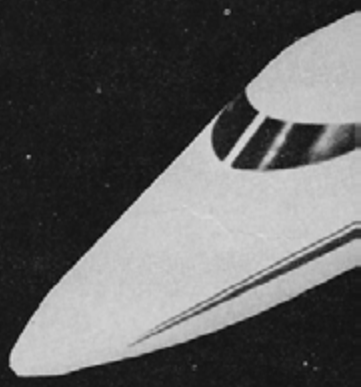
"The Lear Liner uses about 100 yards for take off with flaps at 15%, then lifts up smoothly. The flying characteristics of the model are superb with excellent low speed characteristics."



BY B. HUBER, TELAVES

LEAR LINER 40

PHOTO BY LEAR JET INDUSTRIES, INC.

The Lear Jet Corporation, manufacturers of the famous Lear Jet, announced their model 40 as a commercial and small passenger-jet in October 1965. Unfortunately, this design never evolved past the drawing board and mock-up stages. The aircraft was intended to be used by 16 passengers in the commercial version and by 40 persons in the airliner-version, a relatively small aircraft compared to the newest "Jumbo-Jets" with over 500 passengers.

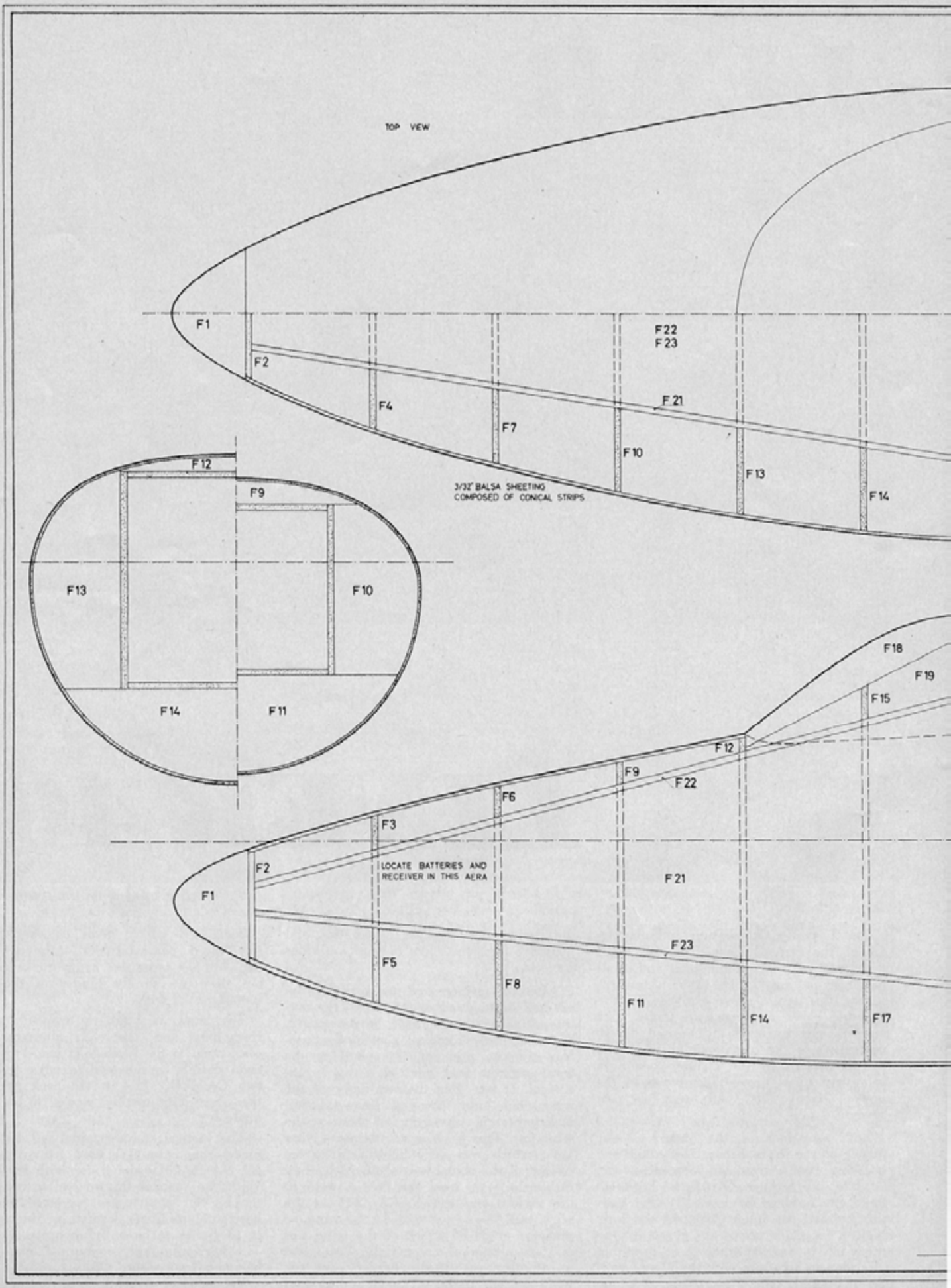
Let's now look on the history of our model of the Lear Liner. Designing and building was started on September 30, 1967 by my brother, Gerd, who began to build the fuselage by himself. After having finished the inner "box" of the fuselage, a length of about 10', there was no room left in our workshop to do anything else than to help him with the Lear Liner! So, my father and I started to work on the project out of sheer desperation and necessity for some room to work on other projects.

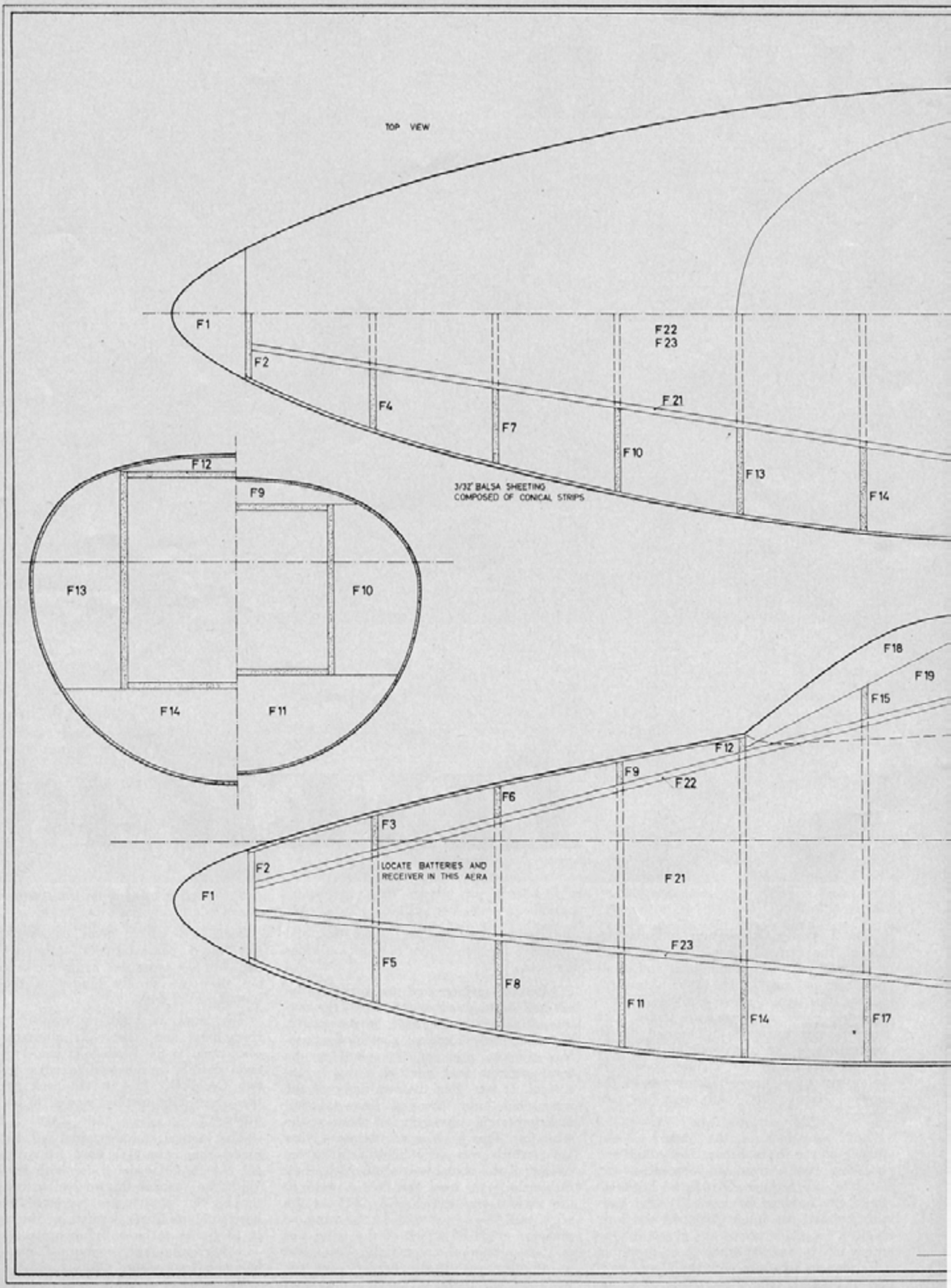
After the formers and the spruce-stringers had been glued to the "box" the outline of the fuselage could be recognized. Planking the cylindrical part of the fuselage was no problem, but planking the front and the back part of it was rather critical. It was then that we designed the wing. The only variation from the full scale prototype was a larger chord at the wing-tips. This gave us a little more wing area, which was very helpful, since the weight of the model was about 25 pounds. For airfoils we used the NACA 4415 in the middle and the NACA 2415 at the wing tips. We also "twisted" the wing, so that the angle of attack of the wing tips is 1° less than in the middle. This gives us an elliptical lift-distribution over the wing at high angles of attack and at high c_L-coefficient which gives us very good low speed characteristics. Ailerons and flaps are the same size as on the original, but they are simply hinged at the top surface of the wing.

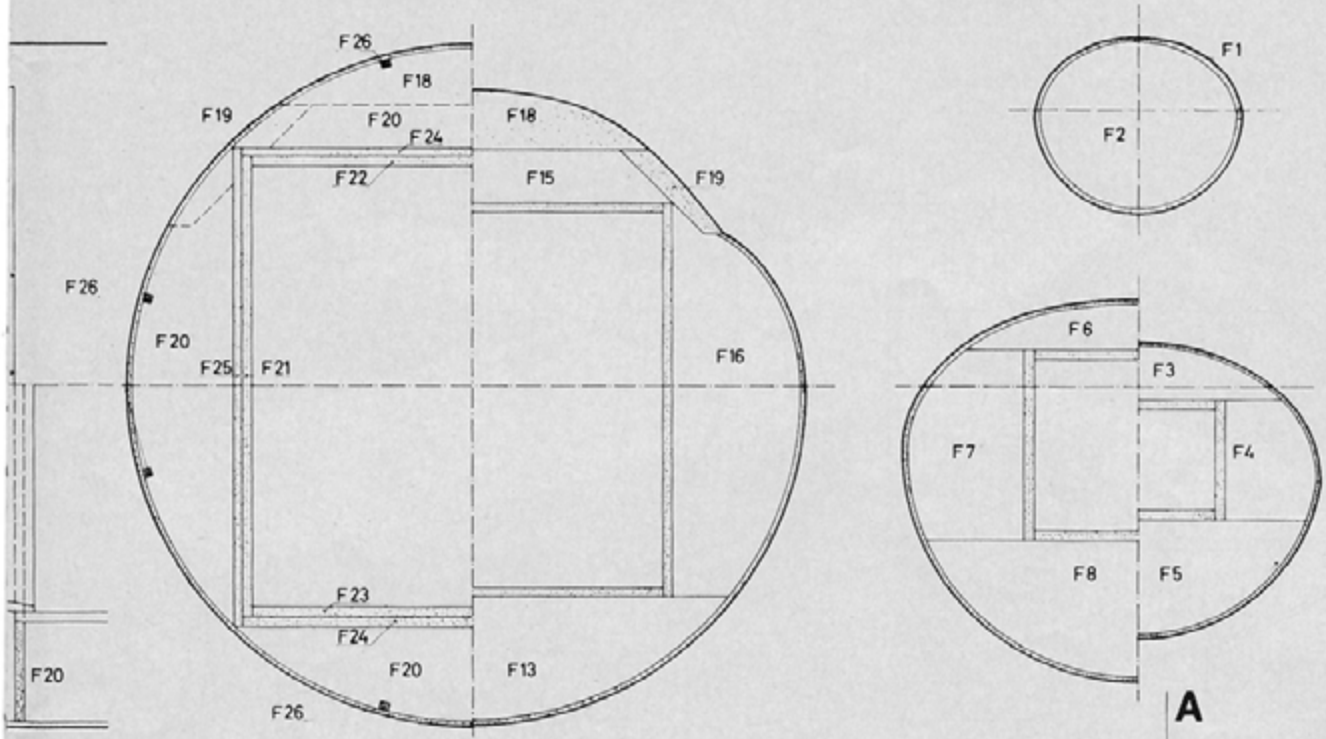
The wing is built up conventionally from balsa and completely planked. The connection to the fuselage is made by two rigid dowels in the leading edge and by two CAMLOC 12's in the back part of the wing. This method proved to be adequate.

The vertical and horizontal tail are also made from balsa. We used the symmetrical NACA 0015 airfoil for both surfaces. With the vertical fin we had to consider the big forces that are produced by the horizontal stabilizer located on the top of it, so it has to be built up quite rigidly. The horizontal tail is mounted by means of two nylon screws.

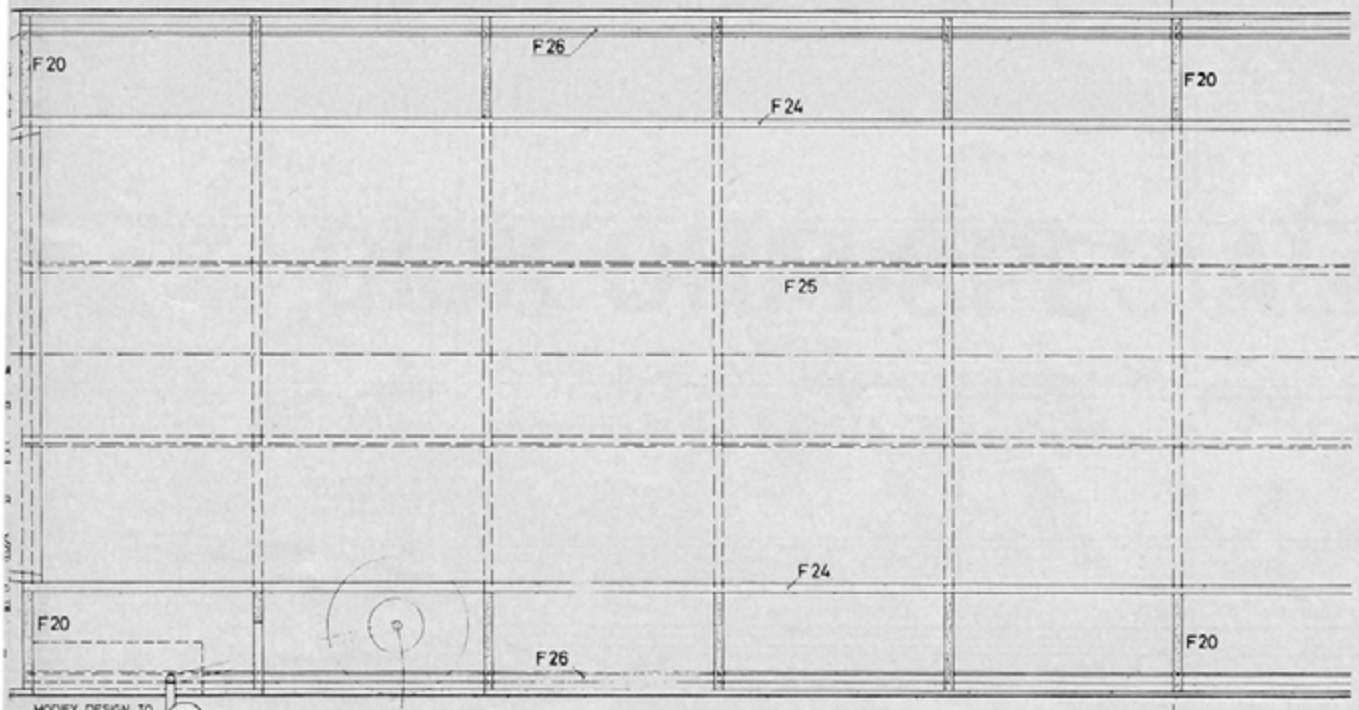
Yet another problem was the engine-


TOP VIEW
F1
F2
F4
F7
F10
F13
F14
F22
F23
F21
3/32" BALSA SHEETING
COMPOSED OF CONICAL STRIPS
F12
F9
F13
F10
F14
F11
F18
F19
F15
F12
F9
F22
F6
F3
F2
F1
LOCATE BATTERIES AND
RECEIVER IN THIS AERA
F21
F23
F5
F8
F11
F14
F17

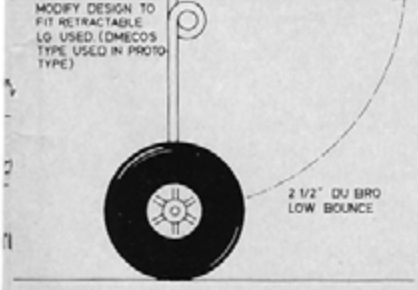

TOP VIEW
F1
F2
F4
F7
F10
F13
F14
F22
F23
F21
3/32" BALSA SHEETING
COMPOSED OF CONICAL STRIPS
F12
F9
F13
F10
F14
F11
F18
F19
F15
F12
F9
F22
F6
F3
F2
F1
LOCATE BATTERIES AND
RECEIVER IN THIS AERA
F21
F23
F5
F8
F11
F14
F17



A



A



R/C MODELER MAG.

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	Lear Liner		
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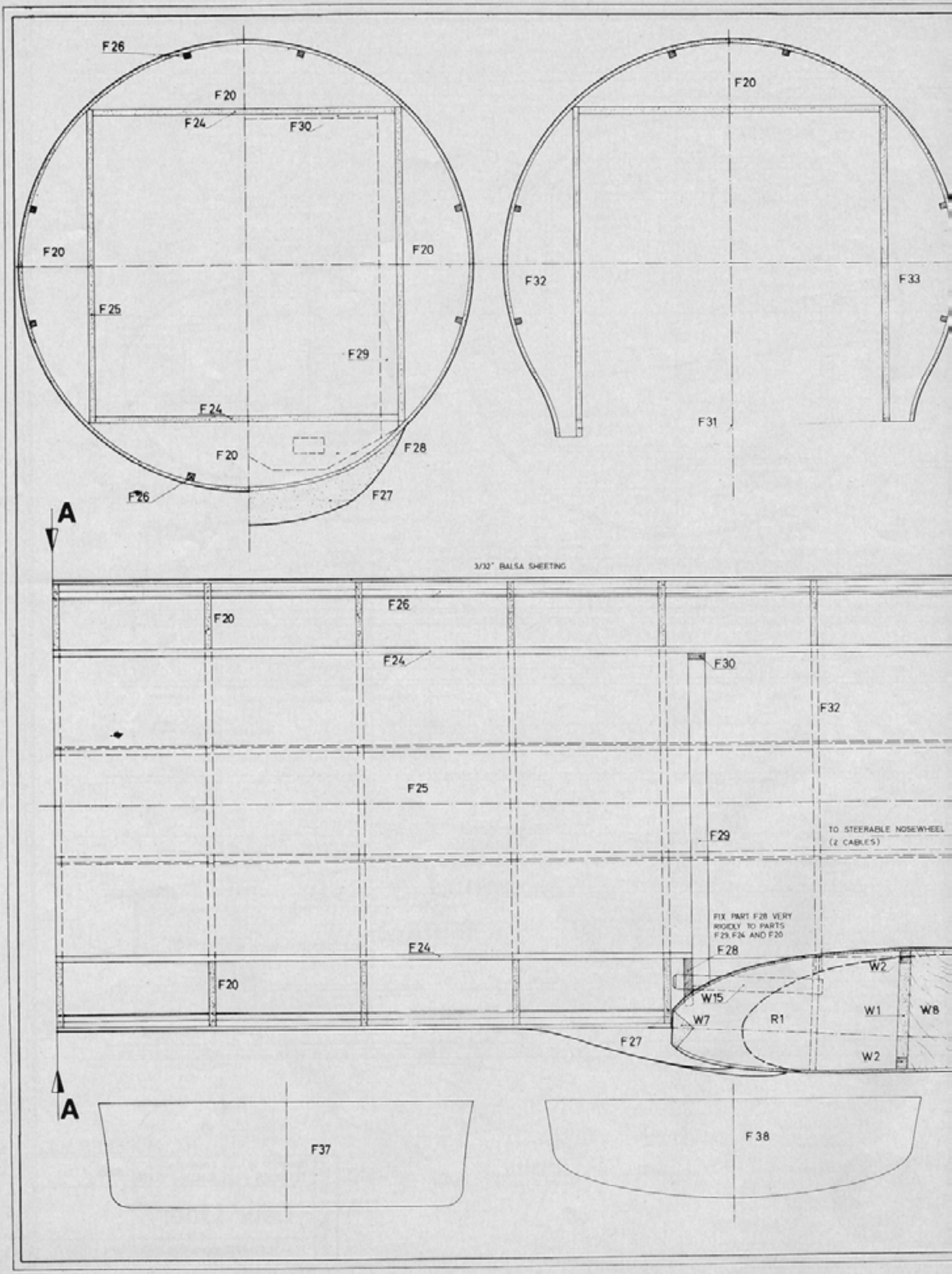
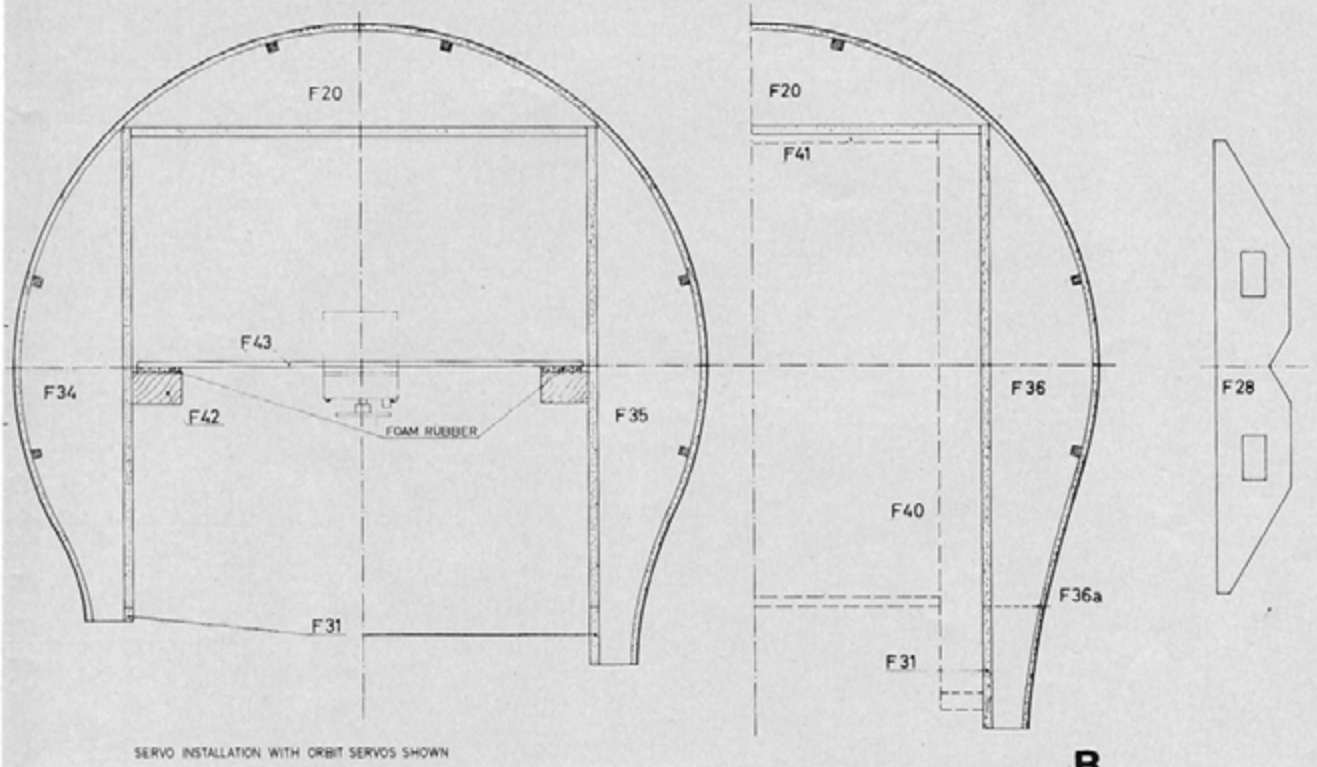
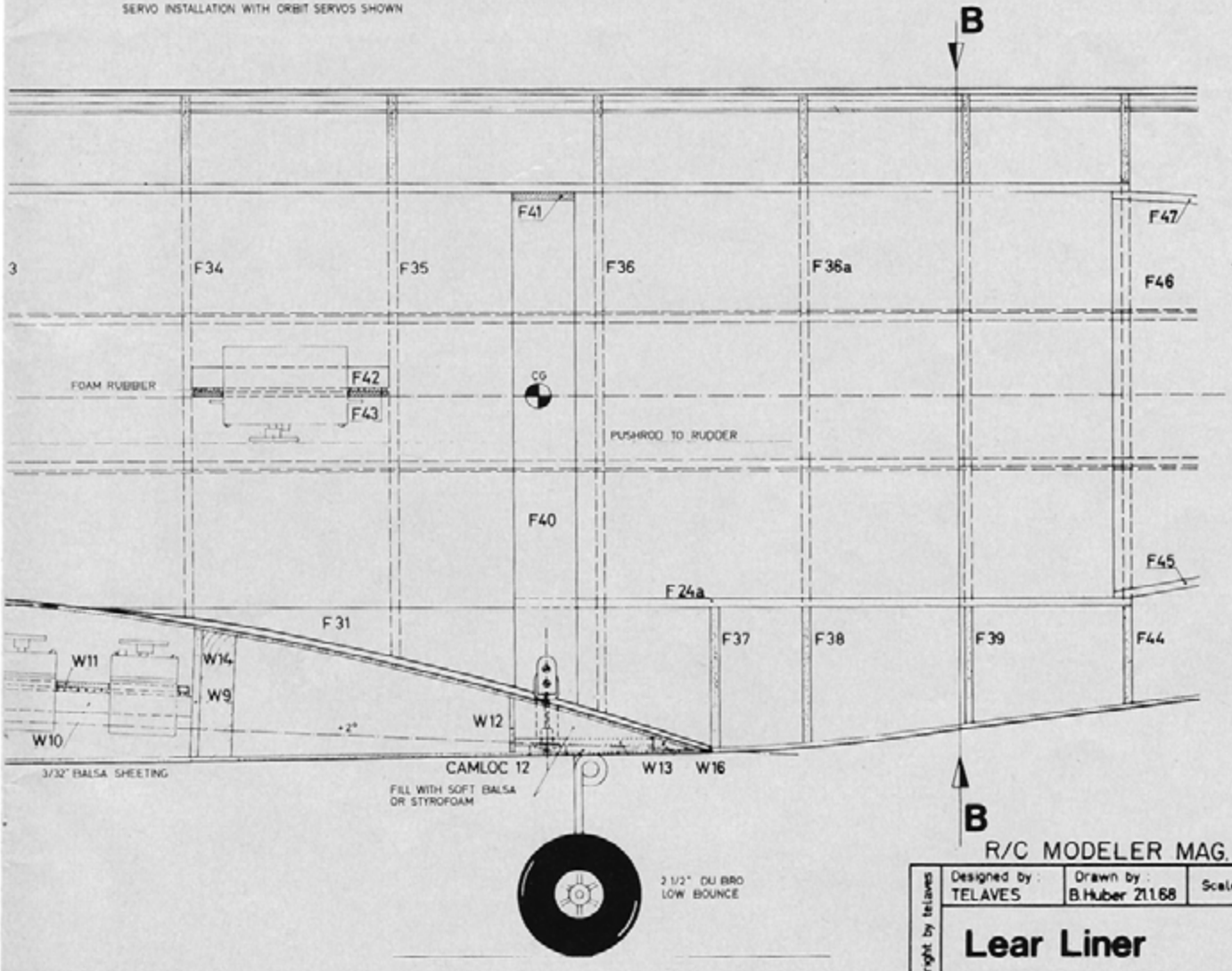

F26
F20
F24
F30
F20
F20
F25
F29
F24
F20
F28
F26
F27
F20
F32
F33
F31
A
3/32" BALSA SHEETING
F20
F26
F24
F30
F32
F25
F29
TO STEERABLE NOSEWHEEL
(2 CABLES)
FIX PART F28 VERY
RIGIDLY TO PARTS
F29, F24 AND F20
F24
F28
F20
W2
W15
W1
W8
W7
R1
F27
W2
A
F37
F38



SERVO INSTALLATION WITH ORBIT SERVOS SHOWN



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	Lear Liner		
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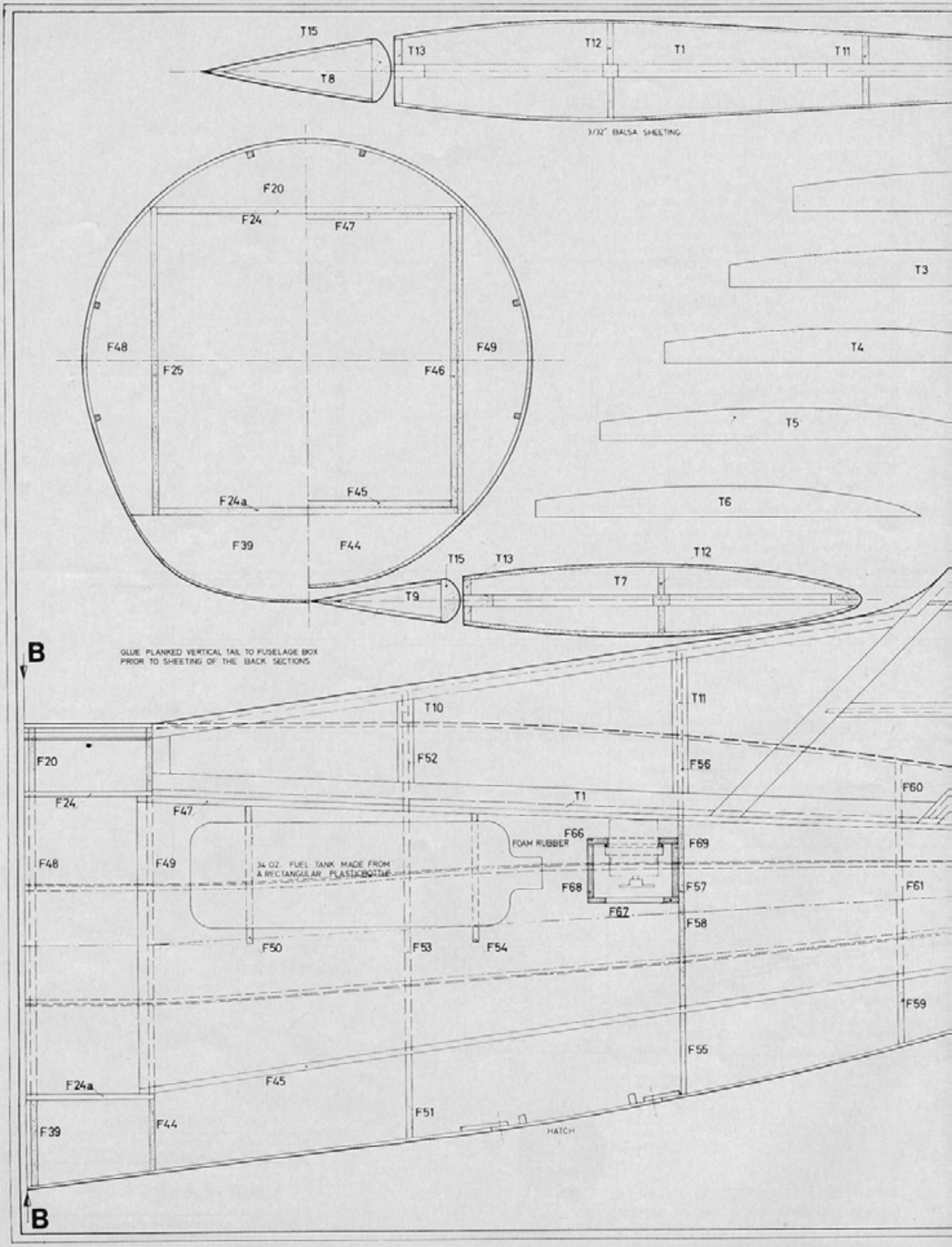
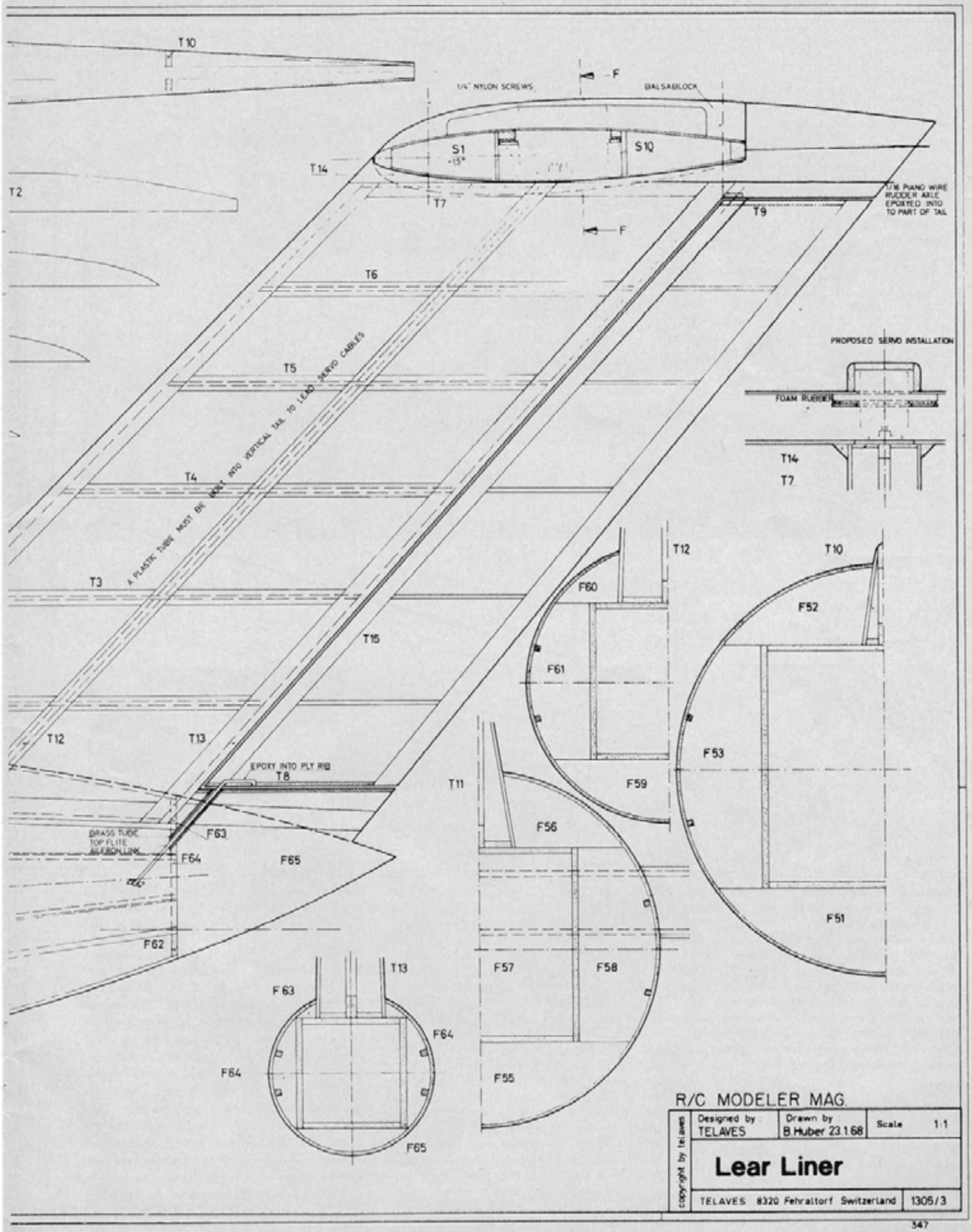

T15
T13
T12
T1
T11
T8
3/32" BALSA SHEETING
F20
F24
F47
T3
F48
F49
T4
F25
F46
T5
F24a
F45
T6
F39
F44
T15
T13
T12
T7
T9
B
GLUE PLANKED VERTICAL TAIL TO FUSELAGE BOX
PRIOR TO SHEETING OF THE BACK SECTIONS
T10
T11
F20
F52
F56
F60
F24
T1
F47
F66
FOAM RUBBER
F69
F48
F49
34 OZ. FUEL TANK MADE FROM
A RECTANGULAR PLASTIC BOTTLE
F68
F57
F61
F67
F58
F50
F53
F54
F59
F55
F24a
F45
F51
F39
F44
HATCH
B


T10
1/4" NYLON SCREWS
F
BALSABLOCK
S1
-15°
S10
T14
T2
T7
T9
1/16 PIANO WIRE RUDDER AXLE EPOXYED INTO TO PART OF TAIL
F
T6
PROPOSED SERVO INSTALLATION
FOAM RUBBER
T5
A PLASTIC TUBE MUST BE GLUE INTO VERTICAL TAIL TO LEAD SERVO CABLES
T14
T7
T4
T12
T10
F60
F52
T3
T15
F61
T12
T13
F53
EPOXY INTO PLY RIB
T8
T11
F59
BRASS TUBE TOP FLITE AILERON LINK
F63
F56
F64
F65
F51
F62
T13
F57
F58
F63
F64
F64
F55
F65
R/C MODELER MAG.
Designed by: TELAVES
Drawn by: B.Huber 23.1.68
Scale 1:1
Lear Liner
TELAVES 8320 Fehraltorf Switzerland
1305/3
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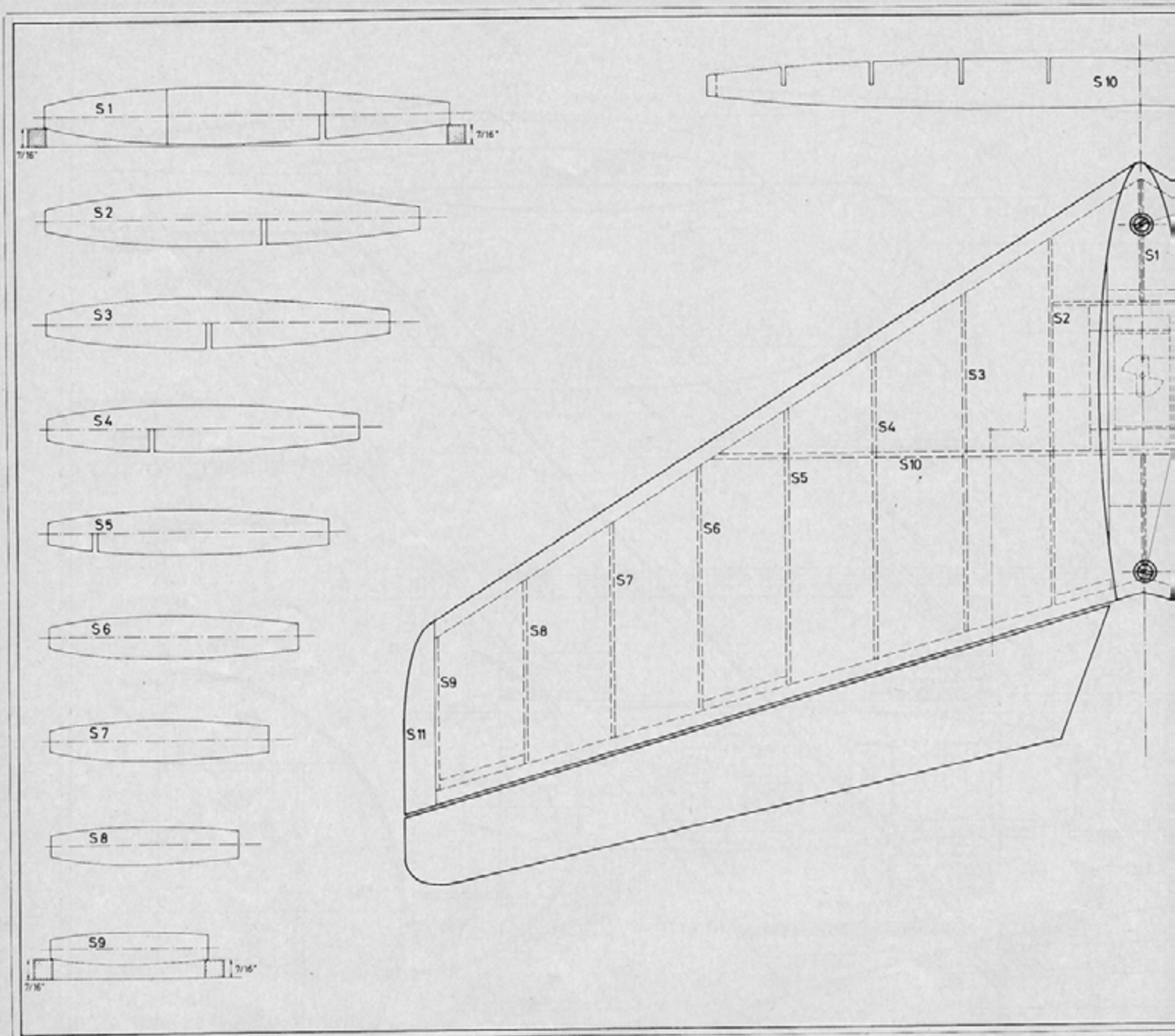


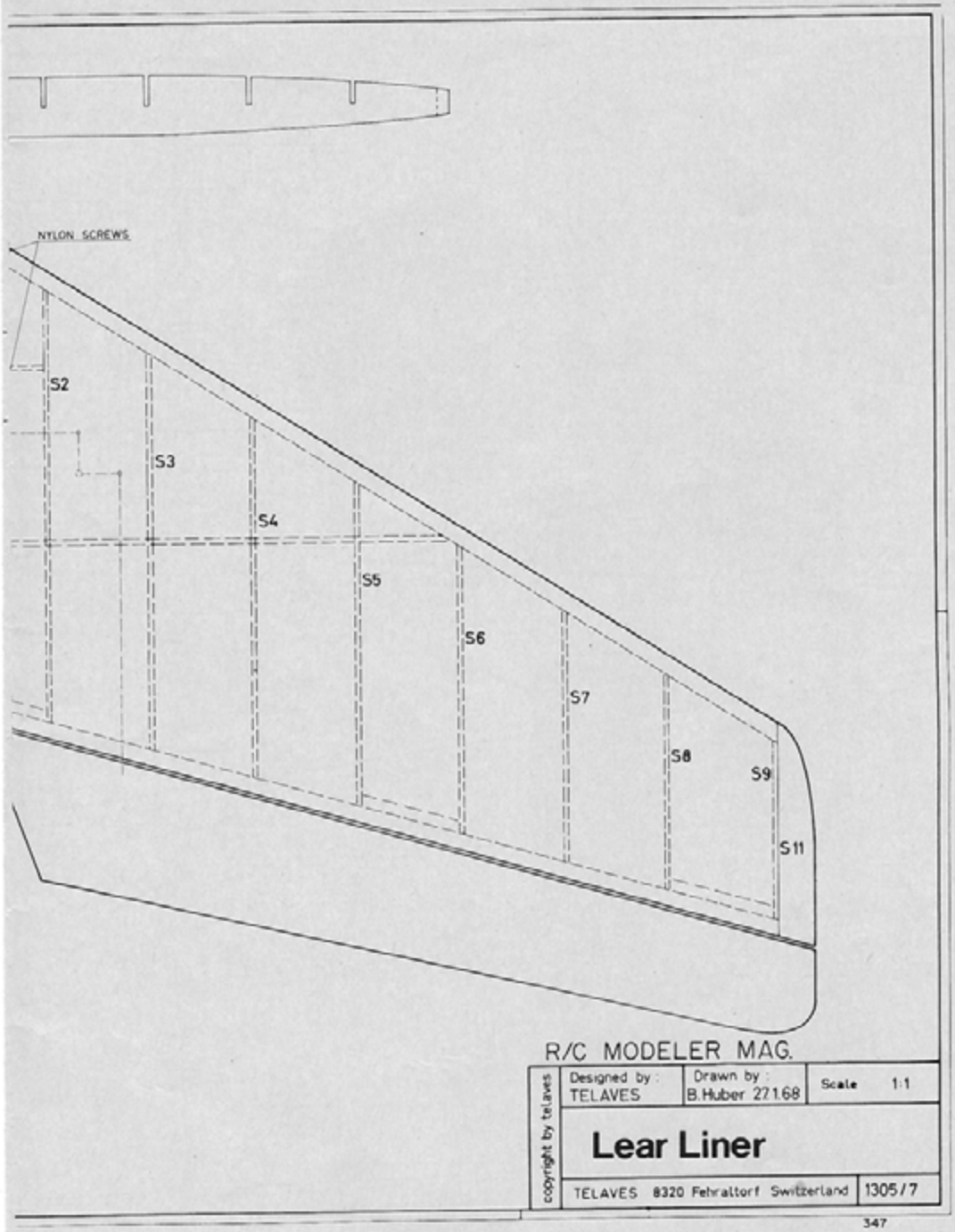
mounting. A box made from 5/32" ply is the engine-base and serves also for fixing the jet-engine-pod. It took us about the same time to build the fuselage as to build the two jet-pods, since they had to be planked outside as well as inside. This was necessary in order to lead the inner airflow to the engine to help in cooling. We used a Dmeco retractable landing gear and 2½" DuBro flat low bounce wheels, since only these were able to support the machine without "flatting out."

POWER

The main problem confronting us in building the Lear Liner was that of power. We intended to use the engines in a pusher configuration, since it was very neat, and because it was the only possibility of using a 12" diameter prop. But then we had no 12 x 6 pusher available, so we remembered that it is possible to run an engine clockwise. With the Enya 60 TV II you are able to turn the front part of the crankcase 90° counter-clockwise, which results in the engine turning clockwise as well as it did before counter-clockwise. This makes it possible to use standard propellers, such as a conventional 12 x 6". The static thrust of both engines was about 11 pounds, which results in a true airspeed of about 75 miles/hour. The engines were both equipped with especially designed Ko-Mufflers, since it is illegal, here in Switzerland, to fly a model without a muffler. The engines use a little side thrust to the middle, so that little differences in thrust have no effect. If one engine fails, this side thrust helps to trim the model with the rudder. With only one engine operating it is possible to fly, but is not possible to start.

RC

We used the Swiss "Digifly 5" proportional RC gear for test flights, operating elevator, rudder, ailerons, throttle and flaps. The retractable landing gear was inoperative for the first test flights. Because the "Digifly" RC uses the mechanical part of Orbit servos, there was enough thrust to operate the large control surfaces. The installation of the RC equipment is a bit unconventional. The servos are mounted where they have to produce their movement, permitting us to omit overly long control links. The elevator-servo is mounted directly into the horizontal tail, while the throttle servo is mounted on the box engine mount. This servo mounting, and the fact that the receiver and the batteries had to be mounted as far to the front of the fuselage as possible because of CG-problems, resulted in 120 foot cables that had to be installed in order to connect the servos with the receiver!



FINISH

After planking the model it was covered with silkspan and then sprayed with white dope. Then the red stripes, the red around the white cross, and the silver on the engine lining was brushed on. The windows are black "MonoKote". Then we covered the Lear Liner with a clear two component epoxy lacquer.

THEORETICAL WORKS ON THE LEAR LINER

Parallel with the construction of the model we had also some theoretical engineering data on the Lear Liner. Because we had a big effort in material as well as in man hours, we wanted to execute the first flights with as small a risk as possible. So, we calculated the exact position of the CG, and flight tests proved that the calculated position was absolutely correct.

FAA — LICENSE

Because the model weighs over 10 lb., and since we used engines with over 60 cu. in., it was necessary to get a license from the Swiss Federal Air Administration, and it was further obligatory to have a separate assurance for the Lear Liner, which was a rather expensive thing. Everything was O.K., and we obtained permission to fly the Lear Liner on a private airfield at Lachen on the border of Lake Zurich.

TEST FLIGHTS

The most exciting aspect of model building are the test flights of a new design. Ours took place on Saturday, November 25, 1967. The transportation of the Lear Liner was another problem, but we finally found out that it was possible to load the whole thing into a VW bus, if the two back seats were thrown out, and the man beside the driver was ready to have the nose of the fuselage on his right shoulder!

We had marginal flight conditions on that day, since the temperature was at the freezing point, and the fog so heavy that we had no visibility above 150 feet. The only good thing on that morning was, that there was practically no wind. The airfield presented its problems, since the landing strip runs about 250 yards parallel to the edge of the lake. Furthermore, there is a little bay, so that you have to turn over the free water when you want to land, the landing strip beginning about 25 yards from the edge! But because we trusted our design and our test pilot, (my brother Gerd) we had no ship ready to rescue a damaged model! And I think there was nobody who wanted to swim out to rescue even the Lear Liner!

So we decided to go ahead and try taxiing the model with engines throttled. But Gerd gave full power successively, and after about 180 yards, the Lear Liner lifted up smoothly and climbed to an angle of about 10°. The flying characteristics of the model were superb, and the Lear Liner proved to have excellent low speed characteristics. With the flaps at 15° the model uses about 100 yards for the start, and with the flaps at 45°, the landing is absolutely no problem and really quite slow. The flight is very smooth, with the reactions of the Lear Liner slower than that of an ordinary RC model, due to its size and weight.

So we had two flights of about 7 minutes duration on that morning, then we went home due to the cold and the lack of visible altitude. Since that time, many successful flights have been completed.

SOME REMARKS

First we would like to thank all of the fellows that helped to build the Lear Liner. Then we wanted to make it possible for anybody to build this model. By publishing it in R/C Limited, we hope you, too, will be able to enjoy the pride, satisfaction, and thrills it brings.

CONSTRUCTION

The Lear Liner is a model that should only be built and flown by experienced model builders. That is the reason why detailed building instructions are not being presented. The numbering on the plans enables you to find the pieces in the different sections and views. The materials used are: (1) Balsa - dotted; (2) Plywood - hatched; and (3) Poplar or Limba wood (wavy hatched). Do not hesitate to modify the design, if you have better ideas, because the plans are based on the prototype, and we would not build everything in the same manner for a second aircraft.

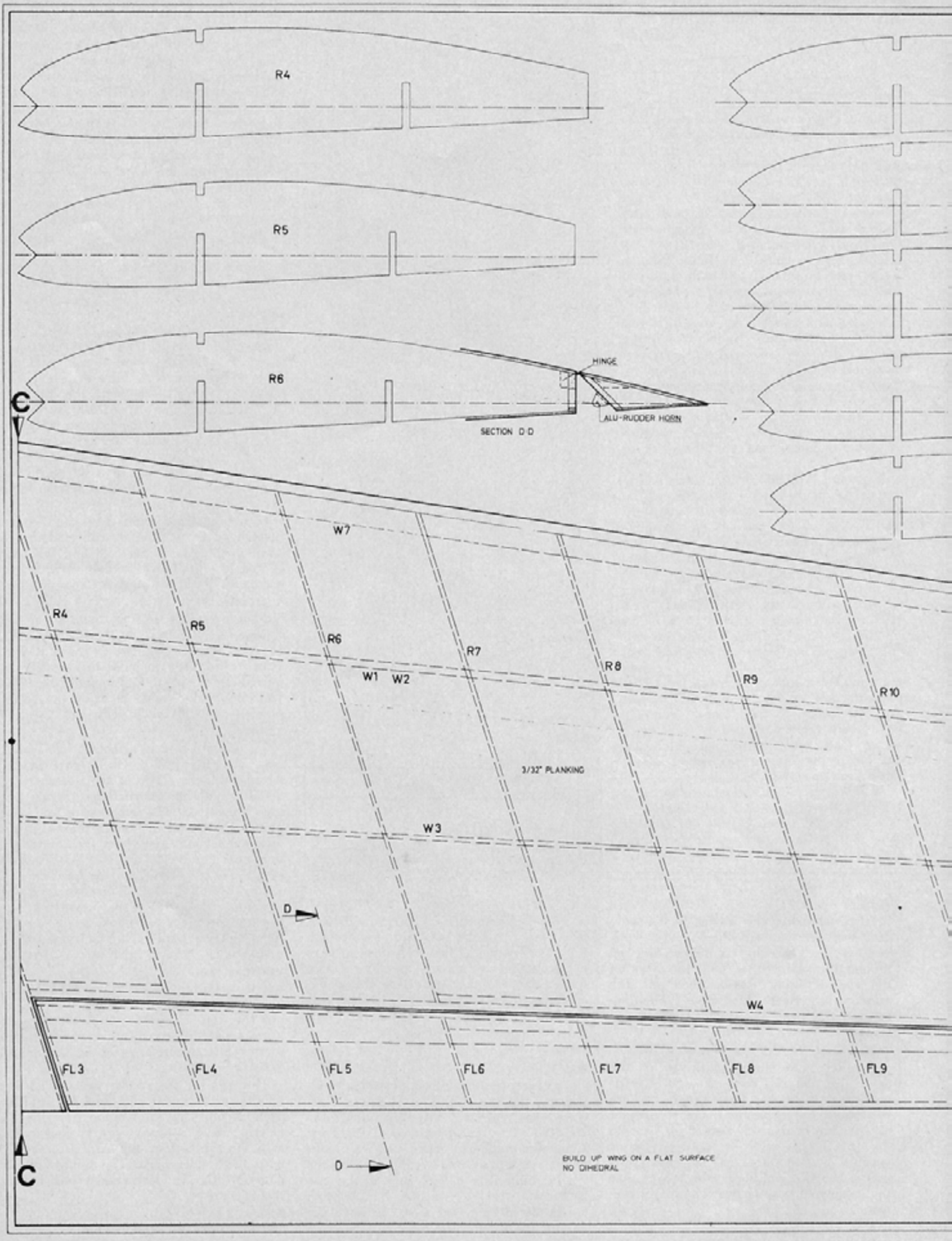
VERTICAL FIN

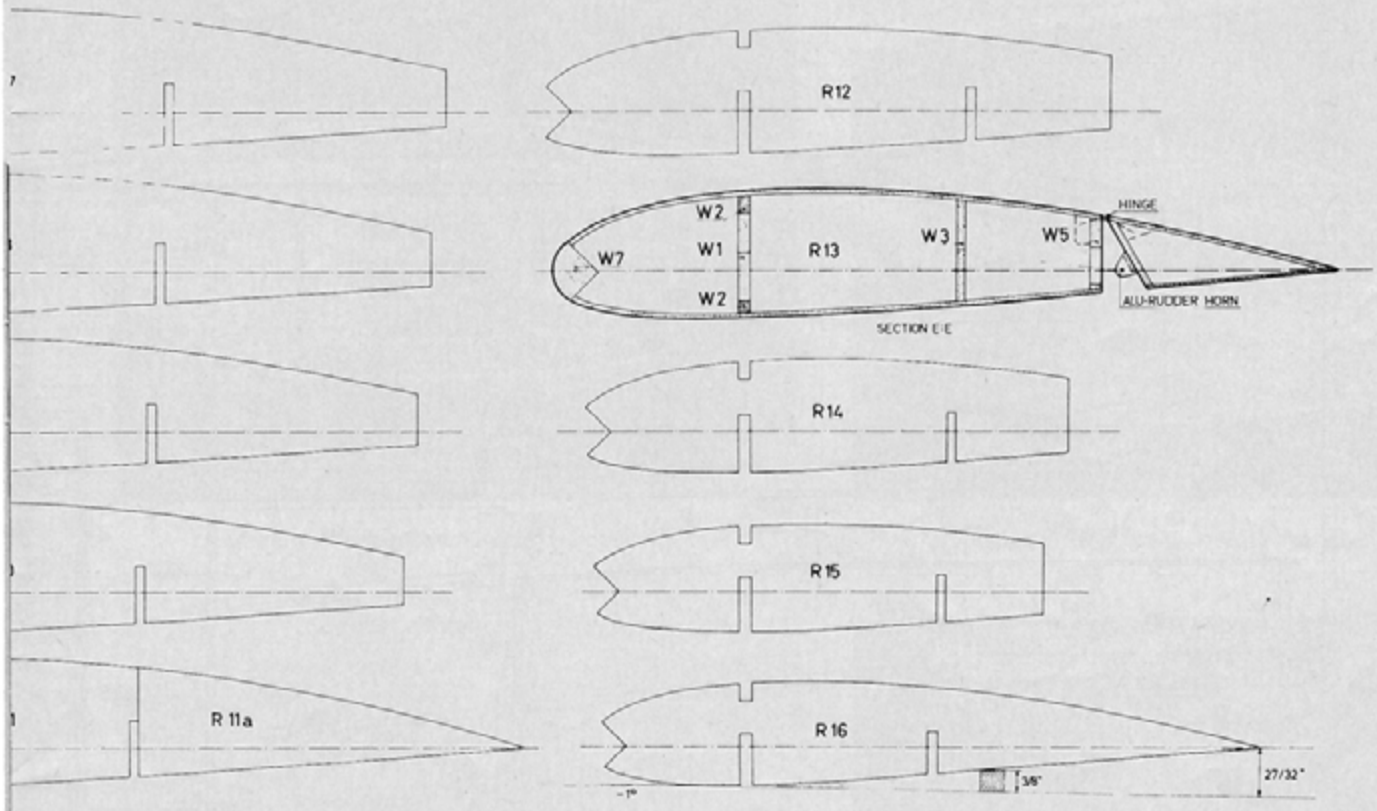
The vertical fin is built up first by gluing the central construction and mounting the half ribs to it. A plastic tube is glued in at this time to lead the elevator servo cables. Afterwards the fin is planked with 3/32" balsa.

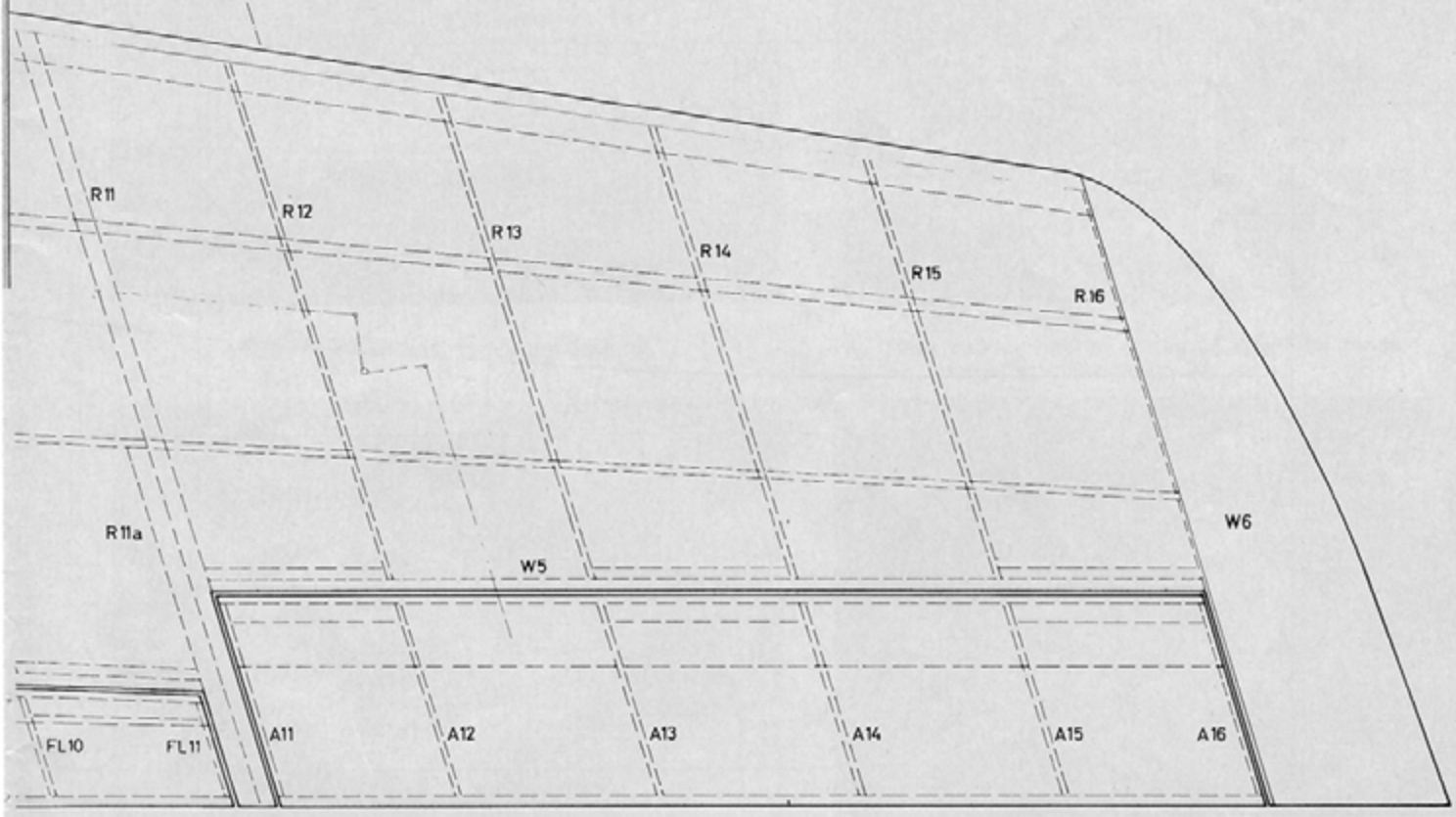
The ribs for the rudder are sanded between the two end ribs, and the rudder itself is built up conventionally. On top of the rudder a piano wire is used as an axle. On the bottom, the axle is combined with the rudder horn. The vertical fin is glued to the inside fuselage box before this is planked.

FUSELAGE

The fuselage construction is started with the inside box, made from 5/32" balsa.


R4
R5
R6
HINGE
ALU-RUDDER HORN
SECTION D D
C
C
W7
R4
R5
R6
R7
R8
R9
R10
W1
W2
3/32" PLANKING
W3
D
W4
FL3
FL4
FL5
FL6
FL7
FL8
FL9
D
BUILD UP WING ON A FLAT SURFACE
NO DIHEDRAL





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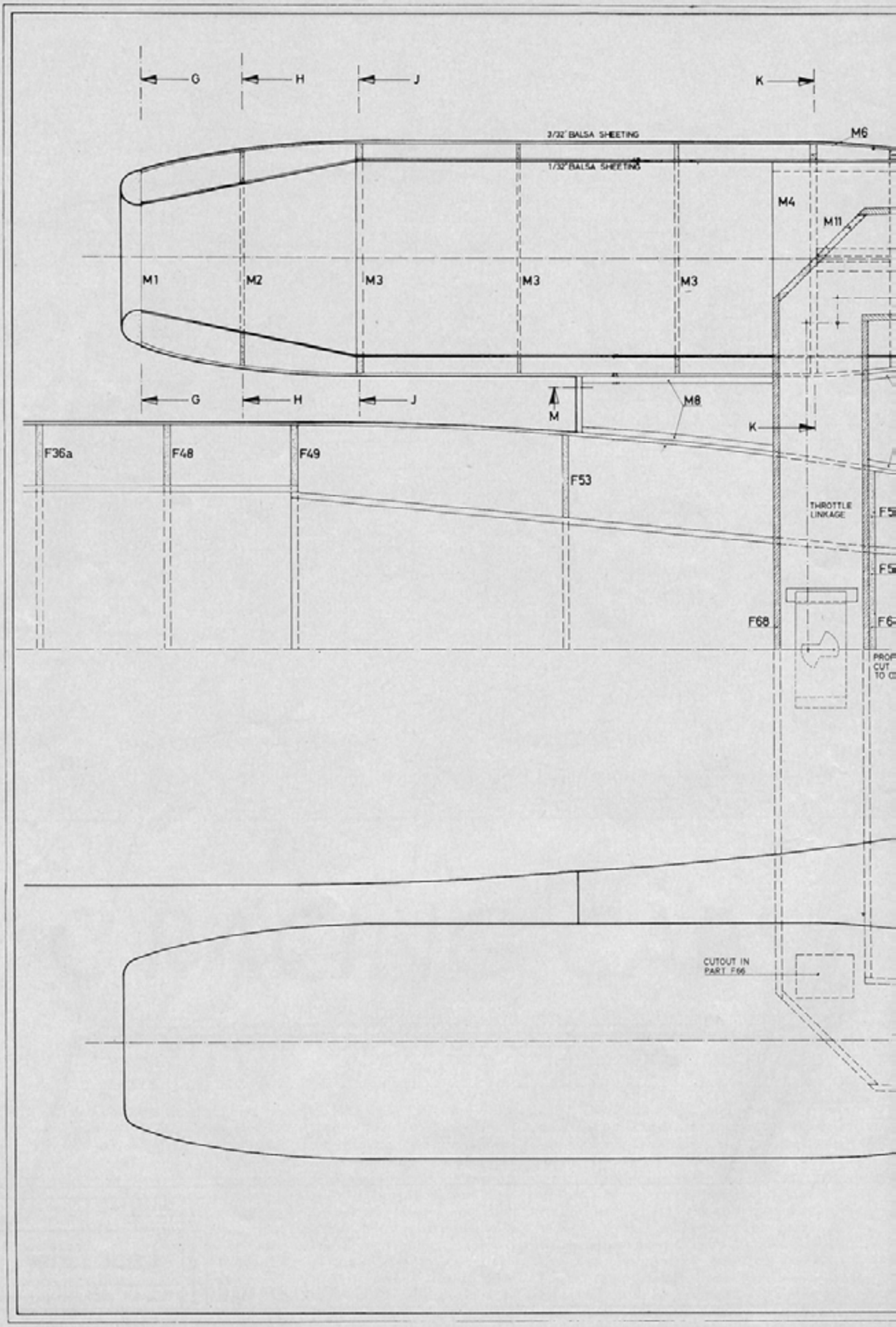
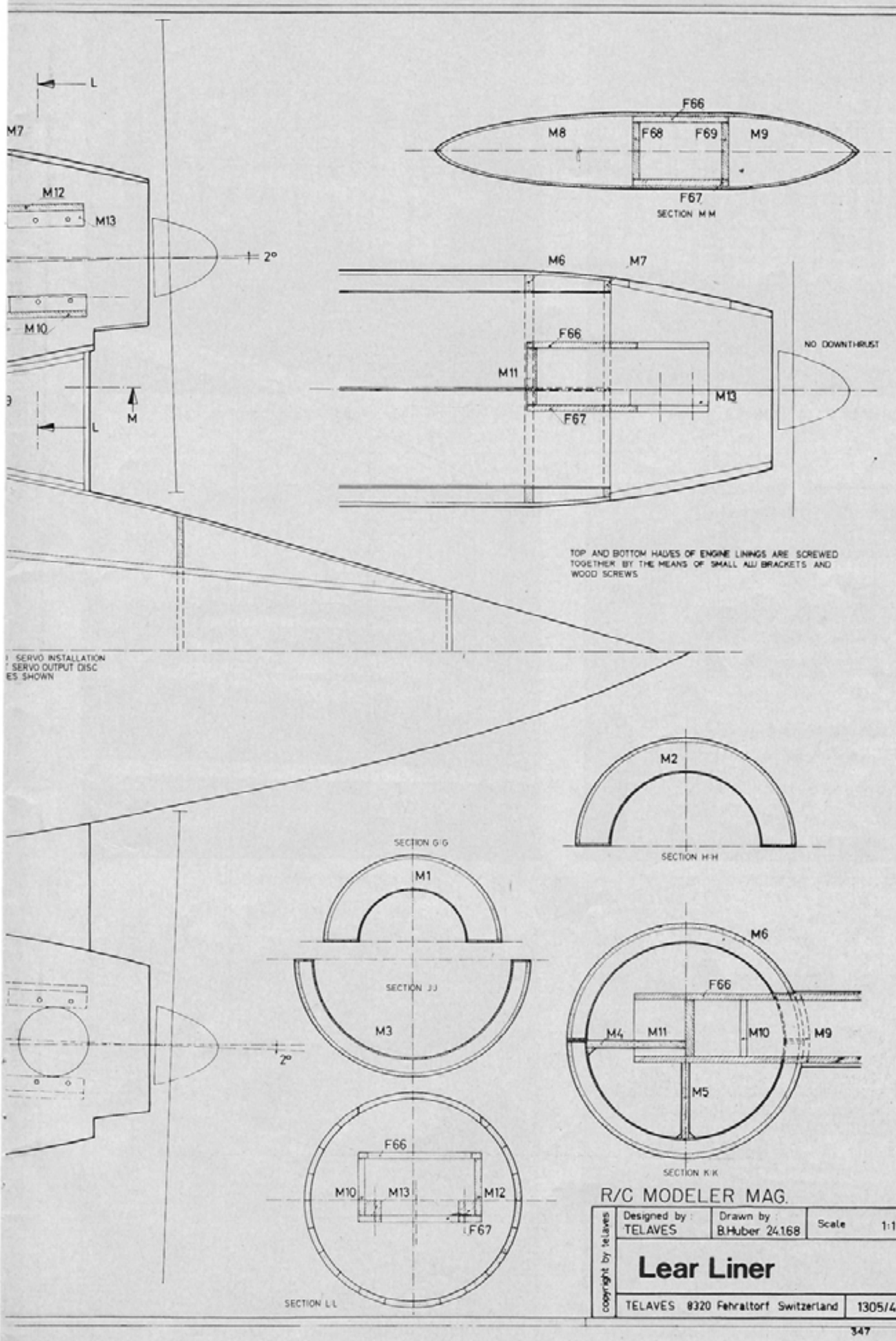
	Lear Liner		
	TELAVES 8320 Fehraltorf Switzerland		1305/6

R/C MODELER MAG.

347


G
H
J
K
3/32" BALSA SHEETING
1/32" BALSA SHEETING
M6
M4
M11
M1
M2
M3
M3
M3
M
M8
F36a
F48
F49
F53
THROTTLE LINKAGE
F68
CUTOUT IN PART F66


L
M7
M12
M13
2°
M10
M
L
F66
M8
F68
F69
M9
F67
SECTION M-M
M6
M7
F66
M11
M13
F67
NO DOWNTHRUST
TOP AND BOTTOM HALVES OF ENGINE LININGS ARE SCREWED TOGETHER BY THE MEANS OF SMALL ALU BRACKETS AND WOOD SCREWS
SERVO INSTALLATION
SERVO OUTPUT DISC
ES SHOWN
M2
SECTION H-H
SECTION G-G
M1
SECTION J-J
M3
2°
M6
F66
M4
M11
M10
M9
M5
SECTION K-K
F66
M10
M13
M12
F67
SECTION L-L
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Lear Liner
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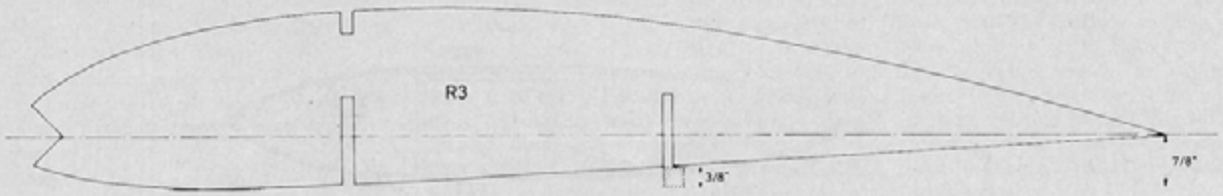
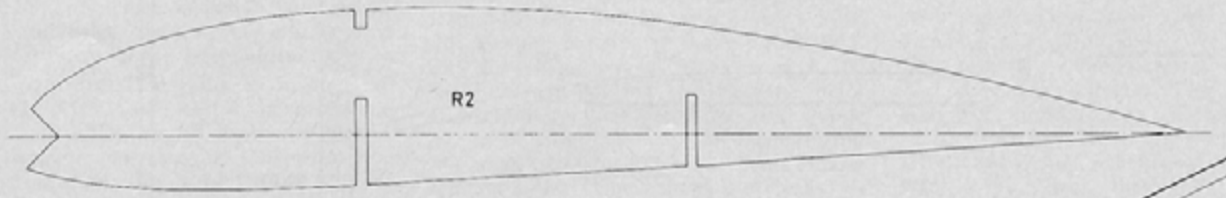
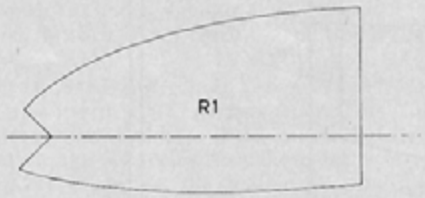
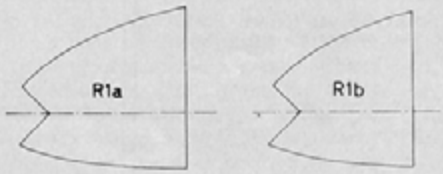
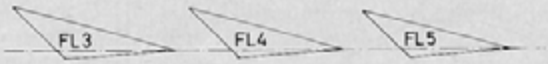
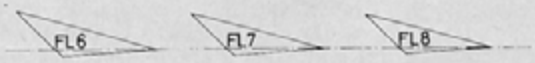

R3
3/8"
7/8"


R2

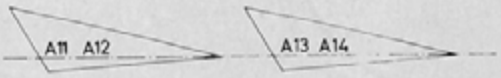

R1

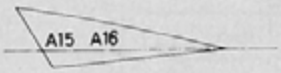

R1a
R1b

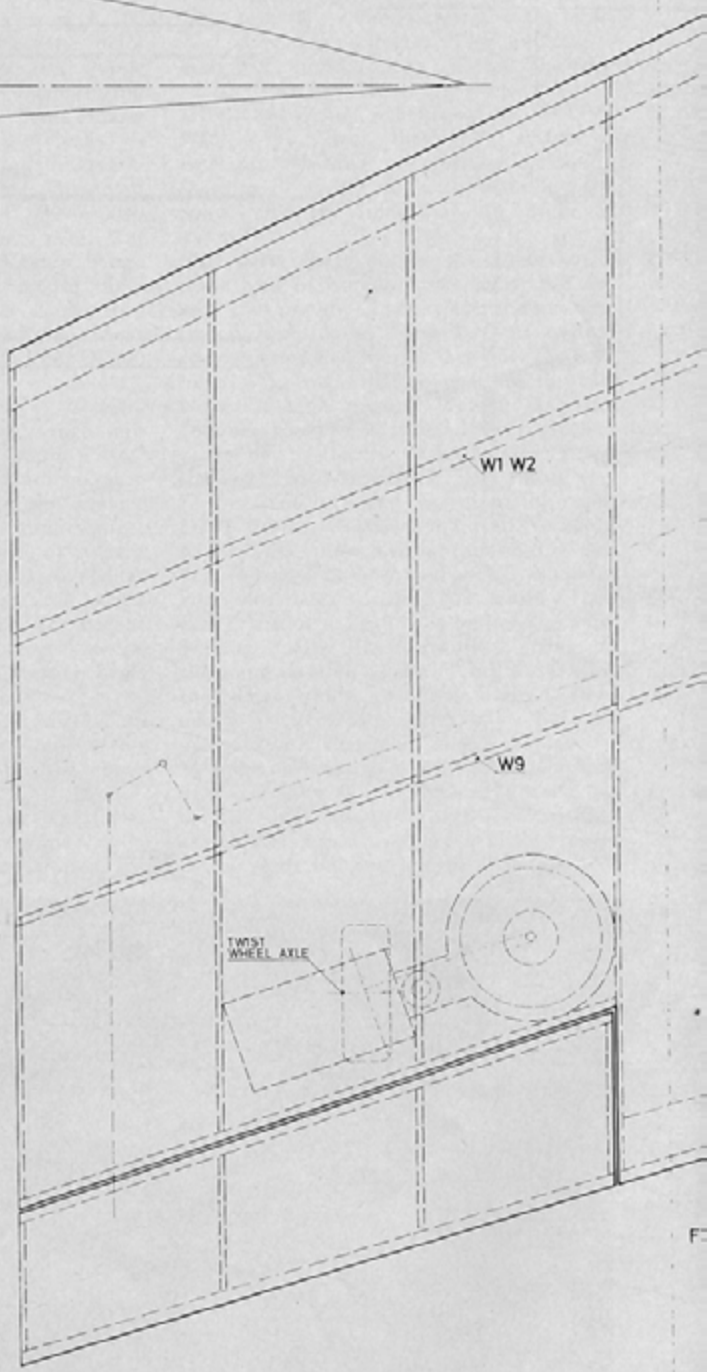

FL3
FL4
FL5

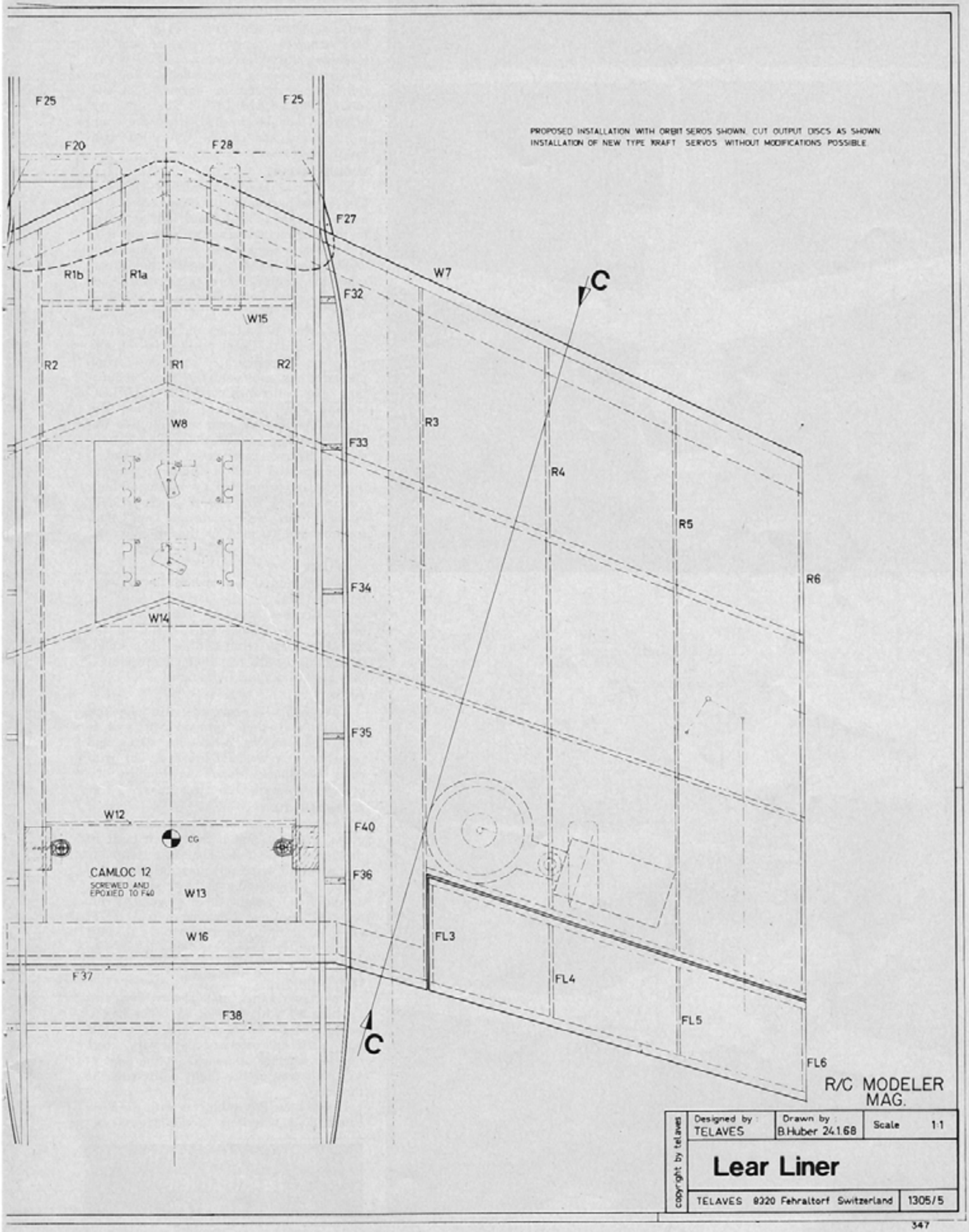

FL6
FL7
FL8


FL9
FL10
FL11


A11 A12
A13 A14


A15 A16


W1 W2
W9
TWIST
WHEEL AXLE


PROPOSED INSTALLATION WITH ORBIT SEROS SHOWN. CUT OUTPUT DISCS AS SHOWN.
INSTALLATION OF NEW TYPE KRAFT SERVOS WITHOUT MODIFICATIONS POSSIBLE.
F25
F25
F20
F28
F27
R1b
R1a
W7
C
F32
W15
R2
R1
R2
W8
R3
F33
R4
R5
R6
F34
W14
F35
W12
CG
F40
CAMLOC 12
SCREWED AND EPOXIED TO F40
F36
W13
W16
FL3
F37
FL4
F38
FL5
C
FL6
R/C MODELER MAG.
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Designed by: TELAVES
Drawn by: B.Huber 24.1.68
Scale 1:1
Lear Liner
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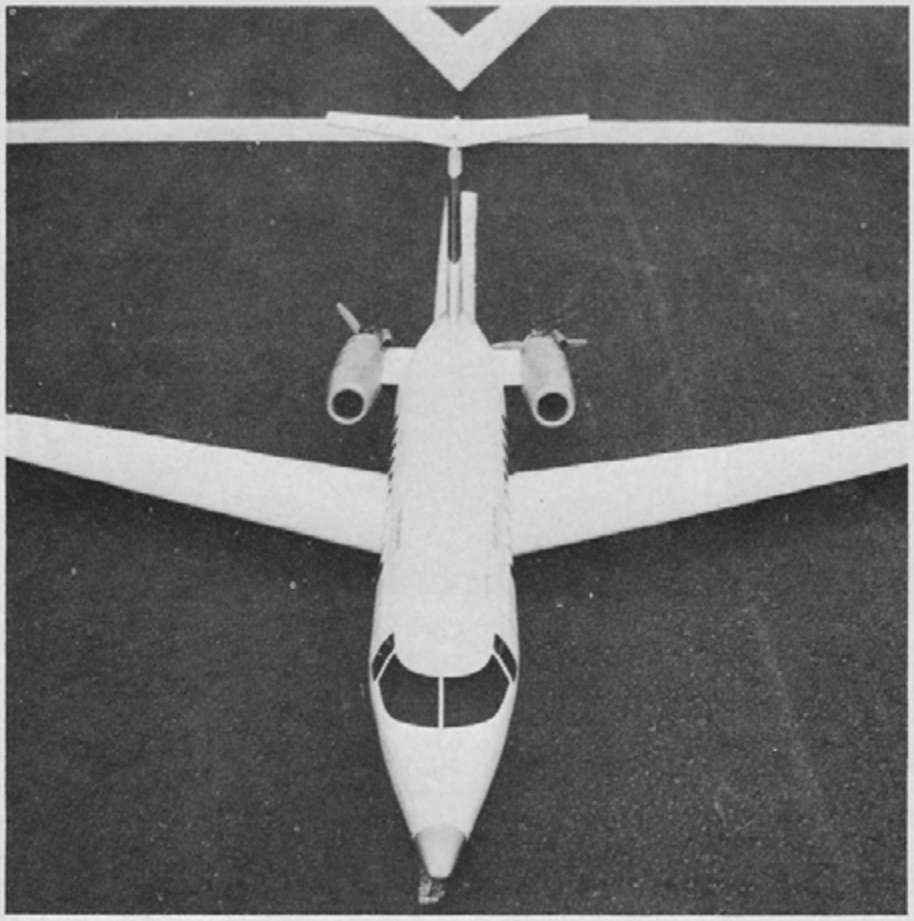
1305/5
347



After gluing in the two conical end pieces, the vertical tail, the formers and the engine supports are glued. The 5/32" x 5/32" stringers (spruce) are glued and the fuselage planked, excepting the area where the wing contacts the fuselage. Glue the reinforcement parts for former F28 and mount the CAMLOC's. The fuselage planking may be finished, when the wing is completed and can be controlled with the fuselage.

ENGINE BEARERS

The engine bearers consist of 3/16" ply. The engine pods are built up conventionally in two halves. The bottom half is glued to the engine bearer, while the top half is removable and fixed by 4 aluminum brackets and wood screws. In the prototype, the engines were fitted with especially designed Ko mufflers.

WING

The wing is built up on a flat surface (no dihedral). Check the twist of the wings at the indicated positions. After planking the top side, the servo mountings, the bellcranks, and the CAMLOC bearing plate are glued in. Mount the retractable landing gear according to the manufacturer's specifications. The bottom side of the wing can now be planked.

Ailerons and flaps are built up conventionally and connected by means of high quality hinges. The rudder horns are fabricated from 1/16" aluminum and then screwed and epoxied to the ailerons and flaps.

STABILIZER

The horizontal tail is built up conventionally. Because the servo is built in, the bellcranks must be built in before planking the bottom side. Build up the top keel to the servo outlines. The stabilizer is fixed with two nylon screws, making sure that they hold tight!

FINISH

The model is covered with medium silkspan and then sprayed with white dope. The engine pods with silver and red stripes, were hand brushed. The windows are black MonoKote. Finally, the model is covered with clear epoxy.

RC INSTALLATION

The servo installation is drawn on the plans. Receiver and batteries are built in the forward position. For the retractable LG separate batteries may be used, because it is necessary to have some 2 lbs. of additional weight there to get the correct CG position. Since there is a lot of electrical cabling in the model, the RC gear must be tested carefully before the first flights.

TEST FLIGHTS

The Lear Liner uses about 100 yards for take off with flaps at 15°. The handling of the model is not critical, and the low speed characteristics are very good. For the landing approach, set the flaps at 45°, and control the flight path with the throttle.

If you have any problems with the Lear Liner, do not hesitate to contact us.

Full size plans for the LEAR LINER see page 96