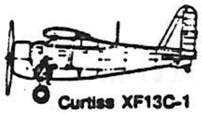
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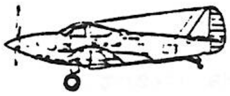
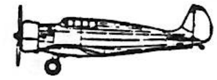

Bell XFL-1


Vought XF5U-1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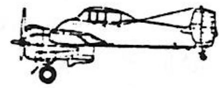
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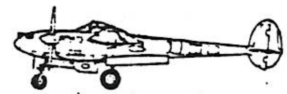
Lockheed FO-1

D.C. MAXECUTERS

# MAX - FAX

**THE NEWSLETTER OF THE D.C. MAXECUTERS**

NOV/DEC 1985

### MEMBERSHIP

Dues for membershp in the D.C. Maxecuters is $10.00 per year for residents of the U.S.A., Canada, and Mexico, and $11.00 for all other countries. Your mailing label indicates the year and month of the last issue of MAX—FAX for your current membership. A red mark in the box below is a reminder that your current membership is nearing its end. Send a check, payable to D.C. Maxecuters, to the Treasurer.

DUES REMINDER ☐

### MEETINGS

The D.C. Maxecuters hold meetings on the first Wednesday of every month at the College Park Airport, the oldest continuously operating airport in the world.


**PRESIDENT**

TOM SCHMITT
11014 Marcliff Road
Rockville, MD 20852

**SECRETARY**

BILL POOLE
9301 Lynmont Dr.
Adelphia MD. 20783

**TREASURER AND NEWSLETTER EDITOR**

ALLAN SCHANZLE
20008 Spur Hill Dr.
Gaithersburg, MD 20879


## MAXECUTER'S CALENDAR

NOV 6: MAXECUTER Monthly Meeting 8:00 PM at College Park Airport; Election of Officers - Be There!

NOV 9: Saturday Indoor Flying at Northwood High School 2:00 to 5:00 PM. See map in this issue.

NOV 16: Indoor Contest at Patuxent N.A.S.. See announcement and map in this issue. Don't miss this one!

NOV 30: Saturday Indoor Flying at Northwood High School 2:00 to 5:00 PM.

DEC 4: Special Meeting 8:00 PM at AMA HDQS Bldg., Reston, Virginia to see original Cleveland Models by courtesy of Hurst Bowers. No regular monthly meeting at College Park Airport.

DEC 7: Annual Christmas Banquet at Evans Farm Inn - see announcement at end of this calendar.

DEC 14: Saturday Indoor Flying at Northwood High School 2:00 to 5:00 PM.

JAN 1: No Monthly Meeting - Moved to January 8.

JAN 8: MAXECUTER Monthly Meeting 8:00PM at College Park Airport; Installation of New Officers and 1986 Program Organization.

JAN 18: Bull Session and HouseWarming 8:00 PM at Dan Driscoll's; 2825-B South Abingdon St., Arlington Virginia, 22206; Phone 931 2611. See map in next MAX-FAX.

MAR 8: Mark your calendars - another great indoor contest at Patuxent.

APR ?: Possible Fun Fly at Naval Academy.

JUL/AUG ?: Don't miss the FAC NATS Mk V near Rochester, New York!

## THE CHRISTMAS BANQUET

The banquet is scheduled at Evans Farm Inn, McLean, Virginia on Saturday December 7, 1985. Cash bar from 6:30 to 7:30 PM with dinner at 7:30PM. Send your check for $15.00 per person ( wives and friends welcomed ) to Don Srull, 941 Kimberwicke Road, McLean, Virginia 22101.

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## CLUB NEWS

Tom Schmitt

Do not worry Maxecuters, Allan has not deserted us. His eloquent and pervasive wit will return. As this is being written he is enjoying a bit of well deserved R&R in Germany and England. Hopefully he will regale us with a full report on English scale modeling and German Octoberfest hospitality.

Our September Fun Fly contest has come and gone, and regardless of the terrific heat, everyone had a wonderful time as usual. Flight conditions were good with many long flights within COMSAT confines. There were over 30 entries and we welcomed back some familiar faces from a distance such as Fred Ewing. We also had some new contestants from St. Mary's County, Maryland and North Carolina, and we hope they will come back again. It was also good to see Earl Stahl, who is contemplating some model building in his future activities. A big thanks to COMSAT personnel for rescuing some errant models from their roof. Lastly a note of appreciation to our able C.D. Allan Schanzle and the event directors who performed yeoman service in the terrific heat. Contest results are tabulated in this issue. Please note the FAC CO2 power scale results. This event was run on a trial basis with a change in the use of bonus points. Instead of adding them to scale points as stated in the rules, they were added as flight time points. Maximum flying time was retained however. This different method of scoring did not change the results for this contest. So the jury is still out on Power Scale bonus points. More thought is required to sort out this problem. This substitute editorialist likes the trial scoring of last years contest when a maximum flight score was set by the model's scoring of scale points (including bonus points ).

Claude Powell is keeping us busy this winter's flying season. He has worked hard to schedule two indoor contests at Patuxent N.A.S., the first on November 16. Do not miss these contests- everone who attended last year will attest to a great time had by all including a fun filled social gathering at a local seafood restaurant afterwards. Look for the schedule and map in this MAX-FAX. See you there!!

This issue features another great fold-out plan from the talented hand of Hurst Bowers. Hurst never fails to come up with some interesting and obscure oldies. 'MAX' has done another great job in capturing the Cunningham-Hall on this issue's cover. All you builders out there; send in black and white photos ( or negatives which will be returned ) of your MAX-FAX models. We want to publish them.

This temporary editor is very grateful for all the assistance offered and received in producing this issue. Now the efforts of our editor, Allan are fully appreciated. Come on Maxecuters - support your editor - flood him with original model designs and interesting articles. Make his job easier and his selection more difficult! Share your wealth of ideas with your fellow Maxecuters.

The Maxecuters were fortunate to welcome Bill and Phyllis Warner to COMSAT in August. A great time was enjoyed by all including the social gathering at Roy's place afterwards. We believe Bill is responsible for the missing sod at COMSAT - we hope he is successful in getting it to grow and spread at TAFT and other favorite California flying sites. Come back again soon Bill and Phyllis.

Some final notes: Do not overlook the Spitfire contest for 1986. Build a Spitfire and you have a model for two events since you can enter it in WW II and even FAC scale. Also we will be looking for lots of simple all balsa scale jobs for Rich Hensel's contest. Let's not disappoint him. If this catches on, perhaps we can include it as an event in a contest in the future. Remember the No-Cal event at the coming Patuxent contest. They are quick to build and fly great. There have been lots of plans published in the past years if you do not want to tackle an original. The FAC NATS MK V will be held in the Empire state for 1986 with a location near Rochester. Our fearless leader Lin Reichel has confirmed this in the last FAC newsletter. The dates have not been fixed but will be in July or August. Thank Bob Clemens for this one. This should be a great FAC meet as the location seems ideal. Start building! Absolutely the last words; this writer would be completely remiss without congratulating all the Maxecuters who journeyed to the AMA NATS and had a great time come rain or high water, winners or losers - actually a lot more winners than losers. See Bob Clemens great articles in Model Aviation for the full story and ask our local Wakefield hero about foul weather flying. The Brits have nothing on us..

WELCOME BACK ALLAN!!!

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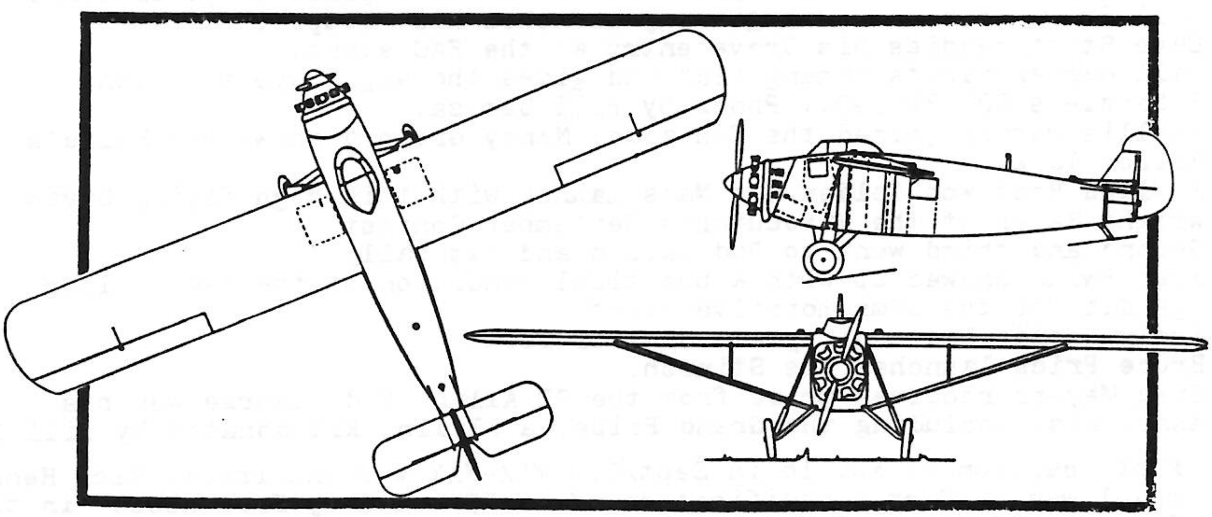
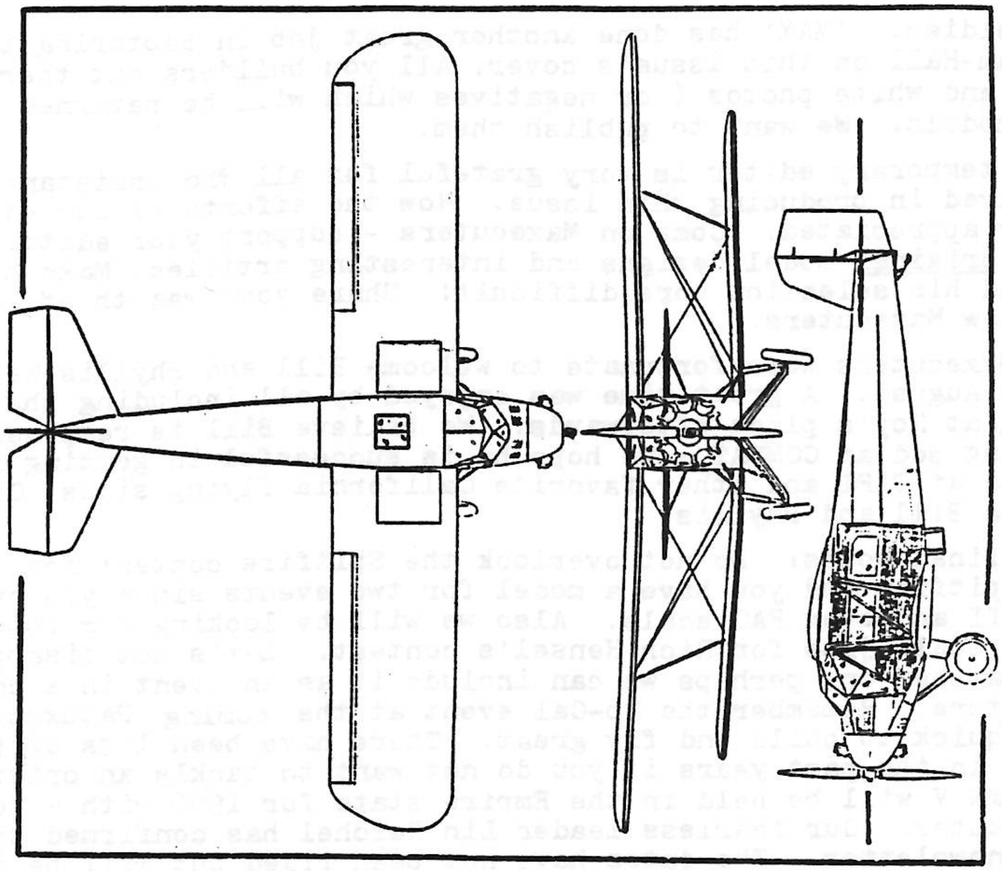


DOLE Trophy Travel Air "Woolaroc"



Three-view outline drawings of the Cunningham-Hall biplane

PHOTO PAGES

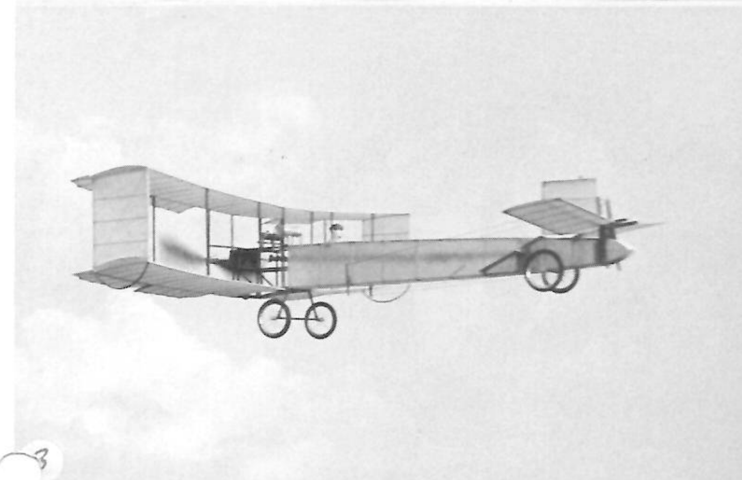
Tom Schmitt

1. Hurst Bowers and Bob Kennedy judging indoor rubber scale at the AMA NATS. Fairchilds by Walt Eggert Sr. and Jr..
2. Don Srull poses for National Geographic photographer. Look for great article on the NATS in an issue next year.
3. Don's winning indoor rubber model, an early Voisin canard.
4. Dave Rees built a twin CO2 Short which flew terrifically for a first.
5. Misery loves company; Don and the photographer encourage Dan Driscoll to fly this round in a pouring rain.
6. Bill Bell cranks up his Flyline Stearman for a place in power scale.
7. Bill Brown from down Georgia way launches his "Coupe".
8. Dave Stott readies his Greve entry at the FAC event.
9. Bill Warner visits "Shangrila" and gives the eagle eye to Allan Schanzle's CO2 FW-190.. Photo by Bill Ceresa.
10. Phyllis Warner joined the fun also; Nancy Gregory shows her Rolfe's Fairchild 24.
11. Rowland Hoot won Golden Age Mass Launch with this high flying Dayton Wright Racer at the Maxecuter's September Contest.
12. Second and third went to Bud Carson and Pat Daily.
13. Fred Ewing showed up with a beautiful rendition of the P-47 Golden Age Kit for the Commemorative event.
14. Evelyn holds Dad's nifty Art Chester Goon.
15. Bruce Price launches his Stinson.
16. Greg Meyers receives prize from the CD Allan. Dad, George won his share also including the Grand Prize, a Flyline kit donated by Bill Ceresa.

NOTE: Photo caption of No. 16 in Sept/Oct MAX-FAX was incorrect. Rich Hensel's model was in fact a modification of an RC model by Fred Reese in the January '85 issue of Model Aviation.


FAIRCHILD
1


2


3


G-BDBS
SD3-30
4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6


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8


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10


11

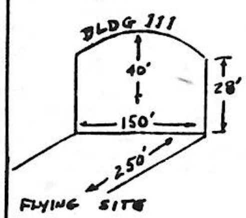
12

13


14


15

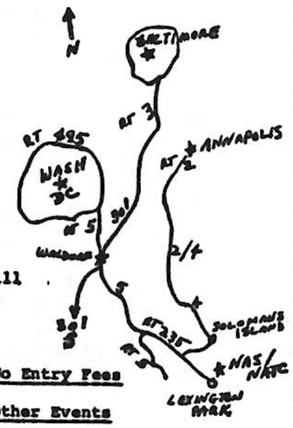
16




# 1985 (WINTER)
## INDOOR MODEL AIRPLANE
## CONTEST

**16 November 1985**
**9:00 AM - 5:30 PM**

Rotary Wing Hangar, Building 111
NAS/NATC Patuxent River, Md.
(Lexington Park, Md.)




<u>1983 FAC Rules</u>

<u>No Entry Fees</u>

| <u>Mass Launch Events</u> | | <u>Other Events</u> |
|---|---|---|
| WWI | 1:10 - 2:00 | FAC Scale - Rubber |
| Navy Scale (Any Navy/ERA) | 2:10 - 3:00 | NO-CAL |
| P-Nut Scale (Any P-Nut) | 3:10 - 4:00 | Bostonian |
| Golden Age | 4:10 - 5:00 | EMBRYO |
| Awards | 5:10 - 5:30 | |

FAC scale juding starts at 11:00 AM. <u>NO</u> qualifying flight required. All flight scores submitted by 4:00 PM.

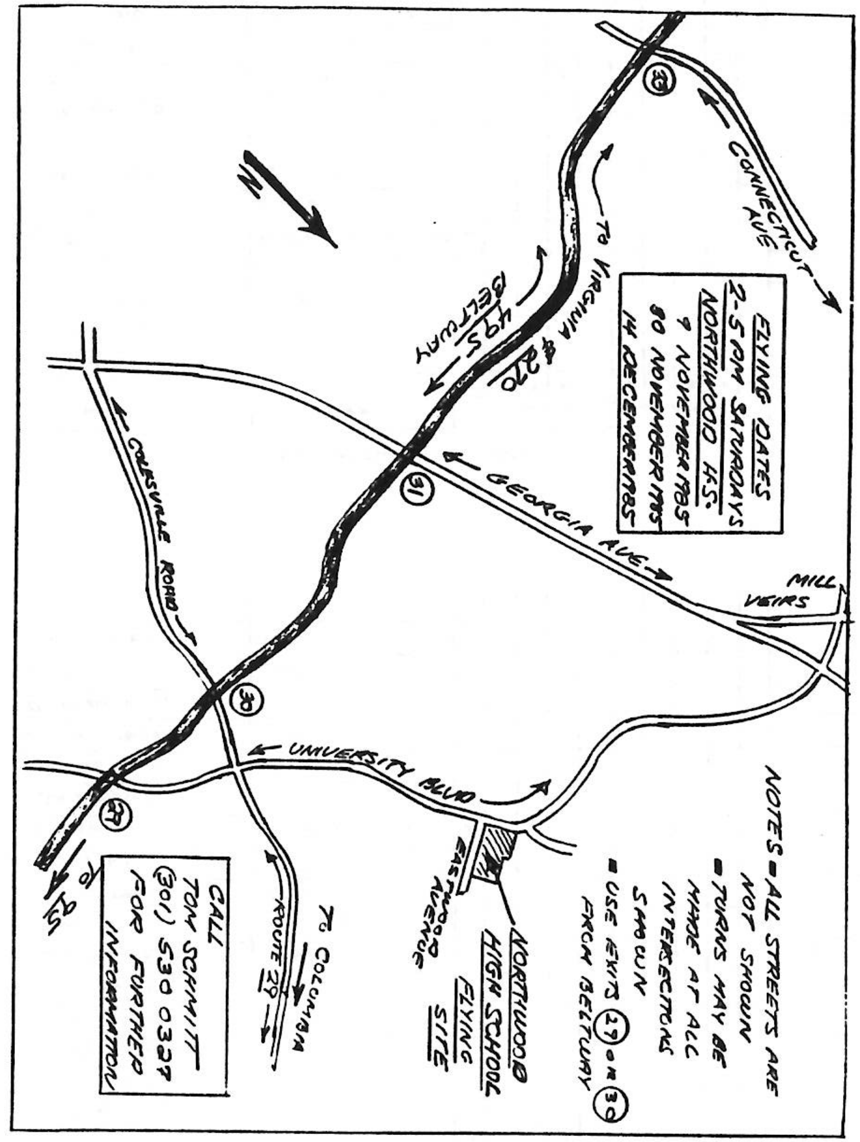
<u>Local Rule</u>: One event per model.

<u>Information</u>: Claude Powell (301) 872-4105 (Coordinator)
Alan Schanzle (Contest Director)
Tom Schmitt (301) 530-0327 (Alternate POC)

<u>Sponsored By</u>: Naval Air Station/Naval Air Test Center, Patuxent River, Md. and St. Mary's County Recreation and Parks.

<u>Special Events</u>: <u>No Awards</u>

Indoor Hand Launch Glider
Manhatten
Penny Plane



## CONTEST RESULTS FOR GOLDEN AGE

| NAME | AIRCRAFT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | PLACE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLIGHT A | | | | | | | | | | | | |
| MARVE YODER | LINCOLN APK-5 | X | | | | | | | | | | |
| ALLAN SCHANZLE | FAIRCHILD 24 | | | X | | | | | | | | |
| BUD CARSON | FAIRCHILD 24 | | | | | X | | | | | | 2 |
| FRED EWING | GADFLY | | X | | | | | | | | | |
| DAVE REES | NICKOLIS BEASLEY NB-3 | | X | | | | | | | | | |
| MIKE MOSCOW | REARWIN SPEEDSTER | X | | | | | | | | | | |
| TOM ODEM | GADFLY | X | | | | | | | | | | |
| FLIGHT B | | | | | | | | | | | | |
| BILL BELL | TAYLOR CUB | | | X | | | | | | | | |
| JOHN HOUCK | NORTHROP GAMMA | | | X | | | | | | | | |
| MARK HOUCK | TAYLORCRAFT | X | | | | | | | | | | |
| PAT DAILY | LOIRE 46 | | | | X | | | | | | | 3 |
| ROLAND HOOT | DAYTON WRIGHT | | | | | | | | | | | 1 |
| DUDLEY PRISEL | F11C-2 | | X | | | | | | | | | |
| DAN DRISCOLL | PIPER J3 | X | | | | | | | | | | |
| CLAUDE POWELL | CESSNA C-34 | X | | | | | | | | | | |

## CONTEST RESULTS WW-II

| NAME | AIRCRAFT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | PLACE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLIGHT A | | | | | | | | | | | | |
| ALLAN SCHANZLE | P-39 | X | | | | | | | | | | |
| RANDY KLEINERT | HELLCAT | | | X | | | | | | | | |
| FRED EWING | He-112 | | | | X | | | | | | | 3 |
| DAVE REES | PZL 24G | | X | | | | | | | | | |
| GREG MEYERS | P-40 | | | | | X | | | | | | 2 |
| JOHN HOUCK | He 100 D | X | | | | | | | | | | |
| BRUCE PRICE | HELLCAT | X | | | | | | | | | | |
| FLIGHT B | | | | | | | | | | | | |
| ROLAND HOOT | VULTEE VENGENCE | X | | | | | | | | | | |
| BOB WEDEL | ZERO | | | | | | | | | | | |
| GEORGE MEYERS | P-51 | | | | | | | | | | | 1 |
| DUDLEY PRISEL | F8F | X | | | | | | | | | | |
| DAN DRISCOLL | HELLCAT | | X | | | | | | | | | |
| DON SRULL | CAUDRON | X | | | | | | | | | | |
| MARK HOUCK | P-51 | | X | | | | | | | | | |

## CONTEST RESULTS FOR THE RACES

| NAME | AIRCRAFT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | PLACE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLIGHT A | | | | | | | | | | | | |
| KEVIN SHARBONDA | CHAMBERMAID | | | | | | | | | | | |
| RANDY KLEINERT | CHAMBERMAID | | | | | | | | | | | 2 |
| FRED EWING | SUZY | | | | | | | | | | | |
| DAVE REES | MR MULLIGAN | | | | | | | | | | | 3 |
| BERT PHILLIPS | CESSNA CR-3 | | | | | | | | | | | |
| JOHN HOUCK | CHESTER JEEP | | | | | | | | | | | |
| ROLAND HOOT | SUZY | | | | | | | | | | | |
| FLIGHT B | | | | | | | | | | | | |
| GEORGE MEYERS | MISS SAN FRANCISCO | | | | | | | | | | | 1 |
| DUDLEY PRISEL | SEVERSKY P-35 | | | | | | | | | | | |
| ROLF GREGORY | SUZY | | | | | | | | | | | |

## CONTEST RESULTS FOR WW-I

| NAME | AIRCRAFT | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | PLACE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FLIGHT A | | | | | | | | | | | | |
| CLAUDE POWELL | SE-5 | X | | | | | | | | | | |
| KEVIN SHARBONDA | BRISTOL SCOUT D | | X | | | | | | | | | |
| DAVE REES | ROLAND WALFISCH | | | X | | | | | | | | 3 |
| BERT PHILLIPS | MIRCRO PLANO VALEE | X | | | | | | | | | | |
| BILL BELL | FOKKER D-7 | | X | | | | | | | | | |
| MARK HOUCK | FOKKER D-7 | X | | | | | | | | | | |
| FLIGHT B | | | | | | | | | | | | |
| ROLAND HOOT | FOKKER D-7 | | | | X | | | | | | | 2 |
| GEORGE MEYERS | MARTINSYDE S1 | | | | | | | | | | | 1 |
| DUDLEY PRISEL | GRAIN KITTEN | X | | | | | | | | | | |
| DAN DRISCOLL | SE-5 | X | | | | | | | | | | |
| JOHN HOUCK | FOKKER D-7 | X | | | | | | | | | | |
| PAT DAILY | FOKKER D-7 | | X | | | | | | | | | |

MAXECUTER'S SEPTEMBER '85 CONTEST RESULTS

## CONTEST RESULTS FOR HAND LAUNCH GLIDER

| NAME | FLIGHT TIMES (SECONDS) 1 | 2 | 3 | 4 | 5 | 6 | TOTAL | PLACE |
|---|---|---|---|---|---|---|---|---|
| RANDY KLEINERT | 120 | 33 | 43 | 120 | 33 | 81 | 321 | 1 |
| JOHN SITES | 18 | 74 | 5 | 72 | 36 | 14 | 182 | 2 |
| JOHN HOUCK | 14 | 19 | 58 | 23 | 21 | 12 | 102 | 3 |
| | | | | | | | | |
| MARK HOUCK (JR) | 10 | 8 | 17 | 7 | 4 | 11 | 38 | 2 |
| GREG MEYERS (JR) | 4 | 8 | 9 | 12 | 14 | 16 | 42 | 1 |

## CONTEST RESULTS FOR CATAPULT GLIDER

| NAME | FLIGHT TIMES (SECONDS) 1 | 2 | 3 | 4 | 5 | 6 | TOTAL | PLACE |
|---|---|---|---|---|---|---|---|---|
| ALLAN SCHANZLE | 28 | 32 | 32 | 68 | 35 | 83 | 186 | 2 |
| JERRY PERSCH | 35 | 22 | 58 | 21 | 11 | 17 | 115 | 4 |
| RANDY KLEINERT | 120 | 18 | 32 | 33 | 38 | 38 | 196 | 1 |
| JOHN SITES | 26 | 34 | 57 | 65 | 39 | 28 | 161 | 3 |
| MARK HOUCK (JR) | 10 | 22 | 48 | 2 | 23 | 23 | 94 | 1 |

9.

## CONTEST RESULTS FOR EMBRYO

| NAME | BONUS PTS | FLIGHT TIMES (SEC.) 1 | 2 | 3 | 4 | BEST 3 | TOTAL PTS | PLACE |
|---|---|---|---|---|---|---|---|---|
| CLAUDE POWELL | 8 | 55 | 60 | 70 | 68 | 198 | 206 | 4 |
| BUD CARSON | 9 | 32 | 37 | 45 | 38 | 120 | 129 | 6 |
| JOHN HOUCK | 9 | 34 | 8 | – | – | 42 | 51 | 9 |
| TOM SCHMITT | 9 | 51 | 46 | – | – | 97 | 106 | 8 |
| ROLAND HOOT | 9 | 62 | 93 | 120 | 81 | 294 | 303 | 1 |
| CY HANZELY | 9 | 98 | 95 | 73 | 66 | 266 | 275 | 3 |
| BILL BOWLES | 8 | 35 | 39 | 111 | 120 | 270 | 278 | 2 |
| MARV YODER | 6 | 52 | 35 | 10 | 46 | 133 | 139 | 5 |
| JOHN HOWARD | 9 | 19 | 35 | 28 | 40 | 103 | 112 | 7 |

MAXECUTER'S SEPTEMBER '85 CONTEST RESULTS

## CONTEST RESULTS FOR F.A.C. SCALE

| NAME | AIRCRAFT | STATIC (0-30) | (0-20) | (0-10) | [illegible] | [illegible] | FLIGHT (SECONDS) 1 | 2 | 3 | FLIGHT POINTS | TOTAL PTS | PLACE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KEVIN SHARBONDA | GRUMMAN TBM | 23 | 17½ | 10 | 5 | 55½ | 43 | 120 | 120 | 82½ | 138 | 4 |
| BUD CARSON | FAIRCHILD 24 | 20 | 16 | 10½ | 0 | 46½ | 42 | 62 | – | 52 | 98½ | 8 |
| DAVE REES | NIC. BEALLEY NB-3 | 23 | 18 | 12 | 10 | 63 | 63 | 69 | 120 | 82½ | 145½ | 3 |
| BILL BELL | LINCOLN APK-5 | 20 | 17 | 10½ | 0 | 47½ | 37 | 40 | 40 | 40 | 87½ | 10 |
| JOHN HOUCK | LOCKHEED P38 | 19½ | 15½ | 10 | 25 | 70 | 21 | – | – | 21 | 91 | 9 |
| PAT DAILY | FOKKER D-7 | 22 | 19½ | 10½ | 15 | 67 | 42 | – | – | 42 | 109 | 6 |
| ROLAND HOOT | SANTOS DUMONT | 26 | 18 | 11½ | 30 | 85½ | 34 | 71 | 52 | 65½ | 151 | 2 |
| GREG MEYERS | CURTISS P-40 | 17½ | 15½ | 7 | 10 | 50 | 52 | 45 | – | 52 | 102 | 7 |
| GEORGE MEYERS | SOC-3 SEAGULL | 20 | 17½ | 10 | 15 | 62½ | 43 | 59 | – | 59 | 121½ | 5 |
| ROLF GREGORY | CURTISS BABY SPEED SCOUT | 22 | 16½ | 9½ | 15 | 63 | 20 | – | – | 20 | 83 | 11 |
| DON SRULL | LIPIECH P-13 | 22 | 18 | 11½ | 35 | 86½ | 61 | 50 | 97 | 76¾ | 163¼ | 1 |

## CONTEST RESULTS FOR F.A.C. $CO_2$ SCALE

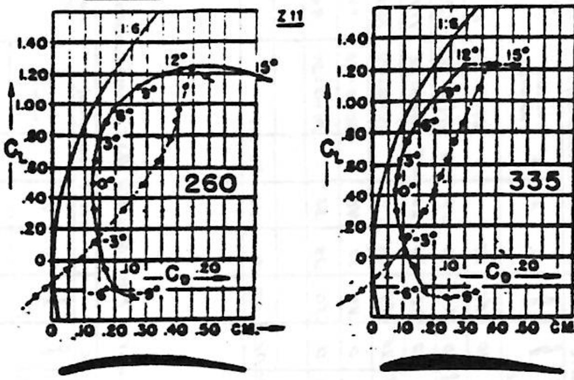
| NAME | AIRCRAFT | STATIC (0-30) | (0-20) | (0-10) | [illegible] | [illegible] | FLIGHT (SECONDS) 1 | 2 | 3 | FLIGHT POINTS | TOTAL PTS | PLACE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOM SCHMITT | CLAUDE | 22 | 18 | 11 | 10 | 51 | 74 | – | – | 67+10=77 | 128 | 2 |
| ALLAN SCHANZLE | FW-190A | 25 | 19 | 11½ | 10 | 55½ | 50 | 59 | 83 | 71½+10=81½ | 137 | 1 |
| KEVIN SHARBONDA | AVIA 534 | 18 | 15½ | 9 | 15 | 42½ | 28 | 20 | 57 | 57+15=72 | 114½ | 3 |
| DAVE REES | SHORT SD-330 | 27 | 18½ | 11½ | 25 | 57 | 24 | – | – | 24+25=49 | 106 | 4 |
| MARK HOUCK | TAYLORCRAFT | 15 | 12 | 7 | 0 | 34 | 31 | 40 | – | 40+0=40 | 74 | 6 |
| ROLF GREGORY | LUSCOMB PHANTOM | 23 | 17½ | 9½ | 0 | 50 | 29 | 34 | – | 34+0=34 | 84 | 5 |

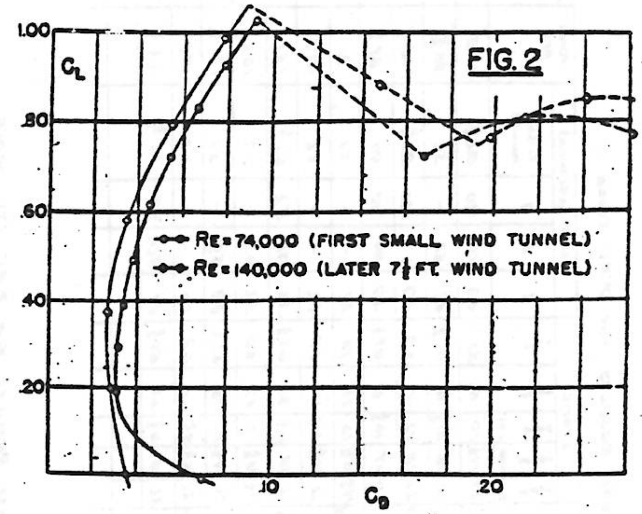
NOTE: BONUS POINTS ADDED TO FLIGHT TIME

## CONTEST RESULTS FOR GOLDEN AGE COMMEMORATIVE

| NAME | AIRCRAFT | STATIC (0-30) | (0-20) | (0-10) | [illegible] | [illegible] | FLIGHT (SECONDS) 1 | 2 | 3 | FLIGHT POINTS | TOTAL PTS | PLACE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FRED EWING | P-47 | 22½ | 19 | 12 | 10 | 63½ | 31 | 35 | – | 35 | 98½ | 3 |
| ALLAN SCHANZLE | DAVIS DI-W | 23 | 17 | 9½ | 3 | 52½ | 89 | – | – | 71½ | 124 | 2 |
| BILL BELL | BOEING F4B-4 | 25 | 17 | 11½ | 15 | 68½ | 21 | 25 | 25 | 25 | 93½ | 4 |
| TOM SCHMITT | REARWIN SPEEDST. | 20 | 17 | 10 | 0 | 47 | 33 | 80 | 102 | 78 | 125 | 1 |
| DUDLEY PRISEL | SEVERSKY P35 | 21½ | 17 | 10½ | 10 | 59 | 25 | – | – | 25 | 84 | 5 |

FIG. 1



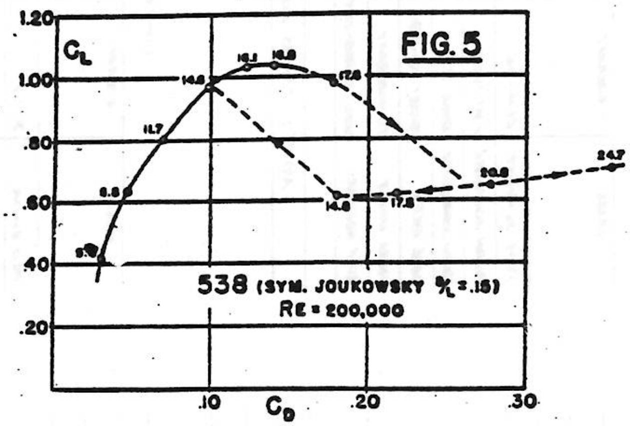
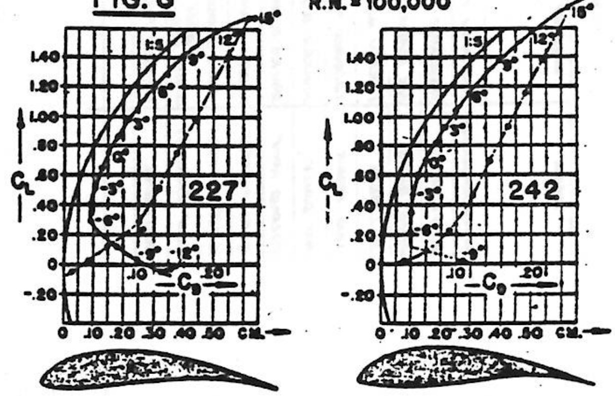




FIG. 6




# Wing Sections for Model Planes Part 1

**World-famous aerodynamicist, designer of the ME-163, presents his researches in the field of model airfoils**

By Dr. Alexander M. Lippisch

THE skilled model designer, whose aim it is to build models of high aerodynamic quality, will always find that even the most accurately constructed models do not attain the performance of the corresponding full-scale aircraft.

We know that this "scale effect" is due to the fact that the friction drag coefficient ($C_{fr}$) is decidedly higher at the low Reynolds' numbers of the flying models, and that in addition the low RN range shows an earlier separation of the boundary layer. This phenomenon, which has been proved by wind tunnel measurements, exercises its influence mainly on the characteristics of the wing and the wing sections.

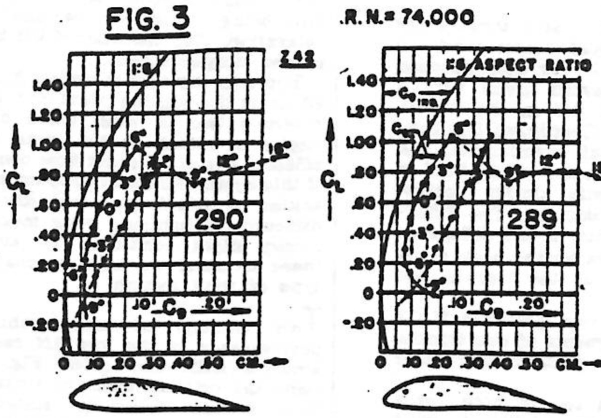
You may ask what the Reynolds' number means. The law of similarity for fluid motion, discovered by Osborne Reynolds, states that two flow conditions (for instance the flow around wing sections) are similar if the Reynolds' numbers of the two tests are the same. The RN is calculated by forming the product of a characteristic length—say the chord length—and the velocity of the flow and dividing by the kinematic viscosity of the fluid:

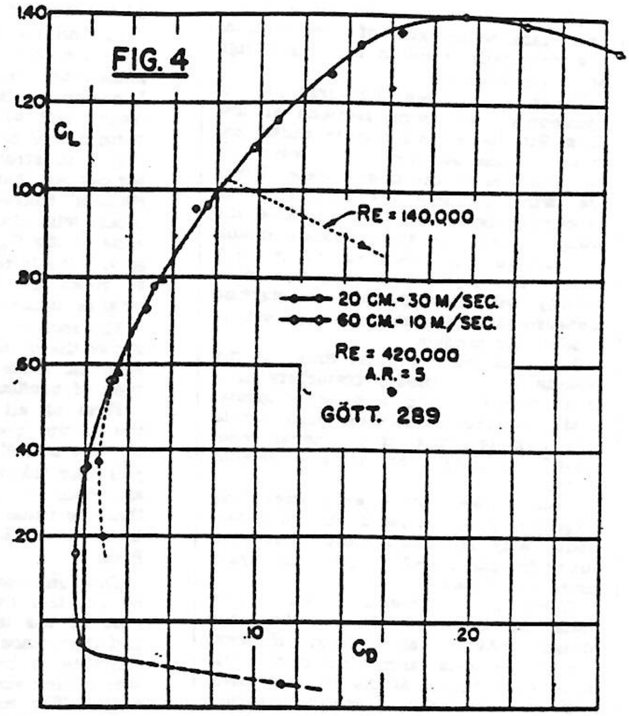
$$RN = \frac{V \times L}{v} \left( \frac{\text{velocity x length}}{\text{kin. viscosity}} \right)$$

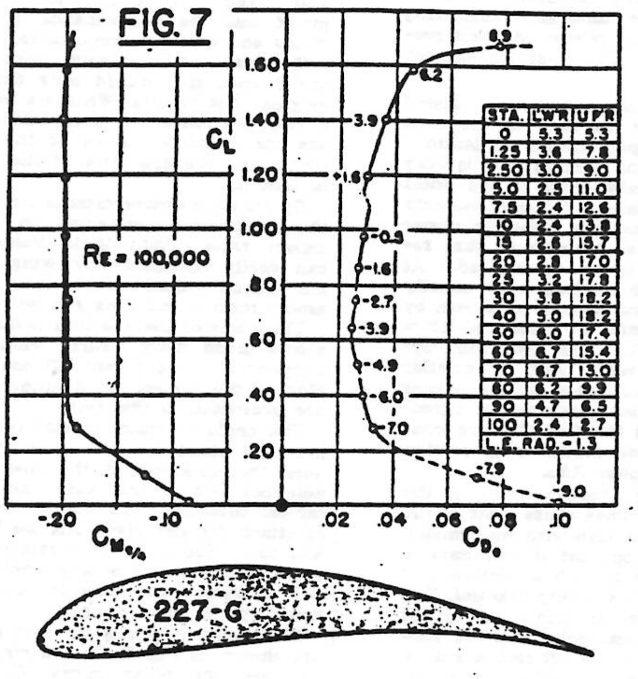
That means that two tests carried out in two different fluids—for instance, air and water—can be compared if we consider the different values of the kinematic viscosity.

The Reynolds' law of similarity is essentially important if we apply test results from wind tunnels to

FIG. 3

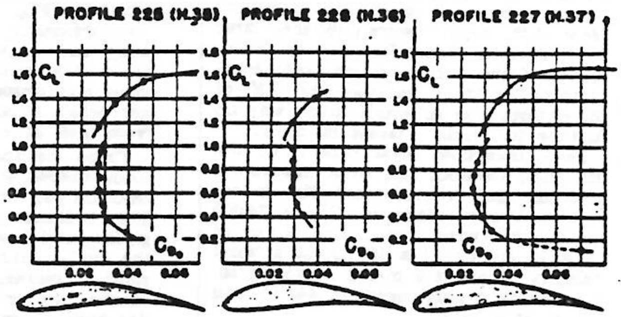



| STA. | LWR | UPR |
|---|---|---|
| 0 | 5.3 | 5.3 |
| 1.25 | 3.6 | 7.8 |
| 2.50 | 3.0 | 9.0 |
| 5.0 | 2.5 | 11.0 |
| 7.5 | 2.4 | 12.6 |
| 10 | 2.4 | 13.8 |
| 15 | 2.6 | 15.7 |
| 20 | 2.8 | 17.0 |
| 25 | 3.2 | 17.8 |
| 30 | 3.8 | 18.2 |
| 40 | 5.0 | 18.2 |
| 50 | 6.0 | 17.4 |
| 60 | 6.7 | 15.4 |
| 70 | 6.7 | 13.0 |
| 80 | 6.2 | 9.9 |
| 90 | 4.7 | 6.5 |
| 100 | 2.4 | 2.7 |
| L.E. RAD. = 1.3 | | |

FIG. 8 WIND TUNNEL TESTS OF CAMBERED SECTIONS AT LOW REYNOLDS NUMBER. R.N. = 100,000 -FROM T.B. III 3 (MUNK AND HUECKEL)




flight conditions, and we can only expect to obtain the same performance if the RN of the wind tunnel test and the RN of the free flight condition are the same. Since this condition cannot always be realized completely, the influence of the RN—let's call it the aerodynamic scale—was carefully investigated and it was found that the similarity is not seriously affected if the RN of the flight condition is somewhat larger than the test RN.

As we know that the friction coefficient usually decreases with increasing RN, we may get something better than indicated by the wind tunnel test. But if we apply a test result to the flight conditions of a flying model where the RN is considerably smaller than at the test, we will get something completely different and unfavorably lower in performance. At low RN flow conditions, the flow character can change so much that two different sections will give reversed performance, profile A being much better than profile B at an RN of $3 \times 10^6$ and profile B being much better than profile A at an RN of $1 \times 10^5$.

To calculate the RN for air at standard (sea) level, multiply the chord length in inches by flight speed in miles per hour and take then 800 times this product. For instance, take this as an example:

chord length = 6 inches
flight speed = 25 mph
Reynolds number = (6x25) x 800
= 120,000
= $1.2 \times 10^5$

The wing sections which have been successfully developed for modern high-speed aircraft — as for instance the laminar flow sections—are not favorable if you use these special high RN sections for your models. But even the wing sections of the full-scale gliders, the RN of which is about 1,000,000, are not applicable for a glider model with an average RN lower than 100,000. (Cont'd on page 71)

# Wing Sections

(Continued from page 45)

Therefore the question arises again and again, which kind of wing sections are especially suitable for the design of flying models?

There exist some measurements of commonly used wing sections at low RNs. But these tests merely show that most of these sections have a very low performance at the model scale. While the wing sections for aircraft were especially developed for high RNs, the wing sections for flying models should be selected from tests at the low RN range. But it is clear that nowadays nobody will have the idea of starting measurements for the development of profiles for models.

So I was asked several times by my friends of the model fraternity if I could provide them with some special model sections—something that would give a glide angle of 1: "never meet again" (infinity), or even somewhat better.

I remembered there were some long forgotten measurements on wing sections. Why shouldn't these tests turn out to fit into the RN range of the flying models of today?

These "Measurements of Wing Sections" by Dr. Max Munk (who later joined NACA) and Ernst Hueckel present the tests carried out in the first small wind tunnel at the Prandtl Institute at Goettingen, Germany, during the years of the First World War. They were printed in the "Technische Berichte der Flugzeugmeisterei Adlershof (TB)," (Technical Reports of Air Materiel Center, Adlershof, Vols. I and II), which were under selected distribution. Most of the reports were published later in a revised form. But the measurements of the wing sections were completely forgotten because the RN of these tests was so small there was no further full-scale interest in them.

So I unearthed these reports on the old wing sections, and what interesting material they represented! The measurements were made at RNs of 74,000 and 100,000 with rectangular wings of 72 x 12 cm or 80 x 16 cm at a wind velocity of about 9 m/sec (q=5 kg/sq. m.), which means chords of 4¾ in. and 6¼ in. at 20 mph.

Fig. 1 shows you two of these polar curves. Section 260 is like the airfoils used in the early days of aviation and the section 335 was used on the biplanes in World War I.

The curve with the angles of attack plotted along the points measured, indicates the polar curve, that means the function between $C_L$ (lift coefficient) and $C_D$ (drag coefficient). The dotted line illustrates $C_M$, the moment coefficient (related here to the leading edge point on the chord) as a function of $C_L$. At any point the ratio $C_M/C_L$ gives the position of the center of pressure point in fractions of the chord. (For instance, for #335 at 6° $C_M=0.29$; $C_L=0.85$; $C_M/C_L=0.34$ giving the C.P. position, at 0.34 chord from leading edge.)

The parabolic curve through the origin point gives the induced drag for the aspect ratio of the wing measured (here A. R.=1:6). The horizontal distance between the parabola and the polar curve is the section drag coefficient—the drag coefficient for infinite A. R.

You see by comparing these two sections that the thin cambered plate #260 has lower performance than the somewhat thicker but streamlined sections, because the #335 polar is nearer to the induced drag parabola than the polar of the curved plate.

To find out how closely these early measurements would correspond to some later tests in larger wind tunnels, I compared the results given with a recent test at low RN in the 7½ ft. wind tunnel of the Goettingen Institute. Fig. 2 illustrates this comparison, and we can see that even the special kind of stalling characteristic closely corresponds with the earlier test. The difference of the $C_D$ is due to the difference in RN, the latter test having been made at twice the RN of the test in the smaller tunnel.

The section used was #289 and Fig. 3 shows the measurements of two thicker sections, #289 and #290 of this usual type of profiles.

First of all you see in both cases the abrupt breakdown of lift at about $C_L=1.0$ and 6° angle of attack. I show you only these two examples but there are many of the same kind indicating that the usual flat cambered thick sections have a low $C_{L\,max}$ at the smaller RNs.

This unfavorable behavior is caused by the fact that the flow on the nose part of the upper surface is laminar and that, since the laminar flow is very unstable, it breaks down at the point where the decrease of the local velocity begins. The separation from the upper surface is then so pronounced that recovery can never be established. At higher RNs such sections have usually pretty good characteristics as shown by the measurements of #289 at RN=$4.2\times10^5$. (Fig. 4). The two different measurements made with a smaller wing and higher speed and a larger wing with smaller speed are in agreement *and prove the fact that we cannot select a good model wing section from tests at higher RNs.*

These stalling characteristics of the usual-shaped sections cause most of the troubles you may have with your model. This becomes apparent if you have a glider model with such a section and the model enters a strong thermal. The sudden increase of angle of attack reaches the critical point and the sudden breakdown of the lift causes a dive. Now speed increases and angle of attack decreases, which leads to a recovery of the lift. The model begins to climb again and the same oscillating movement happens in a stronger way and may in the end bring the model into such a stalling position that a spin or even a loop is produced by this instability.

We must realize that when going down with the angle of attack from a stalling position, as for instance the 9° point of the #289 section, we have to go back along the recovery polar which is illustrated by Fig. 5, taken from another test showing similar behavior. The curve shows the results of a test where the angle of attack of the wing was increased above stalling and then decreased while still stalling. Several tests show that two branches of the polar curve can be measured—the usual one from smooth conditions up to the stalling point and further, and the recovery branch from complete stalling down to smooth conditions again. The upward branch may show a more continuous change in lift and drag, if you have a good section, but the recovery branch has usually a sudden change from stall to perfect flow at nearly the same angle of attack. So now, when your plane is diving after being stalled, a sudden change in lift will occur and the abrupt increase of the lift forces will bring a considerable upward acceleration. This unbalanced lift increase causes steeper climb.

You may say that there is a hysteresis effect at the stalling point and you can measure two or even three different angles of attack at the same lift coefficient but at different flow conditions. If this hysteresis effect happens at lower angles of attack you will have great difficulty in bringing your model to a steady flight condition. To avoid all these troubles we have to change the type of wing section.

Two sections of considerable high performance in the low RN range are sections #227 and #242. Fig. 6 presents the original measurements. These sections are especially suitable for glider-models or larger powered models carrying high load. The $C_{L\,max}$ of nearly 1.80 makes the models almost stall-proof, and the performance at aspect ratios above 1:8 is remarkable.

It would not be of very much use to my friends if I would only show the original test results. What we need for a real evaluation of a certain section are the absolute values of the coefficients and the ordinates of the section to plot it.

By absolute characteristics I mean the the coefficients converted to infinite aspect ratio. From these values you can easily calculate any wing if you add the individual induced drag for the aspect ratio of the wing you will design.

The slope of the absolute polar curve shows much more clearly what really happens at the different lift conditions. Most of the modern wind tunnel results are presented in this way.

The angle of attack is also converted into the absolute value and indicates here the direction of the flow in the neighborhood of the wing and not at far-off conditions. To obtain the angle of attack for any given AR we have to add the induced angle of attack to the value shown on the absolute polar. (We will calculate an example later, that you may see how it works.)

The absolute values for section #227 are shown in Fig. 7. On the right hand you see the polar curve, $C_{Do}$ as a function of $C_L$. On the left hand you have the moment coefficient related here to the ¼ chord point.

If you take now $C_{M\,c/4}/C_L$ the value indicates the distance in fractions of the chord length from the ¼ chord point backward (if negative). I chose the ¼ chord point because it is near to the theoretical focus of the section and the $C_{M\,c/4}$ values are then nearly constant. Below is a larger drawing of the section and on the right hand you find the ordinates given for a chord length of 100 parts. The ordinates of most of the sections I evaluated were not counted from the chord which touches the section from underneath. The reason was a practical one because there are no ordinates given in the original report and to get the values as exactly as possible from the enlarged pictures of the sections I measured from a line farther below, which could be drawn with better accuracy.

You can see that this evaluation and research were quite a job and in order to select the best sections from some two hundred many of them had to be converted, plotted and compared until I could see which were the best. What we see is of even greater interest than I had expected. Let us go along the polar of the section #227.

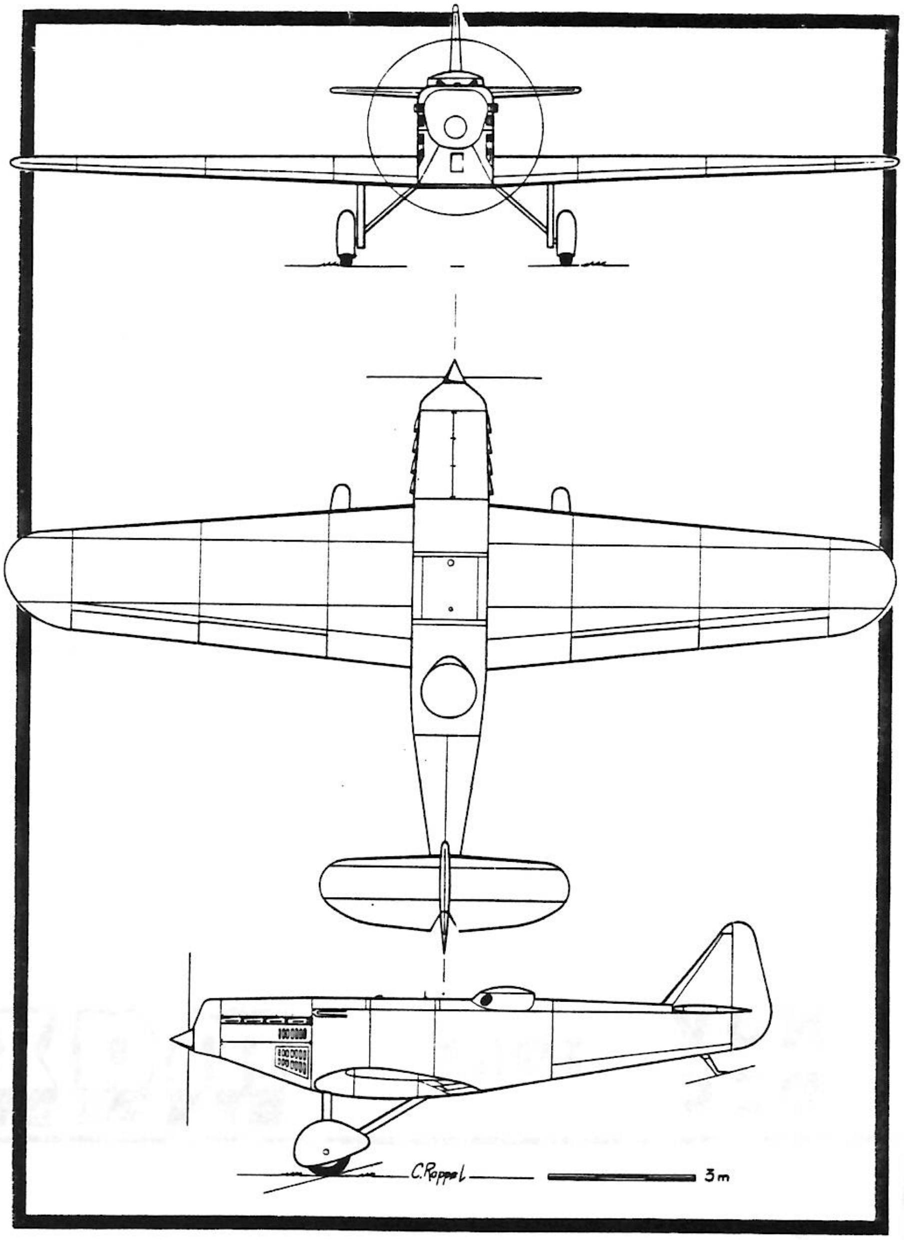
At the larger negative angles of attack or at low lift coefficients we have stalling on the lower surface due to its camber. At about 7° or $C_L=0.2$ the "sane" flow condition begins to establish and the drag coefficient $C_{Do}$ decreases slowly. At $C_L=0.6$ the minimum drag is attained and the flat peak in this region indicates that also at this low RN we have a small laminar flow effect! You can see that faint swelling in the $C_{D\ minimum}$ region. This is characteristic of the selected family of airfoils and sometimes the laminar bump is really pronounced.

You may say that the $C_{D\ min}$ is much too large for being laminar flow, but remember first that we are working with a RN=1 x $10^5$ and that there can only be a fraction of the whole surface at laminar flow conditions. When we proceed now to higher lift conditions something much more surprising happens. At zero angle of attack or $C_L=1.0$ just in the region where the #289 and #290 section types had the complete breakdown, we can clearly observe a sudden change in the drag to some smaller value. The polar curve is shifted to the left by about ¼ of the $C_D$ value. When I first drew the polar curve along the points plotted I could not get a smooth curve through the points and I feared an error in the calculations. But I had been right. I checked some other measurements of similar sections and they turned out to have the same discontinuity as you can see on Fig. 8 which illustrates the results of three of the cambered sections. Sometime later I was looking at some recent wind tunnel tests and I found that this discontinuity of the section drag coefficient appeared in many different tests even in the higher RN range.

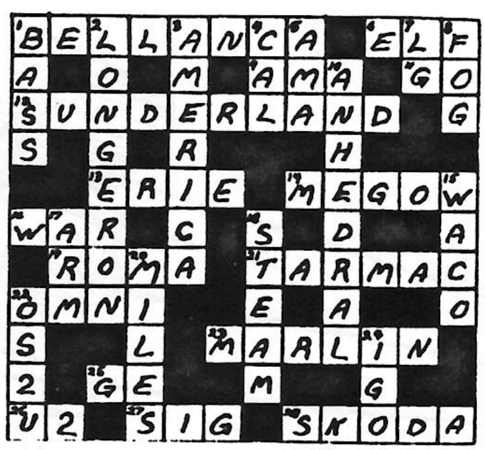
The question arises, what flow effect causes this most favorable decrease in drag? I think there is only one answer, and that is a considerable increase of the laminar flow range on the lower surface of the wing. At the larger angles of attack we have on the lower surface a continuous decrease of pressure or increase of velocity. This flow condition has a stabilizing effect on the boundary layer, so that a more extended laminar flow along this surface is produced. By these means the drag decreases to a lower value and the point where this happens is usually also the point of the absolute maximum of $L/D_o$ in respect to $C_L/C_{Do}$. In the low RN range the discontinuity is more pronounced and we therefore get pretty high values of the absolute $L/D_o$ being sometimes even better than in the higher RN region!

I will not go too far into the physical background of this effect, but it is most important for us to realize that the lower surface is the "sacred surface" on the wing of a model (or even a glider). To get this high performance point of L/D and sinking speed, you have to keep the lower surface as clean as possible and so smooth that "even a fly would break a leg on this slick polished slide."

It is interesting to mention that the profiles showing this effect have almost an "undercamber," as they call it. The sections with a straight lower surface as the Clark Y types do not have such a pronounced discontinuity effect. That means that the velocity distribution should have a certain shape. This could be investigated more theoretically. For the model designer it is sufficient to know what he can expect and how to get it.




GUERCHAIS T110 Stratospheric Monoplane
Almost completed- never flown.
(From Le Fana de l'Aviation)




Solution to Dave Stott's puzzle in the last MAX-FAX.

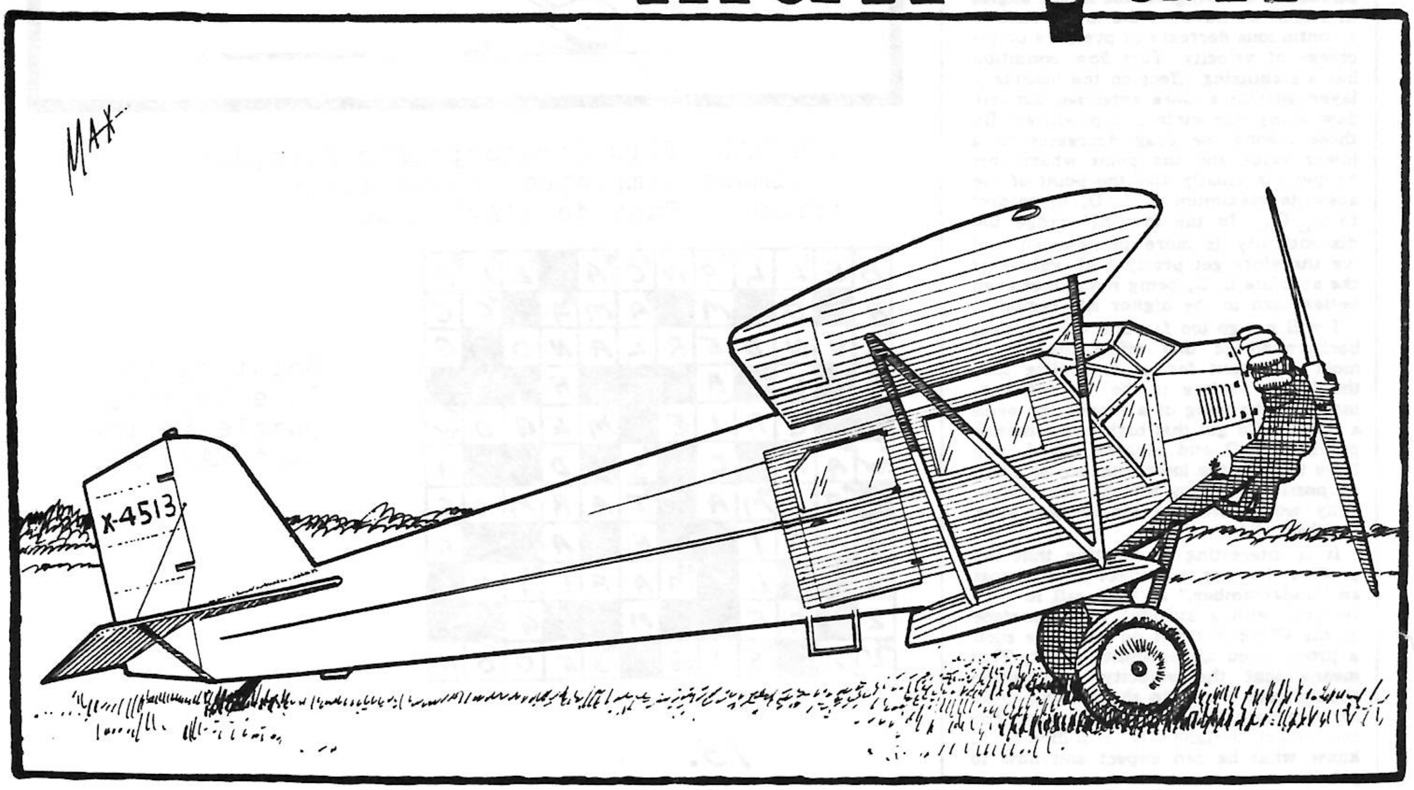
FIRST CLASS

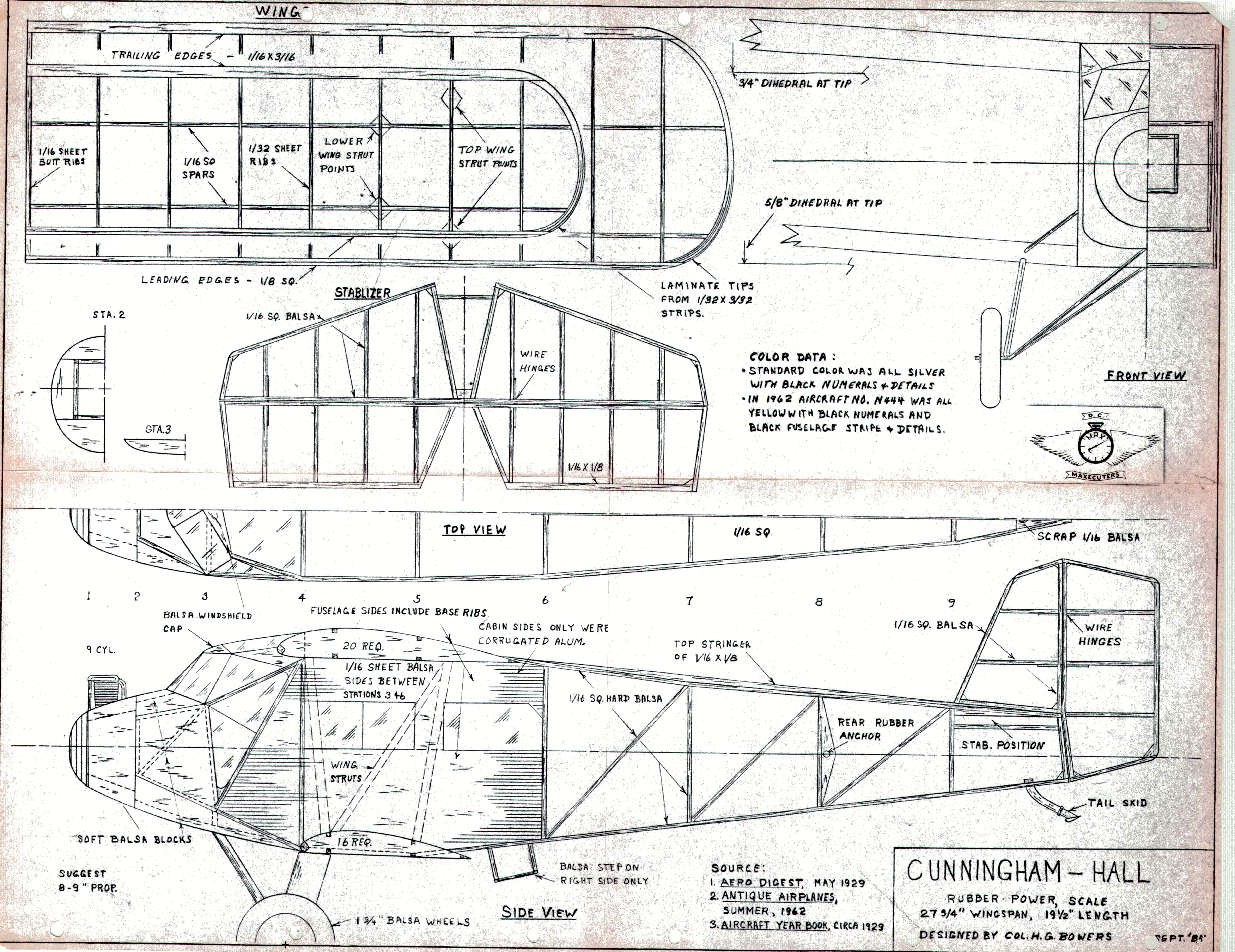
20008 Spur Hill Dr.
Gaithersburg MD 20879

NOV
DEC

1985

# max-fax




WING
TRAILING EDGES - 1/16 X 3/16
1/16 SHEET BUTT RIBS
1/16 SQ SPARS
1/32 SHEET RIBS
LOWER WING STRUT POINTS
TOP WING STRUT POINTS
LEADING EDGES - 1/8 SQ.
LAMINATE TIPS FROM 1/32 X 3/32 STRIPS.
3/4" DIHEDRAL AT TIP
5/8" DIHEDRAL AT TIP
FRONT VIEW
STABLIZER
1/16 SQ. BALSA
WIRE HINGES
1/16 X 1/8
STA. 2
STA. 3
COLOR DATA:
• STANDARD COLOR WAS ALL SILVER WITH BLACK NUMERALS & DETAILS
• IN 1962 AIRCRAFT NO. N444 WAS ALL YELLOW WITH BLACK NUMERALS AND BLACK FUSELAGE STRIPE & DETAILS.
D.C.
MAXECUTERS
TOP VIEW
1/16 SQ.
SCRAP 1/16 BALSA
1
2
3
4
5
6
7
8
9
BALSA WINDSHIELD CAP
FUSELAGE SIDES INCLUDE BASE RIBS
CABIN SIDES ONLY WERE CORRUGATED ALUM.
9 CYL.
20 REQ.
1/16 SHEET BALSA SIDES BETWEEN STATIONS 3 & 6
TOP STRINGER OF 1/16 X 1/8
1/16 SQ. BALSA
WIRE HINGES
1/16 SQ. HARD BALSA
REAR RUBBER ANCHOR
STAB. POSITION
WING STRUTS
TAIL SKID
SOFT BALSA BLOCKS
16 REQ.
SUGGEST 8-9" PROP.
BALSA STEP ON RIGHT SIDE ONLY
1 3/4" BALSA WHEELS
SIDE VIEW
SOURCE:
1. AERO DIGEST, MAY 1929
2. ANTIQUE AIRPLANES, SUMMER, 1962
3. AIRCRAFT YEAR BOOK, CIRCA 1929
CUNNINGHAM - HALL
RUBBER POWER, SCALE
27 3/4" WINGSPAN, 19 1/2" LENGTH
DESIGNED BY COL. H.G. BOWERS
SEPT. '85