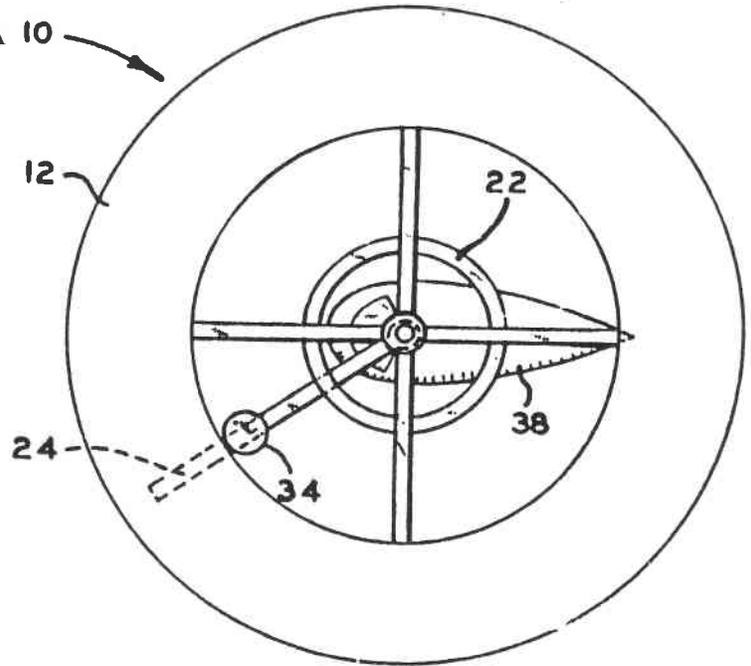
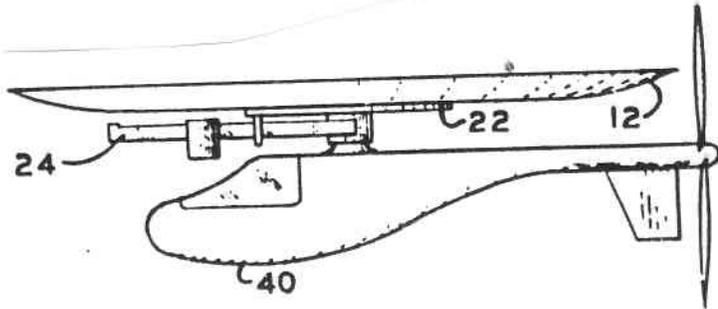


# T.W.I.T.T. NEWSLETTER

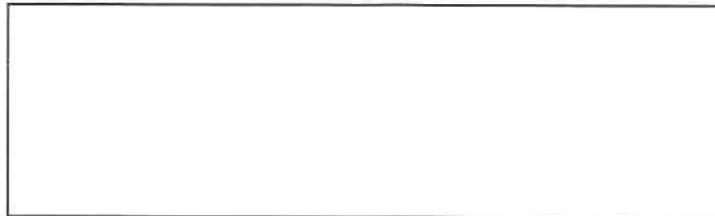
Diagram from a patent submitted by Harold J. Walker of NASA featuring an annual wing particularly suited for use in supporting in flight an aircraft characterized by the absence of directional stabilizing surfaces.

(This material was submitted by Serge Krauss in a recent letter to be published next month asking some interesting questions about this concept. He describes it as a "uniform, radially oriented, vertically and longitudinally symmetrical wing section, conically inclined for decolage/dihedral. While the control means might run afoul of Newton's third law, the patent is interesting and appealing.")



## T.W.I.T.T.

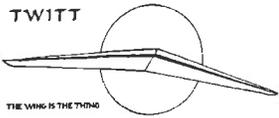
The Wing Is The Thing  
P.O. Box 20430  
El Cajon, CA 92021



The number to the right of your name indicates the last issue of your current subscription, e.g., **9602** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, **March 16, 1996**, beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - East side of Gillespie).

TWITT



**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, east side of Gillespie).

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**PRESIDENT'S CORNER**



**Well,** the new year got a good

start with Doug Fronius' program on the TIER II PLUS project at Teledyne Ryan here in San Diego. I appreciate everyone getting there early so we could begin right at 1:30. It worked out

well and Doug was able to make his flight on time.

I would like to thank the contributors to this month's newsletter. Some of it came via Internet E-Mail which made it much easier to put the material together since I did not have to retype it. If you have a computer and are not hooked up to one of the many Internet access programs, you might want to consider it. I am sure many of you would find people and things on the net of great interest.

An upcoming event to be held in San Diego will be the dedication of a new plaque to be added to the existing monument at a site on Point Loma. The two pilots being recognized are Hawley Bowlus and John Barstow who were among the first pilots to use the natural cliffs along the point to launch gliders, including the training of Charles Lindbergh. The ceremony will be held on April 27, 1996 at 11:00 am (more specific information will be published later).

The supporting organizations, The National Soaring Museum, The Environmental Trust, and San Diego Soaring enthusiasts need your donations to help cover the cost of the plaque and other overhead expenses. They are currently \$600-800 short of their goal and are asking for everyone's help in seeing this monument to early soaring pioneers completed. If you want more information or would like to make a donation, please contact The Environmental Trust's representative Jacqueline Rice at (619) 283-3393. I know they will be grateful for any support you can give.

I know that many of our members live in the mid-west and eastern seaboard areas and can only imagine the type of cold they are currently experiencing. Hopefully, receipt of your newsletter will warm you somewhat.

*Andy*

## MINUTES OF THE JANUARY 20, 1996 MEETING



As promised, Andy called the meeting to order right at 1:30 so our speaker would have sufficient time for his presentation and still make another appointment.

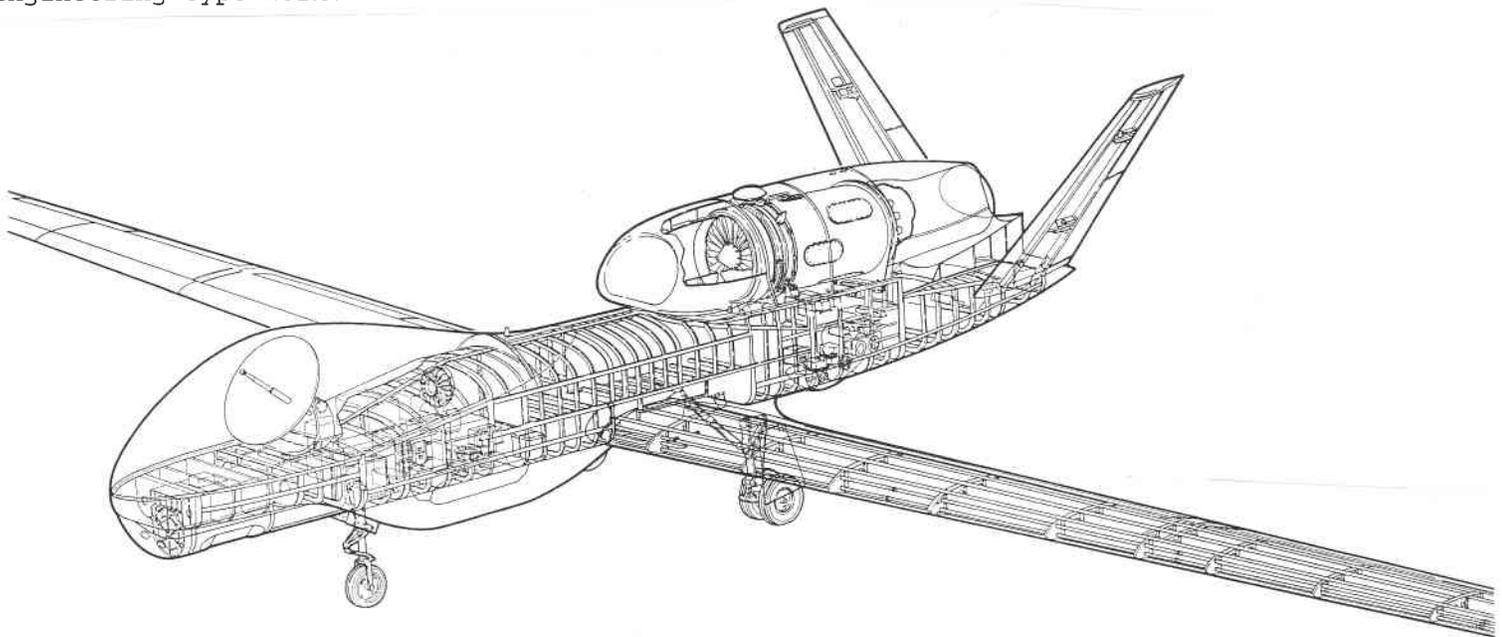
Andy then introduced **Doug Fronius** who would tell us all we ever wanted to know about the Teledyne Ryan Aeronautical Company's **TIER II PLUS** High Altitude Endurance Unmanned Aerial Reconnaissance System.

Doug began by explaining he works for Teledyne Ryan Aeronautical at Lindbergh Field in San Diego, and has been there for about 11 years. Doug acknowledged that Ladiso Pazmany, who was in the audience, was responsible for getting him the job back then having known Doug through the EAA and from hanging around Gillespie over the years. He was originally hired as a designer but ended up working at positions overseeing the development and construction of prototypes versus straight engineering type work.

Initial deployment is scheduled for the year 2000.

They are currently making parts for two prototypes with the first one scheduled for flight in December 1996 if all goes well. It will be eighteen months from contract award to first flight if they maintain the program on its current pace. The whole thing is more of a system than just an airplane, since it is composed of many "black box" components that allow it to do the job and the airframe is simply the method for getting the "systems" over the target area.

Doug acknowledged that although it is not a flying wing, it did start its initial design layout as tailless. There were a number of flying wing iterations considered and compared with conventional configurations before deciding on the current airframe. The basic reason the conventional layout was chosen was because it was cheaper. This is important since the basis of the contract is that the tenth production aircraft must come in at \$10 million or less in 1994 dollars. So Ryan's goal is to come up with the maximum airplane possible that comes close to or meets the performance goals outlined in the contract and do it for \$10 million.

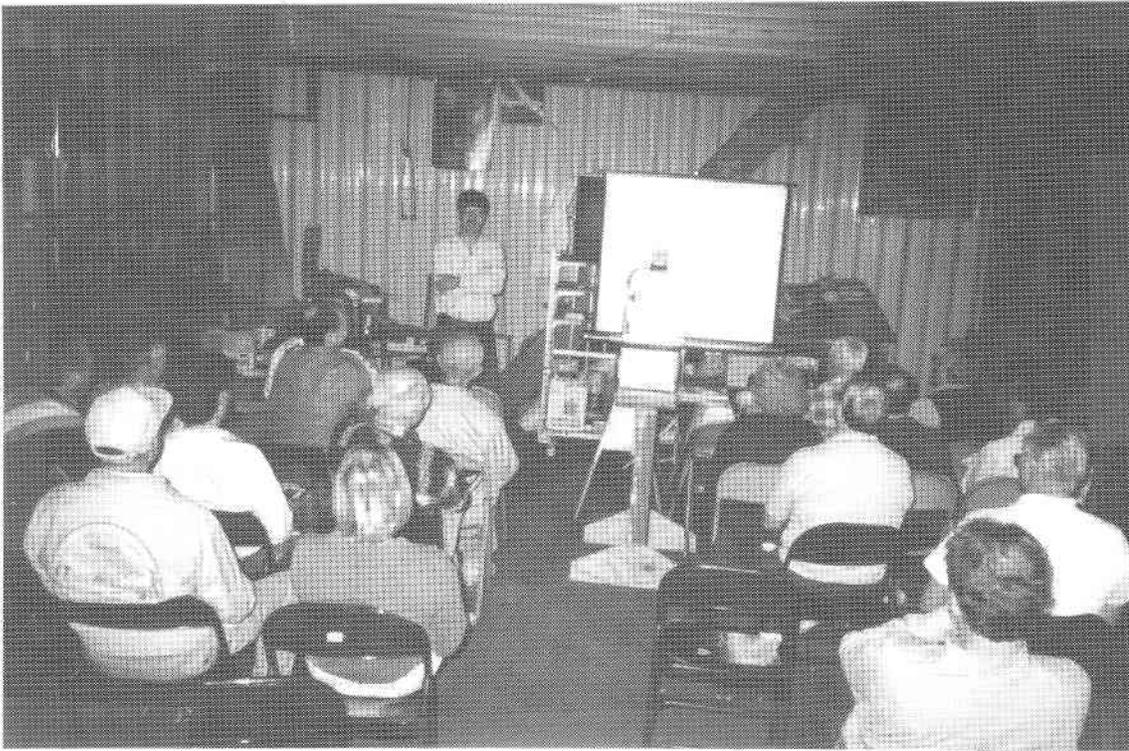


Ryan's current big project is an unmanned reconnaissance and target searching military aircraft called the TIER II PLUS. This is one in a series of three aircraft being developed for the Department of Defense (DOD) as the next generation replacement for the U-2 spy plane. The program itself is unclassified and consists of a TIER I, TIER II, TIER II PLUS, TIER III MINUS and TIER III. Ryan's TIER II PLUS is designed to be the workhorse truck of the reconnaissance fleet for the next 50 years.

The specifications for the aircraft are:

Wingspan	116.2 feet
Length	44.4 feet
Height	15.2 feet
Weight	22,914 lbs (estimate)
Payload	2,000 pounds
Ferry Range	14,450 Nmiles
Maximum Endurance	42+ hours
On-Station Endurance at 3,000 Nmiles	24 hours

(Data obtained from Teledyne Ryan Aeronautical promotional brochure.)

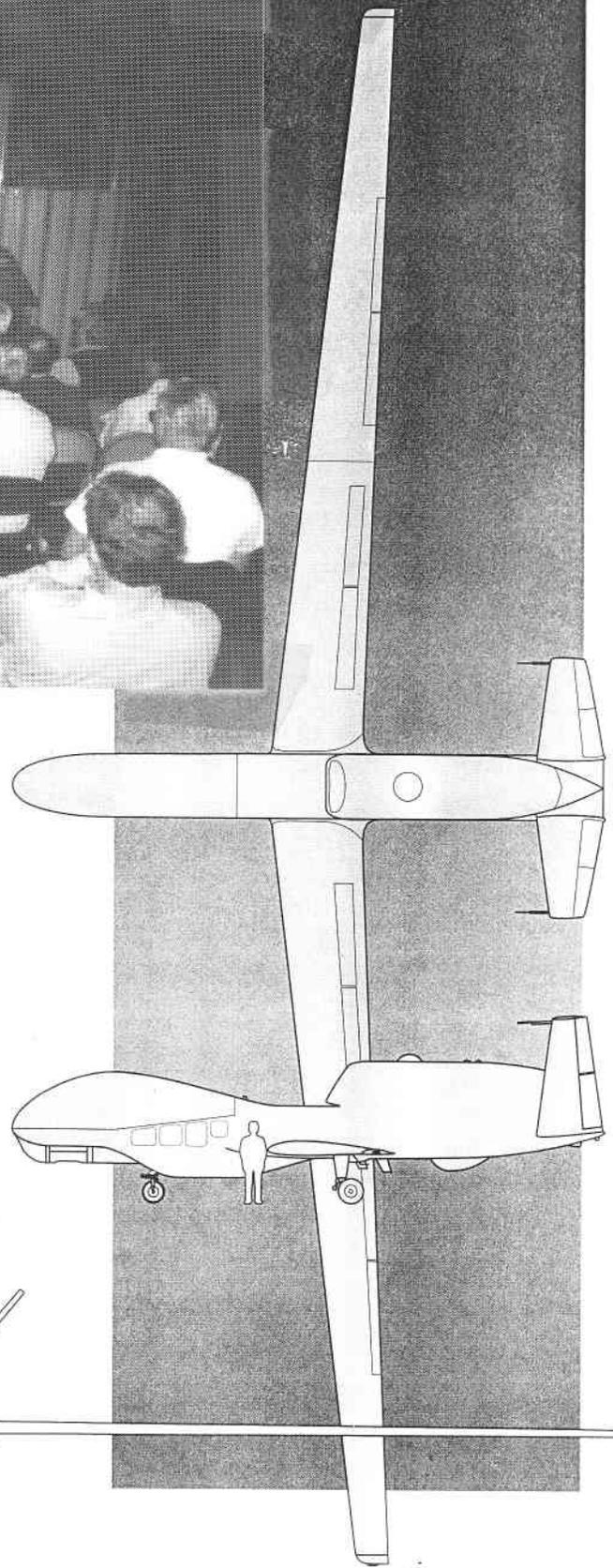


ABOVE: Doug Fronius addressing the group.  
RIGHT: Three-view of the TIER II PLUS as shown in the Teledyne Ryan promotional brochure.

This is a different type of government contract than most aerospace people are used to seeing. It is purely cost driven (the only hard requirement being the \$10 million) and has a number of desired goals the aircraft should meet in order to perform the mission. It has resulted in tradeoffs in terms of having lower performance due to the higher cost of higher performance.

Ryan Aeronautical is the prime contractor with their Model 367 aircraft with the following companies providing major system's components:

- ▶ Hughes Aircraft - Electro-Optical, Infrared and Synthetic Aperture Radar (SAR).
- ▶ Rockwell Aerospace North American Aircraft is building the wing in Tulsa, Oklahoma.



- ▶ GDE Systems is doing the mission planning.
- ▶ E-Systems is doing the ground stations which represents about 30% of the program.
- ▶ Loral is doing the communications links through the 32 antennas on the aircraft.
- ▶ Allied Signal is providing the turbofan engine, model A3007 from the Citation business jet with modifications to reach altitudes of 65,000 feet. It produces 7000 lbs thrust at sea level, but only has 400 lbs left at final cruise altitude.
- ▶ Heroux of Canada is producing the landing gear.

The overall program is under the supervision of ARPA (Advanced Research Products Agency) who is under the Defense Airborne Reconnaissance Office. Doug was asked what TIER stood for in the program and he explained that it represented the steps or phases of the original design. TIER III was supposed to be the end aircraft which would be refined by learning from the other tiers. However, after reaching what look like the ultimate TIER III solution it was found to be so costly that other alternatives had to be explored. Hence the intermediate tiers like TIER II PLUS.



**ABOVE: Part of the post-meeting hanger flying with (left to right) Bruce Carmichael, Ralph Wilcox, Ladiso Pazmany, and Marc de Piolenc.**

TIER III was reduced to TIER III MINUS which will be a low observable (stealth) platform with limited capabilities to get costs under control (being built by Lockheed Boeing and is of a flying wing configuration). This will allow more airframes to be purchased, however, the TIER II PLUS airframe will become the truck to carry out the long haul mission with less

stealth capability. Each type of aircraft appears to be a compromise, but when all the tiers are combined they become a comprehensive surveillance package.

Doug went over the history and projections for schedules to be met over the next several years. It is a major aircraft project for the city of San Diego, which is a change for the good what with all the other losses in aerospace industry.

The next slide showed how the mission profile would look. The design mission is to takeoff from a runway (no more than 5,000' balanced field length), fly 3000 nautical miles to an orbit point, loiter for 24 hours (yes a full day) at 65,000' and then return 3,000 nm to the original runway. Phil Barnes offered a comparison to a typical high performance fight jet that would have a 500 nm radius with a loiter time of only a few minutes before having to leave due to fuel. This type mission will last about 90 minutes, whereas TIER II PLUS will be airborne for over 42 hours in completing the mission profile.

He then covered what it can do during that 24 hours on station using the SAR which takes radar pictures even through weather, the infrared thermal imaging, and regular optical cameras. It can:

- ▶ Photo map all of Illinois.
- ▶ Take pictures of 1,900 spot targets within Illinois for enlargement.
- ▶ Specify the location of target to within 60' of it Lat/Long coordinates from 65,000'.
- ▶ Resolution is one meter.

Doug was asked if any areas of the plane were pressurized. He commented there were two areas with heating, cooling and pressurization so that standard commercial avionics could be used right off the shelf. This is one of the methods used to control costs, with only a minimum number of items being engineered and developed specifically for the aircraft or mission.

The aircraft can perform the mission completely hands-off through its own internal computer systems, or can be given new commands from ground stations through a satellite communications link. It is compatible with existing ground support equipment like communications vans, etc. The aircraft will fly itself to any forward operating area, and the

remaining support equipment can be moved in three C-141Bs.

An interesting side note to aircraft control is the "pilot's" (in this case the systems controller in a ground based van) ability to have full air to ground communications capabilities just like any normal aircraft. However, the "pilot" can be in California and be responding to an air traffic controller in Newfoundland without the controller even realizing the aircraft is unmanned.

Ralph Wilcox asked why it has a swept wing. Doug responded it was for CG control and was dictated by where the wing had to attach through the fuselage versus where the mean MAC had to be. It cruises at about 100 kts but due to the high altitude the wing is fighting transonic problems.

Ralph asked if the mid-body shape was to achieve area-rule benefits. Doug commented that at the speeds it was flying there was no need for putting area-rule into the design. He also went over what the various other bumps contained.

Phil Barnes asked how far the fuel went out into the wing. Doug pointed to the wing tip and commented that the all up gross weight is around 25,000 lbs, 15,000 lbs of which is fuel. Ralph then asked about whether it needed some dihedral in the wing and Doug mentioned that it does end up with dihedral once it is airborne. Since it is built from graphite composites it is very stiff so it is not anticipated the tip will touch the ground on takeoff with full fuel. The tip is about 3' off the ground empty and only displaces about 6" with full fuel, and the engineers feel the spar would probably break before the tip could touch the ground.

Ryan/NASA section specially developed for the airplane. The reason for the V-tail is due to the single engine configuration and the cost of producing a horizontal tail with verticals on the tips. The tail sections appear to be tall, but it is necessary to achieve the necessary control authority over the long wing.

Doug headed off the question of engine inlet airflow by telling us that there have been extensive wind tunnel tests and all have shown very good flow into the engine and sensational recover.

Ralph asked (ed. - hey, who the heck keeps waking Ralph up) about the affects of the large area forward of the MAC. Doug said this was not a problem since they had a 50 mhz computer flying the aircraft which could respond much faster than any pilot to variations in attitude. The benefit of a unmanned aircraft is that you can make it marginally unstable without worrying about controllability problems.

Jorge Padilla asked about whether the wings would be better if built from metal versus composites. Doug responded that some gains might be achieved but not in any significant amounts. Composites gave them a smoother wing surface which was needed for performance. He

did mention that the main sections of the fuselage are aluminum, with the tail and engine nacelles being composites and the non-structural radomes being made out of fiberglass. The metal structure makes it easier to incorporate the various components of the payload.

The aircraft is navigated by a SATCOM INS (there are 5 of them on-board) and updated by GPS which makes it independent of any ground station for inflight maneuvering.

It uses differential GPS for takeoff and landing which will put it down on a 10' wide runway. Without the differential capability a 300' wide runway would probably be needed to get in down on the concrete. It uses spoilers for glide slope control and thrust for airspeed control. There is so much reserve power at sea-level the airplane can climb out very easily with full spoilers deployed.

Another interesting side note is that Ryan has received numerous requests from non-military companies wanting to buy the

aircraft for other types of work involving photo mapping. Its capabilities mean a lot of work can be done in just one flight and the system is totally mobile versus a satellite that has positioning problems.

Doug gave a quick overview of how much of the program can be done with strictly off-the-shelf components (in their case about 90%). Once the program moves out of Phase II where it is now, the Air Force will become more involved in further testing and flight trials



ABOVE: Chris Tuffli and June Wiberg serving up that good cake and ice cream for Bernie Gross' birthday party.

Any critical system, such as electrical or flight controls, are all redundant. It is a fly-by-wire system driving two aileron and ruddervators through electro-mechanical actuators.

Bruce Carmichael asked what wing section was being used, and Doug commented it was a

of the aircraft. Phase IV is full Air Force control with Ryan providing much of the ground support capability.

Doug was asked what the anticipated L/D would be and he responded it should be about 34:1 due to the high Reynolds numbers. He also commented that the wing skins are pure graphite which makes them very strong (he related something about driving a truck down them). Bruce asked about turning it into a sport glider, to which Doug noted it could be a 20 passenger glider at its current gross weight, but would require a bigger tow plane than most glider ports use.

He finished the program explaining that they will be starting assembly of the fuselage within the next week, and the wing is already in the first stages of assembly. The anticipate having a complete airframe within five months.

After the audience thanked Doug for his excellent presentation they quickly left their seats, essentially bring the meeting to a close. Therefore, there was no raffle, and no old or new business, or any of the usual housekeeping things Andy normally covers (ed. - thank goodness for small favors). However, we did have a surprise birthday party for **Bernie Gross**, with **Chris Tuffli** providing a fine birthday cake and June Wiberg the ice cream. Everyone had a good time eating and hanger flying for the next hour or so.

## LETTERS TO THE EDITOR

1/15/96

TWITT:



**Just** off the phone with **Jim Marske**. Here is the latest Group Genesis News:

Despite its impressive showing at the U.S. Standard Class Nationals (a 1st and a 2nd, with two other possible wins lost to circumstances unrelated to aircraft performance), Genesis I is not yet in production. After hearing comments that Genesis climbed and ran (only) "as well as" the German ships, they again checked performance vs. the same Discus that it had previously beaten handily at high speed. They discovered that root modifications to improve thermaling performance had actually reduced high-speed L/D in the configuration used at the Nationals. In 20 iterations, John Roncz then developed a new root section (1st two feet) said to make the craft superior at both low AND high speeds. Marske then provided a tip section that Roncz found to improve climb and run significantly; "two more points in L/D". Finally, they have taken out 2 degrees of twist for improved climb, L/D, and run,

especially above 95 kts. Burt Rutan's SCALED Composites is milling out the molds to new specs now. Shipments of the 45 current orders will begin in May or June.

Asked about performance, Jim said that the most recent flight measurements placed (L/D)max right at 44:1 - before changes listed above. He added that he wants to use a lower-drag section on the horizontal trimmer, but that even John Roncz is taking a serious second look at elimination of the trimmer (and its two lbs+ of drag) altogether. Marske: "He may be seeing the light"... spoken as a true champion of the cause! In response to another (L/D)max query, he said only that he felt that he knew how to push it above 50:1. He also said that they were considering producing a flapped version. When I asked about stretching this for the open class, he replied that it can be done, but that the present Genesis I can win in open competition.

Other developments include a weight savings in carbon fiber spar caps of 15 lbs and mention of a "Genesis II", the meaning of which I forgot to pursue.

The business end of things has changed: kits are to be produced in Lithuania - at the same factory that produces the LAK-12. Asked about lack of security regarding wing sections, he remarked that they agreed not to build any other Standard Class sailplanes, and that Roncz could still do even better (I suppose the sections will be free for the measuring upon release to customers anyway). Advantages are European licensing at their own expense, lower cost, savings in liability, abundance of expert composite workers, and free, full lab testing. He said that over three times as many sales would be to European customers as Americans, due to the sport's popularity there. An initial run of 50 is set.

Building of prototypes and final assembly, fitting, and instrumentation of complete sailplanes will take place at Group Genesis in Marion, Ohio. Eighty percent of all kit customers have switched their orders to completed aircraft at around \$40,000, complete compared to \$70/80,000 for competitive European planes. The first five domestic craft should be flying this June.

'hope this proves of interest...

Serge Krauss

P.S. If this comes by FAX, there is another pack (letter, enclosures for Newsletter) coming by mail.

*(ed. - Many thanks for the update on the Genesis I project. This might even be a "news scoop" depending on what other publications Marske may have talked with in the past few weeks.*

*It obvious that a designer is never happy with what he has accomplished, even when it has proven to work well. The Genesis project will probably never settle on a final combination of airfoils, configurations, etc., but continue through many more "iterations" trying to ring that extra point out of the airplane's performance capabilities.*

*By the way, the other package did come in and I will probably use the material in the March Newsletter.)*

1/5/96

TWITT:

**Thank** you for your consideration or whatever it was that prompted you to send me an issue past my expiration date. My renewal is enclosed.

I set aside my tailless design (which looks a good deal like Georges Brittard's GB 80 & 83, except it tapers from the root (pg 9 TWITT Jan 96) mostly because the authority for flaps demands a tail -- and so I went to Jim Maupin's Dragon.

This is doing rather well (with a few "mods" by me, chief of which is a one piece kevlar pod and carbon tailcone -- all out of a mold in one piece). When I thought of an off-field landing in the original design I almost quit because I helped pull a victim out of a splinter-box -- not fun! Kevlar or aluminum is the only way to land -- off-field. My pod is larger on the inside but smaller on the outside, like a GE refrigerator and much cleaner thanks to Bruce's (Carmichael) Aircraft Drag Reduction -- a "plug" for a good book.

Best New Year's wishes.

Sincerely,  
Syd Hall

*(ed. - Thanks for the note updating us on your project, even though it is no longer a tailless design. Sometimes getting airborne is more important than coming up with something unique.*

*Perhaps you might consider helping others building the Dragon to incorporate your pod and tailcone design, both for safety and ease of building.)*

1/10/96

TWITT:

I have just seen your advertisement in the December R/C Soaring Digest for TWITT. As a modeler who is developing an increasing interest in flying wings I would like to build a reasonably sized model for slope/thermal work. Scale is also a great interest, so I am looking around for something a bit different. From the articles that have appeared in R/C Soaring Digest I think TWITT could provide valuable help.

Please find enclosed \$22 for a year's subscription.

Best regards,  
Dave Camp  
Dorset, England

*(ed. - Welcome to TWITT. I think that over time you will be able to find the things you described in your letter. The organization is comprised of many modelers who are looking to do the same things and we try to include material in the newsletter that can be used for scale modelling.*

*In the future, if you are pleased with the material you have been seeing in the newsletter, you might consider ordering some of the back issues as outlined on page one.*

*The newsletter is for and by the members, so if you have anything that*

*would be of interest to other members, please send it along. If you have access to the Internet, we have an address published on page one that will get it straight to me for transcription.*

*Again, welcome to TWITT.)*

1/14/96

TWITT:

**Santa** Claus was kind enough to bring me a couple of books on our favorite topic, so I thought I would provide a brief review.

The first book is called The Flying Wings of the Horten Brothers by Hans-Peter Dabrowski. This book focuses mostly on the powered versions of the Horten wings, mainly as a prelude to the Horten IX (Go229). It includes a very nice collection of photos of the Ho IX, in various stages of construction, testing and in flight. This book is softbound and reasonably inexpensive considering the rarity of its subject matter.

The other book is Northrop Flying Wings by Garry Pape and John Campbell. This is a large hardbound book, and a little pricey at \$49.95, but well worth it. It includes practically every photo I have ever seen published of the N-1M, N9M, MX324, XP-56, XP-79, XB-35, YB-49 and YRB-49, as well as drawings and illustrations from the Tech Orders, and a complete log of all of the flights of the big wings.

Of particular interest are photos of the wings under construction (from quarterly contract progress reports). It also includes a color photo section at the end that chronicles the B-2, and the restoration and flight of the N9M as a way of bringing closure to the story.

The text is well researched, and is drawn from interviews with the people involved in the projects and more significantly, from official reports and correspondence between the government and Northrop. It lays out a very clear, unbiased story of the development and demise of the Flying Wings, including the technical problems encountered along the way.

I learned a lot from reading it. In my opinion, this book may become the definitive source of data on the Flying Wings, and belongs on the coffee table of any true "wing-nut". Both books are produced by Shiffer Publishing; 77 Lower Valley Rd; Atglen, PA 19310-9717. They will provide a free catalog on request.

Kevin Renshaw  
Ft Worth, TX

*(ed. - Thanks for the reviews on the books that every TWITTER probably should have in their personal library. Also, thanks for E-mailing the material. It sure made it easier to put it in the newsletter. I did receive your snail-mail copy and it will be added to the library. Keep in touch.)*

1/14/96

TWITT:

**Thanks** to Alain MIROUZE for sending the interesting material in TWITT Newsletter for January 1996. I especially appreciated the page 4 left-hand column section with the two low aspect ratio glider designs. The Piana-Canova 100 design reminds me somewhat of the Etrich Zanolonia Wing glider of 1907.

Also in the July 1995 newsletter issue (page 4) is shown Alain's inflatable low aspect ratio wing design. Could you tell me if he ever constructed a rigid wing glider of that style design?

Also enjoyed the article on Chuck Rhodes on page 2-4 of the December 1995 issue with material on George (In Search of World Records) Worthington. If anyone belongs in the aviation hall of fame amongst the all time aviation greats it's George Worthington. He started his aviation career as a naval aviator in multi-engine aircraft, then later took up sail planes and then took up flex and rigid wing foot launch gliders, setting records in both types in his late fifties and possibly when he reached sixty years of age. He recorded his rigid and flex wing travels in a number of foot launch glider magazines. He had boundless zest and enthusiasm, always ready to set a new world record, first to fly over the "century" mark in both rigid and flex wing foot launch gliders and always some new project going; George Worthington, we'll not see his like again.

Yours truly,  
Edwin Sward

*(ed. - Thanks for the comments about what interested you in some of the past newsletters. Hopefully, other found it tantalizing in terms of giving them ideas for their own projects. Perhaps the modelers out there saw something that would translate well into a scale sailplane.*

*Also, thanks for the bio on George Worthington.)*

1/23/96

Dear Bob & June:

**Enclosed** you will find some photos including two of me at a young age showing my own design "flying wing" models. They were not R/C, just free flight as my running legs were very young, and since radio control was not developed at that time (1940-1947).

Many thanks for the surprise birthday party, overnight lodging and pizza too.

Bernie (Gross)

*(ed. - As everyone can see, Bernie has been involved with flying wings for quite some time. He built and flies the "Deaf Hawk" Marske Pioneer sailplane, and has been a supporter of TWITT for many years. You saw in the minutes that we had a cake and ice cream for his birthday, which was hard to keep a surprise since he had offered to bring his own cake.*

*Happy Birthday Bernie, and may you have many more.)*



## LOCAL BOY MAKES GOOD

**We** are proud to announce that Bob Chase, TWITT Vice President, has been selected as a member of the Los Angeles County Aviation Commission. He will be able to add the voice of a private aviator to the usual political fray that ensues when trying to deal with airspace allocations and other related subjects. We wish Bob good luck in this new aspect of his already busy life.

## AVAILABLE PLANS & REFERENCE MATERIAL



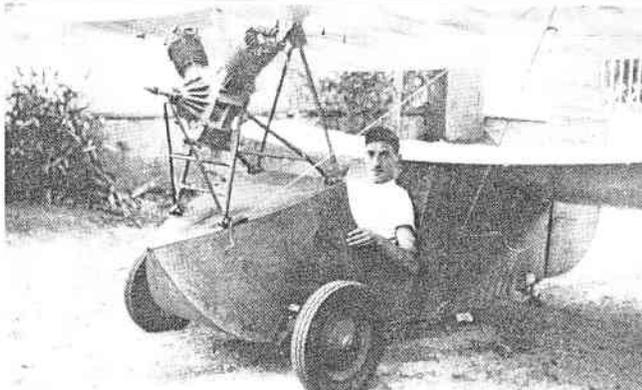
### Tailless Aircraft Bibliography

by Serge Krauss

**4th Edition:** An extensive collection of about 2600 tailless and over 750 related-interest listings. Over 15 pages of tailless design dates, listing works of over 250 creators of tailless aircraft, and the location of thousands of works and technical drawings for the Ho 229 (IX), Me 163, & Me 262.

Cost: \$23 (Domestic)  
\$32 (European destinations)  
\$35 (Asia/Australia destinations)

Order from: Serge Krauss  
3114 Edgehill Road  
Cleveland Hts., OH 44118



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Le G.B. 10 vu de l'arrière.



Le G.B. 6, ailes repliées.



Le G.B. 11 "Touraco" II à moteur Citroën.