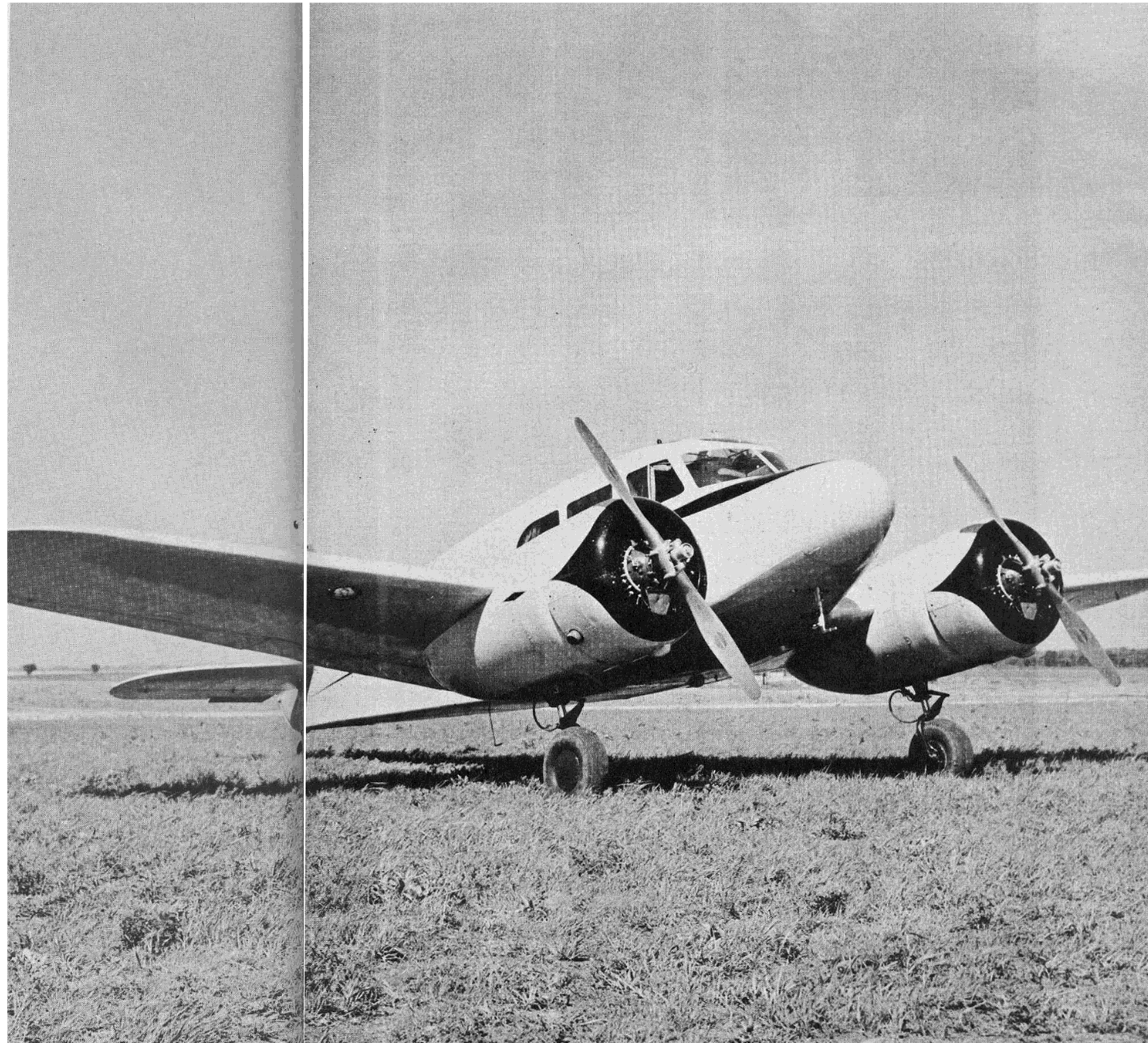
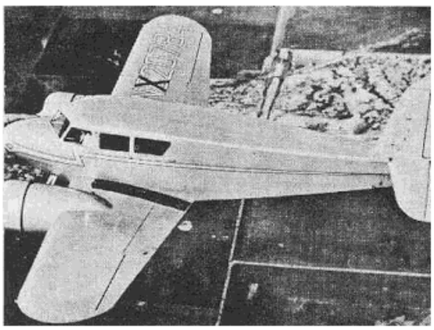
UC-78

Bob Morse and Mearle Hickman's magnificent twin-engine Cessna UC-78 has been in the development stage for over two years. The next few pages represent the combined efforts of many individuals --- the text and plans are by the authors, the final drawings by George Walker. The full color cover transparency was provided through the courtesy of Gordon Madison. Full-Scale photographs, research data, and authentic factory drawings were furnished by Bill Robinson, Public Relations Director for Cessna Aircraft Corporation. Photographs of the model are by Bud Phillips. The historical preface is by the Editor. R/C Modeler Magazine is proud to take part in the presentation of the UC-78 --- one of the finest radio control scale construction articles ever published.

By Bob Morse and Mearle Hickman



Prior to WWII, during the summer of 1938, Cessna Aircraft Corporation began a review of the twin-engine aircraft market. Their investigation disclosed a definite need for a small twin to sell in the $10-$30,000 price bracket. With this goal, and certain pre-determined specifications in mind, Cessna engineers began the design of their experimental twin. Less than a year later, the Cessna Model T-50 was ready for its first test flights.



The maiden flight of the first T-50 on March 26, 1939. Note "V" windshield converted to a curved unit on production models.

The new prototype was a low wing, five passenger model powered by two Jacobs 225 h.p. engines and equipped with Curtiss Reed all-metal, fixed pitch props. A retractable landing gear system was incorporated in the new design, the first since Cessna's CR-3 racer, produced in 1933.

Following the successful maiden flights and subsequent flight test and developmental engineering phases, the CAA granted Cessna approval for full-scale production of the T-50. Production actually began in early 1940, and it was apparent that the T-50 was an immediate success.

The production model of the T-50. Windshield, rear cabin window, vertical tail, and constant speed props the most noticeable changes.

Designed as a business personnel transport, it was anticipated that the T-50 would soon see usage as a high-speed charter plane; for instrument training and major airline route-checking; for aerial photography, ambulance work and twin engine flight instruction. The cruising speed of the T-50 was 191 m.p.h. with a cruising range of 750-1000 miles. Single engine absolute ceiling was 6300 feet. The T-50 was capable of a short take off run of 520 feet and a landing run of 630 feet. Climb, fully loaded, was 1500 feet per minute. Landing speed was 55 m.p.h.

Construction of the T-50 consisted of a welded fuselage assembly of chrome molybdenum seamless steel tubing, jig built in one piece, with the aft section strengthened for lifting and ground handling. The wing was of wood construction, full cantilever, and continuous from tip to tip. The front wing spar passed through the cabin at the rear edge of the pilots seat, and the rear spar under the rear seat, offering no obstruction to full use of the cabin space. Airfoil utilized was an NACA 23012. Six degrees of dihedral was used. Wing flaps lowered 35 degrees and were directly driven by a single electric motor.

The T-50's retractable gear was operated by an irreversible chain-driven worm operated by a single electric motor, assuring perfect synchronization of both wheels at any point during extension or retraction. Brakes were hydraulic, and toe-operated from the pilots seat. Two 60-gallon aluminum alloy fuel tanks were located between the nacelles and the fuselage. An auxiliary 40-gallon tank was located under the rear seat.

Cessna's commercial T-50 had a wingspan of 41 feet 11 inches and an overall area of 925 square feet. Fuselage length was 32 feet 9 inches with a height of 9 feet 11 inches. Gross weight was 5000 pounds, with an empty weight of 3500 pounds, leaving a useful load capacity of 1500 pounds. Payload was rated at 850 pounds. The spacious cabin area had a volume of 214 cubic feet, and handled 300 pounds of luggage. Wing loading was 16.9 pounds per square foot with a power loading of 10.2 pounds/HP. Service ceiling was 22,000 feet. Gasoline consumption, 28 gallons per hour. Oil capacity was ten gallons.

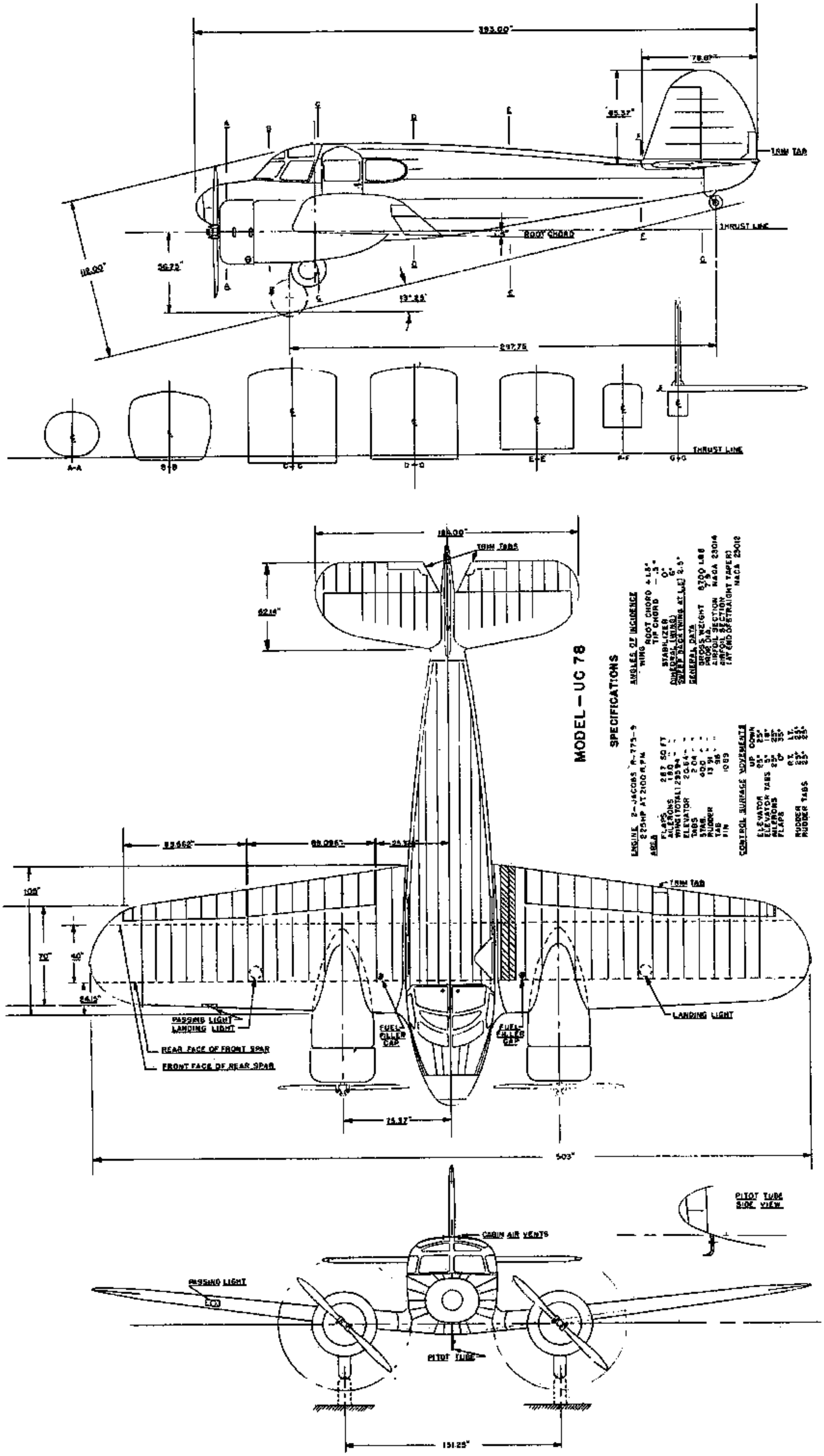
Available also as an optional ski-plane and photoplane, the Civil Aeronautics Association purchased several of the new twins for use in patrolling airway radio facilities.

A T-50 purchased by the CAA. All T-50's were redesignated UC-78A when taken over by the government during WWII.

As the war in Europe became more and more prominent, it became apparent that the U.S. and Canadian governments would need bomber training planes. The U.S. Army was interested in the remarkable success of the T-50 and ordered 33 ships from Cessna in 1940. As advanced trainers, the Jacobs engines were replaced with 290 h.p. Lycoming R-680-9, nine-cylinder motors. Redesignated the AT-8, the new trainers differed from the commercial T-50's only in their increased power, special radio and military equipment, different cabin top windows, and khaki paint job. All AT-8's were equipped with Sperry hydraulic autopilots.

The AT-8 — same as the T-50 except for cabin top windows, equipment, paint job, and 290 H.P. Lycoming engines.

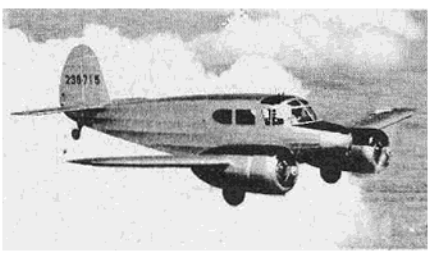
The Army purchase order was soon followed by an order from the Canadian government for 180 of these aircraft. The Canadian T-50 was designated the Crane I, and was identical to the commercial T-50 with the exception of wooden, fixed-pitch props, radio gear, special interior equipment, and exterior markings. Power for the Crane I was two 245



MODEL — UC 78
SPECIFICATIONS
ENGINE 2-JACOBS R-775-9
225HP AT 2100 R.P.M.
AREA
FLAPS 28.7 SQ FT
AILERONS 18.0
WING (TOTAL) 295.94
ELEVATOR 20.64
TABS 2.04
STAB. 40.0
RUDDER 13.91
TAB .98
FIN 10.89
CONTROL SURFACE MOVEMENTS
UP DOWN
ELEVATOR 25° 25°
ELEVATOR TABS 5° 18°
AILERONS 25° 25°
FLAPS 0° 35°
RT. LT.
RUDDER 25° 25°
RUDDER TABS 25° 25°
ANGLES OF INCIDENCE
WING
ROOT CHORD +1.8°
TIP CHORD -.5°
STABILIZER 0°
DIHEDRAL (WING) 6°
SWEEP BACK (WING AT L.E.) 2.5°
GENERAL DATA
GROSS WEIGHT 5700 LBS
PROP. DIA. 7'9"
AIRFOIL SECTION NACA 23014
AIRFOIL SECTION
(AT END OF STRAIGHT TAPER)
NACA 23012
TRIM TAB
THRUST LINE
ROOT CHORD
TRIM TABS
PASSING LIGHT
LANDING LIGHT
REAR FACE OF FRONT SPAR
FRONT FACE OF REAR SPAR
FUEL FILLER CAP
CABIN AIR VENTS
PITOT TUBE
PITOT TUBE SIDE VIEW

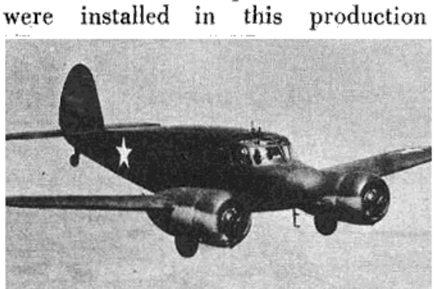
h.p. Jacobs engines.

By December of 1940, less than six months after receipt of the Army contract, the first AT-8 was delivered to Dayton, Ohio for military flight evaluation. The first Crane I was delivered to the Canadian Air Force one year later, only three months after contract negotiation with Canadian officials. Following the successful tests and evaluations by both governments, Canada responded with additional orders totaling 640 planes. Army officials placed additional orders with a change from the Lycoming powerplants to two Jacobs R-755-9, 245 h.p. engines, standardizing the motors in both the U.S. and Canadian versions. The new Army order designated the T-50 as the AT-17, promptly nicknamed the "Bobcat."



The AT-17 with additional top windows and Jacobs 245 H.P. engines. Volume production model of the T-50.

Top speed of the volume production AT-17 Bobcat was 195 m.p.h. with a cruising speed of 175 m.p.h. Gross weight of the AT-17 was 5100 lbs, later increased to 5700 pounds in the AFT-17 A, C, and D versions. Hamilton Standard constant speed props were used on the initial AT-17 order, and Hartzell wooden, fixed pitch blades on the remainder of the series. Additional top cabin windows were installed in this production



The UC-78 series, used for light cargo and general transportation. Sold for civilian use after WWII.

series. A total of 1140 were built during the war years of 1941 to 1943.

In the latter part of 1942 and early 1943, the original T-50 was again redesignated the UC-78. This new series was used primarily for general transportation and light cargo missions. Gross weight was 5700 pounds. A total of 3356 were built and deliverd.

From the original Cessna T-50, 5402 aircraft were built during the period from 1940 to 1943. The AT-17 series was used by the Army Air Force as an advanced trainer. As aircraft developments progressed during the war years, the later model UC-78 series was relegated to simpler tasks. All of the commercial T-50's built were later taken over by the U.S. government and designated as UC-78A's. Other than minor changes in equipment, all AT-17, UC-78, Crane I, and Crane II aircraft were basically alike.

Canadian Crane II's. Same configuration as the AT-17 series but painted all yellow with Canadian markings.

Due to a shortage of material for constant speed propellors, wooden fixed-pitch props were used on Models AT-17A, AT-17B, AT-17C, UC-78B, UC-78C, and Crane I, in order that production of these ships would not be delayed.

One other experimental version of the T-50 was the Cessna P-7, identical to the T-50 except that it was powered with two 330 h.p. Jacobs engines, and the wings and tail were plywood covered. Only one prototype was produced, the P-7 making its test flight on June 2, 1941.

THE MODEL

As you took your first glance at the Bobcat you probably wondered what kind of a nut would spend all that time working on such an "ugly duckling." But if you stay with it long enough, you will feel as we do — "it's so damned ugly that, in real truth, it has a beauty all its own."

The model is an excellent flier with only one major vice — it does like to drink fuel! If you start a UC78 of your own, get a gallon of fuel now!

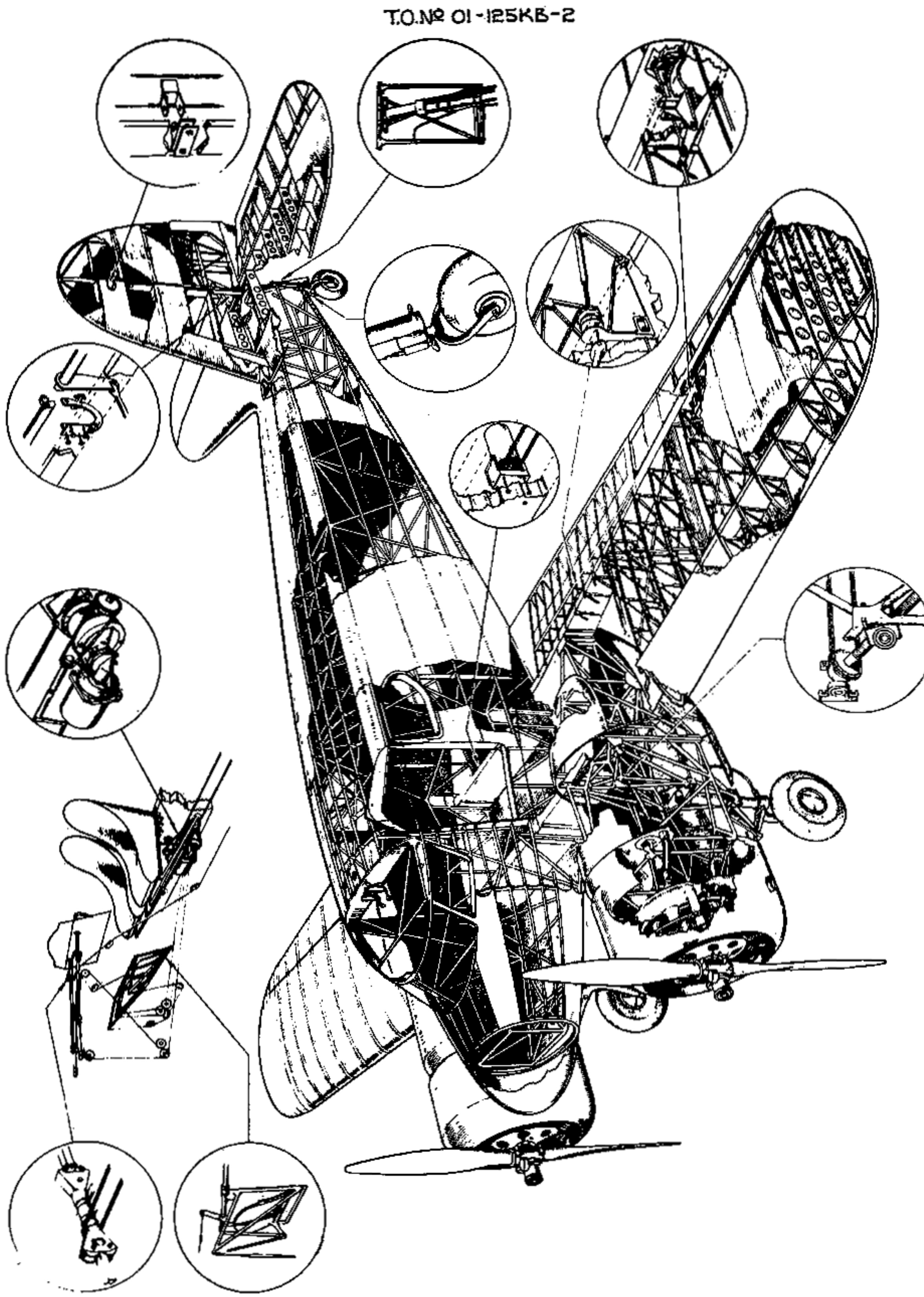
There is no magic secret in the design of the model. The Cessna engineers took care of these when they designed the full scale T-50 in 1939. The only deviation from scale is the fabric covered wing being replaced by conventional RC wing construction for greater durability, plus the substitution of a modified NACA 2417 airfoil. The ship is extremely stable and responsive, and to date, without vices. We are most emphatic in recommanding the use of contra-rotating propellers to cancel the torque effect. With two 35's screaming away, this torque could be a real problem — if not disastrous. Models to date have used K&B 35 R/C mills with the left hand engine equipped with a reverse ported crankshaft (usually available from the manufacturer).

Propellers used were Tornado 10-6, right hand and left hand. Prototypes #3 and #4 are now being built. #1 met its demise at the 1963 Indian City meet in Detroit when the elevator pushrod went out with the engine in high speed! #2 is in mint condition and was recently displayed at the 1964 Fresno, California Open contest. While we do not recommend the Bobcat for the beginner, the average sport multi-flier can fly this ship without any difficulty if he has any degree of faith in his flying ability.

Very few problems are encountered in constructing the model. The fuselage is large, but light. The wing is no more difficult than the average contest multi wing with the exception of the two nacelles that are built-on after the basic structure is finished. DO NOT increase wood thickness anywhere in the model as this is the only area where you can keep the weight down. (Come to think of it, you'd better get some more fuel!).

The eight ounce DeBolt metal clank tanks should have 3/8" trimmed from their length so that they will fit between the firewall and sheeted wing leading edge. DO NOT cut into the leading edge to install standard tanks, as this will seriously weaken the beam strength of the leading edge box structure.

Assembly of the nacelles starts with the installation of the main vertical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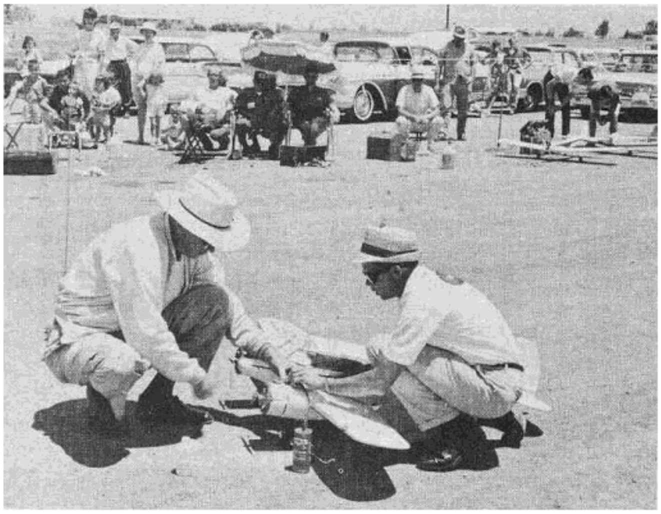
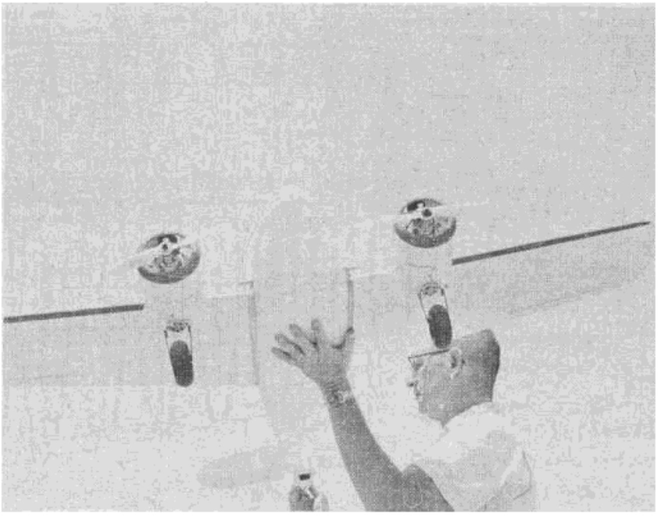


Port engine starting on second flip at Fresno demonstration. Bob Morse starting while Bob Francis holds.



Author holds the UC-78 up for attentive spectator. Note width of fuselage and overall size.

plywood keel that simply slips over, and is glued to the sheeted wing structure. The fuel tank is positioned in the vertical keel and then the horizontal plywood keels are cemented in position at each side of the tanks. The nacelle is now ready for the quarter section balsa frames, the plywood firewall (with its blind nuts installed for engine and cowling), and the plywood landing gear mount plate with its blind nuts installed.

When these parts have set, begin the 1/8" 3/8" **soft** balsa planking at the bottom of the nacelles. Plank up each side until you can get back into the landing gear mounting plate to resin coat the interior areas around this plate, being careful not to "blob" resin into the nut threads. Once the resin is in, finish the planking operation.

We would like to assure you that the nacelles are **not** difficult to build — two or three evenings and they will be finished. This is the lightest nacelle structure that we could devise, and they have proven extremely sturdy. So, again, do not add heavy beam mounts or any more plywood than what is shown.

The fuselage is of straightforward construction and no difficulty should be encountered until you come to the cockpit enclosure. The first ship had a meticulously built plywood frame with inset panels of lucite. Number 2 model had a heat-formed plexiglass unit with painted framing members.

The landing gear that we have used, due to its simplicity, strength, and availability, is the old style deBolt two leg nose gear. We simply bored through the aluminum wire clamping plates and passed three 4-40 bolts through into the blind nuts in the nacelle gear mounting plate.

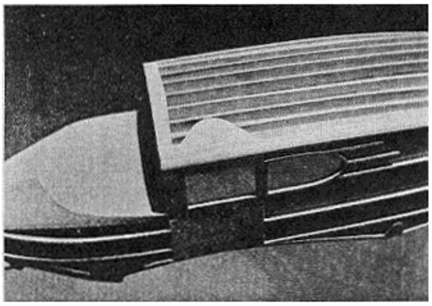
The engine speed control and aileron bellcranks shown are Top Flite cranks which we strongly recommend because of the positive mounting method provided.

With the wing completed, the fuselage can be built and matched to the wing as you go along. We installed the door paneling and window trim spacers to the fuselage side panels before final assembly. The fuselage sides are built up of 1/16" medium sheet, adding the cabin details as mentioned above, followed by assembling the sides to the plywood frames. Again, **do not** increase your wood sizes. You'll begin to wonder about the 1/16" sheet fuselage box when you start construction, but the entire fuselage is a strong integral unit once the frames and stringers are installed.

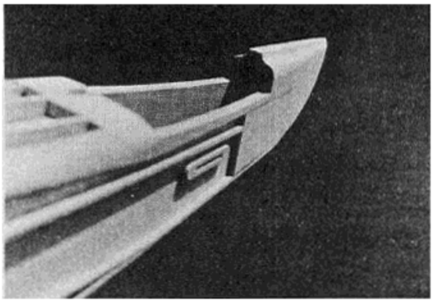
Radio equipment used in #1 model was a Min-X 10 channel reed outfit. 3/8" soft balsa pushrods were used to prevent buckling when signaling "up" elevator. A Kraft Custom 10 transmitter and receiver combination was used in prototype #2.

The original aircraft was finished in Army Corps olive drab with light powder blue on the under sides. The Crane I and II, to the best of our knowledge, were all yellow with Canadian Air Force markings. Our #2 models was finished with the same color scheme shown on the cover shot of the UC-78 in this issue of R/C Modeler. Following WWII, many of the UC-78's, and their earlier predecessors, the AT-8's and AT-17's, were sold to civilian buyers, as was the plane on this month's cover. Color schemes ran the full gamut of the various purchasers whims, although most of them seemed to maintain a light basic color with darker trim striping.

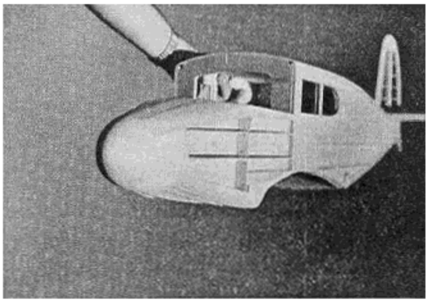
A word or two about the engine cowlings — our first thoughts on this matter centered around metal cowls, but this required some very special tools which were not available to us. In lieu of this, fibreglass was selected for this purpose. A basic pattern of hardwood turned on a lathe was used as the male mold, which in turn, was cast in plaster of paris. A hole was drilled in the casting to allow air to replace the wood pattern when it was withdrawn from the casting. The plaster pattern was coated with releasing agent and the fiberglass cowls were built up inside this pattern. Don't forget to apply a coat or two of resin to the interior of the pattern in order to form a smooth exterior surface before placing fiberglass cloth



Detail: General cabin structure

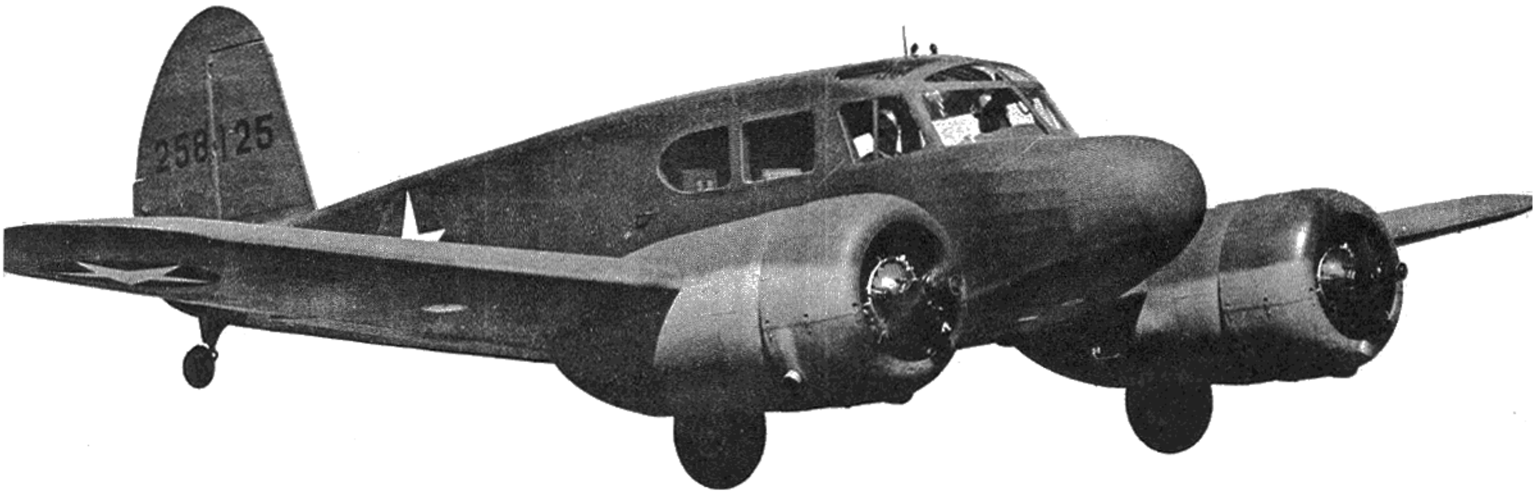


Detail: Aft section and tail mount



Detail: Nose cone and cabin area

in the pattern. Several layers of resin and cloth will produce a sturdy cowl. After the cowl is removed from the plaster pattern, water sand it and fit with an inside ring of plywood for mounting to the firewall.

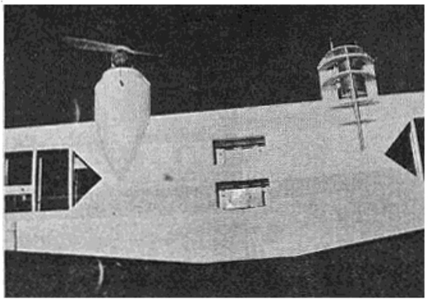


The model stays pretty free of oil when the engines are running. With the exhaust closures such as they are, it is difficult to devise a suitable exhaust extension. We simply let the exhaust blast into the interior of the cowls, the residue collecting on the inner surface, running down to the bottom of the cowl, then dribbling out the trailing edge. This may appear to be rather primitive, but it does keep the model free from continuous exhausted fuel soakings.

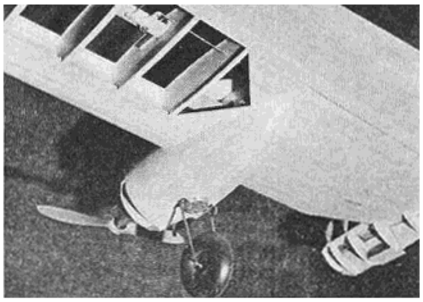
Both Mearle and I would like to thank Cessna Aircraft Corporation for their cooperation in supplying the data necessary to prepare these plans. In addition, our appreciation to Don Parsons of Albuquerque and his ME 210 twin for the words of encouragement regarding the flying of twin engine RC models. He was right — the sound of those twins winding up will really get to you!

In closing, we would like to say again that the flight characteristics of this model are excellent. The ship is extremely stable and easy to fly. In the event one engine quits, simply throttle back enough on the other engine so that the ship is flying straight, and bring her in to a normal touchdown.

Detail: Wing and servo mounting



Detail: DeBolt landing gear mount



Detail: Nacelle and engine mounting