk of carrier suitability.) He spoke of the remaining three areas, mainly in terms of what the test pilot looks for when he's putting a plane through its paces.

"You have to prove out the entire flight envelope," said Evans, "meaning that you not only fly to the limits of what the plane is supposed to do but you push it further, to make sure it'll live up to its billing. For example, you might roll it, do pull-ups—just about anything you can think of to find out whether it's going to hold together. You might even overload a section of it to force it **almost** to flutter."

Hazards of flight testing

Almost, in this case, is critical, for as Don points out, a real flutter can literally destroy an aircraft **in less than a second!** Obviously, to approach but not get flutter takes (among other things) a truly expert pilot. More important, both the pilot and the plane are heavily instrumented and every quiver—every breath —is read from equipment on the ground; and the people there can see it before you feel it. He also points out that whenever something new is put on an aircraft, such as heavy avionics gear, it could be a "new plane" and, therefore, must be test-flown. (This is one of the reasons that wind-tunnel tests of an original aircraft may not be valid after a plane has been modified.)

The question of flying qualities encompasses a number of things, such as how much stick force is needed to move a plane from one G to two Gs to three Gs. How about stalls—and are there stall warnings? "In the course of testing the plane," says Evans, "you have to stall it and spin it. You have to think of the guy who might be flying it in combat zones or under adverse conditions: he **has** to know exactly what he can and can't do with that aircraft, and giving him that information is our job."

Evans also pointed out a couple of things that "some of your readers may not know: It's the low pressure **over** the wings that enables the plane to fly; and, although we have to make spins in all configurations, you can stall without spinning but you can't spin without stalling.

Flying any modern fighter is much different, says Evans. The SAS (Stability Augmentation System) automatically smooths out a ride so effectively, he points out, it "cons the pilot" into thinking that the aircraft is more stable and easier to fly than it actually is.

Don Evans

"Then there's performance testing, determining such things as fuel consumption at various altitudes, at different speeds; thrust; drag; takeoff and landing distances; climb rates; eight Mach dynamic performance testing at 30,000 feet, and so on. And, oh yes: did I mention weapons separation? Launching a missile in flight . . . that's critical."

Back to the desk

But, as Evans had said earlier in the discussion, test flying isn't all there is to it. "I probably spend as much as 50 or 60 percent of my time at a desk, keeping current, hashing over design or flight problems, and, mostly, writing flight reports. Really, the reports can be the bulk of the job. We have to put it all down—when we went up, under what conditions, what we were supposed to check out, what actually took place in f where were the bugs and surprises—the whole th so that everyone with a need to know does know. That's it."

In a way, that **is** it. In another way, it isn't it. For what is inside a man that draws him toward this extraordinarily hazardous type of work? Don smiles and shrugs his shoulders.

FAIRCHILD HILLER
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March 11, 1970

Ref.: EFT-942

Mr. C. E. Moore
Corporate Secretary
SOCIETY OF FLIGHT TEST ENGINEERS, INC.
P. O. Box 1186
Seattle, Washington 98111

Dear Colleague:

I was surprised and pleased on receiving the February 1970 issue of the Flight Test News, to see the good use you had made of the Fairchild material. I shall be on the lookout for other items which may be of interest, although naturally we do not expect to figure as prominantly in all issues of the News.

If you have extra copies of the February issue, will you please send five for distribution to key personnel in other divisions of our corporation. This may stimulate interest in furnishing us timely items in the future.

You at Boeing are doing a great job in fostering the Society and its publications. Let us hope you will be getting assistance from more flight test engineering groups as time goes on.

Yours sincerely,

J. A. Clopper
Chief, Test Engineering

JAC/j

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Articles needed

A continuous source of articles is urgently needed if **Flight Test News** is to continue publication. The most regular source of news articles is your company newspaper. As you can see from Mr. Clopper's letter above a **Flight Test News** is good publicity. You can help us by contacting your public relations department and ask them to put us on their mailing list. The more sources of articles for **Flight Test News** the better SFTE can serve you.

WICHITA CHAPTER MARCH MEETING NEWS

The Wichita Chapter met on March 18, 1970.

Under the sponsorship of the Wichita State University Engineering Department, Dr. Gerlach presented a synopsis of his paper entitled 'Determination of Performance and Stability Parameters From Unsteady Flight Test Maneuvers'. Dr. Gerlach is Professor of Aeronautical Engineering at the Technological University, Delft, Netherlands and is currently here in the U.S.A. on a lecture series tour. Copies of his paper No. 700236 may be obtained through the S.A.E.

SFTE Chapter to sponsor symposium

The Long Island Chapter of the Society of Flight Test Engineers will sponsor a nation-wide symposium on October 6, 7 and 8, 1970, to exchange information and foster understanding of flight testing as it will be conducted in the 1970's. A forum will be provided for the presentation of ideas and accomplishments linking advanced testing and computing techniques. Prime airframe contractors, government test agencies, data processing representatives and data acquisition specialists are being asked to participate. The symposium will discuss mutual problems of the flight test community in implementing technological advances and in applying new techniques.

Papers dealing with this subject are invited from all interested sources for presentation at the symposium.

FOR MORE INFORMATION CONTACT:

Mr. R. Kenefick, President, Long Island Chapter SFTE, P.O. Box 38A, Ridge, N.Y. 11961.

The National Office received information today from Mr. Kenefick that so far over 33 people have officially expressed their intent to submit papers for this seminar.

We are pleased that most SFTE chapters, or chapters in the process of forming, have expressed interest in this seminar. Those companies listed below have committed at least one paper for presentation.

Aerodata	Long Island
Boeing	Seattle
Boeing	Wichita
Egland Air Force Base	Florida
General Dynamics/Convair	Fort Worth
General Electric	Philadelphia
Grumman	Long Island
LTV	Dallas
NASA/Kennedy Space Center	Florida
Naval Air Test Center	Patuxent River

CALL FOR NOMINATIONS FOR ATIONAL OFFICERS

Nominations for the following national offices are still open:

Office	Term of Office
President	1 year
Vice President	1 year
Secretary	1 year
Treasurer	1 year
Director at Large	2 years
Director at Large	2 years

According to the SFTE National Constitution an election of officers is required with the results announced prior to July 1, 1970. There must be at least two nominees, who have agreed to take the office if elected, for each vacant office. The current Board of Directors is in the process of spreading the workload out over the various chapters. It is anticipated that this will eliminate much of the officers' work which was necessary prior to the formation of the chapters such that new officers can function primarily as directors.

It is however recommended by the present Board of Directors that at least five members of the new board, including the new president and vice president be located in the same general location. This makes it logistically much easier to conduct business. It is the nominations and elections committees recommendation therefore that you strive toward submittal of a slate of at least five officers. In addition where no local chapter is available individual nominations are welcome.

Please send nominations which are to include a paragraph of qualifications and present job assignment to:

F.W. McIlroy
Chairman, Nominations and
Elections Committee
SFTE, P.O. Box 1186
Seattle, Wash. 98111

CONGRATULATIONS PATUXENT RIVER — Chapter No. 4

During the April 1, 1970 National Board of Directors meeting the Patuxent River Chapter was approved as Chapter No. 4. Presently the Chapter consists of 41 approved members with 15–20 more local potential members. The Chapter membership committee is organizing a campaign to contact presently untapped sources of membership the Naval Air Test Center, the Naval Air ystems Command, and the University of Maryland. Chapter meetings in January and February of 1970 resulted in an election of officers and a set of by-laws for submittal to the national office. The National Board is pleased to recognize Patuxent River Chapter as an enthusiastic new member to the ranks of SFTE.

Superjet Engine Test Completed In Warmth

With Seattle temperatures lower than required and hot weather lacking at any closer points, a Boeing 747 test airplane flew 3,800 miles to San Juan, Puerto Rico, last week to complete takeoff tests requiring temperatures over 80 degrees and wind speed less than 10 knots.

The airplane, the No. 2 test 747, is equipped with engine water injection to sustain maximum power during takeoff in high temperatures. The tests were part of Federal Aviation Administration certification trials of the Block 2 engine water injection system.

The airplane made two test takeoffs at San Juan International Airport, with the temperature at 85 degrees and wind speed at 8 miles an hour.

Results of the tests were recorded by on-board instrumentation. Two portable wind stations were set up by the test crew adjacent to the runway to record wind velocity and direction, and calibrated thermometers measured the precise temperature at takeoff.

Following the tests, the airplane returned to Seattle.

The crew was made up of Lew Wallick, experimental test pilot; Earl Chester, FAA, co-pilot; John Britt, flight engineer, and Warren Wilson, flight test group engineer assigned to the ir- plane. About 50 additional ing personnel — engineers and maintenance specialists—accompanied the airplane.

The certification test program on the water injection system was completed Friday.

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