No. 302 AUGUST 2011

T.W.I.T.T. NEWSLETTER

The Ultimate Flying Wing. Photo by Peggy Collins
http://www.fun-nature-photography.com/coyote-stories.html

T.W.I.T.T.
The Wing Is The Thing
P.O. Box 20430
El Cajon, CA 92021

The number after your name indicates the ending year and month of your current subscription, i.e., **1108** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, September 17, 2011, beginning at 1:30 pm at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - Southeast side of Gillespie).

THE WING IS THE THING (T.W.I.T.T.)

T.W.I.T.T. is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is affiliated with The Hunsaker Foundation, which is dedicated to furthering education and research in a variety of disciplines.

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Meetings are held on the third Saturday of every other month (beginning with January), at 1:30 PM, at Hanger A-4, Gillespie Field, El Cajon, California (first row of hangers on the south end of Joe Crosson Drive (#1720), east side of Gillespie or Skid Row for those flying in).

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PRESIDENT'S CORNER

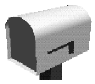
This month takes a break from the series of Weyl papers but still covers some historic aspect of "flying wings". I have included part of the patent information from a "disc-wing" that looks pretty much like a flying saucer right out of the Twilight Zone. I think you will find it interesting, especially since the Air Force turned it away as being too costly to develop the idea into a flying prototype.

The second part of his patent has to do with the unique power plant and it will use for achieving flight, including hovering. I will put this in the September issue so you can get the full picture of what was proposed here.

The rest of this issue is an extensive thread on U-2 landing gear problems, how you can fix them and what not to do when experiencing some landing issues presented by the gear. Some differences of opinion are present but that is to be expected when you have homebuilders who have there own ideas even when building from a kit or plans.

The last page has a couple of pictures of an electric powered Exxtacy hang glider that was flown at the Berblinger event in Germany in April of this year. My thanks to Peter Selinger for sending me two disks with a multitude of pictures from the event. This version of the Exxtacy by Michael Kellermann seemed to be the only flying wing type aircraft that was in the competition, which seems surprising considering their efficiency.

Andy



LETTERS TO THE EDITOR

July 13, 2011

Firstly, I enclose my check for two years subscription to the TWITT Newsletter.

Second, I am enclosing a packet on the flying platform. I sent you some information on this concept years ago saying I would follow through with more. I did not intend it to take this long.

This is a concept a student of mine put together back in the 80s. I do not know what ever happened to him or the project. I hope you enjoy looking at it.

"Forever Wings"

John D. Patten
Jackson, LA
<jppatten@aol.com>

(ed. – My thanks to John for this excellent package on "Dis-Type Airborne Vehicle". In the package was a letter that answered my question on how much of this could be used in the newsletter. It said:

"August 2, 1989. Dear John. As I promised, please find a copy of my patent and some samples of my writings in trying to launch this concept. These are all copies and non-confidential so you may do as you wish with them. I am still refining and finishing my hopeful article with Aviation Week. It is always refreshing and encouraging to meet a person who shares a mutual interest in innovative aviation concepts. I hope you find this interesting." Signed Norman Heuvel.)

The abstract for Patent 4,193,568 is:

An annular, radial flow gas turbine engine and airborne vehicle utilizing same for jet propulsion. The engine comprises counter-rotating rotors and a compressor section with counter-rotating annular rows of intermeshing compressor blades, an annular combustion section common to both rotors wherein the combustion zone is defined by oppositely rotating rotor walls, and a turbine section made up of annular rows of counter-rotating exhaust turbine blades. No stator blades are present in either the compressor or the turbine sections. The craft comprises a central hub on which the engine rotors rotate on thrust bearings, and air bearings maintain rotor tolerances with respect to each other and to non-rotating shell portions above and below the engine rotors. Air inlet guide vanes leading to the compressor section are also housed in the hub portion of the craft. Exhaust gases emitting from the turbine section are selectively ducted through annularly arranged, downwardly directed lift thrust producing ducts and/or rearwardly directed ducts or vanes for generation of forward propulsion. Directional control during hovering and low speed flight is by selective braking of one or the other of the rotors, and during high speed flight also by selective control of spoiler surfaces arranged in the upper and lower external surfaces of the craft.

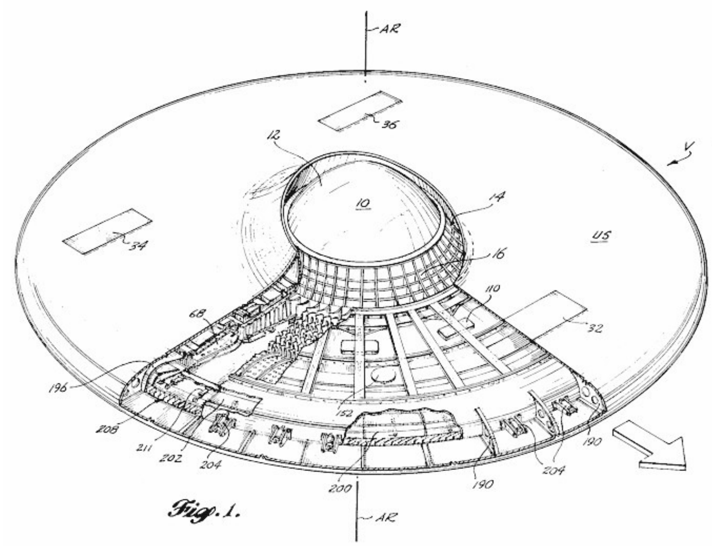


Fig. 1.

Mr. Heuvel had submitted a proposal to the USAF in 1987 and received a rejection letter that contained some of the following statements:

"The subject proposal was sent to the Flight Dynamics Laboratory, Technology Assessment Office, for evaluation. Their report indicates that the concept is considered to be technically feasible; however, a circular vehicle is not considered to be a particularly efficient aerodynamic configuration. The concept is a highly integrated engine and airframe configuration – one being dependent upon the other. As noted in the information provided, low aspect ratio planforms have inherent high induced drag. The circular vehicle should possess excellent low radar observable characteristics with the proper edge treatment accomplished. The maneuver allowing large heading changes in forward flight is technically feasible. The performance efficiency of the vehicle and flight control aspects are dependent upon the effectiveness of the trust deflection system."

"However, the real issue with the concept is the development costs. The concept would required the development of a new and unique engine and a highly integrated airframe together with attendant systems, structural aspects, flight control laws, etc. At the present time there is no know Air Force need or requirement which could embody the subject concept"

"Your proposal covers a potentially important area of research and development. However, work in this particular area has not been assigned a sufficiently high priority to be undertaken at this time."

The letter was signed by an untitled representative of the Unsolicited Proposal Focal Point Programs Branch, Flight Dynamics Laboratory.

(ed. – Maybe this explains some of the observations of flying saucers reported out of Area 51 over the past years. Conspiracy theorists would say the USAF has actually taken this design and made prototypes for secret testing.

For this issue I plan on concentrating on the airframe aspects of the design and then cover the radial flow gas turbine engine in the next issue. Below are excerpts from the patent document.

How many of us even knew there was a section within the Air Force called the Unsolicited Proposal Focal Point Programs Branch.)

United States Patent 4,193,568, March 18, 1980, Inventor Norman L. Heuvel, filed October 17, 1977.

U.S. PATENT DOCUMENTS

1,868,143 7/1932	Heinze 60/39.3
2,448,972 9/1948	Gizara 60/39.35
2,508,673 5/1950	Guthier 416/21
2,628,473 2/1953	Frye 60/39.35
2,718,364 9/1955	Crabtree 244/12 C
2,836,958 6/1958	Ward 60/39.35
2,850,250 9/1958	Smith 244/7 R
2,927,746 3/1960	Mellen 244/12 C
2,973,166 2/1961	Stahmer .
2,997,254 8/1961	Mulgrave et al. 244/12 C
3,018,068 1/1962	Frost etal. .
3,020,003 2/1962	Frost et al 244/23 C
3,045,951 7/1962	Freeland 244/23 C
3,276,723 10/1966	Miller et al 244/23 C
3,395,876 8/1968	Green .
3,519,224 7/1970	Boyd et al 244/23 R
3,568,955 3/1971	McDevitt 244/23 C
3,699,771 10/1972	Chelminiski 416/21
3,727,401 4/1973	Fincher 60/39.16 C
3,774,865 11/1973	Pinto 244/23 C
3,838,835 10/1974	Kling 244/23 C

FOREIGN PATENT DOCUMENTS

523055 3/1956	Canada 60/39.35
678700 1/1964	Canada
787245 6/1968	Canada

(ed. – I am not sure what is in all of these related patents but they can be researched through the Internet. I have included below Heuvel's brief overview on some of them. Perhaps there are some other interesting concepts related to flying wings or tailless aircraft, but right now I don't have the time for this degree of research. If any of our members do look at some of them and finds anything interesting, please share it with the rest of us. Thanks.)

DISC-TYPE AIRBORNE VEHICLE AND RADIAL FLOW GAS TURBINE ENGINE USED THEREIN CROSS REFERENCE TO RELATED5 APPLICATION

This is a continuation-in-part of application Ser. No. 702,523, filed July 6, 1976, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention
This invention relates to an annular radial flow gas turbine engine and a disc type airborne vehicle employing same in conjunction with thrust and aerodynamic surface control means enabling the vehicle to take off and land vertically, to hover and to engage in both low speed and high speed aerodynamic flight.

2. Description of the Prior Art
The broad concept of an aircraft powered by a radial flow gas turbine engine is old, such as disclosed in Smith U.S. Pat. No. 2,850,250. In the engine disclosed by Smith, an internal set of stator blades is required for the compressor and turbine sections which adds weight to and unduly complicates the engine. Air input to the first stage of the compressor is restricted due to a plurality of conduits or openings of somewhat smaller diameter than the opening to the compressor. This feature together with the counter-rotational rotor blades creates a noncontinuous flow of air to the compressor input. Also, the Smith engine employs a plurality of so-called "can type combustion chambers" of relatively limited volumetric capacity per given weight and which of themselves simply house the

combusting products, i.e. contribute no turbulence or mixing effect to the fuel air mixture or combusting products. It is also a disadvantage of the engine and aircraft arrangement disclosed by Smith that the products of combustion emitting from the annular array of combustion chambers are simply ducted in essentially only one direction from the craft.

Heinze U.S. Pat. No. 1,868,143 discloses a turbine engine utilizing a premixture of fuel and air for communication to a compressor comprising counter-rotational blades. This premixture is drawn into the compressor through an input chamber of relatively small diameter by a hollow rotating shaft having a plurality of holes at one end. As in the Smith patent, this feature creates a noncontinuous flow of premixed fuel and air to the compressor input. Heinze also teaches the use of a rectangular shape combustion chamber with a capacity of at least three times that of an input chamber in communication therewith prior to compression. This configuration has inherent safety and operational disadvantages in that Heinze discloses the compression of a potentially explosive fuel air mixture while providing a combustion chamber of a geometric shape insufficient to sustain combustion.

Frost et al Canadian Pat. Nos. 683,142 and 787,245 present essentially identical disclosures of disc type aircraft with essentially identical radial flow gas turbine engine propulsion systems. In the Frost et al propulsion systems the engines also require compressor and exhaust stator blading and also employ stationary can type combustion chambers with the same disadvantages as discussed above with respect to Smith. A further and significant disadvantage of the Frost et al engine is its 65 use of a single rotating compressor and turbine element interfacing with corresponding stator elements in contrast to use of counter-rotating elements in the manner characteristic of the present invention. A single rotating compressor and turbine element result in excessive torque and the direction of the rotor rotation and also causes large gyroscopic precessional forces presenting serious design and operational complication in the practical use of this type of engine. Further, although Frost et al discloses the use of air bearings to support radial and axial loads, the Frost et al engine provides no conventional mechanical bearings for support of the rotor portions of the engine during engine start-up and shutdown and during other engine operating conditions when air bearings alone do not entirely satisfy required engine tolerances.

Mulgrave et al U.S. Pat. No. 2,997,254 discloses the use of lift means annularly disposed beneath a vehicle. Forward propulsion of the vehicle is provided by a plurality of panels sequentially disposed about the upper surface of the vehicle. Although Mulgrave teaches the use of the propulsion in the forward direction by ducting a portion of the exhaust gases, such propulsion is not accomplished by a continuous annular ducting means generally disposed peripherally around the underside of the vehicle.

Freeland U.S. Pat. No. 3,045,951 shows a propulsion ducting system which appears to be continuous but is on the horizontal side of a vehicle and is not disposed peripherally beneath the vehicle.

McDevitt U.S. Pat. No. 3,568,955 although showing annular propulsion means disposed beneath a vehicle, does not teach the use of a continuous annulus of forward propulsion. In McDevitt, forward propulsion is provided by four dampers located at opposite ends of the vehicle.

Finally, virtually all aircraft gas turbine engines in present use are of the axial flow type providing only point thrust axially of a jet nozzle and aircraft using this type of engine must be designed accordingly. While axial flow gas turbine engines have been used for propulsion purposes in a few prototype vertical take-off and landing vehicles, the design limitations dictated by the inherent point thrust of the axial flow type engine necessitates extensive exhaust ducting and control features with the result that these vehicles have met with only modest overall success.

SUMMARY OF THE INVENTION

Radial flow jet engines according to the present invention receive air at a central cylindrical hub section and compress the air in an outward, radial direction under action of two counter-rotating, generally symmetrical rotors made up of a plurality of alternating, intermeshed rotor blades. The aw thus compressed is delivered in radial flow into the combustion chamber through holes interspersed in the combustion chamber walls, with air turbulating vanes being also provided in the air flow path into the combustion chamber to aid in cooling the combustion chamber walls. Fuel is injected into the combustion zone and is continuously burned with the air to add velocity or kinetic energy to the air mass. Energy is extracted from the products of combustion by reaction thereof with counter-rotating turbine blades in the turbine section, with a portion of the energy thus extracted being used to drive the compressor section, and the remaining portion of the energy being utilized as jet thrust through annular exhaust outlets arranged generally peripherally of the craft to provide what may be termed "area" thrust, as distinguished from the "point" thrust characteristic of thrust systems used with axial flow jet engines.

The jet thrust system used in airborne vehicles according to the present invention comprises an annular array of lift thrust producing ducts, each occupying a sector of the craft, and also an annular array of forward propulsion thrust generating ducts or vanes, both of which arrays of thrust producing devices are arranged generally peripherally of the lower surface of the craft near the edge thereof. As will be apparent, such thrust ducts, acting in concert, effectively provide thrust over a substantial "area", as distinguished from one or more "point" thrust producing devices of the axial exhaust nozzle type, and inherently provide a more stabilized craft attitude during flight.

No stator blading is present or required in either the compressor or turbine sections of the engine, with the result that the net torque of the engine is nominally zero in that all rotating engine elements are essentially equal and oppositely reacting. The essentially symmetrical nature of the opposed rotor elements of the engine, particularly with regard to the opposed turbulating vanes in the combustion section, provide favorable air flow characteristics in terms of improved cooling and enhanced combustion efficiency.

It is a significant feature and advantage of the airborne vehicle of the present invention that the engine rotor elements, and particularly the counter-rotating compressor blades and thrust blades thereof, rotate at radii of relatively great length, i.e. several feet. As a consequence, for any given rotational speed desired (in terms of lineal feet per second), the revolutions per minute (rpm) of the rotor elements is relatively quite low so that much lower centrifugal forces are developed. Stated otherwise, the relatively high rpm characteristically needed for axial flow jet engines in order to develop a given amount of gas flow and thrust is not necessary in radial flow engine according to the present invention. As a further and somewhat related advantage and feature, the annular, continuous configuration of the combustion chamber defined by the oppositely rotating combustion chamber wall portions of the rotor elements of the engine presented inherently provides a relatively large combustion chamber volume for a given engine weight, as compared with the weight and relative complexity of a comparable propulsion system involving a plurality of can-type combustion chambers of like total volume.

Additional features and advantages of jet engines and airborne vehicles incorporating same according to the invention will be apparent from the following description of a typical, illustrative embodiment thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 (see page 2) is a top perspective view of a disc-type aircraft embodying the invention, with various parts broken away to further show the constructional detail of certain portions thereof;

FIG. 2 is a bottom perspective view of said aircraft in flight attitude;

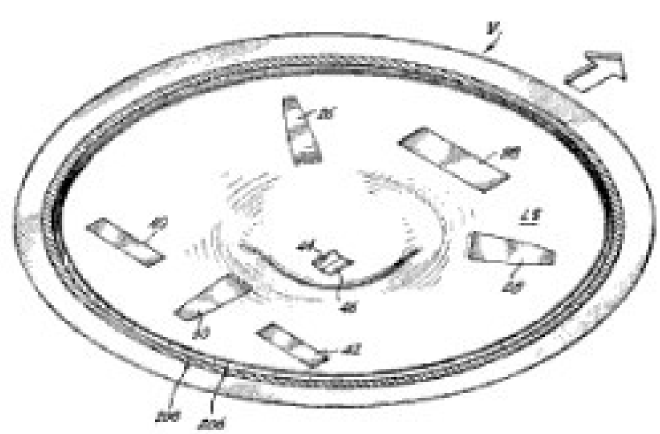


FIG. 3 (next page) is a front view of said aircraft in landed attitude, with a portion thereof broken away in radial section through one radial dimension of the engine and control components thereof;

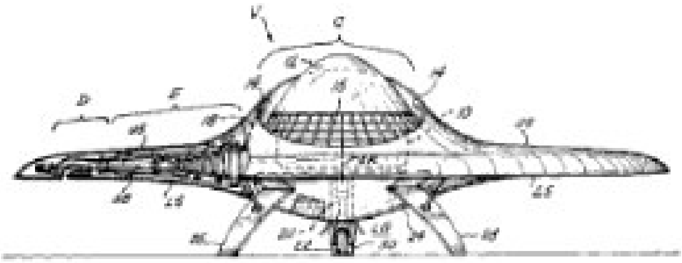


Fig. 3.

FIG. 4 is a side view of said aircraft;

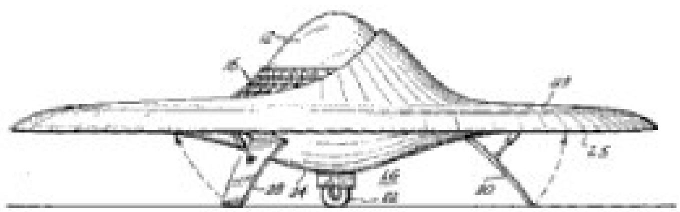


Fig. 4.

FIG. 5 is an enlarged radial section view of a portion of the engine of said aircraft, taken substantially on a line perpendicular to the forward direction of flight, i.e. taken substantially along the cutaway portion shown in FIG. 3;

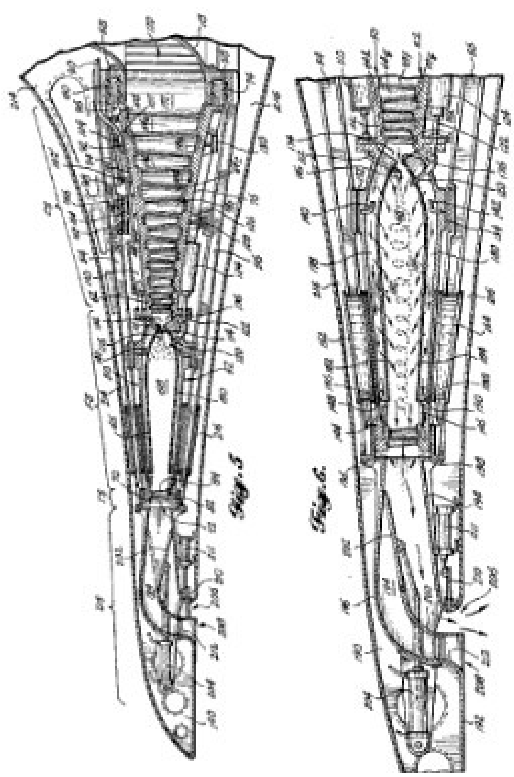


FIG. 6 is a further radial sectional view on a larger scale of certain parts of the engine and thrust control components shown in FIG. 5;

Mitchell U-2 Group Threads

(ed. – Although this is dated in terms of the aircraft being for sale, I thought the landing gear thread was worth including the letters. It is quite extensive with lots of participants and some of the English is a little fractured, but I think you will get the points they are trying to make.)

June 3, 2011

Tibor has decided to quit flying and his U2 is for sale.

On August 23 2008, Tibor failed to do a proper landing in a hard wind on a grass strip at Sorunda, south of Stockholm. He bumped into the air after touchdown on the main gear and then he moved the stick a little bit to much forward and dived with the nose gear into the ground. The nose gear and nose cone broke, but no other damage.

The machine has since then stayed in the hangar.

It needs a repair of the wooden members in the floor that supports the plate with the steering mechanism and it needs a new nose cone.

Besides that, it needs an overall inspection and a little sanding and varnish on the wooden parts around the nose cone and cabin.

Contact Tibor Hajnal directly by mail tibor.hajnal@folkbildning.net [1] or phone +46 704 922363

Carl Hyllander
<carl.hyllander@bredband.net>

I have now repaired the crack in the plywood of the wing spar (by epoxying a 12x12 inches plywood plate over the entire section of the wing spar).

After having taxied the machine for a couple of minutes, I discovered that a steel tube in the engine mount had broken.

After removing and inspecting the engine mount closely, I discovered cracks at 2 more places in the tubing.

Obviously, the mount has suffered some very heavy negative G-forces (=hard landings). Probably the same forces that had created the crack in the wing spar.

This means that I will be at least one more week delayed, before the U2 will be ready for continued flight-testing.

I am hoping to get in the air before June 21.

Hope you are all flying or building successfully.

Carl Hyllander

Yes, my U2 is for sale. But Carl's explanation why the plane crashed is not completely right. There is a problem with the U2´s main gear. They should be mounted at least 10, probably 20, centimeters further back.

Now they are mounted on the back of the main spar. Center of gravity should not be further back then in the middle of the spar.

This leads to only a few centimeters gap between them. The result is that there can be only about 5-8 kg of pressure on the front wheel.

If there is a bump in the ground it makes the front wheel jump and if the plane has enough velocity it will jump into air, immediately stall, and you can figure out the rest.

Tibor Hajnal
<hajnaltibor@hotmail.com>

Are you saying that the main gear is not built cording to the plans?

If the gear is as drawn then moving it farther aft would cause problems of it's own. Moving the main gear aft would increase the slap load on the nose gear, thus making damage to the nose more likely, and it would make rotating for takeoff harder due to the limited elevator authority of flying wings

Norm Masters
<libratiger62@yahoo.com>

Main gears are mounted on the back of the main spar, I suppose cording to the plans.

So, it's not a good idea to move the main gear aft? Is there another way to make the U2 less sensible to: bumps-jumps into air-stall-crash?

Tibor

Glider pilots are generally taught to do full "hold-off"
landings. The only exceptions are the few sailplanes with a weak tail-wheel attachment (like the Schweitzer 2-32). These are gently "flown-on". In these cases, full spoilers are pulled upon first ground contact to minimize remaining lift on the wings.

Sailplanes aren't normally allowed to land until fully stalled. Then the stick is pulled fully back to "glue" the tail wheel or skid to the ground.

Full back stick might be inappropriate for a tri-gear set-up, but the nose should still be held-off until it naturally sinks down as lift decreases across the wing(s). At that point there shouldn't be enough energy left to lift any craft back into the air, especially with the reduced angle of attack as the nose wheel settles.

There is always the possibility however of a very strong head-wind gust while the nose wheel is high.

"Flying on" landings with sailplanes, especially glass fiber (that have more energy) do sometimes result in PIO, sometimes resulting in nose wheel damage.

Sailplanes are generally fairly pitch positive, though not as much as a flying plank like the U-2!

Andrew Coles
<andydcoles@verizon.net>

I asked about this a while back, but never really got a response. I currently plan on changing the gear design and incorporate it into the pod. The location of the wheels on the ground would be the same and the struts would still be right behind the spar, but the stress would be removed from the spar itself. I'm planning on using Grove gear for this.

Andy Gamache
<andyomigosh@juno.com>

Andy G.

That is definitely the way to go! A few years back I posted pictures of the cantilever spring gear I designed, built, and tested on the project I sold. (Tom's U2) I used wood struts. These were mounted ahead of the spar and raked back, because at that point the fuselage truss was already built. Mounting behind the spar would be better. I did some calculations comparing wood, aluminum, and fiberglass (Scotchply). Wood was lighter. Wheels were at the plan location.

The spar on the U2 cannot, by itself, take the torsion moment of the gear as shown on the plans. It transfers the moment to the d-tube formed by the leading edge. Moving the wheels back would make it much worse.

In my opinion it is too much to ask of a pilot to make a perfect landing every time, in all wind conditions.

Dave Gingerich
<dgingerich@cox.net>

I remember that there was some discussion of moving the mains to the pod. Wasn't there mention of using a transverse leaf spring from a Corvette suspension? Moving the main gear to the pod will change the landing load on the spar, but so will going to an energy absorbent gear leg, and should be analyzed by someone who knows more about structures than me. That's why I didn't have a lot to say about that change. I don't think wing mounted gear is a bad idea just that the legs are too rigid. As long as the contact patch is directly below the CG at a degree or two above stall AoA you can do anything you want with the structure that attaches the wheels to the airplane. But one should take into consideration how loads are absorbed by the rest of the structure and, since this is supposed to be a motorglider, how much drag those legs make.

Norm

Not sure about the loads. I'm basing my ideas on my current aircraft where the landing load is mostly absorbed by the fuselage. One thing to consider I guess is the downward force that would be applied to the wing upon landing. But the gear is close enough to the fuselage anyway, that it might not make a difference. I'm no engineer though, and didn't stay in a Holiday Inn Express last night, so someone with more knowledge may be able to provide more insight.

As far as drag is concerned, you can get aluminum spring gear that is faired. Put a fairing around the tire, and you just might have less drag.

Andy G.

For your info Tibor, the easiest way to make a suspension in front is to run with the front tire almost flat...just enough air that the tire will not split from the rim when turning. We've done this on all our stock B-10s and U-2 and it really helps. This allows for tiny bumps to be absorbed. For sure, everybody will tell you that you have a flat but you get used to that. Now, I do not recommend to any beginner to start flying the U-2 from a bumpy runway. The main gear if I remember right, is 3.25 inches from the back of the spar. Also, the wing must have an AOA of 7 degrees (to be confirmed) relative to the ground with you aboard. With that angle of attack, the ship transition by itself into flying mode (between 35 and 40 mph depending different ships) with just a little bit of elevons input. There is a technic for take-off from a bumpy runway: As soon as you have enough speed, you raise the front gear just enough to clear the bumps and maintain that level while accelerating. To do that, you must substitute the peg in the back for a tiny free wheel. It is tricky cause if you raise it too much, power won't be sufficient to lift off, (too much drag). This is something to practice AFTER you are comfortable (many hours) with the ship. If the plane while taking-off suddenly jump because it did hit a bump, pull the stick to your stomach and wait. It only will do that jump and land on the main gear. You might break the mains but usually it does cause less damage than the porpoising. Do not try to pitch down to regain flying speed because you are always too late. However, if you LAND with too much speed, let's say 50 mph and you hit, your first jump will be high enough to regain speed, this is a judgment call. About the torsion, it is in fact a real problem, after few hours, a crack in the lower skin start to develop in that area spanwise right in the back of the spar. Also the back ribs in that area start to split from the spar. The skin has to be beefed up among other reinforcements. Dave, I did follow your landing gear project and I found it really looked good and it was something easy to build with ordinary tools which translate in reducing the cost.

Guy Provost
<guy.provost01@videotron.ca>

Hi Guy, and everybody else on the list.

Thanks for once again reminding us of these very important things. There will always be the need for new people becoming U2 and B10 pilots to learn from this.

I agree that novice pilots never should try to take-off or land a B10 or U2 (or any other aircraft) in difficult wind conditions and/or on a bumpy runway.

I once tried the technique you describe with Tibor´s U2, taking off from a bumpy grass strip. After the front wheel hit a bump and rose, I kept the front wheel in the air but as close to the ground as possible while accelerating. A difficult maneuver, but it saved me from porpoising.

I actually found out, after having a puncture on the front wheel of my B10, that even a flat tire worked (as long as you didn´t have to make sharp turns).

I still plan to replace the diagonal tubes in the landing gear by motorcycle shock absorbers. I found suitable ones with the perfect length, but it will be necessary to widen the fittings at the bottom of the gear to accommodate them. This will need welding (which only a welder authorized by the aviation authority is allowed to do), so i decided to wait with this mod until winter. Until then, I will just keep the tires with low pressure (especially the in the front), try to avoid hitting bumps (like I learned to do with my B10) and try to do perfect landings every time.

I have now finished the repair of my wing spar. It had a vertical crack originating from one of the round holes in the plywood skin, halfway between the left gear and the cockpit. No one can really be sure to judge what might have caused it, although the most probable explanation is hard landings. This conclusion seems to be supported by the cracks in upper horizontal tubes in the motor mount. My motor mount will hopefully be welded within a week and then I will soon be ready for continued flight testing.

If someone would be interested, I can add photos of the damage and my repair to the photo folder.

Good luck with building and flying

Carl Hyllander

I am a structural engineer, but you don't need to be one to understand what's going on here. The two big loads, the engine and pilot, are in the fuselage. Together they account for most of the load on the gear. If the load from the seat and motor mount are taken directly to the gear mounting, it takes all that load out of the spar, forever. The maximum load on the gear can be assumed to be 3 times the gross weight of the aircraft, due to impact from a hard landing. The gear mount should be designed for this load.

The gear legs should be designed to meet 3 criteria:
1. No breaking or permanent distortion at 3 x gross. (each leg takes half)
2. Deflected position of the wheel should be at the plan location under fully loaded condition.
3. Deflected position of the wheel at 3 x gross should be acceptable.

In other words, the legs should be designed for strength and deflection. Computations for strength are fairly easy, but for deflection of a tapered member they get kind of tricky.

Dave Gingerich

I have the Mitchell Victory Wing. The landing gear is mounted to the Fuse, not the wing. The landing gear broke on a rough landing so i'm replacing it with a 1987 (I think) Corvette rear Leaf Spring. The leaf spring on Corvettes from 1982 on are composite. And same width as my landing gear. I'm not sure about the compression rate but lets face it, a Vette weighs a bit more than my plane. BTW, the Vette uses ONE spring for the rear. Half the spring for the left rear tire, half for the right.

Ray Landa
<RaymondLanda@hotmail.com>

You could cut the spring on a band saw or table saw and make it more narrow front-to-back to make the spring rate more appropriate for the weight of your aircraft. Might take a little "eyeball engineering", just be conservative in your guess because you can always cut a little more off later.

When cutting off too much I have found it most difficult to "uncut" things. I tried putting the blade on my table saw on backwards to "uncut" but all it did was make cutting metal much smoother and a little quieter.

Bill Jackson
<billj@hevanet.com>

So, since I have a U2 to rework that only did taxis tests (no spar damage yet), I could still opt for a fuselage-mounted gear.

Now, where do I get a Corvette leaf spring (I'm in Europe), and how much would people ask for that?

My B10 has a laminated wood "leaf spring" gearleg, a bit heavy but fine.

Jean-Claude Bertin's B10 has a two part fiber gear with bolted on, tapered gear legs. Wonder how he figured out the flexion question: trial-and error, or adjustable mounting plates for the half legs?

Solo210er
<johanprins@free.fr>

Several cars besides Corvettes use transverse springs. A trip to a salvage yard might be the fastest way to learn which models over there have them. However a leaf spring gear is going to have to attach to the wheels and the transverse springs that I've seen pictures of all have holes in the ends to mount to a bolt ~90 degrees to an aircraft style stub axle. Designing a softer strut for the existing gear may be easier than adapting an automotive leaf spring. Here's a thread on homebuiltairplanes.com about making fiberglass landing gear:

<http://www.homebuiltairplanes.com/forums/composites/5106-scotchply.html>

Cured Composites of Lancaster Massachusetts sells composite parts for the HiMax kit plane. He says he can make custom gear legs lighter and cheaper than aluminum landing gear. There are pictures of a fiberglass gear being molded here:
<http://curedcomposites.netfirms.com/gear.html>

Norm

DON'T move the gear aft. Richard told me that some guys built their B10 cages with the gear further aft and especially with the angle of attack being lower than 7 degrees, they would take off suddenly and need *very quick* counteraction on the stick or would go ballistic and crash.

The elevon authority is so low on U2 and B10, that any gear located further aft

My B10 has the gear some 5cm forward of CG, and when rotated, due to the relatively high cage, the gear goes right under the CG.

When I then get a bump from the runway, nothing happens, the ship just hops but does not rotate.

This makes me think that the gear on the U2 could even go a bit forward, to enable early rotation and eliminating the jumping/porpoising problem (provided you have enough engine power, of course, as Guy noted correctly).

Richard Avalon said that the "nose flying" attitude was almost not possible on the U2, which could mean there is a little more weight percentage on the nose, but also, the B10 has the drag force pushing in much higher compared to the combined CG.

Solo210er

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This is an electric powered Exxtacy rigid wing hang glider being flown at the Berblinger Flight Competition in April 2011. The article by Peter Selinger that I published in Sailplane Builder didn't include any information on this entry and I couldn't find anything on the Internet that showed this variation of the Exxtacy by Michael Kellermann. Photos by Carsten P. Selinger.