STAR-STRUCK

RE-CREATION OF THE LITTLE DIPPER

BY JIM BUSHA

PHOTOGRAPHY BY **DARIN LACRONE**

SHOOTING STAR

The reports coming in to the Axis field commander were startling; "All army ground troops in the western sector have surrendered after being overwhelmed by hundreds of Allied forces who had arrived en masse and undetected operating small single-seat airplanes behind our lines and capturing key infrastructures and command centers. These 'sky soldiers' simply landed in small fields and on roadways behind our lines causing so much confusion and chaos we had no other alternative but to surrender."

Although that report was never actually drafted during World War II, it was exactly what the Lockheed Aircraft Corporation was hoping would play out when it presented its new airplane concept to military planners in early 1944.

April 1944

Airplane Model Specifications

The airplane shall be a single-place, low-wing monoplane, incorporating a single engine, tractor propeller and fixed tricycle landing gear; and shall be of all metal semi-monocoque construction with full cantilever wing and tail. Each component shall be designed to provide light weight, reasonably low maintenance cost, and the lowest possible cost of manufacture consistent with safety and easy maintenance.

The cockpit shall be arranged to give the pilot maximum visibility. The fixed tricycle landing gear shall incorporate air-oil shock absorbers on the main and nose wheel struts. The nose wheel shall be steerable by the foot pedals, and the main wheels shall be equipped with hand operated hydraulic brakes. The wing shall be provided with partial-span slotted flaps, and the horizontal tail shall consist of a single all moveable surface provided with a trailing edge adjustable anti servo tab.

Lockheed Aircraft Corporation, Model Number 33-82-01-"Little Dipper"

By September of 1944, the Lockheed Little Dipper design team led by John W. Thorp (of Thorp T-18 fame) created an inexpensive, simple airplane that was made of all aluminum with an empty weight of 439 pounds and a gross weight of 710 pounds. It had a 25-foot wingspan, was just over 17 feet in length, and was powered by a specially made Franklin two-cylinder Model 2A-4 engine that produced 45 hp with a 90 mph cruise and a 210 mile range. But the best thing about the Little Dipper according to Lockheed was that any soldier could fly it with very little training, a feat that was proven when a GI with no prior flying experience was given a short cockpit checkout and then took off and landed without incident. After numerous flying displays were presented to military leaders proving the concept, and with the war winding down, the military decided to pass on the airplane. For a fleeting moment Lockheed was ready to shift gears and target the tens of thousands of returning servicemen with a cheap, easy to fly airplane during the post-war boom. But when the boom became a bust the powers that be decided against that plan, and the only example of the Little Dipper along with a partially completed sister ship were ordered to be chopped up and destroyed. The story of that airplane could have ended right there, faded away unnoticed in the history books, had it not been for an article written by John Underwood and published in a 1960s issue of *Air Progress*. That short article dramatically changed the life of one homebuilder who made it his lifelong quest to see the Little Dipper fly again.

LOVE AT FIRST SIGHT

Although a hard-core devotee of Piper Cubs at an early age, Al Eke, EAA 56571 of Lino Lakes, Minnesota, admitted his eyes began to wander when he saw that article about the Little Dipper more than 50 years ago.

"I couldn't stop thinking about it," Al said. "The main reason I wanted to build this airplane was the fact that I am interested in going slow, not fast, and this airplane could not only fly slower than most anything out there, it could also turn a very tight circle and land in a confined area, maybe in my own backyard. I called

PHOTOGRAPHY COURTESY OF **AL EKE**

PERSONAL FLYING MACHINES AND THE U.S. MILITARY

BY HAL BRYAN

Lockheed's Model 33 wasn't the only personal flying machine ever considered for military use. In addition to conventional aircraft like the Little Dipper/Sky Trooper, the U.S. Army, along with other branches of the armed forces, has evaluated all manner of single-seat powered aircraft over the years, but none have ever gone into full-scale production.

FLYING PLATFORMS

First flown in 1955, Hiller Aircraft's 1031 Flying Platform, forerunner of the VZ-1 Pawnee, was meant to be used by regular infantry, providing a bird's-eye view of the battlefield and a stable platform for firing their personal weapons. As it turned out, the flying platforms couldn't go very high, and even though they were surprisingly stable, the original proto-Segway "fly where you lean" control system proved ineffective and had to be replaced with traditional helicopter controls. This added complexity, along with the inherent vulnerability of an unprotected infantryman hovering noisily in a combat zone, and ultimately led the Army to abandon the project. Another flying platform, the Williams X-Jet, known as the "flying pulpit," was evaluated some 30 years later, but was also discontinued.

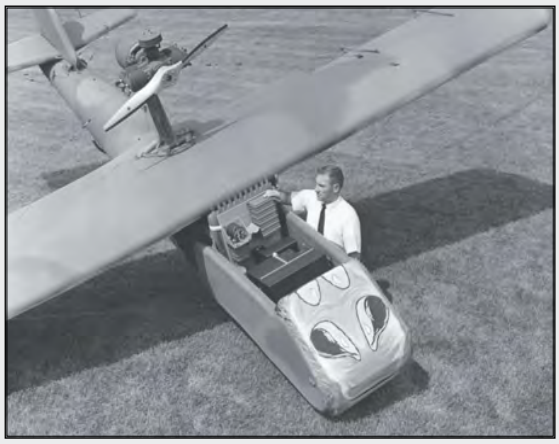
JET PACKS

Starting in 1958, companies like Thiokol, Aerojet, and, more famously, Bell began experimenting with Buck Rogers-style jetpacks in response to the U.S. Army's expressed interest in a "small rocket lift device." The Army wanted its soldiers to have personal, aerial mobility to be used for reconnaissance, river crossings, amphibious landings, etc. Bell's design proved the most viable and was first flown untethered in 1961, but was ultimately crippled by its 21 *second* flying time. The scene in the opening of the film *Thunderball* where James Bond uses one to escape to his waiting Aston Martin shows him flying for exactly 21 seconds, but doesn't mention that he'd have been completely out of fuel the instant he touched down.

PERSONAL FLYING MACHINES AND THE U.S. MILITARY

ROTORCRAFT

While the Germans towed gyrokites behind submarines in World War II, and the British experimented with their Rotachute at the same time, the United States didn't really start looking seriously at one-person rotorcraft until about 10 years later. In 1954, the Rotor-Craft Corporation first flew a backpack helicopter called the RF-1 Pinwheel. Other companies followed suit, and both the Army and the Navy evaluated designs like the Gluhareff MEG-2X and the Aerospace General Mini-Copter well into the late 1970s. Like the jetpacks and flying platforms before them, the concepts were never proven to be practical.



THE INFLATOPLANE

One of the most unusual ideas for a military-use personal aircraft came from the Goodyear Aircraft Company, which built and flew the Inflatoplane in 1956. Built of sandwiched rubber with a nylon mesh interior frame, the Inflatoplane fit inside a 1.25-cubic-meter container that was meant to be dropped to servicemen trapped behind enemy lines. Once unpacked, it could be inflated and flown in less than five minutes, and it boasted a takeoff distance of just 250 feet. In spite of the obvious vulnerability to just about any kind of weapon, the Inflatoplane was flown and tested extensively for more than 15 years until the project was canceled in 1973. The concept lives on to some extent in the Swiss-designed and delightfully named Woopy-Fly, a light, powered trike with an inflatable wing.

THE FUTURE

In spite of several decades of experimentation, the idea of personal flying machines for our troops has never really caught on. The concept still resurfaces from time to time, however, with the Trek Aerorpace Springtail dual-ducted fan aircraft (similar to the Martin Jetpack) and companies like Parajet and its paramotor solutions both being looked at by the U.S. armed forces. The idea that swarms of jetpack-wearing infantry will fly themselves into battle seems increasingly unlikely as we discover that it's simpler—and safer, for our side anyway—to simply send in the drones.

John W. Thorp to get his thoughts about re-creating the Little Dipper, and John told me he used to fly it for 15 minutes staying in a 300-foot circle before he got so dizzy he had to land. The performance of this airplane was leaps and bounds ahead of anything else in its day. Unfortunately even John didn't have a set of plans to share with me; there was just nothing available."

While Al was teaching at a local college he would discuss his desire to build this airplane with anyone who would listen, including a fellow professor who liked to travel.

"He visited Washington, D.C., and obtained a large assortment of photos from the Smithsonian, and that enabled me to get a better grasp on what I was about to undertake," Al said. "I also had a copy of the Lockheed specification manual, so I knew the size, weight, and dimensions including the weight of each component. I also had a three-view drawing of the airplane so I had a starting point."

When Al first set out to build the Little Dipper, he initially thought about trying to keep it in the ultralight arena. But no matter how much he bent the slide rule, he just couldn't get the weight down.

Al shifted focus and thought about making it out of foam and fiberglass and worked out the system on how to accomplish that, but he still couldn't get the weight down.

"Another problem I encountered was the fact that I needed a two-cylinder engine," Al said. "I obtained an Aeronca 40-hp, two-cylinder engine that probably would have worked fine, but I couldn't stand the looks of it so I sold it. I was worried it would detract from the great looks of the Little Dipper."

After getting sidetracked and building a home-built Cub in 2006 (see *Sport Aviation,* February

A LOOK BACK IN TIME

Above: *Lockheed chief test pilot Milo Burcham flies the Dipper.*

Right: *The Little Dipper nestles in under its big brother, the Lockheed Constellation.*

PHOTOGRAPHY COURTESY OF **JOHN LYON**

2006), Al was bound and determined to build the Little Dipper and received support from his growing fan base associated with EAA Chapter 237 located at Anoka, Minnesota.

"A couple of the guys probably got so sick and tired of me talking about the Little Dipper for so long that they threw some seed money at me and forced my hand," Al said with tongue in cheek. "I thought it was going to be a quick building process, but after seven years of trial and error, I thought wrong."

BUILDING BUDDIES

According to Al, sometime in 2000 after sitting around the airport hangar flying, one of the longtime members of the group, Ellsworth Jorgenson, suddenly spoke up and said he would like to throw some money and time at making the Little Dipper a reality.

"We began in earnest to make the Little Dipper fly, as a group of retired schoolteachers and EAA chapter members worked away while Ellsworth became the expert coffee taster," Al said. "Unfortunately Ellsworth, who had provided the seed money, didn't live long enough to witness the Dipper fly. Another newcomer named Jack Smith, a retired former police helicopter pilot from Burbank, California, who had been flying since 1959, moved to Minnesota, joined EAA Chapter 237, and began turning wrenches on the project."

Jack, who grew up near the Lockheed plant where the Dipper was first built, was familiar with its history.

"When I was 10 years old I saw photos of it and thought it was a great-looking airplane, and I wanted to fly it," Jack said. "I got real excited when I found out Al was building a replica, and I had some old Lockheed magazines that I showed to Al. Al allowed me into his workshop, and for the next seven years of my life, working on it four days a week, we were determined to bring it to Oshkosh."

Al drew up some plans on a computer using the three-view drawings as a reference, but he had to move some things around because he knew he would have a heavier engine and had to estimate the weights of other things including the spar and bulkheads.

The team initially began with the fuselage and knew from the *Air Progress* article that the structure is monocoque with stringers. When they had the fuselage all put together they realized that the only way to install the control cables and pulleys were in spaces that became smaller and tighter.

"It was very difficult to attach certain parts with old shaking hands and fingers that lost their dexterity," Jack said. "Some of the openings were just small inspection holes that you could barely fit one hand in to work. At times it was trying and difficult and was very time-consuming, especially when you had to try and attach a nut to a bolt with one hand—not very easy!"

With the fuselage completed the Little Dipper gang focused on the wings. Al knew that the original airplane used the NACA 4415 airfoil and that the original skin was at 0.020, and the original wing had four ribs.

Al and his team ended up with a 25-foot wingspan, and a 17-1/2-foot long fuselage that was 7 feet and some change to the top of the tail.

"It has a flying tail with an anti-servo tab courtesy of John Thorp," Al said. "And for me it was the most difficult item on the airplane to design because the information was impossible to obtain. I get the theory but not the nuts and bolts of how it's designed. I looked at some other Cherokee airplanes and his T-18 design for guidance. I studied it and experimented with it, including making a trim system, which works very well."

The weight began to creep up because Al used 0.025 aluminum skins instead of 0.020, and he used 0.20 on the control surfaces instead of 0.012 found on the original.

"The spars were built very similar to those found on a Van's RV because they don't use the pins for mounting the wings," Al said. "These wings come through to the center and are bolted at the bulkhead. Needless to say it takes a few hours to take

Al Eke, right, with fellow Little Dipper building assistants.

PHOTOGRAPHY COURTESY OF **AL EKE**

the wings off now, but it can be done. We also decided to go with flush riveting on the entire project, which gives us a smoother finish all around and also gives us some extra speed to play with. We riveted all of it by hand, one rivet at a time. You can begin to understand why it took us so long."

Al ended up having to manufacture the landing gear himself, because he couldn't find anything close enough from any existing airplanes that were that small to use.

"My landing gear weighs a little more, and the wheels are a little heavier because I used regular brakes that came off a Piper product," Al said.

For power Al finally settled on the 45-cubic-inch, 65-hp Lycoming O-145 engine to power the Dipper. Now it was time to add the exhaust system, and Al knew that those can get really expensive in a hurry.

"Like most of my parts, I didn't have the extra money lying around, so I decided to build my own exhaust system," Al said. "I knew I wanted it to be stainless steel so I mirrored somewhat of the exhaust system on a Piper Cub. If I had it manufactured for the Lycoming, it would have cost me well over $1,200. I found some tubing from handrails you find in bathrooms, and those cost me around $18 apiece for two tubes. I looked at the Cub mufflers, and they ran above $400 dollars, so I scrounged around and found one off an old Ford tractor which is built exactly like those found on a Cub. Everything worked perfectly, and I had enough stainless steel left over to have two pipes running beneath the cowling—it looks really cool! I think I have around 80 bucks total in the whole exhaust system."

Al made some other modifications from the original design including adding a 19-gallon center fuselage tank mounted behind the pilot and a curved stick for the control instead of a straight one.

"After reading some of the original Lockheed test pilot comments that it was difficult to enter the cockpit because of the straight stick, I installed the stick farther forward and put a nice curve in it. Makes getting in and out a whole lot easier," Al said.

But the one item that gave Al more gray hair, sleepless nights, and fits of rage was the Plexiglas canopy.

"I figured out every method in the world on how not to make a canopy," Al said. "The process calls for it to be stretch-formed over a mold. After countless failures we finally have one installed. In my humble opinion it could be better, but it works so I am inclined to leave well enough alone—that's the curse of being a perfectionist I guess!"

With the airplane assigned N189SE, S for Smith and E for Eke, it was finally ready for its maiden flight, or so the team thought.

FLYING THE LITTLE DIPPER

Bob Heavirland, EAA Chapter 237 president, was given the honor of making the inaugural first flight almost 70 years to the day when the original Dipper flew. Unfortunately some teething problems prevented him from lifting off.

"I thought it was going to be a quick building process, but after seven years of trial and error, I thought wrong."

"We found out right away that when he lifted the nose he didn't have the rudder authority to keep it tracking straight as it wanted to pull left," Jack said. "He aborted his takeoff, and we found that some incidences were set in the tail to counter torque, but when it was mounted during final assembly it was placed in the wrong direction. We ended up rebuilding the tail and reduced the height of the vertical stabilizer by 4 inches. We also added a little more rudder as well as correcting the incidences on the vertical tail, which immediately rectified the problem."

Jack jumped into the saddle after Bob made the initial flight and took over the test flying duties.

To enter the airplane the canopy lifts from the right and opens to the left; there is also a small door located on the right to facilitate getting inside.

"The seat is comfortable, but the rudder pedals are very close together and so your legs are pretty close together and can begin to ache after awhile," Jack said. "The brake system is manual on the mains only and is activated by a lever handle on the left side right next to the throttle. The nose wheel steering is amazing, and it can turn around completely in the width of a taxiway; it's got great steering capabilities."

On takeoff Jack uses 15 degrees of flaps and rotates at 45-50 mph, where he lets it accelerate to 60 mph for his climb-out.

Sipping gas, Jack sees his fuel burn rate at about 4 gallons an hour. The Little Dipper will climb out at about 300-350 fpm with a throttle setting of 2550 rpm, indicating 90 mph in cruise.

"Visibility is good, but the canopy has some distortion looking forward," Jack said. "But out the sides it is excellent. The airplane handles really well; controls are very light and crisp. With the anti-servo tab on the stabilator it is extremely sensitive, and I just barely have to nudge it to make it do what I want it to do in any direction.

"It stalls clean around 45 mph and with flaps at 42 mph. But in a steep climb situation like a departure stall it will drop off pretty quickly on the right wing. Ironically in level flight, easing the throttle back and slowing it down with the stick almost all the way back causes it to just mush along with no wobble or burble.

"In landing configuration I need to carry some speed because if you get the Dipper too slow, it will sink on you pretty quickly. I try to avoid flaring it and try to fly it onto the runway as it seems to like this approach much better. The nose wheel steering is very sensitive both in takeoff and landings—you really have to be careful and pay close attention to where you have the rudder pedals situated."

According to Jack the Little Dipper is a fun little airplane to fly and has really satisfied his dream of building an airplane and then flying it. But Jack isn't the only one who realized a dream.

"I am thrilled to have finally made it here to the EAA convention in Oshkosh with it," Al said. "My dream has always been to have people see it, to know the history of it, and to comprehend what went into it and know what we have re-created, as close as we can, to the original John Thorp creation. It was also very satisfying to build the Little Dipper the old-fashioned EAA way; start with nothing but a dream, some random parts with very little money or drawings, and build an airplane. I think Paul Poberezny would have been proud of us!" EAA

Jim Busha, EAA 119684, is an avid pilot and longtime contributor to EAA publications. He is EAA director of publications and editor of *Warbirds* and *Vintage Airplane* magazines, and the owner of a 1943 Aeronca L-3.