The Flightline

Volume 43, Issue 4 Newsletter of the Propstoppers RC Club AMA 1042 April 2013

President's Message

This winter went flying by fast, so to speak, and the indoor flying went well.
C/A field is in good shape and will be cut soon and Elwyn in about 1 week.
At the last meeting we set up the Picnic dates;

- Middletown Community Day at Penn State May 11th Club drinks only; free food from vendors.
- June 15th, Christian Academy. Food and drinks by club.
- Sept.28th Christian Academy. With Church People; 4 p.m. till 7. We can start 12 ~ till when ever. Food and drinks by the club.

Al Tamburo and I are working on a control line spot but it is hard to fit in. But we will come up with something.
See you at the meeting and please bring a show and tell.

Dick Seiwell, President

Agenda for April 9th Meeting At Middletown Library;

Doors open 6:00, meeting at 6:30

1. Membership Report
2. Finance Report
3. Plan for Middletown Day
4. Show and Tell

INSIDE THIS ISSUE

Minutes of the Propstoppers Model Airplane Club

March 12 Th, 2012 at the Middletown library

Call to order by Vice-President Jeff Frazier took place at 630 PM

Roll call by membership chair Ray Wopatek showed 18 members present.

Minutes of the February meeting were approved by the membership

Treasurer's report was given by President Dick Seiwell. He noted we're somewhat behind last year but adjustments can easily be made.

Old business:

Dick Seiwell noted that the fields have dried up somewhat but we have been having rain recently which can make some of the fields problematic.

Middletown community day is May 11 at the Penn state Lima campus. We are now working with the township to coordinate activities so that we can have our flying and static demonstrations.

New business:

We will plan on having two picnics the summer with the dates posted in the newsletter.

Show and tell:

Phil W showed a new charger that can charge several cells in parallel. This is handy when a model uses two batteries per flight.

Jeff Frazier showed a new HABU jet model Thunderbird that he outfitted with flaps and retracts. It is electric ducted fans that can ROG and flies quite fast.

Mick Harris showed a new scratch built 1950s Texan old timer model that he converted to electric power. He described the novel tissue over Mylar covering fused with dope.

Al Tamburo showed a delta jet model with pusher prop. He upgraded the Electric Motor to improve performance. He uses an elevon mixer for control and says it flies well.

Adjournment took place at 7:50 PM

Dick Bartkowski, Secretary

Calendar of Events

Club Meetings

Monthly Meetings
Second Tuesday of the month.
Middletown Library
Doors open at 6:00, meeting at 6:30 pm.

Next Meeting; 9th April

Tuesday Breakfast Meeting
Tom Jones Restaurant on Edgemont Avenue in Brookhaven. 9 till 10 am. Just show up.
Flying after in the summer at CA Field or Chester Park; 10 am. Weather permitting.

Regular Club Flying

At Christian Academy; Electric Only
Monday through Friday after school till dusk
Saturday 10 am till dusk
Sunday, after Church; 12 pm till dusk
At Elwyn Field; Gas or Electric
Monday through Saturday 8 am till dusk
Sunday 12 pm till dusk

Indoor Flying

Wait till the Fall!

Special Club Flying

Saturday mornings 10 am
Wednesday Helicopter evening in summer
Thursday evenings in the summer
Tuesday mornings 10 am weather permitting after breakfast.

Check our Yahoo Group for announcements;
http://groups.yahoo.com/group/propstoppers/

Beginners

Beginners using due caution and respecting club rules may fly GWS Slow Stick or similar models without instructors.
The club also provides the AMA Introductory Pilot Program for beginners without AMA insurance.

Propstoppers RC Club of Delaware County, Pennsylvania.
Club Officers

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Eric is salivating over flying his new de Havilland DH-88 Comet. A model of the plane "Grosvenor House" that won the UK to Australia air race in 1934

Black Hornet Nano UAV helping keep UK soldiers safe in Afghanistan

Unmanned aerial vehicles (UAV) are becoming an ever more common site in the skies, but they are seen in their greatest numbers over combat zones. It makes sense to use them there as they can remain airborne for many hours monitoring, and even attacking a target without putting a soldier's life in danger.

Drone technology is always improving though, and a new unit is helping to keep UK soldiers safe by its ability to quickly check what's around the next corner while at the same time being small enough to fit in a pocket.

It's called the Black Hornet Nano Unmanned Air Vehicle and measures just 10 x 2.5cm and weighs a mere 16 grams. It looks very similar to a miniature helicopter, but inside you'll find a tiny camera alongside the motor and battery that allow it to fly.

The Black Hornet has been developed by Norwegian company Prox Dynamics AS, with 160 of them being entrusted to UK soldiers through a contract with Marlborough Communications Ltd. Each one can be deployed while soldiers are on patrol to check out an area before the troops expose themselves to any danger. Control can either be directly through an accompanying control pad and display, or pre-programmed to follow GPS coordinates.

Each Black Hornet can fly for 30 minutes on a full charge and has a range of roughly half a mile. It's too small to be taken out by a weapon even when stationary, but the nano drone flies at up to 22mph making it an impossible target. I also imagine it wouldn't take long to recharge the battery inside the Hornet, and having a backup or two isn't going to add much weight to a soldier's pack.

The Black Hornet has been used in Afghanistan since last year, and is helping to stop soldiers being pinned down by enemy fire (*click this link to experience a firefight through a soldier's head cam).* They aren't cheap though, as the Marlborough contract delivered 160 of them for US$31.4 million.

From the Web.

Eric's Autogiro

The model is made by Durafly and was purchased from HobbyKing's U.S. warehouse. As is so often the case, there is little information in the instructions and you are for the most part left to guess how much to use for the control throws or how to connect various components. The rotor is a fixed pitch affair with the rotor shaft movable in pitch and roll via a gimbal mount and two servos. See the pictures below.

After reading a lot of advice and watching videos of the Auto Gyro I attempted to fly the first flight with a hand launch, but upon launching, the rotor immediately stalled (stopped rotating) and the Auto Gyro made like a propeller driven lawn dart. Picture cutting the wings off your plane and attempting to fly!

The next day, after replacing the propeller, and some blades plus doing some additional research on the web, I was able to successfully take off from the ground, but it was a short flight! One piece of advice gleaned from the web was to not use the "ailerons" which tilt the rotor in this case, but instead do most of your flying with the rudder and elevator and of course I instantly forgot that once it was airborne and I proceeded to overcorrect using the ailerons/tilt rotor and crashed. Old habits got me again!

I have repaired the Auto-Gyro, but I'm waiting for yet more spare blades to be back in stock at HK U.S. and I need to order more propellers too. A single 1300 ma battery supplies the power.

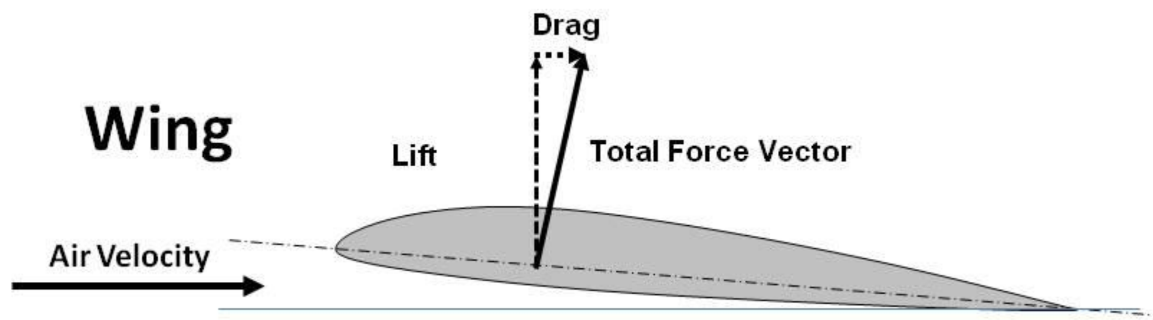
Eric Hofberg

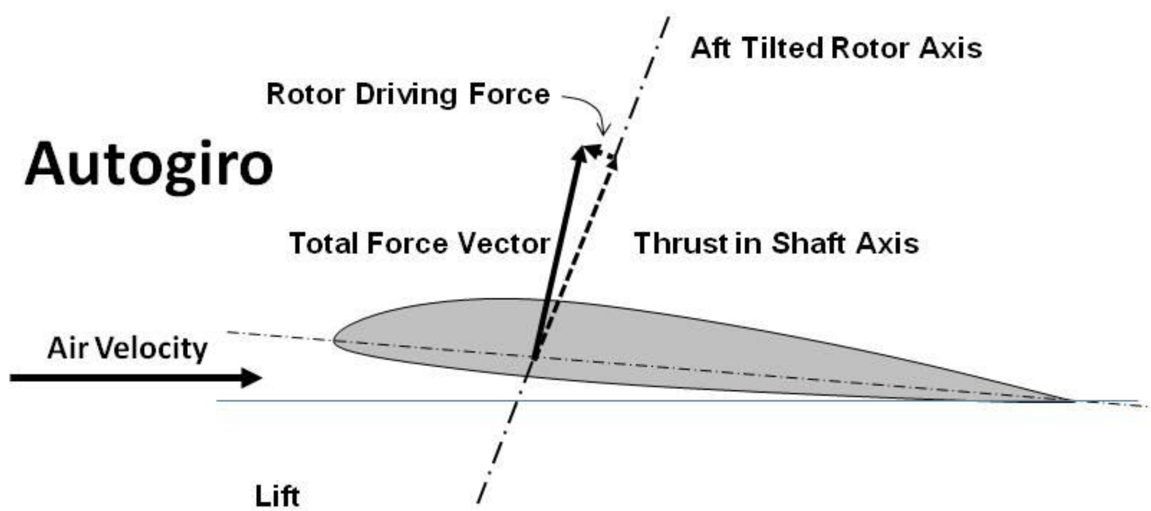
Autogiros

Eric's plunge into autogyros tickled a fancy I have had for years. In fact we at Boeing spent quite some effort working on very advanced autogyros some years back. The Autogyro is probably the main seed from which today's rotary wing aircraft have developed. The main pioneering work was carried out by Juan De la Cierva, a son of a wealthy family and a native of Spain.

De la Cierva started building aircraft as early as 1912, and in 1919 he started to consider the use of a rotor to generate lift at low airspeed, and eliminate the risk of stall. I was told it was the concern for his safety expressed by his father that led him to explore aircraft that could not stall; a primary means of crashes in early aircraft.

In order to achieve this, he utilized the ability of a lifting rotor to autorotate. This is accomplished by arranging the rotor mast to be tilted aft such that the total "lift" force on the blade is oriented slightly forward of the axis. In this arrangement the portion of total force perpendicular to the rotational axis provides the driving torque causing the rotor to maintain rotation while also providing lift through the shaft.

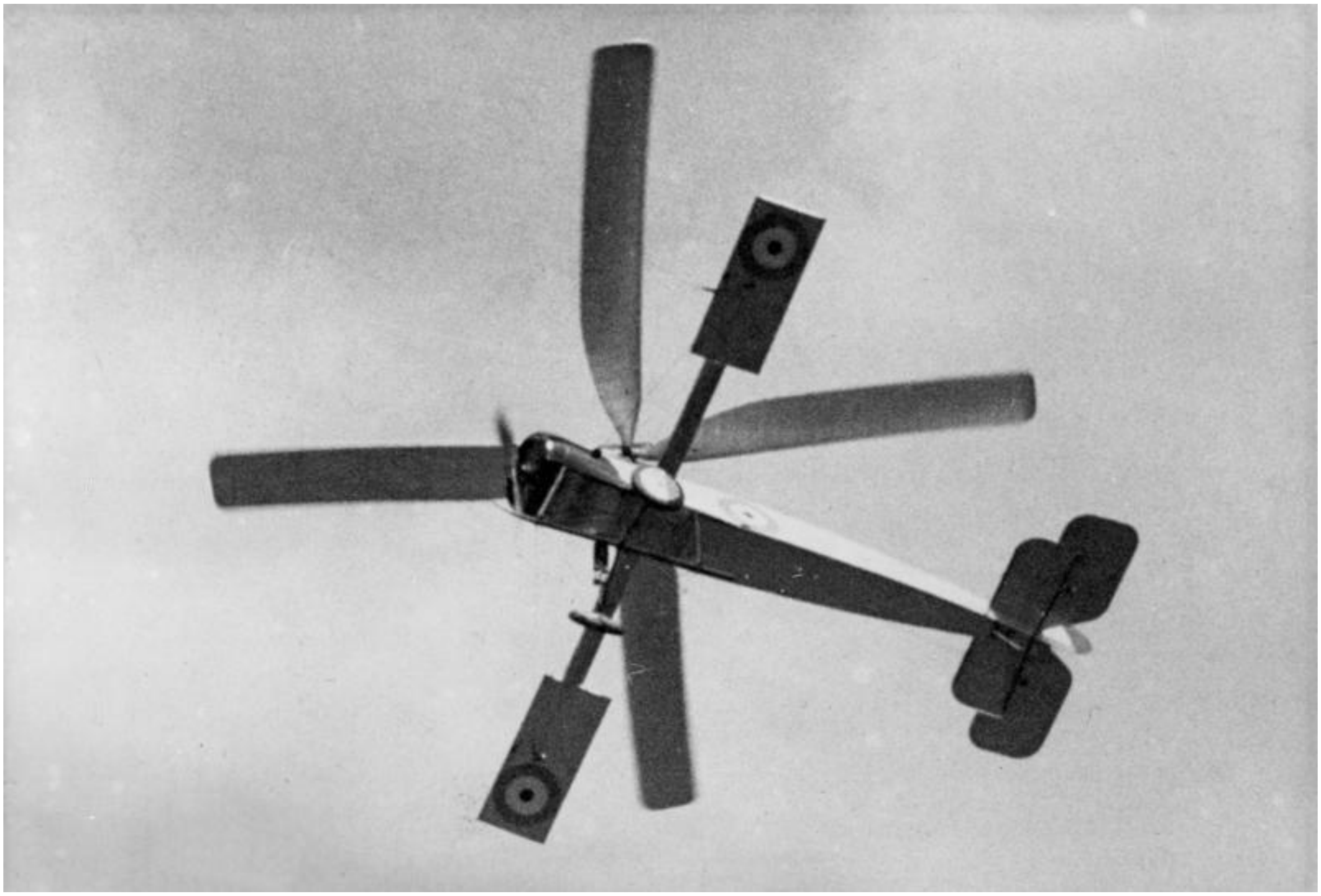




This phenomenon was already known, and was available as a safety feature to allow controlled descent in the event of engine failure. With de la Cierva's autogiro, the rotor was drawn through the air by means of conventional propeller, with the result that the rotor generated sufficient lift to sustain level flight, climb and descent.

Before this could be satisfactorily achieved, De la Cierva experienced several failures primarily associated with the unbalanced rolling movement generated when attempting take-off, due to dissymmetry of lift between the advancing and retreating blades. This major difficulty was resolved by the introduction of the flapping hinge. In 1923, De la Cierva's first successful Autogiro was flown in Spain by Lt. Gomez Spencer following a series of developments with prior unsuccessful designs. Here is the first really successful Cierva Autogyro the C-6 In 1925 he brought his C.6 to England and demonstrated it to the Air Ministry at Farnborough, Hampshire.

This machine had a four blade rotor with flapping hinges but relied upon conventional airplane controls for pitch, roll and yaw. It was based upon an Avro 504K fuselage; initial rotation of the rotor was achieved by the rapid uncoiling of a rope passed around stops on the undersides of the blades.



The Farnborough demonstration was a great success, and resulted in an invitation to continue the work in the UK. As a direct result, and with the assistance of the Scottish industrialist James G Weir, the Cierva Autogiro Company, Ltd., was formed the following year. From the outset De la Cierva concentrated upon the design and the manufacture of rotor systems, relying on other established aircraft manufacturers to produce the airframes, predominantly the A.V. Roe Company.

The Avro built C.8 was a refinement of the C.6, with the more powerful 180hp Lynx radial engine, and several C.8s were built. The C.8R incorporated drag hinges, due to blade flapping motion causing high blade root stresses in the rotor plane of rotation; this modification, however, resulted in other problems such as ground resonance for which drag hinge dampers were fitted.

Pitcairn

Harold Frederick Pitcairn, the youngest son of PPG Industries founder, John Pitcairn, Jr. founded Pitcairn Aircraft Company. The business started with the formation of Pitcairn Flying School and Passenger Service on 2 November 1924 which later became Eastern Airlines. In 1926, Pitcairn started Pitcairn Aircraft Company initially to build aircraft for his growing airmail service. He purchased a field in Horsham Township, Montgomery County, Pennsylvania and built Pitcairn Field no. 2

In 1928, Pitcairn purchased a Cierva C.8W and the American manufacturing rights from Juan de la Cierva for his autogiro designs for $300,000. In 1929, Pitcairn formed a separate patent holding company to build autogiros, the Pitcairn-Cierva Autogiro Company, which was later renamed the Autogiro Company of America. Kellett autogyros competed with, and eventually licensed production rights from Pitcairn-Cierva Autogiro Company for $300,000. As a part of the licensing agreement, Pitcairn used Cierva's copyrighted variant of the name autogiro (spelt with an i) as opposed to the currently more common spelling of autogyro which was initially used to bypass his copyright.

In 1929, three prototypes were built with one being demonstrated in the 1929 Cleveland Air Races. Following a fire in November 1929, the first PCA-1 was built and tested the same month

In 1931 the company was renamed to the Autogiro Company of America (ACA). In 1931, *The Detroit News* made history when they bought the first Pitcairn PCA-2 for use as a news aircraft due to its ability to fly well at low altitude and speed, land and take off from restricted spaces and semi-hover for better camera shots. This PCA-2 was the ancestor of today's news helicopters. Also in 1931, pilot James G. Ray landed an autogiro on the South lawn of the White House. Harold F. Pitcairn, the pilot and three other company members of the Pitcairn-Cierva Autogiro Company were present to receive the Collier Trophy for their development of the autogyro.

Now the problem with the early autogyros was it was often difficult to get the rotor spinning up to takeoff speed. So you had a machine that could land vertically, but not takeoff that way. So developments to enable pre-spinning the rotor were made starting with a rope wrapped around the rotor mast being pulled by a staff of willing helpers. Eventually the designers realized all these machines had the installed power to do this task and all that was needed was a gearbox and a clutch.

The logical next step was to make these parts strong enough to carry all the onboard power and they had a helicopter that could take off and land vertically, and hover in still air too. So the autogiro lost its attraction and with a few exceptions became a dormant branch of rotary wing for a long time, with a few exceptions.

Focke-Achgelis

The German company Focke-Achgelis built Cierva machines under license and eventually produced the unusual autogiro glider for operation from submarines.

Aside the radar, maybe the most ingenious defensive measure used by German submarines was the *Focke-Achgelis*. The 'Focke' was basically a manned rotary glider with a triple blade rotor. It was as simple to operate as it was to assemble. Housed in a storage cylinder on the afterdeck, the Focke was quickly armed and launched. It remained connected to the U-boat by an umbilical cord. From its advantageous position high above the sub (10-12,000 feet ~ ?) Ed.), the pilot could spot any target approaching the boat. Unfortunately for the Focke, if the U-boat came under direct attack, there was no time to reel it in, thus the sub cut the cord and left the pilot to defend himself until all was cleared to surface back again.

By the end of World War II, some 200 of these small, motorless, three-bladed autogyros had been built for Focke Achgelis by the Weser Flugzeugwerke at

Delmenhorst. This rotorcraft was flown as a kite towed by a submarine from a cable 60 to 150 metres in length. The collapsible assembly was made of steel tubes, and just behind the pilot's seat was a pylon to support the rotor. The latter's hub was of the simplest possible autogyro type with flapping and drag hinges. The rotor was set in motion by a rope or by hand alone, if there was sufficient wind blowing. To bring the autogyro back, the towing rope was pulled in by winch, and when the aircraft landed the rotor was brought to a standstill with a brake.

Training to handle this autogyro was given in a wind tunnel at Ghalais Meudon in France.

Perhaps the experience with the Cierva design led the Focke-Wulf concern to the FW 61. The **Focke-Wulf Fw 61** is often considered the first practical, functional helicopter, first flown in 1936. It was also known as the **Fa 61**, as Focke began a new company—Focke Achgelis—after development had begun.

Professor Henrich Focke had through his development of the Fw 186, and through his work on the C.19 and license-built C.30 autogyros – come to the conclusion that the limitations of autogyros could only be eliminated by an aircraft capable of vertical flight, the helicopter. He and engineer Gerd Achgelis started the design for this helicopter in 1932. A free-flying model, built in 1934 and propelled by a small two-stroke engine, brought the promise of success. Today, the model can be seen in the Deutsches Museum in Munich.

Using rotor technology licensed from the Cierva Autogiro Company, a single, radial engine drove twin rotors, set on outriggers to the left and right of the fuselage - the counter-rotation of the two rotors solved the problem of torque-reaction as also shown by Louis Bréguet. The small horizontal-axis propeller directly driven by the engine was purely to provide the necessary airflow to cool the engine during low speed or hovering flight- it provided negligible forward thrust,

Only two aircraft were produced. The first prototype, the V 1 D-EBVU, had its first free flight on 26 June 1936 with Ewald Rohlfs at the controls. By spring 1937, the second prototype, V 2 D-EKRA, was completed and flown for its first flight. On 10 May 1937, it accomplished its first autorotation landing with the engine turned off. In February 1938, the Fw 61 was demonstrated by Hanna Reitsch indoors at the *Deutschlandhalle* indoor sports stadium in Berlin, Germany.[It subsequently set several records for altitude, speed and flight duration culminating, in June 1938, with an altitude record of 11,243 ft and a straight line flight record of 143 miles.

Post War Autogiros and Convertiplanes

Perhaps the post war interest in autogiros was stirred by a Russian immigrant, Igor Bensen. He two started with a towed machine but quickly developed a line of machines powered by pusher propellers mounted behind the rotor shaft and pilot.

Similar machines quickly followed and a cult like following grew among do-it-yourself operators who could buy kits from Bensen and others directly out of Popular Science magazine.
Perhaps the biggest boost in this class of air vehicle came from their use in the James Bond movie "You Only Live twice". Little Nellie as it was called was piloted by Wing Commander Wallis in the movie and subsequently in many air shows in the UK.

Ian Fleming, author of the James Bond books, took his inspiration for the novels from his top secret work as liaison officer between Naval Intelligence and Bletchley Park throughout the war. In 2008, his centenary year, we celebrated his contribution with a dedicated family day. Above is Little Nellie from the films with her owner Wing Commander Ken Wallis and Double M Seven - a Sean Connery lookalike.

Compounds and Autogiro Variations

Of course engineers can never stop dreaming and inventing and soon after WWII there was a flood of rotorcraft developments, many of them based in some way on the autogiro.

The Fairy Company in England began development on a series of so called compound rotorcraft, these are machines where the thrust for forward flight is separate from the rotor propulsion, much like the autogiros. The first of these for this firm was the Gyrodyne.

The Gyrodyne was a compact, streamlined rotorcraft weighing just over 4,410 lb (2,000 kg) and powered by a 525 hp (390 kW) Alvis Leonides radial engine, the power from which could be transmitted in variable ratios to the fixed-shaft/swashplate-actuated tilting hub-controlled rotor and the wing tip mounted propeller. The Gyrodyne possessed the hovering capability of a helicopter, while its propeller provided the necessary thrust for forward flight to enable its rotor, driven at low torque in cruise flight, to operate at low collective pitch with the tip-path plane parallel to the flight path to minimize vibration at high airspeed.

On 4 December 1947, the first of the two prototypes took off from White Waltham Airport, and continued to build up flying time until March 1948 when it was dismantled for a thorough examination. The second prototype, basically similar to the first but with more comfortable interior furnishings befitting its role as a passenger demonstrator, was flying by the time of the next SBAC Display, in September 1948, at Farnborough. The first prototype was reassembled and, following further test flying, took part in an attempt to set a new world helicopter speed record in a straight line. On 28 June 1948, flown by test pilot Basil Arkell, the Gyrodyne made two flights in each direction over a 2 mi (3 km) course at White Waltham, achieving 124 mph (200 km/h), enough to secure the record.

The extensively modified second prototype, renamed Jet Gyrodyne, flew in January 1954. Though retaining the name "Gyrodyne", the Jet Gyrodyne was a compound gyroplane, and did not operate on the same principle as the original aircraft. It had a two-blade rotor manually controlled with cyclic and collective pitch mechanisms that acted directly on each rotor blade; and was driven by tip jets fed with air from two compressors driven by the Alvis Leonides radial engine. Pusher propellers, one mounted at the tip of each stub wing, provided yaw control through differential collective pitch, and thrust for forward flight. The Jet Gyrodyne was constructed to provide rotor drive and operational data for the Fairey Rotodyne compound gyroplane.

The Rotodyne's tip drive and unloaded rotor made its performance far better when compared to pure helicopters and other forms of "convertiplanes." The aircraft could be flown at 175 kn (324 km/h) and pulled into a steep climbing turn without demonstrating any adverse handling characteristics.

Throughout the world, interest was growing in the prospect of direct city-to-city transport. The market for the Rotodyne was that of a medium-haul "flying bus": It would take off vertically from an inner-city heliport, with all lift coming from the tip-jet driven rotor, and then would increase airspeed, eventually with all power from the engines being transferred to the propellers with the rotor autorotating. In this mode, the collective pitch, and hence drag, of the rotor could be reduced, as the wings would be taking as much as half of the craft's weight. The Rotodyne would then cruise at speeds of about 150 kn (280 km/h) to another city, *e.g.*, London to Paris, where the rotor tip-jet system would be restarted for landing vertically in the city centre. When the Rotodyne landed and the rotor stopped moving, its blades drooped downward from the hub. To avoid striking the vertical stabilizers on start-up, the tips of these fins were angled down to the horizontal. They were raised once the rotor had spun up.

However, the end came when the interest shown by BEA declined to order the Rotodyne due to tip-jet noise concerns and a request for a military order was also turned down. Funding for the Rotodyne was terminated in early 1962.

The one great criticism of the Rotodyne was the noise the tip jets made; however, the jets were only run at full power for a matter of minutes during departure and landing and, indeed, the test pilot Ron Gellatly made two flights over central London and several landings and departures at Battersea Heliport with no complaints being registered,[5] though John Farley, chief test pilot of the Hawker Siddeley Harrier later commented:

From two miles away it would stop a conversation. I mean, the noise of those little jets on the tips of the rotor was just indescribable. So what have we got? The noisiest hovering vehicle the world has yet come up with and you're going to stick it in the middle of a city?

High Speed Pure Helicopters

The machines above used separate propulsion means while allowing the rotor to largely autorotate in cruise flight. But the quest for speed applied to the "pure" helicopter too; a machine where both lift and propulsive force comes from the rotor. The problem becomes one of reducing the aerodynamic drag and increasing the propulsive force from the rotor, but there are physical limits, mostly associated with the asymmetry in lift associated with a rotor moving through the air in an edgewise orientation. The following figure depicts the velocity variation across the rotor as the blades move from an advancing side, where the apparent airspeed is the rotational speed plus the vehicle's airspeed - to the retreating blade side where the apparent airspeed is the rotational speed minus the vehicle's airspeed. The diagram identifies the relative speeds at the blade tips as 494 kts on the advancing side and 294 kts on the retreating side.

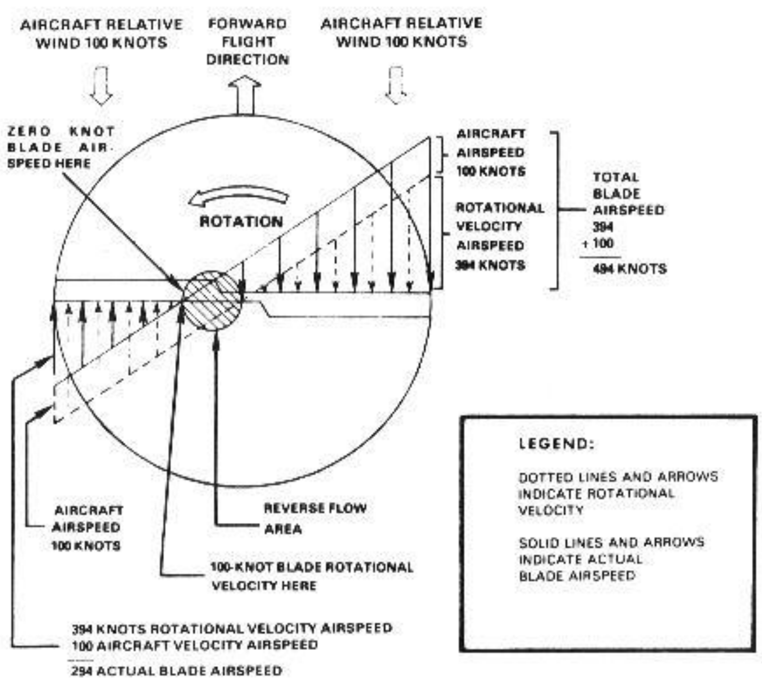
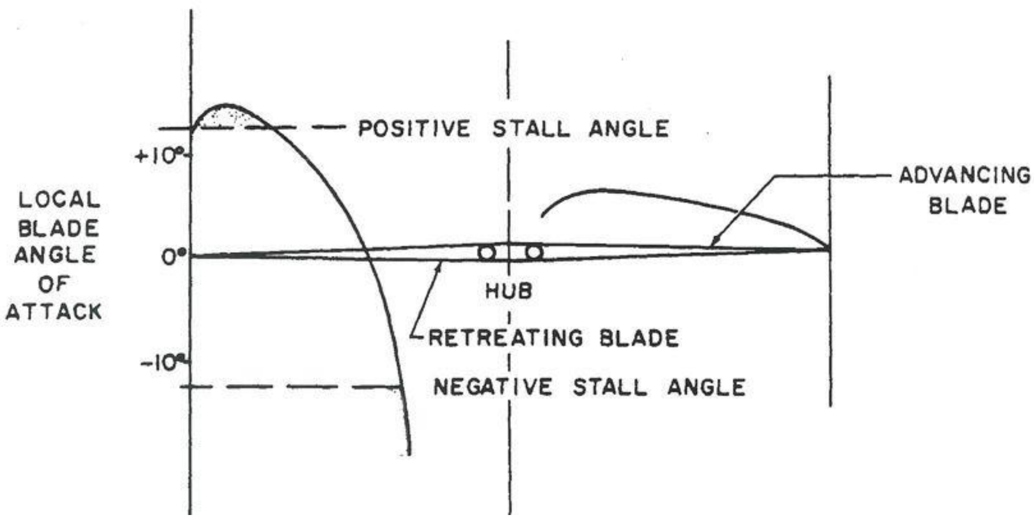


FIGURE 2-49. DISSYMMETRY OF LIFT.

Now the dynamic pressure, and thereby the potential for lift is a function of speed squared so the relative aerodynamic pressure advancing to retreating is; 2.8:1 higher on the advancing side, at the tip. But the asymmetry is worse than that because as you see although the advancing blade enjoys a positive velocity over its entire length the retreating blade has a region in which the flow is actually moving backwards. Only a small portion of the blade experiences positive velocities resulting is massive asymmetric lift potential at high speeds.

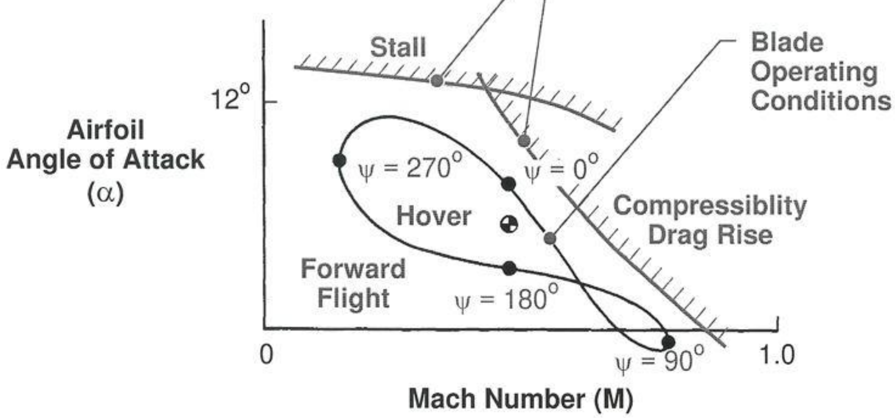
Of course the unbalanced aerodynamic pressure distribution cannot be turned into asymmetric lift or the airplane will roll off to one side. So the advancing blade must reduce its angle of attack while the retreating blade increases to balance the roll forces, resulting in a net reduction of lift/thrust potential. Since in a pure helicopter lift and thrust for maneuver must be maintained it is thrust that diminishes with high speeds.

Rotor Flow Conditions in Forward Flight



Why not just increase the speed of rotation you ask. Well, good practice means that the advancing blade should not experience supersonic or critical Mach number flows at the tip or high drag and noise penalties will result. Thin tapered tips reduce this effect, but only a modest amount. So the well developed pure helicopter ends up in a narrow solution set between advancing blade Mach number with its noise and drag penalties and retreating blade stall which minimizes maneuver performance and produces high blade loads and stresses.

Airfoils



So the pure helicopter is doomed to a speed limit practically to less than 200kts. If you want to go faster you must find propulsive force and maybe lift from other sources. And it don't come cheap!

Compound Helicopters

With the quest for speed and the limits of pure helicopter a whole field of compound helicopter developments were conducted through the 1950s and 60s. Compounding came in two varieties and combinations of the two; auxiliary thrusters and wings. The former unloaded the helicopter rotor from the function of providing forward thrust and the latter unloaded the rotor from its lifting functions, particularly in maneuvers.
The US Army funded a series of experimental compounds, some of them quite successful in their accomplishments. Perhaps the most successful was the Bell UH-1 based Model 533. On 15 April 1969, the Model 533 achieved its highest speed of 274.6 knots, 316.0 mph,

Lockheed's entry in this activity was the XH-51. This machine had a unique rotor design featuring a stiff hingeless rotor controlled through a top mounted gyro bar. The pilot's controls moved the gyro bar which in turn controlled the rotors.

These design features were incorporated in the winning Lockheed Advanced Aerial Fighter System, or AAFS design called the Cheyenne.
The Cheyenne incorporated the main rotor design of the XH-51 but used a separate pusher propeller mounted in the tail for propulsion. It also had modest wings.

But these very features were also the death of the program as in high speed forward flight a rotor weaving instability was discovered leading to an unfortunate fatal accident when the rotor cut into the cockpit. The program was eventually cancelled and compound rotorcraft took a back seat for quite a while.

But others continued to explore the potential of compound helicopters among them Sikorsky and our local entrepreneur, Frank Piaseki.

Sikorsky tackled the asymmetric lift problem with high speed rotors by building a coaxial rotor airplane with very stiff rotor blades. This allowed them to load the advancing blade and mount the rotors fairly close together. They called the design the Advancing Blade Concept, ABC. But there was little interest at the time.

Tilt Rotors and Tilt Wings

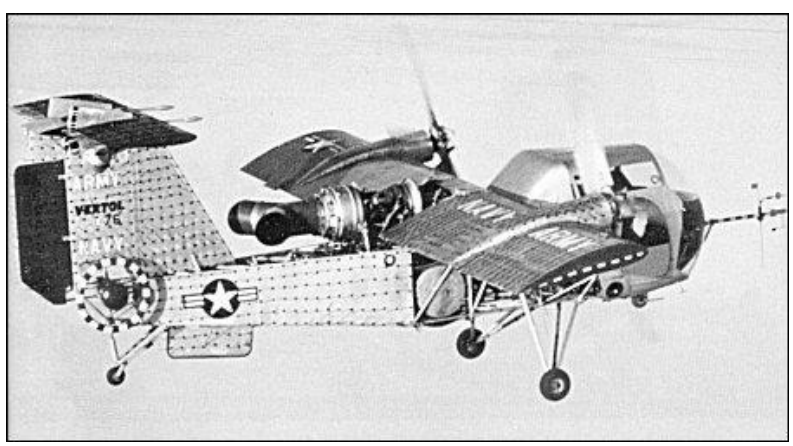
But there was another thread in the development of high speed airplanes that could hover efficiently and they incorporated tilting propellers or rotors.

The highly loaded propeller is more effective in high speed flight, but the downwash download on the airplane in hover must be alleviated by tilting the wing along with the propeller, and the hover performance is inefficient for long duration hover flight.

The tilt rotor hovers efficiently but has less high speed capability than the tilt wing.

In 1951 Bell began development of the tilt rotor XV-3. This program highlighted the possibilities but experienced rotor instabilities that took more than a decade to solve. But solved it was and resulted in the very successful XV-15 which in turn begat today's equally successful V-22 Osprey.

The Tilt Wing route was pioneered by a small group of Vertol (now Boeing Helicopters) engineers in the late 1950s. The designed, built and flew the first tilt wing airplane in a bit over a year on company funds. The Model 76 led to contracts to continue the work with the VZ-2 which was involved in extensive research flying.



This accomplishment led to Boeing Vertol's entry to the AAFS competition being a tilt wing aircraft. Sadly the Army decided to build on their investment in compound helicopters and rejected the Boeing Vertol bid.

But the Air Force took up the concept and applied it to a program to replace the H-130 with a VTOL tilt wing aircraft. The funded the development of a demonstrator the LTV XC-142. The program was executed with a team of primary members working on a very complicated airplane resulting in a great deal of failures and very high maintenance. But perhaps the prime customer, the Air Force, was losing interest in a VTOL capable fleet of transports so the program was cancelled.

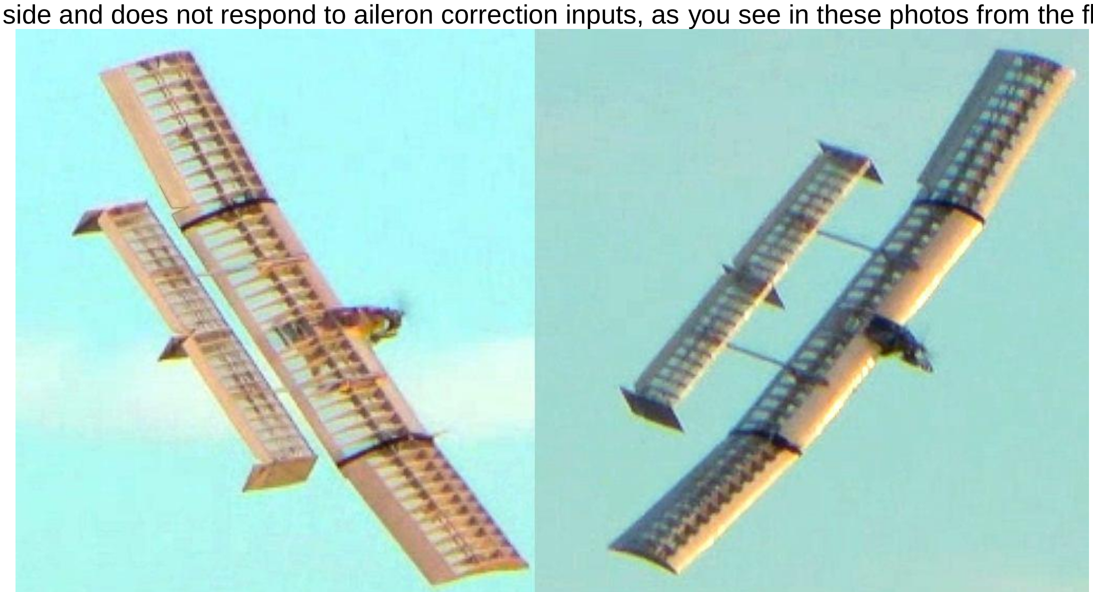
Author's disclaimer; I have lived through a good deal of this story as a Boeing engineer dealing with many of the people and companies that have lived these dreams. The foregoing story is of course just one thread through this period of rich aviation developments. Please forgive me is I missed your favorite airplane, but my intent was to show some of the major developments and factors in getting us to where we are today. Of course a great deal (all!) of this material was garnered from the web, but much of it was in my mind, the fat fingers and creepy mouse just helped get it out. Gotta cut it off here, the Widener guys have just asked me to cut 100 24 inch wing ribs.

Next Month; The 21st Century Fascination with Compound Rotorcraft

Dave Harding

Widener SAE Aero Design Developments

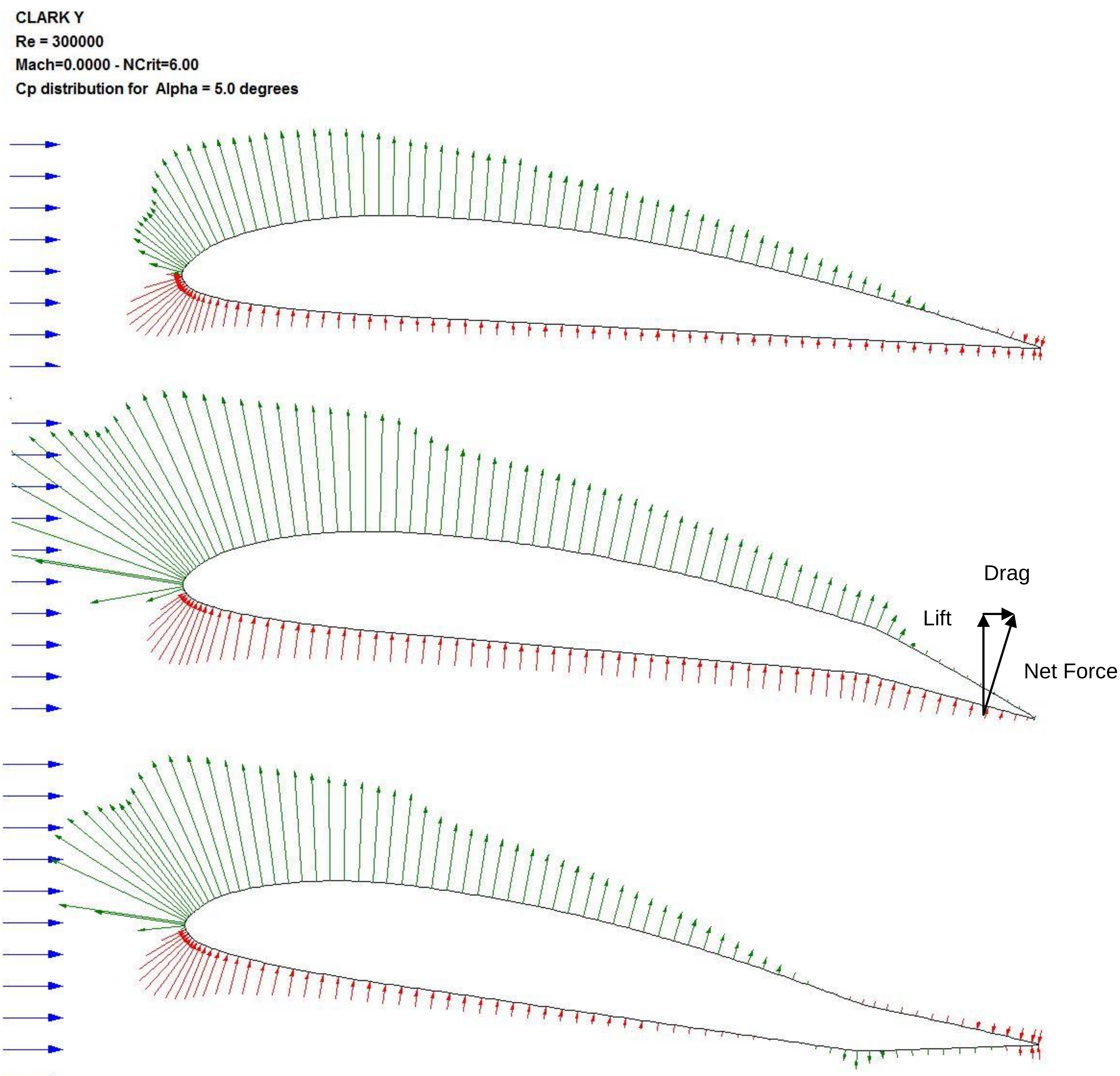
The Widener students have continued the development of their SAE Aero Competition entry with a great deal of frustrating results. The fundamental problem is one of roll and directional control. Basically the airplane falls off to either side and does not respond to aileron correction inputs, as you see in these photos from the flight movie.



The development of the aileron control started with tapered wing tips with fairly small ailerons mechanized to give twice the up travel than down (see last month's newsletter. You do save them don't you?). This was done for the usual reason; i.e. to minimize or eliminate adverse yaw.

If you are flying an aerobat you want ailerons to provide roll control with no change in any other axis. Unfortunately in steady forward flight an aileron that moves down generates more drag than one that moves up the same amount. This causes the airplane that is rolling to the left, to yaw to the right, and if there is any dihedral in the wing, or dihedral effect due to the wing placement on the fuselage, this effect causes the airplane to experience a right roll moment. The two effects can cancel each other out resulting in the airplane flying straight but with a roll and yaw attitude; Not desirable! Here are the pressure distributions around a conventional Clark Y airfoil with a +/- 10 degree aileron deflection. The pressure is positive with the red arrows and negative (suction) with the blue and the length of the arrow is the magnitude of the pressure at that point.

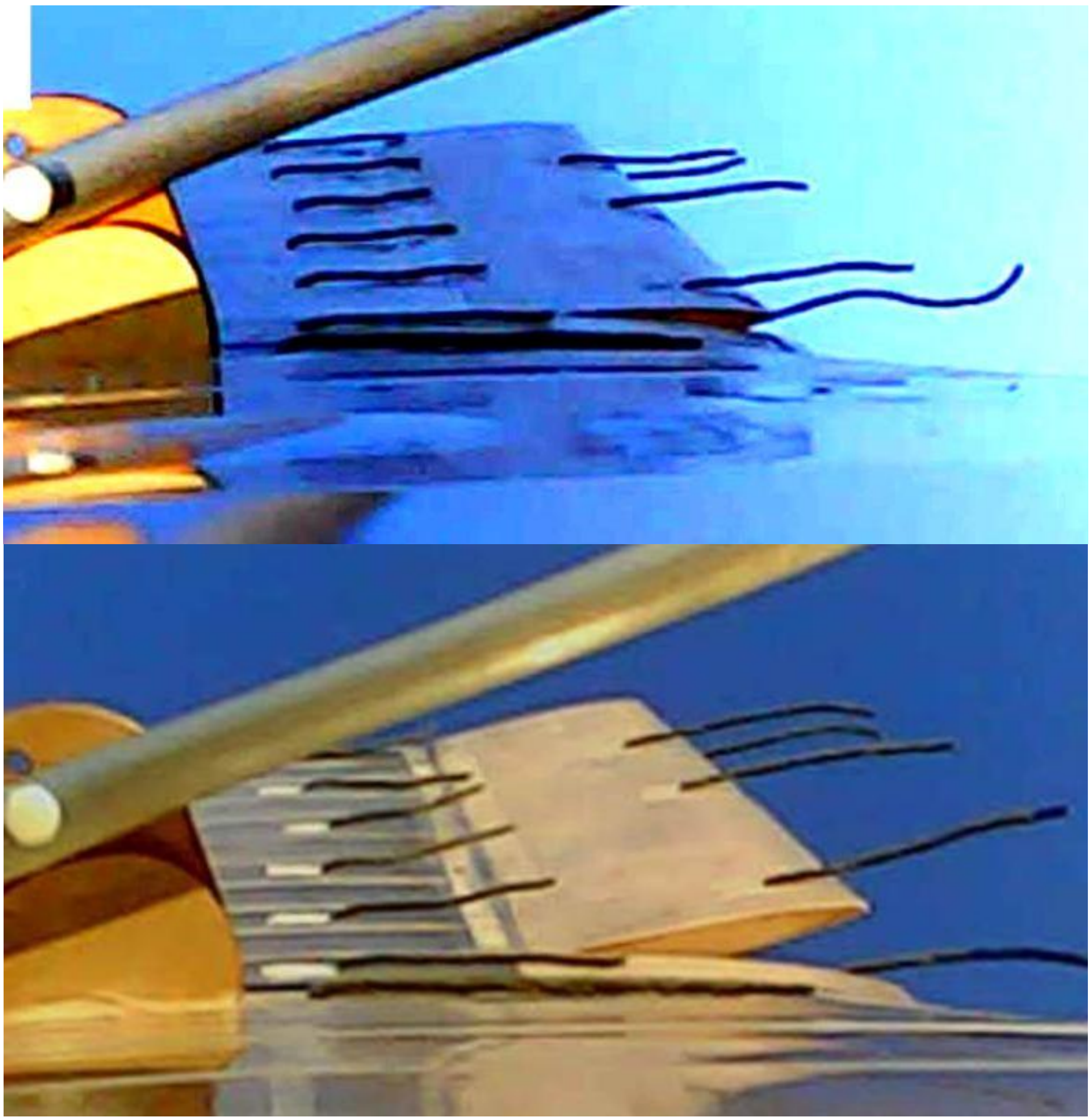
Note there is very little pressure on either surface on an aligned and up deflected aileron and as a consequence, little or no drag increase. The down deflected aileron shows a marked positive pressure below the aileron surface and indeed the whole airfoil lower surface this pressure integrates over the tilted surface into a lift force (intended) and a drag force; unintended or undesirable.



So the usual fix is the aforementioned practice to have the ailerons with greater motion up than down, thereby either cancelling the adverse yaw or even enhancing the turn with proverse yaw (opposite of adverse, commonly used in this context, but not in the dictionary!). And this the Widener team did on the first configuration; but it didn't work and control was essentially inoperable; the model crashed.

The model was rebuilt with new tip sections, this time with a parallel chord for ease of construction and full length ailerons. Dihedral was increased to 8 degrees on the outer panels with the expectation of some turn control via the effective rudders. The aileron motion was changed so they only moved up. The thinking being that perhaps the wing was stalling with down aileron motion with this highly cambered airfoil. Warps were noted in the original configuration and these were removed. This is the model configuration shown in the photos above. It still had essentially little or no roll/directional control although two flights were made in still air with successful landings.

The next flight was made with an on-board aileron camera with flow tufts to explore the flow patterns around the ailerons. The CG was moved slightly forward to enhance pitch stability which was a bit twitchy on the earlier flights. The flight was made in fairly high winds and a slightly higher weight. It ended after the first turn downwind after takeoff when performance and loss of altitude in the turn brought the model to treetop level. An avoidance maneuver caused the model to once again spiral in. But we had some aileron flow data to examine.

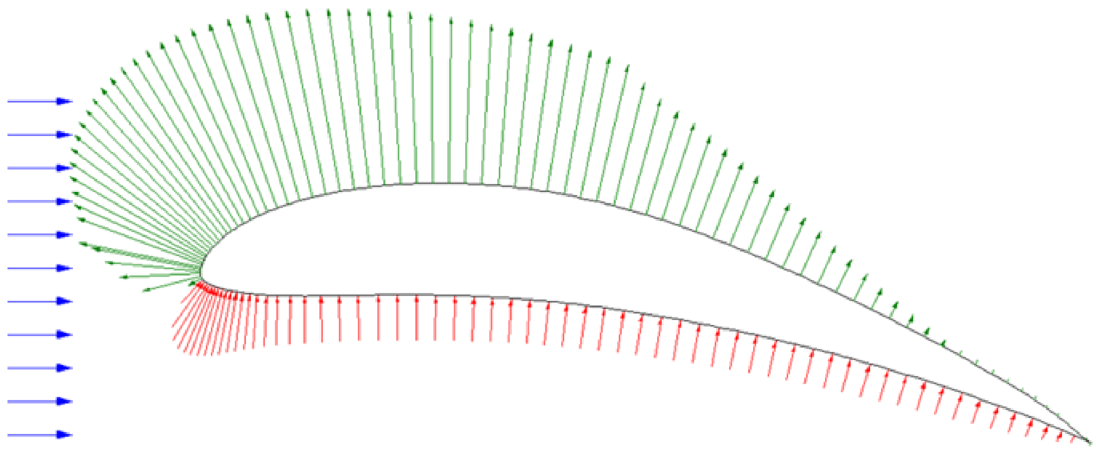


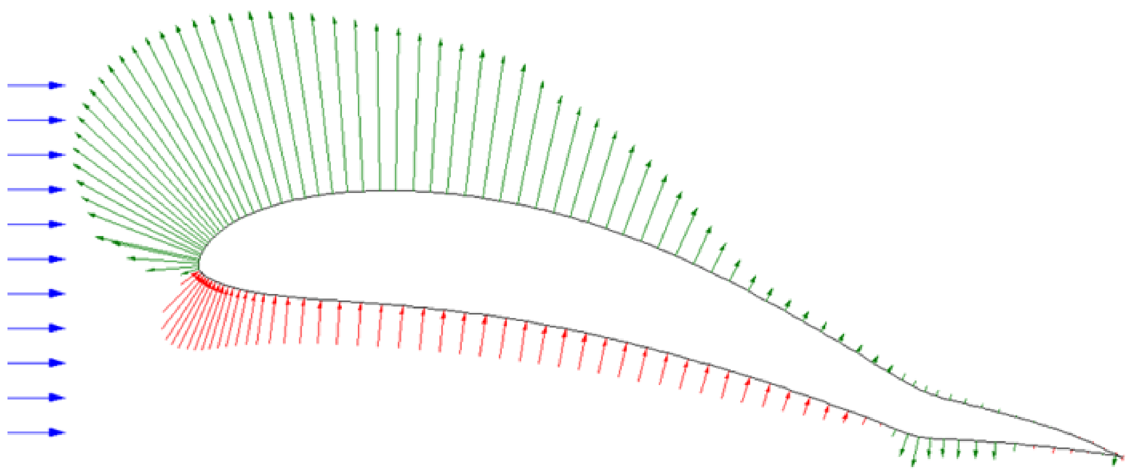
The flows were nicely attached and aligned in yaw and with the departing flows. So it seemed that the ailerons were working properly, but still they didn't have control. But on comparison with the calculated pressure field the flows seemed a confirmation. So how do we get the combination of roll and yaw that is desired?

The next configuration tried in flight was based on the observation that the tailplane is huge; six feet span actually. With large elevators it looked like an ideal opportunity to try operating the elevators as elevons, so they were split in two and an additional servo added to provide the necessary control configuration. It was decided to leave the ailerons in the closed position but provide a roll trim capability via the transmitter knob. The plan was for your editor to "man the knob" while Hot Hands Pete, the Boeing engineer pilot was on the sticks.

Unfortunately this was a complete failure as the control was nonexistent and cranking the knob did no better than the original mechanization of the ailerons through the sticks. The model quickly crashed into the trees giving the team another major rebuild.

So back to studying how the ailerons might be made effective. We examined the pressure distributions on the Epler airfoil with ailerons and discovered that the drag actually decreases with an up turned aileron compared to the neutral condition so the proverse yaw case applied even when we restricted the ailerons to only move upl

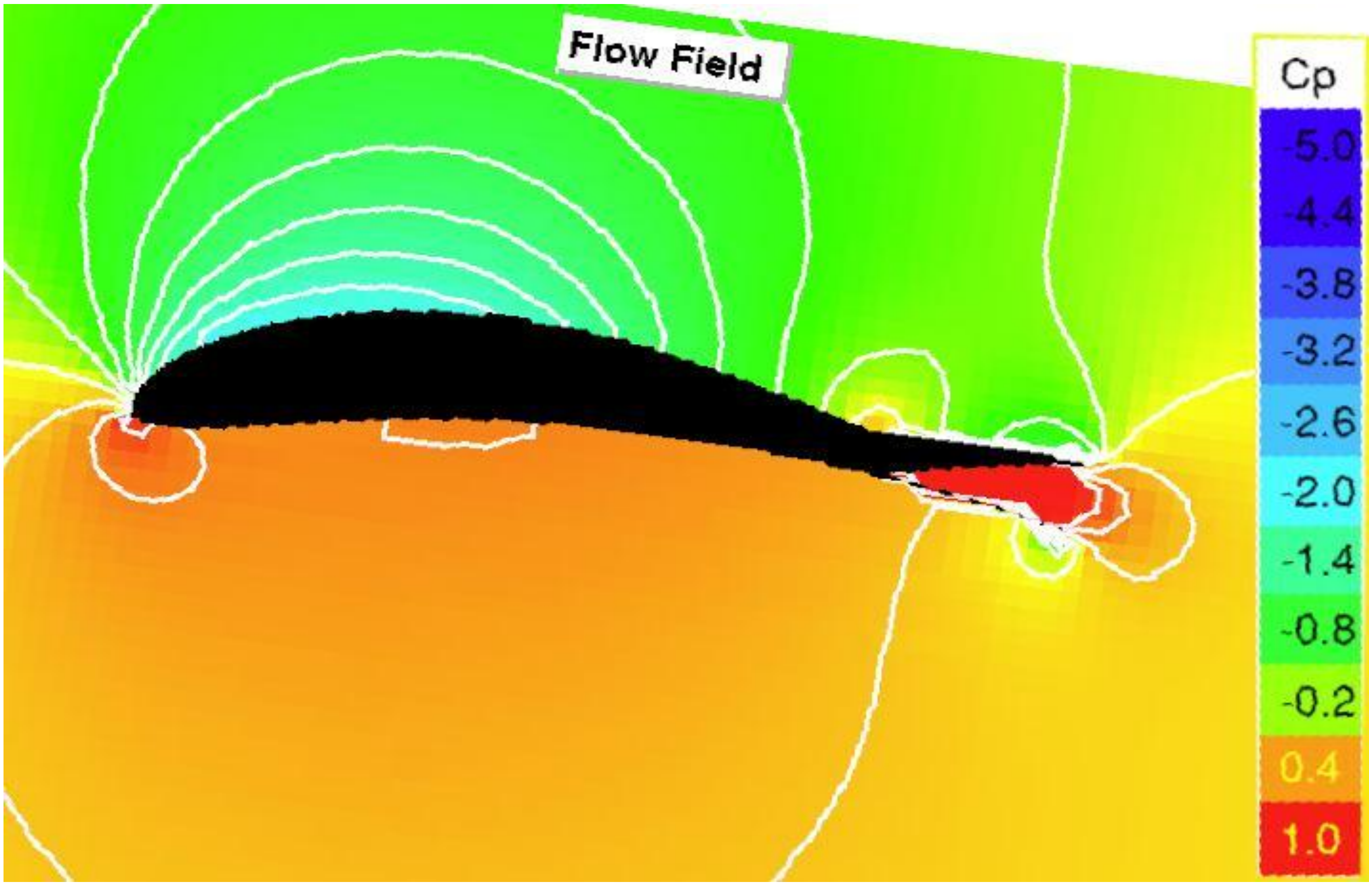




The clue was provided by watching some of the YouTube videos of other competitive planes flying in the competitions. We looked at those with similar highly cambered airfoils and found one that was controlled with spoilers on the upper outer surface, like today's jet airliners.

First we discovered a 1934 NACA paper on tests with the Clark Y airfoil equipped with various ailerons, split flaps and spoilers. The conclusion was the most effective location for a spoiler is at 30% chord but that would mean a change from the design specified in the team's design report; a loss of points event. But one of the team suggested we make split ailerons as they would probably act as adequate spoilers and had two other advantages, first they could be retrofitted to the existing model and second, probably didn't constitute a change from the reported design; They didn't specify what kind of ailerons, only their position and size!

So the change was first examined analytically. Computing the pressure distribution similar to those above using Profili Pro proved too hard to conquer, but one of the Widener guys used Martin Heperle's javafoil to produce these pressure distributions. The stagnation (high) pressure behind the split aileron is clearly apparent so it was expected the desired proverse yaw and favorable roll would be achieved with this approach. All that was necessary was to make the repairs to the model from the last arrival and incorporate the split ailerons.



In the photos below from the test flight on 23rd March you can see the split aileron behaved just as the analysis predicted, and better yet, the model was controllable although the flight was rather like Mr Rabbit's Wild Ride at Disneyland. But the model survived and a continuing series of flight tests are planned as they build a second model to be shipped to California for the competition.

Dave Harding

An Open Source Radio

By Phil Wittingham

Introduction

As part of my recent FPV adventures I've been looking at alternative radio equipment to the ubiquitous Spektrum equipment. The main reason for doing this was the need for a longer range solution than Spektrum's 2.4 GHz DSMX/DSM2 solution. In addition there are alternatives that provide additional functionality such as RSSI (received signal strength indication) and PPMSUM which multiplexes all radio channels onto a single receiver connection.

Whilst looking for alternative radios that met the above requirements, I stumbled across several threads on RCGroups.com that were discussing a Turnigy 9R radio from Hobbyking. In particular I saw a thread about a soon to be released updated Turnigy 9XR radio that featured several nice upgrades. I decided to take the plunge and order one of the new radios when they became available, this wasn't that easy as they were in demand, but I was lucky to score one of the second batch of radios that Hobbyking had available.

What is open source?

The open source movement initially began with computer software, and has been responsible for producing operating systems such as Linux and its derivatives, as well as applications such as OpenOffice (productivity suite) or GIMP (image editor). The same ethos that was used to develop, maintain and enhance these software packages is now been used to initiate hardware and other projects, Open Source means that the intellectual property behind these projects is available for other people to utilize, adapt and enhance, There are various licensing models that are used in conjunction with open source, the idea being that they ensure that if someone divides to utilize the source intellectual property, that it be made available for others to reuse, if they so wish,

Why does open source matter
Open Source offers the user some unique advantages over the traditional closed sourcing approach.

1) Defense against obsolescence. Community support means that Open Source products are typically used longer than commercial products.
2) Ability to modify enhance. Access to the source code is easy so you can make changes if required, although this may require programming skills.
3) ability to participate in a community. Strong communities grow around vibrant open source initiatives, providing a rich source of support and education materials.

The Hardware

As mentioned my decision was to look at using the Turnigy 9XR radio. This is an upgraded version of the Turnigy 9X model, and comes with the following features.

- Complex mixing
- Digital trims
- Aircraft and Helicopter mixing
- 16 model memory
- Assignable switches
- 9 channels

http://www.hobbyking.com/hobbyking/store/__31544__Turnigy_9XR_Transmitter_Mode_2_No_Module_.html

The specifications are pretty impressive, especially when you consider the $50 price point. The radio does not include a transmitter stage, but utilizes interchangeable transmitter modules. This gives maximum flexibility and reusability as you can choose to utilize and JR or Futaba module (depending on which 9XR model is ordered)

Examples of modules available include:

1) Hobbyking Orange Transmitter module for DSM2 receivers
2) FRSky 2.4 GHz Transmitter module
3) Turnigy 433 MHz Long Range UHF module

The 9XR transmitter feels pretty good in the hands, although the hardware is not in the same league as Futaba, Spektrum etc. However I feel it represents excellent quality for the price charged. The 9XR includes a backlit display, and has provision for a LiPo battery, although this cannot be charged internally. I'd also recommend ordering a protective case and maybe a neck strap, as these are not included.

What are the software options?

Once you've obtained suitable hardware, there's a choice to be made over what software you would like to run on the radio. Unlike commercially supported products from major vendors, the software program that the radio runs can be updated (or flashed) with a completely different version than that supplied by Hobbyking, As is the case with most open source projects, there are multiple versions of firmware available for the 9XR radio. These include ER9X, Open9x and the as supplied Hobbyking version which is based on a slightly modified version of ER9X. These different versions of firmware include different features, and to cover these in detail would take a separate article. I'd recommend doing some research on the following web sites but the great thing is that you have the ability to test out all of these options quickly and easily to determine which firmware best meets your needs.

https://code.google.com/p/open9x/
https://code.google.com/p/er9x/
http://openrcforums.com/forum/viewtopic.php?f=42&t=114

PC Software

A great example of the benefits of open source, is the fact that a really nice application has been developed to allow the Turnigy radios to be linked to a PC. The companion9x application utilizes and FTDI to USB interface (link here) to allow a PC to be used to program the radio. Functionality in Companion9x includes:

- flash the radio with new or updated firmware
- read model and radio configuration, save this to the PC for backup
- modify and simulate the radio and model configurations on the PC
- write updated radio and model configurations back to the radio

This type of application, with this depth of functionality doesn't exist for other radio platforms as manufacturers have chosen to utilize and not publish the internal format for model storage and configuration.

Summary

If you're looking for a new radio platform, and are looking to save a little money over the mainstream products then the Turnigy radios may be a viable alternative. If you're looking for a better way to program, modify models on the radio, I can highly recommend using the 9XR platform with one of the mentioned open source firmware options. This is a great way to get involved in the open source movement, and a great opportunity to experiment!

Phil

Signs the apocalypse is near

From Sunday's L A Times.

Sammy's is a volume camera dealer in the Los Angeles area with many stores and voluminous newspaper advertisements. How long before our hobby is banned? After all the founding fathers didn't know to enshrine our flying machines, or even our aerial surveillance equipment in an amendment to the constitution.