Biography of ROSS A. HULL

Modeler, Designer, Inventor,
"Father of the Modern Radio Controlled Sailplane"
Inventor of the Escapement, Single Tube Receiver, and DC Servo

Modeler since c. 1910 1902 - September 13, 1938

Written & Submitted by GBF (01/08) Formatted & Edited by JS (1/08)

Career:

- 1902 – Born in Melbourne, Australia
- 1922 – Noted as first Australian radio operator to hear American radio signals
- 1924 – Became Federal Vice President of the Wireless Institute of Australia
- 1926 – As Secretary to the Wireless Institute of Australia, Hull visited the American Radio Relay League (ARRL) headquarters in Connecticut to study American radio activity; filled a vacancy in technical information service in the editorial department
- 1928 – Director of a special technical development program at the ARRL
- 1929 – Returned to Australia to become technical editor of *Wireless Weekly*
- 1931 – Returned to America to become Associate Editor of *QST* magazine; continued developing new radio equipment at the ARRL headquarters laboratory
- 1934 – Demonstrated for the first time that a five-meter amateur radio station could receive signals over 100 miles, considered at the time to be a revolutionary development in amateur radio
- 1935 – Developed a device for correlating signal strength with other data, and this led to his discovery that VHF signals are refracted in the lower atmosphere in a manner similar to light rays, a major scientific discovery
- 1937 – Invented the escapement, a device that used rubber bands to control the surfaces of model airplanes
- 1937 – Designed and built a series of radio-controlled model sailplanes, making over 100 flights in the summer and fall
- 1938 – Flew radio-controlled model sailplane *Skyrider* on July 1 at the National Soaring Contest held at Elmira, New York with the help of Bourne (W1ANA), with Bourne acting as control operator. The *Skyrider* used an improved, though bulkier and heavier, method of control employing continuously reversible small D.C. motors; also experimented with radio gear in manned gliders to allow the contest crowd to hear pilot chatter from the ground, following the example of Grant Meeker (W8ADV) who conducted similar installations at the 1937 National Soaring Contest
- 1938 – Died as the result of an accidental electrocution at his home in Vernon, Connecticut on September 13

Personal Achievements:

- First to construct a practical apparatus using the high-C circuit for self-excited oscillators
- First to describe presentations of 100%-modulation
- First use of linear radio frequency (RF) amplifiers
- First to introduce a signal monitor
- Set the pace in radio apparatus design in the late 1930s with many unusual designs to

shorten leads, etc.

- First to describe the escapement system of control actuation for radio-controlled model aircraft
- First to describe the one-tube on-board receiver for radio-controlled model aircraft

The following biography was written and submitted by Gary B. Fogel, Ph.D.

Background on Ross Hull and Early Radio-Controlled Gliders and Equipment

Ross A. Hull cultivated a strong interest in model aviation throughout his childhood in Melbourne, Australia. (*QST*, November, 1938) In 1926, at the age of 24, he made his first visit to the United States with the intent on learning more about modern advances in American radio communication. Within ten years of this visit, Hull became a recognized world leader in amateur radio communications. A combination of experience in amateur radio, enthusiasm for unusual radio applications, and lengthy interest in aviation served as key ingredients for his development of pioneering radio-controlled sailplanes.

Hull devoted most of his life to the American Radio Relay League (ARRL) and their publication, *QST* magazine. Between 1936 and 1937, several amateur radio operators recognized the possibility of combining the technology of radio control and model aircraft; however, no practical system had yet been described. Ross Hull (amateur operator VK3JU) and friend Roland B. Bourne (amateur operator W1ANA, Chief Engineer of the Maxim Silencer Company in Hartford, Connecticut), were first introduced to the concept of Radio Control for model airplanes at the 1937 National Soaring Contest in Elmira, New York. This contest was for manned gliders, and members of ARRL would assist with radio communication at the contest. According to former National Soaring Museum Historian Victor Saudek, "Ross Hull was well known at those early meets, for he would load up a utility glider with radio gear, generally a Franklin *PS-2*, and then patch the pilot's chatter into the public address system. When it worked, it was a real crowd pleaser." (personal communication, V. Saudek) Also on display for the crowd at the 1937 National Soaring Contest was a Radio Control model sailplane built by Carl W. Thompson, Jr. with radio gear installed by H. M. Plummer. This sailplane had only rudder control and a fixed elevator. Carl Thompson was a member of the Delaware Soaring Association and interested in manned gliding. Although several successful flights were made for the crowd, the model had an unfortunate landing that ended the series of experiments at the National Contest. Hull and Bourne purchased the remains of this model sailplane and took them back to Hartford, Connecticut, where they focused on the problem of on-board control. Using this repaired sailplane, they made over one hundred flights by October of 1937 and developed several ingenious devices to help control the aircraft. An article, "Radio Control of Model Aircraft," by Ross A. Hull and Roland B. Bourne, was the first to describe in detail a working radio system suitable for model aircraft. They wrote:

> "Most hams are usually far from being one-hobby men and one discovers, almost invariably, an interest in the other sciences and the crafts. A common interest in ham radio, aeronautics, model building, and photography is almost the rule. We happen to be built that way and our

> interest in aircraft led us, this summer, to take an active interest in this problem of radio control." (*QST*, October, 1937)

Hull and Bourne decided to incorporate the use of rubber band motors to activate the control surfaces onboard the aircraft. "With a motor four or five feet long we knew that we could 'charge' the thing with at least 1000 turns and obviously this would serve for several thousand control motions." (*QST*, October, 1937) This "escapement" system, as it was called, was attached to the rudder surface such that the rudder could be moved in a step-wise fashion from left to straight, and then to right. However, this system had one major disadvantage. The rudder positions were operated only in continuous sequence. Once the rudder had been in the left position and then centralized, it was only possible to return to the left position by first traveling through the right position, back to the central position, and then to the left position. This proved to be quite challenging for the operator and a ground system was developed to keep track of the last rudder position during a flight's progression.

Hull and Bourne also developed a unique two-tube receiver weighing merely 2.5 pounds for the aircraft. This "lightweight" receiver operated on the 56 MHz band. However, later improvements were made using a heavier three-tube version. The transmitter, considered very large by current standards, was powered by a six-volt car battery and consisted of 45 tubes based on drawings from the *ARRL Amateur's Handbook*. A ten-inch wooden control wheel could be rotated to give the pilot control of right, center, left, and again center positions, always in a continuous sequence.

These early flights were best described by Hull and Bourne themselves, as they shared their experiences with the readership of *QST* magazine. Generally, the airplane was taken to the top of a sloping hill overlooking a valley. A bit of hard running and "an almighty shove" was all that was needed to get the aircraft airborne. (*QST*, October, 1937)

> "It is relatively simple to fly the machine in a simple curved path in still air and it is reasonably simple to steer the machine clear of objects providing both they and the machine are within a hundred yards or so. Trying to land the plane on a tree-studded field a quarter of a mile long is, however, something that demands a very special order of skill and, we know, simply cannot be done without a great deal of practice. But it all adds up to a most extraordinary field for experiment and one for which we can see a grand future." (*QST*, October, 1937)

After their summer experiments of 1937, it was time to develop a two-channel sailplane with both rudder and elevator control. It became a challenge for both the radio community and Ross Hull to perfect the marriage of radio and model aircraft. At the time, it was reported that Hull made a series of model sailplanes in the fall of 1937 to test his new designs. (*QST*, September, 1938) Other ham operators, such as Harner Selvidge, helped test these early model gliders. On one occasion, with Selvidge operating as the pilot, the model lost radio contact in mid-flight and continued on a long "Free Flight" excursion, completing a perfect landing between a set of houses. According to Selvidge, several of the homeowners were impressed with the obvious

skill that Selvidge had shown in managing to avoid the houses on landing (much to the amusement of the glider crew!) (personal communication, Harner Selvidge) Hull and Bourne's initial story in *QST* generated "a flood of correspondence on the subject [of model airplanes] the like of which we haven't seen in many a moon." (*QST*, July, 1938) Because of these successes and those of the Good brothers, amateur radio operators began introducing radio into all facets of modeling.

In late 1937 or early 1938, after tests at the *QST* lab, Ross Hull developed for the first time a simple one-tube receiver to replace the bulky and much heavier three-tube receiver. (*QST*, July, 1938) This new radio equipment gave the modeler more room within the model itself, and more importantly, less weight onboard. In addition, Ross Hull adapted an improved method of onboard control surface activation. By using small DC motors, a distinct advantage was gained, allowing for the precise degree of control to be applied to a control surface instead of an "all or nothing" affair. (*QST*, September 1938) However, since these new DC motors added significant weight to the aircraft, Hull and Bourne set out to design a new model sailplane to carry a total load of close to ten pounds. (*Model Airplane News*, Nov., 1994) This new sailplane was to be named the *Skyrider*.

The *Skyrider* was constructed as a gull-winged, "higher performance" sailplane with a wingspan of 16 feet and a total wing area of twenty square feet. Gull-shaped wings were common on leading competitive manned sailplanes of the period and were widely considered optimal for design. The airfoil section was a high-lifting, undercambered NACA 6412 (modified), with an approximate wing loading of close to ten or twelve ounces per square foot. The aircraft was designed to survive many hard landings and as a result was built of ¼-inch plywood bulkheads covered with "rolled" plywood. The wing was equally robust with two wing spars and planking. The *Skyrider* was most likely constructed during the winter of 1937, with flight tests conducted in the spring of 1938. By July of 1938, Hull and Bourne were anxious to take the ship to the Ninth Annual National Soaring Contest, held once again at Elmira, New York. Some reports suggest that Hull and Bourne actually wanted to enter the *Skyrider* in the competition along with the manned gliders, but "unfortunately, technicalities in the rules prevented this!" (*QST*, September, 1938) The sixth day of the meet was a day of poor soaring conditions with weak thermals. However, the lull in activity provided the perfect opportunity to fly the *Skyrider*. With Bourne at the controls, the *Skyrider* "made several experimental flights" and was a crowd pleaser. (*Soaring*, August, 1938) A photo of the *Skyrider* in flight appeared later in the September 1938 edition of *QST*. After this great success, Hull and Bourne made plans for a winter program to build a lighter weight on board receiver for the *Skyrider*. One of the last proposed changes to the *Skyrider* came at the suggestion of Clinton B. DeSoto, Assistant Secretary of the ARRL, another amateur radio operator, and pioneer in the use of powered radio-controlled models. "When launching the monster glider proved a problem, Hull and DeSoto decided to add power using a Forester "99" engine. The fuselage was full of radio equipment, so the engine was mounted on a tripod above the wing. Aluminum rods supported a wooden engine nacelle in a pusher arrangement." (*Model Airplane News*, November, 1994)

Unfortunately, Ross Hull's experiments in radio-controlled flight were tragically foreshortened.

While working on an experimental television receiver in the evening of September 13, 1938, Hull was accidentally electrocuted when he came in contact with a 4,400-volt transformer. The members of the ARRL noted later that "for over ten years his name has been representative of the best and newest that radio offered the amateur. Our loss is the world's loss, because not every generation produces a Ross Hull, and a man of his genius and drive was certain to make even greater contributions to the world's progress had he been spared." (*QST*, November, 1938) Ross Hull's *Skyrider* was one of the earliest radio-controlled model aircraft in the United States, and was a decided advancement relative to contemporary achievement by other Radio Control model aircraft pioneers from 1936 to 1938. It is clear that Hull's experimentation, the design of escapements, a single-tube receiver, and DC motors for surface actuators (servos) paved the way for many other advancements that occurred in model aviation in future decades.

References

Hull, R. A. and Bourne, R. B. "Radio Control of Model Aircraft," *QST*, October 1937 (Note the cover of the October 1937 *QST* issue shows a picture of the 13-foot wingspan, 10-pound radio controlled glider originally designed and built by Thompson and Plummer in 1937 but purchased, rebuilt, and reflown by Hull and Bourne later in 1937)

"Connecticut," *Soaring*, February 1938, p. 9 (has a picture of the *Skyrider* in flight)

Hull, R. A. "New Gear for Radio-Control Systems," *QST*, July 1938

DeSoto, C. B. "Ham Radio and Models," *QST*, September 1938

"Lethal machine," *Time*, September 26, 1938

DeSoto, C. B. "Radio Control of Powered Models," *QST*, October 1938

"Distance, Altitude, Duration: The Story of the Most Successful Contest," *Soaring*, August, 1938

"It Seems to Us…" *QST*, November 1938

Isberg, R. A. "A Radio-Controlled Gas Model," *Popular Aviation*, March 1939

Friend, A. W. "A Summary and Interpretation of Ultra-High-Frequency Wave-Propagation Data Collected by the Late Ross A. Hull," *Proceedings of the IRE*, June 1945

Personal Communication, Victor Saudek to Gary Fogel, October 12, 1994

Personal Communication, Harner Selvidge to Gary Fogel, 1994

Personal Communication, Paul A. Schweizer to Gary Fogel, 1994

DeBolt, H. "The Glider Experiment," *Model Airplane News*, November 1994

Program from the R/C Soaring Symposium, National Soaring Museum, May 3, 1997

Selvidge, H. "Some Notes on the Early Flight Tests of the Hull/Bourne Radio Controlled Glider 1936-37," May 3, 1997

"Golden Age of R/C" *Model Airplane News*, December 1997 (incorrectly attributes the *Skyrider* to Clinton DeSoto, not Ross Hull)

"Ross A. Hull VHF Pioneer," *Amateur Radio*, January 1998

Fogel, G. B. "Ross Hull and the 1938 Skyrider," *Sailplane and Electric Modeler*, Vol. 3(4), pp. 60-65

Jamieson, E. "The Ross Hull Story," *QST*, September 2000

McElroy, G. "A Short History of the Handheld Transceiver," *QST*, January 2005

Wendt, J. "Black Sky," June 18, 2005 (http://www.eham.net/articles/11154)

Martin, J. “Ross A. Hull: VHF Pioneer” (http://www.wia.org.au/contests/ross_hull/)
DeSoto, C. B. “On the Frontiers of Science” (http://www.qsl.net/ng3p/haminfo/desoto/chap11.html) (incorrectly attributes Hull as having flown the first successful radio-controlled soaring model, which neglects the earlier contribution by Thompson and Plummer)

-End-