



The Douglas XO2D-1

by Nicholas V. Karstens and Robert E. Williams

Early in 1933, the U.S. Navy was interested in procuring a new, single-float amphibious scout-observation biplane. It was to replace the Vought O3U Corsair series as a standard scout-observation biplane aboard U.S. Navy battleships, cruisers, and aircraft carriers. In June 1933, contracts were issued to Curtiss, Douglas, and Vought for three prototype designs from which one would be selected for production. All three designs, the Douglas XO2D-1 (BuNo 9412), the Curtiss XO3C-1 (BuNo 9413), and the Vought XO5U-1 (BuNo 9399), were powered by 550-hp Pratt & Whitney R-1340-12, 9-cylinder air-cooled radial engines.

The XO2D-1, last of the Douglas biplane designs, was a two-place sesquiplane amphibian of conventional design. The airframe structure was all metal, covered by a mixture of doped fabric and aluminum.

The fabric-covered wings of the XO2D-1 had a slight sweepback. The lower wing was six feet shorter than the upper with a much narrower chord. Hinged at the rear spar, the wings were folded back manually and secured for shipboard storage. This was made possible by anchoring the rigging wires at their inboard ends into the hinge fittings, allowing the wing units to fold without losing their rigged posi-

tions. Triangular wing-folding gap covers were rubberized fabric with trailing-edge adjustable cables to keep the covers taut.

Several high-lift devices were studied before arriving at the final configuration. Wind-tunnel tests on models were conducted at the California Institute of Technology, and 33 test flights were made with various devices installed on a Moreland Trainer parasol monoplane. Among the designs tested were free air or "park-bench" ailerons, spoilers of various types, up-only ailerons, and several aileron/flap combinations.

The final design consisted of large chord ailerons at the tips of the upper wing only,

with hydraulically operated all-metal split flaps from the ailerons to the center section, and full span all-metal split flaps on the lower wings. When the flaps were lowered, a special linkage drooped the ailerons to further reduce the landing speed. The ailerons had limited movement in the lowered position. All movable control surfaces were static-balanced, fabric-covered aluminum structures, while the elevator trim tabs were all metal.

The XO2D-1 fuselage had metal formers and stringers over a welded steel tube frame. The forward part was covered with removable aluminum panels for easy access to vital accessories, and a semi-mono-coque all-aluminum structure made up the last 91 inches, carrying all-aluminum horizontal and vertical stabilizers and capped by a metal tail cone. The midsection of the fuselage, like the wings, was fabric covered. The two-place tandem cockpit was enclosed by a sliding greenhouse canopy much like that on the XO-46. The cockpit arrangement was conventional, with pilot controls and instruments in front. Radio equipment, a flexible .30-caliber Browning machine gun, and flares were in the rear. One novel feature was a compact navigation chart-board and plotting protractor which retracted breadboard style into the front cockpit instrument panel when not in use.

The XO2D-1 was fitted with an amphibious undercarriage with two retractable main wheels incorporated in the main float. They were operated hydraulically by a hand-operated pump in the front cockpit. A retractable tail wheel was normally locked in the neutral position. For ground maneuvering, the tail wheel could be disengaged to caster by pulling a cable in the pilot's cockpit. This mechanism gave considerable trouble during early tests. Two auxiliary floats were located near mid-span of the lower wing in early designs, but were moved outboard to the wingtips in the final configuration. A small rudder on each side of the main float, installed flush and hinged at the front like miniature dive brakes, gave directional control in the water.

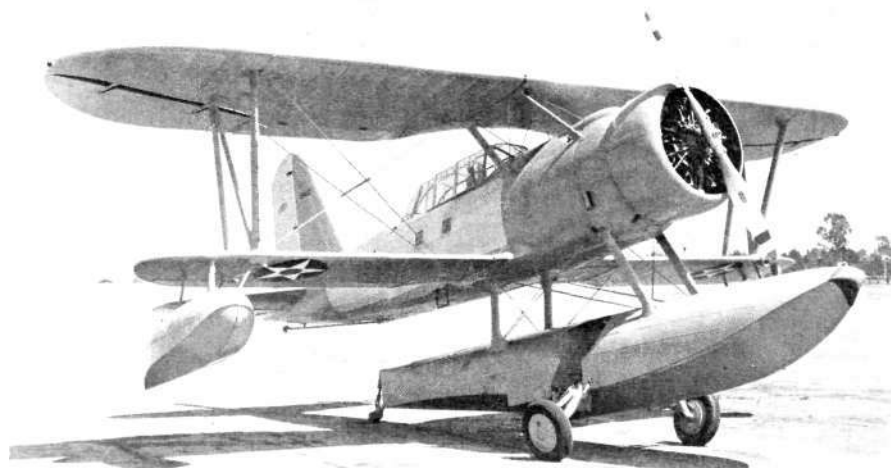
A retractable tail hook under the fuselage could be lowered for carrier landings, and a catapult hook protruded from the flush-riveted bottom of the main float.

Armament consisted of one fixed .30-caliber model M-2 Browning machine gun firing forward, and another, covering the aft sector, on a flexible mount in the rear cockpit. One bomb rack under each lower wing carried one 116-pound demolition bomb each. For practice, a special bomb rack under the left wing only could carry 10 Mk IV practice bombs.

The XO2D-1 was completed in March



One of the three contenders in the 1933 U.S. Navy amphibious scout-observation biplane competition was the Vought XO5U-1 (BuNo 9399). Both it and the XO2D-1 lost out to the Curtiss XO3C-1. (Vought Corporation via N.V. Karstens)



The XO2D-1 at Clover Field, Santa Monica, on the day of its first flight. Directional control while taxiing was difficult due to the narrow track of the main gear, a high center of gravity, and touchy brakes (later corrected). (MDC via Bob Williams)

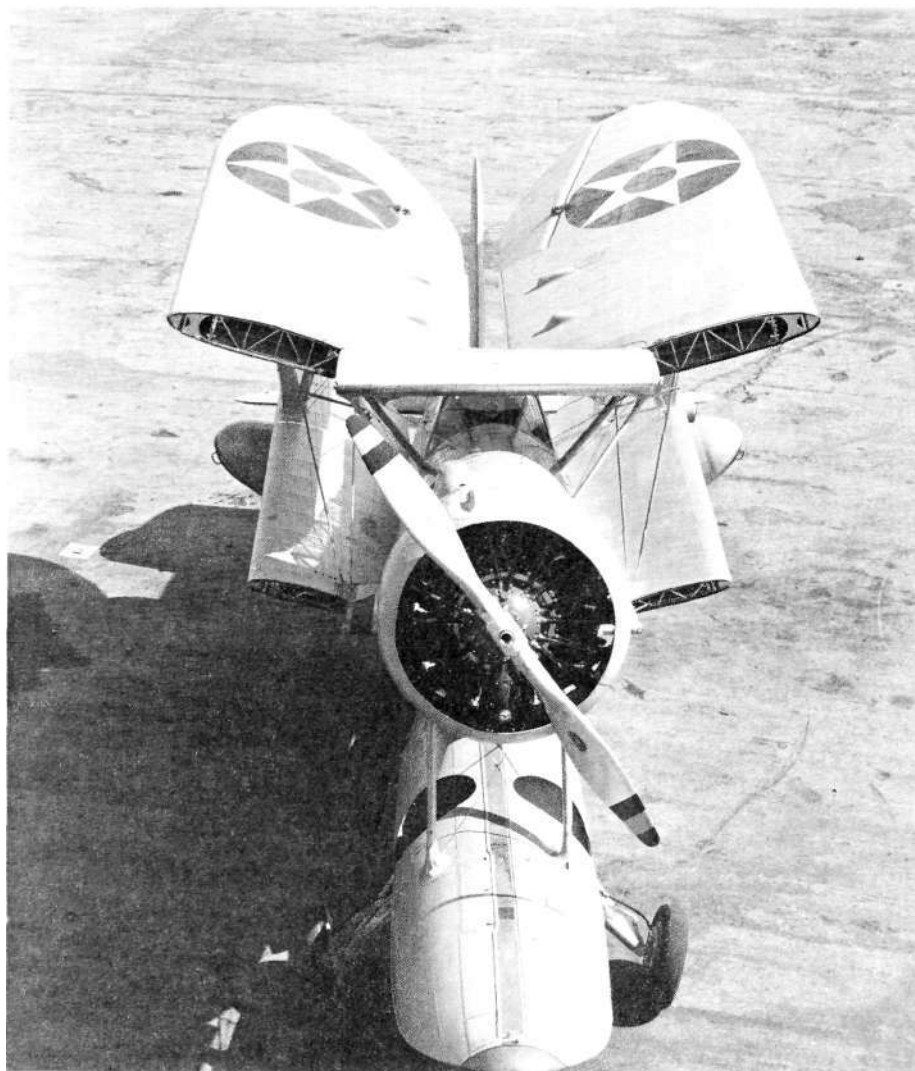




The XO2D-1, with lower surface flaps down and ailerons drooped 14 degrees, boasted full-span flaps.
(MDC via Bob Williams)

1934, and first flown from Clover Field on the afternoon of March 27. It was piloted by Douglas-Northrop test pilot Edmund T. Allen, who also made the test flights in the Moreland Trainer. Flight characteristics were generally good. Some adjustments were needed on the controls, but the brakes and tail wheel were the major problems. The brakes locked up repeatedly by just a light touch on the pedals while taxiing, causing the tail wheel to rise up about two feet before rebounding on the runway. Repeated impacts sprung the plating on the main float and caused a three-inch tear near the stern. Also, the brakes could not be operated differentially for ground steering.

Fifteen test flights were made, each followed by minor fixes, between March 27 and April 11. The water test portions were conducted at San Pedro Harbor April 4 on Flight No. 4. With flaps one-third down the first water landing was very normal with no excessive spray. The second, with two-third flaps, gave a considerably smoother and softer impact. The third was with full flaps and still further reduction in spray and impact. During taxiing, the water rudders were effective enough to turn the airplane at all angles to the wind. On takeoff the airplane got up on the step very quickly, but accelerated slowly from that point on. (Mote about that in Navy tests.) During takeoff, due to crosswind conditions relative to the test recorder camera position, a wing float was forced deep in the water, but with very little noticeable drag. After completion of company tests, the XO2D-1 was shipped to Anacostia, D.C., for Navy trials, arriving there on April 23, 1934.



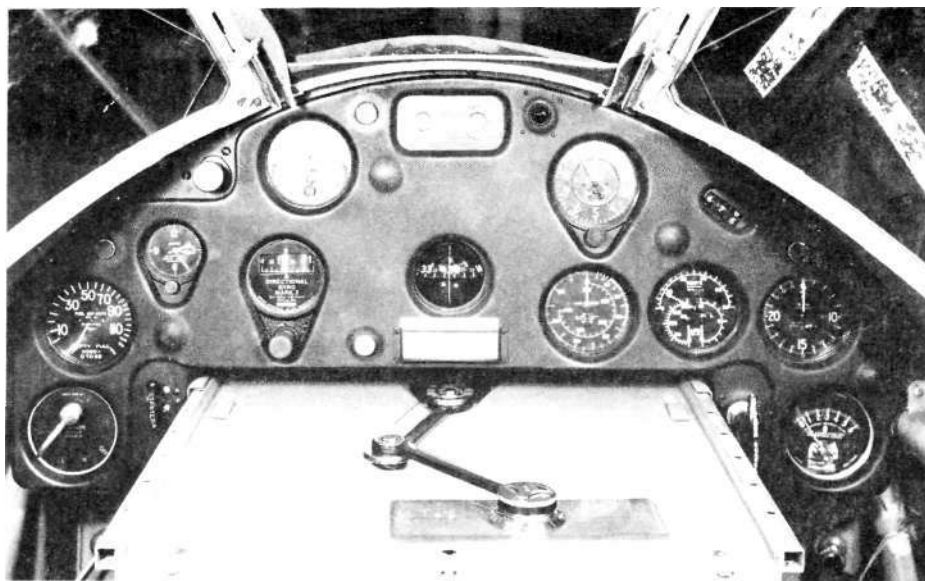
Although it was to operate from battleships and cruisers, the wing-folding requirement was for restricted size elevators and storage aboard aircraft carriers.
(MDC via Bob Williams)

Bad luck plagued the XO2D-1 during Navy acceptance trials. The Navy, too, noted that "takeoff in smooth water was slow and difficult with radical heeling after the plane was on the step and before lateral control was attained." They recommended "that the airplane be equipped with an adjustable propeller as were the XO5U-1 and the XO3C-1 airplanes." In a memo a week later, they stated that "the availability of a controllable pitch propeller for this airplane is being investigated." Less than three weeks after arriving at Anacostia, an engine change became necessary when the number three cylinder head burned through. Two days later, on May 11, the airplane nosed over while attempting an emergency water landing near Anacostia. The right shock absorber strut stop failed, causing a complete disengagement of the right landing gear so it could be neither retracted nor landed on. Immediately after salvage, the XO2D-1 was disassembled, all fabric was removed, and all parts thoroughly washed with fresh water.

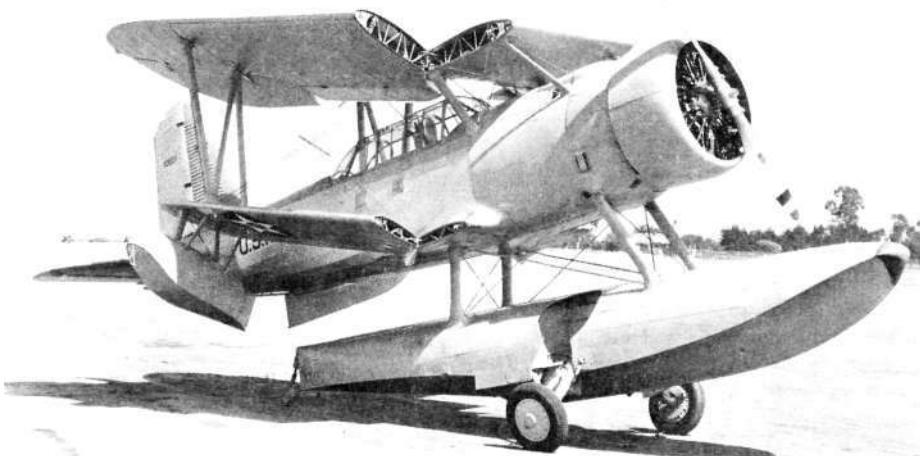
Rather than ship it back to Santa Monica for repairs, the aircraft was trucked to the Brewster Aeronautical Corporation in Long Island City, N.Y., where a more thorough cleaning was accomplished and repairs were made under Navy inspection. At the same time back at the factory, Douglas rebuilt the elevator trim tabs to the length shown on the drawing, which was about half the original length. Brewster also took care of a number of squawk items. New instruments and a new engine were furnished by the government.

After repairs were completed, the XO2D-1 was returned to flight status on July 7, 1934. Service trials were then continued by Detachment Five of Experimental Squadron One (VX1D-5) at NAS Norfolk during August and September. It was then returned to Anacostia for additional trials which lasted until March 1935. While trials were being conducted, the Navy changed its requirements for all future shipboard aircraft: They were to be convertible land or float planes without the amphibian feature. Therefore, the three competing aircraft were outfitted with plain floats for the remainder of the sea trials, the wheel landing gear tests to be accomplished on the first production aircraft.

During all this testing time many memorandums were going between the Naval Board of Inspection and Survey, the Chief of the Bureau of Aeronautics, the Inspector of Naval Aircraft at Santa Monica, and Douglas Aircraft Company. One such memo contained a page of "defects" that would make the XO2D-1 unacceptable as a service type, and furthermore three of the items would prevent acceptance as an experimental type. Meanwhile, Douglas was making redesigned



Pilot's instrument panel with chartboard and Mark II aircraft protractor pulled out for use. (MDC)



The XO2D-1 wings were hinged at the rear spars, each side folding up and aft as a unit without affecting the rigging. Wing lock mechanisms on the front spars were operated by a crank which was stowed in the left forward fuselage. (MDC via Bob Williams)



The XO2D-1 seen pulled up to the beach at Anacostia during amphibious trials. Mooring rings attached to the nose of each outrigger float facilitated handling. (MDC via Bob Williams)



Rare photo of the XO2D-1 taking off from the water during service trials.

(MDC via Bob Williams)

parts for some previous squawks and endeavoring to get them installed. It was finally decided to let Douglas fly the plane back to Santa Monica and make all of the recommended changes.

During the flight back west, the Douglas pilot experienced trouble with a rough engine which was fully inspected when it arrived at Santa Monica by the Pratt & Whitney representative and recommendations made for clearances of spark plug wiring from exhaust manifolds. Douglas, meanwhile, dismantled the aircraft, where subsequent inspection showed evidence of general corrosion and the necessity for a rather complete overhaul besides the Naval recommended changes to put it in good serviceable and acceptable condition. However, Douglas, knowing that the Curtiss plane was selected for production and that the XO2D-1 would be surveyed anyway at completion of the trials, offered to drop the project and forego final payment, 70% of the contract price having been paid. The Navy agreed and authorized shipment to NAS San Diego. The aircraft was trucked there on September 13, 1936, where the engine, instruments, and other usable items were removed. Stricken from the Navy inventory on October 31, the airframe was shipped in December to the naval aircraft factory in Philadelphia for structural tests.

The XO2D-1 was manufactured at the same time as the DC-2 and shared some of the same structural design concepts. The XO2D-1 was short-lived, lasted a little over a year, and logged a total of 86 flight hours. The DC-2 evolved into the DC-3, many of which are operating today after untold millions of flight hours.

The Curtiss XO3C-1, the winner, was built in production as the SOC-1 *Seagull*, using the R-1340-18 engines, with deliveries starting on November 12, 1935. Pro-



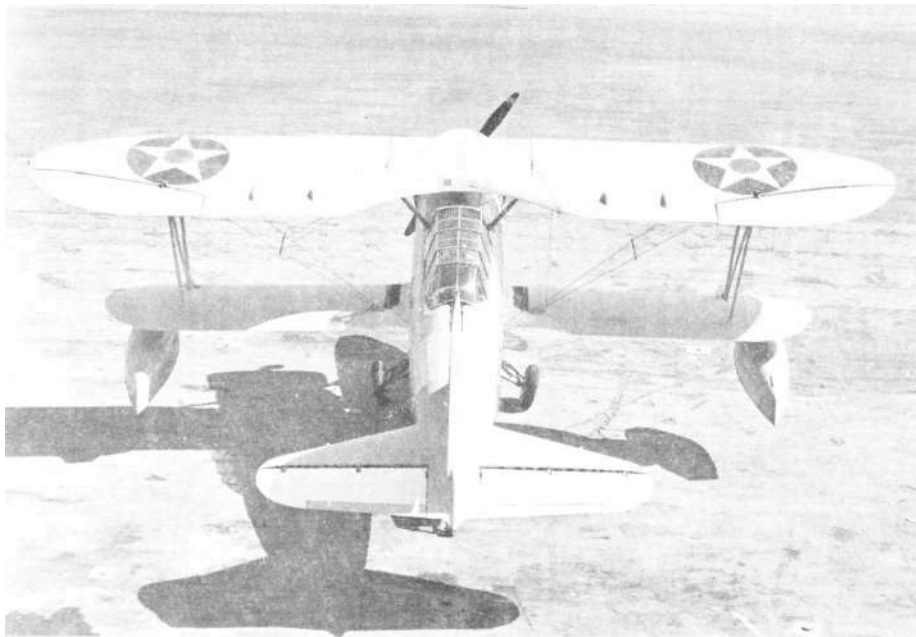
The elevators were reworked after the first flight to shorten the span of the trim tabs 40%. The two dark rectangles on each side of the fuselage by the cockpit are flush-covered recessed steps. The fuselage design looks very clean.

(MDC via Bob Williams)



BuAer canceled the amphibious requirement during acceptance trials at Anacostia and tests were completed with plain floats. The XO2D-1 is seen on plain floats after repairs following the crash caused by a defective landing gear.

(MDC via Bob Williams)



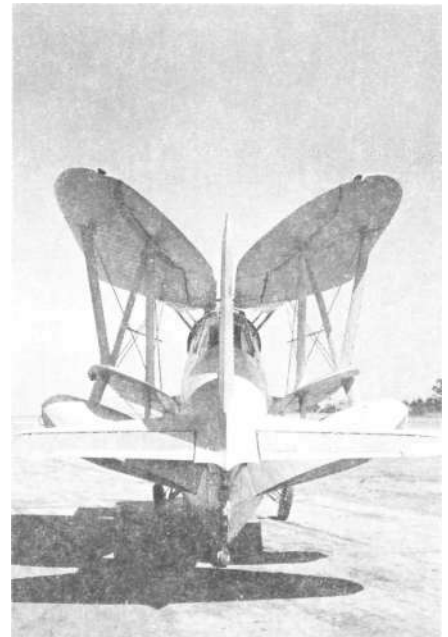
The XO2D-1 sat high off the ground on very narrow track gear, which made taxiing difficult. The wings were locked in the stowed position by latches on the outrigger floats engaging sockets on the lower aft fuselage sides. (MDC via Bob Williams)



This view of the XO2D-1 shows some interesting design features. The lower wing chord was only about half that of the upper, and the aft fuselage was all metal. The center fuselage, like the wing, was fabric-covered metal frame construction. (MDC via Bob Williams)



Left side view of the XO2D-1, April 19, 1934. The left water rudder can be seen flush mounted between round access plates at the rear of the main float sides. (MDC via Bob Williams)



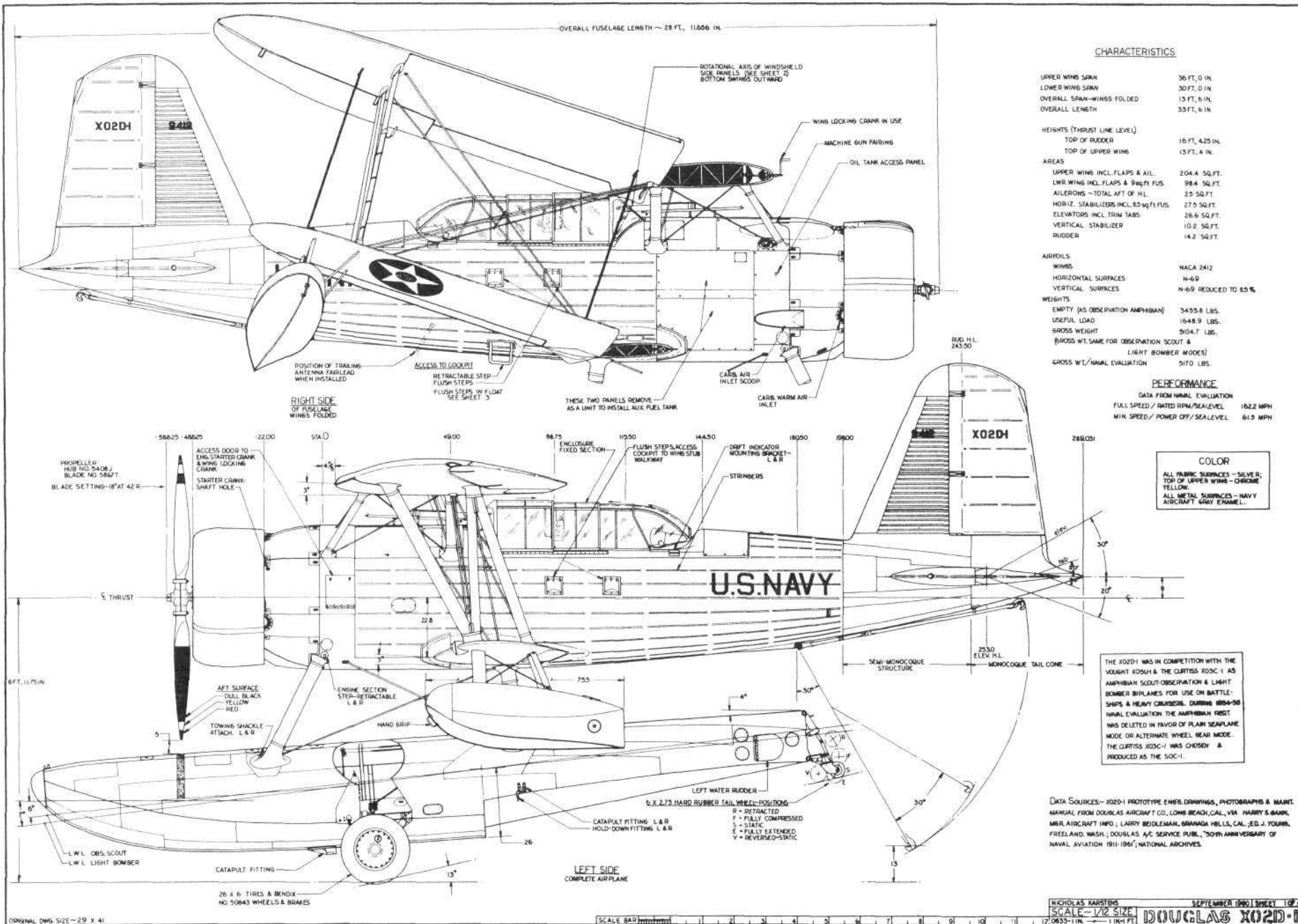
duction totaled 135 machines (with floats) and then 40 more land-based SOC-2s with the R-1340-22 engines, followed by 83 SOC-3s which had interchangeable landing gear. After modification in 1942, the planes fitted with arrester gear were designated SOC-2A and SOC-3A. The naval aircraft factory built 64 of the *Seagulls*. Three final *Seagulls* for the Coast Guard were built by Curtiss.

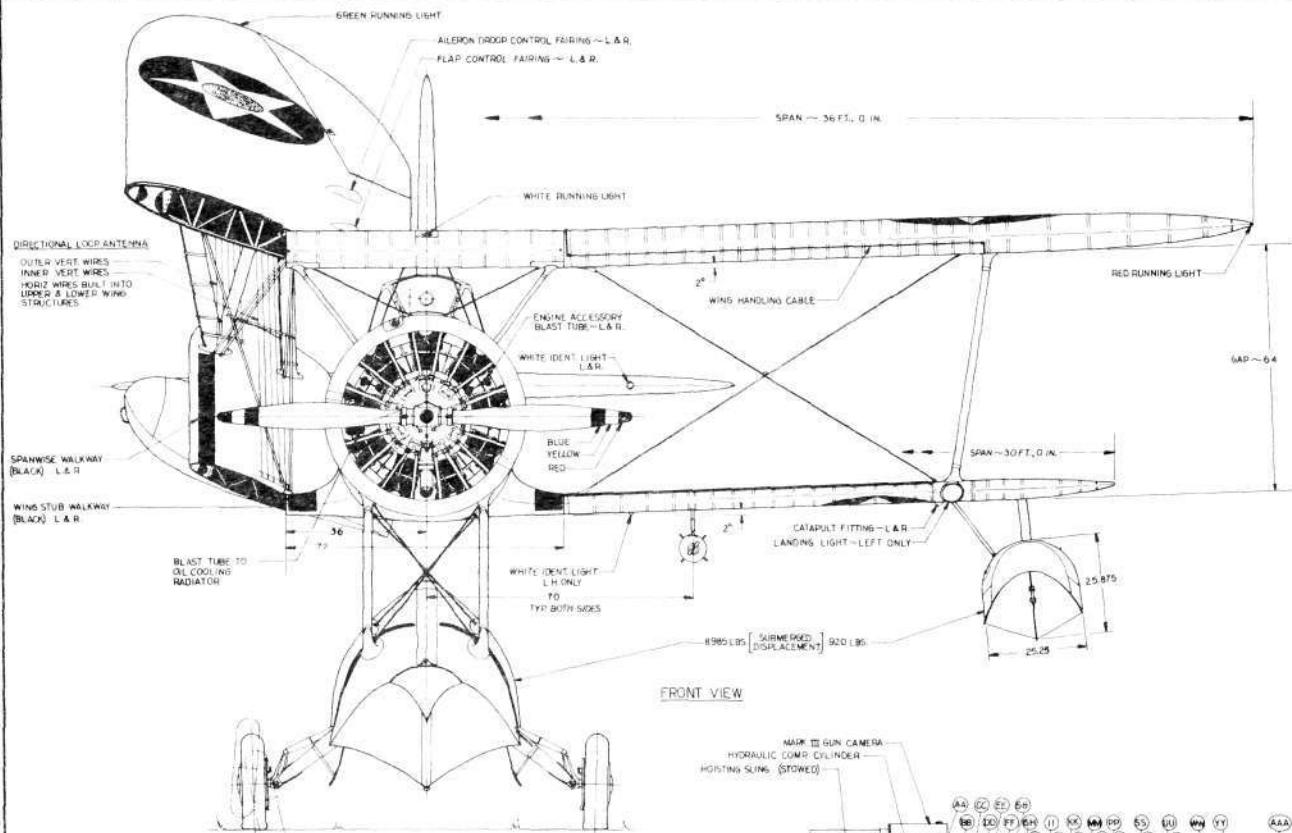
The Curtiss SO3C, a new replacement monoplane, had a somewhat unsatisfactory operational career and was withdrawn from service in 1944. The SOC *Seagulls* that were still in existence were restored to operational status and provided yeoman service until the end of WWII.

ABOUT THE AUTHORS

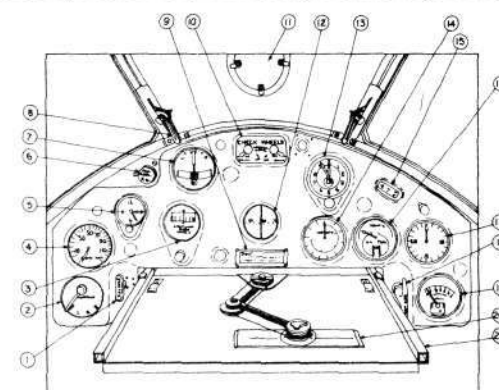
Nick Karstens first worked at Douglas as a co-op engineering student from Riverside, California Junior College in the spring of 1934. He then spent the summer months of 1936 working in Douglas Experimental Tool design. In June 1937 he joined Douglas Engineering after receiving his B.S. degree in M.E. from the University of California at Berkeley. After working on many aircraft and missile projects he retired from McDonnell Douglas with 33 years under his belt. As a lifelong flying enthusiast he had received his private pilot license with SEL and glider ratings. Since retirement he has been active in aviation historical projects, aircraft plans and models. He currently resides in Northern California.

Bob Williams, a lifelong aviation enthusiast, was born in Indiana and educated in Indiana and Ohio. He has spent 35 years in the aerospace industry as an illustrator, art director and editor. He first turned to writing aviation history 15 years ago doing a series of articles for McDonnell Douglas (his employer) entitled "Yesteryear." His prolific pen has produced nearly 50 pieces on McDonnell and Douglas historical aircraft. His work has appeared in several magazines including *Cockpit* (Switzerland), *de Model Bouwer* (Netherlands), *Naval Aviation News*, and *Koku-Fan* (Japan) who is publishing the whole series. His first article to appear in the *Journal* is in collaboration with his friend Nick Karstens, who deserves most of the credit. He has been Editor/Managing Editor of the AAHS *Journal* for nearly eight years, residing with his wife Gerry in Long Beach, California.





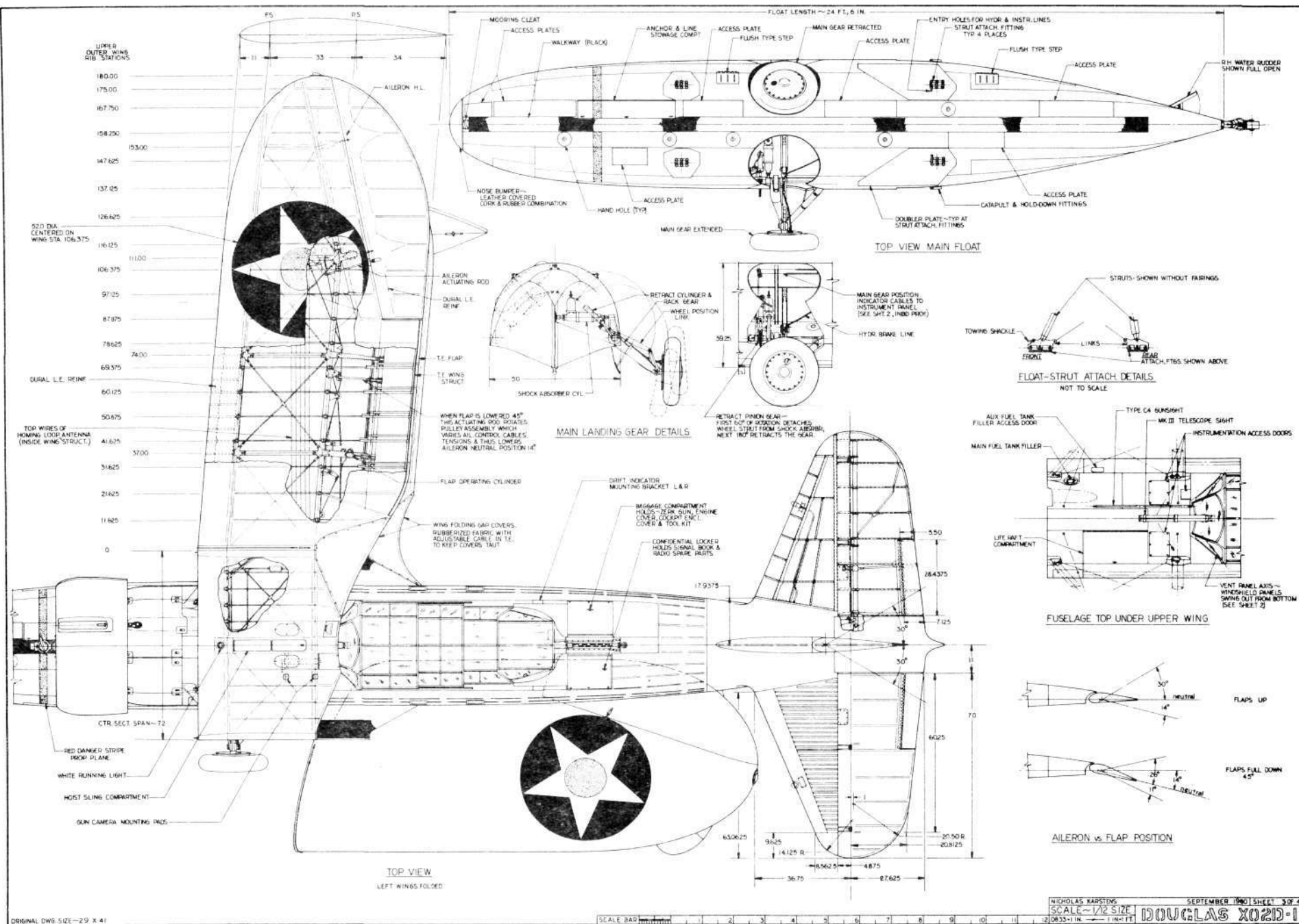
FRONT VIEW



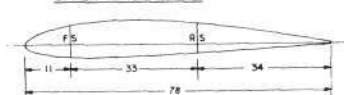
PILOT'S INSTRUMENT PANEL
FROM DAC PHOTO

1. INERTIA STARTER ENGAGE HANDLE
2. IGNITION SWITCH
3. DIRECTIONAL gyro
4. FUEL QUANTITY GAUGE
5. CLOCK
6. FUEL GAUGE PUMP
7. TURN & BANK INDICATOR
8. PIVOTING SIDE PANEL LOCK
9. COMPASS CORRECTION DATA
10. LANDING GEAR POSITION IND.
11. TELESCOPE SUN SHOT HOLE COVER
12. COMPASS
13. SENSITIVE ALTIMETER
14. AIRSPEED INDICATOR
15. FIVE N.B. ROUNDS COUNTER
16. ENGINE GAUGE UNIT
17. TACHOMETER
18. GUN CHARGE
19. THERMOCOUPLE INDICATOR
20. MK II AIRCRAFT PROTRACTOR
21. CHARTBOARD (STOWS FWD)

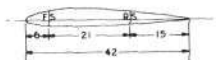
INBOARD PROFILE DOWNS INDEX	
A	MARK II TELESCOPE SIGHT
B	TYPE CA GUN SIGHT
C	BOMB RELEASE TYPE (L & R)
D	ADDRESSING GEAR CONTROL (R)
E	LIFE SIFT COMPARTMENT (L)
F	30 CAL MOD M-2 BROWNING MACHINE GUN
G	AMMUNITION BOX - 500 RDS
H	LINE EJECTION CHUTE
I	EASE EJECTION CHUTE
J	MAIN GUN SWICH UNIT
K	TYPE GP-3 GENERATOR
L	SPRINKLER UNIT (R)
M	INERTIA STARTER CRANK (SUPT. (L))
N	OIL COOLING RADIATOR (R)
O	OIL TANK - 15 GAL
P	MAIN FUEL TANK - 140 GAL
Q	CABLE HOT AND INTAKE OYST
R	CABLE CONTROL ROSS
S	ACCESSORY FUEL TANK - 30 GAL (R)
T	HYDRAULIC CONTROL VALVE -
U	SEMI-AIR WATER DROOLER (R)
V	MASTER CYLINDER - BOMB & W/T (R)
W	PROXIMITY FIRE EXTINGUISHER (R)
X	INERTIA STARTER CRANK (L)
Y	WING LOCKING CRANK (L)
Z	WING LOCKING CRANK (R)
AA	FUEL VALVE & CONTROL
AB	LANDING GEAR POSITION INDICATOR
AC	AMMUNITION SOUNDS COUNTER
AD	ENGINE STARTER CONTROL (L)
AE	MACHINE GUN CHARGING HANDLE (R)
AF	SAFETY CONTROL (L)
AG	WING FLAP & LANDING GEAR
AH	HYDRAULIC CONTROL VALVE (R)
AI	MACHINE GUN TRIGGER
AJ	PILOTS CONTROL STICK
AK	ENGINE CONTROLS (L)
AL	ENGINE CONTROLS (R)
AM	TAIL WHEEL LOCK CONTROL (L)
AN	CABLE AND HEAT & OIL TMO CONTR (L)
AO	W FLAP & LNDG GP RETRACT PUMP (R)
AP	PILOTS WHEEL PUMP HANDLE (L)
AQ	ELEV. TRIM CONTROL WHEEL (L)
AR	PILOTS SAFETY BELT
AS	DO PROTECT SEAT
AT	VERT. PRISTAL CARTIDGE BOX (R)
AV	VERT. PRISTAL (R)
AW	VERT. PRISTAL ON TOP OF
AX	ELECT DISTRIBUTION PANEL (R)
AY	55 HAND FIRE EXTINGUISHER
AZ	UNNUNES THROTTLE (L)
BA	UNNUNES WHEEL PUMP HANDLE (L)
BB	SEAT & FLY GUN RING
BC	UNNUNES REARSTAYS GUN GRIPS
BD	UNNUNES SAFETY BELT
BE	30 CAL MOD M-2 BROWNING MACHINE GUN (SHOWN STOWED)
BF	MARK II GUN CAMERA
BG	HYDRAULIC COMP. CYLINDER
BH	HOLDING SLING (STOWED)
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KT	WHITE SIGNAL LIGHT
KU	WHITE SIGNAL LIGHT
KV	WHITE SIGNAL LIGHT
KW	WHITE SIGNAL LIGHT
KX	WHITE SIGNAL LIGHT
KY	WHITE SIGNAL LIGHT
KZ	WHITE SIGNAL LIGHT
LA	WHITE SIGNAL LIGHT
LB	WHITE SIGNAL LIGHT
LC	WHITE SIGNAL LIGHT
LD	WHITE SIGNAL LIGHT
LE	WHITE SIGNAL LIGHT
LF	WHITE SIGNAL LIGHT
LG	WHITE SIGNAL LIGHT
LH	WHITE SIGNAL LIGHT
LI	WHITE SIGNAL LIGHT
LJ	WHITE SIGNAL LIGHT
LK	WHITE SIGNAL LIGHT
LM	WHITE SIGNAL LIGHT
LN	WHITE SIGNAL LIGHT
LO	WHITE SIGNAL LIGHT
LP	WHITE SIGNAL LIGHT
LQ	WHITE SIGNAL LIGHT
LR	WHITE SIGNAL LIGHT
LS	WHITE SIGNAL LIGHT
LT	WHITE SIGNAL LIGHT
LU	WHITE SIGNAL LIGHT
LV	WHITE SIGNAL LIGHT
LW	WHITE SIGNAL LIGHT
LX	WHITE SIGNAL LIGHT
LY	WHITE SIGNAL LIGHT
LZ	WHITE SIGNAL LIGHT
MA	WHITE SIGNAL LIGHT
MB	WHITE SIGNAL LIGHT
MC	WHITE SIGNAL LIGHT
MD	WHITE SIGNAL LIGHT
ME	WHITE SIGNAL LIGHT
MF	WHITE SIGNAL LIGHT
MG	WHITE SIGNAL LIGHT
MH	WHITE SIGNAL LIGHT
MI	WHITE SIGNAL LIGHT
MJ	WHITE SIGNAL LIGHT
ML	WHITE SIGNAL LIGHT
MM	WHITE SIGNAL LIGHT
MO	WHITE SIGNAL LIGHT
MP	WHITE SIGNAL LIGHT
MQ	WHITE SIGNAL LIGHT
MR	WHITE SIGNAL LIGHT
MS	WHITE SIGNAL LIGHT
MT	WHITE SIGNAL LIGHT
MU	WHITE SIGNAL LIGHT
MV	WHITE SIGNAL LIGHT
MW	WHITE SIGNAL LIGHT
MX	WHITE SIGNAL LIGHT
MY	WHITE SIGNAL LIGHT
MZ	WHITE SIGNAL LIGHT
NA	WHITE SIGNAL LIGHT
NB	WHITE SIGNAL LIGHT
NC	WHITE SIGNAL LIGHT
ND	WHITE SIGNAL LIGHT
NE	WHITE SIGNAL LIGHT
NF	WHITE SIGNAL LIGHT
NG	WHITE SIGNAL LIGHT
NH	WHITE SIGNAL LIGHT
NI	WHITE SIGNAL LIGHT
NJ	WHITE SIGNAL LIGHT
NK	WHITE SIGNAL LIGHT
NL	WHITE SIGNAL LIGHT
NM	WHITE SIGNAL LIGHT
NO	WHITE SIGNAL LIGHT
NP	WHITE SIGNAL LIGHT
NQ	WHITE SIGNAL LIGHT
NR	WHITE SIGNAL LIGHT
NS	WHITE SIGNAL LIGHT
NT	WHITE SIGNAL LIGHT
NU	WHITE SIGNAL LIGHT
NV	WHITE SIGNAL LIGHT
NW	WHITE SIGNAL LIGHT
NX	WHITE SIGNAL LIGHT
NY	WHITE SIGNAL LIGHT
NZ	WHITE SIGNAL LIGHT
OA	WHITE SIGNAL LIGHT
OB	WHITE SIGNAL LIGHT
OC	WHITE SIGNAL LIGHT
OD	WHITE SIGNAL LIGHT
OE	WHITE SIGNAL LIGHT
OF	WHITE SIGNAL LIGHT
OG	WHITE SIGNAL LIGHT
OH	WHITE SIGNAL LIGHT
OI	WHITE SIGNAL LIGHT
OJ	WHITE SIGNAL LIGHT
OK	WHITE SIGNAL LIGHT
OL	WHITE SIGNAL LIGHT
OM	WHITE SIGNAL LIGHT
ON	WHITE SIGNAL LIGHT
OO	WHITE SIGNAL LIGHT
OP	WHITE SIGNAL LIGHT
OQ	WHITE SIGNAL LIGHT
OR	WHITE SIGNAL LIGHT
OS	WHITE SIGNAL LIGHT
OT	WHITE SIGNAL LIGHT
OU	WHITE SIGNAL LIGHT
OV	WHITE SIGNAL LIGHT
OW	WHITE SIGNAL LIGHT
OX	WHITE SIGNAL LIGHT
OY	WHITE SIGNAL LIGHT
OZ	WHITE SIGNAL LIGHT
PA	WHITE SIGNAL LIGHT
PB	WHITE SIGNAL LIGHT
PC	WHITE SIGNAL LIGHT
PD	WHITE SIGNAL LIGHT
PE	WHITE SIGNAL LIGHT
PF	WHITE SIGNAL LIGHT
PG	WHITE SIGNAL LIGHT
PH	WHITE SIGNAL LIGHT
PI	WHITE SIGNAL LIGHT
PJ	WHITE SIGNAL LIGHT
PK	WHITE SIGNAL LIGHT
PL	WHITE SIGNAL LIGHT
PM	WHITE SIGNAL LIGHT
PN	WHITE SIGNAL LIGHT
PO	WHITE SIGNAL LIGHT
PP	WHITE SIGNAL LIGHT
PQ	WHITE SIGNAL LIGHT
PR	WHITE SIGNAL LIGHT
PS	WHITE SIGNAL LIGHT
PT	WHITE SIGNAL LIGHT
PU	WHITE SIGNAL LIGHT
PV	WHITE SIGNAL LIGHT
PW	WHITE SIGNAL LIGHT
PX	WHITE SIGNAL LIGHT
PY	WHITE SIGNAL LIGHT
PZ	WHITE SIGNAL LIGHT
QA	WHITE SIGNAL LIGHT
QB	WHITE SIGNAL LIGHT
QC	WHITE SIGNAL LIGHT
QD	WHITE SIGNAL LIGHT
QE	WHITE SIGNAL LIGHT
QF	WHITE SIGNAL LIGHT
QG	WHITE SIGNAL LIGHT
QH	WHITE SIGNAL LIGHT
QI	WHITE SIGNAL LIGHT
QJ	WHITE SIGNAL LIGHT
QK	WHITE SIGNAL LIGHT
QL	WHITE SIGNAL LIGHT
QM	WHITE SIGNAL LIGHT
QN	WHITE SIGNAL LIGHT
QO	WHITE SIGNAL LIGHT
QP	WHITE SIGNAL LIGHT
QQ	WHITE SIGNAL LIGHT
QR	WHITE SIGNAL LIGHT
QS	WHITE SIGNAL LIGHT
QT	WHITE SIGNAL LIGHT
QU	WHITE SIGNAL LIGHT
QV	WHITE SIGNAL LIGHT
QW	WHITE SIGNAL LIGHT
QX	WHITE SIGNAL LIGHT
QY	WHITE SIGNAL LIGHT
QZ	WHITE SIGNAL LIGHT
RA	WHITE SIGNAL LIGHT
RB	WHITE SIGNAL LIGHT
RC	WHITE SIGNAL LIGHT
RD	WHITE SIGNAL LIGHT
RE	WHITE SIGNAL LIGHT
RF	WHITE SIGNAL LIGHT
RG	WHITE SIGNAL LIGHT
RH	WHITE SIGNAL LIGHT
RI	WHITE SIGNAL LIGHT
RJ	WHITE SIGNAL LIGHT
RK	WHITE SIGNAL LIGHT
RL	WHITE SIGNAL LIGHT
RM	WHITE SIGNAL LIGHT
RO	WHITE SIGNAL LIGHT
RP	WHITE SIGNAL LIGHT
RQ	WHITE SIGNAL LIGHT
RR	WHITE SIGNAL LIGHT
RS	WHITE SIGNAL LIGHT
RT	WHITE SIGNAL LIGHT
RU	WHITE SIGNAL LIGHT
RV	WHITE SIGNAL LIGHT
RW	WHITE SIGNAL LIGHT
RX	WHITE SIGNAL LIGHT
RY	WHITE SIGNAL LIGHT
RZ	WHITE SIGNAL LIGHT
SA	WHITE SIGNAL LIGHT
SB	WHITE SIGNAL LIGHT
SC	WHITE SIGNAL LIGHT
SD	WHITE SIGNAL LIGHT
SE	WHITE SIGNAL LIGHT
SF	WHITE SIGNAL LIGHT
SG	WHITE SIGNAL LIGHT
SH	WHITE SIGNAL LIGHT
SI	WHITE SIGNAL LIGHT
SJ	WHITE SIGNAL LIGHT
SK	WHITE SIGNAL LIGHT
SL	WHITE SIGNAL LIGHT
SM	WHITE SIGNAL LIGHT
SN	WHITE SIGNAL LIGHT
SO	WHITE SIGNAL LIGHT
SP	WHITE SIGNAL LIGHT
SQ	WHITE SIGNAL LIGHT
SR	WHITE SIGNAL LIGHT
SS	WHITE SIGNAL LIGHT
ST	WHITE SIGNAL LIGHT
SV	WHITE SIGNAL LIGHT
SW	WHITE SIGNAL LIGHT
SX	WHITE SIGNAL LIGHT
SY	WHITE SIGNAL LIGHT
SZ	WHITE SIGNAL LIGHT
TA	WHITE SIGNAL LIGHT
TB	WHITE SIGNAL LIGHT
TC	WHITE SIGNAL LIGHT
TD	WHITE SIGNAL LIGHT
TE	WHITE SIGNAL LIGHT
TF	WHITE SIGNAL LIGHT
TG	WHITE SIGNAL LIGHT
TH	WHITE SIGNAL LIGHT
TI	WHITE SIGNAL LIGHT
TJ	WHITE SIGNAL LIGHT
TK	WHITE SIGNAL LIGHT
TL	WHITE SIGNAL LIGHT
TM	WHITE SIGNAL LIGHT
TO	WHITE SIGNAL LIGHT
TP	WHITE SIGNAL LIGHT
TQ	WHITE SIGNAL LIGHT
TR	WHITE SIGNAL LIGHT
TS	WHITE SIGNAL LIGHT
TT	WHITE SIGNAL LIGHT
TU	WHITE SIGNAL LIGHT
TV	WHITE SIGNAL LIGHT
TW	WHITE SIGNAL LIGHT
TX	WHITE SIGNAL LIGHT
TY	WHITE SIGNAL LIGHT
TZ	WHITE SIGNAL LIGHT
UA	WHITE SIGNAL LIGHT
UB	WHITE SIGNAL LIGHT
UC	WHITE SIGNAL LIGHT
UD	WHITE SIGNAL LIGHT
UE	WHITE SIGNAL LIGHT
UF	WHITE SIGNAL LIGHT
UG	WHITE SIGNAL LIGHT
UH	WHITE SIGNAL LIGHT
UI	WHITE SIGNAL LIGHT
UJ	WHITE SIGNAL LIGHT
UK	WHITE SIGNAL LIGHT
UL	WHITE SIGNAL LIGHT
UM	WHITE SIGNAL LIGHT
UN	WHITE SIGNAL LIGHT
UO	WHITE SIGNAL LIGHT
UP	WHITE SIGNAL LIGHT
UQ	WHITE SIGNAL LIGHT
UR	WHITE SIGNAL LIGHT
US	WHITE SIGNAL LIGHT
UT	WHITE SIGNAL LIGHT
UU	WHITE SIGNAL LIGHT
UV	WHITE SIGNAL LIGHT
UW	WHITE SIGNAL LIGHT



UPPER WING AIRFOIL



LOWER WING AIRFOIL



NACA 2412 AIRFOIL % COORDINATES

% OF CHORD	UPPER	LOWER
0	0	0
1.25	2.15	-1.65
2.5	2.99	-2.27
5	4.13	-3.01
7.5	4.96	-3.46
10	5.63	-3.75
15	6.61	-4.10
20	7.26	-4.23
25	7.67	-4.22
30	7.88	-4.12
40	7.80	-3.80
50	7.24	-3.34
60	6.36	-2.76
70	5.18	-2.14
80	3.75	-1.50
90	2.08	-.82
95	1.14	-.48
100	0	0

LE RADIUS = 156

DRAIN HOLES

LOWER OUTER WING RIB STATIONS

144
139
135
130
120
111.25
102.5
92
81.5
71
68
60.5
50
39.24
34
29
22
15
8
0

STA 0

STA 49

STA 86.75

FUSELAGE SECTIONS
LOOKING AFT
4" SQUARE GRIDS

STA 108

STA 180.5

STA 144.5

STA 110.5

FABRIC COVERED - FUSELAGE MID-SECTION, WINGS & AILERONS, ELEVATORS, RUDDER.
METAL COVERED - FORE & AFT FUSELAGE, WING FLAPS, HORIZ. & VERT. STABILIZERS, ELEVATOR TRIM TABS, ALL FLOATS.

29.0 DIA. CENTERED ON WING STA 82.0

TRAILING EDGE WING STRUCTURE

TRAILING EDGE FLAP

FLAP ACTUATOR

BOMB RACK ATTACH POINTS

WHITE IDENT. LIGHT (L.H. ONLY)

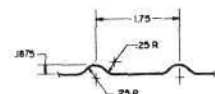
STIFFENERS REMOVED FROM SIDE PANELS WHEN AUX. TANK IS INSTALLED

SECTION AT FUEL TANKS

LOOKING AFT

FOR LONGER RANGE FLIGHTS AUXILIARY TANK IS CARRIED, BUT ONLY IN SEAPLANE MODE & WITH WHEELS & DETACHABLE PARTS OF AMPHIBIAN GEAR REMOVED.

DRAIN HOLES



CORRUGATION
USED ON HORIZ. & VERT. STABILIZERS
FULL SIZE

FLOAT OUTLINE ONLY TO SHOW FUSELAGE DETAILS

MACHINE GUN CASE EJECTION CHUTE

FLOAT STRUT ATTACH FITTINGS

WING LOCK FITTING EXTENDED (UNLOCK POSITION)

STAGGER-38

PITOT TUBE

BOTTOM VIEW

RIGHT WINGS FOLDED

SCALE BAR 1 2 3 4 5 6 7 8 9 10 11 12 INCHES 1 FT.

NICHOLAS KARSTENS
SCALE 1/2 SIZE
SEPTEMBER 1960 SHEET 4 OF 4
DOUGLAS X020-1

ORIGINAL DWG SIZE-29.25 X 41