The WREN 460 STORY

means great new capability for safe, economical STOL performance

HISTORY OF WREN AIRCRAFT CORPORATION

The company was formed and incorporated on July 3, 1962, as a Texas corporation. The incorporators were: James L. Robertson, Albert E. Morris, Jr., and E. H. Pickering, with Robertson serving as President, Morris as Vice President, and Pickering as Secretary-Treasurer.

Between July 1962 and January 1963 the company worked on the design and construction of an STOL airplane utilizing a 1958 model Cessna Skylane (182) airframe. This plane (the first WREN) flew for the first time on January 5, 1963. Test flights were conducted for 45 days. On February 20, 1963, public announcement was made of the project.

On June 30, 1964, the Federal Aviation Agency certificated the WREN 460. At that time six WRENS had been built or were nearing completion to fill orders previously placed.

With award of F.A.A. certification, on June 30th, Robertson resigned as President to be succeeded by Pickering. George S. Adams was named as Secretary-Treasurer, and Morris was named as Executive Vice President.

As of December 1967, 47 WRENS have been manufactured and 44 have been delivered.

THE PRODUCTS

1. The WREN 460 is capable of cross-country cruise with the speed and comfort of an ordinary airplane, but with the added advantages of very slow speed capabilities (level flight in level attitude down to 45 mph and with slightly nose high attitude down as low as 26 mph I.A.S. under certain conditions). This makes the WREN 460 ideal for patrolling power lines, pipe lines, timber cruising, etc.. The WREN 460 is not excelled by any other airplane in STOL (Short Take-Off and Landing) capabilities. At full gross weight in zero wind from a dry, paved surface at sea level in standard atmosphere, the WREN 460 takes off in 270 ft. and clears a 50 ft. obstacle in a total of 560 ft.. It lands over a 50 ft. obstacle to a stop in 454 ft., of which 205 ft. is landing roll. Under the same conditions, but at 10,000 ft. altitude (the highest airport in the U. S.) the WREN's take off roll is still only 761 ft. and the landing roll is only 422 ft.. The WREN 460 has the finest control response at slow speeds of any airplane. It is stall resistant, and stalls are very docile. It is extremely spin resistant in flaps-down mode, and spins can only be encountered by deliberate intent. All of this adds up to what may well be the world's safest airplane.

2. The WREN Beta Control system reversible pitch propeller is the only reversible pitch propeller available to light aircraft. The propeller itself is manufactured by Hartzell Propeller Co.. The control system which makes it practical was developed and is covered by a patent application by Wren. Currently it is applicable only to aircraft powered by Continental engines equipped to operate constant speed propellers. Use of the Wren Beta Control system reversible pitch propeller gives a pilot two advantages: first, the ability to make steep approaches to pin-point landings and: second, the ability to reduce landing roll by 40% on paved, dry surfaces and up to 80% on wet or icy surfaces.

3. Under development are the following potential products:

   A. An improved mechanical arrangement to achieve the same results from the WREN 460. The improvements reduce weight by about 40 lbs., increase cruising speeds by about 4 mph, decrease production costs by better than $1,000.00, and decrease production time by a third. The prototype new wing is completed and ready for FAA static testing. About 30 days of concentrated effort could result in FAA certification. Production tooling is 50% complete.

   B. A "kit" that can be applied to new and used Cessna 180, 182, and 185 aircraft (and, with slight variations, to Cessna 172, 175, and 206 aircraft) is under development and scheduled for FAA certification and ready for production in 45 days. This kit will give semi-STOL capabilities to these airplanes. Unlike any other such "kits" on the market, the Wren "kit" (tentatively named the Pea Patcher) will have control augmentation for improved safety at lower speeds.

   C. Engineering is completed and only production and flight test is necessary to certification of a WREN 460C model utilizing a Cessna 180 airframe, thus making available a WREN on skis, floats, amphibious floats, or with conventional landing gear. This version will utilize wings fully interchangeable with the present WREN 460 except that it appears likely that a changeover from the manually operated 180 flaps to electric flaps will be advisable.

D. Arrangements have been tentatively agreed to with Cessna Airplane Co. to provide engineering data upon which FAA certification can be readily achieved of a full WREN version of the Cessna 337 Super Skymaster (military 0-2). This is the center-line-thrust twin-engine, 4 to 6 place, high wing airplane that permits the single-engine pilot to move up to twin-engine performance without the proficiency needed to handle asymetric thrust problems encountered by loss of power on one engine in other twin-engine aircraft. The Air Force is quite interested in this airplane, and at least three commercial sales are already assured. To be designated the TWIN WREN 840, this should be beyond question the world's safest airplane. It should prove of interest to air taxi operators, especially those offering short-haul, scheduled operations in the New York area.

E. A future WREN entirely of company design and manufacture is in the preliminary design stage and basic wind tunnel tests have been conducted. This design utilizes a lifting-body principle. In its initial phase, it will utilize exactly the same wings as presently used on the WREN 460 to save time and money. This first model will be an eight place aircraft capable of cruising speeds near 200 mph yet retaining the present WREN 460 slow speed capabilities. This airplane will have many advantages for scheduled air taxi and bush airline operation. It will have practically no center-of-gravity (CG) loading problems. It's retractable landing gear can be heavy duty with large, high-floatation tires. It will be very simple and inexpensive to build. Its flying characteristics will place minimal demands on the pilot. It can be quickly convertible from passenger to cargo with ample room for on-board storage of passenger seats. It will be readily subject to growth potential to larger versions.

Patent Status

Patent No. 2,746,553 dated May 22, 1956
covering Aircraft Lateral Control Systems -- not presently being used.

Patent No. 2,760,738 dated August 28, 1956
covering method of operating a Propeller Driven aircraft -- not presently being used.

Patent No. 3,253,809 dated May 31, 1966
covering method of controlling an aircraft during Ultra Low Speed -- being used in nose mounted pitch control of Wren.

Patent Application No. 614,586 dated February 8, 1967
covering a method of controlling a reversible pitch propeller -- not being used in Wren Beta Control system for reversible pitch propeller # dated April 7, 1967.

Patent Application No. dated October 3, 1967
covering an aircraftyaw correction means which is a variable drag control linked to ailerons to offset adverse yaw resulting from excessive down aileron deflection as may be encountered in slow flight when aileron is also used as part of flap system.

Patent Application now being prepared for submission covering a differential control that permits variable aileron droop for dual use of aileron as a flap and as an aileron.

WREN OWNED STCs

STC No.	Covering	Applied to Aircraft
SA403SW	Wren 460 manufacture	Cessna 182F
SA430SW	Wren 460 manufacture	Cessna 182G
SA485SW	Wren 460 manufacture	Cessna 182H,J,K,L
SA513SW	Dual Goodyear brakes	All Wren 460 All Cessna 182
SA626SW	Oversize nose wheel fork to accomodate 8.00x6 tire	All Wren 460 All Cessna 182
SA692SW	Beta Control System reversible pitch propeller	All Wren 460 Cessna 182 E,F,G,H,J,K,L
SA816SW	Beta Control System reversible pitch propeller	Cessna 180 on floats or amphibious floats
SA816SW (reb 1/29/68)	as above	Cessna 180 on wheels or castered wheels
SA874SW	Beta Control System reversible pitch propeller	Bellanca 260

Official WREN Specifications and Performance

Power		Continental 0-470-R 230 hp
Propeller		McCauley Constant Speed or Wren Beta Control system reversible pitch
Weights - Empty (approximate)		1680 lbs. (1697 lbs. with Beta)
Useful		1120 lbs. (1103 lbs. with Beta)
Gross		2800 lbs.
Airspeeds - Max. N. E. (red line)		193 mph tas (168 kts)
Top		160 mph tas (139 kts)
Cruise:		
A. 75% power at 6500'		
Standard tires:	wheel fairings	156 mph tas (135 kts)
	no fairings	153 mph tas (133 kts)
Oversize tires:	wheel fairings	152 mph tas (132 kts)
	no fairings	149 mph tas (129 kts)
B. 65% power at 6500'		
Standard tires:	wheel fairings	146 mph tas (127 kts)
	no fairings	143 mph tas (124 kts)
Oversize tires:	wheel fairings	142 mph tas (123 kts)
	no fairings	139 mph tas (121 kts)
Stall - power off, flaps 0°, gross		54 mph ias (47 kts)
power on, flaps 0°, gross		46 mph ias (40 kts)
power off, flaps 30°, gross (Vmin)		42 mph ias (37 kts)
power on, flaps 30°, gross (Vmin)		38 mph ias (33 kts)
power on, flaps 30°, lightest		26 mph ias (23 kts)
Approach speed:		55 mph ias (48 kts) (Standard)
		60 mph ias (52 kts) (With Beta)
Landing speed: (touchdown)		35 mph ias (31 kts) (Standard)
		45 mph ias (39 kts) (With Beta)
Take-off speed:		35 mph ias (31 kts)
STOL Performance: take-off roll, zero wind, gross, paved surface, sea level, std. atmosphere		270 ft.
clear 50' obstacle, same conditions		560 ft.
landing roll, same conditions		270 ft. (Standard)
		205 ft. (With Beta)
land over 50' obstacle to stop, same conditions		555 ft. (Standard)
		454 ft. (With Beta)
take-off roll, same conditions but 10,000 ft. atmosphere		760 ft.
landing roll, same conditions but 10,000 ft. atmosphere		420 ft. (Standard)
		360 ft. (With Beta)
Fuel consumption: 65% power		11.5 gph
75% power		14 gph
35% power (50 mph, 30° flaps)		6.5 gph
22% power (70 mph, 20° flaps)		5.3 gph

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(Continued)

Ranges (No Reserve) standard tires, wheel fairings

Miles				Standard Tanks 1/	Long-Range Tanks 2/
Optimum:	115 mph,	10,000 ft.,	40% power	730 st. miles	1,000 st. miles
Normal:	156 mph,	6,500 ft.,	75% power	595 st. miles	758 st. miles
Slow speed cruise:	45 mph,	S.L.	40% power	282 st. miles	380 st. miles
	55 mph,	S.L.	30% power	423 st. miles	564 st. miles
	70 mph,	S.L.	21% power	651 st. miles	924 st. miles
Hours					
Optimum:	115 mph,	10,000 ft.,	40% power	7:30 hours	10:00 hours
Normal:	156 mph,	6,500 ft.,	75% power	8:54 hours	5:52 hours
Slow speed cruise	45 mph,	S.L.	40% power	7:30 hours	10:00 hours
	55 mph,	S.L.	30% power	8:54 hours	11:45 hours
	70 mph,	S.L.	21% power	9:20 hours	13:10 hours

Dimensions - span	35.8 ft.
length	27.3 ft.
height	9.0 ft.
Wing area	175.4 sq. ft.
Service ceiling	19,200 ft.
Rate of climb (sea level)	1,080 ft./min.
Power loading	12.2 lbs/hp.
Wing loading	16.09 lbs/sq. ft.
Capacities - seating, std. (max)	4 (6)
cargo	790
cargo - cu. ft.	44
cabin size - length	7.7 ft.
width	3.2 ft.
height	4.0 ft.
cargo door dimensions	34 x 40 in.
baggage	120 lbs.

Turning maneuvers

In slow speed flight (full flaps)	
Maximum effort, minimum time	
180° turn	4 sec at 55 mph, 103 ft. radius
Power off 180° turn	8 sec at 55 mph, 205 ft. radius
	100 ft. loss of altitude

Note:

There is no way of expressing in numbers the exceptional control response of the WREN in its slow speed regime. At comparable speeds it will out-maneuver a helicopter and do it with much of the ease of driving a car.

1/ Standard tanks, 65 gallons, 60 usable, standard tires, no fairings

2/ Optional long-range tanks, 84 gallons, 79 usable, standard tires, no fairings

Official WREN Specifications and Performance
(Continued)

Acceleration in flight:

	Maintaining Altitude	Losing Altitude
From slow flight at 50 mph (43 kts) to 60 mph (52 kts)	3 sec	2 sec
70 mph (61 kts)	6 sec	4 sec
80 mph (70 kts)	9 sec	6 sec
90 mph (78 kts)	12 sec	7 sec
100 mph (87 kts)	16 sec	9 sec
110 mph (95 kts)	20 sec	12 sec
120 mph (104 kts)	25 sec	15 sec
	(total loss of 100 ft.)	

Deceleration in flight:

	Maintaining Altitude	Gaining Altitude
From cruising flight at 120 mph (104 kts) to 110 mph (95 kts)	3 sec	3 sec
100 mph (87 kts)	6 sec	5 sec
90 mph (78 kts)	9 sec	7 sec
80 mph (70 kts)	12 sec	9 sec
70 mph (61 kts)	17 sec	10 sec
60 mph (52 kts)	21 sec	13 sec
50 mph (43 kts)	24 sec	15 sec
	(Total gain of 100 ft.)	

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Quietness of the WREN 460 in Flight

Tests made of the noise level of a standard, unmodified WREN 460 indicate that this airplane in slow speed flight (50 mph, 1600 rpm, 21" mp) is inaudible when flying 1,000 feet directly overhead.

Using a Bruel and Kjaer precision sound level meter in open pasture land, at least a mile away from highway traffic, with a breeze of less than 5 mph, the following decibel readings were recorded with the WREN 460 flying directly overhead at the following altitudes above the ground level:

	db level (Wren plus ambient)	
Altitude	@ 2200 rpm	@ 1600 rpm
Ambient (background level)	72 db	72 db
100 ft.	96 db	92 db
200 ft.	95 db	88 db
300 ft.	85 db	80 db
500 ft.	82 db	
800 ft.		72 db
1,000 ft.	72 db	

It will be noticed in studying the above table that the airplane in flight 800 feet above the ground at 1600 rpm caused no measurable increase above the ambient in sound meter reading. This was confirmed by the observer on the ground, who reported the airplane noise as inaudible at the time.

Similarly, at the 1,000 ft. altitude at 2200 rpm the meter indicated no increase above the ambient sound level, and the observer reported the airplane noise as inaudible.

Static tests (with the airplane on the ground and the engine power developed at the same power settings) indicate that at these settings the predominate sound appears to be engine exhaust noise. This could be readily muffled and reduced by a substantial degree, probably to the point that (of the remaining total noise of the airplane in flight) propeller tip noise, engine intake noise, or airstream noise might remain as the resulting dominant sound.

Fiscal 1965-66 Cont'd		Sold To	Resold To	Location
May		William Blakemore II		Midland, Texas
June	d	Furnas Electric Co.		Brazil
Fiscal 1966-67				
July	d	Cenorte Elec. Co.		Brazil
August				
September	d	Moctezuma Pedrero A.		Mexico
October				
November	d	Empresa delValle Lugo		Venezuela
December	d	Safari Air Services		Kenya
January				
February	d	Citelc Electric Co.		Brazil
March	c	Texas Gulf Sulphur Co.		Australia
April	d	Popular Library, Inc.		New York
May				
June	d	Texas Parks & Wildlife Dept.		San Angelo, Texas
	c	Dr. Norman Cutler		Wilmington, Del.
Fiscal 1967-68				
July	c	Esponda Ranch		Buffalo, Wyo.
August	*	Jetair		Everett, Wash.
September				
October				
November	c	Pipe Line Technologists, Inc.		Calgary, Can.
		CAAEB		Brazil
		CAAEB		Brazil
		Pemex		Mexico
December		Pemex		Mexico

* Indicates an airplane sold to be used as a demonstrator by a Wren distributor. Seventeen of the 19 demonstrators have now been resold to customers, leaving two still as demonstrators (marked with **).

** Indicates an airplane still being used as a demonstrator by a Wren dealer.

d Indicates a sale by a Wren distributor or dealer.

c Indicates a sale by a Wren company salesman (12 to date).

Sales Summary

Fiscal Period	Delivered by Factory	Sold Direct to user by Factory	Sold to Dealers	Resold by Dealers	Sales to Users
1963-64	4	2	2	1	3
1964-65	19	6	13	4	10
1965-66	5	1	4	4	5
1966-67	9	2	7	14	16
1967-68 (to date)	8	2	5	6	8
Totals	45	13	31	29	42

On Hand	
Dealers	2
Factory	3
	5

1-29-68

4 YEAR DELIVERIES OF AIRCRAFT

THAT CAN USE WREN/BETA SYSTEM

	1967	1966	1965	1964
Aero Commander 200	24	43	-	-
Beech Debonair	111	200	171	100
Beech Bonanza	316	339	291	435
Bellanca 260B/300	86	65	-	-
Cessna 180	90	167	156	146
Cessna 182/Skylane	836	993	865	778
Cessna 185/Skywagon	151	193	181	116
Cessna 206/Super Skylane	106	161	128	96
Cessna 206/Super Skywagon	243	252	180	240
Cessna 210/T210/Centurion	226	257	224	283
	2,189	2,670	2,196	2,194
All single-engine deliveries 1/	11,149	12,156	7,341	6,356
Percent applicable	20%	22%	30%	35%
Total all deliveries 2/	13,577	15,589	11,852	9,336

1/ Does not include agricultural airplanes.

2/ Includes ag planes, twins, and jets

All of the stock of Wren Aircraft Corporation is $ .10 par value common stock. All shares are equal in all respects.

As on December 31, 1967, there were $14,000 in 7½% convertible debentures issued. These debentures are convertible to common stock in Wren by or before the fall of 1970 at $3.00 per share.

As of December 31, 1967, 1,000,000 shares are authorized. There are 354,600 shares issued and outstanding as of March 1, 1967. These shares were sold as follows:

44,650	shares at $1.00 (prior to 2-1-63)
33,205	shares at $2.50 (prior to 6-30-64)
3,750	shares at $3.00 (since 7-1-64)
1,096	shares at $2.55 (employee purchase by payroll deduction)
83,999	shares for services, patent rights, engineering
700	shares as debenture bonus
200	shares at $2.61 (stock option)
187,000	shares at $ .1336 (June, 1967)

Total cash investment in Wren is, therefore, $167,229.30.

Direct Cost of Manufacture

(Shop Labor, Shop Overhead, Parts & Hardware, Shop Rent)

(During this period 6 Wrens were completed,
one was underway at beginning of period.)

Aircraft #44 (Brazil)		
Direct Labor - assembly	$ 1,665.15	
Overhead @ 65% of above	1,082.35	
Wren built parts @ inventory cost	819.02	
Outside mfr. parts completed by Wren @ inventory cost	1,770.96	
Outside mfr. parts at cost	588.19	
Hardware (est.)	200.00	
		$ 6,125.67
Aircraft #45 (Brazil)		
Direct labor - assembly	$ 1,488.08	
Overhead @ 65% of above	967.25	
Wren built parts @ inventory cost	819.02	
Outside mfr. parts completed by Wren @ inventory cost	1,770.96	
Outside mfr. parts at cost	588.19	
Hardware (est.)	200.00	
		5,833.50
Aircraft #46 (Demo 460V)		
Direct labor - assembly	$ 1,755.63	
Overhead @ 65% of above	1,141.16	
Wren built parts @ inventory cost	819.02	
Outside mfr. parts completed by Wren @ inventory cost	1,770.96	
Outside mfr. parts @ cost	588.19	
Hardware (est.)	200.00	
		6,274.96
Aircraft #47 (Pemex)		
Direct labor - assembly	$ 1,214.47	
Overhead @ 65% of above	789.41	
Wren built parts @ inventory cost	819.02	
Outside mfr. parts completed by Wren @ inventory cost	1,770.96	
Outside mfr. parts @ cost	588.19	
Hardware (est.)	200.00	
		5,382.05
Aircraft #48 (Pemex)		
Direct labor - assembly	$ 1,550.16	
Overhead @ 65% of above	1,007.60	
Wren built parts @ inventory cost	819.02	
Outside mfr. parts completed by Wren @ inventory cost	1,770.96	
Outside mfr. parts @ cost	588.19	
Hardware (est.)	200.00	
		5,935.93

Direct Cost of Manufacture - 2

Aircraft #49 (Pemex)		
Direct labor - assembly	$ 1,467.70	
Overhead @ 65% of above	954.01	
Wren built parts @ inventory cost	819.02	
Outside mfr. parts completed by Wren @ inventory cost	1,770.96	
Outside mfr. parts @ cost	588.19	
Hardware (est.)	200.00	
		$ 5,799.88
Average of 6 planes		$ 5,892.00

Total cost of base airplane

#44	Cessna	$ 15,208.09
	Wren	6,125.67
		$ 21,333.76
#45	Cessna	$ 15,115.59
	Wren	5,833.50
		$ 20,949.09
#46	Cessna	$ 15,208.09
	Wren	6,274.96
		$ 21,483.05
#47	Cessna	$ 15,643.09
	Wren	5,382.05
		$ 21,025.14
#48	Cessna	$ 15,643.09
	Wren	5,935.93
		$ 21,579.02
#49	Cessna	$ 15,643.09
	Wren	5,799.88
		$ 21,442.97

Cash Operating Cost Analysis

Variable costs:

Cost of producing one Wren 460:		
Direct labor (disassemble Cessna, install integrated trim system, install ULS, disassemble wings, remanufacture wings, assemble surfaces, assemble wings on plane, replace interior) - average of last six planes manufactured	$ 1,523.53	
Wren manufactured parts (including surfaces) at inventory cost 1/ (which includes overhead)	819.02	
Parts partially manufactured outside, but completed by Wren, at inventory cost 1/	1,770.96	
Outside manufactured parts, at cost 2/	588.19	
Hardware (rivets, bolts, washers, bearings, etc.)	200.00	
	$ 4,901.70	
Plus Cessna aircraft, less optionals ($17,995 less 20%)	14,396.00	
Total direct cost per Wren 460 (less optionals)		$ 19,297.70
Cost of producing one Beta propeller kit:		
Direct labor	$ 15.75	
Wren manufactured parts	101.24	
Woodward governor	85.00	
Hartzell propeller	603.00	
Shipping charges	18.00	
Total direct cost per Beta propeller kit		$ 822.99

Overhead costs:

Shop overhead costs	
Rent (80% of $1,666.20, which includes utilities)	$ 1,332.96
Average monthly shop maintenance & servicing supplies	290.26
Combined purchasing agent and stock control	400.00
Shop superintendent	650.00
Inspector	575.00
Unallocated shop labor (includes holiday and sick pay, janitor, work scrapped, etc.)	557.73
	$ 3,805.95

1/ Recent production of Wren manufactured parts shows substantial reduction in per-item costs, thus inventory replacement items will be at about 25% lesser inventory cost.

2/ Recent purchases of contracted manufactured parts indicate rising costs which can only be offset by higher quantity purchases.

Engineering overhead costs:		
Rent (5% of $1,666.20)	$ 83.31	
Chief Engineer (also Executive V.P.)	1,100.00	
Consulting engineer	300.00	
Supplies	150.00	
Draftsman	500.00	
Shop labor	657.48	
	$ 2,790.79	
General & administrative:		
Rent (10% of $1,666.20)	$ 166.62	
Supplies and services	1,775.33	
President	1,100.00	
Treasurer	900.00	
Secretarial	450.00	
	$ 3,391.95	
Marketing: 3/		
Rent (5% of $1,666.20)	$ 83.31	
Travel (including fuel and oil)	1,500.00	
Advertising and promotion	1,555.51	
Postage	103.00	
Telephone	550.00	
Salaries (two salesmen)(does not include commissions)	800.00	
Depreciation on demonstrator aircraft @ $15/hr	1,500.00	
	$ 6,091.82	
Total overhead (monthly)		$ 16,080.51
Potential revenues:		
Wren 460 sales:		
List price of Wren 460 less optionals	$ 32,720.00	
Cost of Wren 460 less optionals	19,297.70	
Gross profit @ list		$ 13,422.30
Net price to export distributor	$ 24,540.00	
Gross profit on sale to distributor		$ 5,242.30
Optional equipment on average Wren 460 @ list	$ 7,500.00	
Average cost of equipment installed @ 65%	4,875.00	
Gross profit @ list		$ 2,625.00
Net price to export distributor	$ 5,625.00	
Gross profit on sale to distributor		$ 750.00

3/ This is average of experience during last six months of 1967. Needed (but not available) is a Vice President Marketing and secretarial assistance.

Beta prop kit sales:			
List price of Beta prop system kit		$ 1,995.00	
Cost of Beta prop system kit		882.99	
Gross profit @ list			$ 1,172.01
Net price to distributors		$ 1,396.50	
Gross profit on sale to distributor			$ 573.51
Miscellaneous sales & service (average 7 months)		$ 1,421.73	
Direct labor cost (average 8 months)	$ 169.38		
Parts & materials cost (estimated)	450.00	619.38	
Gross profit on misc. sales & service			$ 802.35

WREN 460

A CONVENTIONAL AIRPLANE WITH EXCEPTIONAL SAFE STOL AND SLOW FLIGHT ABILITY

An airplane for Very Special People . . .

The Wren is designed to be a useful tool for people who need to go places where airports are non-existent or inconveniently located. The Wren makes it possible for such people to safely land near construction sites, beside drill rigs, alongside remote villages, or in pastures to inspect or doctor cattle.

The Wren is designed for people who want usable slow-speed flight in the 40 to 60 mph range. The Wren makes it possible for such people to slowly and safely patrol power lines, forest land, fishing areas, game land, highways, or international borders.

The Wren provides increased safety with its very low landing speeds and its ability to proceed at slow speeds when visibility gets low. The Wren does all of this in *level* attitude. It is an easy airplane to fly — try the Wren for an entirely new and desirable concept in peace-of-mind flying.

Yet with all of these remarkable features, the Wren also has the get-up-and-go cruising speeds of the ordinary airplane — over 1200 miles in an eight hour day in comfort and style.

IN ALL THE WORLD . . . ONLY THE

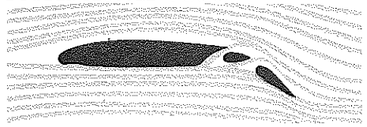
WREN 460

- ☐ CAN TAKE-OFF IN LESS THAN 300 FT.—SAFE AND LEVEL
- ☐ CAN APPROACH AT 40 TO 50 MPH IN LEVEL ATTITUDE
- ☐ CAN TOUCH DOWN AT 35 MPH AND STOP IN 200 FT.
- ☐ CAN PATROL ALL DAY AT LESS THAN 50 MPH
- ☐ AND CAN STILL CRUISE WITH 4 PEOPLE AND ALL THEIR LUGGAGE AT OVER 150 MPH

WHAT MAKES THE WREN SO SPECIAL?

The inter-related effects of the Wren's four special devices combine to provide exceptional controllability, maneuverability, and docile stall characteristics so that for the first time, safe and practical use of an airplane's low speed range is available to the average pilot. These devices are: (1) full-span, double-slotted flaps, (2) drag plates called "Wren's Teeth" mounted atop the wings, (3) an augmented wing leading edge, and (4) a nose-mounted pitch control system.

WHY USE FULL-SPAN DOUBLE-SLOTTED FLAPS?

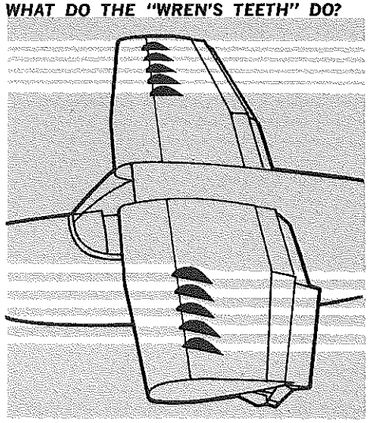


These flaps provide an 87% increase in the wing's lift coefficient when extended to their maximum position, thus providing the ability to maintain required lift at slower airspeeds. But they do much more than this, for lowering the flaps also reduces speed. With the ailerons acting both as flaps *and* ailerons ('flaperons'), the interrelated position of wing, turning vane, and flaperon with the air spaces between, direct the high energy flow of air from below the wing surface through the spaces and smoothly over the upper surfaces of the flaperons to give unusually effective aileron response even at slowest speeds. In effect, the air is being "blown" over these surfaces in much the same manner as is derived by the pumping of air over similar surfaces to produce boundary layer control as used in the latest designs of military aircraft.

Because the Wren flaps are externally hinged (instead of riding on an intricate system of rails or tracks) the center turning vane is *always* in optimum position relative to the wing and trailing flap. This results in a smooth flow of air over both the vanes and flaps at all times with the *complete* elimination of flap buffeting in any setting or condition. The Wren never encounters flap buffeting.

With flaps extended, aileron ("flaperon") power is so great that the Wren can be rocked from left wheel to right wheel while slowly taxiing down the runway.

WHAT DO THE "WREN'S TEETH" DO?

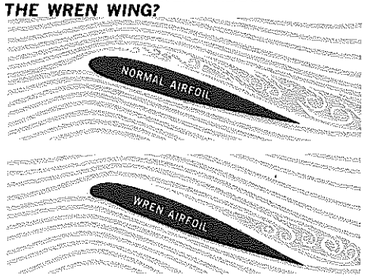


Mounted atop each wing is a series of five drag plates called "Wren's Teeth" which are normally feathered into the airstream. In slow flight (and *only* in slow flight) these Teeth turn (up to 60°) broadside to the airstream ahead of the "up" aileron *only*. The degree of turning of these Teeth is in relation to the amount of up-aileron applied and the drag thus induced offsets a like amount of drag on the opposite wing created by the use of "down" aileron that becomes almost broadside to the airstream. Without the balancing effect of the Wren's Teeth, the drag of the down aileron would create an adverse yaw making coordinated turns impossible.

The action of the Wren's Teeth augments both yaw *and* roll control with the result that coordinated turns are made using aileron only.

The ingenious rigging of the Wren ailerons, to which the Wren's Teeth are coupled, is such that the Teeth move *only* in slow-flight operation. At cruising speeds the Teeth always remain feathered into the airstream.

WHAT'S SO DIFFERENT ABOUT THE WREN WING?



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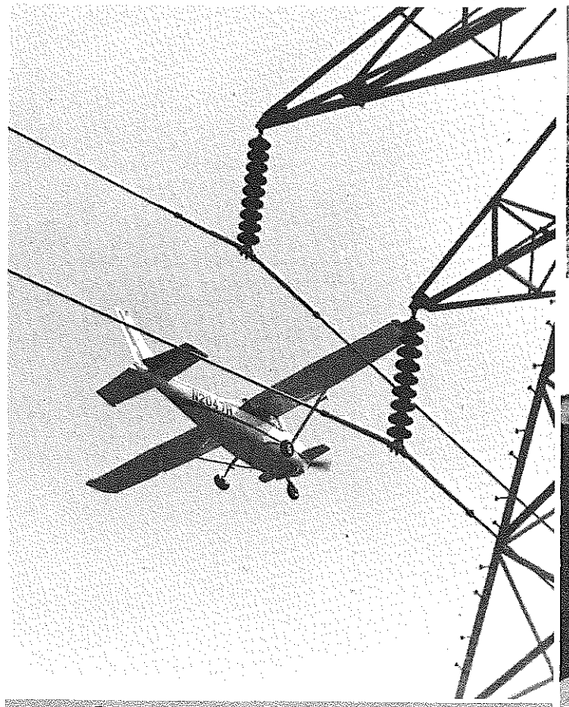
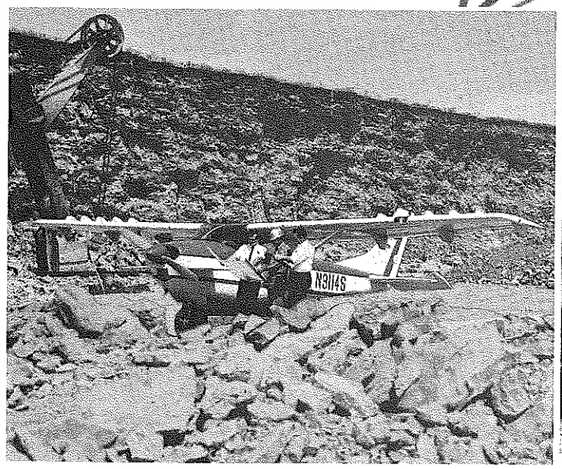
SPECIFICATIONS

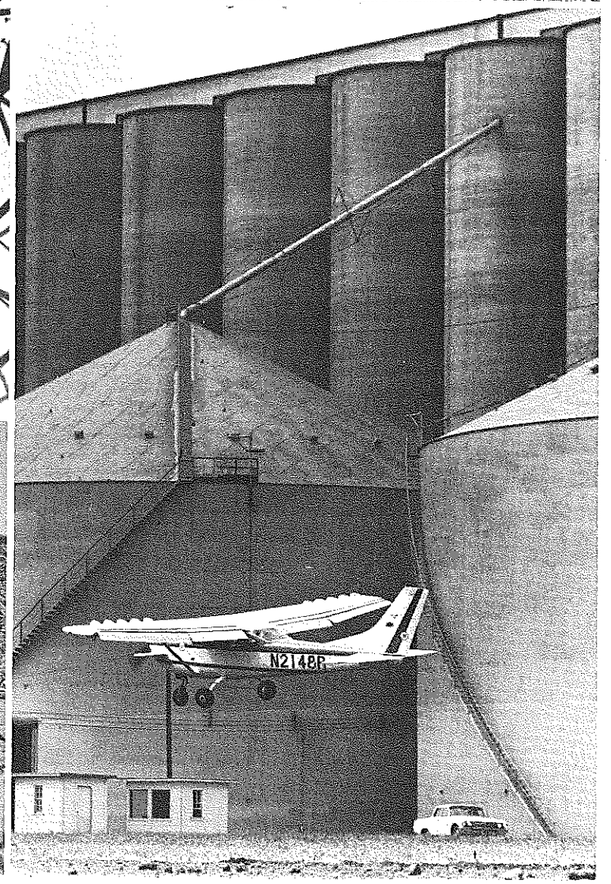
Gross Weight	2800 lbs.	Take-off (gross load, zero wind, sea level)		Range @ 10,000'—no reserve	
Empty weight (approximate)	1710 lbs.	Ground roll	300 ft.	79 gal. @ 115 mph (optimum)	1150 miles
Useful load	1090 lbs.	From stop to clear 50' obstacle	605 ft.	79 gal. @ 151 mph (normal)	872 miles
Seats	4 - 5	Landing (gross load, zero wind, sea level)		Power loading	12.2 lbs./h.p.
Speeds (gross weight)		Ground roll	300 ft.	Wing loading	16.09 lbs./sq. ft.
Top - sea level	160 mph	Clear 50' obstacle to stop	612 ft.	Power	
75% power @ 6500 ft.	151 mph	Rate of climb, sea level, flaps up	1080 ft./min.	Continental O-470-R	230 h.p.
Approach	55 mph	Service ceiling	19,200 ft.	Fuel Capacity	
Touchdown or take-off	35 mph			Standard	65 gal.
				Optional	84 gal.

THE WREN 460 WILL TAKE YOU WHERE YOU COULDN'T GO BEFORE

Those tight little spots that are marginal or impossible in other airplanes are routine in a WREN 460 . . . we call it "THE ACRE AIRPORT AIRPLANE" . . . and that's conservative.







IN ALL THE WORLD . . . ONLY THE

WREN 460

- ☐ CAN TAKE-OFF IN LESS THAN 300 FT.—SAFE AND LEVEL
- ☐ CAN APPROACH AT 40 TO 50 MPH IN LEVEL ATTITUDE
- ☐ CAN TOUCH DOWN AT 35 MPH AND STOP IN 200 FT.
- ☐ CAN PATROL ALL DAY AT LESS THAN 50 MPH
- ☐ AND CAN STILL CRUISE WITH 4 PEOPLE AND ALL THEIR LUGGAGE AT OVER 150 MPH

WHAT MAKES THE WREN SO SPECIAL?

The inter-related effects of the Wren's four special devices combine to provide exceptional controllability, maneuverability, and docile stall characteristics so that for the first time, safe and practical use of an airplane's low speed range is available to the average pilot. These devices are: (1) full-span, double-slotted flaps, (2) drag plates called "Wren's Teeth" mounted atop the wings, (3) an augmented wing leading edge, and (4) a nose-mounted pitch control system.

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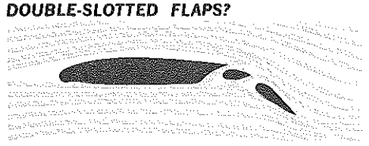

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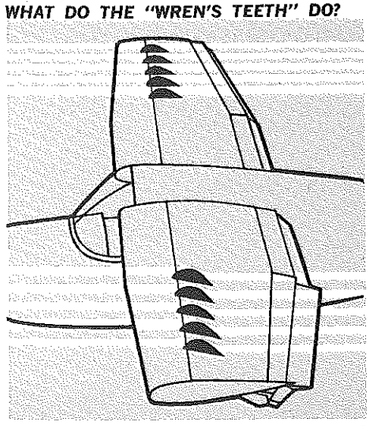

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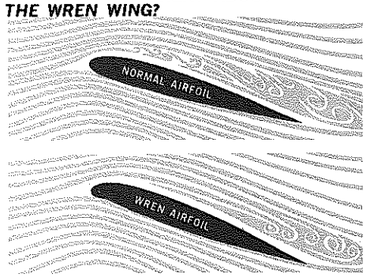

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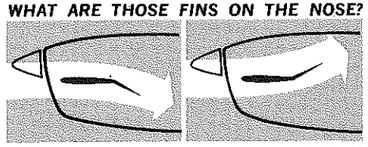
Inadvertent stalls are next to impossible, deliberate stalls *can* be effected by the usual methods, but recovery from these intended stalls is noticeably docile and complete control around all three axes is solidly available through the stall.

Power off and flaps down, the Wren will never encounter an unintentional spin.

WHAT ARE THOSE FINS ON THE NOSE?



Mounted on the nose directly behind the propeller where they are immersed in the blast of the slipstream is a small set of horizontal stabilizers and elevators. Acting upon the strong blast of air from the propeller, these ULS controls (Patent Pending) give agile pitch response at low speeds providing added pitch power when the conventional elevators begin to be inadequate.

So powerful are these controls that the nose wheel can be lifted clear of the ground before the Wren moves even a length forward on take-off. This overcomes the only serious objection to the use of tricycle gear on airplanes operating out of sandy, muddy, or extremely rough strips.

WHY DOESN'T WREN BUILD ITS OWN AIRFRAME?

Wren uses brand new 4-5 place Cessna 182 airframes in the manufacture of the model 460, just as Cessna purchases engines, tires, brakes, radios, electrical fixtures, fittings, etc. from their suppliers.

Because Wren uses the Cessna 182, Wren owners have the advantages of economy, proven reliability and years of refinement inherent in this airframe of which more units have been built than of any airframe in commercial production today.

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The combined effect of the Wren devices operating in "cooperation" with each other and with the dependable and rugged Cessna airframe results in maneuverability, controllability, safe and easy use of the lowest speed regime, and the ability to take-off and land in very short distances.

WHAT ABOUT THE WREN'S TAKE-OFF?

Take-off is accomplished dependably within 300 feet at sea level, standard atmosphere, from a hard surface, at gross weight and in no wind. This combination of conditions exists only in about one out of a thousand take-offs. Generally there is a light to moderate breeze, loading varies from light to heavy, the altitude is somewhat above sea level, temperatures vary as much as 50° either side of standard, and still other variables such as field conditions enter the picture. As a result, take-off distances can vary from 50 feet lightly loaded in a stiff breeze at sea level to as many as 600 feet at extreme altitudes, with heavy loads, and no wind. In any case, the Wren is off safely and easily in *less than half* the distance of the ordinary airplane under comparable conditions.

Experienced bush pilots, accustomed to getting maximum performance from ordinary airplanes can cut substantially from the quoted 300 foot rolls at sea-level, no-wind conditions. Take-off rolls of only a little more than 200 feet under these conditions are possible by the pro pilot. The 300 foot figure is based on capable handling by average pilots.

Take-off roll is a function of the time required to accelerate to flying speed. Accelerating into the take-off from a turn reduces the forward rolling distance required. When this is not possible, locking the brakes until full power is achieved is an aid. But any or all such efforts serve only to reduce the take-off roll by maybe one or two plane lengths. With flaps extended, the Wren just naturally flies off after a very short roll.

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Once free of ground friction, the Wren accelerates very rapidly, thus the time in which it could be considered as "flying in ground effect and below stalling speed," is so brief that it creates no problem at all. This is difficult to express in words, but becomes clearly evident in flying the Wren.

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Obstacles in the climb-out path can be avoided by turns which can be started as soon as the Wren is airborne. Such is the controllability and maneuverability of the remarkable Wren, that with moderate practice, climbing turns of 250 ft. radius can be accomplished beginning within 50 to 100 feet of the lift-off spot.

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The same features that make take-offs short, level, comfortable and safe apply equally as well to landing approaches and landings.

Approaches at airports are made in clean configuration until about 500 feet out on final when full flaps are lowered. An immediate slow-up results and the approach continues at 65 mph to as low as 45 mph as desired, all in level to slightly nose-down attitude.

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Shortest landing rolls are accomplished by flaring with power *in ground effect* (within the last three to four feet above the surface).

The slowness of the approach with full flaps, plus the addition of power to hold the nose off, coupled with the flare (ample flare power is produced by the ULS nose control) to "roll up the ground effect cushion" results in slowest touchdowns. Immediate flap retraction places the weight on the wheels. Application of full braking will bring the Wren to a stop in about 300 feet at sea level, zero wind, gross weight, standard atmosphere, and hard surface.

Again, this combination of conditions is seldom encountered. Suffice it to say that landings are readily accomplished with ground rolls no longer than take-off runs under similar circumstances.

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WHAT ABOUT A GO-AROUND IN THE WREN?

In event of an aborted landing, a go-around is simply accomplished without change of flap setting; application of additional power is all that is required. Full power is *not* required. Trim settings may be adjusted if desired, but can be easily overpowered without creating any adverse conditions.

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Crosswind landings, and/or take-offs are no more of a problem for the Wren, even with full flaps, than would be encountered in flying the basic Cessna 182 airframe *with flaps retracted.* Crosswind landings and take-offs in winds as high as 40 knots have been accomplished with no unusual difficulty. Of course, with the Wren 460, as the crosswind increases in strength, it becomes increasingly possible to arrange to land or take-off *into* the wind because rolling distance required recomes remarkably short into strong winds. A 30 knot wind, for example, will ordinarily shorten take-off or landing rolls to less than 100 feet.

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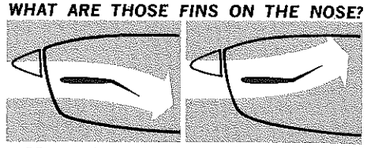

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The reasons for the almost gentle reactions to turbulence is the slow speed with which rough air is encountered. At 60 miles per hour the effect of turbulence shock is reduced by half from the effect at 90 mph. At 120 mph the shock of turbulence is four times as great as at the Wren's 60 mph speed, and at 180 mph the shock of turbulence is nine times as rough.

The end result of slowing down the Wren is to almost completely smooth out moderate turbulence and even make severe turbulence seem only moderate.

Turbulence off the end of the landing strip on slow approaches will disturb the Wren's equilibrium (as it would with any airplane), but very gently and leaving ample time for corrective action with the Wren's nimble controllability.

WHAT ABOUT CLIMB OUTS IN THE WREN?

Climbs in the Wren with flaps fully extended are best made at 59 mph, IAS. After all obstacles are cleared and it is desired to leave the area of take-off, flaps should be retracted and a climb speed at 91 mph, IAS, established which will give a solid rate of climb of 1,080 feet per minute.

WHAT ABOUT THE WREN'S SLOW FLIGHT CRUISING?

With flaps extended, level flight *in level attitude* can be made at speeds down to 50 mph. At this speed, at sea level, power settings of 16 in. and 2,000 to 2,200 rpm are used, amounting to approximately 30% of power available. This is barely above idling power, hence no cooling or overheating problem is encountered. At this speed, fuel consumption is 7 gal. per hour and endurance is over 11 hours with long range tanks.

With flaps retracted the Wren 460 is a conventional airplane. The nose-mounted ULS control provides an additional amount of lift, but otherwise its effect is not noticeable in cruising flight except to provide a slight flattening of airplane attitude in turbulent air.

WHAT ABOUT SLOW SPEED MANEUVERING?

From the Wren's low level-flight speeds, it is possible to execute a 180° turn in 7½ seconds and 360° turns in 12 seconds without losing altitude. The turning radius in such turns is less than 200 feet. Further, because of the low speeds, "g" forces are negligible (less than 1½ g's), so slight as to be barely noticeable.

WHAT HAPPENS WITH THE WREN IN CASE OF POWER FAILURE?

Take-off is the most critical situation in any flight, even though landing accidents are by far more numerous. The critical condition in any airplane on take-off results from power failure — whether single or multi-engined.

With the Wren's level attitude during take-off and climb-out, the pilot is at all times able to execute a fully controlled forced landing—only much slower than in any ordinary airplane.

A loss of power below 20 feet altitude finds the Wren still in ground effect and flying at its slowest speed, therefore an immediate slow touchdown can be effected.

Above 20 feet, the Wren has accelerated to a speed that permits a power-off glide of 50 to 60 mph to a fully controlled forced landing with adequate flare power for a touchdown speed below 50 mph, and a landing roll of less than 400 feet. Finding a spot this size to sit down in is many times more likely than finding a cleared area twice to three times this size.

In this respect it is interesting to note the following quote concerning landing accidents from the Federal Aviation Agency's Airworthiness Manual, Part 8, Appendix B, page 92:

> "The record indicates that fatality rate increases rapidly above 55 mph."

WHAT ABOUT MAINTENANCE?

The Wren features are intentionally designed to be readily inspected, maintained or repaired *in the field* away from normal repair facilities. There are no forgings, castings, or intricately formed parts. Sheet metal and steel tubing are used exclusively for ready repairability. Yet the Wren features are those least likely to need repair or replacement. Oversized and conveniently located inspection plates permit easy access for viewing or adjusting. Unique locating holes assure quick and accurate rigging. The ULS nose control does not interfere with normal engine servicing and can be removed in 10 minutes for complete access for major engine work. Parts and service for the Cessna airframe and Continental engine are available from the world's largest aircraft and engine service networks.

WHAT DOES THE WREN GIVE UP TO GAIN ITS SPECIAL FEATURES?

Every airplane is a compromise. Period. The Wren 460 is no exception.

To gain a desirable feature in any airplane requires a sacrifice in some other feature or features. It's like a tangled mess of jackstraws . . . move one and many others are moved also.

For example, an attempt to gain more speed (as most every new model attempts to do) is invariably accompanied by a sacrifice, or a series of sacrifices, in one or more of the following: economy, ease of handling, useful load, structural limitations, cabin size, mechanical simplicity, or some other desirable feature.

The Wren had to sacrifice a little speed, useful load, and price.

HOW MUCH SPEED IS LOST?

The Wren's top speed is 160 mph. This speed is faster than eight four-place, single-engine planes on the market and slower than 15 others. It represents a loss of six miles per hour from the cruising speed of the Cessna 182 (which is utilized in the Wren's manufacture). In an eight-hour flight, this loss amounts to 48 miles.

HOW MUCH IS LOAD REDUCED?

The Wren 460's over half-ton of useful load is greater than that of 10 other four-place, single-engine models and less than that of 13. The Wren special parts add 140 lbs. to the empty weight of the airplane.

HOW ABOUT COST?

The Wren 460 is an EXTRA SPECIAL airplane, with EXTRA SPECIAL design features that are expensive to produce in the limited quantities dictated by the selective market of people with EXTRA SPECIAL desires in aircraft designed for EXTRA SPECIAL performance. As a result, the Wren 460 is the highest priced single-engine airplane with conventional airplane performance, but it is also by far the *lowest priced STOL airplane* in production.

HOW CAN THE WREN BE USED?

Obviously, to get in and out of strips too short for ordinary airplanes.

For patrol work where safe flight speeds of 50 mph to 70 mph in level attitude is required.

For pilots who desire extra safety and greater ease of flying or who may have been sweating out the use of short fields.

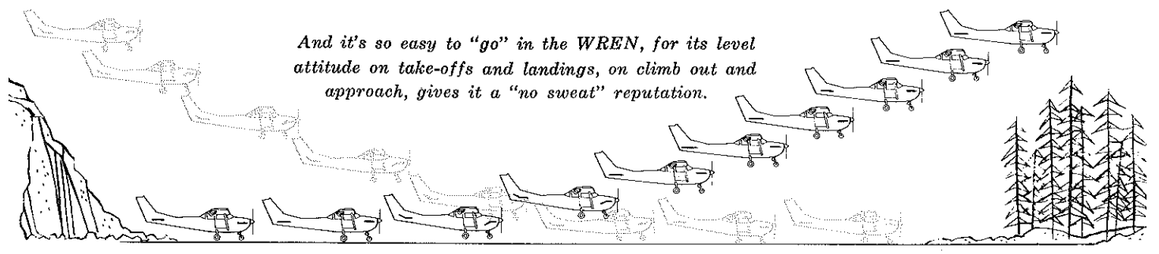
For mountain and canyon flying where a short turning radius can be vital.

For nap-of-the-earth reconnaissance where nimble maneuvering at slow speeds is important.

For comfortable flying in turbulent air.

WHO CAN USE THE WREN?

If you drill for oil; run a ranch; build roads, bridges, dams, buildings, or pipelines; patrol power lines, forests, or highways; spot fish or game; operate in the bush or mountains; make calls at remote plant sites, farms, or wells; take aerial photographs or make geological surveys; operate an aerial ambulance service, or provide medical care (people or animals) in remote areas . . . yes, if you have any occasion to operate out of strips or pastures too short for safe operation in ordinary airplanes, and you want to do it safely and easily regardless of the number of hours in your log book . . . *you* need a Wren 460.



And it's so easy to "go" in the WREN, for its level attitude on take-offs and landings, on climb out and approach, gives it a "no sweat" reputation.

IN ALL THE WORLD . . . ONLY THE

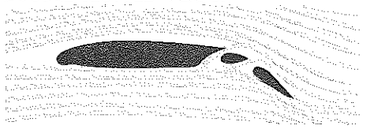
WREN 460

- ☐ CAN TAKE-OFF IN LESS THAN 300 FT.—SAFE AND LEVEL
- ☐ CAN APPROACH AT 40 TO 50 MPH IN LEVEL ATTITUDE
- ☐ CAN TOUCH DOWN AT 35 MPH AND STOP IN 200 FT.
- ☐ CAN PATROL ALL DAY AT LESS THAN 50 MPH
- ☐ AND CAN STILL CRUISE WITH 4 PEOPLE AND ALL THEIR LUGGAGE AT OVER 150 MPH

WHAT MAKES THE WREN SO SPECIAL?

The inter-related effects of the Wren's four special devices combine to provide exceptional controllability, maneuverability, and docile stall characteristics so that for the first time, safe and practical use of an airplane's low speed range is available to the average pilot. These devices are: (1) full-span, double-slotted flaps, (2) drag plates called "Wren's Teeth" mounted atop the wings, (3) an augmented wing leading edge, and (4) a nose-mounted pitch control system.

WHY USE FULL-SPAN DOUBLE-SLOTTED FLAPS?

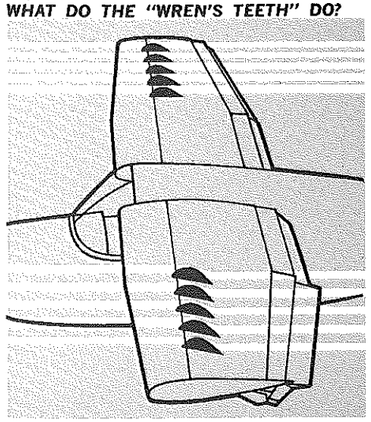


These flaps provide an 87% increase in the wing's lift coefficient when extended to their maximum position, thus providing the ability to maintain required lift at slower airspeeds. But they do much more than this, for lowering the flaps also reduces speed. With the ailerons acting both as flaps *and* ailerons ('flaperons'), the interrelated position of wing, turning vane, and flaperon with the air spaces between, direct the high energy flow of air from below the wing surface through the spaces and smoothly over the upper surfaces of the flaperons to give unusually effective aileron response even at slowest speeds. In effect, the air is being "blown" over these surfaces in much the same manner as is derived by the pumping of air over similar surfaces to produce boundary layer control as used in the latest designs of military aircraft.

Because the Wren flaps are externally hinged (instead of riding on an intricate system of rails or tracks) the center turning vane is *always* in optimum position relative to the wing and trailing flap. This results in a smooth flow of air over both the vanes and flaps at all times with the *complete* elimination of flap buffeting in any setting or condition. The Wren never encounters flap buffeting.

With flaps extended, aileron ("flaperon") power is so great that the Wren can be rocked from left wheel to right wheel while slowly taxiing down the runway.

WHAT DO THE "WREN'S TEETH" DO?

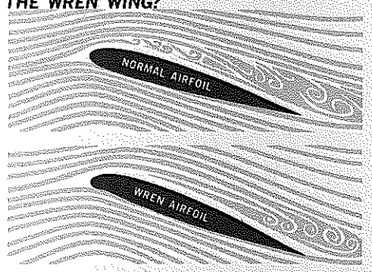


Mounted atop each wing is a series of five drag plates called "Wren's Teeth" which are normally feathered into the airstream. In slow flight (and *only* in slow flight) these Teeth turn (up to 60°) broadside to the airstream ahead of the "up" aileron *only*. The degree of turning of these Teeth is in relation to the amount of up-aileron applied and the drag thus induced offsets a like amount of drag on the opposite wing created by the use of "down" aileron that becomes almost broadside to the airstream. Without the balancing effect of the Wren's Teeth, the drag of the down aileron would create an adverse yaw making coordinated turns impossible.

The action of the Wren's Teeth augments both yaw *and* roll control with the result that coordinated turns are made using aileron only.

The ingenious rigging of the Wren ailerons, to which the Wren's Teeth are coupled, is such that the Teeth move *only* in slow-flight operation. At cruising speeds the Teeth always remain feathered into the airstream.

WHAT'S SO DIFFERENT ABOUT THE WREN WING?



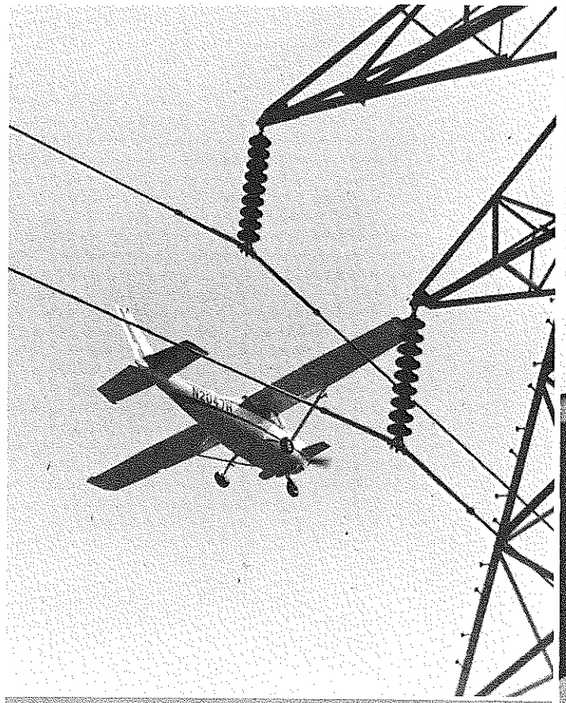
The Wren's "Safe-Stall" wing results from the combination of the full-span flaps coupled with an augmented leading edge "cuff." Most of the credit, however, goes to the leading edge cuff which prevents a stall commencing in the critical forward wing area where a separation of the smooth flow of air is difficult to re-attach. Instead, flow separation begins back near the trailing edge where it can quickly re-attach with only the slightest reduction in angle of attack. Slight release of back pressure on the

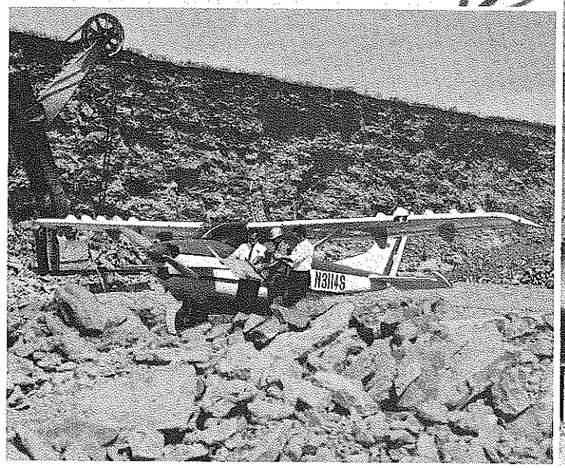
SPECIFICATIONS

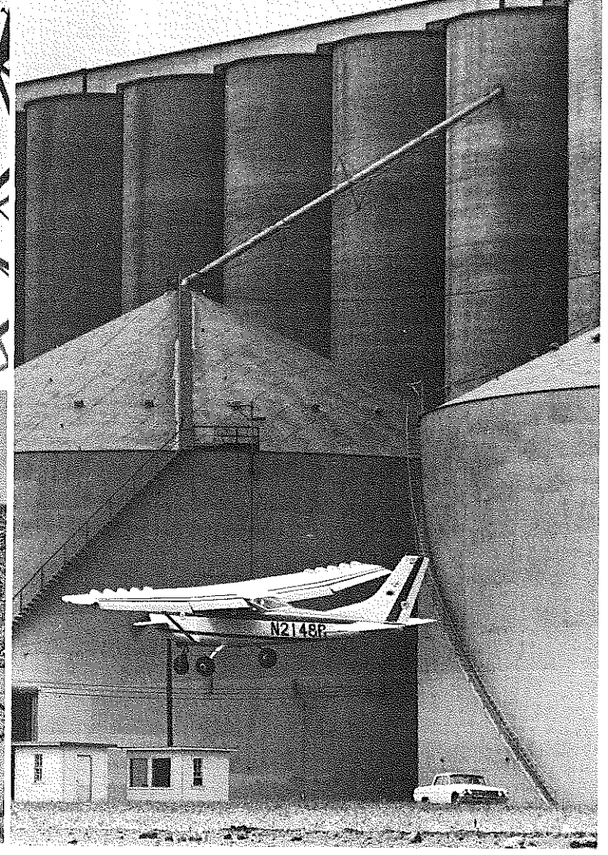
Gross Weight	2800 lbs.	Take-off (gross load, zero wind, sea level)		Range @ 10,000'—no reserve	
Empty weight (approximate)	1710 lbs.	Ground roll	300 ft.	79 gal. @ 115 mph (optimum)	1150 miles
Useful load	1090 lbs.	From stop to clear 50' obstacle	605 ft.	79 gal. @ 151 mph (normal)	872 miles
Seats	4 - 5	Landing (gross load, zero wind, sea level)		Power loading	12.2 lbs./h.p.
Speeds (gross weight)		Ground roll	300 ft.	Wing loading	16.09 lbs./sq. ft.
Top - sea level	160 mph	Clear 50' obstacle to stop	612 ft.	Power	
75% power @ 6500 ft.	151 mph	Rate of climb, sea level, flaps up	1080 ft./min.	Continental O-470-R	230 h.p.
Approach	55 mph	Service ceiling	19,200 ft.	Fuel Capacity	
Touchdown or take-off	35 mph			Standard	65 gal.
				Optional	84 gal.

THE WREN 460 WILL TAKE YOU WHERE YOU COULDN'T GO BEFORE

Those tight little spots that are marginal or impossible in other airplanes are routine in a WREN 460 . . . we call it "THE ACRE AIRPORT AIRPLANE" . . . and that's conservative.







PRICE LIST

WREN 460 with standard equipment (listed below):..... $31,875.00

Airframe:
- New Production Cessna 182
- Wren "Safe-Stall" Wing with Wren Full-Span, Double-Slotted Hi-Lift Electric Flaps and Wren Augmented, Stall-Resistant Leading-Edge Cuffs
- Wren's Teeth Drag Plates
- ULS (Ultra Low Speed) Nose Control System

Power:
- Continental O-470-R 230 hp Carbureted Engine Driving 82" Diameter Constant Speed Propeller

Instruments:
- Airspeed Indicator
- Standard Altimeter
- Magnetic Compass
- Manifold Pressure Gauge
- Tachometer (Recording)
- Engine Unit Gauges
  - Ammeter
  - Cylinder Head Temperature
  - Oil Pressure
  - Oil Temperature
  - Electric Fuel Gauges (2)
- Flap Position Indicator
- Stall Warning Indicator

Cabin Accessories:
- Arm Rests (4)
- Ash Trays (4)
- Polycloud Seat Cushions
- Carpet
- Heating System
- Clothes Hanger Hook
- Cigarette Lighter
- Dome and Map Light (2 ea.)
- Red Instrument Panel Lights, Variable Intensity
- Map Compartment
- Radio Call Plate
- Map and Storage Pockets (4)
- Compass Card Retainer
- Rear Seats, Adjusting Backs
- Front Seats, Adjusting Fore and Aft, Reclining Backs
- Sound Proofing
- Assist Straps (2)
- Cabin Air Ventilators (Front)
- Hinged Window, Left Side
- Windshield Defroster
- Shock-Mounted Instrument Panel

Accessories:
- Battery, 12 Volt
- Gravity Type Fuel System (60 gal.)
- Alternator (52 amp. 14 volt)
- Cowl Flaps
- Carburetor Air Heating System
- Carburetor Air Filter
- Main Wheel Hub Caps
- Dual Magneto Ignition System
- Landing Light (Dual Beam)
- Navigation Lights
- Engine Exhaust Muffler (With Heat Exchangers)
- Steerable Nose Wheel
- Constant Speed Propeller
- Spring Steel Landing Gear
- Voltage Regulator (50 amp. 12 volt)
- Tie-Down Rings (Retractable)
- Engine Ignition Shielding
- Propeller Spinner
- Electric Starter
- Fuel Strainer (Cabin Quick Drain)
- Nylon Tires (With Tubes)
- Wing Strut Speed Fairing
- Elevator and Rudder Trim Systems

Controls:
- Parking Brake
- Hydraulic, Toe-Operated Brakes
- Cowl Flap Control
- Fuel Strainer Drain Control
- Mixture Control ("Braille" With Safety Lock)
- Propeller Control ("Braille"—Vernier Type)
- Throttle Control ("Braille")
- Four Position Fuel Valve
- Ignition Switch, Key Operated
- Aileron and Elevator Control Lock
- Engine Priming System
- Circuit Breakers

Other:
- Outside Baggage Compartment Door
- Baggage and Cabin Door Locks
- Cabin Steps (2)

OPTIONAL EQUIPMENT:

	Factory Installed
Axles, Heavy Duty (Exchange)	$ 55.00
Controls, Dual (Wheel, Pedals, and Toe Brakes)	140.00
Corrosion Proofing, Internal (includes Stainless Steel Cables - Exchange)	580.00
Curtains, Rear Windows	20.00
Fairings, Speed (Wheel Only) For Standard Tires	220.00
Fairings, Speed (Wheel Only) For Over-Size Tires	270.00
Fire Extinguisher, Hand Type	22.00
Gage, Carburetor Air Temperature	67.50
Ground Service Plug Receptacle	25.00
Group, Primary Includes: Sensitive Altimeter (Exchange), Clock, Outside Air Temperature Gage, Rate-Of-Climb Indicator, Turn and Bank Indicator, Sun Visors	405.00
Gyros, Horizontal and Directional - Remanufactured (Includes Suction Gage and Vacuum System)	775.00
Headrests, Front Seats (Set of Two)	ea. 20.00
Headrests, Rear Seats (Set of Two)	ea. 20.00
Heating System, Stall Warning Transmitter and Pitot	30.00
Light, Rotating Beacon	95.00
Light, Map	20.00
Lights, Courtesy (Set of Two)	15.00
Oil Cooler, Large (Exchange— Non-Congealing Type)	200.00
Oil Filter (Full Flow)	70.00
Oil Dilution System	55.00
Oxygen System	540.00
Paint Scheme, All-Over (Using Vinyl Paint)	325.00
Priming System, Engine (6 Cylinder)	60.00
Seat, Child's	125.00
Seats, Individual Front Vertical adjusting (Exchange—Specify Right, Left, or Both)	ea. 47.50
Shelf, Utility	10.00
Stabilizer, Abrasion Boots	40.00
Stretcher Installation (Completely Stowed)	140.00
Tires, Over-Size (8.00 x 6 Main and 6.00 x 6 Nose—Exchange)	115.00
Tow Bar, Aircraft	16.50
Ventilation System, Rear Seat	62.50
Windshield, Tinted (Exchange)	25.00
Wings Extended Range (Total Fuel Capacity 84 U.S. Gallons—Exchange)	375.00
Winterization Kit, Engine	25.00
Kidwell Exhaust Gas Analyzer	145.00
Communication Installation Package "A", Includes One Navigation Antenna, One Communication Antenna with Associated Cables to Instrument Panel, Cabin Speaker, Headset Jack, Microphone Jack, Radio Light Rheostat, Radio Cooling System, Radio Circuit Breaker	175.00
Electronic Equipment (Communications Package "A" Must be Purchased)	
VHF NAV/COM	
Collins 618 FIA, 360 Channel Transceiver and Navigation Receiver, Remoted	2,727.00
Narco Mark XII, 360 Channel Transceiver and Navigation Receiver, Remoted	1,765.00
with VOA4 Indicator	1,865.00
with VOA5 Indicator	
ARC 300, 100 Channel Transceiver and Navigation Receiver, Integral Mounted VOR/LOC	1,405.00
Bendix M-450, 360 Channel Transceiver and Navigation Receiver, Remoted	1,983.00
HF Communications	
SunAir SA 14, 14 Channel, 65 Watt, Transceiver	1,908.50
Pantronics DX 10-D-12, 10 Channel, 50 Watt, Transceiver	1,529.00
Auto-Pilot	
Brittain B-4, 3 Axis	3,520.00
ADF	
Bendix T-12-B	1,260.00

All Prices Less Microphone and Headphones

Prices for Other Equipment Quoted on Request

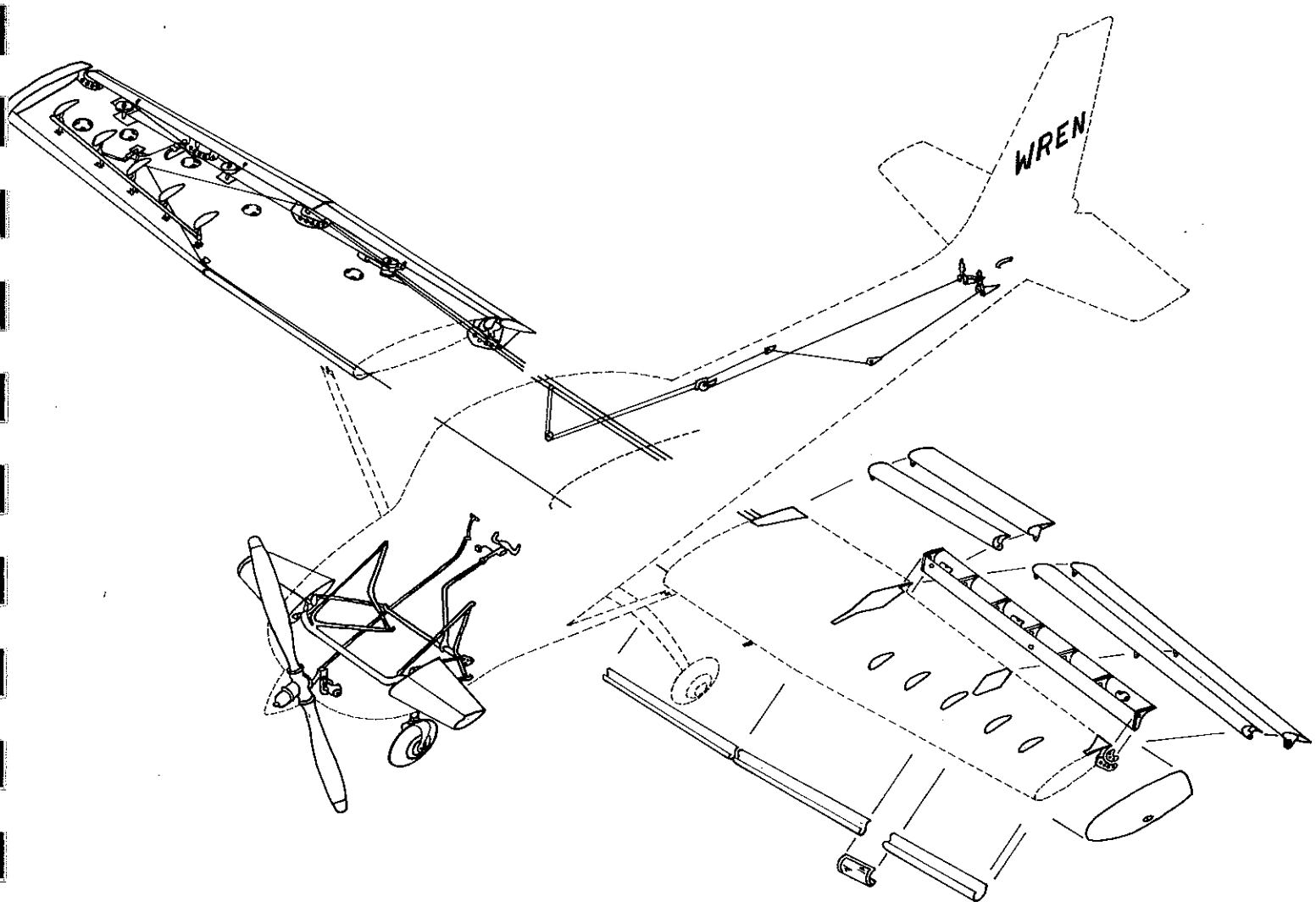
PRICES AND EQUIPMENT SUBJECT TO CHANGE WITHOUT NOTICE

WREN 460

WREN AIRCRAFT CORPORATION
MEACHAM FIELD • (817) MA 6-3739
BOX 4115 • FORT WORTH, TEXAS 76106

LITHO IN U.S.A. GORDON-KIETZMAN-DENNIS, INC. ADVERTISING • OKLAHOMA CITY, OKLAHOMA

What makes a WREN a "WREN"..?



A Wren is a performance package of unusual design features, 1,064 Wren parts, 2,114 pieces of standard hardware, and one new Cessna 182 airframe. (Solid lines in drawing show many of the Wren parts.)

THE WREN APPROACH
to STOL
and SLOW FLIGHT PERFORMANCE

One major handicap to the sale of STOL airplanes has been their very few sales and service outlets, brought about by limited production. Hence, there is a lack of ready availability of spare parts and experienced service personnel — not only in the U. S., but, even more important, in the remote areas of the world where STOL aircraft are most needed.

Wren eliminated this handicap by adopting a world-standard airframe to Wren's STOL configuration. Wren uses only new production Cessna 182 airframes in the manufacture of the WREN 460. Such an approach is entirely new, for no aircraft manufacturer has ever previously gone into production utilizing brand new standard airframes manufactured by another company.

The advantages of this approach are obvious. Not only can Wren owners take advantage of Cessna parts and service availability throughout most of the free world for practically all routine service items, but they also gain through a lower initial cost because Wren takes advantage of Cessna's mass-production cost effectiveness. Thus Wren can offer the most effective all-around STOL on the market at the lowest price.

A WREN consists of 1064 Wren parts plus 2114 nuts, bolts, bearings, etc., and one Cessna airframe.

In Wren production, the mass-produced Cessna fuselage remains relatively unaltered. The wing, however, is another matter. Wren removes Cessna's ailerons, flaps and attendant mechanism, along with the outboard cove skins and wing tips. Wren adds a full-span rear spar and eight doubler plates to each wing for increased strength. Wren adds eight additional access holes to the right wing and seven to the left wing to simplify servicing and inspection. All of these holes are "oversize", easing the work of mechanic or inspector, and reducing service bills for the owner.

Cessna's bellcranks are replaced with Wren-made spools for greater reliability of control cable routing to flaps, ailerons, and the Wren's teeth atop each wing. Wren uses only stainless steel cables to control the Wren devices.

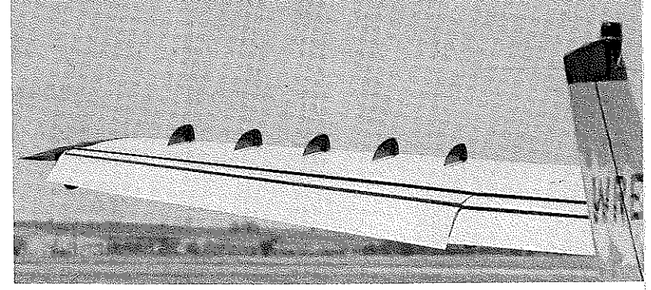
To simplify servicing, Wren adds one-eighth inch "locating holes" that are template-drilled in upper and lower skins and match a corresponding hole drilled in each of the spools to which aileron and flap control cables are attached. Lining up these "locating holes" by inserting a length of welding rod through them assures perfect rigging in a matter of minutes. Adjusting cable tension completes the rigging requirements quickly and accurately.

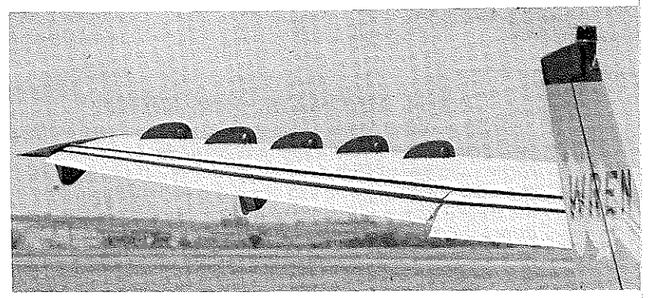
WREN FLAPS

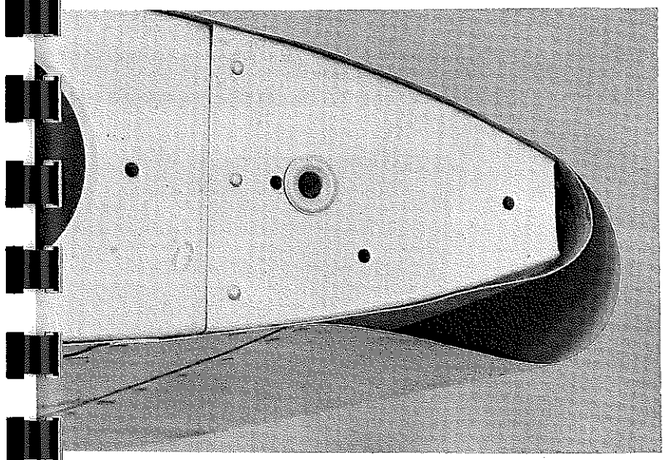
Wren designed full-span, double-slotted flaps are added to each wing. These flaps extend and lower to 30° where they add 87% to the wing's lift co-efficient, providing the lift needed for slow flight. Full 30° flaps are used both in takeoff and landing, and for slow speed patrol. Lesser amounts of flaps can be used for intermediate speeds of 55 to 90 mph. The Wren designed ailerons are part of the flap system. External hinging makes for ease of inspection and permits the intermediate turning vane to be always at optimum position in relation to wing and trailing flap, eliminating flap buffeting at any setting. With this flap system, forward and slide slips are highly effective. The Wren flap system is a high-lift system as opposed to a high-drag system, thus Wren STOL performance is achieved through aerodynamic lift as opposed to STOL designs that depend on power to hold the plane in a nose-high attitude where the resulting high drag slows down the forward speed of the plane.

WREN'S TEETH

Mounted atop the wings immediately ahead of and permanently linked with the ailerons are a series of Wren designed drag-inducing plates called "Wren's Teeth". At normal cruising speeds and ahead of the "down" aileron in slow flight (upper picture) these teeth are at trail position, streamlined with the air stream. Ahead of the "up" aileron in slow flight, they turn as much as 60° broadside to the air stream (lower picture) to produce a balancing drag to offset the otherwise adverse yaw created by the drag of the "down" aileron of the opposite wing. These plates in broadside position (lower picture) also provide a "directional" or "rudder" effect. Thus the "teeth" provide both roll and yaw augmentation.





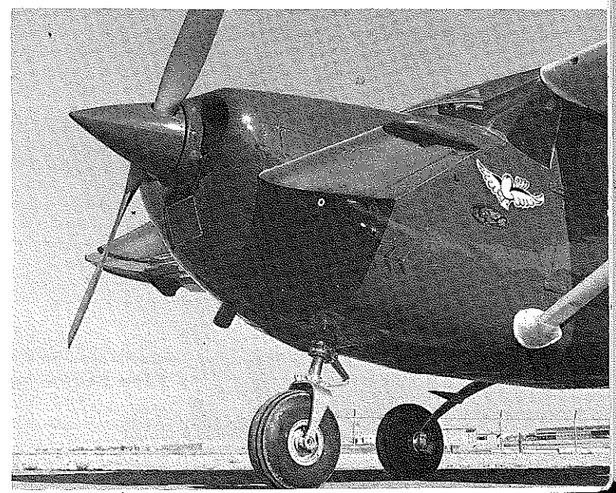


WREN SAFE-STALL WING

The leading edge of the Wren's wing is given a greater radius by the addition of a full-span "cuff" (see picture). This augmented leading edge provides much the same result as a leading edge "slot", but has no moving parts. It changes the airflow so as to move the "burble" (or stall originating point) rearward, resulting in a trailing-edge type of stall from which recovery is immediate as the air flow instantly reattaches to the wing with only the slightest reduction in angle of attack (accomplished by the pilot very slightly releasing back pressure on his control wheel). This docile stall, preceded by ample warning and with recovery almost instantaneous without loss of control or altitude provides the ability to fully utilize the low speed regime without fear of catastrophic results.

WREN NOSE-MOUNTED CONTROL

A small set of Wren-designed horizontal stabilizers and elevators mounted immediately behind the propeller disc utilizes the high energy of the propeller slipstream blast to provide additional pitch control in slow flight. Additional overall lift provided by these surfaces coupled with a reduction in the download normally resulting from deflection of the rear elevators gives the Wren increased overall lift and an additional 100 ft./min. rate of climb. So powerful is this "nose control" that the nose wheel can be lifted clear of the ground (at the start of takeoff) in less than the Wren's length. This is an important feature when operating from muddy or sandy surfaces or in slush. Wren holds a patent on the nose-mounted control surfaces.



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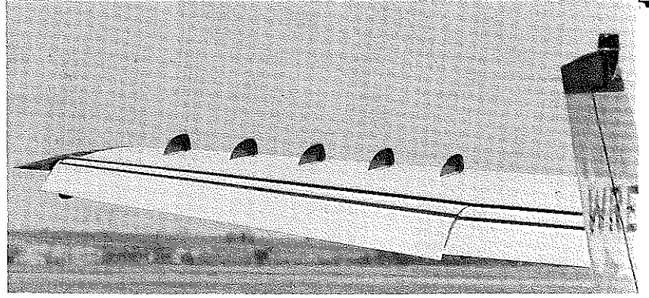
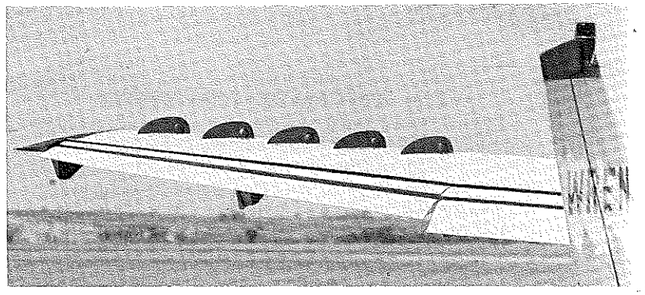
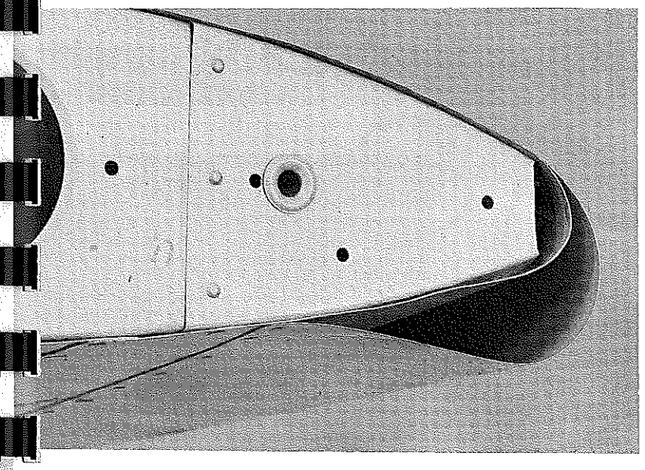
Mounted atop the wings immediately ahead of and permanently linked with the ailerons are a series of Wren designed drag-inducing plates called "Wren's Teeth". At normal cruising speeds and ahead of the "down" aileron in slow flight (upper picture) these teeth are at trail position, streamlined with the air stream. Ahead of the "up" aileron in slow flight, they turn as much as 60° broadside to the air stream (lower picture) to produce a balancing drag to offset the otherwise adverse yaw created by the drag of the "down" aileron of the opposite wing. These plates in broadside position (lower picture) also provide a "directional" or "rudder" effect. Thus the "teeth" provide both roll and yaw augmentation.







WREN SAFE-STALL WING

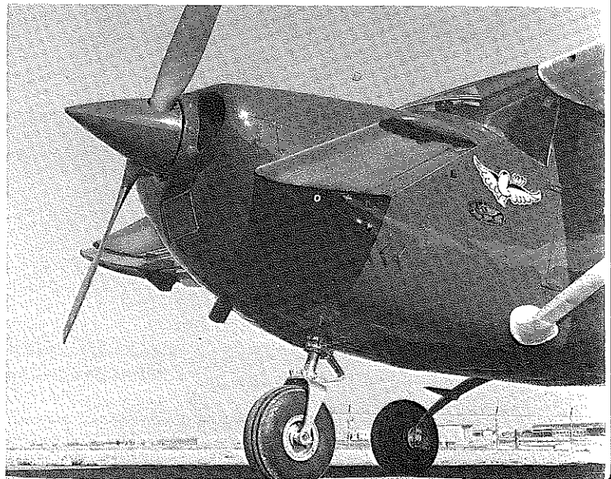
The leading edge of the Wren's wing is given a greater radius by the addition of a full-span "cuff" (see picture). This augmented leading edge provides much the same result as a leading edge "slot", but has no moving parts. It changes the airflow so as to move the "burble" (or stall originating point) rearward, resulting in a trailing-edge type of stall from which recovery is immediate as the air flow instantly reattaches to the wing with only the slightest reduction in angle of attack (accomplished by the pilot very slightly releasing back pressure on his control wheel). This docile stall, preceded by ample warning and with recovery almost instantaneous without loss of control or altitude provides the ability to fully utilize the low speed regime without fear of catastrophic results.

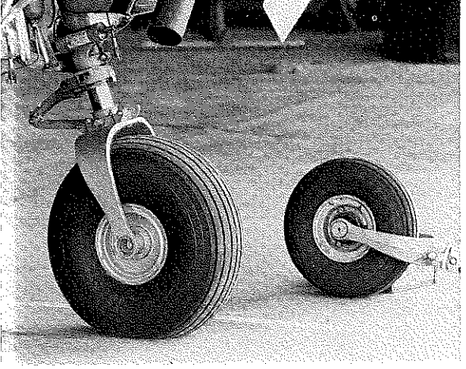
WREN FLAPS

Wren designed full-span, double-slotted flaps are added to each wing. These flaps extend and lower to 30° where they add 87% to the wing's lift co-efficient, providing the lift needed for slow flight. Full 30° flaps are used both in takeoff and landing, and for slow speed patrol. Lesser amounts of flaps can be used for intermediate speeds of 55 to 90 mph. The Wren designed ailerons are part of the flap system. External hinging makes for ease of inspection and permits the intermediate turning vane to be always at optimum position in relation to wing and trailing flap, eliminating flap buffeting at any setting. With this flap system, forward and slide slips are highly effective. The Wren flap system is a high-lift system as opposed to a high-drag system, thus Wren STOL performance is achieved through aerodynamic lift as opposed to STOL designs that depend on power to hold the plane in a nose-high attitude where the resulting high drag slows down the forward speed of the plane.

WREN NOSE-MOUNTED CONTROL

A small set of Wren-designed horizontal stabilizers and elevators mounted immediately behind the propeller disc utilizes the high energy of the propeller slipstream blast to provide additional pitch control in slow flight. Additional overall lift provided by these surfaces coupled with a reduction in the download normally resulting from deflection of the rear elevators gives the Wren increased overall lift and an additional 100 ft./min. rate of climb. So powerful is this "nose control" that the nose wheel can be lifted clear of the ground (at the start of takeoff) in less than the Wren's length. This is an important feature when operating from muddy or sandy surfaces or in slush. Wren holds a patent on the nose-mounted control surfaces.



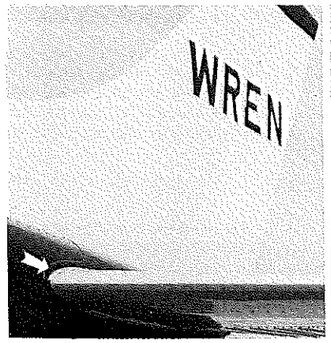


WREN HEAVY DUTY NOSE GEAR

An extra strength nosewheel installation and larger nosewheel fork is an optional Wren feature. Practically every Wren to date has been sold with oversize main (8.00 x 6) and nosewheel (6.00 x 6) tires. A still larger nosewheel fork developed and certificated by Wren permits the use of an 8.00 x 6 nosewheel tire for use on extra-rough or extra-soft landing areas. The adjacent picture shows the size of the 8.00 x 6 nosewheel tire compared with an ordinary 5.00 x 5 nosewheel tire.

WREN AUTOMATIC TRIM SYSTEM

Another Wren development is a new and separate "integrated" trim system that automatically builds in the correct amount of trim to offset center of lift changes as flaps are lowered or raised. The system is actuated by the electric flap motor and lowers or raises the angle of attack of the horizontal stabilizer as the flaps are lowered or raised. (Trim tab on right elevator is still manually controlled by pilot for C.G., speed and power trim adjustments.) Pilot is relieved of need to adjust trim as flap position is changed and trim tab system remains to provide much more available flare power for power-off landings. In addition to relieving some of the work load on the pilot, this new trim system reduces takeoff ground run and landing roll by about 10%-270 ft. takeoff roll at sea level, standard atmosphere, zero wind, 2800 lb. gross weight and 250 ft. landing roll under the same conditions. Patent is pending on this integrated trim system.

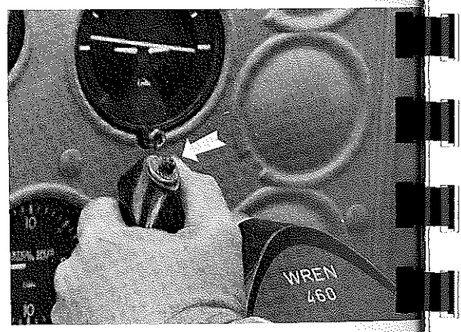


WREN BETA-CONTROL SYSTEM REVERSIBLE PITCH PROPELLER

As an optional item of equipment, Wren, in conjunction with Hartzell Propeller Company, has developed a reversible pitch propeller that is useful in making steep, precision approaches to accurately touchdown on a pre-selected spot and substantially reducing landing roll. The Beta-Control prop is especially useful on slick runways, wet grass or icy surfaces where normal braking would be ineffective. This device adds substantially to safety when landing on short, one-way strips where no go-around is possible. It is most applicable for use in turbulent, gusty, cross wind conditions and where tricky up or down drafts may be encountered at the very edge of a short strip.

The Wren Beta-Control system has an added advantage of permitting the airplane to be backed into or out of parking position. When used for taxiing this device adds at least 100 percent to the life of tires and brakes. The Wren Beta-Control propeller is available not only for WREN's, but also for many single-engine aircraft using Continental engines and constant speed propellers.

The Beta-Control system developed by Wren is covered by a patent application.



WREN FLAPS-UP BUTTON

Still another Wren development is a small button on the control wheel used to retract flaps on landing. Because the Wren flaps are of the high-lift, low-drag design, their retraction at the instant of touchdown decreases lift and provides better braking action. Wren's wheel-mounted button permits the pilot to retract flaps without removing his hands from the wheel and throttle.

WREN 460
WREN AIRCRAFT CORPORATION
MEACHAM FIELD • BOX 4115 • FORT WORTH, TEX. 76106
AC 817 MArket 6-3739

LET'S TALK SAFETY

WREN 460
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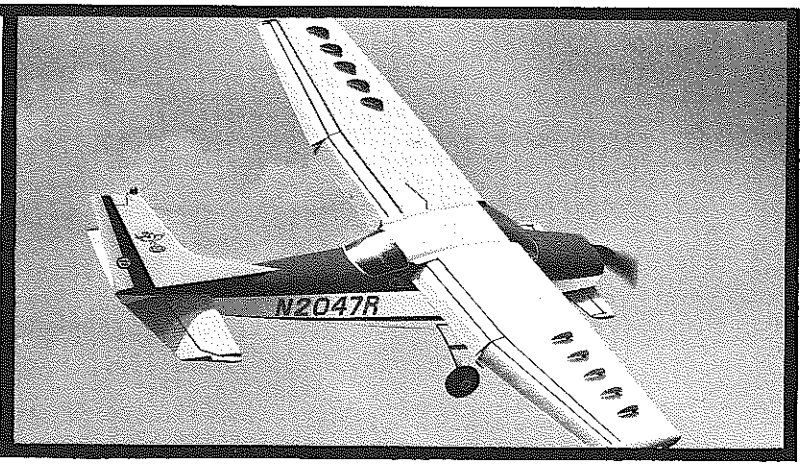
WREN 460

DESIGN □ PERFORMANCE □ UNUSUAL CAPABILITIES □ PRICE □ STANDARD EQUIPMENT □ OPTIONAL ACCESSORIES



A CONVENTIONAL AIRPLANE WITH EXCEPTIONAL SAFE STOL AND SLOW FLIGHT ABILITY

WHAT MAKES THE WREN SO SPECIAL?

The inter-related effects of the Wren's four special devices combine to provide exceptional controllability, maneuverability, and docile stall characteristics so that for the first time, safe and practical use of an airplane's low speed range is available to the average pilot. These devices are: (1) full-span, double-slotted flaps, (2) drag plates called "Wren's Teeth" mounted atop the wings, (3) an augmented wing leading edge, and (4) a nose-mounted pitch control system.

WHY USE FULL-SPAN DOUBLE-SLOTTED FLAPS?

These flaps provide an 87% increase in the wing's lift coefficient when extended to their maximum position, thus providing the ability to maintain required lift at slower airspeeds. But they do much more than this, for lowering the flaps also reduces speed. With the ailerons acting both as flaps *and* ailerons ('flaperons'), the interrelated position of wing, turning vane, and flaperon with the air spaces between, direct the high energy flow of air from below the wing surface through the spaces and smoothly over the upper surfaces of the flaperons to give unusually effective aileron response even at slowest speeds. In effect, the air is being "blown" over these surfaces in much the same manner as is derived by the pumping of air over similar surfaces to produce boundary layer control as used in the latest designs of military aircraft.

Because the Wren flaps are externally hinged (instead of riding on an intricate system of rails or tracks) the center turning vane is *always* in optimum position relative to the wing and trailing flap. This results in a smooth flow of air over both the vanes and flaps at all times with the *complete* elimination of flap buffeting in any setting or condition. The Wren never encounters flap buffeting.

With flaps extended, aileron ("flaperon") power is so great that the Wren can be rocked from left wheel to right wheel while slowly taxiing down the runway.

WHAT DO THE "WREN'S TEETH" DO?

Mounted atop each wing is a series of five drag plates called "Wren's Teeth" which are normally feathered into the airstream. In slow flight (and *only* in slow flight) these Teeth turn (up to 60°) broadside to the airstream ahead of the "up" aileron *only*. The degree of turning of these Teeth is in relation to the amount of up-aileron applied and the drag thus induced offsets a like amount of drag on the opposite wing created by the use of "down" aileron that becomes almost broadside to the airstream. Without the balancing effect of the Wren's Teeth, the drag of the down aileron would create an adverse yaw making coordinated turns impossible.

The action of the Wren's Teeth augments both yaw *and* roll control with the result that coordinated turns are made using aileron only.

The ingenious rigging of the Wren ailerons, to which the Wren's Teeth are coupled, is such that the Teeth move *only* in slow-flight operation. At cruising speeds the Teeth always remain feathered into the airstream.

WHAT'S SO DIFFERENT ABOUT THE WREN WING?

The Wren's "Safe-Stall" wing results from the combination of the full-span flaps coupled with an augmented leading edge "cuff." Most of the credit, however, goes to the leading edge cuff which prevents a stall commencing in the critical forward wing area where a separation of the smooth flow of air is difficult to re-attach. Instead, flow separation begins back near the trailing edge where it can quickly re-attach with only the slightest reduction in angle of attack. Slight release of back pressure on the controls effects an immediate stall recovery so rapid that little or no altitude is lost in the stall.

Inadvertent stalls are next to impossible, deliberate stalls *can* be effected by the usual methods, but recovery from these intended stalls is noticeably docile and complete control around all three axes is solidly available through the stall.

Power off and flaps down, the Wren will never encounter an unintentional spin.

WHAT ARE THOSE FINS ON THE NOSE?

Mounted on the nose directly behind the propeller where they are immersed in the blast of the slipstream is a small set of horizontal stabilizers and elevators. Acting upon the strong blast of air from the propeller, these ULS controls (Patent Pending) give agile pitch response at low speeds providing added pitch power when the conventional elevators begin to be inadequate.

So powerful are these controls that the nose wheel can be lifted clear of the ground before the Wren moves even a length forward on take-off. This overcomes the only serious objection to the use of tricycle gear on airplanes operating out of sandy, muddy, or extremely rough strips.

WHY DOESN'T WREN BUILD ITS OWN AIRFRAME?

Wren uses brand new Cessna 182 airframes in the manufacture of the model 460, just as Cessna purchases engines, tires, brakes, radios, electrical fixtures, fittings, etc., from their suppliers.

Because Wren uses the Cessna 182, Wren owners have the advantages of economy, proven reliability and years of refinement inherent in this airframe of which more units have been built than of any airframe in commercial production today.

Further, Wren owners are assured of parts availability and trained service for the Cessna airframe throughout the free world with the world's largest aircraft service network.

WHAT EFFECT DO THE WREN DEVICES PROVIDE?

The combined effect of the Wren devices operating in "cooperation" with each other and with the dependable and rugged Cessna airframe results in maneuverability, controllability, safe and easy use of the lowest speed regime, and the ability to take-off and land in very short distances.

WHAT ABOUT THE WREN'S TAKE-OFF?

Take-off is accomplished dependably within 300 feet at sea level, standard atmosphere, from a hard surface, at gross weight and in no wind. This combination of conditions exists only in about one out of a thousand take-offs. Generally there is a light to moderate breeze, loading varies from light to heavy, the altitude is somewhat above sea level, temperatures vary as much as 50° either side of standard, and still other variables such as field conditions enter the picture. As a result, take-off distances can vary from 50 feet lightly loaded in a stiff breeze at sea level to as many as 600 feet at extreme altitudes, with heavy loads, and no wind. In any case, the Wren is off safely and easily in *less than half* the distance of the ordinary airplane under comparable conditions.

Experienced bush pilots, accustomed to getting maximum performance from ordinary airplanes can cut substantially from the quoted 300 foot rolls at sea-level, no-wind conditions. Take-off rolls of only a little more than 200 feet under these conditions are possible by the pro pilot. The 300 foot figure is based on capable handling by average pilots.

Take-off roll is a function of the

time required to accelerate to flying speed. Accelerating into the take-off from a turn reduces the forward rolling distance required. When this is not possible, locking the brakes until full power is achieved is an aid. But any or all such efforts serve only to reduce the take-off roll by maybe one or two plane lengths. With flaps extended, the Wren just naturally flies off after a very short roll.

In ground effect the full-span, double-slotted flaps create a cushion of air that permits the Wren to achieve flying speed that is literally *less* than its stall speed at altitude. It is estimated at about 35 mph, perhaps a little less.

Once free of ground friction, the Wren accelerates very rapidly, thus the time in which it could be considered as "flying in ground effect and below stalling speed," is so brief that it creates no problem at all. This is difficult to express in words, but becomes clearly evident in flying the Wren.

Normal take-offs in the Wren with full flaps find the airplane airborne in a *level attitude* and climbing out *still in level attitude.* The Wren's "safe-stall" and high-lift wing is doing the flying. It is not dependent upon thrust from the propeller to contribute lift — in other words, it does not hang-on-the-prop with the nose up at a 'hairy' attitude as do most STOL airplanes.

The Wren's level attitude in take-off and climb-out is a *safe* flight attitude free of any potential stall possibility, *and* with unobstructed forward visibility for still added safety. It is a comfortable as well as a safe attitude.

Obstacles in the climb-out path can be avoided by turns which can be started as soon as the Wren is airborne. Such is the controllability and maneuverability of the remarkable Wren, that with moderate practice, climbing turns of 250 ft. radius can be accomplished beginning within 50 to 100 feet of the lift-off spot.

WHAT ABOUT WREN LANDINGS?

The same features that make take-offs short, level, comfortable and safe apply equally as well to landing approaches and landings.

Approaches at airports are made in clean configuration until about 500 feet out on final when full flaps are lowered. An immediate slow-up results and the approach continues at 65 mph to as low as 45 mph as desired, all in level to slightly nose-down attitude.

There is no single "recommended" procedure for landing approach and landing. Approaches can be made with or without power or with intermittent application of power. They can be made steep or flat or in-between. A long, shallow approach with partial power gives a better opportunity to chop power and touch down on an exactly predetermined spot. At the other extreme, a high, steep approach with power provides for the shortest touchdown distance after clearing an obstacle, and usually results in a slightly shorter landing roll.

Shortest landing rolls are accomplished by flaring with power *in ground effect* (within the last three to four feet above the surface).

The slowness of the approach with full flaps, plus the addition of power to hold the nose off, coupled with the flare (ample flare power is produced by the ULS nose control) to "roll up the ground effect cushion" results in slowest touchdowns. Immediate flap retraction places the weight on the wheels. Application of full braking will bring the Wren to a stop in about 200 feet at sea level, zero wind, gross weight, standard atmosphere, and hard surface.

Again, this combination of conditions is seldom encountered. Suffice it to say that landings are readily accomplished with ground rolls no longer than take-off runs under similar circumstances.

CAN THE WREN BE SLIPPED?

Even with flaps fully extended, it is not only possible but highly effective to slip the Wren, as a maneuver to get in shorter over an obstacle or to adjust for an approaching over-shoot. Slipping the Wren brings a rapid increase in rate of descent, but is accomplished with full controllability and instant control response. It can be likened to being "shot out of the air" while maintaining full control and recovery at will.

WHAT ABOUT A GO-AROUND IN THE WREN?

In event of an aborted landing, a go-around is simply accomplished without change of flap setting; application of additional power is all that is required. Full power is *not* required. Trim settings may be adjusted if desired, but can be easily overpowered without creating any adverse conditions.

WHAT ABOUT CROSSWIND OPERATIONS WITH THE WREN?

Crosswind landings, and/or take-offs are no more of a problem for the Wren, even with full flaps, than would be encountered in flying the basic Cessna 182 airframe *with flaps retracted.* Crosswind landings and take-offs in winds as high as 40 knots have been accomplished with no unusual difficulty. Of course, with the Wren 460, as the crosswind increases in strength, it becomes increasingly possible to arrange to land or take-off *into* the wind because rolling distance required recomes remarkably short into strong winds. A 30 knot wind, for example, will ordinarily shorten take-off or landing rolls to less than 100 feet.

WHAT ABOUT THE WREN IN TURBULENT AIR?

Turbulence is another bugaboo that is practically eliminated as a problem in the Wren 460. Because of its ability to drastically slow up while still retaining complete controllability, what would be bone-jarring turbulence in an ordinary airplane can be smoothed out absolutely phenomenally in a Wren. An entirely new and happy attitude toward turbulence is available to Wren owners. Even in summer afternoons in rugged mountain areas, the Wren's slow flight capability permits journeys to be made with only the most moderate of turbulence reaction under conditions where even experienced mountain pilots would otherwise prefer to remain grounded.

The reasons for the almost gentle reactions to turbulence is the slow speed with which rough air is encountered. At 60 miles per hour the effect of turbulence shock is reduced by half from the effect at 90 mph. At 120 mph the shock of turbulence is four times as great as at the Wren's 60 mph speed, and at 180 mph the shock of turbulence is nine times as rough.

The end result of slowing down the Wren is to almost completely smooth out moderate turbulence and even make severe turbulence seem only moderate.

Turbulence off the end of the landing strip on slow approaches will disturb the Wren's equilibrium (as it would with any airplane), but very gently and leaving ample time for corrective action with the Wren's nimble controllability.

WHAT ABOUT CLIMB OUTS IN THE WREN?

Climbs in the Wren with flaps fully extended are best made at 59 mph, IAS. After all obstacles are cleared and it is desired to leave the area of take-off, flaps should be retracted and a climb speed at 91 mph, IAS, established which will give a solid rate of climb of 1,080 feet per minute.

WHAT ABOUT THE WREN'S SLOW FLIGHT CRUISING?

With flaps extended, level flight *in level attitude* can be made at speeds down to 50 mph. At this speed, at sea level, power settings of 16 in. and 2,000 to 2,200 rpm are used, amounting to approximately 30% of power available. This is barely above idling power, hence no cooling or overheating problem is encountered. At this speed, fuel consumption is 7 gal. per hour and endurance is over 11 hours with long range tanks.

With flaps retracted the Wren 460 is a conventional airplane. The nose-mounted ULS control provides an additional amount of lift, but otherwise its effect is not noticeable in cruising flight except to provide a slight flattening of airplane attitude in turbulent air.

WHAT ABOUT SLOW SPEED MANEUVERING?

From the Wren's low level-flight speeds, it is possible to execute a 180° turn in 7½ seconds and 360° turns in 12 seconds without losing altitude. The turning radius in such turns is less than 200 feet. Further, because of the low speeds, "g" forces are negligible (less than 1½ g's), so slight as to be barely noticeable.

The Wren's airspeed system is accurate to within 3 mph of calibrated airspeed at any point from 40 mph IAS through 180 mph IAS. Below 40 mph IAS, the Wren system shows higher IAS than CAS.

WHAT HAPPENS WITH THE WREN IN CASE OF POWER FAILURE?

Take-off is the most critical situation in any flight, even though landing accidents are by far more numerous. The critical condition in any airplane on take-off results from power failure — whether single or multi-engined.

With the Wren's level attitude during take-off and climb-out, the pilot is at all times able to execute a fully controlled forced landing—only much slower than in any ordinary airplane.

A loss of power below 20 feet altitude finds the Wren still in ground effect and flying at its slowest speed, therefore an immediate slow touchdown can be effected.

Above 20 feet, the Wren has accelerated to a speed that permits a power-off glide of 50 to 60 mph to a fully controlled forced landing with adequate flare power for a touchdown speed below 50 mph, and a landing roll of less than 400 feet. Finding a spot this size to sit down in is many times more likely than finding a cleared area twice to three times this size.

In this respect it is interesting to note the following quote concerning landing accidents from the Federal Aviation Agency's Airworthiness Manual, Part 8, Appendix B, page 92:

> "The record indicates that fatality rate increases rapidly above 55 mph."

WHAT DOES THE WREN GIVE UP TO GAIN ITS SPECIAL FEATURES?

Every airplane is a compromise. Period. The Wren 460 is no exception.

To gain a desirable feature in any airplane requires a sacrifice in some other feature or features. It's like a tangled mess of jackstraws . . . move one and many others are moved also.

For example, an attempt to gain more speed (as most every new model attempts to do) is invariably accompanied by a sacrifice, or a series of sacrifices, in one or more of the following: economy, ease of handling, useful load, structural limitations, cabin size, mechanical simplicity, or some other desirable feature.

The Wren had to sacrifice a little speed, useful load, and price.

HOW MUCH SPEED IS LOST?

The Wren's top speed is 160 mph. This speed is faster than eight four-place, single-engine planes on the market and slower than 15 others. It represents a loss of six miles per hour from the cruising speed of the Cessna 182 (which is utilized in the Wren's manufacture). In an eight-hour flight, this loss amounts to 48 miles.

HOW MUCH IS LOAD REDUCED?

The Wren 460's over half-ton of useful load is greater than that of 10 other four-place, single-engine models and less than that of 13. The Wren special parts add 160 lbs. to the empty weight of the airplane.

HOW ABOUT COST?

The Wren 460 is an EXTRA SPECIAL airplane, with EXTRA SPECIAL design features that are expensive to produce in the limited quantities dictated by the selective market of people with EXTRA SPECIAL desires in aircraft designed for EXTRA SPECIAL performance. As a result, the Wren 460 is the highest priced single-engine airplane with conventional airplane performance, but it is also by far the *lowest priced STOL airplane* in production.

HOW CAN THE WREN BE USED?

Obviously, to get in and out of strips too short for ordinary airplanes.

For patrol work where safe flight speeds of 50 mph to 70 mph in level attitude is required.

For pilots who desire extra safety and greater ease of flying or who may have been sweating out the use of short fields.

For mountain and canyon flying where a short turning radius can be vital.

For nap-of-the-earth reconnaissance where nimble maneuvering at slow speeds is important.

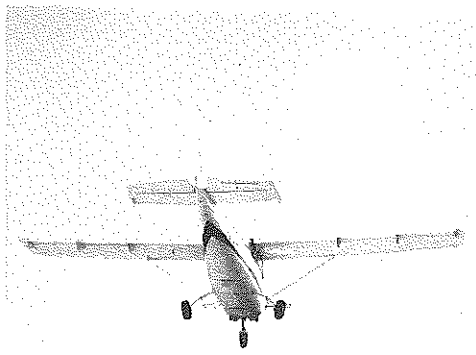
For comfortable flying in turbulent air.

WHO CAN USE THE WREN?

If you drill for oil; run a ranch; build roads, bridges, dams, buildings, or pipelines; patrol power lines, forests, or highways; spot fish or game; operate in the bush or mountains; make calls at remote plant sites, farms, or wells; take aerial photographs or make geological surveys; operate an aerial ambulance service, or provide medical care (people or animals) in remote areas . . . yes, if you have any occasion to operate out of strips or pastures too short for safe operation in ordinary airplanes, and you want to do it safely and easily regardless of the number of hours in your log book . . . *you* need a Wren 460.

SPECIFICATIONS

Gross weight	2800 lbs.	Rate of climb, sea level, flaps up	1080 ft./min.
Empty weight (approximate)	1710 lbs.	Service ceiling	19,200 ft.
Useful load	1090 lbs.	Range @ 10,000′ — no reserve	
Speeds (T.A.S.) (gross weight)		79 gal, @ 115 mph (optimum)	1150 miles
Top—sea level	160 mph T.A.S.	79 gal, @ 151 mph (normal)	872 miles
75% power @ 6500 ft.	151 mph T.A.S.	Power loading	12.2 lbs./ h.p.
Approach	55 mph T.A.S.	Wing loading	16.09 lbs./sq. ft.
Touchdown or take-off	40 mph T.A.S.	Power Continental 0-470-R	230 h.p.
Take-off (gross load, zero wind, sea level)		Fuel capacity	
Ground roll	300 ft	Standard	65 gal.
From stop to clear 50′ obstacle	605 ft.	Optional	84 gal.
Landing (gross load, zero wind, sea level)			
Ground roll	200 ft.		
Clear 50′ obstacle to stop	612 ft.		



PRICE LIST

WREN 460 with standard equipment (listed below): $31,875.00

Airframe:
- New Production Cessna 182
- Wren "Safe-Stall" Wing with Wren Full-Span, Double-Slotted Hi-Lift Electric Flaps and Wren Augmented, Stall-Resistant Leading-Edge Cuffs
- Wren's Teeth Drag Plates
- ULS (Ultra Low Speed) Nose Control System

Power:
- Continental O-470-R 230 hp Carbureted Engine Driving 82" Diameter Constant Speed Propeller

Instruments:
- Airspeed Indicator
- Standard Altimeter
- Magnetic Compass
- Manifold Pressure Gauge
- Tachometer (Recording)
- Engine Unit Gauges
  - Ammeter
  - Cylinder Head Temperature
  - Oil Pressure
  - Oil Temperature
  - Electric Fuel Gauges (2)
- Flap Position Indicator
- Stall Warning Indicator

Cabin Accessories:
- Arm Rests (4)
- Ash Trays (4)
- Attachment Provisions for:
  - Cargo Rings
  - Shoulder Harness
  - Sun Visors
- Carpet
- Seat Cushions and No Sag Seat Springs
- Heating System
- Clothes Hanger Hook
- Cigarette Lighter
- Dome and Map Light (2 ea.)
- Red Instrument Panel Lights, Variable Intensity
- Map Compartment
- Radio Call Plate
- Map and Storage Pockets (4)
- Compass Card Retainer
- Rear Seats, Adjusting Backs
- Front Seats, Adjustable Fore and Aft, Reclining Backs
- Sound Proofing
- Assist Straps (2)
- Cabin Air Ventilators
- Hinged Window, Left Side
- Wiring Provisions, Courtesy Lights
- Windshield Defroster
- Shock-Mounted Instrument Panel

Accessories:
- Battery, 12 Volt
- Gravity Type Fuel System (60 gal.)
- Generator (50 amp. 12 volt)
- Cowl Flaps
- Carburetor Air Heating System
- Carburetor Air Filter
- Main Wheel Hub Caps
- Dual Magneto Ignition System
- Landing Light (Dual Beam)
- Navigation Lights
- Provisions for Rotating Beacon
- Engine Exhaust Muffler (With Heat Exchangers)
- Steerable Nose Wheel
- Oil Cooler
- Constant Speed Propeller
- Spring Steel Landing Gear
- Voltage Regulator (50 amp. 12 volt)
- Tie-Down Rings (Retractable)
- Engine Ignition Shielding
- Propeller Spinner
- Electric Starter
- Fuel Strainer (Cabin Quick Drain)
- Nylon Tires (With Tubes)
- Wing Strut Speed Fairing
- Elevator and Rudder Trim Systems

Controls:
- Parking Brake
- Hydraulic, Toe-Operated Brakes
- Cowl Flap Control
- Fuel Strainer Drain Control
- Mixture Control ("Braille" With Safety Lock)
- Propeller Control ("Braille" — Vernier Type)
- Throttle Control ("Braille")
- Four Position Fuel Valve
- Ignition Switch, Key Operated
- Aileron and Elevator Control Lock
- Engine Priming System
- Circuit Breakers

Other:
- Outside Baggage Compartment Door
- Baggage and Cabin Door Locks
- Cabin Steps (2)

OPTIONAL EQUIPMENT:

	Factory Installed
Axles, Heavy Duty (Exchange)	$ 47.25
Controls, Dual (Wheel, Pedals, and Toe Brakes)	140.00
Corrosion Proofing, Internal (Includes Stainless Steel Cables—Exchange)	580.00
Curtains, Rear Windows	16.00
Fairings, Speed (Wheel Only) For Standard Tires	220.00
Fairings, Speed (Wheel Only) For Over-Size Tires	270.00
Fire Extinguisher, Hand Type	21.50
Flasher Unit, Navigational Lights (Includes Detectors)	43.50
Gage, Carburetor Air Temperature	67.50
Ground Service Plug Receptacle	24.00
Group, Primary Includes: Sensitive Altimeter (Exchange), Clock, Outside Air Temperature Gage, Rate-Of-Climb Indicator, Turn and Bank Indicator, Sun Visors, Maplight	425.00
Gyros, Horizontal and Directional—Remanufactured (Includes Suction Gage and Vacuum System)	530.00
Gyros, PICTORIAL Horizontal and Directional (Includes Suction Indicator Lights and Vacuum System)	825.00
Headrests, Front Seats (Set of Two)	38.00
Headrests, Rear Seats (Set of Two)	38.00
Heating System, Stall Warning Transmitter and Pitot	25.00
Light, Rotating Beacon	95.00
Lights, Courtesy (Set of Two)	12.00
Oil Cooler, Large (Exchange—Non-Congealing Type)	190.00
Oil Filter (Full Flow)	55.00
Oil Dilution System	30.00
Oxygen System	495.00
Paint Scheme, All-Over (Using Vinyl Paint)	325.00
Priming System, Engine (6 Cylinder)	55.00
Seat, Child's	115.00
Seats, Individual Front Vertical Adjusting (Exchange—Specify Right, Left, or Both) ea.	42.50
Shelf, Utility	7.50
Stabilizer, Abrasion Boots	40.00
Stretcher Installation (Completely Stowed)	140.00
Tires, Over-Size (8.00 X 6 Main and 6.00 X 6 Nose—Exchange)	110.00
Tow Bar, Aircraft	15.75
Ventilation System, Rear Seat	62.50
Windshield, Tinted (Exchange)	25.00
Wings Extended Range (Total Fuel Capacity 84 U.S. Gallons—Exchange)	375.00
Winterization Kit, Engine	22.00
Communication Installation Package "A", Includes Navigation Antenna, One Communication Antenna with Associated Cables to Instrument Panel, Cabin Speaker, Headset Jack, Microphone Jack, Radio Light, Rheostat, Radio Cooling System, Radio Circuit Breaker	155.00
Communication Installation Package "B", Same as above, but with Dual Communication Antenna	225.00
Radios (Communication Package "A" or "B" must be Purchased):	
Collins 618 FIA, 360 Channel Transceiver	2602.00
Bendix ADF T12B	1190.00
Narco Mark XII, 360 Channel Transceiver and Navigation Receiver, Remoted	
VOA4	1835.00
VOA5	1935.00
Narco Mark XII, 90 Channel Transceiver and Navigation Recevier, Remoted	1625.00
Cessna NAV/COM 300, 100 Channel Transceiver and Navigation Receiver with Integral Mounted VOR/LOC Indicator	1405.00

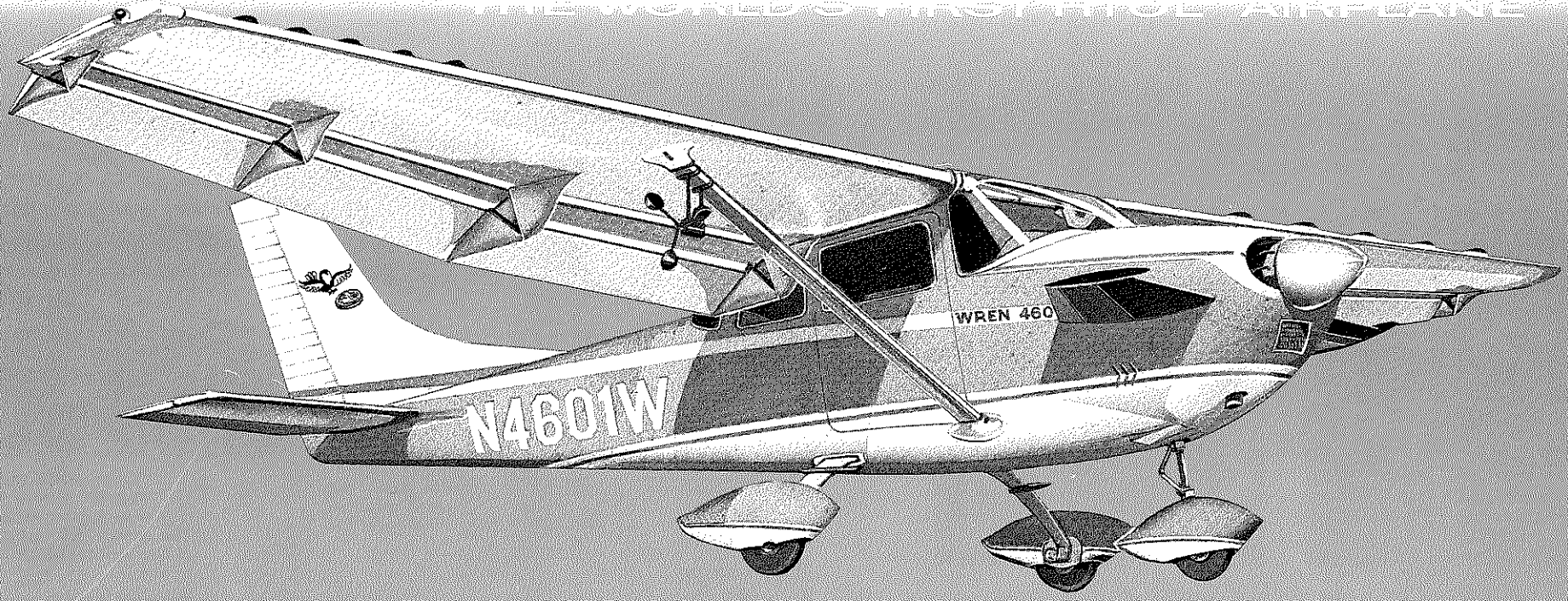
PRICES AND EQUIPMENT SUBJECT TO CHANGE WITHOUT NOTICE

WREN 460

WREN AIRCRAFT CORPORATION
MEACHAM FIELD • (817) MA 6-3739
BOX 4115 • FORT WORTH, TEXAS 76106

LITHO IN USA. THE TOM P. GORDON CO., ADVERTISING - OKLAHOMA CITY

WREN 460



*Heliport Take-Off and Landing

THE REMARKABLE WREN 460 . . . NEW SAFETY IN A NEW

PROTOTYPE WREN 460

. . . Takes you safely and easily in
accessible to airplanes . . . opens new
usage with these unparalleled perfor

TAKE-OFF

Ground roll
Total over 50 foot obstacle

LANDING

Ground roll
Total over 50 foot obstacle

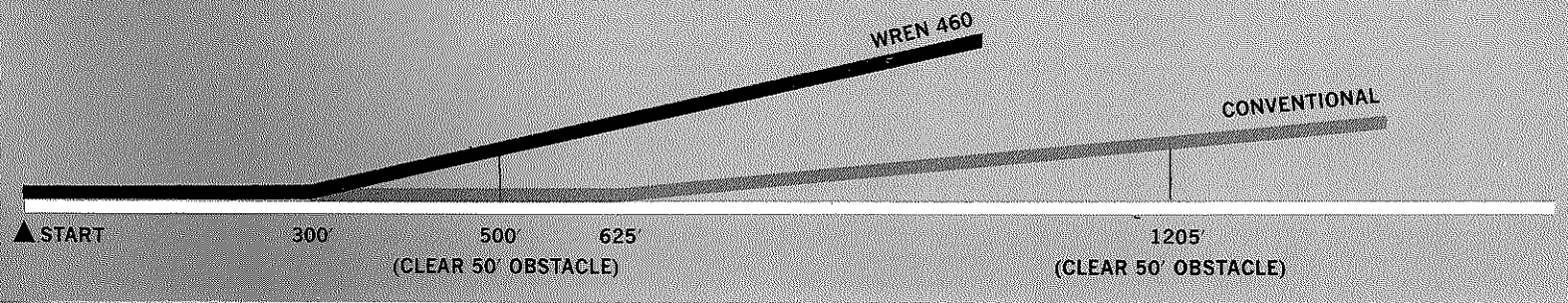
SPEED

Minimum
Maximum

. . . And any pilot can fly the Wren—
the performance figures quoted ab
hour. No special training or license

(All performance figures based on
level.)

TAKE-OFF



A short 30 minute demonstration f
yourself the WREN'S performance
utility advantages. Let
the Wren open for
you a whole
new world
of airplane utility.

EW PRECISION TOOL FOR BUSINESS, INDUSTRY, AND GOVERNMENT

ly in and out of places never before
s new horizons of important airplane
performance features.

	under 300 feet
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	under 200 feet
	under 350 feet
	26 mph
	over 160 mph

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on gross weight, zero wind, at sea

PROTOTYPE WREN 460

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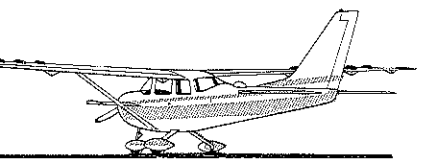
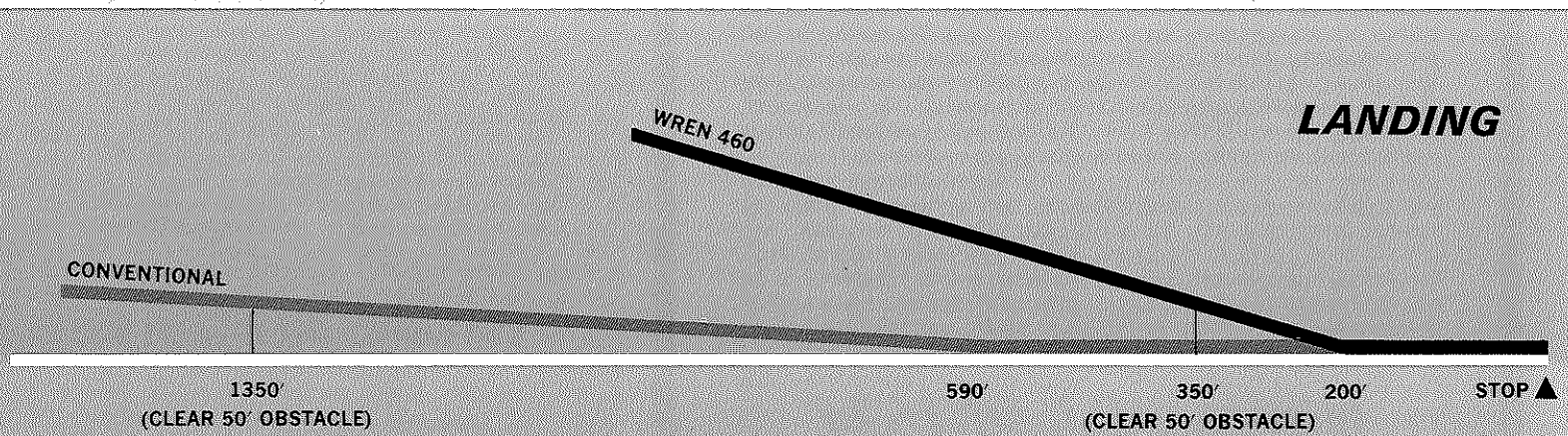




THE REMARKABLE WREN 460

Unites Rotary Wing Utility And Fixed Wing Speed, Safety, Economy, and Simplicity of Operation

STANDARD EQUIPMENT

AIRFRAME:
- NEW PRODUCTION CESSNA 180* OR 182

POWER:
- CONTINENTAL O-470-R 230 HP CARBURETED ENGINE DRIVING 82" DIAMETER CONSTANT SPEED PROPELLER

INSTRUMENTS:
- AIRSPEED INDICATOR (LSI—TRUE AIRSPEED)
- AIRSPEED INDICATOR (CONVENTIONAL)
- STANDARD ALTIMETER
- MAGNETIC COMPASS
- MANIFOLD PRESSURE GAUGE
- TACHOMETER (RECORDING)
- ENGINE UNIT GAUGES
  - AMMETER
  - CYLINDER HEAD TEMPERATURE
  - OIL PRESSURE
  - OIL TEMPERATURE
  - ELECTRIC FUEL GAUGES (2)
- FLAP POSITION INDICATOR
- STALL WARNING INDICATOR

CABIN ACCESSORIES:
- ARM RESTS (4)
- ASH TRAYS (4)
- ATTACHMENT PROVISIONS FOR:
  - CARGO RINGS
  - SHOULDER HARNESS
  - SUN VISORS
- CARPET
- SEAT CUSHIONS AND NO SAG SEAT SPRINGS
- HEATING SYSTEM
- CLOTHES HANGER HOOK
- CIGARETTE LIGHTER
- DOME AND MAP LIGHT (2 EA.)
- RED INSTRUMENT PANEL LIGHTS, VARIABLE INTENSITY
- MAP COMPARTMENT
- RADIO CALL PLATE
- MAP AND STORAGE POCKETS (4)
- COMPASS CARD RETAINER
- REAR SEATS, ADJUSTING BACKS
- FRONT SEATS, ADJUSTABLE FORE AND AFT, RECLINING BACKS
- SOUND PROOFING
- ASSIST STRAPS (2)
- CABIN AIR VENTILATORS
- HINGED WINDOW, LEFT SIDE
- WIRING PROVISIONS, COURTESY LIGHTS
- WINDSHIELD DEFROSTER
- SHOCK-MOUNTED INSTRUMENT PANEL

ACCESSORIES:
- BATTERY, 12 VOLT
- WREN FULL-SPAN, DOUBLE-SLOTTED, HI-LIFT FLAPS (ELECTRIC ON 182)
- WREN'S TEETH VORTEX-GENERATOR SPOILERS
- ROBERTSON ULS (ULTRA LOW SPEED) NOSE CONTROL SYSTEM
- WREN AUGMENTED STALL-RESISTANT LEADING EDGE CUFFS
- GRAVITY TYPE FUEL SYSTEM (60 GAL.)
- GENERATOR (50 AMP. 12 VOLT)
- COWL FLAPS
- CARBURETOR AIR HEATING SYSTEM
- CARBURETOR AIR FILTER
- MAIN WHEEL HUB CAPS (182 ONLY)
- DUAL MAGNETO IGNITION SYSTEM
- LANDING LIGHT (DUAL BEAM)
- NAVIGATION LIGHTS
- PROVISIONS FOR ROTATING BEACON
- ENGINE EXHAUST MUFFLER (WITH HEAT EXCHANGERS)
- STEERABLE NOSE WHEEL (182 ONLY)
- OIL COOLER
- CONSTANT SPEED PROPELLER
- SPRING STEEL LANDING GEAR
- VOLTAGE REGULATOR (50 AMP. 12 VOLT)
- TIE-DOWN RINGS (RETRACTABLE)
- ENGINE IGNITION SHIELDING
- PROPELLER SPINNER
- ELECTRIC STARTER
- FUEL STRAINER (CABIN QUICK DRAIN)
- NYLON TIRES (WITH TUBES)
- WING STRUT SPEED FAIRING
- ELEVATOR AND RUDDER TRIM SYSTEMS

CONTROLS:
- PARKING BRAKE
- HYDRAULIC, TOE-OPERATED BRAKES
- COWL FLAP CONTROL
- FUEL STRAINER DRAIN CONTROL
- MIXTURE CONTROL ("BRAILLE" WITH SAFETY LOCK)
- PROPELLER CONTROL ("BRAILLE"—VERNIER TYPE)
- THROTTLE CONTROL ("BRAILLE")
- FOUR POSITION FUEL VALVE
- IGNITION SWITCH, KEY OPERATED
- AILERON AND ELEVATOR CONTROL LOCK
- ENGINE PRIMING SYSTEM
- CIRCUIT BREAKERS

OTHER:
- OUTSIDE BAGGAGE COMPARTMENT DOOR
- BAGGAGE AND CABIN DOOR LOCKS
- CABIN STEPS (2)

PRICE, FAF, FORT WORTH, TEXAS . . . $29,950.

PRICE AND EQUIPMENT SUBJECT TO CHANGE WITHOUT NOTICE.

*CESSNA 180 AIRFRAME (WITH CONVENTIONAL LANDING GEAR) AVAILABLE ON SPECIAL ORDER.

SPECIFICATIONS WREN 460*

WEIGHTS:

Weight Empty	1,595 lbs.
Useful Load	1,205 lbs.
Gross Weight	2,800 lbs.

CAPACITY:

Number of Seats	4
Fuel Capacity	65 gals. (84 optional)

PERFORMANCE:
(Sea Level Standard, Full Gross Weight, unless otherwise noted)

Top Speed	over 160 mph
Cruise Speed, 75% Power, at 6,500 ft.	153 mph
Minimum Speed, Power On	under 26 mph
Minimum Speed, Power Off	under 35 mph
Stall Speeds:	
With Power, Flaps Retracted	40 mph
With Power, Flaps Fully Extended	24 mph
Power Off	no stall
Cruising Range, 75% Power, 60 gals.	658 mi. @ 153 mph
Cruising Range, Optimum, 79 gals.	1,180 mi. @ 118 mph
Rate of Climb, Sea Level	972 fpm
Service Ceiling	18,900 ft.
Take-off Distance, Full Gross, Zero Wind	under 300 ft.
Take-off Distance, 2,200 lbs. 15 mph Wind	under 150 ft.
Take-off Distance, total over 50 ft. obstacle, Full Gross Weight, Zero Wind	under 500 ft.
Take-off Distance, total over 50 ft. obstacle, 2,200 lbs. 15 mph Wind	under 350 ft.
Landing Distance, Ground Roll	under 200 ft.
Landing Distance, total over 50 ft. obstacle	under 350 ft.

POWER:
Continental O-470-R rated at 230 hp at 2,600 rpm driving 82" diameter constant speed propeller.

DIMENSIONS AND AREAS:

Overall Length	25'3"
Overall Height	10'4"
Overall Span	36'2"
Wing Area	175 sq. ft.
Wing Loading, lbs. per sq. ft.	16.1
Power Loading, lbs. per hp	12.2

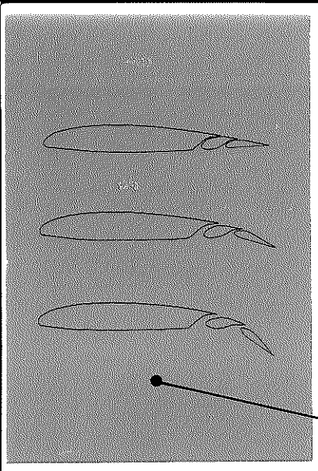
*182 AIRFRAME

WREN AIRCRAFT CORPORATION

P. O. BOX 4115
Fort Worth 6, Texas

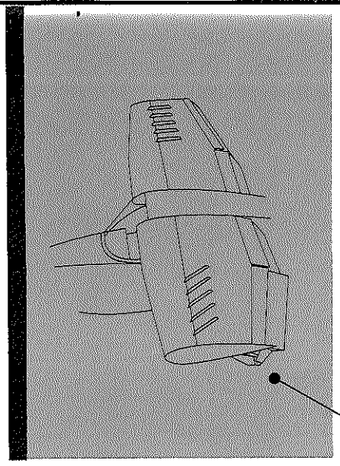
MEACHAM FIELD
817 - MArket 4-1155

LITHO IN U.S.A. BY THE TOM P. GORDON COMPANY, ADVERTISING OKLAHOMA CITY, OKLA.



FLAPS

The Wren's slow speed results from full-span, double-slotted flaps, which at the fully extended 40° position triple the lift of the Wren wing and quadruple the drag. Flaps are hinged on external pivot points to eliminate the weight and maintenance problems of "rails" or "tracks." The unique Wren hinge design permits the turning vane (the smaller flap located between the wing and trailing edge flap) to **always** be in its most effective position at any flap setting and completely eliminate buffeting. Strength and accessibility are engineered into the flap system to assure long life and easy maintenance under rugged operating conditions.



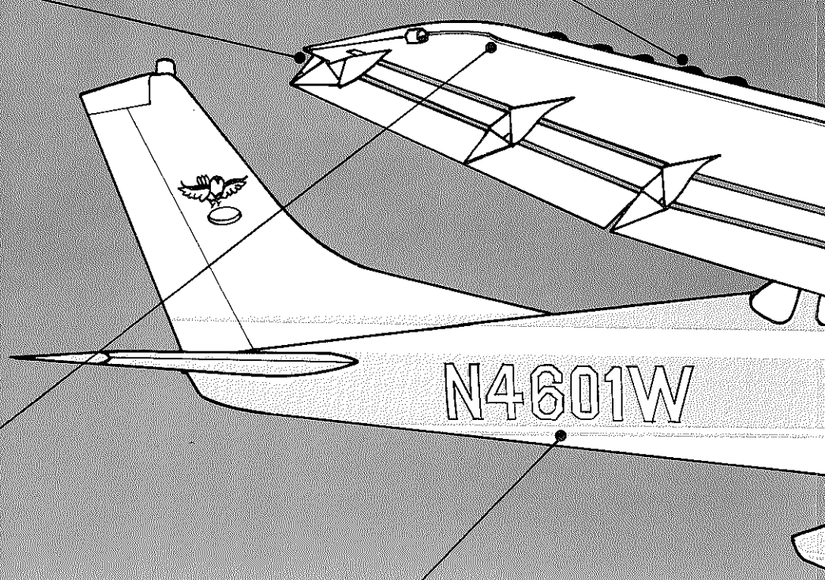
WREN'S TEETH

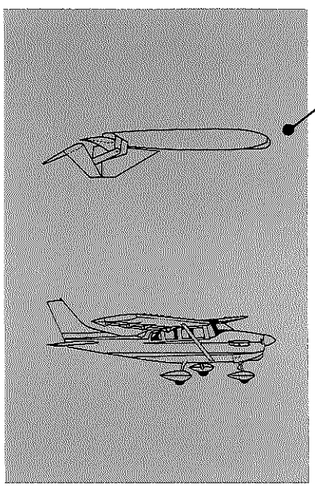
At slow speeds, spoilers mounted atop the wing directly ahead of the ailerons "bite" into the airstream to balance the drag of the up-wing aileron during slow speed turns. Permanently tied into the Wren's aileron controls, the "teeth" remain feathered into the slipstream until the aileron on that wing is deflected upward, at which time they rotate up to 60° broadside to the airflow, providing balanced control for effortless co-ordinated turns.

HTOL* PERFORMANCE

a WREN exclusive through these unique design features

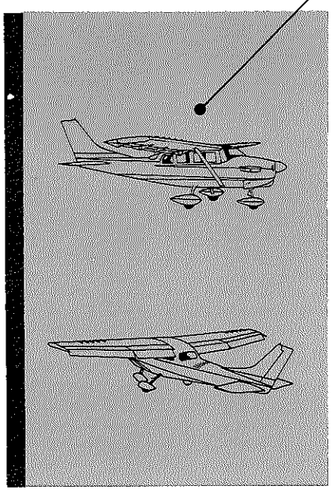
*Heliport Take-Off and Landing





AUGMENTED WING LEADING EDGE

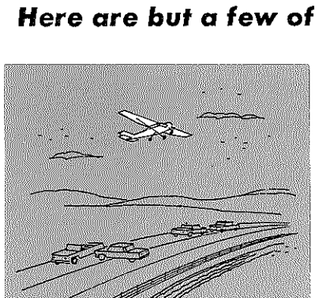
Effective stall resistance at slow speeds is achieved by an "augmented" leading edge. A wrap-around sheet metal "cuff" enlarges the radius of the leading edge with a slight "droop" appearance in cross-section. This design produces exceptional stall resistance up to a 28° angle of attack. Because of the strong control forces generated by the ULS control surfaces, the Wren can be stalled with power on, although the stalls are extremely docile. Slight release of back pressure on the controls allows the Wren to fly out smoothly and safely without loss of altitude. The Wren will **not** stall power-off with normal load distribution.

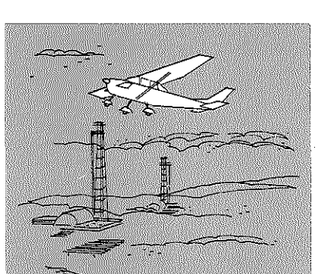


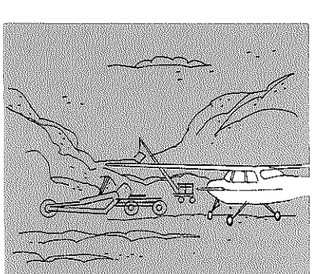
DEPENDABLE, PROVEN AIRFRAMES

The Wren 460 incorporates new production Cessna 180/182 airframes of unquestioned structural integrity, matched with an engine of outstanding simplicity and dependability. Parts availability is established for these prime components on a world-wide basis through the most extensive service organizations in the airframe and aircraft engine industry. By holding Wren design and tooling costs to a minimum, purchasers of the Wren 460 are assured of maximum value to match maximum aircraft utility.

Here are but a few of the jobs the HTOL* WREN 460 *can do better than any other fixed wing airplane . .*







HIGHWAY PATROL—AMBULANCE SERVICE

The Wren 460's wide usable speed range of 26 mph to over 160 mph makes it an ideal plane for highway patrol and spotting use. Landing on a short stretch of highway, the Wren provides fast emergency ambulance service for traffic accident victims.

PIPELINE AND POWER LINE PATROL

Pipelines and powerlines may be patrolled in the Wren at any desired speed from 30 to 150 mph. A minimum cleared area allows the Wren to land for further investigation of line conditions.

CONSTRUCTION SITE ACCESSIBILITY

Construction company personnel can save valuable time and cut costs of reaching distant construction sites. Low first cost and economy of operation make the Wren 460 the best means of transportation between the office and remote locations.

BUSH OPERATION AND MISSIONARY SERVICE

Bush pilots and missionaries will appreciate the rugged, simple design of the Wren 460. Special consideration has been given to ease of repair and maintenance in remote areas, including a model with conventional landing gear. The short take-off, landing, and the docile slow flight characteristics make the Wren 460 ideal for bush operation.

OIL DRILLING AND WELL INSPEC

A small bulldozed area is a
drilling men, production men,
nel to quickly reach the well
speed ability allows complete
inspection.

RANCH AND FARM OPERATION

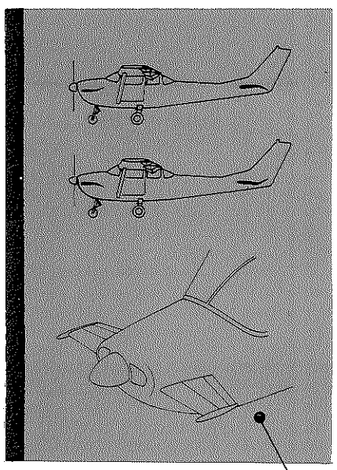
Fences, wells, and cattle
the Wren 460 at slow speeds,
ing for equipment repair or catt
The Wren's 153 mph cruising s
is also well suited for family trip

MILITARY SURVEILLANCE AND

Artillery fire control, perso
lance, rescue and supply of crit
for the Wren 460. The wide ran
ing radius at slow speeds permi
Only minimum cleared area
operations.

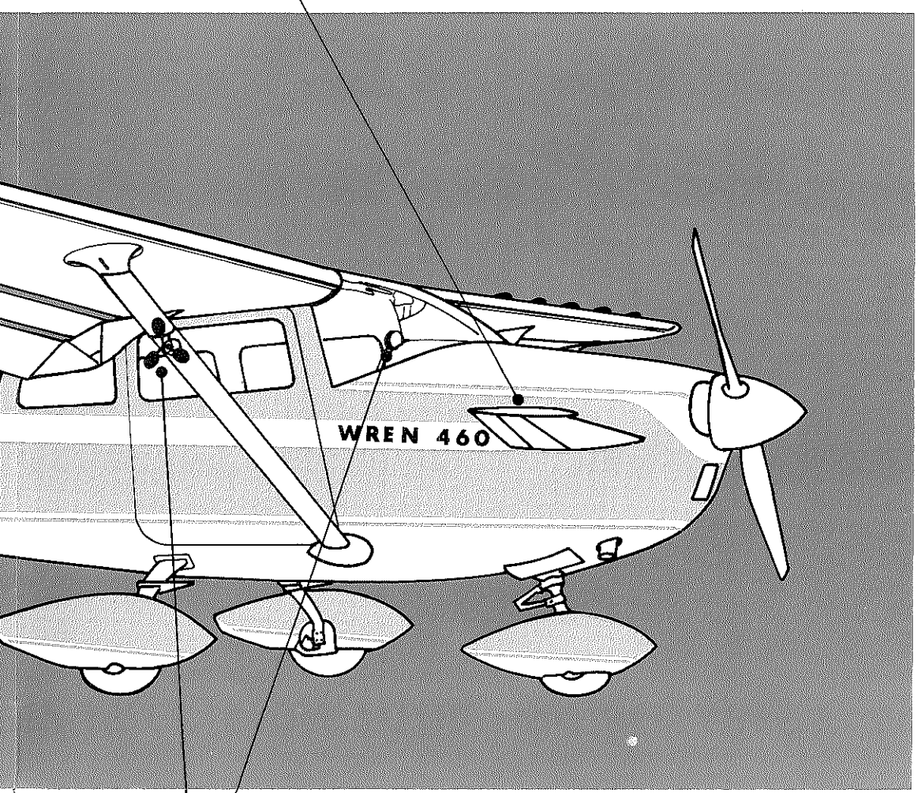
FLOAT OPERATION

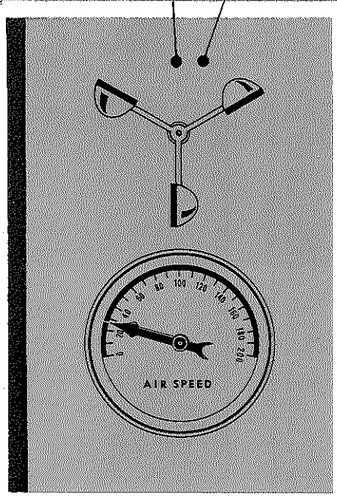
The Wren 460 adapts to fl
versatility for business and pl
and out of small lakes and s
many new game fishing water
the sportsman.



ULTRA LOW SPEED CONTROLS

Positive control effectiveness and solid feel during take-off, landing and slow flight is made possible through the Robertson ULS (Ultra Low Speed) control system (patent pending) mounted directly behind the propeller. Operated by direct push-rod linkage to the control yoke, the ULS control utilizes the strong propeller air blast to generate pitch control at low speeds. The vibration free ULS control system is securely mounted on a rugged steel tubing framework that does not interfere with engine servicing procedures and can be removed in minutes for engine maintenance.





LOW SPEED INDICATOR

The Wren is the first airplane capable of fully utilizing the slow speed regime. To accurately measure these slow speeds, Wren has had developed an LSI (Low Speed Indicator) based on an anemometer principle. This instrument, standard equipment on every Wren, gives TRUE air speed from 0 mph to 200 mph. It is accurate to 1½ mph, does not need to be compensated for atmospheric pressure or temperature. The anemometer is mounted outboard of the strut and the recording instrument is mounted above the instrument panel where it can be readily visible during take-off and landing approach.

...more economically than any other rotary wing aircraft.

ECTION

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ON

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g speed and four seat capacity
trips to the city.

D SUPPLY

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ange of speeds and short turn-
mit outstanding evasive action.
reas are required for Wren

float operations to give added
pleasure flying. Able to get in
streams, the Wren opens up
ers previously inaccessible to

FORESTRY AND GAME PATROL

With its low speed advantages, the Wren is well suited to the needs of foresters, conservationists, and lumbermen. Game and fires are easily located, and timber may be carefully observed and evaluated for future lumbering operations.

AERIAL APPLICATION

The combination of the turbulent downwash created by the Wren's large flaps and the plane's wide speed range permits the pilot to select the best application conditions for complete coverage and crop penetration. The use of low speeds coupled with agile maneuverability offers new safety for ag-flying.

AERIAL SURVEY

Aerial photography, surveys and route selection gain in accuracy at low speeds with the Wren 460. Land evaluation and real estate sales are easily handled in the Wren, landing in small cleared areas for detailed investigation when required.

GENERAL BUSINESS AVIATION

A Wren 460 located at a business or factory site drastically cuts the high cost of lost time for executives traveling to and from a commercial airport. Because of its doorstep capabilities, the Wren's portal-to-portal time is normally lower than by commercial air transportation on trips as great as 600 miles.

*HTOL—HELIPORT TAKE-OFF AND LANDING

FLYING THE WREN

Once in the air and "going places" at over 150 mph, the Wren handles much the same as any of today's four-place, single-engine business airplanes. But it is in taking off, in landing, and in its slow-flight regime that the Wren stands separate from **every** other airplane ever built.

Let it be said, right from the start, that in all flight phases, the Wren is a most docile airplane, devoid of any "tricks" or undesirable characteristics.

Only one new "dial" shows up on the instrument panel—the only change in the entire cockpit. This is the LSI (low speed indicator). The **conventional** air speed indicator becomes increasingly inaccurate as speed decreases below about 70 mph indicated, until, with the airplane flying at 35 mph, it becomes completely unreliable. The new LSI takes its reading from an anemometer—like the gadget with the three revolving cups found at weather stations to measure wind velocity. The anemometer in the Wren is mounted outboard from the right-hand wing strut. Air speed is read from a large-faced dial mounted top-center above the instrument panel and is accurate to within 1½ mph. The LSI indicates **true** air speed at all times (from 0 to 200 mph) needing **no** correction for altitude or temperature.

Other than the conventional wheel and rudder pedal controls, the only other "control" used for slow flight conditions is the normal flap control which can be set from 0° to 40°.

TAKE-OFF

For take-off, the flaps are set to 40° position, the trim indicator is set at the "neutral" or "cruise" position and **need not be subsequently changed** until required for cruise trim. The "cruise" setting is used for take-off and climb out regardless of CG loading.

On take-off, the Wren accelerates to 30 mph (on the LSI) in about six seconds, or 200 ft. (zero wind, full gross). At 30 mph the nose is rotated slightly upward with a gentle back pressure on the wheel. The Wren breaks ground cleanly at 33 mph (less than one second after starting to rotate) and climbs out about 10 degrees nose up, passing quickly through 40 mph and on to 50 mph. In 10 seconds from breaking ground the Wren will be 100 ft. high with the LSI reading above 50 mph. Power is reduced to 23″ manifold pressure and 2350 rpm, enough to maintain 50 to 60 mph during climb out. When clear of all obstacles begin retracting flaps and set up a desired rate of climb as with any conventional airplane. There is no change in trim required upon raising flaps. Best climb speed is 90 mph at 900 ft/min.

SLOW SPEED FLIGHT

With flaps fully retracted (in clean configuration) the Wren stalls power-on at 40 mph (lightly loaded) to 45 mph (gross weight). This is a very docile stall with ample warning, first in a slight rudder pedal buffet, then in a gentle elevator buffet (both of which occur about five mph above stalling speed and are supplemented by the warning horn). Full pitch, roll, and yaw control are maintained, even up to **and through** the stall. Power stall recovery is simply effected by only slightly releasing back pressure on the wheel, without loss of altitude and before the nose reaches the horizon.[1]

Slowing the Wren to 75 mph permits the flaps to be easily lowered to 20° position. As the flaps are lowered, about three or four short "blips" on the trim-control wheel trims the Wren for level flight in a very slight nose-down attitude.

With 20° flaps the Wren can be flown for extended periods at 50 to 65 mph at power settings of 16″ manifold pressure and 2100 rpm. Because of the low power setting, no engine heating occurs. At these speeds the Wren is ideal for search operations or patrolling. The pilot has perfect visibility forward and to the sides, the engine is not laboring, and there is no noticeable difference in controllability over that at normal cruising speeds except for a shorter turning radius.

ULTRA-SLOW FLIGHT

Lowering flaps to the 40° (full flap) position reduces speeds to a 30 to 50 mph range. No trim adjustment is needed, as the same trim setting is used at all flap positions from 20° through full flap setting. A little power should be added (about 17″ manifold pressure at 2100 rpm) to maintain altitude and level attitude at 40 mph.

At 35 mph the Wren will still perform steep turns (60° bank) and all maneuvers that could logically be required. The Wren flies with solid control "feel" and full response down to speeds below 30 mph **true** air speed on the LSI. Low speed stability is such that the airplane can be flown "hands off" for long periods of time even at this speed.

A full 180° turn to reverse direction can be easily accomplished in 12 seconds on a radius of less than 150 ft. with a 45° bank at 35 mph. At the same speed, full 360° turns are completed from level flight attitude and return to level attitude on the original heading in 20 seconds.

Flying at 35 mph still leaves a 35% margin above the Wren's minimum speed of 26 mph.

This type of solid, dependable controllability at ultra low speeds is, admittedly, hard for any pilot to accept until he has actually experienced it himself.

LANDING

On base leg, power is reduced, and air speed lowered to 75 mph when flaps are extended to 20° position. Adjust trim control about three or four "blips" nose-up. Continue reducing speed to about 55 or 60 mph. Delay turning final until actually opposite the desired final approach path (the Wren makes a very tight turn at these slow speeds).

Continue approach at 45 to 50 mph (power off) to about 500 ft. from desired touch down point at a 200′ altitude. Lower flaps to 40° position reducing airspeed to 35 to 40 mph. Use throttle in minor adjustments to maintain a steady approach path toward the landing spot.

The full approach is conducted at a very slight nose-down attitude (about 8°). Make a normal "flare" for landing. Flaring reduces touchdown speed to about 30 mph. The shortness of the landing roll will depend primarily on the speed with which the flap retraction is begun in order to "dump" lift and increase friction. Normal ground roll in zero wind is **less** than 200 feet using only one good application of brakes.

The slow approach speed leaves ample time to complete every action without haste.

At these approach speeds, the Wren does not float. With a little practice the Wren can be landed on a desired spot **every** time, and landing rolls of about 150 feet can be accomplished—even less into surface winds.

There is nothing difficult or complicated about flying the Wren. On the contrary, pilots consider the Wren safer and simpler to fly than other aircraft, due to the very slow speed that eliminates the need for split-second decisions.

The one element required is acceptance of the **reality** of **safe, controllable** slow air speeds. Wren Aircraft invites pilots to experience safe, utilitarian, ultra-slow flight in a Wren 460.

[1]At all except the rearmost CG loadings, the Wren will **not** stall power off.