

Chapter 3

Army Aviation Comes of Age

As indicated earlier, Board Six Tales has an upstairs-downstairs quality. This is an upstairs tale that relied on various sources: Colonel Williams, materials provided by Major Jon Gray and Joe Givens. I knew only Colonel Williams at the time and then from a very distant, uninformed perch that you will learn more about later. Colonel Williams and Joe Givens provided first hand accounts and are deferred to in establishing the “truth” when contradictions arise. I was very fortunate that these two key players were available and able to provide details from memory as well as personal records. Major Gray, who was not directly involved with the in-flight refueling test, provided materials obtained from the Army Aviation Museum as well as visiting the museum a number of times to obtain information.

In the words of Joe Givens, “The first transcontinental helicopter flight using in-flight refueling was possibly Board Six’s greatest single achievement.” It was a sign of things to come. At the time there was an almost desperate reach for the skies in order to prove that helicopters had a major role to play in Army tactics and strategy. Something the Korean War had only given an inkling of. As you read the story, you feel the unrestrained dedication, the daring gamble and, yes, a great deal of chutzpah.

Self Contained

As I put this together, it became clear that Board Six operated as a self contained unit. Not self contained in the sense of a rogue unit, but self contained in the sense that if they couldn’t do it, it would not get done - no committee meetings with outside agencies or consultants. Consultations yes, but, in the end Board Six controlled the agenda. Colonel Williams had assembled a group of people that could get things done through official or unofficial channels.

The self contained nature came about from something I had not known before. Joe Givens indicated that Board Six was under the direct command of Test & Evaluation Command from Fort Monroe, Virginia. Board Six was only a tenant at Fort Rucker.

Moreover, Board Six had a critical mission that was widely recognized at higher levels so Colonel Williams was given a great deal of latitude and support. I am sure there were some unhappy parochial interests; however, Colonel Williams had a lot of friends and supporters (all well deserved). Moreover, Korea had shown the great potential of helicopters. There was so much to be done – little time to lose. Colonel Williams undoubtedly thought that if I can do only half of what I want, it will be spectacular.

The Korean experience added urgency to Board Six’s mission. Army aviation was at a strategic fork in the road. It had demonstrated that helicopters could have a major impact on tactics and strategy. There remained and still remains a bureaucratic battle between the Air Force and the Army regarding the amount of fire power allowed on Army helicopters. And there is currently (2007) a struggle regarding UAVs (Unmanned Aerial Vehicles) such as the predator.

If there was a board motto (and there was, but this was not it) it would be: Make it Work.

Mundane Side

It is fair to say that not all activities were heroic. Board Six still had to carry out a number of mundane activities that were part of its mission when Colonel Williams assumed command and began pushing into new territory. As they say, even in heroic activities bedpans still need

emptying not to mention KP, buffing floors and moving desks. But all that is for other chapters. Here, we deal with the heroic.

There are various kinds of honeymoons and Colonel Williams had about a two year honeymoon with Board Six when they accomplished so much before once again becoming part of the establishment. That is to say: committee meetings, long range planning, strategy sessions, interagency reviews, performance reviews, budget fights and the list goes on. What would a bureaucracy be without bureaucrats?

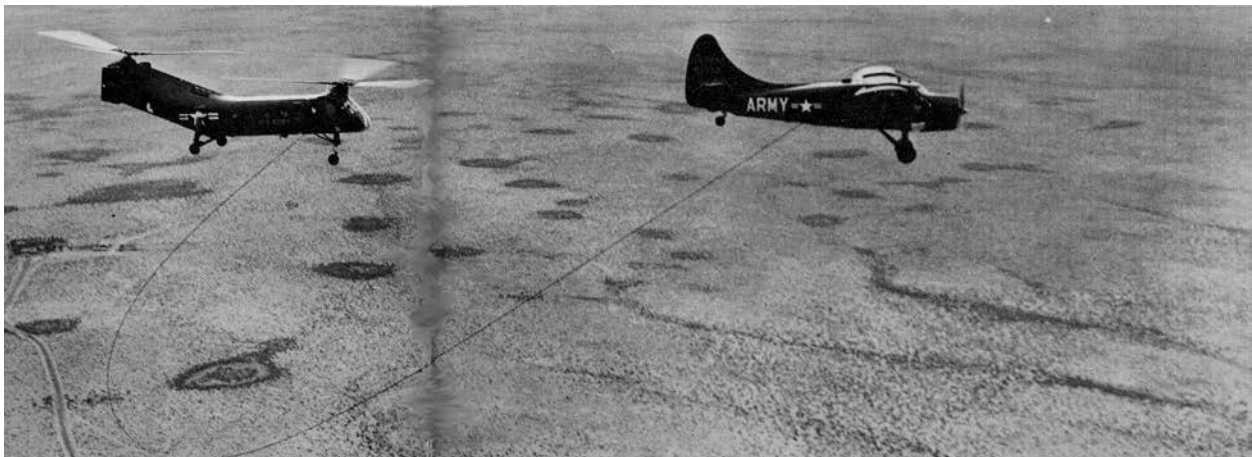
The in-flight refueling tale begins with the 1956 decision (made in Washington with Colonel Williams on the committee) to hold a national air show (first and only) similar to the Paris, France and Farnsborough, England air shows. This presented Board Six with the challenge to demonstrate something of note at the show. A program was set up to establish recognized world records and demonstrate **a first: In-flight helicopter refueling**. As many in Board Six would say, "You have not heard the last from us."

Getting Ready

Inflight Configuration

The development and testing of the in-flight refueling configuration was accomplished at Fort Rucker. Although it could have been helicopter to helicopter, it was decided a fixed wing aircraft would refuel the helicopter, primarily because a fixed wing aircraft would be the tanker of the future. The de Havilland U-1 (Otter) was chosen because it was the largest fixed wing available to the board. The first problem: determine which helicopter and fixed wing aircraft were compatible considering speed. The first attempts at in-flight refueling were made with an H-13; however, it could not keep up with the Otter flying at its lowest speed – needed a faster helicopter. However, that test did establish that a helicopter could fly in the Otter's prop wash.

The next test flight (no refueling) determined the best combination would be the Otter and the Vertol H-21C (tandem rotor, banana shaped - which the Army named the Shawnee) - flying at 70 knots (most compatible and comfortable). Tests were run between 65 and 85 knots.



The Board Six H-21 (Ambling Annie), with a normal range of 300 miles, was fitted with three additional 300 gallon internal tanks arranged in series. On August 11, Lt. Col Harry Bush and Major Bill Dysinger used that configuration to establish an official world distance record of

1,200 miles in a closed-circuit course between Hightstown and Haddonfield, N.J. [Aircraft Year Book 1956, p. 407; Aviation Week, Aug. 27, 1956, p. 32].

Remember that 1,200 miles on Saturday, August 11. The H-21 is flown back to Fort Rucker to begin development and testing of the in-flight refueling on August 14. Note: Miles are used for such closed course distance records; however, helicopter flight records are kept in the terms of flight hours. To provide some perspective to those whose main frame of reference is the automobile that uses mileage for its maintenance schedules, I provided mileage at certain points (rough calculations from map coordinates).

The Otter was Board Six's largest fixed wing aircraft. For this project, it was fitted with a 300-gallon tank and refueling equipment rented from In-Flight Refueling Corp. of Baltimore. This included a reel with a 107 foot refueling hose and a male coupling compatible with a female coupling mounted on the cargo compartment floor of the H-21.

Development Team

Joe Givens was a Board Six civilian test pilot and I think it would be fair to say that he was, at the development and test level, the official or unofficial leader of the in-flight refueling project. Joe, a Navy fighter pilot, had his first combat at Okinawa (eventually 112 combat fighter missions, including the Korean War where he was shot down and received his first ride in a helicopter). Graduating in 1952 from the Navy Helicopter School in Pensacola, Florida, he became an instructor until 1955. From that point he became a civilian instructor at Fort Rucker and joined Board Six February 1, 1956. I arrived three and half months later.

Joe Givens (pilot), Major Hugh Gaddis (co-pilot), and Captain Jim Bowman (fuel management) were on the H-21. On the second and third practice flights, Givens gave Gaddis and Bowman (both new to the H-21) limited flying instruction. Captains Len Seitz and June Stebbins were in the Otter.

There were also two H-21 crew chiefs: Sgt. W. Harrington and Sfc. Joseph Loncar. However, newspaper and magazine articles gave little mention of them.

Given my level of knowledge about the goings-on at Board Six, they needed a Board Six monthly newspaper to keep the troops informed as well as for the historical record. We just did not know all the important things we were doing. Well, maybe not doing, but being associated with. I don't know if it would have made us any happier then but somehow it helps now. It would have sounded great in our letters back home. **History was being made.**

Development and Test

On initial refueling attempts during the fourth flight, the end of the hose swirled around in the air and the H-21 could not grab it. Joe Givens applied his experience as a Marine fighter pilot and came up with a solution to this difficult problem by trailing the refueling hose from the Otter with a 24 inch drag chute - making that last 50-60 feet nice and flat at the 70 knot air speed that was previously determined.

With that problem solved the team found that the H-21's one-prong light-weight hook could not be controlled - it whipped around at the 70 knot air speed. So a thirty-inch three-pronged grappling hook was fabricated with a 20 pound lead ball mounted in the center to stabilize it. On August 17th, the new hook on the end of the helicopter's hoist caught the refueling hose and pulled it up to the door of the helicopter where the crew caught it and connected the nozzle to the tank (55 gallon drum for testing) and fuel was transferred.

The H-21 still had the three 300 gallon tanks installed in its cargo bay. In each in-flight refueling cycle, the Otter transferred 300 gallons to the H-21. When the 300 gallon tanks were

installed there was also a fuel vapor venting system going out the rear of the H-21. It was a crude system but it worked.

Let's Do It

With the successful test, Colonel Williams decided to really expand the objective and go for a nonstop coast-to-coast in-flight helicopter refueling demonstration - a first. The odds of making it coast to coast were small, so, to get special treatment on flight clearances, the FAA were the only people advised of the attempt. Media attention or, for that matter, any attention beyond Board Six was undesirable to say the least. Even in Board Six it seemed to be a need-to-know restriction of information. Thanks to my work at North American Aviation, I did have a Top Secret Clearance.

An Army project number was assigned to the test (AVN 5556).

The in-flight refueling demonstration was the final feat on the list of planned accomplishments. As the date of the National Air Show approached, things became very rushed. On August 18th (one day after the successful in-flight refuel), the H-21 and the Otter took off from Fort Rucker and after an over night in El Paso, Texas; arrived at Miramar Naval Air Station in San Diego on the 19th to begin flight preparations.

Saved by the Navy

Remember, the H-21 is in New Jersey on Saturday, August 11th and leaves (via Fort Rucker) for Miramar Naval Air Station on the 18th. Not much time to develop and test or for the H-21 to get any rest. No wonder Colonel Williams gave success such a low probability.

Add about another 3,000 miles plus the development and test mileage. It should be noted that the crew chiefs, along with Captain Stebbins (Board Six's senior maintenance officer), performed all necessary maintenance during downtime at night.

On the first practice refueling attempt at Miramar (2:00 PM, August 22nd), a limited amount of fuel was transferred; however, the fuel management officer pushed the nozzle-disconnect prematurely so the fuel pump pressure from the Otter coupled with the weight of the fuel in the swirling disconnected fuel line blew the male coupling nozzle off - into the Pacific Ocean. With no replacement available, the Navy came to the rescue and machined a new nozzle overnight.

Takeoff

At six in the morning, Thursday, August 23rd the H-21 left Miramar and the in-flight refueling coast-to-coast flight began. Before leaving Miramar the Otter and its refueling tank were full; the H-21 and its three 300 gallon tanks were full. There was another plane involved, an L-23 flying cover and providing guidance (necessary because electrical problems left the H-21 with just navigation lights which as Joe Given noted was a minor problem).

The west to east direction was chosen to take advantage of the winds and the shortest distance - Miramar to the Savannah, Georgia coast. The final destination (Pentagon) and landing time (between two and four in the afternoon) was for exposure and publicity. They got that.

The Otter's refueling tank held only 300 gallons so the refueling was sort of a topping off process. While Miramar provided several snacks for each person on the H-21, the Otter and L-23 got only one snack per person.

Joe Givens mentioned that he was the only one with formal H-21 experience and formation skills. I thought this was some sort of typo because formation skills meant little to me. Later he told me that it meant skills flying in formation, which is quite standard for a combat pilot. And

in-flight refueling required flying in formation: H-21 and Otter. Consequently, Joe was at the controls at take-off and landing and all the refueling sessions – 21 hours (not continual) of the 28:30 hours cross-country flight time.

Although the focus was on the H-21, the Otter had a very difficult assignment. Not only did they have to go through the nerve wracking refueling process they also had to land and pick up fuel. Being under constant time pressure, there was no time to sleep or even get out of the plane and get snacks or walk around. They also might have been a little cramped: two pilots and two H-21 crew chiefs.

Fuel Management

This section is based on my conjecture, given the objective evidence. My back of the envelop calculations indicate that the H-21 had close to exhausted its supplementary gas tanks by the time it reached El Paso and only had its normal capacity. It left El Paso with a total of 600 gallons and at each subsequent refueling stop added 120 gallons to its departing gallonage. The lower fuel load over most of Texas provided lower fuel consumption. The H-21 left the Fort Benning refuel with a full complement of fuel for the final run to the Savannah, Georgia coast and on to the Pentagon where it would land with its normal capacity and empty supplemental tanks. Back of the envelop calculations have the H-21 never digging into its normal fuel tank.

As refueling takes place, weight is being shifted from the Otter to the H-21 so the Otter needs to gradually reduce engine power while H-21 increases engine power. Three hundred gallons of gas weighs 1,875 pounds, plus or minus ten pounds. Since Joe had experience flying in formation, the Otter likely maintained a constant airspeed (70 knots) and the H-21 followed the lead.

One might question why the Otter did not leave early and land in El Paso to fill up its own tank and the 300 gallon refueling tank. They could then rendezvous with the H-21, do the in-flight refuel and head out to the next stop and load up again. As it turned out, the El Paso stop did not use the Otter (did a hover refuel at an airfield). Once that was decided, the Otter only needed to head out for the next rendezvous point and after in-flight refuel, load up on fuel and head out again.

Had the Otter left early for El Paso, it would only need to fill its own tank once. All that assumes that they started in El Paso and landed at Fort Rucker after the Fort Benning refuel. But that would have spoiled the fun weekend after landing at Fort Belvoir.

However, Joe comments that this was a team effort. They would leave together and arrive together. And so they did.

Itinerary

The following itinerary comes from my back of the envelop calculations for the non-stop in-flight refueling test that began August 23, 1956 – 2610 miles in 28 hours and 40 minutes. Except as noted, times are departure times in Pacific Standard Time (local time in parenthesis). Refueling times are plus or minus thirty minutes.

Miramar, CA	6:00 AM
El Paso, TX	3:30 PM (4:30 PM) hover refuel.
Wink, TX	5:15 PM (7:15 PM), in-flight refuel.
Abilene, TX	7:20 PM (9:20 PM), in-flight refuel.
Shreveport, LA	10:00 PM (12:00 PM), hover refuel.
Maxwell AFB, AL	12:00 PM (2:00 AM), in-flight refuel.
Fort Benning, GA	1:45 AM (4:45 AM), in-flight refuel.

Arrive Washington, DC (Pentagon) at 10:40 AM (1:40 PM).

The news accounts totally overlooked a slight technicality. The transcontinental flight went from the Pacific coast (Miramar Naval Airbase in San Diego) to the Atlantic coast (Savannah, Georgia) – the shortest transcontinental route. So, its transcontinental flight did not end at the Pentagon. But that is where all the Army brass and CEOs were – don't spoil a good party and press coverage. You need talk, walk and a good publicity agent.

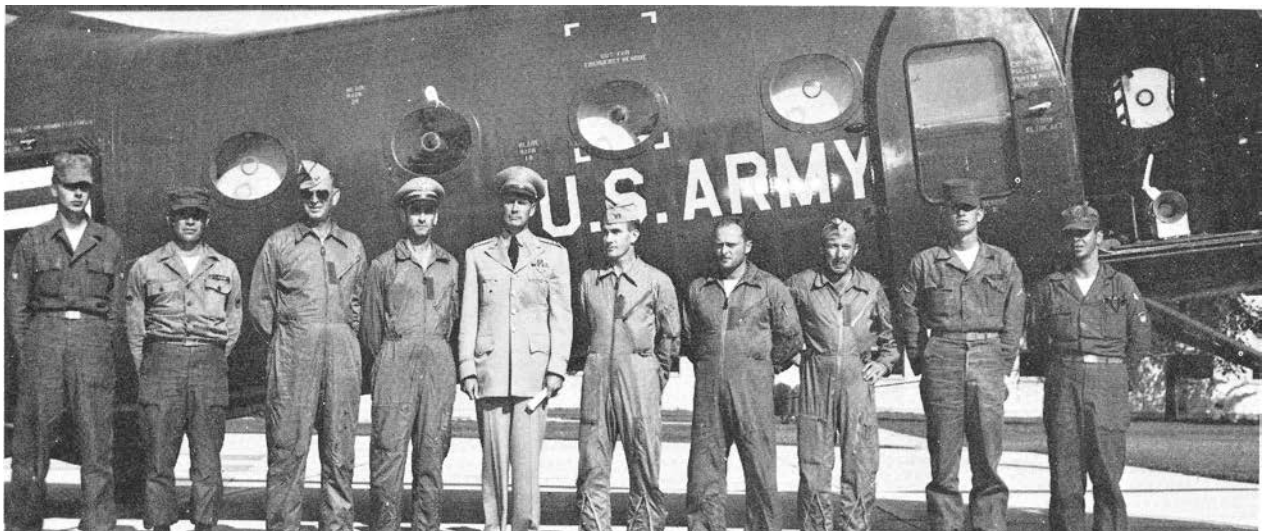
Wing and a Prayer

Shifting to Colonel William's voice: When the flight was about half way across the country, I was sitting nervously back at Fort Rucker and decided it was time to advise my bosses and interested manufacturers what Board Six was doing. First I called General Howze, Director of Army Aviation in Washington. He asked me what I thought the odds of success were. I told him the odds were improving by the hour and I would give a one out of ten chance of success. When I told him I was departing immediately to join the flight, he instructed me to provide an hourly report on the progress of the flight.

I then called the general at CONARC who was my immediate boss. He chewed me out for pulling some publicity stunt and taking on a project for which there was no requirement [Ed. the bureaucracy puts in its two cents and covers butt]. He also wanted an hourly report. Colonel Powell monitored the flight from Fort Rucker and notified General Howze, CONARC, DeHavilland, Vertol and the In-Flight Refueling Corp. of Baltimore that the flight was in progress - planning to fly directly to the East Coast (completing the transcontinental flight) and then turn North and land at the Pentagon. I departed for Washington and monitored the flight by radio on the way.

Hallalueah

At 1:30 in the afternoon (28:30 hours after taking off from Mirimar), on Friday, August 24rd the flight landed on the Pentagon helicopter pad. To the delight of us all, it was met by the Secretary of the Army, General Howze, the President of Vertol, the President of the refueling equipment company, Russ Bannock of de Havilland and some others. The Otter Crew landed at Fort Belvoir as I did and made it by ground transport to the Pentagon helicopter pad to greet Amblin' Annie.



We are now at about 6,000 miles on the H-21 since the beginning of the endurance test in New Jersey.

General Howze meant well when he offered to setup VIP accommodations at Fort Belvoir for the crews. I objected and told the three manufacturers that this was great publicity for their companies so they should arrange accommodations for the crews at a good hotel and feed them well. They readily agreed. Enjoy the weekend.

The President of the refueling equipment company said he was all for it but would like to point out that we came to him and rented the tank and the rest of the refueling equipment without telling him what we were doing. He had a \$1 million contract with the Navy to develop an in-flight refueling system for helicopters and probably was afraid of losing the contract. Apparently, the Navy people at Miramar were not aware of this conflict when they so expeditiously machined that new nozzle.

We now leave Colonel Williams' voice. My August 24 diary entry: Did not get much done but there is an air of urgency about the place.

The downstairs does not know what is happening upstairs.

Prior to the Army social function celebrating the accomplishment, Major Gaddis and Captain Bowman were presented with the Distinguished Flying Cross. Captains Seitz and Stebbins and each enlisted man associated with the flight received Air Medals. Later at Fort Rucker, Colonel Williams presented Joe Givens the Decoration for Exceptional Civilian Service Award (medal) and an accompanying citation signed by the Secretary of the Army, Wilber M. Brucker.

After landing at Fort Belvoir and the Pentagon, the next stop was the three day National Air Show that began Saturday, September 1 in Oklahoma City, Oklahoma where the refueling technique was demonstrated four times to 150,000 spectators with Dick Followill and Captain Jack Cranford flying the Otter. Dick Followill was a Dept of Army Civilian Employee at Board Six as a Flight Test Pilot. In 1951, Dick was a Civilian Flight Instructor at the Aviation Tactics School, Ft. Sill, Oklahoma and joined Board Six after the school and Board Six were moved to Ft. Rucker.

At the end of the air show, the H-21 had about 9,000 miles since New Jersey. I assume the H-21 went back to Fort Rucker for some extensive maintenance and evaluation.

Got no Respect

About 20 years later the Air Force published an article in the Army Aviation Digest that they had successfully refueled a helicopter in flight - telling about the Army's 160th Special Operations Aviation Regiment flying a CH-47 (Chinook) from Panama to Fort Knox – refueled by the Air Force from a C-130. The picture with the article showed the team that looked like about 50 people. Colonel Williams sent the magazine a letter pointing out that their claim of being first was invalid and that many years ago Board Six flew an H-21 twice as far, 2610 miles, with only a crew of five.

The joint Army and Air Force effort may have a small quibble because there were six refueling cycles: four in-flight and two in hover mode (El Paso – high winds and Shreveport – night and high winds). The hover mode refueling cycles were both at municipal airports.

After the in-flight refueling success, it seemed almost anticlimactic that Board Six set new world records for helicopter speed, distance, and altitude. I did go on one of those altitude flights. I guess for ballast because they handed me a parachute with no instructions and said climb in were going for a record. Naively, I said OK.

Inherent Weak Link

While helicopters appear to be a model of simplicity, they have a number of inherent weak links that are not apparent to the man on the street. One weak link involves something called the angle of attack. In a fixed wing, the angle-of-attack is the angle (going into the air-stream) that the wing is above horizontal. Increasing the angle-of-attack increases both lift and drag. The plane stalls when the drag reduces airspeed to the extent that there is not enough lift to overcome the plane's weight. The standard maneuver is to dive and pick up enough airspeed to provide necessary wing lift.

Now think of the helicopter, a so-called rotary wing aircraft. Looking at the blades as wings, when the helicopter is moving forward, say 50 miles an hour, the blade on one side of the plane is heading into the air-stream and the blade on the other side is heading away from the air-stream. There is a 100 mph difference in the speed of two blade's air-streams. As the blades (small wings) rotate, their angle of attack has to change so that the blade on the left provides the same lift as the blade on the right or else the helicopter will simply roll over.

The blade's angle of attack changes constantly (cyclic control) as it goes from moving into the air stream to moving away from the air stream. The cyclic control must be constantly adjusted as the helicopter moves forward, backward, sideways, etc. This involves a complex system of mechanical controls. The blades are going around pretty fast and for each rotation the blade switches from a high angle of attack to a low angle of attack – sort of wig-wagging, as it goes around. Think about that the next time you get into a helicopter.

H-23C Endurance Record

Major Jon Gray and Joe Givens provided materials gleaned from the Army Flier and the Aviation Digest as well as a few other sources. These serve as source materials.

On Friday, June 1, 1956 (about two weeks after my arrival at Board Six), two test pilots (Joe Givens, one of four civilian pilots at Board Six and Captain James Bowman) flew for 1,520 miles in thirty hours. The 1520 miles were flown by traveling 38 times over a closed circuit course. The refueling was, to say the least, straightforward and primitive. Five gallon gas cans along with food and other necessities were handed up from the ground. A platform attached to the left skid allowed Captain Bowman to pour the gas into the tank behind the engine housing (behind the cockpit).

In a picture of the refueling, I saw the gas cans being poured into the H-23 gas tank while in a hover mode. The downdraft from the helicopter blades probably blew the gas fumes away from any hot spots, although I expect they tested that theory by mounting a smoke or vapor source at that point.

This hover mode refueling was a precursor to the more ambitious cross-country flight. The H-23C endurance record established the feasibility of sustained flight that tested the helicopter as well as crew. Crew fatigue was an issue, but not a critical one. As a matter of record, at Board Six there were, on average, about 8 hours of maintenance performed for each flight hour. However, this endurance test showed that this level of routine maintenance could, if necessary, be reduced substantially. Helicopters could withstand rigorous combat conditions.



H-34 Speed Records



On July 12, 1956, Captains Claude Hargett and Ellis Hill established a new closed-circuit speed record for helicopters by flying a Sikorsky H-34 at a speed of 141.915 mph at Milford, Conn. December 7th, 1956, Hargett as pilot and Hill, made substantial improvements by

setting three official world speed records (still standing 2007 – maybe nobody cares) on closed courses at Milford, Connecticut. These were without payload. For a 100 km course, 228.39 km/hr, 500 km course, 218.89 km/hr and 1000 km course, 213.45 km/hr. The H-34 had been stripped of nonessentials and equipped with a 500-gallon auxiliary fuel tank.

H-13 Endurance Flight

At the National Aircraft Show on September 1-3, Board Six used seven pilots to keep an H-13 airborne for 57 hours and 50 minutes, consuming 731 gallons of fuel and 19 quarts of oil. All refueling was in the hover mode. A large audience witnessed this demonstration of helicopter durability. Board Six was slowly burying myths about helicopter potential. Army Aviation was coming of age in front of a live audience.