RECORD-SET
TRANSATLA

MAYNARD THE MAN

If you know anything about Maynard Hill, then you know that he has been setting records with RC models since 1963 when he snatched the altitude record from the Soviet Union. On July 5, 1963, he almost doubled it with an altitude of 13,328 feet. From then on, Maynard was hooked, and he has since set 22 other records for distance, duration and altitude. If the FAI certifies this Atlantic crossing as a record, then Maynard will have a total of 25 records to his credit.

Born in 1926 in Pennsylvania, Maynard has been building model planes since his youth. In college, he trained as a metallurgist, and several years ago, he retired from Johns Hopkins University's Applied Physics Laboratory as a

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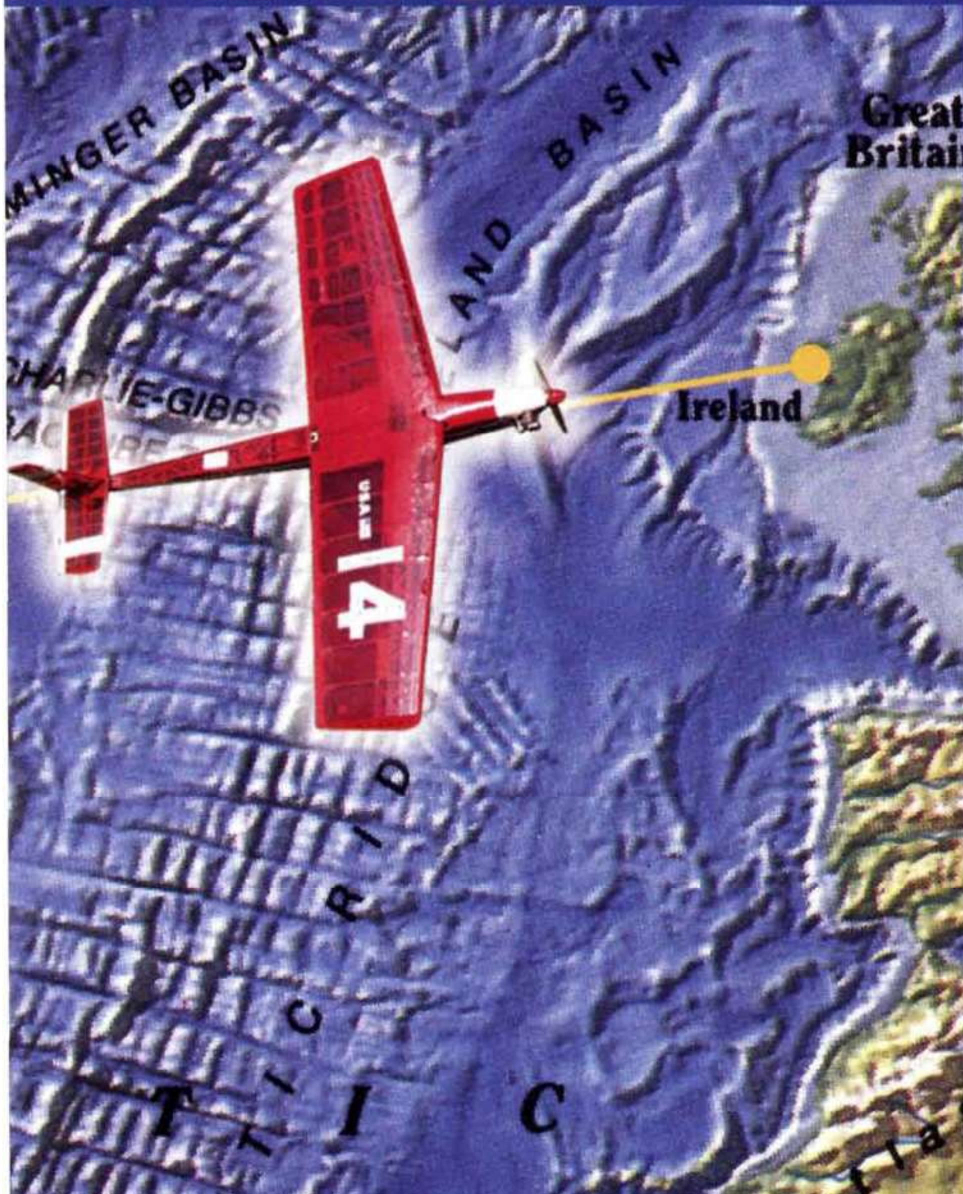
NTIC FLIGHT



1,882 miles on less than 1 gallon of fuel

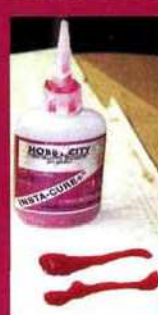
by Rick Bell

Thirty-eight hours and counting: members of the Irish landing team scanned the clouds and anxiously checked their watches, as the minutes seemed to drag. They were afraid that the model—along with their hopes for a record-setting flight—had crashed into the Atlantic only a few miles from its destination. Landing pilot and AMA president Dave Brown remembers, "At one point, our instruments began telling us that the aircraft was inexplicably diving and climbing 100 feet at a time, and then we lost contact with it."

Just 19 minutes later, the simple balsa-and-ply aircraft came into view, right on target. In a telephone interview, Dave noted, "A great cheer went up when we saw it, and four minutes later, I landed it in the field. It was so thrilling!" When asked about the significance of this record-setting journey, Dave paused, and then remembered that after the aircraft had landed, two young boys came over to check it out. "Wow! That's a pretty simple model; even we could build an airplane like that!"

Those young would-be modelers had summed it up: the accomplishment wasn't necessarily the fact that it had flown across the ocean, but that it had inspired and invited future generations to pursue their goals and push the limits.

robotic airplane expert. He's also a past president of the Academy of Model Aeronautics (AMA) and the Society for Technical Aeromodel Research (STAR). The idea of flying an RC model across the Atlantic occurred to Maynard 20 years ago, and he has actively pursued it since 1998. A lot of the data garnered for the crossing was accumulated from his many long-distance, cross-country flights. What's really remarkable is that Maynard is hearing-impaired and legally blind. To make his building chores a little easier to see, Maynard buys a red dye from Bob Smith Industries that he uses to color his CA a dark magenta.



In the beginning, Maynard thought that flying a model 2,000 miles in 40 hours would be relatively easy. "But the longer we worked at it, the harder I realized it was. It's almost a miracle that we made it all the way," related Maynard from his Maryland home. His first plan was to follow the model in a yacht and guide it from there, but he soon concluded that the cost of the yacht—and sufficient beer for his friends to drink during the crossing—would be prohibitive. Maynard is obviously someone who never gives up on a goal!

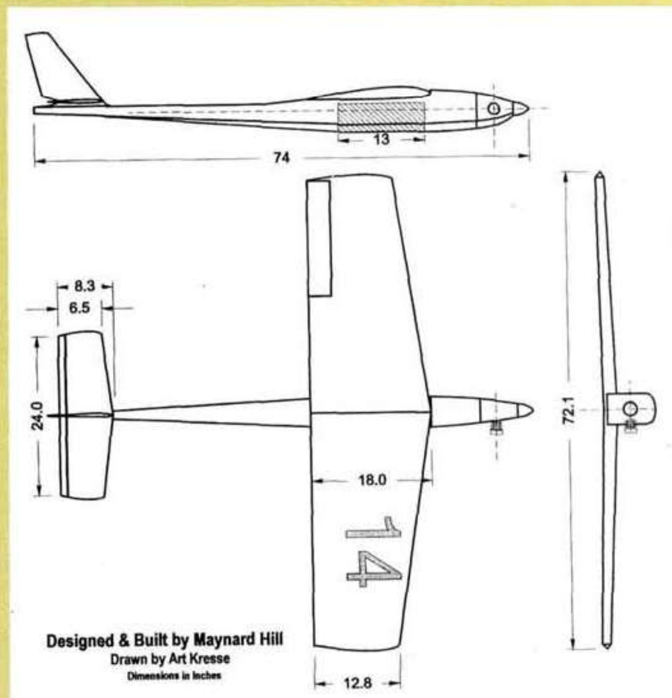
PHOTOS BY RICK BELL

TAM 5 (Trans Atlantic Model), nicknamed "The Spirit of Butts Farm," is an unusual name for any aircraft, let alone an RC model. What this model achieved is also unusual: it flew nonstop across the Atlantic Ocean, fulfilling a 20-year dream of Maynard Hill and a dedicated team of believers. Hand-launched by Maynard and piloted by Joe Foster, on August 9, 2003, at 7:45 p.m. (local time) from Cape Spear, Newfoundland, the model flew a distance of 1,882.3 miles in 38 hours and 52 minutes before being landed in Clifden, County Galway, Ireland, on August 11 at 2:08 p.m. (local time) by AMA President Dave Brown, thus completing a flight of historic proportions.

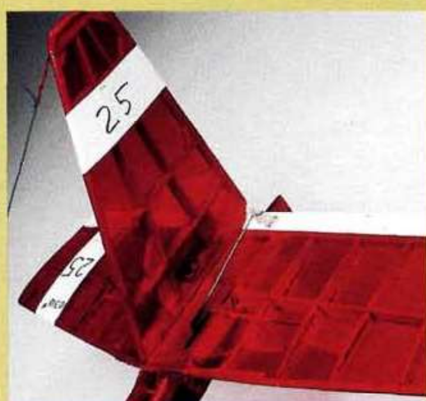
How does one go about designing an RC model that, in addition to having the endurance and stability to fly unassisted by human input, still meets the stringent guidelines set down by the Federation Aeronautique Internationale (FAI) to qualify as a record-setting flight? That was one of the many questions I asked Maynard when I visited him in late September for an in-depth look at TAM 5.

TAM 5—THE MODEL

This overall view of the model shows its sleek, functional design to good advantage. Note the single aileron and no rudder.



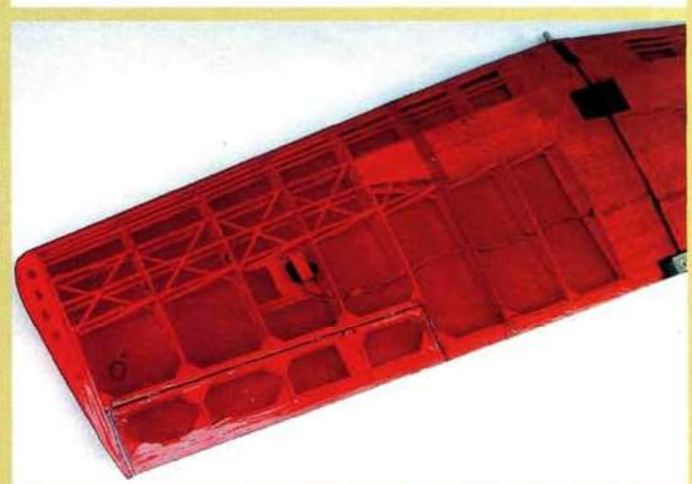
"The Spirit of Butts Farm"
TAM 5



The removable tail feathers are very light and simple in design. You can see that there isn't any rudder. The stabilizer houses the elevator servo and a telemetry transmitter.

To submit the flight as a record attempt, the model had to meet FAI criteria, and Maynard's approach to this was simple. The plane could have a maximum weight of 11 pounds fueled and a wingspan of around 72 inches. The engine could displace no more than 10cc, and Maynard uses 1980's vintage O.S. .61 4-stroke engines. The model uses very traditional free-flight construction methods for both light weight and strength. As an example, the wing weighs only 1.1 pounds yet it can sustain more than 3G. The model has no landing gear (excess weight and drag) and uses only one aileron (in the left panel). The tail feathers are of open-bay construction and are removable. To further reduce weight, the vertical fin doesn't have a movable rudder, and the entire model is covered with transparent red MonoKote.

A Futaba radio system is used along with three S3103 microservos for aileron, elevator and throttle. The aileron and elevator servos are installed inside the wing and stabilizer to again reduce drag and to be as close as possible to the control surfaces. When viewing the model, you realize how simple and low-tech it really is; quite a contradiction to what's inside the plane. By the way, the model's name, "Spirit of Butts Farm," is in honor of Maynard's friend, 89-year-old Beecher Butts, at whose farm much of the testing and flying was done.



A view from the top of the left wing panel shows only one aileron is used, and its servo is installed internally. Note the extensive use of truss-type construction, which provides a lot of strength.

THE POWER SYSTEM

For the flight to be successful, a reliable engine is key. Over many years of testing, Maynard developed an engine-testing system that works for his needs, but you must understand that this isn't something for the average modeler. After all, most of us don't want to run our engines at 3,800rpm for 30-plus hours.

A close-up of the remotely mounted carb. Maynard modified the barrel to get the maximum efficiency needed for the flight.

Each engine was a vintage O.S. FS .61 4-stroke from Maynard's extensive collection. The engines are basically stock but are modified for C&H spark-ignition systems. The props used are wooden Zinger 14x12s that Maynard modifies to his specifications.

Maynard runs each engine for 30 to 40 hours before it's flight-ready. He remotely installs the carburetor in the fuselage and uses a length of Tygon to attach the carb to the intake manifold. To obtain the fuel economy needed for duration flights, Maynard modifies the carb barrel with special cuts and grooves. The carb is calibrated to deliver about 2.05 ounces of fuel per hour.

The float with the drill bit. Very clever!

Maynard uses Coleman stove fuel because it burns clean with very little carbon buildup and produces a lot of energy when ignited. To prevent the engine from seizing, Maynard uses an industrial lube that's used in the food-industry; it, too, burns clean without carbon buildup.

The one-way valve used to pressure the fuel cell. It was designed for use in aquariums.

This is the alternator drive installed on the rear of the O.S. engine. A short length of vinyl tubing connects it to the alternator.

A close-up of the link that connects the alternator to the crankshaft. The pin inserts into the crankshaft.

The fuel-delivery system is unique and uses nonstandard hobby items. For example, Maynard uses crankcase pressure to pressurize the fuel cell, but he uses a one-way valve from a fish tank. This valve allows the engine to pressurize the fuel cell to about 10 water inches of pressure. This is far too much pressure for the carb to handle, so Maynard designed a float chamber that precisely meters the fuel. The chamber follows Maynard's philosophy "simple is best." The chamber is a plastic jar that holds a float that's soldered together from thin brass sheet. The kicker, though, is the metering needle: it's a no. 40 drill bit that picks up vibrations from the airframe. As it vibrates, fuel swirls down the flutes of the drill bit and into the chamber, making the float rise; this in turn controls the fuel level in the chamber. The system works very much like a float chamber in an automotive carburetor.

To power the electronics on board during the flight, Maynard again devised a simple method to generate power through the engine. A new backplate was machined that incorporates a pseudo crankshaft that couples the engine's crankshaft to drive a modified electric Aveox motor. The rewound motor acts like an alternator and provides electricity to run the autopilot, servos and spark ignition system. Again, the system works very much like an automotive electrical system. As you can see, a tremendous amount of work and modifications has gone into the engine, fuel system and carburetor to get the maximum efficiency and reliability from each.

Maynard's homemade float chamber is pure simplicity: a plastic jar, some sheet brass and a no. 40 drill bit.

Here's the sensor pickup for the ignition. A total of 8.5 million sparks were produced during the flight!

HOW IT WORKS

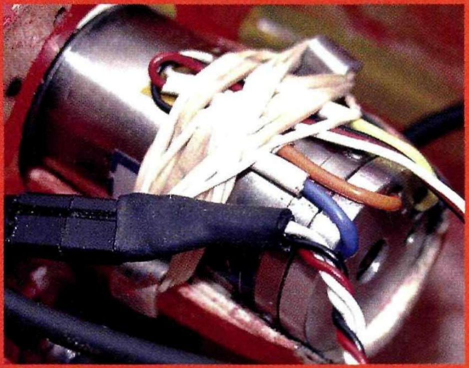
Don't let the model's simple form fool you: inside, it's a very sophisticated piece of equipment. Besides the receiver and servos, the model carries an alternator, a barometric-pressure sensor, a piezo gyro, an autopilot, a Global Positioning System (GPS) receiver, a tachometer, two telemetry transmitters and an electronic ignition for the engine.

Here's a rundown of how TAM 5 works. After launch, the model is flown via the transmitter to a predetermined altitude and then trimmed for straight and level flight. A signal is then sent from the transmitter to put the model into an autopilot mode. The GPS determines the model's position with respect to eight preprogrammed waypoints along the route. During the flight, the receiver is active to reject stray signals. The barometric sensor keeps the model at the desired altitude. From time to time, the sensor is calibrated for atmospheric pressure variations by applying data from the GPS altitude system. The tachometer regulates the engine, and the piezo gyro levels the wings whenever the roll attitude is disturbed.

The GPS receiver is installed in the center wing section. Hook-and-loop fastener holds it in place.

Navigation is carried out by software that generates steering commands to hold the model on a heading to fly along a line between the waypoint behind and the waypoint ahead of the model. A secondary software routine is applied to the steering to minimize any drift from crosswinds, thus keeping the model on track.

The position of the model during the flight is periodically transmitted to the operation center in St. John's, Newfoundland, by one of the telemetry transmitters. The transmitter sends data every minute to ARGOS satellites. (ARGOS satellites are used for wildlife tracking and are in a low polar orbit.) When one of the satellites comes within range of the model, data from the onboard transmitter is recorded in the satellite. Later, as the satellite passes over a ground station along its orbit, the stored data is sent to a receiver and computer system, which in turn sends the data to the St. John's operation center via email messages. The satellites record latitude, longitude, engine rpm, ground speed, altitude, elevator position and other data.



This is the alternator that supplies electrical power to all onboard systems. The engine's crankshaft provides the power to turn it.

As the model approaches its final waypoint, it's programmed to descend to 200 meters (600 feet). At the waypoint, the autopilot is programmed to turn the model back toward Newfoundland and fly for about half a kilometer (3/10 mile) and then turn back toward the waypoint. This circle pattern allows the landing pilot to acquire sight of the model, gain control of it and land it at the intended place. To alert the Ireland team of the model's impending approach, the team in St. John's used a cell phone to call them with the ETA (estimated time of arrival). When the model is sighted, the pilot (Dave Brown) punches in the proper code on the transmitter to gain manual control of the model. The pilot then sends a signal to kill the engine and guides the model to a landing. The system worked so well that Dave was able to land TAM 5 within 10 meters of its desired landing coordinates.

THE RECORD FLIGHT

It's said that the third time is a charm. For Maynard's team, however, the fifth attempt was the lucky one. The first three attempts took place in August 2002 and the fourth on August 8, 2003, the day before the successful flight.

The flight's start location and the time of year were carefully selected to take advantage of the prevailing winds and to maximize the chances of success. The team also chose this site to honor the accomplishments of Capt. John Alcock and Lt. Arthur Whitten Brown, who made the first transatlantic flight from Newfoundland to Roundstone Bog, Ireland, on June 14 and 15, 1919.

Maynard calculated that TAM 5 would need a tailwind so the model would average a ground speed of nearly 60mph to complete the estimated 32-hour flight with about one gallon of fuel. Right after Maynard launched the model, Joe Foster flew it to an altitude of approximately 820 feet, at which time the autopilot is switched on. The plane then encountered crosswinds, not the required tailwinds. TAM 5 was also gaining and losing altitude. To add even more concern, the engine wasn't running at the prescribed 3,800rpm. It, too, varied in rpm, probably from the loss and gain in altitude. Several hours into the flight, the needed tailwinds developed and TAM 5's groundspeed increased—just like everyone's hopes! All appeared well.

This is the barometric pressure sensor. Its function was to keep the model at a steady altitude.

Many hours later and almost 1,600 miles into the flight, the unthinkable happened: the observers stopped receiving data from the model. For more than three long, suspense-filled hours, TAM 5 wasn't heard from. Everyone thought its fate was sealed. But then, all of a sudden, the data flowed in again! TAM 5 was still alive! But not without problems: the tailwind was gone, and the model's speed was only 43mph with 280 miles yet to go. That meant TAM 5 was 6.4 hours away from land. Would the fuel supply be sufficient for a flight that now looked to be more than 39 hours long? Time would tell.

An overall view of the nose compartment. From left: on/off switch, backup battery, float chamber, C&H ignition module, carb and alternator. The throttle servo is mounted under the ignition module.

Just a little before 2:00 p.m. local time, the data received indicated that TAM 5 was 13 miles from its intended landing point and flying at 58mph. But how much fuel remained? Was there enough? Shortly thereafter, a member of the Irish team spotted TAM 5. Landing pilot Dave Brown flipped some switches on his transmitter, regained control of the model and landed it. The rest, as they say, is history!