At some sacrifice in vision, Jim Church, versatile engineer and lightplane fan, builds a mid-wing ship from a Standard Parasol which can easily do 90 mph.

Imagine ourselves at the National Air Races at Cleveland. There are 100,000 spectators thrilling at sight of a group of tiny lightplanes which come droning and whining across the flat prairie to the starting pylon — the checkered orange and black tower before the grandstand. They pass the pylon in a group, a race horse start, and are off in a mad dash that will not end until their knife-like, glistening wings have cleft the invisible air of 10 laps around that five-mile triangular course marked by three tall pylon towers, the farthest being invisible in the light ground haze.

A moment after the start the little planes are so far away that they can hardly be seen as they skim along like projectiles over the plain. An eager young man wants to know if that fast yellow-and-black one is the famous “Baby Bullet” and another excited fellow screams in his ear that the “Bullet” is not entered in this race, which is Event No. 2, for planes with 100 cu. in. piston displacement or less, and that fast one is the Church Mid-Wing Sport Monoplane which he hears is built from the Super Parasol fuselage and wings, together with a few conversion parts designed by James Church and can do better than 90! The attention of the mammoth crowd is taken again by the return of the racers completing their first lap. Here they come almost on the ground it seems—who’s ahead? No. 40, the yellow-and-black, the Church Mid-Wing, is a long way ahead. Freddie Lund, magnificent pilot, holder of the world’s outside loop record, who is flying her, dives at the pylon.

Vertically he banks around it with his wing tip almost dragging the ground and is off again in a twinkling. The other contestants hurl their planes around the pylon in dizzy succession, the backwash from each plane throwing up a regular explosion of dust from the ground at the foot of the pylon.

On and on through the golden sunlight of the September day dash these little man-birds, each guided by a high heart and a steady hand, each a manifestation of the wonders of physics and chemistry as yet imperfectly understood by man. The

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**Fig. 1.** This is the profile and front elevation drawing of the cleverly converted monoplane. It shows the somewhat flatter bracing, with the consequent reduction in carburettor interference which partially accounts for the speed increase of about 20 to 30 mph.
SPORT MONOPLANE

Left — This shows the ground view of the Church Mid-Wing monoplane when it is in the air. Note the slot through which the pilot has a fair view of the ground.

By Stewart Rouse

Standard Heath Parasol parts are used plus the Church conversion parts in making this high-performance ship. Note the reduction of parasite resistance.

other planes fight hard to cut down the yellow-and-black plane's lead, but to no avail.

Imagine the thrill of the pilot, with throttle wide, cleaving along in the lead, pylon after pylon, lap after lap. With the crowd No. 40 is clearly the favorite, when, just at the beginning of the fifth lap her pilot's heart sinks to hear that all is not well with that little hummingbird of a motor in the nose, for it halts in its steady roar and limps bravely on, on three cylinders, and Freddie Lund has to land in honorable defeat while his opponents stream past overhead in quick succession. Being in walking distance of the grand stand pylon, Freddie walks over and is met by a disappointed but still smiling, yellow-haired, large-framed young man. They talk the race over. This genial looking man is James Church, designer and builder of the Church Mid-Wing, and an interesting train of events has brought him this day to the races.

Jim is a technical man. He has been designing electric elevators and large machinery in Chicago for several years with good success. He was badly bitten by the airplane bug as a boy and has never even showed signs of recovery from the bite. Consequently, he built and flew one of the first Heath "Parasols" in Chicago three or four years ago. This one had Thomas-Morse scout wings. Ed Heath used to fly it so high you could hardly see it. It was somewhat faster than the "Super Parasol" type, but would not climb so fast.

In the winter of 1928-1929 Jim built the first Church Mid-Wing Sport Monoplane. He built it from raw material. He could have built any other type, but this type seemed to him the ideal light-plane. Liking the Super Parasol fuselage, he built one of the welded type with minor changes which will be described in the technical portion of this article. The Super Parasol wings are also mighty strong and good, so he built a pair with the wing beam ends drilled with different holes, and the wing strut fittings he replaced with longer ones shaped for the new angle of the wing struts in the new design. The idea was to build a ship with as little parasite resistance as possible.

He built a sort of steel tube super structure at the cockpit opening, to support the wing butts about 2 in. above the top longerons of the fuselage which would give the pilot downward vision between the wing and top longeron. The regular streamlined wing struts of the type used on the "Super Parasol" were used, only in shorter length. A nice snug cowling and turtleback were built which resemble those of the "Baby Bullet", and the propeller was provided with a spinner. As the tanks are in the wing butts as in the Super Parasol, and as this does not give sufficient fall from the tanks to the carburetor, it was necessary to install a Church Special Extra-Long Carburetor Flue on the Heath-Henderson engine used in the Church Mid-Wing to place the carburetor low, for more gravity fall. Rather unaccountably this long flue gave Jim's Heath-Henderson 3,000 instead of its usual 2,800 rpm, an increase of 200 revs!

As the ship neared completion it looked so nice and the motor worked so well that Jim decided to enter it in last year's National Air Races at Cleveland. He sent in his application in April and was pleased to receive a notification from the race committee that his plane was entered in the Closed Course Race Events, Event No. 2, for planes powered with motors of 100 cu. in. or less. Finally the yellow-and-black Church Mid-Wing Sport Monoplane was finished and ready for flight tests.

The day of the flight tests was just right. Jim was in a fever of anticipation and I was almost as eager as he. Ed Heath test flew the new lightplane...
and it surprised us all. Its top speed was around 90 mph and we couldn't see that it landed any faster than a regular Super Parasol. One thing that impressed us was the easy way a pilot can climb in and out of the cockpit; this is well shown in Fig. 8. As the ship was all right it was disassembled and taken back to Chicago for shipping preparations. The motor then received final adjustment and the black walnut racing propeller of 4 ft. 6 in. diameter and 2 ft. 4 in. pitch was completed.

The National Air Races were from August 24 to September 3. Jim Church secured a vacation from work for this period, and the week preceding it. Ed Heath and Jim decided to form a caravan and tow their entries to Cleveland. Ed's well known old 12-cylinder Packard school truck, with pictures of airplanes printed all over it like a circus wagon, was to lead with two "Super Parasol" race entries, the fuselage of one being in tow. Jim was to follow in his Buick with his Church Mid-Wing fuselage in tow and his wings in a big crate on the roof. The Baby Bullet was sent by train in its magnificent crates.

This caravan left Chicago at 5 o'clock one fine summer morning a week before the races, with Jim, Ed Heath and about six mechanics. It was a picnic. At first they were afraid to turn corners for fear of hurting the fuselages, but as the 400 mile trip wore on, the speedometer on the old Packard truck was hanging between 60 and 70 mph and the wheels of the towed fuselages had to be greased about every 45 miles. Some of the bumps threw the fuselages in the air, but they were undamaged. They made a fast trip, for Jim's Buick had a hard time keeping up, and that's saying something. The odd caravan attracted a lot of attention whenever it stopped en route.

On arriving at Cleveland the Heath-Church caravan drove to the Cleveland Municipal Airport, about 15 miles from the city's heart. On arriving at the airport, they were accorded royal courtesy and attention by the various committees. They were given large hangar space together. Setting up the planes was great sport and everyone enjoyed it. A crowd of spectators was always on hand and some of the comments they made were amusing. They insisted that the Church Mid-Wing was the Baby Bullet. Many thought the Bullet was a model airplane and were astounded to see Ed
Heath get in and fly away with awful velocity. It was noticed, though, that no airplanes attracted so much attention and appreciation as the lightplanes.

Newspaper men took numerous photos of the Church Mid-Wing Sport Monoplane in action, and large pictures and remarkably inaccurate stories about Jim and his "wonder plane" appeared in the papers; in fact, in reading about himself Jim learned many new things about his history that he didn't know himself. Newspaper accounts are like that. Mostly hooey.

The races were wonderful to watch and Jim could hardly wait until his plane should be in competition. Two days before the Race Committee told Jim that, as his pilot did not have the F.A. 1 rating, he could not race. Naturally Jim was greatly disturbed by this bad news. In Freddie Lund, Waco test pilot, and holder of the civilian outside loop record, a matchless pilot, he found a real friend,
for Fred agreed to pilot No. 40, the Church Mid-Wing.

The day of the race arrived, the planes were wheeled forth to the starting line with a mechanic at propeller and tail. The motors were warmed, cameramen took their pictures and stood back, the starting gun was fired and the tiny ships were off in Event No. 2, Closed Course Races, National Air Races! How the motor of No. 40 failed has already been told. The exhaust valve in No. 3 cylinder warped because of an incorrect carburetor adjustment. But, win or lose, air racing is its own reward in high hearted sport; the gold prizes are not large, but that is not what the air racers race for!

Here are the general specifications of the Church Mid-Wing Sport Monoplane:

Span, 26 ft. 8 in.; chord, 4 ft. 6 in.; angle of incidence, 1 deg.; wing area, 110 sq. ft.; aileron area, 10 sq. ft.; elevator area, 5.2 sq. ft.; stabilizer area, 5.5 sq. ft.; rudder area, 3.8 sq. ft; length over all, 16 ft. 9 in.; height over all, 4 ft. 7 in.; weight, empty, 260 lbs.; rate of climb, (first minute), 650 ft.; useful load, 300 lbs.; gas capacity, 5 gals.; oil capacity, 6 qts.; high speed, 90 mph; landing speed, 28 mph; cruising radius, 400 miles.

Technical. Building the Center Section Conversion: We will assume that the reader is already in possession of a complete Heath "Super Parasol" Sport Plane or its plans with either the bolted or welded type fuselage, and familiar with its constructional details. In the bolted type it will be necessary to move the longeron fitting at "J" for-
ward about 2½ in. See Fig. 2. This done, another wrap-around 18 ga. longeron fitting must be made and fastened in place on the longeron, with a rivet made from a 2 penny shingle nail; just in front of fitting “J” and separated from it by a ½ in. space to hold the loop ends of the No. 12 plated diagonal brace wires which cross inside the fuselage at this point. The large, newly made fitting just described embraces a simpler wrap-around longeron fitting of 18 ga. sheet steel, the inward pointing ends of which hold the horizontal brace wires of the horizontal bay behind the pilot’s shoulders. The upward pointing ends of the large fitting embrace the lower flattened end of the rear vertical strut of the center section conversion to which it is attached with a 3/16 in. nickel steel bolt. Note that whenever a tube is flattened at its end a 3 in. reinforcement of the next smaller size tubing of the same gauge
must be slipped in the end to be flattened, and the
flattening must be done with the tube end red hot. 
All four vertical struts of the center section conver-
sion are made in this way of % in. by 20 ga. 
Shelby seamless tubing. Their tops are cut as shown
in Fig. 2, at 45 deg., and the horizontal top struts
are laid on and their 45 deg. cut ends welded to
the tops of the vertical struts.

Vertical Struts

Note that the rear pair of vertical struts are
connected top and bottom with curved horizontal
struts, see Fig. 2, Fig. 5 and Fig. 6. The top curved
strut is welded to the vertical strut tops, and the
bottom curved strut has its flattened and bent ends
held by the 3/11 in. bolts, which hold the rear ver-
tical struts to their longeron fittings. These curved
horizontal struts are of % in. by 16 ga. tubing. They
are bent by filling them with sand, plugging the
ends with wood plugs and bending them gradually
around a curved surface. The sand keeps the tubing
from crushing. When bent to the right curve, let
out the sand and cut the ends properly. The wing
beam end fittings, see Figs. 2, 5, and 6 are made of
16 ga., half-hard cold rolled steel which is the grade
used for all metal fittings. These fittings are shaped
as shown and welded and bolted with 10-32x7/18
in. machine screws to the vertical struts.

The holes for these bolts must be reinforced
by short tubes welded in the holes. Note that the
upper portion of these large clevis-like fittings is
two ply and welded together along its edges. The
top ply extends inward along the top of the top
horizontal strut for several inches and is welded to
the horizontal strut. The front bay of the center
section conversion formed by the front vertical
struts and the horizontal top strut between them
is braced by a pair of diagonal No. 12 plated wires
with No. 324 turnbuckles. These wires are fastened
at their lower ends bylooping the longerons, and
at their upper ends by a shackle fastened to a 3/16
in. bolt through a 16 ga. gusset welded in the angle
of the vertical and horizontal struts. This same
3/16 in. nickel steel bolt also holds the flattened
and bent end of the sloping ½ in. by 20 ga. drag
strut, the lower end of which, flattened and drilled,
is held by the ½ in. nickel steel motor mount bolt
passing through the front end of the top longeron.

Corresponding changes in the welded type
fuselage can easily be effected.

Changes Necessary in the Wings. The wing
beam ends must have new holes bored in them as
shown in Fig. 3, two in each wing beam. One of
these holes is 1½ in. from the end, the other 4 in.
from the end. They are drilled down vertically for
the ¼ in. nickel steel bolts of the wing beam end
fittings.

New wing strut fittings must be made of 16
ga. sheet steel and attached.

The wing struts must be shortened, the drag
and anti-drag cables and lower aileron cables
shortened.

Changes in the Engine. The Church Special
Extra-Long Carburetor Flue must be made up of
1¼ in.-18 ga. steel tubing as shown in Fig. 2.

Cowlng. 18 ga. half hard aluminum should
be used for the parts of the cowlng which require
no beating in shaping. 18 ga. soft aluminum should
be used for those which do. The windshields is the
only part of the Church Mid-Wing's cowlng which
must be beaten. To shape the windshield it may
be beaten over a small sack of sand with a rounded
wooden mallet. While beating it should be softened
occasionally by heating it a little with a blow torch
and plunging it in cold water. The cowling plans in
Fig. 2 should make the cowling simple. One point
is especially worthy of note. The wing sockets have
all the top cowling riveted to them with ½ in.
aluminum rivets.

These sockets are made by nailing a sheet
of 18 ga. aluminum between two 1 in. boards cut
to the rib section of the wing, and flanging the
protruding metal around the edges, over with a
hammer. In Fig. 2, note how clevis pins are fastened
in the cowl supporting disk, at the front of the
motor cowlng to hold the cowlng. Fig. 2 should
explain the propeller spinner sufficiently.

The Turtleback Fairing. The turtleback fairing should present no difficulty. The drawing of the first bulkhead is used as a start. There are three more bulkheads and a cross piece in front of the leading edge of the horizontal stabilizer. The height of these bulkheads can be scaled from Fig. 1, and their width is that of the fuselage at their position. They are fastened to the horizontal struts as shown in Fig. 4. Nine 1 in. by 1\(\frac{1}{16}\) in. stringers complete the turtleback.

The Side Fairing. Two 1 in. by 1\(\frac{1}{16}\) in. spruce strips are used on each side for side fairing. They are fastened as shown in Fig. 4. Their front ends fasten in a curved nailer fastened to the front vertical strut of the fuselage.

The Bottom Fairing. Fig. 1 shows the short bottom fairing. It is made of two false, curved, wooden longerons; two rectangular bulkheads and two fairing strips. Pretty but not essential.

Here are the parts listed in Figs. 5 and 6:
1. rear wing beam fitting; 2. front wing beam fitting; 3. air scoop for cooling rear cylinders; 4. gasoline lines from wing tanks; 5. rudder pedals; 6. rudder control cables; 7. altimeter; 8. oil gauge; 9. tachometer; 10. gasoline throttle; 11. choke; 12. ignition switch; 13. turtleback; 14. wing butt socket; 15. seat bottom minus cushion; 16. headrest pad; 17. windshield integral with top fuselage cowl; 18. hole through windshield for aileron control cable between top horns of aileron.

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**Biplane Gliders Are Popular Too!**

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Another type of biplane glider in which H. P. Hentzen, a young student of the Hanover Technical School of Germany, made a flight of 3 hours and 10 minutes.