CAFE FOUNDATION

AIRCRAFT PERFORMANCE REPORT

Sponsored and Funded by the Experimental Aircraft Association
and the Federal Aviation Administration

Thorp T-18

BY BRIEN A. SEELEY

TRIAVIATHON TROPHY

CHALLENGE TROPHY

INTRODUCTION

John Willard Thorp (1912-1992) designed and built the first Thorp T-18 in 1961 as an all-metal, low wing monoplane. He employed the "matched hole" riveting technique to meet his priorities of a low cost and quick to build aircraft. Using the Lycoming O-290 engine, it became one of the first high-performance homebuilt aircraft. Thorp published a series of articles on how to build the T-18 in ***Sport Aviation*** in 1962-63.

Over the last 33 years, the T-18 has been one of the more popular designs among EAA builders. The ruggedness of the design was showcased in 1976 by Don Taylor's flight around the world in his T-18, N455DT, which now resides in EAA's Air Adventure Museum in Oshkosh. This was the first homebuilt ever to circumnavigate the globe.

Thorp was inducted into EAA's Hall of Fame in November 1995. Well known as an aeronautical designer, he received his formal training at the Boeing School of Aeronautics in Oakland, California, and later worked at Boeing, Vega, Lockheed and Fletcher Aircraft.

Richard C. Eklund, a former Piper Aircraft engineer who received much of his education from his long association with Thorp, now manages the T-18 plans and product support from the historic Locke Family Home in Lockeford, California. John Thorp was the grandson of Dr. Dean Jewett Locke, the founder of Lockeford, and was raised from age 4 in that same home.

LARRY FORD

C.J. Stephens and Otis Holt in Ken Brock's beautiful T-18, fitted with the CAFE Barograph, data recording system and camcorder. All tests were conducted offshore at Pt. Reyes National Seashore to avoid turbulence.

THE TEST AIRCRAFT

N42KB was built by Ken Brock in 1982 with a 180 hp Lycoming engine and Hartzell constant speed prop. When asked to provide the aircraft for this Aircraft Performance Report, Ken enthusiastically agreed. He did an excellent job of making the camcorder mount, sensor and wiring installations necessary for these tests. Mike Melvill and the team at Scaled Composites made the barograph wing cuff mounts exceptionally strong and light.

Both Ken and Richard Eklund attended the CAFE testing sessions and were very helpful in making flight test preparations.

N42KB differs from "stock" in having gear legs that are 3" longer and in having no wing leading edge stall strips. Its gross weight is 1600 lbs. while the original Thorp used a 1500 lb. gross weight. Otherwise, it was built according to plans.

The setting for the propeller flat pitch stops on N42KB limited it to 2600 RPM instead of the allowable maximum 2700 RPM. This produced lower speeds than would have been obtained if the propeller RPM had been set for its maximum.

TEST NOTES

The testing consisted of 7 flights, the last 2 of which were the flying qualities assessments at forward and aft CG's, respectively. Flight #5 was used to determine the level speed and power performance. Flights #1 through #4 were devoted to zero thrust glides. Otis Holt served as flight engineer for all of these flights, with C.J. Stephens as PIC on flights #2-7.

This was the first zero thrust glide test performed by the CAFE Foundation on an aircraft with a constant speed prop. A consistent 6.8 thousandths of an inch dynamically measured thrust bearing clearance was observed, with 3.4 thousandths thus chosen as the zero thrust position of the crankshaft.

Due to the excellent climb capability of this T-18, the zero thrust glides

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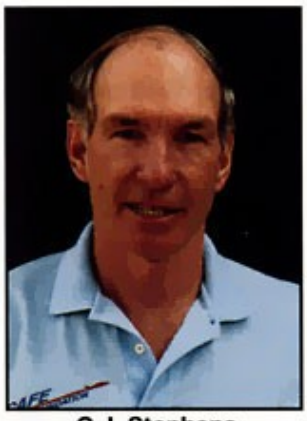
CAFE TEST SUMMARY

Vmax Cruise *	201.7 mph
Rate of Climb**	1539 fpm
Stall Speed	59.3 mph
Takeoff Distance	600 feet, no wind
Cabin Noise Level, Cruise	98.2 dBA

*75% power, 10.8 gph, 2500 RPM, 22.2" M.P., 1513 lb, 8124' density altitude.

**2500'-3500' Std. Day, 2560 RPM, 105 CAS, 27.4" M.P., 15.4 gph, 1585 lb, see text.



C.J. Stephens

ABOUT THE OWNER

Ken Brock (EAA 26913) learned to fly at Long Beach Airport in 1955 while working as a machinist at Martin-Decker in the Los Angeles basin. Ken and his wife, Marie, who is the namesake for his T-18 "Sweet Marie", married in 1955. He joined EAA in 1960.

Ken bought his first aircraft, a Stinson 108-3, in 1959 and still owns it. In fact, he has never sold any of the cars or aircraft that he has owned. Conse- quently, he still owns his Smith Mini-plane, Volksplane, Brantly B2B helicopter, Cessna 210 and a few other designs.

Ken has been thrilling airshow crowds for many years with his aerobatic demonstrations in the K2B gyrocopter.

Ken Brock Manufacturing, Inc. is a well-respected source for a wide variety of high quality machined, stamped and welded parts for homebuilt aircraft. These include exhaust systems, propeller extensions, engine mounts, landing gear, wing attach fittings, control systems, bellcranks, etc. All of the component parts for the T-18 are available from Ken's company. In addition, he sells complete supplies for building the McCulloch-powered KB-2 and the Rotax-powered KB-3 gyrocopters. By tooling up to make high-quality, pre-manufactured parts for several of the newly designed homebuilts, he has helped the EAA movement to grow. Ken encourages customers to visit and tour their manufacturing plant. Call 714/898-4366.

were of long duration from 11,000' down to 5,500' over the ocean at Pt. Reyes National Seashore.

Glide data analysis in this report included new software incorporating correction for induced drag artifacts. An additional program to extract the lapse rate during the several climb segments conducted at different times of day was written by Steve Williams to graphically analyze the atmosphere during these tests. The lapse rates so obtained appear consistent with acceptable flight test conditions and this is supported by the smoothness felt in the cockpit. Air mass lift or sink was not measured.

Cruise speeds shown in this report are those measured with the CAFE barograph, corrected for the wing cuff drag penalty, and are felt to be accurate to 0.1 mph.

The crankshaft incidence was 6° nose down. A pitot-static system check showed no leaks. N42KB's pitot-static probe location gave large errors both with change of power setting and yaw angle.

T-18 FLYING QUALITIES

By C. J. Stephens
Nov. 6, 1995

News that Ken Brock was to present his Thorp T-18 for an APR evaluation was met with great anticipation by all the CAFE board members. Given Ken's reputation as supplier of ultra high quality machined components to hombuilders, we knew that we could expect a well built example of the design, and we were not disappointed.

My first glimpse of the N42KB sitting on the CAFE Scales told me this was a no-nonsense, well-cared-for personal plane. As our technicians installed the necessary barograph and many data acquisition sensors I examined the workmanship and airworthi- ness of the aircraft and studied the operating information. I was extremely well satisfied with the quality of this Thorp T-18 and complimented Ken on the quality of his flight test preparations.

This APR was to be accomplished in a slightly different order than our normal routine in that the zero thrust glides were to be conducted prior to the subjective handling qualities and stability flights. The weather was forecast to be perfect on Saturday, 11/4/95, and to deteriorate by Sunday. Since the glide measurements require very calm air to get the best data possible, we deemed it prudent to reverse the order of the test flights. My handling qualities flights were conducted Sunday, 11/5/95, first at a CG. of 21% MAC (forward) and then at 27% MAC (aft), well within the allowable range of 15%-32% MAC.

FIRST IMPRESSIONS

The T-18 is a small homebuilt airplane. It is subtle at first, but as you work around it you soon notice that it has very short wings. The lines are pleasing with a conventional tailwheel design and all metal construction. The aerodynamic look of the plane implies good performance.

EXTERIOR DETAILS

One distinguishing characteristic of the T-18 is the abrupt change in wing dihedral at mid span. Another is the use of a horizontal stabilator with an anti-servo-tab instead of the more common stabilizer-elevator for pitch control. This design has a fairly short fuselage, so I was anxious to see how

these items would affect pitch stability and control in flight.

This T-18 tailwheel has a full swivel capability, a feature that I have grown fond of since we are constantly pushing test aircraft in and out of the CAFE hangar during these flight tests. It can be quite a nuisance with a non-swiveling tailwheel to have to pick up and carry the tail to position the aircraft on our scales.

N42KB had a beautifully chromed constant speed propeller and spinner combination which enhanced the overall beauty of the plane. Adding to this effect was a trim, lightweight cowl. Unfortunately, to check the oil in its 0-360 Lycoming, it was necessary to use a screwdriver to remove an entire cowl cheek, attached by about 10 Dzus fasteners. This installation is a disadvantage since I feel it may discourage a less attentive pilot from checking the oil prior to each flight.

The fuel is all contained in a single 29 gallon tank located between the firewall and the instrument panel. This location is used in a number of homebuilt designs and has both advantages and disadvantages. By having the fuel above the engine it is not necessary to rely upon the fuel pump. The single tank does not require any special in-flight fuel management. The fuel line extends straight down from the tank to a shutoff valve located a good arm's reach forward between the rudder pedals. Any time that simplicity can be kept in an airplane design, the safety of flight seems to improve.

Since the fuel tank is located well forward of the CG, the CG travels aft as fuel is burned. This can set up the situation of tail heaviness as the flight progresses. Some pilots compute the CG at takeoff and don't give much consideration to what happens after that.

Having the tank located in the confines of the cockpit does create a greater potential fire hazard since the area forward of the instrument panel is a busy place with the many electrical devices in that vicinity. Generally this installation was clean and in my opinion was of good design keeping in mind the various pros and cons.

John Thorp and his T-18.

THE COCKPIT

The instrument panel was beautiful in the way it was laid out and manufactured. All of the lettering was hand painted and looked exceptionally nice. With the side-by-side cockpit design, the panel size was excellent, an advantage enjoyed over tandem designs. A neat row of electrical switches and circuit breakers were located to the lower left of the instrument panel. Just above that were the magneto and master switches. This seemed to me to be a very functional and logical layout. Flight control was through dual center sticks with the radio transmit buttons on top of each stick. The manual flap lever was between the seats and had a 20° and 30° setting. Earlier T-18 models had a 40° setting but that was deleted due to a tail blanking and pitch down problem.

There were no entry steps installed. However, the wings are low enough to the ground that it is not difficult to step up on the wing. Entry was the same from either side of the plane. Caution needed to be exercised not to step on the flap since it is not de-signed to support that type of load. This "No Step" was well marked and visible wing walk strips helped remind the unsuspecting where to step.

Getting into the cockpit could be accomplished, without stepping on the seats, by stepping on the center structure that was between the seats. Once seated I found the cockpit to be very comfortable.

The rudder pedals were fixed in position as were the seat backs leaving little adjustment for taller occupants. I believe that persons taller than 6 feet might find insufficient headroom. The shoulder width was adequate for myself (180 lbs) and Otis Holt (150 lbs). However, during flight our shoulders were just touching. A nice sized storage compartment was available under each seat. The main baggage compartment, located behind both seats, was roomy and accessible by leaning either seat forward. The baggage maximum

SAMPLE C.G. CALCULATIONS, T-18 N42KB

Aft sample item	Weight	Arm	Moment	Forward	Weight	Arm	Moment
Main gear	996	55.312	55090.752	Main gear	996	55.312	55090.752
Nose gear	33	215	7095	Nose gear	33	215	7095
Pilot	203	85.5	17356.5	Pilot	150	85.5	12825
Passenger	213	85.5	18211.5	Passenger	0	85.5	0
Fuel, lb	24	50	1200	Fuel, lb	170	50	8500
Oil, included	0	28	0	Oil, included	0	28	0
Baggage	65	109	7085	Baggage	0	109	0
TOTALS	1534		106038.752		1349		83510.752
Gross Weight	1600			Gross Weight	1600		
Actual Weight	1534			Actual Weight	1349		
c.g. range, in	62.5"-71.0"			c.g. range, in	62.5"-71.0"		
c.g. range, %	15%-32%			c.g. range, %	15%-32%		
c.g. in inches	69.13			c.g. in inches	61.91		
c.g. in % MAC	28%			c.g. in % MAC	14%		

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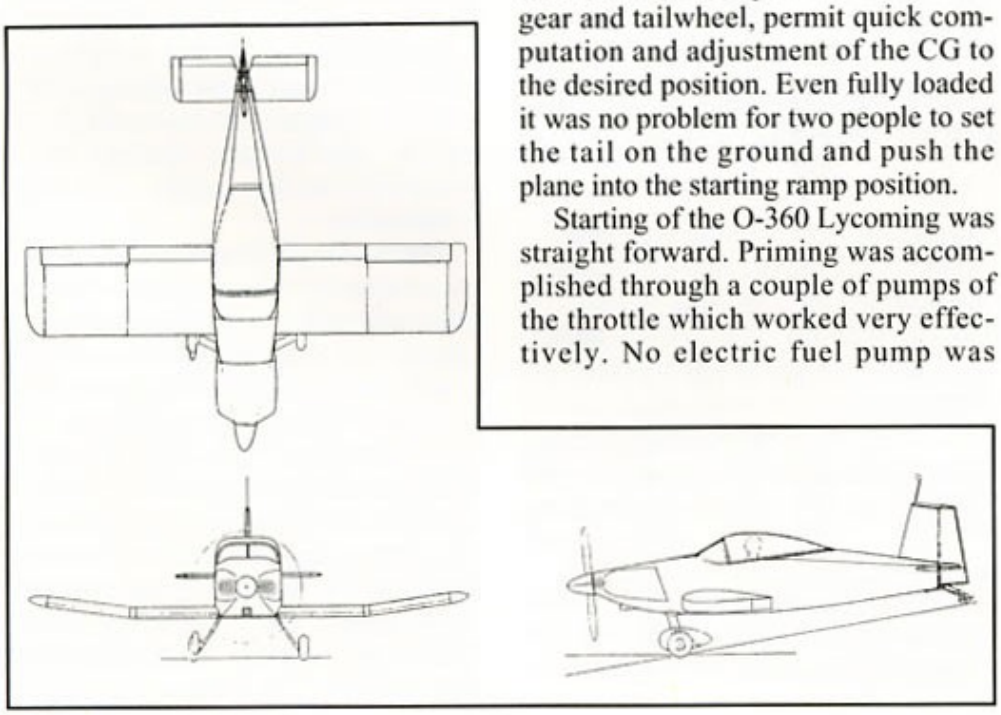
capacity was 40 lbs.

The canopy, which seemed large by comparison to the rest of the plane, slid straight back on excellent rails and rollers. The single canopy locking mechanism located in the center top of the canopy was positive and effective. Air loads during flight tend to push this canopy closed, so there is little danger of the canopy inadvertently opening in flight if the locking mechanism were to become disengaged.

The engine controls were in line left to right along the bottom of the instrument panel and each was color coded with a vernier knob. I liked the layout, but I personally prefer non-vernier throttles, which I find to be a more useful control in formation, traffic patterns and taxiing. Constantly having to deal with the push release of the vernier is distracting and rotating the knob is too slow to be useful.



START/TAXI/RUNUP

Moving the plane around on the ground by hand is easily done, even loaded to its maximum weight. During the CAFE testing the plane is set on the scales in a fuselage level attitude fully loaded with fuel, test gear, and pilots and is then ballasted to the maximum allowable weight. The CAFE digital electronic scales, with their separate flush-to-the-floor platforms for main gear and tailwheel, permit quick computation and adjustment of the CG to the desired position. Even fully loaded it was no problem for two people to set the tail on the ground and push the plane into the starting ramp position.

Starting of the O-360 Lycoming was straight forward. Priming was accomplished through a couple of pumps of the throttle which worked very effectively. No electric fuel pump was installed. Run up and pre-takeoff checks were normal, however, it was noted that no checklist was available for use.

Taxiing gave me a chance to get the feel of the tailwheel and the response delays that would be present during takeoff. The plane responded quickly and positively to all rudder pedal inputs, no matter how slight. With a little practice on the taxiway I was satisfied with the directional control. My main tendency was to use too much rudder input so conscious effort to make very small rudder inputs helped to track straight at varying ground speeds. The toebrakes were positive yet not overly sensitive. There were no toebrakes installed on the rudder pedals for the right seat.

Field of view was better than the average of most tailwheeled aircraft. The taxiway could be seen at about 150 ft. directly in front, or even closer by moving my head to the left. Of course, with the large bubble canopy there was a clear view in all other directions. No canopy defog vent was installed. However, the mild fogging that occurred prior to our pre-dawn departure was quickly dissipated by opening the canopy about 3 or 4 inches. The moving air from the propeller wash rapidly cleared all windshield fogging.

TAKE OFF AND CLIMB

The Thorp's takeoff acceleration really impressed me. The constant speed propeller and 0-360 combination produce the feeling of being shot out of a cannon. Using slight stick forward during the short takeoff roll helps raise the tail improving the view over nose and helps prevent early fly off. Directional control was no problem though I was aware of the sensitive rudder input which on later flights became quite comfortable. The plane literally jumped off of the ground when it was ready to fly. With the trim set the plane climbed easily and quickly to our test altitude of 8,000'. Field of view during climb was adequate over the nose and excellent in all other directions. Shallow turns during climbs ensured good clearing for other airborne traffic.

DYNAMIC STABILITY

Dynamic stability was explored with the input of pitch doublets then observing the natural damping tendencies. Both stick-free and stick-fixed

situations were explored at 93 mph (1.3Vs) and 150 mph (Va). The T-18 displayed excellent dynamic stability with every sample.

STATIC LONGITUDINAL STABILITY

Static longitudinal stability was measured by trimming the airplane to 150 mph then measuring the amount of stick force required to fly at other airspeeds across the range. A hand held stick force guage was used to measure the force and a cockpit in-stalled camcorder recorded the information.

MANEUVERING STABILITY

Classic maneuvering stability at maximum gross weight was examined using the hand held stick force gauge and G meter. The results were as follows:

Cruise configuration and 150 mph IAS, with the CG 21% MAC:

2 g = 10 lbs.
2.5 g = 17 lbs.
3 g = 24 lbs.

Flaps full down configuration, 93 mph IAS, CG 21% MAC:

1 g = 0 lbs.
1.5 g = 3 lbs.
2 g = 6 lbs.

Cruise configuration, 150 mph IAS, 27% MAC:

2 g = 10 lbs.
2.5 g = 12 lbs.
3 g = 14 lbs.

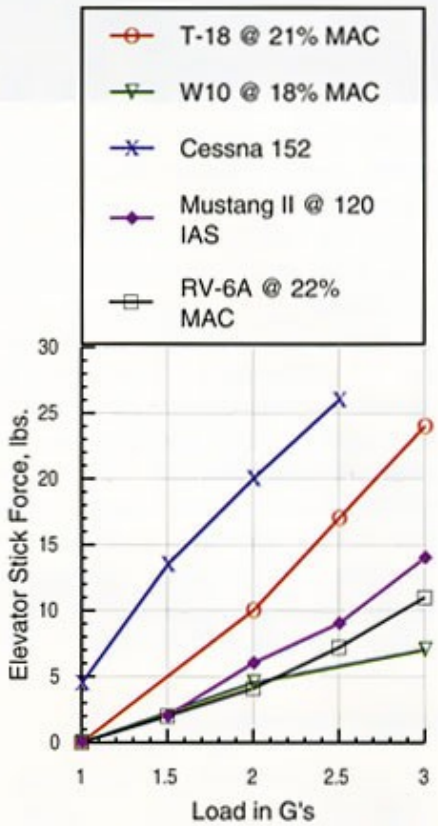
Flaps full down configuration, 93 mph, 27% MAC:

1g = 0 lbs.
1.5g = 3 lbs.
2g = 7 lbs.

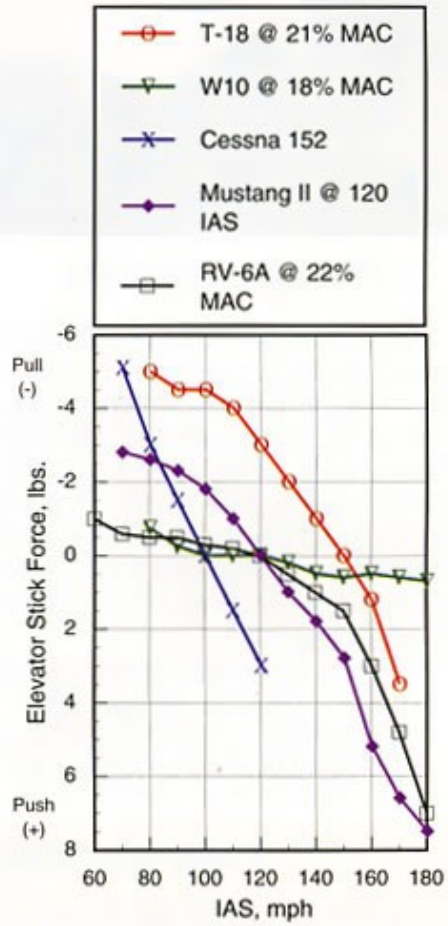
Response to control inputs was smooth and the T-18 showed no tendency to overshoot the intended G-loading, even in the aft-loaded configurations.

SPIRAL STABILITY

Stick-free spiral stability was examined by trimming the airplane for a level 15° bank turn then releasing the controls and recording the tendency to either increase bank or roll out. The test was repeated at both 93 and 150 mph IAS. The results were inconclusive due to a slight right wing heaviness caused by the ballast used to load the plane being located on the right side of the baggage compartment. With no aileron trim installed I was unable to fully trim the ailerons to neutral. My opinion is that the T-18 has neutral spiral stability. The left turns would generally roll level in 12 seconds and turns to the right would increase to 30° of bank in 16 seconds. Entry speed did not seem to affect the results of this test.



Maneuvering stability, Va, forward c.g.



Static longitudinal stability trimmed hands-off at Va

Calibration of Instrument Panel to CAFE Sensors

Panel IAS	CAFE CAS	Panel Alt.	CAFE Alt.	Panel RPM	CAFE RPM	Panel M.P.	CAFE M.P.	Panel CHT	CAFE CHT
80	70.3	2000	2227	1000	970	12	11.6	205	342
90	80	3000	3005	1700	1630	15	14.8	235	348
90	85 Power on	4000	3994	2100	2003	18	17.5	245	361
96	71 Power + rudder	5000	4981	2200	2130	20	19.6		
100	98	7000	6964	2300	2255	22	21.7		
120	112	8000	7972	2500	2434	25	24.4		
140	138	9000	8949	2550	2476				
		10000	9979	2600	2515				
				2700	2628				

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ROLL DUE TO YAW

I found that roll-due-to-yaw could control the bank angle very nicely using rudder alone. The dihedral effect caused by the prominent dihedral change of the wing at mid span produces very effective control. I was so impressed with the rate of roll that could be generated with rudder alone (ailerons neutral) that I took some measurements:

93 mph rolling right 10° per second
93 mph rolling left 15° per second
150 mph rolling right 7.5° per second
150 mph rolling left 4° per second

The lower airspeeds and resulting higher angle of attack obviously produced better roll-due-to-yaw. It was a brisk roll rate compared to that of most straight winged planes that I have flown.

Adverse yaw was observed by slowing to minimum airspeed and introducing high aileron input without any rudder input. The resulting yaw excursion was minimal. The heading would only yaw opposite about one degree before turning in the proper direction. This airplane incorporates differential ailerons that deflect farther up than down in their movement. This, and the short wing span, seem to be contributing factors in demonstrating very little adverse yaw tendency.

ROLL RATES

Clean configuration, 93 mph IAS, full stick deflection, 120° bank change, time includes the time to establish rate.

Rolling right 54° per second; stick force 15 lbs.

Rolling left 67° per second; stick force 13 lbs.

Repeating the test, all elements the same except flaps at 30°.

Rolling right 52° per second.

Rolling left 60° per second.

The pitch and roll stick forces, being about equal, were well blended and they produced an excellent control feel.

ROLL RATE, degrees/second		
Speed, IAS	Va	1.3 Vso
RV-6A	80	36
Tailwind W10	47	45
Cessna 152	47	34
Mustang II	72	na
Thorp T-18	na	60

Rates include the aileron input time.

STALLS

This Thorp T-18, as tested, has a very interesting and predictable stall. The stick force build-up is adequate to

CAFE MEASURED PERFORMANCE

Propeller static RPM, full throttle . . . . . .2605 RPM
Takeoff distance, ft, 120" MSL, no wind, 1583 lbs., 80°F. . . . . .600ft.
Liftoff speed, per barograph data, CAS, 1586 lbs., 80°F . . . . . .70.2 mph
Touchdown speed, barograph, CAS, 1500 lbs., 68°F. . . . . .78.2 mph
Max. rate of climb, 2560 RPM, 2500-3500 ft., Std, 105 CAS,
1585 lbs., 27.4" M.P., 15.4 gph . . . . . .1539 fpm
Max. rate of climb, 2592 RPM, 10,000 ft., Std., 101 CAS
1567 lbs., 21.7" M.P., 13.9 gph . . . . . .1033 fpm
Noise level, full power climb/75% cruise . . . . . .97 dBA/98.2 dBA

Cruise Speeds: bar04.pnt file source
8124' density, 75%,22.2"/2500 RPM/10.8 gph/1513 lbs. . . .201.7 mph
8062' density, 65%,20.5"/2499 RPM/9.8 gph/1511 lbs. . . . .193.6 mph
8025' density, 55%,18.5"/2500 RPM/8.8 gph/1510 lbs. . . . .181.8 mph
10,137' density, 70%,20.5"/2600 RPM/10.0 gph/1557 lbs. .200.0 mph
6,026' density, 84%,24.2"/2605 RPM/14.5 gph/1575 lbs. . .202.2 mph
TRIAVIATION Score 165.0

Stall speed, Vso, CAS, 1 g, level, 1572 lbs., 1978 RPM
22% MAC . . . . . .59.3 mph

KIT SUPPLIER

Eklund Engineering, Inc.
19960 Elliott Road/P.O. Box 1510
Lockeford, CA. 95237.
209/727-0318 FAX: 727-0873

OWNER/BUILDER N42KB

Ken Brock
Ken Brock Manufacturing, Inc.
11852 Western Ave, Stanton, CA. 90680.
714/898-4366 FAX: 894-0811

DESIGNER'S INFORMATION

Cost of plans	$250
Plans sold to date	1600
Number completed	400
Estimated hours to build, basic	2000
Prototype first flew, date	1962
Normal empty weight, with O-290 Lyc.	900 lbs.
Design gross weight, with O-290 Lyc.	1500 lbs.
Recommended engine(s)	Lyc. O-290, O-320, O-360
Advice to builders:	Keep it light, stick to the plans, approved for aerobatics at 1250 lb. or less, however, requires proficiency in aerobatics due to tendency for rapid speed build-up.

CAFE FOUNDATION DATA, N42KB

Wingspan	20 ft. 10 in.
Wing chord	50 in.
Wing area	86 sq. ft.
Wing loading, 1600 lbs./86 sq. ft.	18.6 lbs./sq. ft.
Power loading, 1600 lbs./180 hp	8.9 lbs./hp
Span loading, 1600 lbs./20 ft. 10 in	76.8 lbs./ft
Airfoil, main wing	631412, modified with no bottom T.E. cusp
Airfoil, design lift coefficient	.4
Airfoil, thickness to chord ratio	.12
Aspect ratio, span2/86 sq. ft.	5.05
Wing incidence	1.0°
Thrust line incidence, crankshaft	6° down and 3° to the right
Wing dihedral	8° at midspan
Wing taper ratio, root/tip	1.0
Wing twist or washout	0°
Steering	Differential braking, swiveling tail wheel
Landing gear	Tailwheel, tubular spring steel, wheel pants
Horizontal stabilator: span/area	83 in./14.4 sq. ft.
Horizontal stabilator chord	25 in.
Elevator: total span/area	NA
Elevator chord: root/tip	NA
Vertical stabilizer: span/area incl. rudder	32 in./6.2 sq. ft.
Vertical stabilizer chord: root/tip	22 in./12 in.
Rudder: average span/area	44 in./1.8 sq. ft.
Rudder chord: top/bottom	8 in./16 in.
Ailerons: span/chord, each	49.25 in./10 in
Flaps: span/chord, each	47.6 in./10.7 in.
Tail incidence	variable
Total length	18 ft. 11 in.
Height, static with full fuel	5 ft. 1 in.
Minimum turning circle	13 ft. 3 in.
Main gear track	62.8 in.
Wheelbase, tailwheel to main gear	13.3 ft.
Acceleration Limits at 1250 lbs.	limit load +6/-3 G's and ultimate load +9 G's

AIRSPEEDS PER OWNER'S P.O.H., IAS

Never exceed, Vne	182 kt/210 mph
Maneuvering, Va	138 kt/159 mph
Best rate of climb, Vy	NA
Best angle of climb, Vx	NA
Stall, clean at 1500 lbs. GW, Vs*	*56 kt/65 mph
Stall, landing, 1500 lbs. GW, Vso*	*50 kt/58 mph
Flap Speed, Vf	95 kt/110 mph

* Compare to CAFE measured performance.

prevent an inadvertent stall (as indicated in the static margin results shown above). At about 15 mph before stall there is a mild buffet that can be felt through the stick and in the airframe. This buffet builds up to an easily noticeable level before stall occurs. The stall is instantaneous and crisp. In every case N42KB's left wing dropped about 30° in association with the stall. Recovery was as quick as the stall itself. By simply repositioning the stick about an inch forward, the angle of attack was reduced and the wing started to fly as rapidly as it stopped flying. I enjoyed doing the stalls and felt very comfortable throughout each of them. For beginning pilots, I feel stalls in the T-18 would require good training and regular practice.

TRAFFIC PATTERNS/LANDINGS

This nimble little plane has such nice flying qualities that it is a pleasure making mild turns during de-scent. The T-18 is clearly designed for the enjoyment of flying. With the constant speed propeller the speed increases nicely on the descent, carrying the speed into the traffic pattern. The flaps worked nicely for glidepath control, as did slips.

Wheel landings were my choice to minimize the tailwheel problems that can occur with an unfamiliar and sensitive airplane. Each of the six landings was pleasant and comfortable. The main landing gear struts were stiff enough that there was no tendency to bounce back into the air upon touch down. The pitch control was positive and it was easy to judge the height during the touch down. The plane flew onto the runway very nicely at about 10 mph above stall speed. Directional control was very good as the speed diminished and the tail settled to the runway. As the tailwheel contacted the runway it showed an increased sensitivity to rudder inputs. However, that too could be controlled with care and practice.

CONCLUSION

The Thorp T-18 that Ken Brock presented to the CAFE Foundation for evaluation was an excellent example.

BUDD DAVISSON

The "Special Thanks" listing shown here is painted on N42KB's turtledeck, just behind the canopy, to recognize those who helped in the building and finishing of the Brock T-18. As nice as it is, the airplane is actually a "spare parts" T-18 Ken put together to fly while he was completing his other Thorp. The wing was originally built by Chris Fast and was flown for about 500 hours before being replaced by a Lu Sunderland folding wing. Ken had a spare Lycoming O-360, a Hartzell prop and, of course, a stockroom full of T-18 parts, since his Ken Brock Manufacturing makes them, so with help from his friends, N42KB was completed and flying in a very short time. It has a Gee Bee canopy; Herb Schable fiberglass cowling, wing tips and wheel pants; Wortz lightweight seats - and Ken's latest innovation, a hinged panel mounting for his GPS.

"Sweet Marie" has won a shelf full of trophies over the years, but is no pampered hangar queen. It is used for personal and business transportation and is normally flown several times a week. This past year it transported Ken and Marie to both Sun 'n Fun and Oshkosh.

Ken's other T-18? Well, N42KB turned out so nice that the first one is still sitting unfinished in his shop. EAA has an antique trophy awaiting it . . . if it ever gets finished.

— Jack Cox

Its fine handling qualities, good maneuvering and strong stability qualities show it to be a very well thought out design. It has simple systems that should be easy to maintain and operate. In my opinion it is a "pilot's" airplane. It has quick responses which make it fun to fly but which also re-quire paying attention as pilot. There can be no snoozing during landings or at high angle-of-attack maneuvering flight. If one observes these precautions, it is an airplane that can produce many years of pleasure and satisfaction.

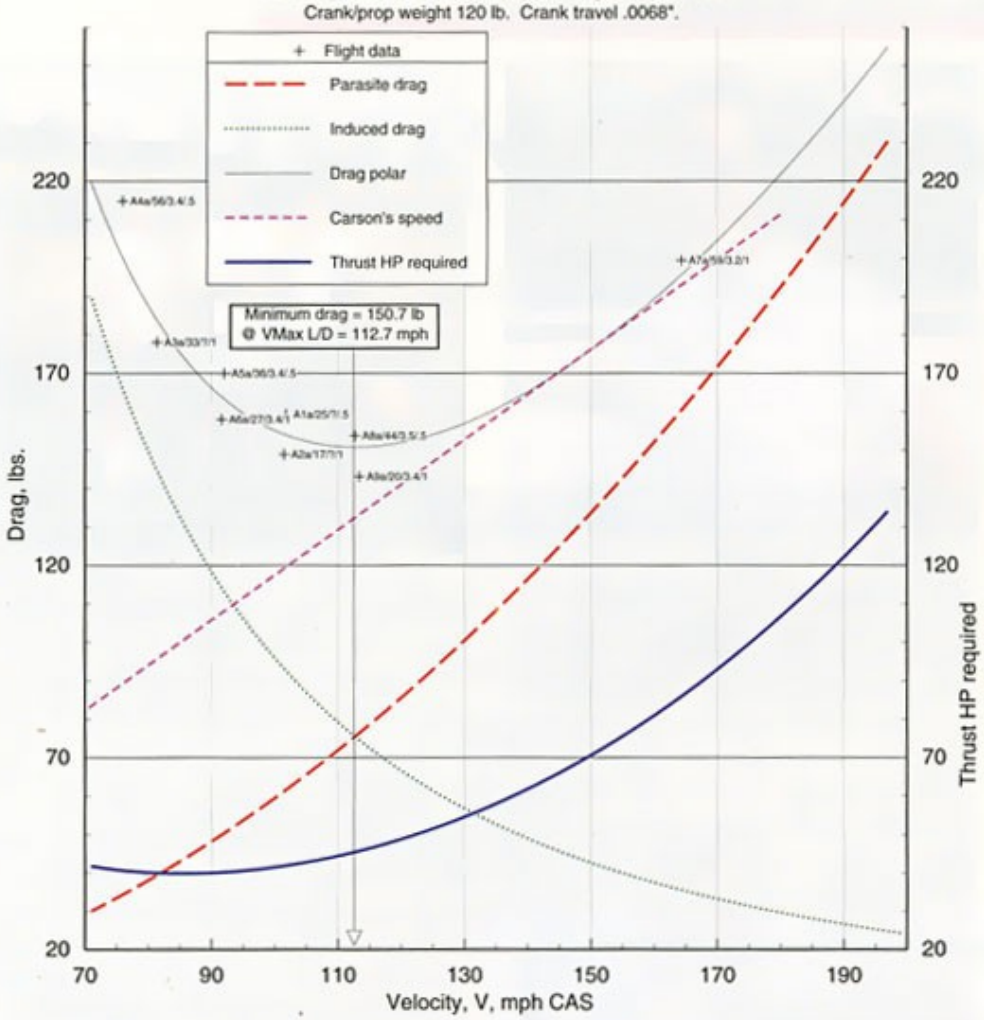
THORP T-18, N42KB

Estimated Cost: $14,000 materials,
$25,000 engine, $7,500 prop, $5,000 instruments and radios
Estimated hours to build: 1950 hours in 18 months
Completion date: July 12, 1982

SPECIFICATIONS

Empty weight, with oil/gross wt.	1029.7 lbs./1600 lbs.
Payload with full fuel	399.9 lbs.
Useful load	570.3 lbs.
ENGINE:	
Engine make, model	Lycoming, O-360 A2D
Engine horsepower	180 BHP
Engine TBO	2000 hrs.
Engine RPM, maximum	2700 RPM
Man. Pressure, maximum	29 in Hg
Turbine Inlet, maximum	NA
Cyl head temp., maximum	500°F
Oil pressure range	25-100 psi
Oil temp., maximum	245° F
Fuel pressure, range	5-8.0 psi
Weight of prop/spinner/crank	120 lbs.
Induction system	MA4-5 carb, bottom mount
Induction inlet area	8.25 sq in
Exhaust system	2 into 1 crossover, stainless, 1.75" O.D.
Oil capacity, type	8 qt., 15W-50
Ignition system	Bendix magneto S4LN200/S4LN-204 on right
Cooling system	Pitot inlets, downdraft
Cooling inlet area	51.8 sq. in.
Cooling outlet area	80.5 sq. in.
PROPELLER:	Constant Speed
Make	Hartzell HCF-2YR-IF/F7666A-4
Material	Aluminum
Diameter	74 in.
Prop extension, length	7 in. from crankface to blade axis
Prop ground clearance, full fuel	4.625 in. with level fuselage
Spinner diameter	12.75 i.n.
Electrical system	Prestolite: P/N ALY8403L5 alternator
Fuel system	1 tank in forward fuselage, mechanical fuel pump
Fuel type	91 octane
Fuel capacity, by CAFE scales	170.4 lbs./28.4 US gal
Fuel unusable	1 oz.
Braking system	Cleveland discs, single caliper
Flight control system	Dual center sticks, push-pull tubes, rudder cables
Hydraulic system	NA
Tire size, main/tail	5:00 x 5/ 8" Maule tailwheel
CABIN DIMENSIONS:	
Seats	2
Cabin entry	sliding canopy
Width at hips	NA
Width at shoulders	36 in.
Height, seat to headliner	37 in.
Baggage capacity/size	65 lbs./ 19.5L x 35.8W x 26H
Baggage door size	oval opening behind folding seatback = 15" x 32"
Approved maneuvers:	No snap maneuvers Roll, Chandelles, lazy 8's can be done. "It spins well and recovers well but has never been through a full spin program" -Ken Brock
CENTER OF GRAVITY:	15% to 32% MAC
Range, % MAC	62.5 in. to 71 in.
Range, in. from datum	60.5 in.
Empty weight CG, by CAFE	Wing L.E. = 55"
From datum location	55.3 in.
Main landing gear moment arm	215 in.
Tailwheel moment arm	50 in.
Fuel tank moment arm	85.5 in.
Crew moment arm	

Thorp T-18 N42KB. CAFE zero thrust glide test results. Barograph # 3, Missile # 2
11-04-95. Test Pilot: C.J. Stephens Engineer: Otis Holt
Crank/prop weight 120 lb. Crank travel .0068".

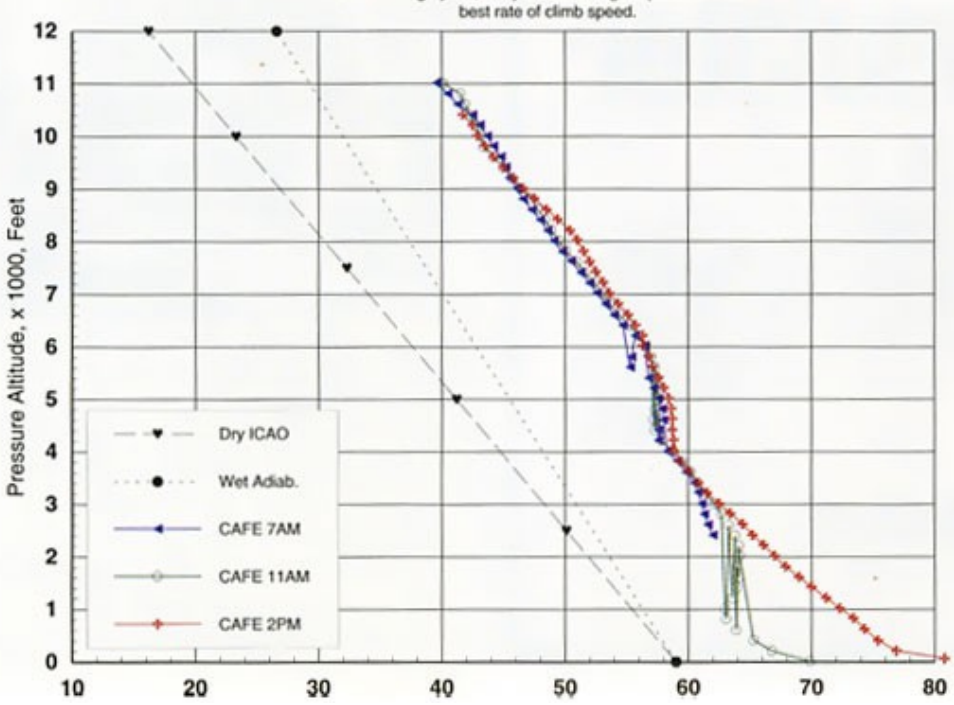


ZTGT data for 1600 lbs GW, 22% MAC c.g., compensated for cuff drag and prop/crank weight.
The ZTGT data points are shown with name/duration in seconds/crankshaft position in thousandths/confidence factor. The very tight crank travel of this aircraft led to glide data being collected with a crankshaft position slightly aft of the zero thrust point. It is therefore felt that the drag area shown here may be as much as 5% higher than actual.

q = .5 x .002377 VxV	D_p = 2.32 x q	D_i = 2448/q	Drag Polar = Dp + D_i
Drag Area = 2.32 sq. ft.	Oswald's e = .767	Maximum L/D= 10.6	$V_{Max\ L/D}$ = 112.7 mph
$V_{Min.\ sink}$ = 85.6 mph	Min. Sink Rate = 820 fpm	Min. Glide Angle = 4.74°	Cdo = .0269
Clmax = 2.03	Carson's V = 148.3 mph	THP = Drag x V/550	(with V in ft./sec.)

T-18, Lapse Rates, 11-4-95

CAFE Barograph #3 temp sensor using full power climbs at best rate of climb speed.



IMPORTANT NOTICE

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