RUSSIAN CP-1

By Bob Wallace

World War II Rocket Powered Interceptor

One of the least known, yet truly remarkable interceptor designs to emerge from World War II, was the Russian CP-1 rocket interceptor. (Its actual Russian designation was "funny B," "backwards N"-1, as it appears on the plan sheet.) As both of these characters are unique to the Russian alphabet, I have been told that "CP-1" is the best English translation. Hopefully, this is correct.

So little has ever been mentioned or published about this unique rocket interceptor, that many World War II aviation buffs are not even aware of its existence. In contrast, the German rocket and jet propelled designs of World War II were photographed and written about quite extensively.

In 1993, it was my good fortune to accompany a group of American aeromodelers from the Sport Flyers Association (SFA), on an aviation oriented tour of Russia and Ukraine, and to prepare an article about it for RCM, which subsequently appeared in the December 1993 issue. A part of this tour included a visit to the Russian Air Force Museum, which is located about 15 miles outside of Moscow. There, much to my amazement sat a CP-1 fighter, plus a spare rocket engine mounted on a display pedestal!

One of the best features of the Russian Air Force Museum is that there are no spectator or visitor barriers, in either the vast outdoor display area or the Museum itself. You can walk right up to any aircraft, and look, touch, and photograph it to your heart's content. I was to learn later that while six versions or variations of the CP-1 were built and flown, that the one on display is the only one that survived.

The CP-1 was conceived in 1941 by a branch of the Russian Scientific Institution known as NEE-3, in their Moscow facility. With the outbreak of hostilities between Russia and Germany, the highly secret CP-1 project was rapidly relocated to a site in the Ural Mountains of Siberia.

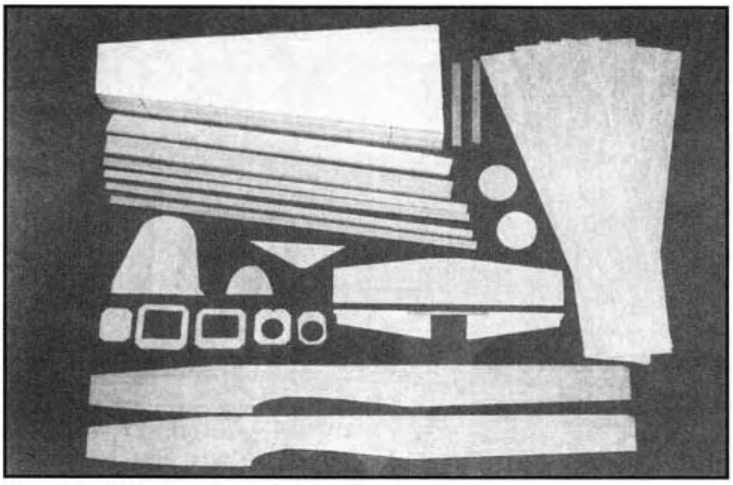
Constructed primarily of wood, the prototype CP-1 was first flown in May of 1942.

The first flight was made using only a 50% capacity fuel load with the projected airspeed being 560 mph.

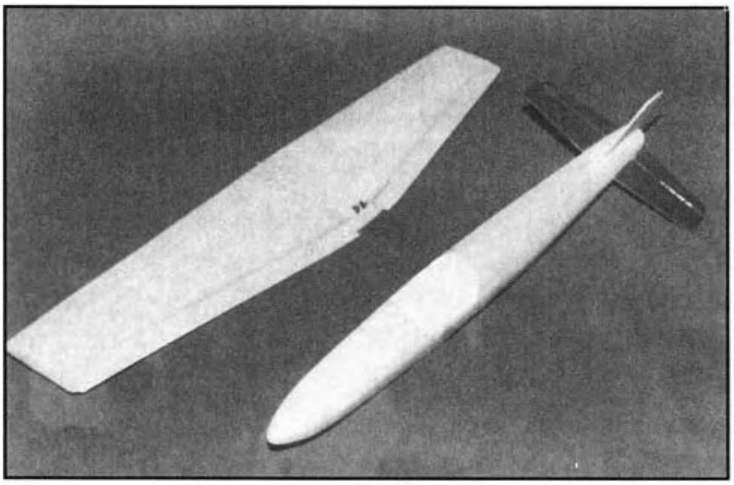
However, the top speed attained on this maiden flight was only 497 mph and the subsequent "dead stick"

The last existing CP-1; located in the Russian Air Force Museum near Moscow.

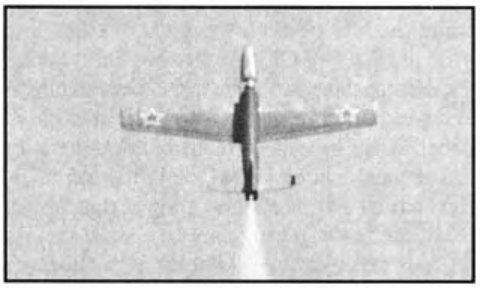
Finished model, ready for flight.



The kit; all the basic parts required.



Wing ready for servo installation and covering. Fuselage/empennage unit, ready for cockpit and canopy installation, then covering.



Up, up, and away! Powered portion of the flight is fast and smooth.

landing approach was made too high and fast, and the CP-1 ran off the end of the runway, wiping out its landing gear. Additional test flights were successful, but on the seventh, the test pilot lost control during high speed maneuvers and was killed in the resultant crash. Six versions or variations of the CP-1 were built and several were equipped with skis. Like the other rocket fighters of World War II, the CP-1 had a very limited powered flight duration. Its rocket engine, which was designated D-1A, employed a fuel mixture of nitric acid and kerosene mixed at a 4:1 ratio.

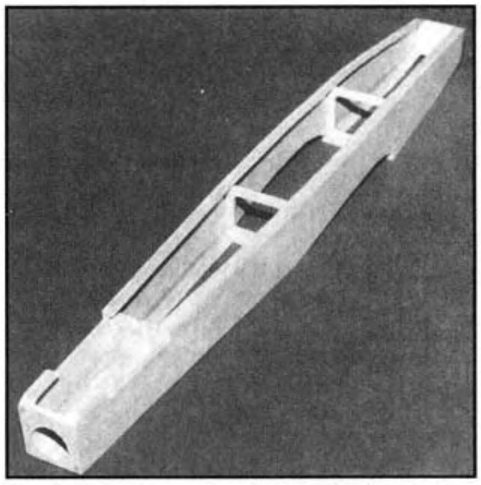
The CP-1's instrument panel was very basic, and the aircraft had no electrical system or radio. The retractable landing gear was manually operated. The CP-1 had a wingspan of only 21'-3". Its empty weight was 2094 lbs. and, fully loaded, it weighed 2645 lbs. Armament consisted of two 20mm machine guns.

The maximum speed attained by the CP-1 was 603 mph, which was quite remarkable, considering that it was accomplished in 1942.

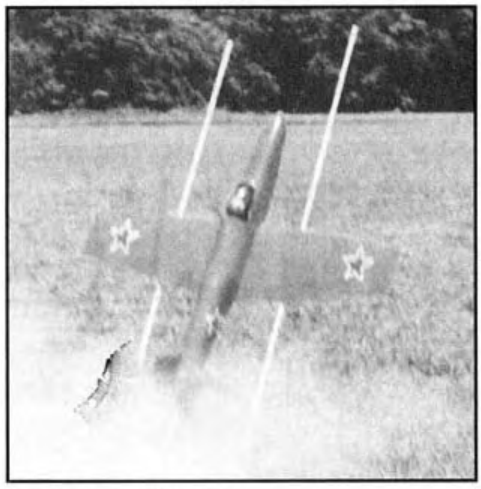
Why the further development of rocket fighter technology was not pursued during World War II by the Russians, is unknown. The thought of constructing an R/C model of the CP-1 was most intriguing, and thanks to several of my Russian aeromodeling friends, I have been able to obtain a surprising amount of scale documentation and data for this rare and unique aircraft. I have a variety of 3-views of the CP-1 variations, cockpit details, and several pages of written information (all in Russian).

For my R/C version of the CP-1 rocket interceptor, I decided that the most practical and realistic power source would be to use the Estes solid propellant type of rocket engines that are readily available in most hobby shops. The intent was to use Estes D11-P engines for the initial test flights, and then to use the more powerful E15-P engines for higher performance flights. The physical size of these rocket engines (both are the same diameter) would determine the scale dimension of my model.

The other criteria established were that the model would be a semi or fun scale-type



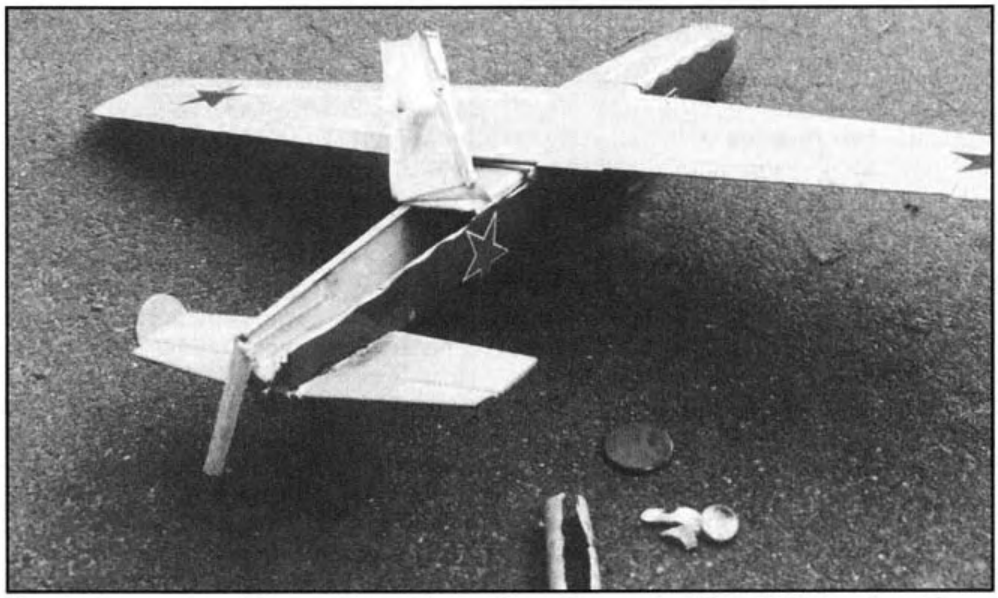
Basic fuselage structure with the motor tube already glued in place.



Ignition and lift-off!

that would also be easy to build and fly, with no special materials or skills being required. My CP-1 has a wingspan of 32-1/2" and 174 sq. in. of wing area, the overall fuselage length is 26".

As the CP-1 employed a double tapering wing, the use of a balsa sheeted foam core type wing was selected. The tail surfaces are solid sheet balsa and the fuselage is essentially of "box-type" construction. Carl Goldberg UltraCote film-type covering material was used in finishing my model.



Here's the results of the rocket engine malfunction on test flight #4. The aircraft was quickly repaired and flying again. No other rocket engine failures have occurred since.

The rocket powered CP-1 will hopefully appeal to those RC'ers who like to build and fly something a bit unique or different, and it is guaranteed to draw attention to both spectator and fellow aeromodeler alike when it "blasts off" with its distinctive "swooshing" sound!

While the CP-1 is a basic and simple design, a brief study of the plan sheet, prior to starting construction is advised; and, as with any "built from plans" aeromodeling project, it seems to speed up the construction process if the various component parts are cut out or fabricated first. Fuselage formers F1, F4, F5, F6, and the circular stabilizer tip plates are cut from 1/8" balsa laminate, which is made by gluing two pieces of 1/16" balsa sheet together, cross-grained. While a bit more work, this balsa laminate is light in weight and much stronger than normal 1/8" sheet. When cutting the holes in formers F5 and F6 for the rocket engine containment tube, use a 1" Forstner drill bit if you have one, as it will produce absolutely perfect, splinter free holes. When selecting the wood for your CP-1, avoid the use of hard balsa stock, particularly aft of the C.G.

CONSTRUCTION

Wing:

Start by cutting the foam core templates from 3/32" plastic laminate, plywood, or sheet aluminum, and then cut your wing panel foam cores from 1 lb. density expanded polystyrene (EPS) foam board. If you do not have a foam cutter, or an aeromodeling friend who does, CP-1 wing foam cores are available from Wallace R/C, 91 Sylvan Street, Avon, CT 06001. The cost is $15.00 which includes first class shipping.

Prepare the four 1/16" balsa sheet wing skins, leaving about 1/4" of excess beyond the foam core blanks.

The foam cores should be lightly block sanded and vacuumed prior to sheeting. I prefer to use epoxy for sheeting my wing foam cores, although contact adhesive or aliphatic type glue may also be used. If you are going to use epoxy for this construction step, apply the epoxy (slow curing type) to the balsa wing skins and squeegee off all excess epoxy. An old playing or credit card works well for doing this. The epoxy coated wing skins should appear to be dull and not have a "wet" glossy appearance that would indicate that too much epoxy has been applied. Apply the epoxy coated wing skins to the foam cores and place them back into the excess foam core cradle pieces. Align both sheeted wing cores and the foam cradle pieces on a flat building surface and place a piece of flat plywood, plate glass, etc., on top, and place heavy weights on the entire assembly. Allow the epoxied wing panels to cure overnight.

Remove the sheeted wing cores from the foam cradle pieces and trim and sand off the excess balsa sheeting, glue the 3/16" x 1/8" balsa leading edge and 1/4" sq. subtrailing edge pieces in place on both wing panels. Block sand the leading and subtrailing edges to the indicated contours. The 3/16" x 3/4" trailing edge stock is now glued in place, with the portions that will ultimately become the ailerons and center section trailing edge being only spot glued in a few locations. Sand the tips of each wing panel flush and glue the 1/4" x 1/2" wingtips in place. Block sand both wing panels to the indicated airfoil and sand the root sections to a slight angle in order to produce the proper dihedral angle of 5/8" at each tip, or 1-1/4" total dihedral. Glue the two wing panels together at the proper dihedral angle, taking care to ensure that no built-in twist or warp is being incorporated into the wing. Sand the center section leading and trailing edge faces flat where they will contact the fuselage bulkheads.

Cut the ailerons and center section trailing edge portion out of the wing. Channel the subtrailing edge to accept the aileron torque rods. I used old bicycle spokes with nylon tubing bearings for my torque rods. However, a Du-Bro 1/2A aileron linkage set (No. 231) will work equally well. Glue the center section trailing edge portion and torque rods in place. Hinge and trial fit the ailerons. Install a 2" wide band of two ounce fiberglass cloth to the wing center section joint with epoxy resin. Cut out the necessary portion of the wing center section for the aileron servo well and install the servo mounting blocks. Drill a 1/8" hole in the center of the leading edge to accept the 1/8" hardwood wing mounting dowel and epoxy the dowel in place. Finish sand the entire wing assembly and set it aside.

Tail Surfaces:

All tail surfaces are cut from 1/8" balsa

sheet, except for the circular stabilizer tip plates which are made from laminated 1/8" balsa sheet. The elevators are coupled with a piece of 1/8" hardwood dowel and the elevator horn is made from 1/16" plywood, which is then epoxied to the dowel coupler.

Fuselage:

Assuming that you have already cut out the various component pieces, mark the positions of the fuselage formers onto the 1/8" sheet fuselage sides. Glue the 1/4" triangle stock pieces to each fuselage side. Be sure to make a "right" and "left"-hand side! Glue formers F2 and F4 in place on one fuselage side, and then glue the opposite fuselage side in place. Using the plan sheet fuselage top view as a guide to ensure fuselage symmetry, pull the nose and tail portions of the fuselage sides together and glue formers F1, F5, and F6 in place. Install the 1/8" x 1/4" fuselage cross braces and former F3. Glue the balsa nose block, forward top block, and bottom sheeting in place.

Glue a block of (blue) polyurethane foam from the tail to former F3 and sand to a radiused contour, allowing enough of a recess at the top of the fuselage sides to accept the 1/16" balsa (turtledeck) sheeting, which can now be glued in place.

Remove the portion of the turtledeck aft of former F5 and glue the completed stabilizer/elevator unit along with the elevator control rod, in place. Replace the turtledeck portion removed, after removing enough of the foam to allow for sufficient movement of the elevator horn and control rod. Cut the ver-

tical fin slot in the sheeted turtledeck and glue the vertical fin in place.

The rocket engine containment tube is made from 1/32" balsa sheet in the following manner. Wrap an Estes E15-P rocket engine with clear vinyl sheet material such as that used as the backing sheet for heat shrinkable covering film. Soak the 1/32" balsa sheet around the covered rocket engine, making sure that there is sufficient balsa sheet to produce an overlap. Wrap with elastic bands and allow to dry. When dry, remove the elastic bands and carefully cut a lateral seam line on the overlapped balsa. Glue the seam with CA adhesive.

Remove the vinyl wrapped rocket engine and discard the vinyl wrapping. Reinsert the rocket engine into the balsa tube and check the fit. It should be snug, yet allow the engine to slide easily out when held vertical. Cut a 1/8" balsa sheet disc to fit into the internal end of the rocket engine tube and glue it in place. Insert the balsa rocket engine tube, with an engine in place, into the precut holes in formers F5 and F6. When the tube is positioned depth-wise so that the rear end of the rocket engine is flush with the exterior face of former F6, glue the balsa tube in place. Remove the rocket engine and sand the tube end flush with the face of former F6.

Install the bottom fuselage sheeting aft of the wing saddle opening. Glue the 1/16" sheet cockpit floor in place and sand the fuselage to the indicated contour. Install the 1/8" plywood wing bolt mounting plate along with the 1/4" balsa triangular stock reinforcing gussets. Position the wing in the wing saddle and when properly aligned, drill the wing mounting bolt hole, using a No. 29 drill. Tap the hole to accept an 8-32 nylon bolt. Install the balsa block below the leading edge of wing center section and contour it into the fuselage.

Install the plastic launching guide bushing onto the bottom of the wing. To do this, I drilled a hole in a piece of 1/4" square balsa and inserted the tubing into it and then glued this to the wing. The tail skid/subfin, which also serves as a launching guide bushing, is now installed. The fin is made from two pieces of 1/8" balsa sheet that are channeled to accept another piece of plastic tubing.

A cut-down Sig plastic canopy was used on my CP-1, along with a lightweight pilot head bust.

Misc. Suggestions:

Mount your radio system components as far forward as possible, in order to offset the weight of the tail mounted rocket engine. Don't bother using a smaller airborne battery pack. Use a standard size 500-600 mAh square pack, positioned as far forward as possible, as you will need the additional weight in order to obtain the indicated balance point (C.G.). Try to keep the airframe weight aft of the C.G. to an absolute minimum.

After the 1/16" balsa turtledeck sheeting has been installed, remove as much of the blue polyurethane foam as possible.

The aircraft should be balanced with a new Estes E15-P rocket engine installed. As mentioned, Estes D11-P rocket engines were used for the initial test flights and these engines are 3/4" shorter and .7 of an ounce (20 grams) lighter than the E15-P engines. I made a "spacer insert" from a piece of hardwood dowel, that was weighted with lead, for use with the D11-P engines. This insert was simply placed into the rocket engine containment tube in front of the D11-P engine.

Launching Pad:

Mine was made using a piece of 3/4" particle board as a base. The main launching guide was a 36" long piece of 1/8" music wire and two 1/4" hardwood dowels were used for the wing panels to rest on. The music wire guide and hardwood dowels were mounted on a wood block that could be pivoted to produce a launch angle from vertical to as low as 30 degrees. After numerous flights with my CP-1, I believe that the launch pad can just be built with a fixed angle of about 75 to 80 degrees. For igniting the rocket engine, a 20 foot length of No. 18

RUSSIAN CP-1
Designed by:
Bob Wallace
TYPE AIRCRAFT
Rocket Powered Sport Scale
WINGSPAN
32-1/2 Inches
WING CHORD
5-3/8 Inches (Avg.)
TOTAL WING AREA
174 Sq. In.
WING LOCATION
Bottom of Fuselage
AIRFOIL
Semi-Symmetrical
WING PLANFORM
Double Taper
DIHEDRAL, EACH TIP
5/8 Inch
OVERALL FUSELAGE LENGTH
26 Inches
STABILIZER SPAN
10-1/2 Inches
STABILIZER CHORD (inc. elev.)
3-5/32 Inches (Avg.)
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
3-5/8 Inches
VERTICAL FIN WIDTH (inc. rud.)
3-1/4 Inches (Avg.)
REC. ENGINE SIZE
Estes D11-P (for first flights)
Estes E15-P
LANDING GEAR
None
REC. NO. OF CHANNELS
2
CONTROL FUNCTIONS
Ailerons and Elevator
C.G. (from L.E.)
1-7/8 Inches (measured at wing root)
ELEVATOR TRAVEL
5/16 Inches Up & Down
(measured at widest point)
AILERON TRAVEL
3/16 Inches (each direction)
BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa, Foam, & Ply
Wing ..... Balsa & Foam
Empennage ..... Balsa
Wt. Ready To Fly ..... 18 Oz.
Wing Loading ..... 14.9 Oz./Sq. Ft.

AWG fixture cord wire was used with mini alligator clips at the rocket engine end. A foot operated microswitch was used, with my flight box 2-volt glow plug battery being used to fire the igniter. If you are considering the use of your glow plug battery as an ignition source, keep in mind that the use of smaller gauge wire, such as that used for connecting remote stereo speakers, etc., may create enough resistance to hamper reliable ignition. I suggest that you test your igniting system with a spare Estes igniter, prior to your initial test flights.

Covering:

My CP-1 was finished with Carl Goldberg UltraCote covering material. Green was used on the upper surfaces, with gray being used on the undersides. Top Flite adhesive backed trim film sheets were used to produce the white outlined red Russian star insignias.

Radio System:

An Airtronics Infinity 600 radio system was used in my CP-1. While microsized 94501 servos were used, there is ample space within the fuselage for standard size servos. The use of standard size servos will naturally add an ounce or two of additional weight to the finished aircraft. A standard size receiver and battery pack were used, along with a W.S. Deans Co. mini-antenna in place of the standard length antenna. This compact unit, which is only 7-1/2" long, is mounted inside the fuselage and eliminates the unsightly wire antenna dangling outside the aircraft. I have never noticed any reduction in radio range with the use of these compact antenna units and I use them with all of my receivers.

Control surface travel limits used were: elevator 5/16" up and down (at widest portion), ailerons 3/16" each direction.

Flying:

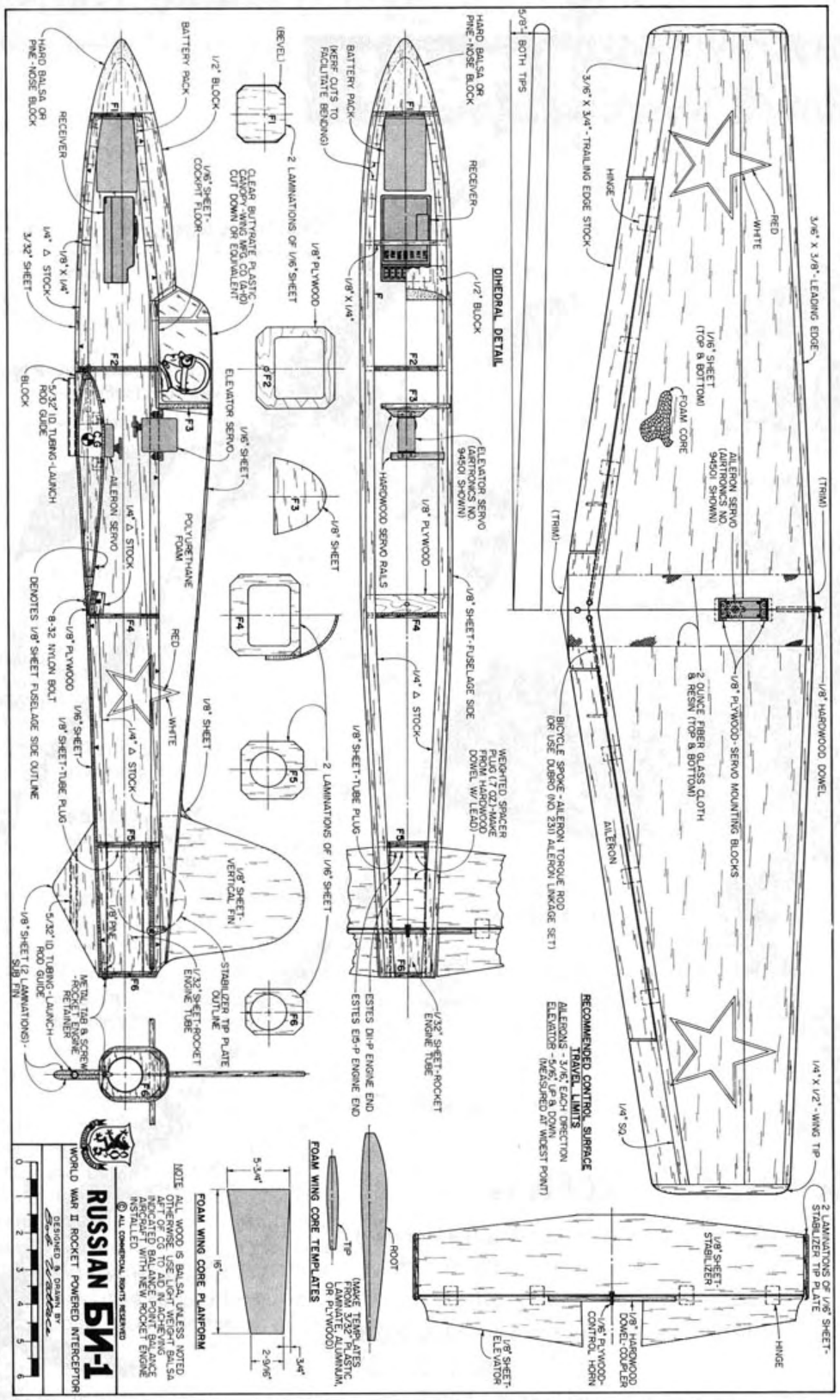
The initial test flights of my CP-1 were made on an ideal spring day. It was sunny with only a slight breeze and the temperature was in the high 60's.

A customary radio range check was performed and the CP-1 was positioned on the launch pad and the rocket engine connected to the ignition source. An Estes D11-P rocket engine was being used for the maiden flight.

Stepping on the igniter switch produced ignition and the CP-1 rapidly shot upwards with a "swooshing" sound. Virtually no elevator or aileron input was required during the brief powered portion of the flight. Once the rocket engine power was spent and the glide portion of the flight began, several clicks of "up" elevator were required in order to maintain thumbs-off level flight. The remainder of the maiden flight consisted of a wide circle around the flying field and an uneventful landing on the grass. Two additional flights were made using the lower power D11-P engines, and loops and rolls were performed during the glide portion of each flight.

It became apparent that the need for a few clicks of "up" elevator trim after the rocket engine had been expended, was due to the weight loss that occurred as the rocket propellant burned off. This weight loss was minimal with the D11-P engine as I was

PLAN NO. 1228



using the .7 ounce weighted insert with this engine, as opposed to the larger E15-P engine where the weight loss associated with the propellant burn-off would produce a weight loss of about 1.3 ounces.

The fourth test flight was to be made using the larger, more powerful E15-P rocket engine. However, this flight did not go according to plan!

Upon ignition, the Estes E15-P rocket engine blew apart on the launch pad, reducing the aft end of our CP-1 to a lot of very small pieces of balsa wood and film covering. Actually, it was rather impressive! There was a rather loud "whomp" accompanied by a large cloud of white smoke; the remains of the rocket engine were found about 15 feet away from the launch pad. I now wish that someone had been videotaping this attempted launch, as it would have been great material for one of those "crash and bash" commercial videotape offerings. Why the rocket engine blew up was to remain a mystery, and all of Estes user instructions were being followed.

As the first three test flights had gone so well, I decided to rebuild the aft portion of my CP-1 and try again.

A few days later, the next test flight using an E15-P rocket engine was attempted and it went flawlessly. The additional power of the E15-P rocket engine, as opposed to the smaller D11-P engine, was quickly apparent, as the CP-1 rocketed to a much greater height. Since then, I have been using only the larger, more powerful E15-P engines and each one has performed consistently well. I

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(Act of August 12, 1970; Section 3685, Title 39, United States Code)

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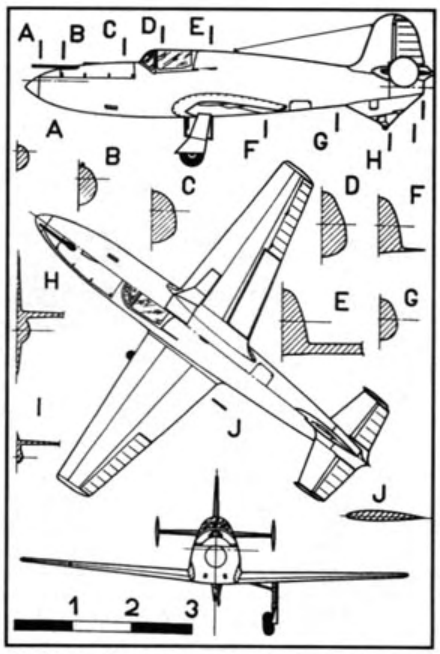


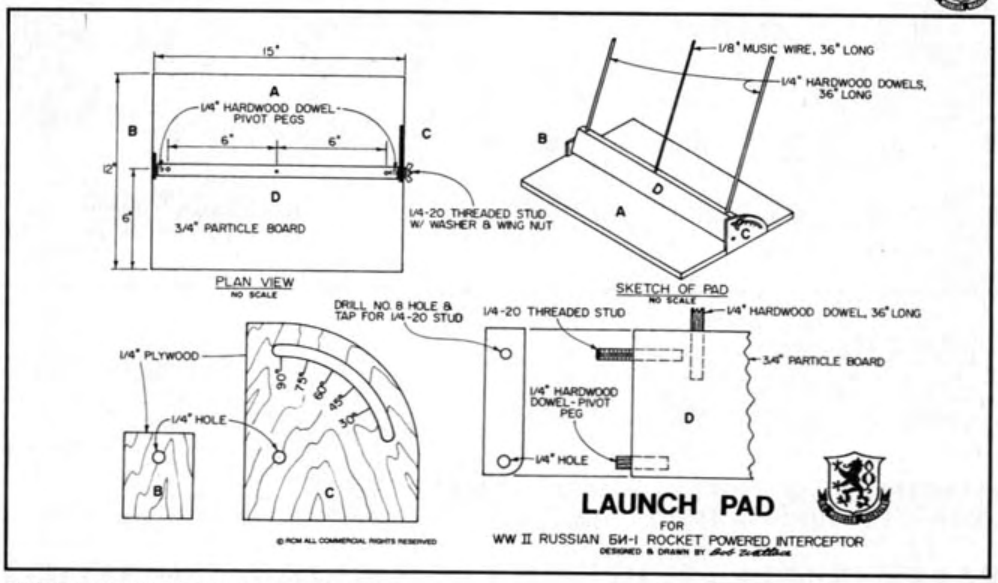
SUPPLEMENT PLAN: Scale 3-view

have now made about 20 flights with my CP-1. The weight loss factor associated with the rocket engine propellant being used up, and thereby necessitating an elevator trim correction, is a minor inconvenience.

While the radio could be programmed to compensate for this, I find it just as easy to hold a bit of "down" elevator during the powered portion of the flight, than to flip a switch after the rocket engine has been expended.

As mentioned, the CP-1 is a unique, change of pace type of aircraft, that is easy to build and fly, and it will certainly attract the attention of all those present as it rockets off the launching pad.

For those modelers interested in additional scale documentation and data on the rare and unique Russian CP-1, eight pages of 3-view drawings, cockpit details, and written information (in Russian) are available from: Wallace R/C, 91 Sylvan St., Avon, CT 06001, for $3.00, postage paid.



SUPPLEMENT PLAN: Launch pad.