The Flightline

Volume 43, Issue 2 Newsletter of the Propstoppers RC Club AMA 1042 February 2013

President's Message

All the fields are wet and the water at Christian Academy Field is a little deep at the gate. I made a small ditch to move the water but it needs to be deeper but it will work for now.
This is the meeting to bring your unwanted planes,motors, anything you want to sell or trade.
Dues are due at this meeting .
This meeting should be short due to swap meet.
Don't forget Feb 9 th. indoor flying in the Brookhaven Boro gym .

Dick Seiwell, President

Agenda for February 12th Meeting At Middletown Library;

Doors open 6:00, meeting at 6:30

1. Membership Report
2. Finance Report
3. February Tag Sale
4. Show and Tell

INSIDE THIS ISSUE

Indoor Flying Last Call

Brookhaven Borough Gym 6till 9:30 pm
Saturdays Feb 9 March 9
Tinicum School Gym 6 till 9 pm
Friday Mar 1
Guests flyers OK with $3 charge, AMA required.

Minutes of the Propstoppers Model Airplane Club January 8, 2013 at the Middletown library

Call to order was at 6:40 PM by President Dick Seiwell
Roll call by membership chair Ray Wopatek showed 19 members present
Minutes of the December meeting were approved by the membership
Treasurer's report by Pete Oetinger was presented to the group

Old Business:

President Seiwell suggested that we avoid the Christian academy field as it is still wet and very soft. He proposed letting the grass grow taller as a barrier to cars crossing and rutting the runway. He also said that the Elwyn Field is still in good shape and available for flying.

New Business:

Chuck Kime announced that North Penn School is having an indoor event late January.
Dick Seiwell suggested we set up a U-Control site at one of the fields. This received a generally positive response from the membership.
Dick also asked that we bring items for a tag sale to the next (Feb) meeting.

Show and Tell:

Mick Harris showed a Kiel Craft Scorpion 36" span electric RC. This model was one of his favorites in a past life. He has flown it on 2 & 3 LiPos.
Al Tamburro showed 2 electric control line planes he built from scratch using foam core sheet from the dollar store. The flight is controlled by a programmable timer and one has auto power adjust for climb.

Adjournment took place at 7:45 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; 12th February

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

Guests OK, AMA required.

Brookhaven Borough Gym 6till 9:30 pm
Feb 9 March 9
Tinicum School Gym 6 till 9 pm
Mar 1

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.

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Propstoppers Web Site; www.propstoppers.org

Show and Tell

Al Tamburo's Planes

. Both the planes were Veco Warriors, the original version, the yellow one, was built the conventional way with a foam core wing and the rest in wood.

Now the camo one was built almost completely from foam core, the only wood was the flaps and the dorsal fin gusset. All the foam core was laminated together and covered with brown paper. You were right about taking off the paper by soaking it, and then it was covered with brown paper. I didn't take off the paper on the horizontal stab, and I covered it with tissue paper from the dollar store. The glue used was called boarder paste it is thick and when it's dry, it's dry.

The paint used was rusolium gray latex primer, sanded between coats with 220 grit paper, 2 coats and once this is done you can spray it without chewing up the paper; light coats only.

A friend of mine from the shore, Chris, had a fun fly on the first of Jan. One of the club members built a similar plane and they shot it with paint balls. It took 20 hits and survived; now that's tough.

The electronics are ready for testing. Need a suitable flying day, one when I can get Jim Barrow out of the house. Yes it has the 2cycle 4 cycle gizmo. It was demonstrated at the club, and they liked it; that's the camo one.

When we have it perfected, and I think we got it, the tech will be given freely to one and all. Unless someone beats us to it, but I doubt they will. If all goes well you will have the exclusive in this newsletter.

PS it looks like it is infectious because they are going to cut a control line circle at the Elwyn field.

Murray Wilson

Murray has been a member of our club for about a year now. He joined us shifting his modeling interests a bit from Steam Trains to aeromodeling, although model airplanes have always been a part of his life. Recently I asked him to pen a piece to introduce himself to the club members. Murray spent his life in the steam power fields and his background led him to offer the article that follows on steam power in aviation. However, he also provided us with a narrative on one of his steam adventures. Here is Murray;

My background and work experience is mainly to do with steam and ships.
There are quite a few stories I could tell but they have not the remotest connection with aviation great or small. However, here is a small sample of something I wrote out for a friend a few years back. At least it mentions a propeller.

The worst fifteen minutes of my life.

In 1956 I was an engineer on a small cargo ship named "Palestinian Prince".

In the early hours of an April morning on the 12 to 4 watch we left Valletta, Malta in fairly rough, but not exceptionally rough, weather. Once clear of the harbor the bridge rang "Full Away" and the watch was mine.

We had a triple expansion steam engine and due to the pitching of the ship it started to race each time the propeller came partly out of the water.

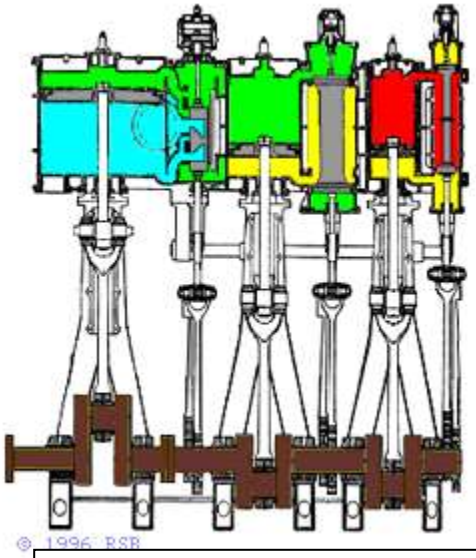
These engines do not respond quickly to the overspeed governor and accelerate rapidly and so to limit the overspeeding I progressively throttled-in the engine. After some minutes the bridge called down on the speaking tube and said maximum revolutions were necessary as we were being carried backwards towards rocks. I told them I was concerned about damage to the engine and that I would get the Chief Engineer down.

The Chief came down, discussed the situation with the Captain on the bridge then ordered the throttle to be opened fully. He and I joined the fireman and the greaser in the stokehold where we would at least be protected from flying pieces if the engine flew apart. What chance we'd have if the ship did go on the rocks in such weather, in the dark, I didn't know, but I supposed it would not be good. So I held on to something solid and listened to the poor old engine racing and shuddering. It seemed a shame that at age 25 these might be my last few minutes, but I felt no more than that.

After about fifteen minutes the bridge called down that we were safely clear of the rocks and could throttle down to safe revolutions. The engine room was a mess, lubricating oil thrown everywhere by the open cranks and rods of the engine, but everything was still in one piece.

Those though were not the worst fifteen minutes of my life. They came years later when I was stuck on a Pocono ski lift right alongside a pylon mounted loudspeaker. For fifteen minutes I was the captive audience for a series of Johnny Mathis recordings. Sorry Johnny, those were the worst.

Murray Wilson



Triple Expansion Steam Engine
Click Here and search some more to see the video of the Titanic's engines

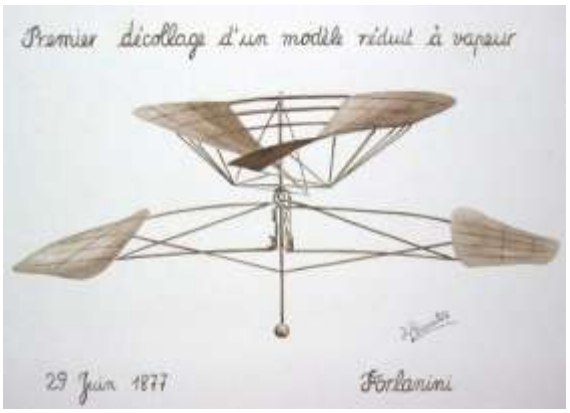
Editor's Note; When Murray saw the picture of "his" ship I dragged out of the internet he sent me this reply;

Thank you Dave, that's her. Looking like she's had a fairly hard voyage. She was built for the Mediterranean trade but my first trip on her we were sent out to Newfoundland. This was early April and so right in the iceberg season. The galley stove was fired with boiler oil and there was insufficient insulation on the oil pipes from the engine room to keep the oil warm enough to flow to the galley, so we had a couple of days of cold food until we got that sorted. We spent the next six months running from New York down to Central and South America, once in a while to the Caribbean. Some real hellholes in Guatemala and Honduras in particular. Everything on the ship was steam driven except for the steering gear, which very unusually was straight electric with a Ward Leonard control system. Being the electrician was part of my duties, but only once did we have trouble with the steering gear and fortunately we were out in the open sea. There are quite a few tales to be told of my time on that ship.

Steam Powered Aviation, A little bit of history.

Fellow Propstopper Mick Harris recently lent me a Brown Junior CO2 engine to play around with. His own interest in CO2 seems to have been revived by discussing suitable airframes, so I may be handing the engine back sooner than anticipated. If he sets his mind to it there's little doubt he will have something built before I do.

Anyway I came home with the engine and went to the internet to see what I could learn. What I read, rather than learned, was that the early days of model aviation were dominated by compressed air motors. As a lifelong enthusiast for all things steam I knew this was not correct, for the early history of heavier than air flight is inseparable from the development of models and lightweight steam engines. There simply was no other source of power available. The writer on the internet was supposing that recreational model flying was the start of it all model flying, but just as the first steam locomotive had been a model, so the first successful ROG flight was by a model and it was steam powered. That much I knew, but I



was surprised to be reminded of the date. 1857. The builder was a Frenchman named Felix du Temple and, unlike so many other claims in the early history of heavier than air flight, this one seems to have been reliably witnessed.

It was characteristic of the early experimenters in flight that in general they went their own way and learned nothing from what had already been done, a tradition that has not been completely lost. The basic requirements for flight had been identified by Sir George Cayley by 1850, http://en.wikipedia.org/wiki/George_Cayley yet the most absurd contraptions continued to be designed and no one built on the success of du Temple. The fixation with ornithopters, even down to feathered wings in some cases, was so ridiculous that it is hard to understand why it was not seen as such. On the other hand the first successful lift off by a model helicopter was achieved in the 1860s by Vicompte d'Amercourt using a clockwork motor, but attempts to fly a similar but larger craft with steam power were not successful. The old adversary, power to weight ratio. An earlier helicopter theoretician, Willhelm von Achenbach, had been the first to appreciate that a tail rotor would be necessary to counteract the torque, but otherwise his design was impractical and never built. Enrico Forlanini was the first to obtain sustained helicopter flight and this was with a steam engine. His aircraft can be seen in the science museum in Milan, which is well worth a visit. Forlanini did not persevere with flight, but became a successful pioneer of hydrofoils.

The Englishman Henry Stringfellow was an important figure in flight history, though it is not certain he ever successfully flew his aircraft. Historians disagree. He attempted to fly it along a wire and certainly lifted off, but that isn't necessarily flying, as anyone who has driven with 1/2" plywood sheets on the car roof can attest. His undoubted contribution was the development of lightweight steam propulsion units, several of which can be admired in museums today and one is possibly in the Smithsonian. He followed Cayley's design guidelines and had he put as much effort into the design and control of the airframe as he did into the power unit he could well have been the first to achieve undisputed success.

So where were the Americans? Hiram Maxim, famous for his quick firing gun, experimented on a grand scale in England. He had in fact emigrated to England and became a British subject. His aircraft had a span of one hundred and four feet and two steam engines totaling 360 horse power. He did serious research on propeller design, but apparently none on flight control and he restrained his creation from rising more than two feet from the ground. This is did, broke through the restraining rails, was badly damaged and Maxim abandoned his quest. In reality it was no nearer to a flying machine than the aforementioned car with plywood sheets tied to its roof.

Samuel Pierpoint Langley was more scientific in his approach, as befitted the Secretary of the Smithsonian Institution, and was very much in the race to be first to fly. Backed by the Smithsonian he had bought a steam engine built by Stringfellow and presumably flew his model "Aerodrome No.5" with it, or a copy of it, in 1896.

This model had a span of just under fourteen feet, so would be considered large even today. You can see it at the Smithsonian and perhaps that is the Stringfellow engine in it. With the added backing of the US Government Langley developed the model's design into the full sized aircraft with which he hoped to achieve a controlled, man carrying flight. For the full sized aircraft he used an internal combustion engine which had been built for him with the resources of the Smithsonian. This piloted aircraft made two catapult launches, on October 7th and December 8th 1903, but each time immediately crashed. The Wright brothers, unable to purchase a suitable internal combustion engine, had to build their own and it was considerably inferior to Langley's. They though had thoroughly researched the fundamentals of flight. Airfoils, airframes, flight controls, propeller design etc., they were truly prepared to fly. *(They used "gear" reduction driving two very large lightly loaded propellers to fly their 750 lb "Flyer" on 12 HP. Ed.)* This compensated for the low power of the "Flyer's" engine and only nine days after Langley's final attempt they achieved the first man carrying, controlled flights. The Smithsonian, presumably because of its backing of Langley, would not recognize the Wright's achievement and so the "Flyer" went on indefinite loan to the Science Museum in London, where I saw it just after WW2. Orville Wright died in 1948 and in his will donated the "Flyer" to the Smithsonian on condition they formally

recognized the Wright brothers as being the first to fly. The Smithsonian conceded, 45 years after the fact, and the "Flyer" is today displayed in Washington, DC.

In 1933 the Bessler Brothers put a Doble steam car engine into a Travelaire biplane and flew it, but only to show it could be done.

Steam had never been the ideal choice for the pioneers, simply the only choice and the rapid development after 1900 of the much more suitable internal combustion engine ended most consideration of steam. There was one last flicker of interest in the late 1930s with the patenting of a power unit consisting of a steam turbine and coaxial rotating boiler. The boiler consisted of U tubes and the act of rotation separated the steam bubbles from the water as in a centrifuge and a high rate of steaming was obtainable from the small boiler without water drops being carried over in the steam. The exhaust steam was condensed and the water fed back to the boiler. The attraction of the engine was its comparative silence, but unbeknown to its inventor the two sides in the coming World War Two already secretly had radar and this perhaps was why no real interest was taken in the patent. One could go on to the subject of water injection being used to boost internal combustion aircraft engines, but steam's place in the history of heavier than air flight is secure without that.

Much of this I already knew, Mick unwittingly prompted me to find out the rest, for which I thank him.

Murray Wilson

Fun in the Sun, again. Editor Dave Harding with Stardust Special Old Timer in Eloy Az . Can this be the perfect place and time; Mid January 2013? Yep, it looks like this in every direction; Modeling Paradise?

Widener University Students SAE Aero Team Make Progress

Scene at the Indoor

A random look at our active Winter scene.

Propstopper's February Freeze Fly at CA Field





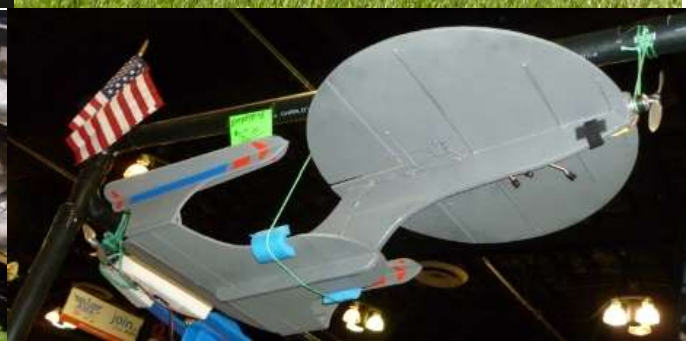

Jeff Frazier, Phil Whittingham and Brian Williams braved the cold and snow covered field for a fine day of flying on a calm Sunday in early February. Following the event Jeff advised our members to enter only if you have a 4WD vehicle!

The AMA Expo 2013, Ontario California

For the last five years my SoCal stay with my daughter in Pasadena includes doing my duty by manning the SAM stand at the AMA Expo. Of course this means I have a good deal of time to wander the show, look at the new stuff, take some pictures, chew the fat with old friends and survey the state of the hobby/sport.

The show consists of four parts; a trade show where most major companies show their wares, two flying areas, one for indoor RC models and the other for the lighter, mostly free flight models where attendees are also encouraged to build models on the spot. There are a series of talks and lectures by leading lights in the hobby, and finally there is a swap meet, but since this was only on the Saturday I was unable to "review" this area which in turn means I kept more money in my wallet. Oh, make that five areas because they also feature a Concours event where people show a huge variety of models. Oh, oh, yes, there are usually a whole passel of "Show Specials" and I am sure there were many this year however, for some unusual reason I bought nothing!

This year the trend to RTF airplanes rather overwhelmed the show with the possible exception of Flat Foamy kit vendors. So here, in no particular order are some pictures of things that caught my attention.



No Hobby King though.


Mini Profile SR-71


Powered By
NEUMOTORS
High Performance Brushless Motors
WHEN 2ND PLACE IS NOT AN OPTION
SPECIALS
NEW GEAR DRIVES

RC flying area above. Hot hands all day long.

Right, this guy continually builds and flies models made from soda straws. Very clever guy. Take the challenge Phl W?

Concours models in the background.

PROPSTOPPERS TAG SALE AT THE FEBRUARY MEETING

TUESDAY 12TH FEB

MIDDLETOWN LIBRARY

Bring your stuff with price labels ready to sell!

Membership Renewal For 2013

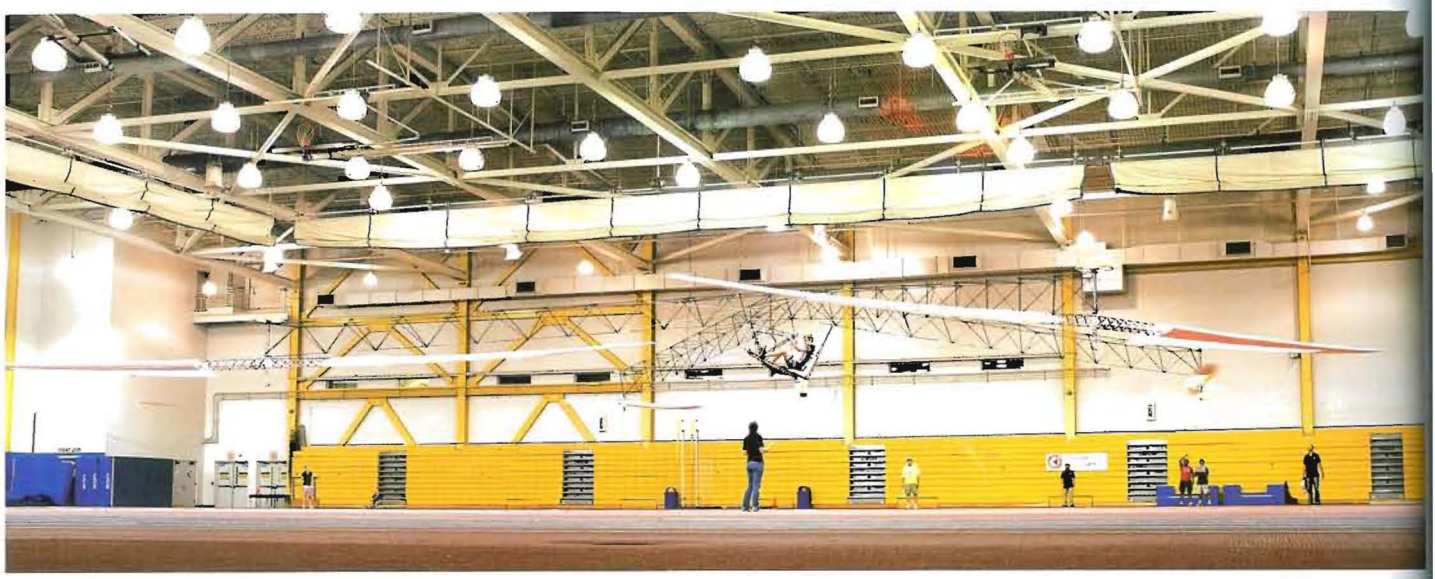
Membership renewal for 2013 is now required. You can renew by mail or at the club meeting in February.
Don't loose your club privileges!
Bring cash or check and your AMA card.
Dues are $60.

Ray Wopatek
1004 Green Lane
Secane, PA. 9018
Please enclose a ***copy*** of your current
A. M. A. Membership card,
And Please, Please enclose a
Stamped ***self- addressed envelope.***
Ray Wopatek Membership Chairman

The following article on the current status of Man Powered Helicopter developments has been extracted from Vertiflite, the magazine of the American Helicopter Society.

Human Powered Helicopters Rise Higher

By Benjamin Hein and Mike Hirschberg



The University of Maryland's Gamera II has reached a height of 9.4 ft (2.9 m) in the AHS Human Powered Helicopter Competition. The AHS banner can be seen in the background. Photo by Andrew Rivers, Essential Eye Photographics.

The year 2012 has proved more significant in the race for the AHS Igor I. Sikorsky Human Powered Helicopter prize than any year since its inception in 1980. Maryland has made leaps and bounds with their flights of the Gamera II, and two new competitors have entered the race from Canada and California, respectively. Team AeroVelo is fresh off success with a human-powered ornithopter, and the Neil Saiki-led NTS Works team has strived to have achieved both the first and the final successful flights in the AHS human powered helicopter competition.

Gamera Breaking Records

As described in the July/August 2012 Vertiflite, the University of Maryland unveiled their Gamera II aircraft and flew it over the course of several weeks in June. This aircraft set an NAA-certified record of 49.9 seconds of flight endurance, piloted by Kyle Gluesenkamp. In late August, Maryland was back testing with a new vehicle, now called Gamera II XR (for "extended radius"), with all new rotor blades and transmission system enhancements.

Each step of the way, from Gamera I to Gamera II and Gamera II XR, significant improvements have been made to the vehicle. This was in no small part due to the guidance and support given by the Aerospace Engineering department at the UMD Glenn L. Martin School of Engineering. Ph.D. student William Staruk said that at every stage of the competition they knew that it was potentially the last chance they would get to fly. However, each time

Seconds after this photo was taken, Gamera II broke up in flight. Fortunately no one was injured. Ph.D. student Elizabeth Weiner's fingertip is 7 ft 2 inches (2.2 m) high. Photo by Earl Zubkoff, Essential Eye Photographics.

flight attempts were undertaken and such significant improvements in altitude and duration were made, that it was virtually impossible for students and faculty to say "no" to continued research and development of the Gamera vehicle.

What was the recipe for the latest round of record breaking flights? Science and cycling. The Maryland team has continued improvements in the drivetrain and optimization of the vehicle for the power-to-weight ratio of the pilot-vehicle-system, zeroing in on 140 lb (63.5 kg) individuals. These pilots are capable of generating approximately 8 Watts/kg, or an impressive 510 Watts (0.68 hp) for 60 seconds.

The basic foundation of the Gamera aircraft family began with testing of isolated rotor systems. This gave Maryland the insight into basic design changes to the rotors to minimize the power required for a large, low-Reynolds number rotor in extreme ground effect. The research surveyed different low-Re airfoils in order to find a combination of high stiffness and good performance for their rotor blades. The team has also conducted extensive research on several factors of human power generation that culminated in the refined hand-foot crank system on all the Gamera aircraft. This research set the stage for a string of success over the past two years. Further improvements were made to the Gamera II, for the August flights, based on extensive calculation, testing and refined manufacturing processes.

For the Gamera II, Maryland students revisited their multi-disciplinary optimization of airfoil and blade structure. These efforts have yielded in a lighter, stiffer and longer rotor blade. As indicated in Maryland's published papers, the first flights in June of Gamera featured a rotor radius of 6.5 m (11.5 ft). However, the second round of testing included a major diameter increase to 7.2 m (23.6 ft). With the increasing size of the rotor system, the Gamera vehicle gained roughly 12 lb (5.4 kg) between the June and August Gamera II vehicles. These design changes predicted a net benefit for pilot workload: a 12% reduction in the power required to hover.

Neil Shah and Jiho Yeom are part of the rotor fabrication team. Seven additional spare blades were stockpiled next to them.

Maryland's engineering effort has obviously paid off. After only a few flights, the vehicle hover endurance was increased dramatically to 65 seconds. Following the endurance expansion flights, the team quickly moved on to breaking altitude records, culminating in a not-yet official altitude of over 9 ft. Measurements showed the pilot's seat was at 9.4 ft, while the vehicle was rolling slightly so that one of the landing posts might have been slightly lower. The longest flights so far have been held by student pilots Colin Gore and Kyle Gluesenkamp. The altitude record has been captured by Henry Enerson. AHS members were on-site to witness the event. Unfortunately, the vehicle sustained significant damage from several hard landings; fortunately, no one was hurt.

As of October, these are the pilot statistics for Gamera II flights, courtesy of Ph.D. candidate Ben Berry:

Colin Gore: totals of 39 flights, 903 seconds and 8.6 ft (2.6 m) maximum altitude. The pilot of the unofficial 65 second endurance flight.

Kyle Gluesenkamp: 24 flights, 673 seconds, 7 ft (2.1 m) max. Kyle holds the official record of 49.9 seconds from June. Kyle also performed a 70 second tethered flight in early August, the longest flight to date.

Henry Enerson: 21 flights, 405 seconds, >9 ft max. Henry's best endurance flight is 55 seconds.

Dennis Bodewits: 13 flights, 259 seconds, 2.5 ft (0.8 m) max.

Maryland student Judy Wexler was the sole pilot who achieved flight with Gamera I. During 2011, she had made a total of 6 flights totaling 37.8 seconds in the air, reaching a maximum altitude of about 12 inches (0.3 m).

While they have nearly the right combination flight parameters to win the prize, it will take further refinements to simultaneously achieve the 3 m altitude and 60 sec endurance flight. To date, the team has accomplished all this without a control system. As a result, drift remains the major challenge for the Maryland team. With both the hands and feet employed by the pilot, it will be tricky for the Gamera team to develop a control system that allows the pilot to control the vehicle. Maryland has gone back to the drawing-board and plans to fly again in November. The rotorcraft and human powered vehicle community must wait for follow-on flight testing to see the next round of upgrades to Gamera.

Atlas First Flight

Most followers will know that another serious team has entered the fray to compete for the AHS Igor I. Sikorsky HPHC prize. AeroVelo ("flying bike") is led by two individuals, carried by a team of volunteers, engineers and others, and supported by friends and family. The team also has a long list of supporters that have donated hardware and money to their cause, including through a fundraising campaign through Kickstarter.com.

Unlike most other human-powered helicopter teams, AeroVelo's pilot Todd Reichert is also one of its chief engineers. Cameron Robertson is the other chief engineer, an indispensable asset when Todd is piloting the aircraft. With many lessons learned from their successful design, build and flight of a human-powered ornithopter AeroVelo exemplifies a tightly knit, efficient team of engineers and mechanics. In 2011, the AeroVelo team also smashed the

AeroVelo's Atlas is the largest human powered helicopter to have ever flown and the first one in Canada. AHS photo.

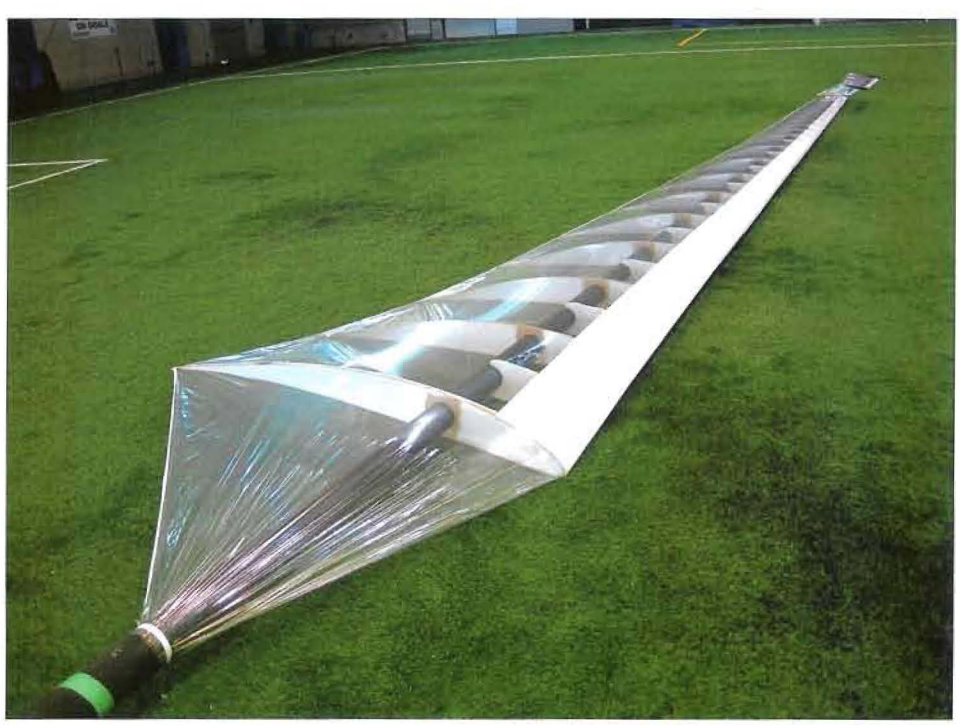
collegiate human-powered bicycle speed record, achieving 72.6 mph (116.9 km/hr).

Like the Nihon University Yuri I tested in the 1990s and the University of Maryland Gamera, AeroVelo is working on a quad-rotor HPH. AeroVelo's vehicle has been appropriately named Atlas, as its dimensions are impressive. Each rotor is 20.4 m (66.9 ft) in diameter, with a maximum dimension of 58 m (190 ft) on a diagonal. Their circular spars are both impossibly long and at the same time unexpectedly light. The blades have a non-linear taper that arguably give the rotor an enhanced efficiency over those with linearly tapered blades. The airframe system is also an incredibly light carbon tube and polymer line truss. Todd pedals on a heavily modified Cervelo carbon bike frame suspended with the same polymer at the center of the truss. The transmission is driven by polymer line to four custom Kevlar-wound spoke wheels at the center of each rotor.

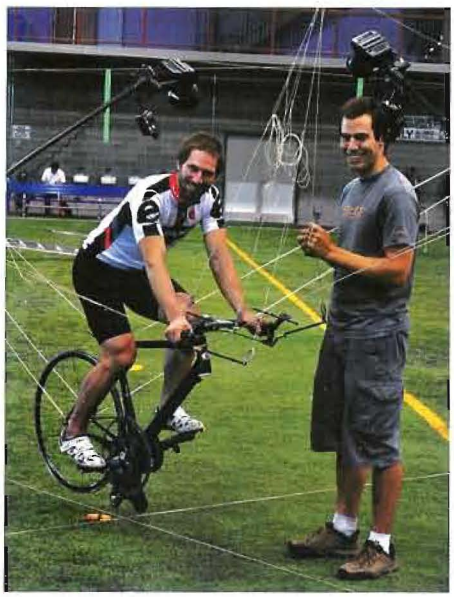
The AeroVelo engineers also conducted extensive analysis on their design. A multi-disciplinary optimization of structural weight, geometry, and aerodynamic performance was conducted with many design variables. Cameron indicated that a lifting-line and wake model was used to study the rotor aerodynamics with details of the root and tip flow considered in their design. At 120 lb (54.4 kb), the Atlas is nearly in line with Gamera I's empty weight. Ultimately, the power required by the pilot to hover is a combination of weight and disk loading, as well as mechanical and aerodynamic efficiency. Based on measurements from the foot-only pedal system, Todd has demonstrated an incredible 770 Watts (1 hp) of power output for over one minute, which is theoretically enough to meet the endurance specification of the competition.

Testing of AeroVelo's Atlas HPH was conducted inside the Ontario Soccer Centre in late August/early September. At the end of each flight day, however, the entire aircraft was disassembled and stored in their trailer around back. This feat was accomplished in as few as 20 minutes, when flights went late into the afternoon. The Gamera is similarly designed for modular deconstruction, a painful compromise for vehicles so sensitive to the performance-weight-strength balance.

The AeroVelo team has dared to think big, and the results speak for themselves. After a few days of shaking out their design, the Atlas flew for an estimated 15 seconds. This statistic puts the Atlas in the top three teams of unofficial endurance records in the history of human-powered helicopter flight. The first being University of Maryland, with its current record of 65 seconds. To put this in perspective, the second best endurance time by any HPH team was the Nihon University flight of the Yuri I at 24 sec (unofficial). This achievement only occurred after years of research and development, and in the second round of testing. However, credit must be given to the Japanese



AeroVelo rotor blade. The taper is not an illusion of the perspective. The wingtip canard is a control surface connected to levels on the handlebars of the bike. Photo by the author.



Todd Reichert (left) and Cameron Robertson are both the brains, and Reichert is the brawn in AeroVelo's human powered vehicle efforts. The team has made extensive use of polymer line for strength, rigidity and even for control lines. AHS photo.

team for laying the groundwork for the success of teams to follow. Similarly, the official flight endurance during the first round of testing for the Maryland – with Gamera I – was 11.4 sec.

AeroVelo does have one distinct advantage over the competition at this point in time. Their vehicle has amenities for a mechanical differential pitch and roll system. The rotor blades have a variable pitch flap, integrated into a canard style wing-tip. This system is expected to enable the aircraft to stay inside a 10 m by 10 m (32.8 ft) square box when significant heights are achieved. While this team has also had their fair share of mechanical failures and fixes on the vehicle, AHS anticipates another round of testing in the following months, with likely a significant improvement in performance.

Upturn First Flight and Passing of the Torch

The other major news in the race to win the AHS Sikorsky prize, also described in the July/August Vertiflite, was the first flight of the Upturn. The aircraft and pilot Robert Pasco achieved an impressive unofficial 10 sec flight, at 2 ft (0.6 m) of altitude on June 24, 2012. The flight was terminated when he became exhausted and the aircraft was caught by a safety line attached to the ceiling above. Robert had competed in a bicycle race earlier in the day in addition to three other flight attempts.

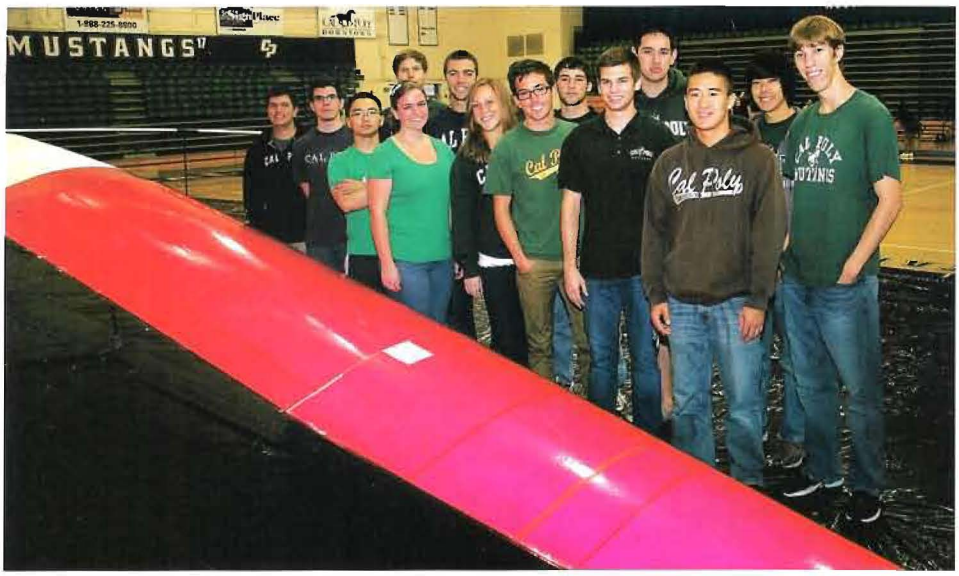
During one of several late August tests, Atlas takes flight. Aeroelasticity, trimming the four rotor systems and gyroscopic precession were all interesting challenges. AHS photo.

Neal Saiki had been part of the 1989 student team at California State Polytechnic University (Cal Poly) in San Luis Obispo, California that built the first human powered helicopters to lift off the ground, culminating in "Da Vinci IV" – it flew for a record 8.6 seconds and a height of 8 inches (20 cm). Saiki's team had achieved the first successful flight in the AHS Sikorsky Competition and hoped than the Upturn would also capture the AHS HPH Prize. However, NTS Works has now turned its focus back to its core business. Nonetheless, the company has generously donated the Upturn to the California Polytechnic State University (Cal Poly) in San Luis Obispo, California for continued development, so Saiki's Upturn may still achieve that goal. Under the guidance of Prof. Kurt Colvin, the new team has begun to consider the tremendous challenges of the AHS competition and approaches to tackle them. The unique propeller-driven Upturn promises to show even better endurance in the future in the hands of the university. It will be interesting to see if they can get the weight out, increase efficiency and/or increase their diameter to beat the quad-rotors to the prize.

2012 – The Year of the HPH

Three human powered vehicle teams have flown in the past year, and the boundary of human-powered VTOL flight has been pushed beyond the 60 second mark. But even with the incredible advancements seen in human powered helicopter technology in the past year, the challenge of the AHS Igor I. Sikorsky Human Powered Helicopter prize still remains unclaimed after 32 years. However, unlike years past, it is safe to say that it will not stay that way forever.

Upturn in the air with pilot Robert Pasco.



Cal Poly has taken over the Upturn. An organization meeting was held in September. Cal Poly Photo.

Significant Challenges Remain

Much as in the early years of the development of the combustion-powered helicopter, weight and control remain significant challenges to human-powered helicopters. With the harsh limitation on power-available to the vehicle by a single human for 60 seconds, the HPH designers must refine their designs even further to eliminate weight, while maintaining stiffness and strength. In hover, conventional helicopters are driven by induced power, which is a function of weight and rotor disk area. If you consult helicopter performance references, you will find that the relationship is more strongly weighted by weight than disk area. So designers must find and expand the limit of practical rotor radius, while maintaining or even lowering the vehicle weight, which is the more powerful parameter when it comes to power-required-to-hover. As we have seen from the historical design solutions, this limit is governed by blades stiffness, airframe strength and the size of the facility in which it can be tested.

The spirit of the competition is to design, build and fly a vehicle powered and controlled purely by a human. Governing the use of controls is strongly limited by the regulation of stored-energy. Past committee chairs were consulted during negotiations with active HPH teams as to whether stored battery power is permissible. It was concluded that use of chemical energy would violate the spirit of the rules, as they were originally written. While clarifications to the rules allow the use of batteries, in systems not contributing to the rotor system power available, these will be prohibited following August 2013. If needed, competitors will have to find a way to generate electrical power derived from the human pilot.

It was fairly obvious from video footage of Gamera's flights that any small disturbance leads to uncontrolled drift, especially as the vehicle gained altitude. Credit must go to the AeroVelo team for pioneering a unique system to control the vehicle's pitch and roll during flight without the use of batteries. Similarly, systems are being developed for Gamera and Upturn to control the vehicles' attitude. It is unlikely that the 10 x10 m flight envelope can be maintained without a control system. AHS looks forward to seeing how novel systems can be employed to add the final leg of the trio of core regulations.

About the Authors

Ben Hein is a senior engineer at Sikorsky Aircraft Corporation, currently investigating active rotor technology. Ben holds patents in helicopter design and rotor system design. He has been the AHS Igor I. Sikorsky Human Powered Helicopter Committee chair since May 2012.

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Scan this QR Code or go to ***www.vtol.org/hph-news*** *to see the latest news and videos in the AHS HPH Competition!*

Successful Human Powered Helicopters in the AHS HPH Competition

Vehicle	Da Vinci III / IV	Yuri I	Gamera I	Gamera II	Gamera II XR	Upturn	Atlas
Team	Cal Poly U.	Nihon U.	U. Maryland	U. Maryland	U. Maryland	NTS Works	AeroVelo
RotorType (# Blades/Rotor)	Single MR, Propeller (2)	Quadrotor (2)	Quadrotor (2)	Quadrotor (2)	Quadrotor (2)	Single MR, Propeller (4)	Quadrotor (2)
First flight	Dec 1989	Dec 1993	May 2011	June 2012	Aug 2012	Jun 2012	Aug 2012
Rotor diameter	100 ft / 30.5 m	33 ft / 10 m	42.6 ft / 13 m	42.6 ft / 13 m	47.2 ft / 14.4 m	85 ft / 25.9 m	66.9 ft / 20.4 m
Max dimension	100 ft / 30.5 m	~ 80 ft / 24.5 m	105 ft / 32 m	105 ft / 32 m	115 ft / 35 m	85 ft / 25.9 m	190 ft / 58 m
Empty weight	97 lb / 44 kg	83 lb / 38 kg	106 lb / 48 kg	76 lb / 34 kg	82 lb / 37 kg	95 lb / 43 kg	120 lb / 54.4 kg
Max endurance	8.6 sec	19.46 sec	11.4 sec	50 sec	65 sec	10 sec	15 sec
Max altitude	8 in / 20 cm	8 in / 20 cm	1 ft / 30 cm	3.5 ft / 1.1 m	9 ft / 2.7 m	2 ft / 0.6 m	1.6 ft / 0.5 m

n/a = not available