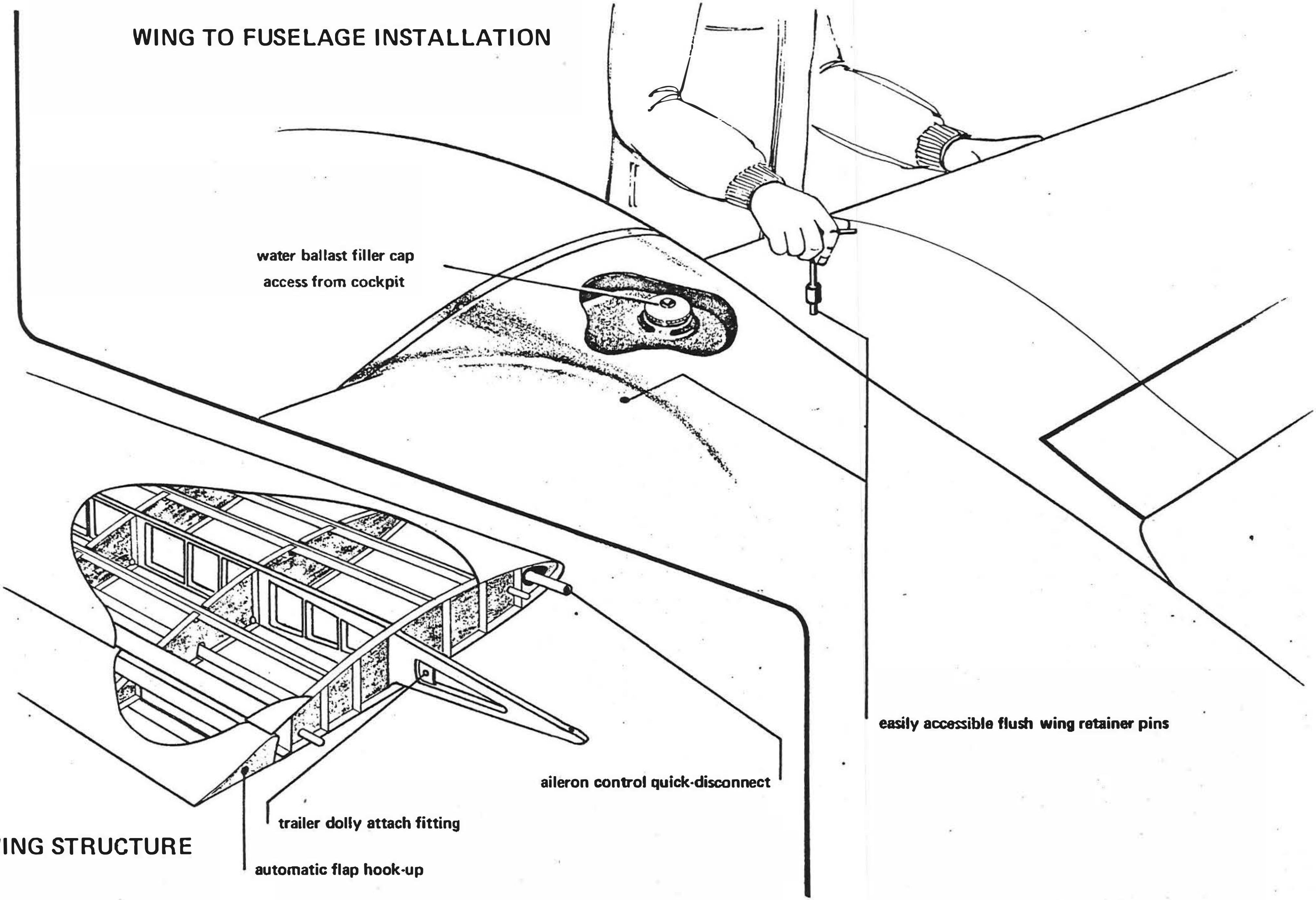
APPENDIX I

ADDITIONAL A.C. DATA

LP-15, N-1, N6LS

This Appendix includes additional descriptive material pertaining to the Nugget Sailplane as flown in 1973.

WING TO FUSELAGE INSTALLATION



WING STRUCTURE

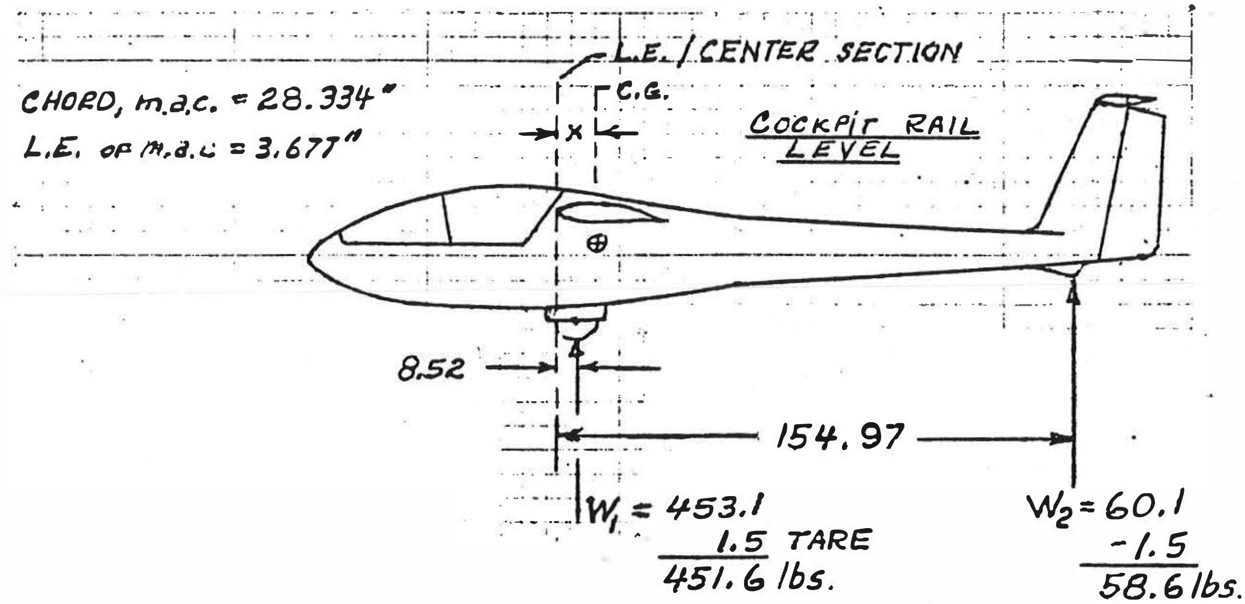
NUGGET DATA – 1973

SPAN	49.2 FT.
AREA	109.3 SQ. FT
ASPECT RATIO	22.2
AVG. CHORD	26.65 INCHES = 2.22 FT.
AIRFOIL	FX 67 170 – 150
THICKNESS	17.3%, CENTER SECTION & ROOT OF OUTER PANEL 15.3%, TIP
FLAPPED AREA	73% OF TOTAL WING AREA
FLAP AREA	12.32 SQ. FT.
FLAP H.L.	17.5% CHORD
INCIDENCE	0°
DIHEDRAL	3° ON GROUND
AILERON H.L	25% CHORD
AILERON TRAVEL	30° UP, 13° DOWN
TAPER RATIO	36.9"/14.7" = 2.5
WING SURFACE	MAX. WAVINESS = .006" – OVERALL ABOUT EQUAL TO AVERAGE "AS DELIVERED" GLASS WING – BUT ONLY AFTER EXTENSIVE FILLING OF N-1 WINGS
SPAN, HOR. TAIL	93"
CHORD	18"
AREA	11.55 SQ. FT.
HINGE LINE	55% CHORD
THICKNESS	9% – SYM.
INCIDENCE	– 1 3/4 DEG.
AIRFOIL, VERT TAIL	63_2 015
HINGE LINE	64%
GEAR, GD. CLEARANCE	7" NO LOAD, 6" STATIC, 5 1/4" FULL DEFLECTION
C.G. RANGE	27% FWD. LIMIT (GEAR LOCATION) 36% AFT LIMIT. BASED ON ACCEPTABLE FLYING CHARACTERISTICS.
BARE A.C. WT.	488 lbs – (INCLUDES APPROX. 50 lbs EXCESS PAINT & FILLER, BALLAST, TEST SYSTEMS)
EMPTY WT.	520 lbs

WEIGHT & BALANCE

LAISTER LP-15, N-1, N6LS
APRIL 28, 1973
FOR FIRST FLIGHT

#1 - READY TO FLY, NO PILOT OR CHUTE



$W_1 + W_2 = \underline{510.2 \text{ lbs}}$

$510.2\, x = (451.6 \times 8.52) + (58.6 \times 154.97) = 3847.6 + 9081.2$

$x = \dfrac{12928.8}{510.2} =$ 25.34" AFT L.E. CENTER SECTION

#2 - SAME AS ABOVE + FULL WATER

$W_1 + W_2 = (609.7 - 1.5) + (68 - 2.5) = 608.2 + 65.5$

$= \underline{673.7 \text{ lbs.}}$

$$x = \frac{(608.2 \times 8.52) + (65.5 \times 154.97)}{673.7} = \frac{5181.9 + 10{,}150.5}{673.7}$$

$x =$ 22.76" AFT L.E. OF CENTER SECTION

WEIGHT & ARM — WATER BALLAST

WT. = 673.7 - 510.2 = 163.5 lbs. OF WATER

$$ARM_{H_2O} = (15,332.435 - 12,928.2) \div 163.5$$

$$= \frac{2404.2}{163.5} = 14.70'' \text{ AFT L.E. OF CENTER SECTION}$$

NOTE: ~ WATER FILL WITH A.C. LEVELLED = 163.5 lbs
ADD. FILL, GR. ATTITUDE = 4.5 lbs.
WT. OF WATER (TAIL DOWN) = 168.0 lbs.
@ 14.8"

WT. #3 - SAME AS #2 - WATER JETTISONED ONLY RESIDUAL H_2O LEFT

WT. = (456.5 - 1.5) + (61.5 - 2.5) = 514 lbs

$$X = \frac{(455 \times 8.52) + (59 \times 154.97)}{514}$$

X = 25.33 AFT L.E. OF CENTER SECTION

WT. #4 - FLIGHT LOADING - SAME AS #1 + PILOT & CHUTE

PILOT WT = 186.4 lbs (DRESSED FOR FLT.) = 186.4 lbs
PARACHUTE = 19.9 lbs
NO RESIDUAL WATER

GROSS WT. = (699.1 - 1.5) + (20.9 - 2.5) = 716 lbs

$$X = \frac{(697.6 \times 8.52) + (18.4 \times 154.97)}{716}$$

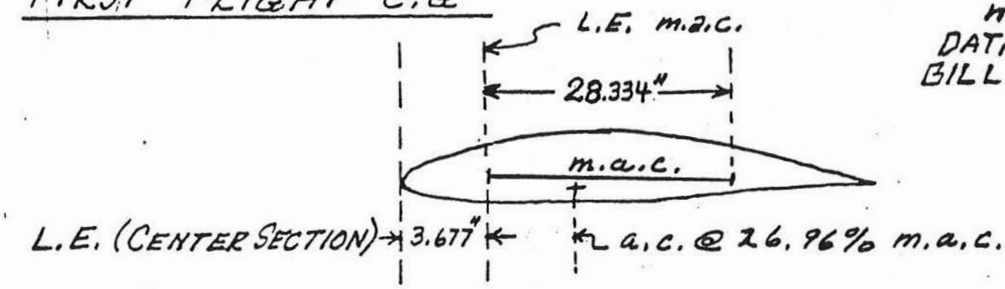
$$X = \frac{8795}{716} = 12.284'' \text{ AFT L.E. CENTER SECTION}$$

DIFF. WTS 1&4 : PILOT & CHUTE WT. = 716 - 510.2 = 205.8
ACTUAL : 186.4 + 19.9 = 206.3

$$ARM(\text{PILOT \& CHUTE}) = \frac{12928.8 - 8795}{206} = 20.1'' \text{ FWD. L.E. OF C.S.}$$

FIRST FLIGHT C.G

m.a.c. DATA FROM BILL LAISTER



C.G. IS 12.284" AFT L.E. OF CENTER SECTION

C.G. IS 12.284 - 3.677 = 8.607" AFT. L.E. m.a.c.

C.G. IS $\frac{8.607}{28.334}$ = 30.38 % m.a.c.

BASED ON AVG. CHORD:

AVG. CHORD = 26.65"
L.E. AVG. CHORD IS 3.62" AFT. L.E. CENTER SECTION

C.G. IS 12.284 - 3.62 = 8.66" AFT. L.E. AVG. CHORD

C.G. IS $\frac{8.66}{26.65}$ = 32.51 % OF AVG. CHORD.

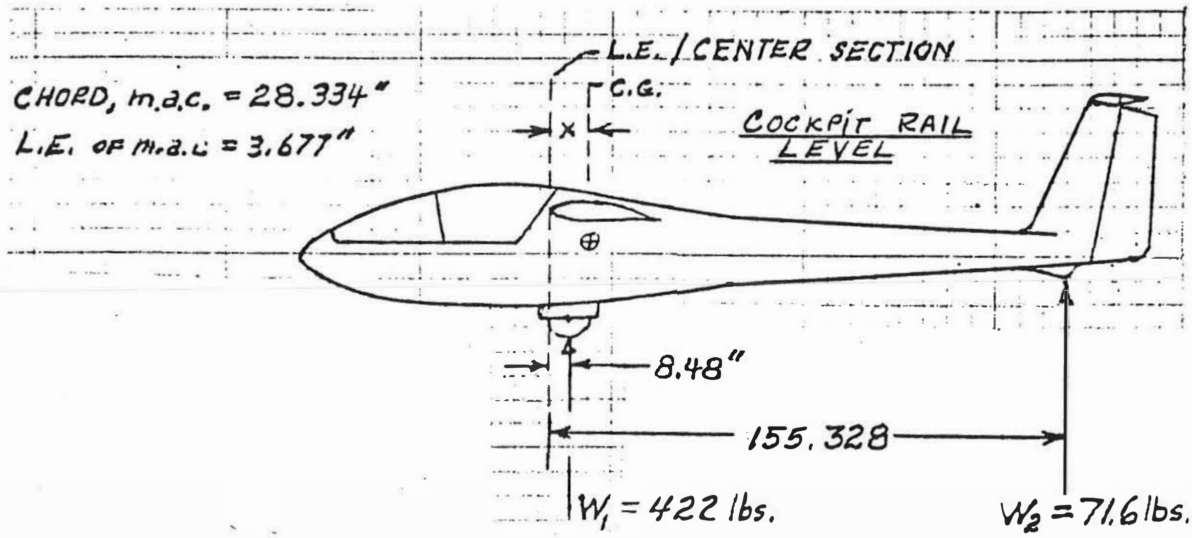
EQUIPMENT INSTALLED

	WT. lbs.	ARM	MOMENT
INSTRUMENT PANEL, INSTRUMENTS, RADIO, AUDIO, LEADS, WIRING, TUBING, AIR VENT	15.4	45 FWD	-693
SUB PANEL & FWD FLOOR, METER, SPEAKER, WIRING	2.4	38 Fwd	- 91.2
BOOM MIKE	.6	8 Fwd	- 4.8
CUSHIONS	2.5	27 Fwd	- 67.5
BATTERY	3.3	10 AFT	+ 33.0
	24.2 lbs		

WEIGHT & BALANCE

LAISTER LP-15, N-1, N6LS
AFTER MODS.
MAY 25, 1973

#1. BARE SAILPLANE - AFTER MODS.



WEIGHT = 422 + 71.6 = 493.6 lbs

$$x = \frac{(422 \times 8.48) + (71.6 \times 155.328)}{493.6} = \frac{3578.6 + 11,121.5}{493.6}$$

$$x = \frac{14,700.1}{493.6} = 29.78'' \text{ AFT. L.E. OF CENTER SECTION}$$

ADD EQUIPMENT:

ITEM	WT.-lbs	ARM	MOMENT
INSTR. PANEL, INSTRUMENTS, RADIO, AIRVENT	15.4	-45	-693
SUB PANEL, SPEAKER, METER, FWD. FLOOR	2.4	-38	-91.2
BOOM MIKE	0.6	-8	-4.8
CUSHIONS	2.5	-27	-67.5
BATTERY	3.3	+10	+33.0
	24.2 lbs.		-823.5

READY TO FLY – MAY 25, 1973 – NO PILOT OR CHUTE :

WT. = 493.6 + ADDED EQUIPMENT (24.2) = 517.8 lbs.

$$X = \frac{14700.1 - 823.5}{517.8} = \frac{13876.6}{517.8} = 26.8\text{" AFT OF L.E. OF CENTER SECT.}$$

EFFECT OF MODS : ΔW = 517.8 − 510.2 = 7.6 lbs
Δ C.G = 26.8 − 25.34 = 1.46" (5%) AFT

REDESIGNED FLAP ACTUATION	N.C.
REWORKED GEAR	N.C
NEW NOSE AIR VENT	N.C.
NEW RELEASE	N.C.
REPLACE CANOPY	N.C.
REPAIR TAIL CONE	+ 1.0#
ADD 5 lbs LEAD TO TAIL (10# TOTAL)	+ 5#
PAINT & FILL, Lt. WING, FUSELAGE	1.6#
	7.6#

READY TO FLY WITH PILOT & CHUTE

(1) NO WATER

GROSS WT. = 517.8 + 207.2 = 725 lbs.

$$X = \frac{13876.6 - (207.2 \times 20.1)}{725} = \frac{13876.6 - 4164.7}{725}$$

(9711.9)

X = 13.4" AFT. L.E. OF CENTER SECTION

$$C.G. = \frac{13.4 - 3.677}{28.334} = \frac{9.723}{28.334} = 34.3\%\ m.a.c.$$

(2) WITH WATER : GROSS WT. = 725 + 168 = 893 lbs.

$$X = \frac{9711.9 + (168 \times 14.8")}{893} = 13.66\text{" AFT L.E.}$$

$$C.G = \frac{13.66 - 3.677}{28.334} = 35.3\%\ m.a.c.$$

NOTE:

FOR MOST OF CONTEST FLYING (JUNE–SEPT):

(1) PILOT WT. WAS 180 lbs
(2) CARRIED 4# MISC ITEMS BACK OF SEAT
(3) 3-4 lbs RESIDUAL WATER

GROSS WT. = 725#, C.G. @ 34.8% M.A.C.

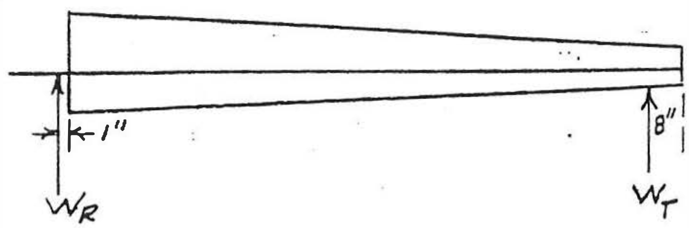
(4) WITH WATER, ALSO CARRIED ADDITIONAL EMERGENCY KIT & DRINKING WATER

GROSS WT = 900#, C.G. @ 35.5%

WING PANEL WEIGHT

PANEL WT. = $W_R + W_T$

LEFT = 71.5 + 41.5 = 113#
RIGHT = 72.4 + 41.4 = 113.8#



BARE WT. ESTIMATE:

BARE SAILPLANE WEIGHED 493.6 WHICH INCLUDED 10 lbs BALLAST. 5 lbs of ballast WOULD BE REQUIRED FOR 170 lb PILOT (STD) THIS ALSO INCLUDED APPROX 0.5 lbs. RESIDUAL WIRING. N-1 BARE WEIGHT WITH 5 lbs ballast IS 488 lbs WITH NO UPHOLSTERY BUT WITH FOLLOWING EXCESS WT.:

(1) EXCESS FILLER, PAINT =	30 lbs
(2) TAIL CONE REPAIR	1
(3) TEST SYSTEMS	10
	41 lbs.

ON THIS BASIS, PROD. LP-15's COULD HAVE BARE WEIGHT = 447 lbs IF 5# BALLAST (REQ. FOR NORMAL C.G.) NOT COUNTED, BARE WEIGHT COULD POSSIBLY BE 442 lbs.

NOTE: FULL NORMAL CONTEST EQ. INCL. O_2 should be 50 to 60 lbs

30% [illegible] –

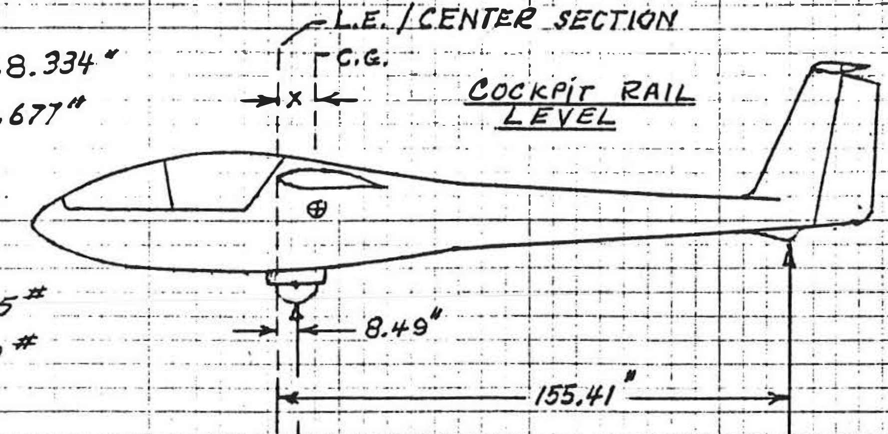
WEIGHT & BALANCE

NUGGET N6LS (TR.
LAISTER LP-15, #1
JAN. 10, 1974

34.% AFT LIMIT
DRY – ready to fly –

(A) – WEIGHING – SAILPLANE COMPLETE, NO PILOT OR CHUTE

CHORD, m.a.c. = 28.334"
L.E. OF m.a.c = 3.677"



Lt. WING = 115.5 #
RT. WING = 114.0 #

W_1 = 468 lbs – GROSS
(11.8) – TARE
= 456.2 lbs

W_2 = 68.3 lbs – GROSS
(7.4) – TARE
60.9 lbs.

$$X = \frac{(8.49 \times 456.2) + (155.41 \times 60.9)}{456.2 + 60.9} = \frac{3873.1 + 9464.5}{517.1}$$

$$X = \frac{13337.6}{517.1} = 25.79'' \text{ AFT L.E. OF CENTER SECTION}$$

EMPTY EQUIPED WEIGHT = 517.1 lbs.

INCLUDES: –

INSTRUMENTS & PANELS	15.0 lbs	29.6 lbs.
RADIO & ANTENNA	3.5	
O_2 REG. & LINE (No BOTTLE)	1.5	
AFT STATIC INSTALLATION	1.0	
T.E. VENTURI, MOUNT & LINE	1.5	
BATTERY & BRACKET	3.0	
GEAR WARNING SYSTEM	1.1	
CAMERAS	1.0	
SEAT CUSHIONS	2.0	

NOTE: – A/C BARE WEIGHT IS 487.5 lbs., APPROX 85 lbs more than ORIGINAL BROCHURE ESTIMATE. WEIGHT OF EXCESS FILLER & PAINT (20.0 lbs.), AIRLERON MODS. FOR INTERCONNECT, REPAIR ON AFT FUSELAGE, AND 5 lbs LEAD BALLAST ON VERT. TAIL SPAR ACCOUNT FOR 33 lbs OF THIS — BUT BASIC A/C IS AT LEAST 50 lbs OVER WEIGHT IT SHOULD BE.

(B) – LOADING WITH 190 lb (PILOT & CHUTE) @ 20.1" Fwd of L.E./CENTER SEC.

$$X = \frac{13337.6 - (20.1 \times 190)}{517.1 + 190} = \frac{13337.6 - 3819}{707.1} = 13.46'' \text{ AFT L.E./CENTER SECTION}$$

$$C.G. = \frac{13.46 - 3.677}{28.334} = 34.5\% \text{ OF MEAN AERODYNAMIC CHORD}$$

GROSS WEIGHT = 707.1 lbs.

(C) SEE FOLLOWING PAGE FOR LOADING WITH WATER BALLAST

WEIGHT & BALANCE — LP-15

 — JAN 10, 1974

Ⓒ - LOADING - SAME AS Ⓑ BUT WITH 168 lbs OF WATER AT 14.7" AFT. L.E. OF CENTER SECTION

$$X = \frac{9518.6 + (14.7 \times 168)}{707.1 + 168}$$

$$X = \frac{11,988.2}{875.1}$$

X = 13.7" AFT. L.E. OF CENTER SECTION

$$C.G = \frac{13.7 - 3.677}{28.334} = \frac{10.023}{28.334}$$

CG = 35.4 % m.a.c.

GROSS WEIGHT = 875.1 lbs.

Ⓓ MINIMUM PILOT & CHUTE WEIGHT = 175 lbs.

175
22
153

Ⓔ WITH CONTEST EQUIPMENT:

OXYGEN BOTTLE = 10.0 lbs
EMERGENCY KIT = 10.0 lbs
LUNCH, WATER, MAPS = 5.0 lbs.

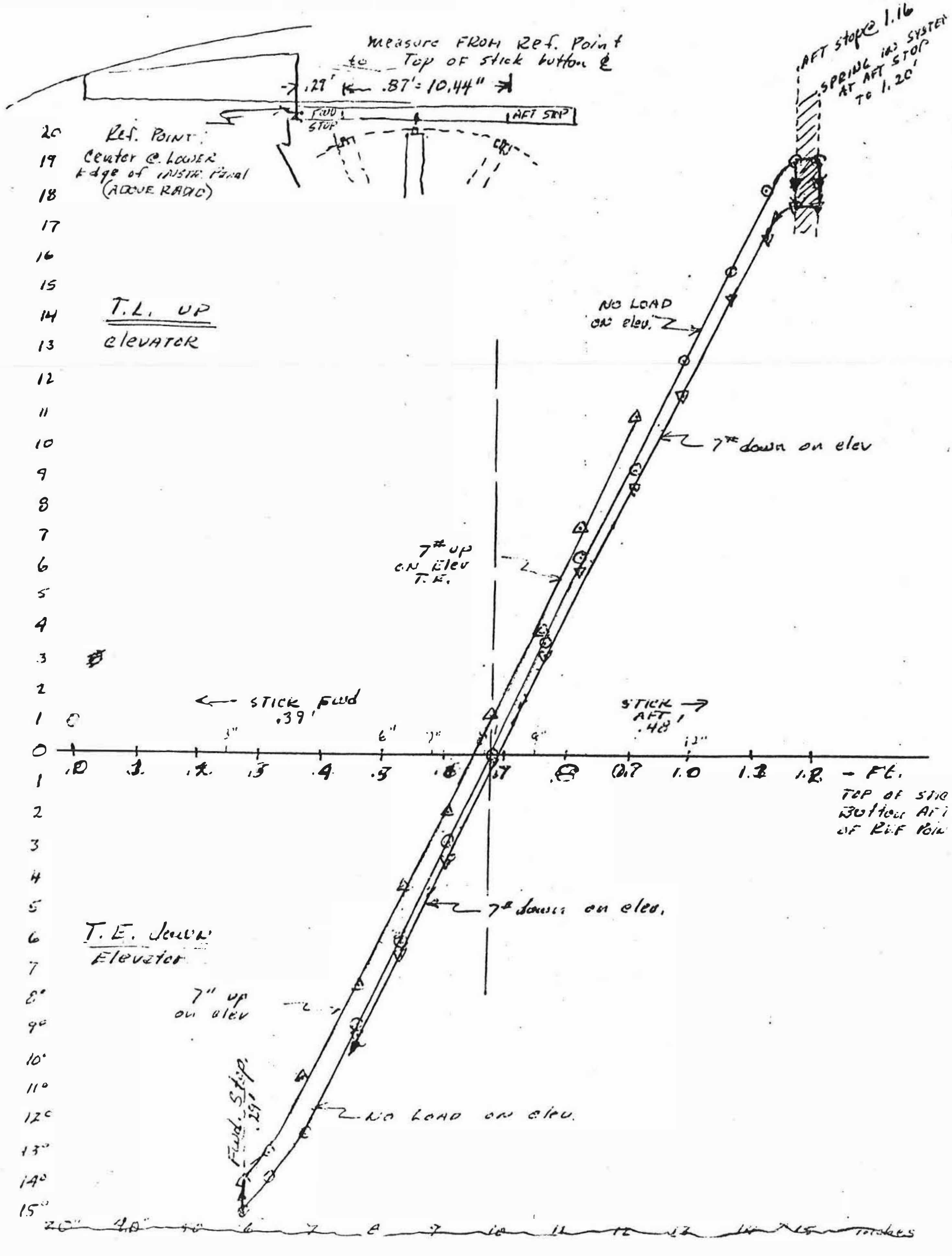
GROSS WEIGHT WILL BE 732# (C.G. @ 34%) - NO WATER
900# (C.G. @ 35%) - WITH WATER

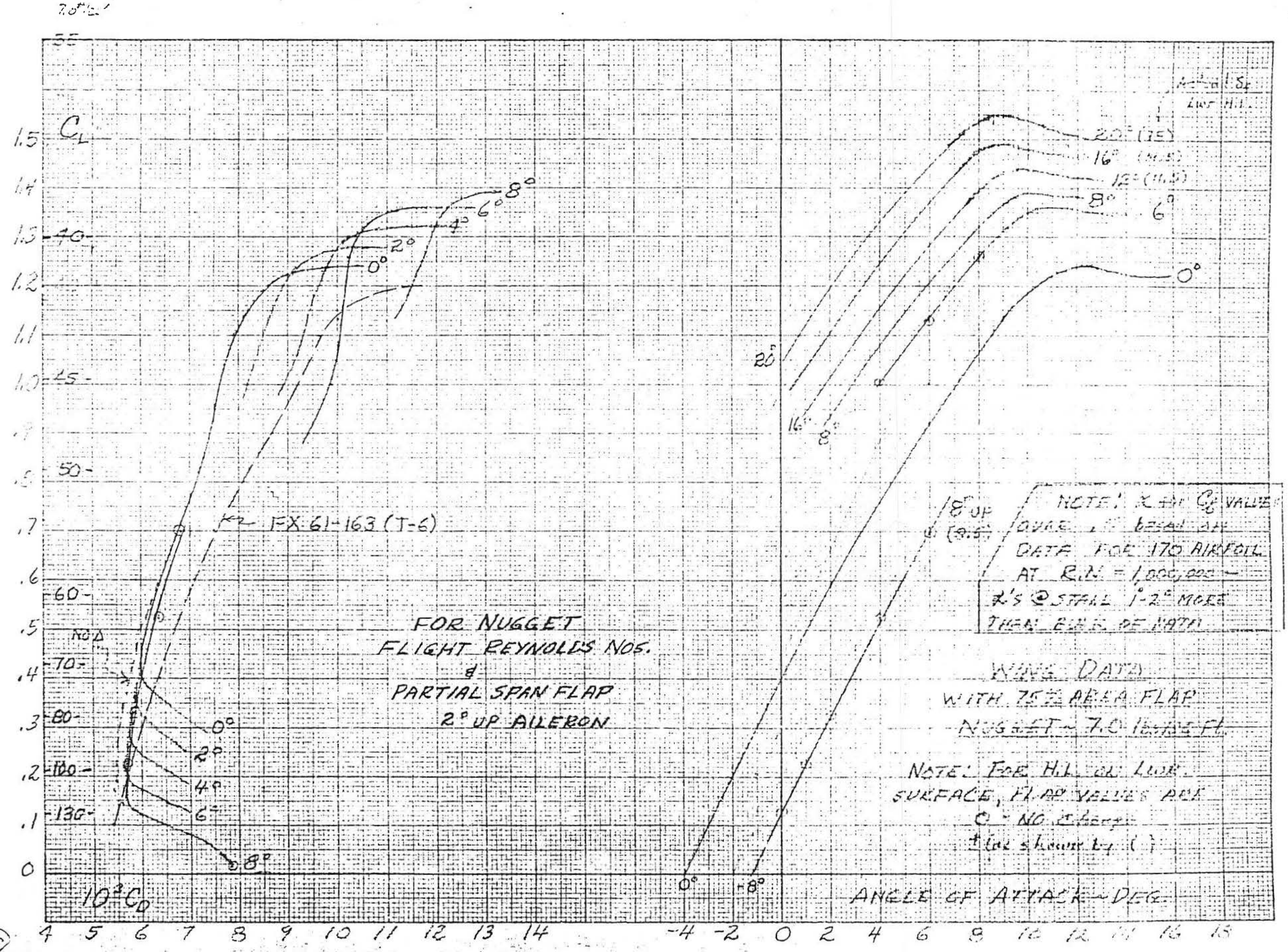
Ⓕ WING AREA IS 109.5 □'

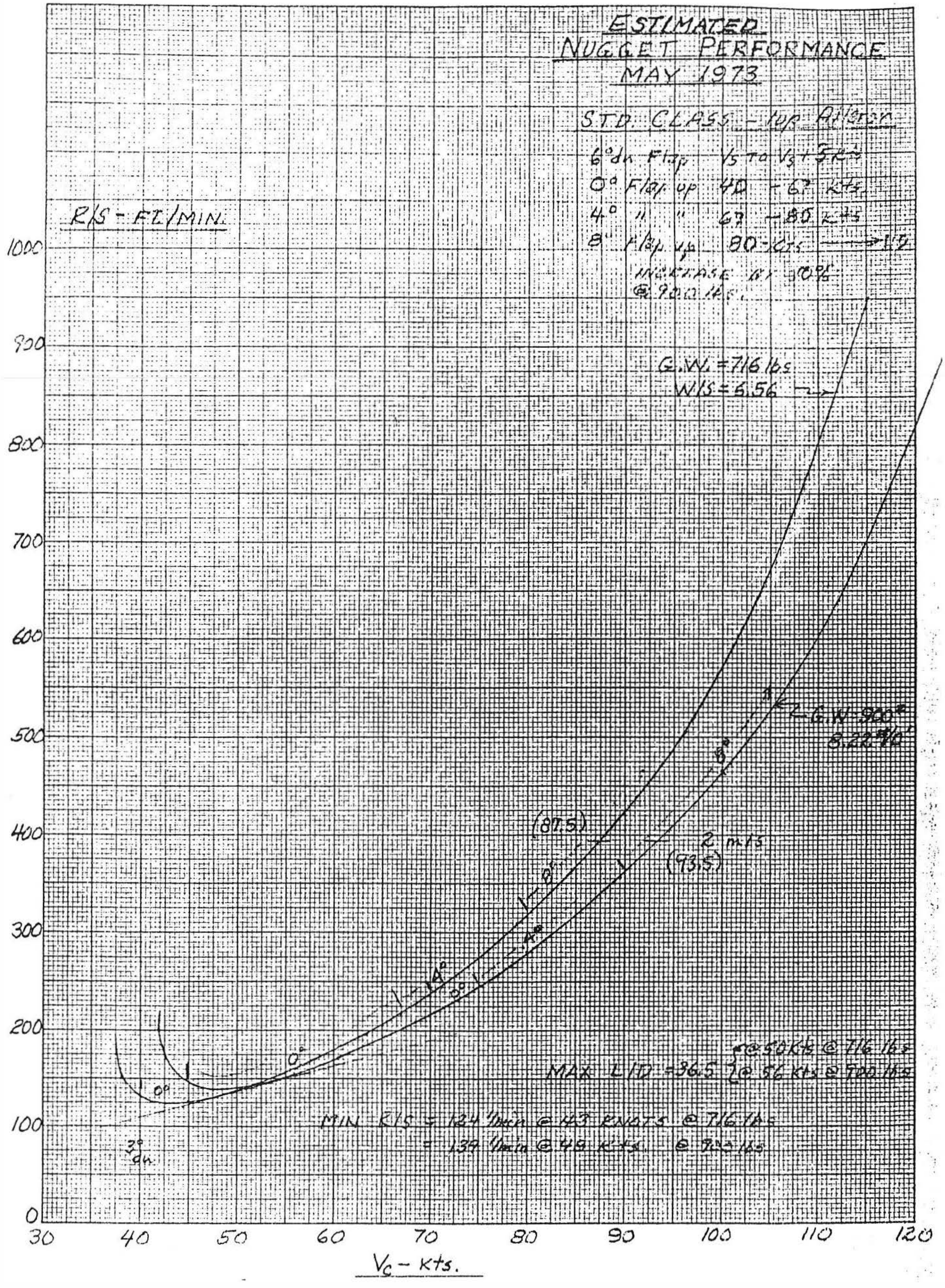
WING LOADING, W/S = 6.45 lbs/sq. Ft. @ 707 lbs
W/S = 6.68 lbs/sq. Ft. @ 732 lbs
W/S = 7.99 lbs/sq. Ft. @ 875 lbs.
W/S = 8.22 lbs/sq. Ft. @ 900 lbs.

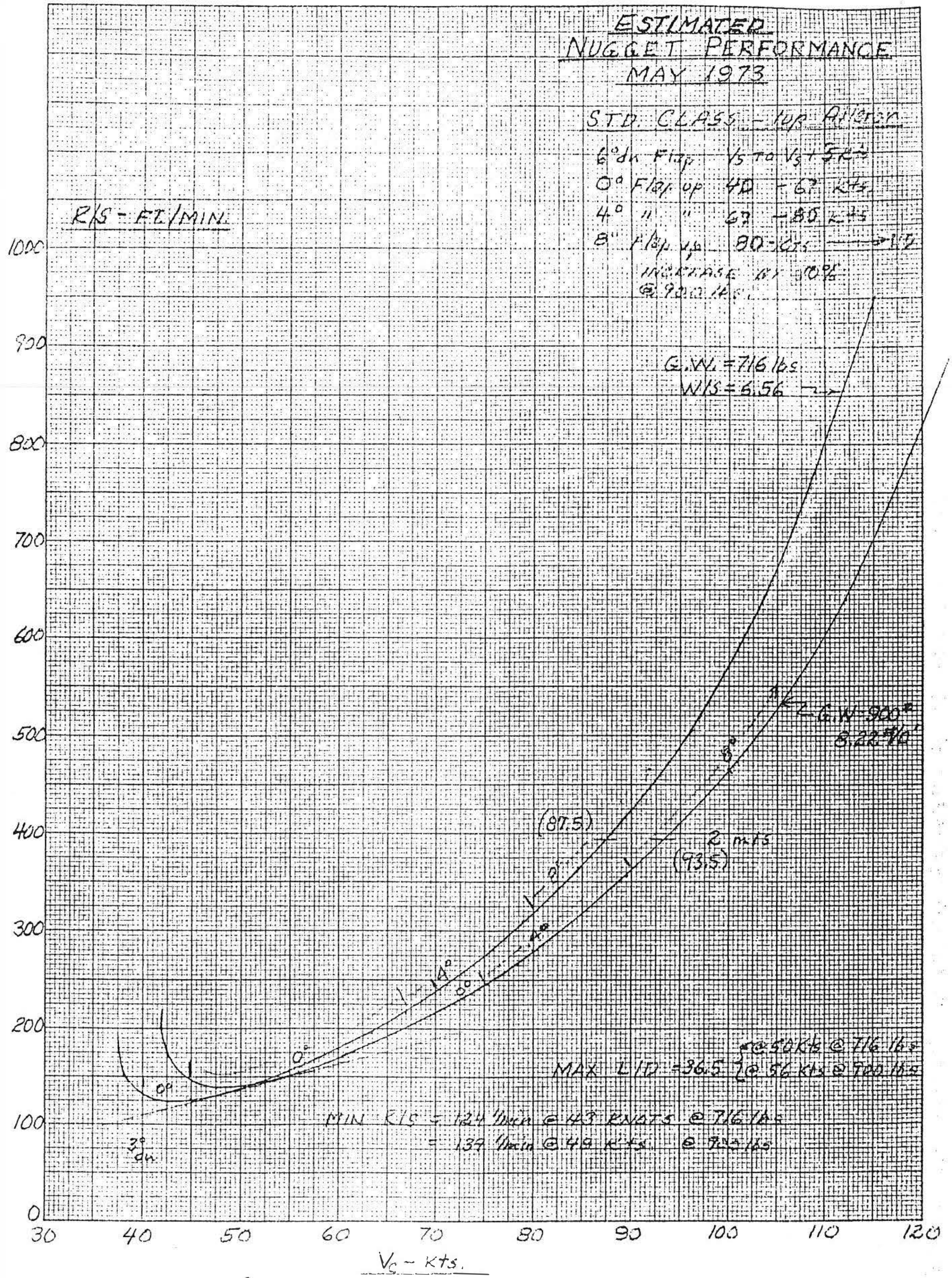
PAUL F. BIKLE
JAN 10, 1974

Elevator vs Stick Position Calibration, April 30, 1973
(P7B & B.L.) Mojave Airport.

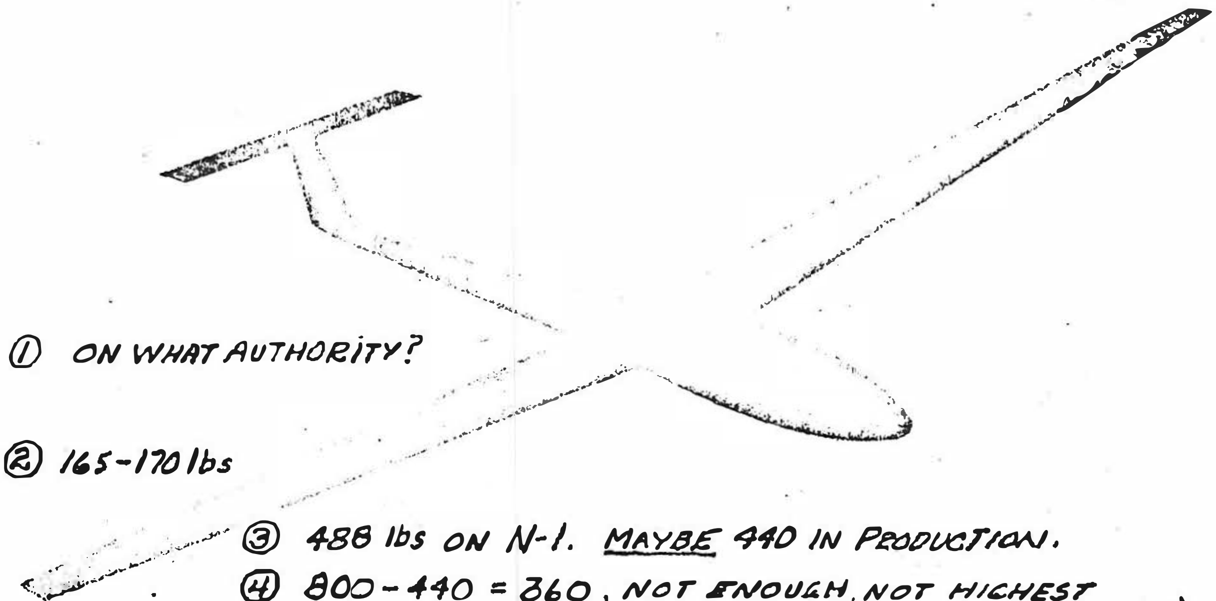



C_L
$10^3 C_D$
FX 61-163 (T-6)
FOR NUGGET
FLIGHT REYNOLDS NOS.
&
PARTIAL SPAN FLAP
2° UP AILERON
NOTE: α + C_L VALUES
DATA FOR 170 AIRFOIL
AT R.N. = 1,000,000
α's @ STALL 1°-2° MORE
WING DATA
WITH 75% AREA FLAP
NUGGET ~ 7.0 lbs/SQ Ft.
NOTE: FOR H.L. ON LWR.
SURFACE, FLAP VALUES ARE
0 - NO CHANGE
ANGLE OF ATTACK ~ DEG.


ESTIMATED
NUGGET PERFORMANCE
MAY 1973
STD. CLASS - w/o Aileron
6° dn Flap Vs to Vs + 5 kts
0° Flap up 40 - 67 kts
4° " " 67 - 80 kts
8° Flap up 80 - kts
INCREASE BY 10%
@ 900 lbs.
R/S - FT/MIN.
G.W. = 716 lbs
W/S = 6.56
G.W. 900#
8.22#/□'
(87.5)
(93.5)
2 m/s
MAX L/D = 36.5 {@ 50 Kts @ 716 lbs / @ 56 Kts @ 900 lbs
MIN R/S = 124'/min @ 43 KNOTS @ 716 lbs
= 139 '/min @ 49 Kts @ 900 lbs
1000
900
800
700
600
500
400
300
200
100
0
30
40
50
60
70
80
90
100
110
120
Vc - Kts.


ESTIMATED
NUGGET PERFORMANCE
MAY 1973
STD. CLASS
0° Flap up 40 - 67 Kts
4° " " 67 - 80
8° Flap up 80
G.W. = 716 lbs
W/S = 6.56
G.W. 900#
8.22
(87.5)
(93.5)
2 mts
MAX L/D = 36.5 @ 50 Kts @ 716 lbs
@ 56 Kts @ 900 lbs
MIN R/S = 124 '/min @ 43 KNOTS @ 716 lbs
= 139 '/min @ 49 Kts
R/S - FT/MIN.
0
100
200
300
400
500
600
700
800
900
1000
30
40
50
60
70
80
90
100
110
120
V - Kts.

THE NUGGET



low you can order an American built 15 meter sailplane designed or highest performance and embodying all the latest features ermitted.

he NUGGET is the world's foremost advanced design sailplane the 15 meter Standard Class. It is designed to the 1974 CIVV rovisions accepted by the Federation Internationale eronautique sporting code.

has full span flaps (except for the ailerons), and provisions for 35 lbs. of water ballast. The flapped airfoil section we are using presents a 15% improvement over the earlier Wortmann sections esently being used on many competitive ships. The NUGGET ater ballast system is unique in that it is carried in the fuselage enter section of the wing, and thus does not involve the movable wing panels as required in other ships to connect the ater dump lines or dump controls. Neither is the roll rate lversely affected when flying with water ballast aboard.

is a very sleek and clean design with glass-like aerodynamic rfaces throughout. We have combined optimum performance ith durable and reliable advanced construction methods, ease of ght characteristics, ease of assembly and disassembly, and ckpit comfort and visibility for all to be proud to own. The UGGET offers one of the lightest minimum wing loadings (5.5 s.f.), the highest useful load (375 lbs.), and one of the highest aximum wing loadings (7.35 p.s.f.) through the use of water allast, available in any Standard Class ship today.

① ON WHAT AUTHORITY?

② 165-170 lbs

③ 488 lbs ON N-1. MAYBE 440 IN PRODUCTION.

④ 800 - 440 = 360, NOT ENOUGH, NOT HIGHEST

⑤ 440 + 50 (EQ.) + 170 (PILOT) + 20 (CHUTE) = 680# = 6.2 (W/S)

⑥ 42 m.p.h. @ 6.2 #/SQ.FT. (0 FLAP)

SPECIFICATIONS

Wing Span	49.2 ft.	Weights	
Wing Area	109 sq. ft.	Each Wing Panel	105 lbs.
Aspect Ratio	22.2	Empty	3 (425) lbs.
		Max. Gross	800 lbs.
Fuselage Length	21 ft.	Useful Load	4 (375) lbs.
Fuselage Height	34 in.	Maximum Placard Speed	140 mph
Cockpit Width.	24 in.	Stall Speed – 0 Flap	6 (39) mph

BASED ON SAME EQ, PILOT & chute WTS & #1 1-35 BARE WT. +25#

COMPARISON OF THE NUGGET'S HIGH PERFORMANCE FEATURES WITH THE BEST OF THE 15 METER SAILPLANES OUT OF EUROPE AND WITH THE LATEST ALL FIBERGLASS AMERICAN DESIGN

(Based on the best information available to us.)

May, 1972

① 465 EQ. EMPTY WEIGHT -50# EQ (LINE 3 BELOW TABLE) = 415# ~ NOT 425# SHOWN ON SPEC. PAGE (18) ~ AND NOT 488# FOR BARE N-1 OR APPRO 440# - MY OPTIMISTIC EST. OF EMPTY WEIGHT OF PROD. SHIP.

② MIN. GROSS WEIGHT = 440 + 50 + 170 + 20 = 680# NO WATER

(440 = EST. PROD. BARE SHIP WT.; 50 = EQUIP. - REF LINE 3; 170 = STANDARD PILOT WT.; 20 = chute)

Sailplane	Equipped Empty Wt. lbs.	Min. Gross Wt. lbs.	Max. Gross Wt. lbs.	Useful Load lb.	Water Ballast lb.	Load Eff. Useful Load / Empty Weight	Min. Wing Loading p.s.f.	Max. Wing Loading p.s.f.	Wing Area sq. ft.	Aspect Ratio	Max. Speed mph	Flap Conditions
1-35	450	640	900	450	300	100%	6.05	8.7	104	23.6	140	8°/85°
NUGGET	490 (465)	680 (635)	800 *	360 (375)	165-170 (185)	82% (~~88%~~)	6.2 (5.8)	7.35	109.3	22.2	140	neg. 8° pos. 85°
STD. CIRRUS	495	660	728	285	110	57%	6.2	6.74	108	22.5	137	None
LIBELLE	465	635	660	250	None	53%	6.0	6.23	106	22.85	137	None
ASW-15	515	685	900	441	176	85%	5.8	7.62	118.2	20.45	137	None
CONCEPT 70	550	720	875	365	200	66%	5.45	6.63	132	18.3	138	0° pos. 90°

A low empty weight is very important when lifting for assembly or disassembly and for trailer loading.
A low possible gross weight is best for weak soaring conditions so as to then provide for minimum wing loadings.
Min. Gross Wt. based on 170 lb. pilot and parachute. Empty weights include 50 lbs. for equipment.
A high useful load is required to take full advantage of water ballast and full normal equipment. Water ballast is very important for high speed running and stronger thermal conditions.
A high max glide speed provides a wider speed range for the optimum use of flaps and ballast between thermaling and high speeds.
Flaps provide the best solution to slow steep approaches into short field landings.

170# is Standard wt. for PILOT NOT PILOT & chute.

YES, IF YOU have enough - APPROACH IS NOT AS STEEP AS Std. CIRRUS WHICH IS NOT STEEP - NOTHING LIKE HP-14, HP-11, HP-12

* — GROSS IS 850# WITH Std PILOT & WATER, WOULD BE 900# WITH 220# PILOT — MAX. GROSS OF 800# IS NOT ENOUGH.

STANDARD NUGGET FEATURES

- Full span flap except for ailerons - designed for negative (up) high speed flight, and positive (8° down) for thermalling, and 85° down for landing. NOT ON N-1
- Plug-in type wing root fitting and a single flush pin to lock each wing in place for fast assembly and disassembly. This eliminates the need for matching and juggling two wings together, with someone on each tip. - ABOUT EQUAL
- Automatic flap hook-up. OK
- Quick-disconnect coupling aileron hook-up with easy cockpit visible access. NOT ON N-1
- Single pin horizontal tail attachment and visible quick-disconnect coupling for elevator control hook-up. NOT ON N-1
- A rugged retractable landing gear with wheel brake and high dampening shock strut. - VERY POOR BRAKE
- Fully upholstered trimmed cockpit with large pockets NOT ON N-1
- Easy in-flight adjustable rudder pedals. OK
- Flush tow release with automatic aft tow line load release; mounted forward of the C.G. for improved directional stability while on tow. OVER WHAT?
- Flush mounted forward fuselage skid plate for added protection and wear resistance on nose-down (fast stop) landings. —
- Wheel brake lever on control stick grip. —
- Flap control on left side of cockpit. —
- Landing gear and water ballast dump controls on right side of cockpit. —
- Pitch trim adjustment on right side of cockpit with flight speed selector markings. NOT ON N-1
- Excellent visibility from semi-reclining seat. - OK
- A long, roomy 24 inch wide cockpit. —
- Retractable canopy air scoop and sliding cockpit window for ventilation. ?
- All control surfaces have internal static balances. NOT ON AILERONS
- Control systems equipped with sealed ball bearings for smoothness of operation. - OK
- Oxygen mounting brackets for 28 cu. ft. cylinder is standard equipment. NOT ON N-1
- Quickly detachable instrument panel shroud for easy access to instruments. NOT ON N-1
- Shoulder and seat belt harness. - OK
- Clean low drag wing root fillets. - OK

ASSEMBLY

The NUGGET assembly features were designed to permit the entire assembly and preflight check operations to be completed in under three minutes by a two man crew. This has been accomplished by making the alignment of the wing panels and tailplane attach points self-guiding, so that one avoids the need for critical positioning of the wing and horizontal tail for assembly. The individual wing panels weigh only 105 lbs. each, and are attached independently to the fixed wing center section with one flush type pin locking each wing in place. During assembly, the main spar tongue enters a slot in the fixed wing center section, and when engaged, the flush locking pin is easily installed in the upper wing surface, thereby completing the wing installation. The flap drive hook-up is automatic, and the aileron control rod hook-up is made with a quick-disconnect coupling located in the upper rear of the cockpit where it is readily accessible and clearly visible for inspection of the hook-up. The horizontal tailplane mounting is accomplished by engaging the forward index bayonet in its socket and then locking the rear surface to its mounting pad with a single Allen Head bolt. The elevator control horn hook-up is by means of a quick-disconnect coupling above the rudder hinge post for quick visual inspection after installation. - NOT ON N-1, TOOK 10-15 MIN. - ALSO MUST TAPE WING - 3 MIN. NOT REALISTIC EVEN IF FIXED RIGHT

CONSTRUCTION

Modern 15 meter optimum sailplane aerodynamics dictates a minimum empty weight, plus a high gross weight capability. This calls for construction materials that will give the best strength/weight ratios within feasible economics. Smooth, wave-free construction, and wing and control surfaces that remain stable, play a most important part. What's the point in paying for it in the beginning if it may not hold up? Structural reliability and durability against weather and fatigue are most important. Another advantage from the achievement of these goals is a lighter and easier ship to assemble and disassemble. Today's materials quickly lead us to a choice of aluminum alloys, or glass fiber reinforced plastic resins (commonly known as fiberglass).

Non-sandwich fiberglass construction provides an economic advantage for compound curved surfaces; therefore advantages for forward fuselage sections and fairings. Beyond this, the aluminum alloys outstrip fiberglass in strength to weight ratio, reliability, durability, stability with age, reduced maintenance, etc.

Single curved wing surfaces, aft fuselage sections, and control surfaces of the same size and strength, can be built lighter, completely stable, with longer life and greater reliability, by utilizing aluminum alloys.

Laister's experience with fiberglass and aluminum alloys used in aircraft dates back to World War II. Accordingly we have built the NUGGET with a fiberglass forward fuselage, and the remainder of aluminum alloys.

REALLY?

The aluminum skins provide inherently wave-free mirror-like surfaces. The secret to retaining the mirror-like final surfaces is in our replacement of riveting with our hot "Chem-Weld" process for attaching the mill rolled smooth skins to the wing and control surface frames. Rivets not only dimple and cause waviness to the skin surface, but provide a shear strength of approximately 500 lbs. per square inch. Our "Chem-Weld" process eliminates filling and sanding, and provides a homogenous assembly with a uniform shear strength of 5,000 lbs. per square inch. - CONSTUCTION GOOD, BUT N-1 NOT SMOOTH - TOOK LOTS OF FILL TO JUST EQUAL AVG. "AS DELIVERED" GLASS SHIP

AERODYNAMIC DESIGN AND PERFORMANCE

There are many factors to be considered when comparing sailplane performance figures. We consider the more important ones to be the performance polar, thermaling ability, the available range of wing loadings, the roll rate about the longitudinal axis, and the short field approach characteristics. Also the 1974 OSTIV provisions allowing water ballast and flaps are two new features which can be used to improve the overall performance of the 15 meter sailplane. They place a strong new emphasis on lightweight design, coupled with the ability to achieve a high wing loading in terms of lbs. per square foot; or in effect, an inflight variable wing loading. A minimum wing and span loading is desired for minimum sink, maximum L/D, and climb when the thermal conditions are weak. After all, one needs to stay in the air to win.

To achieve these goals, we have combined the NUGGET-Wortmann airfoil with trailing edge flaps and a center section contained water ballast system having a single point fill cap and one dump valve. The result is an outstanding performance polar both at the low speed end for unequalled climb performance when thermalling, and at the high speed end for maximum penetration at high inter-thermal cruising speeds. The 165 lbs. in-flight disposable water ballast extends the high speed end of the performance polar for the strong part of the soaring day, and permits selective 1.70 p.s.f. reduction in wing loading, as desired, as the day's soaring conditions weaken. A possible broad range of wing loadings (7.35 p.s.f. to 5.5 p.s.f.) is achieved without sacrificing the rapid roll rate (45°L. to 45° R.) of under 3.5 seconds! The near 90° trailing edge flaps permit steep approach control at low indicated airspeeds for short field landings; another extremely desirable feature for any high performance sailplane whether flown for pleasure or in competition.

165-170 1.55 6.2 ok ONLY LOOKS SO

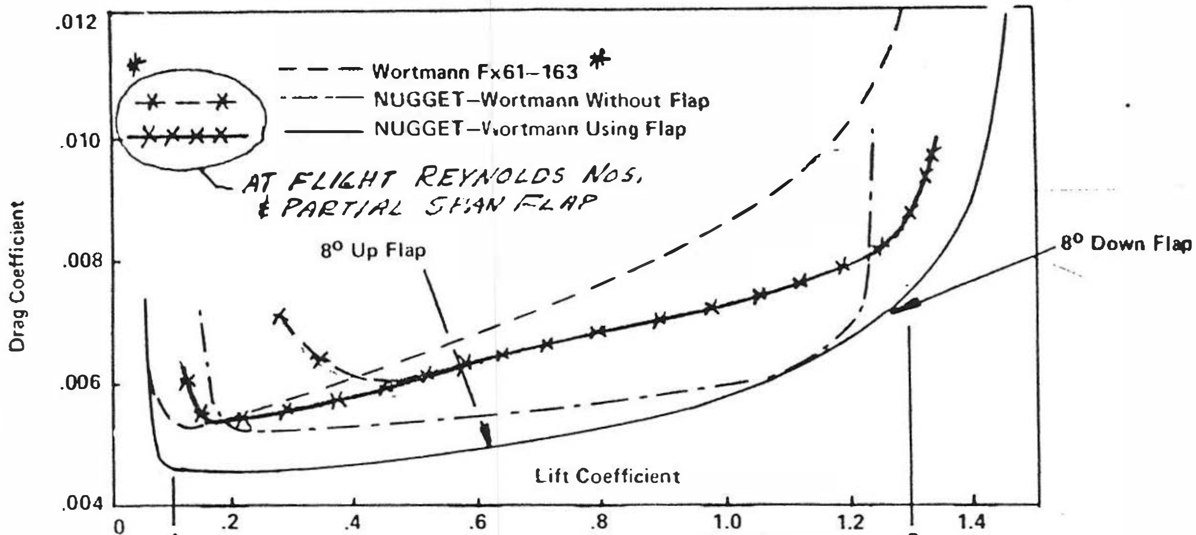
The addition of water ballast provides for the high gross weight required for better penetration and glide ratio in the high speed range. Since the water ballast in the NUGGET is carried in the 43" fuselage wing center section, there is no measurable difference in roll rate, whether flying with full ballast tanks or empty, a [illegible] advantage to the pilot seriously interested in getting the best performance out of his ship.

OVER WHAT WE [illegible] NO [illegible] IN ROLL RESPONSE

Water ballast only a short distance outboard in the wing will adversely affect the roll moment by 77% or more depending on the water weight and the exact location. Similarly such water ballast loadings contribute adversely to the ground looping tendencies. The only way to overcome these adverse effects is with control forces with their attendant added drag, — and of course with body muscles.

The addition of a flap that can be used at 8° positive (down) has the effect of increasing the wing area. Using this flap in a negative (up) position has the opposite effect; that is, of decreasing the wing area. These two features are desired at the high and low ends of the speed range. The negative flap, coupled with the maximum gross weight, maintains the wing in the low drag portion of the polar in the high speed range. The NUGGET's nearly 90° full flap setting is excellent for final approach control and short field landings. It permits extremely steep approach control at low indicated airspeeds; another very desirable feature for any high performance sailplane.

NOT ON N-1 AND PROBABLY NOT AT 90° - ONLY ADEQUATE - PARTICULARLY AT LOW SPEED.



* SEE PAGE 16 FOR COMPARISON - EXAMPLE OK BUT WHY NOT USE REALISTIC EST.

To further explain the soaring flap advantage, look at the unflapped drag polar and the effect of flaps on the Wortmann airfoil we use shown in the graph. - NOT NEEDED AS MUCH AS SHOWN

The dash-dot line above represents the wing airfoil drag polar without a flap. The solid line shows the effect of optimizing the airfoil for the flap, and adding the flap. The best performance of any sailplane is achieved while operating in the low flat area of the drag polar between points A and B. Note the extension of the flat drag curve by the use of flaps and ballast. The third and dashed line shows the Wortmann Fx61-163 without flap. - GROSSLY OPTIMISTIC, FOR ACTUAL FLT. R.N. & PARTIAL SPAN FLAP - DASHED LINE FOR -163 IS CLOSE TO FLT. - SEE PAGE 16

Summing it all up, the best Standard Class sailplane, assuming equally smooth wings and clean fuselage, is a combination of wing area and airfoil whose performance is further extended through optimizing the wing by the addition of a flap, plus the use of water ballast to achieve a broad range of wing loadings, and such that the actual wing area is reduced to a minimum from the standpoint of a desired minimum sink for a given (15 meter) span. - RIGHT ON!

We have refrained from printing even estimated data of the NUGGET with this booklet. It is now pretty well recognized that the various manufacturers are advertising L/D values for their products which are higher than tests by Paul Bikle would indicate. Paul Bikle has found that the highest L/D he could show for the best of other Standard Class ships was 35.2. We are confident that the NUGGET will exceed this, but prefer to await measured results for publication. However, we can tell you this: One of our customers, who has ordered a NUGGET and who placed high in the National competition last year with his glass ship, has advised that he was amazed at the way Ross Briegleb, flying the prototype NUGGET, outclimbed him in the thermals and then ran off and left him on several occasions; this while he was carrying 75 lbs. of water ballast and Ross was carrying 200 lbs. in the NUGGET.

NUGGET MORE - STD LIBELLE 1-35, PIK

The wetted area (total airframe surface) of the NUGGET and the best of the competition appears to be about equal, therefore our flap and water ballast configuration gives the NUGGET a performance advantage, and far superior roll characteristics in the fully loaded (7.35 p.s.f.) flight configuration. NOT SO

The NUGGET pilot will enjoy the fixed horizontal stabilizer/elevator combination. This eliminates the problem of pilot-induced oscillations and makes for easier and more relaxed flying. Ross Briegleb advised: "Don't touch that horizontal tail. It's great!" I AGREE (EXCEPT LIGHT Fs/g CHANGING WITH SPEED)

Now compare the NUGGET with any other ship you might consider.