

SAE ARIZONA • NEVADA SECTION

April 2007

MEETING: APR 19

Section Web Site: www.saearizona.org - Sign up for your newsletter on our website.

HIGHLIGHTS...

- Unmanned Little Bird
- Coffee Talk - SAE @ ASU
- Message from the Chair

- Recap of March Meeting
- Speaker's Biography

- Unmanned Little Bird cont.
- Math and Science Fun Fest
- A World in Motion

Dinner Presentation...

Unmanned Little Bird by Dino Cerchie

The Unmanned Little Bird program is being developed as a low-cost, high performance technology test bed that could also fill near-term, military applications for the vertical lift Unmanned Air Vehicles (UAVs) in the field. The program has been executing a simple approach to create a very capable unmanned aircraft.

(1) Start with the highest performance aircraft in the size and weight class you are interested.

The program used the Boeing developed A/MH-6M helicopter that has a lineage back to the OH-6A, the Vietnam era helicopter that was noted for its crisp handling, multi-mission capability and a ruggedness that let many pilots walk away from what should have been their last flight. The OH-6A and its variants up to the current A/MH-6M, which is currently operated by 160th Special Operations Aviation Regiment (SOAR), still hold many turbine engine helicopter records for its weight class from 1102 to 3858 pounds (500 to 1500 kg) including:

<u>Distance without landing:</u>	2,213 miles
<u>Altitude in level flight:</u>	26,447 feet
<u>Speed over a straight 15/25 km course:</u>	149.3 knots
<u>Time to climb to 6,000m (19,685 ft):</u>	6 min 34 sec.

The aircraft also holds another 10 speed and altitude records recorded by the Federation Aeronautique Internationale beyond the ones noted.

No time, cost or effort has been applied to the airframe, drive train or subsystems because it's not required. The team has concentrated on UAV technologies from the first day to today. There is a growth path for these systems to support the fielded manned fleet that the unmanned variant can incorporate as they become qualified for use.

(2) Leverage as much existing technology and hardware as possible for the aircraft.

Every new helicopter design suffers from the same problem; no one wants the basic aircraft. Users only want the capabilities that can be added to the aircraft. The aircraft is just a means to get the capability where it is needed. The Unmanned Little Bird approach offers the user the complete set of FAA and mil-qualified kits, options and capabilities instantly. This is significant since capabilities development can easily equal or exceed the cost of the initial aircraft development. The auxiliary fuel tanks, the weapons plank and everything that attaches to the plank are good examples of this.

Even for the new UAV specific hardware, very little has been developed from scratch for the Little Bird UAV program. The actuators are part of a three-axes, partial envelope FAA approved autopilot system that were extended to a four-axes, full envelope system for this aircraft without changing the actuator design. The flight control computer is the same design and architecture used on previous AH-64 IRAD programs that will allow growth to the MCAP avionics architecture and the inclusion of SoSCOE for seamless communication between the many applications on the aircraft and external to the aircraft. The avionics development test rack was hardware used on previous IRAD programs. The Ku-band TCDL system was an off-the-shelf solution developed by L3

Unmanned Little Bird, by Dino Cerchie, continued on Page 3.

Coffee Talk - SAE @ ASU

The student chapter of SAE at ASU is currently building a Formula SAE race car, and will be competing at the Formula SAE West Competition in California in June. Members of the team will be speaking about design objectives of the car, and problems they have encountered along the way. If possible, ASU will bring its rolling chassis to the meeting to show before or after the meeting.

DATE	TIME	LOCATION	COST With Dinner	Presentation Only	
Apr. 19	Social	- 6:00 pm	Hilton Phoenix Airport	Members - \$22	\$10
	Dinner	- 6:30 pm	2435 S. 47th St, Phoenix-85034	Guests - \$27	\$10
	Presentation	- 7:30 pm	480.894.1600	Students - \$10	no charge
RSVP by 10:00am Tuesday April 16.			Call Donna Miranda: 602.364.7456		

Message from the Chair

Is it April already? This year is moving fast and we only have a few presentations left before our summer hiatus. I hope you'll be able to join us for an upcoming presentation. I learn a lot in each meeting - either through networking with attendees, a guest or the speakers presentation.

In March, Hal Heule from US Airways gave us an excellent presentation and unique insight into the corporation. While Hal is relatively new to our section, he brings years of engineering experience and expertise. I'd like to thank Hal for taking time out of his busy schedule and filling in for a previously scheduled presenter who was unable to attend.

Speaking of cancellations, you may have noticed that we've had some changes to the last few scheduled presentations. While we work diligently to plan these events, circumstances often require us to be flexible and act quickly, when circumstances change. I thank all the board members who've helped throughout the year to find presenters and coordinate our events!

Don't miss the next meeting - we'll have an update from the nominating committee and an excellent presentation from the Boeing company.



Dave Vasquez, Section Chair

Dave Vasquez
Section Chair

Recap of March Meeting by Dave Vasquez

The section was honored to have the Senior VP of Technical Operations and Safety from US Airways, Hal Heule, present this month. Hal provided a very informative overview of the airlines operations and the merger between US Airways and Phoenix's own America West.

From 2001-2005, the airline industry faced some challenges - mainly a recession and the SARS epidemic. As a whole, the industry lost approximately 35 billion dollars during this period, forcing it to restructure in order to survive.

Airlines started to look at combining resources, and thus reduce capacity. America West made a bid for ATA Airlines, but lost out to SW Airlines, followed by an attempt at US Airways - which was successful.

Hal outlined the three major phases in combining the resources of two airlines. They are Business scheduling/account/marketing, operational integration and merging labor forces. US Airways and America West will combine under one operating certificate on or about June 1, 2007.

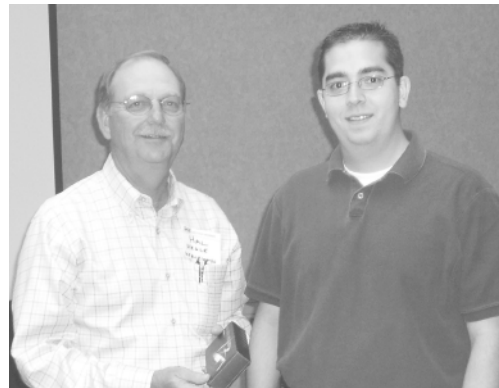
The US Airways name was selected since US Airways

had a larger operation, both in the US and abroad - thus allowing the airline to keep better name recognition. 2005 provided to be one of the most challenging years for the combined company, but by 2006, they were the most profitable large network airline in the industry.

Servicing over 200 cities and 52 international destinations, the fleet of aircraft is diverse. It's composed of 13 different aircraft models, with a total of 350 total aircraft. US Airways has a subset of aircraft that service their express fleet, which is comprised of 309 total aircraft. From flight operations to customer service, US airways currently has 35,000 employees.

Finally, Hal focused his presentation on the airlines organizational structure and operations. Broken into 8 groups, each had an integral part in contributing to the companies success.

From an engineering perspective, they undertake responsibility for modifications and installation of new hardware, reliability, performance configuration management and product development/selection.



Hal Heule (left) and Dave Vasquez (right).

A few interesting facts I learned:

- (1) A significant portion of the aircrafts are leased by the airline industry.
- (2) Each aircraft have FAA type certificates, specifying the certified flight configuration. As a result, any change to the aircraft must be approved. Because the FAA must certify each change, the resources required to approve every change is tremendous. Thus, they rely on dedicated engineering representatives that work for the airlines, under guidance from the FAA. One obvious example was trying to get the same model aircraft, across the fleet, to have the same number of seats in each plane. To change seat configurations requires approval, but in this case, the dedicated engineering representatives can approve the change.
- (3) Airlines have good working relationships with the FAA, original equipment manufacturers and engineering to ensure mechanical safety of the aircraft.
- (4) For those that attended the presentation, we were given an exciting sneak peak at some upcoming changes at the airline, but we aren't allowed to print any of the detail!
- (5) In closing, Hal said that engineering "demands strong technical talent to comply with a complex operating environment."

Thanks Hal for taking time out of your busy schedule to give us an inside look at the airlines!

DINO CERCHIE

Dino Cerchie is the Unmanned Little Bird program manager overseeing the development of the A/MH-6X manned / unmanned concept helicopter.

Cerchie was the Test and Evaluation team lead for Boeing's commercial helicopter division. He was also the lead handling qualities engineer for the commercial helicopter division prior to it split from Boeing in 1999 that included the MD 500E, MD 530F, MD 520N, MD 600N, MD 900 and MD902 aircraft. Prior to his work in the light helicopter division he was an electrical flight controls engineer on the fly-by-wire AH-64 Apache helicopter program in the late 1980's. Cerchie started with McDonnell Douglas working the preliminary design, wind tunnel testing and manned simulation in the Flight Technologies group on the C-17 program.

Cerchie received his undergraduate degree in Aeronautical Engineering from Rensselaer Polytechnic Institute and his Masters in Aerospace Engineering from the University of Southern California. He is currently finishing his PhD at the University of Arizona in the study of active flow control using synthetic jets. He has several published AIAA and AHS journal papers, and received the best paper award in aerodynamics at the AHS International Forum 61. Cerchie holds two patents in his work in aerodynamics and helicopter design.

Unmanned Little Bird cont.

that has allowed the Little Bird aircraft to communicate with other platforms with compatible TCDL hardware. The AH-64 TCDL equipped aircraft is one such system and has demonstrated multiple Unmanned Little Bird payload control from the AH-64 cockpit.

(3) Create a design that follows a different development path where risk can be controlled and the development accelerated.

UAV programs are developing the aircraft as the proposed finished product and then dealing with the question of how to test it. The Unmanned Little Bird program personnel realized that the largest cost for any program is the flight test development and qualification. The program objective was to develop a solution that could be safely tested, and therefore, control the risk. Many UAV programs are faced with airframe, drive system, rotor system, control law and communication issues all at the same time. This leads to extensive pre-flight analysis and ground testing that some times can never can never eliminate enough risk.

The Little Bird approach was to include pilots in the cockpit as an integral part of the unmanned program and then to make the UAV system act in parallel to the standard aircraft design so that at any time the pilot could revert back the basic aircraft with ease. The inclusion of the pilots in the development has provided not only the immense safety aspect, but also the unique cockpit perspective during flight profile development for various missions on this aircraft. It would be hard to development and incorporate autonomous airmanship into the design without this insight.

The control design approach and the pace it has allowed this program to maintain is what really sets this program apart from all others. As a vertical lift UAV the Unmanned Little Bird has over 450 total flight hours since it first flight in September 2004, 11 months after program go-

ahead, and over 250 hours of autonomous flight from take-off to landing, including the recent 20 minute unmanned flight at the Yuma Proving Grounds. This is close to what is considered typical flight-rates for an operational aircraft, not a prototype aircraft that has to flown in 14 demonstrations, in seven sites around the U.S., in nine different configurations. The safety pilot and reversion capability allows the program to advance at an accelerated rate compared to other helicopter UAV programs. The design approach also greatly reduces the risk during prototype hardware and sensor development, where these components can exceed the cost of the aircraft itself.

The future of the Unmanned Little Bird is unknown. However, its impact is already rippling through other programs within and outside Boeing

Math and Science Fun Fest by Dave Vasquez

Hosted at the Tucson Convention Center (TCC), the annual Math and Science Fun Fest is a program geared towards encouraging younger children to get interested in math and science. Each year, companies from around the state gather at the TCC, setup a booth, provide demos and answer questions. This year, the U of A SAEAZ mini-formula car was one of the exhibits from the University of Arizona. Many children, and adults, took the opportunity to explore the exhibit and appreciate the amount of engineering design and fabrication that went into the vehicle. As you may have read before, the SAE projects give students hands-on experience to utilize and expand their engineering knowledge. Attending an event like the Math and Science Fun Fest is another example of an SAE project helping youth learn and experience engineering first hand.



A World In Motion by Joshua Rudin

A World in Motion has been set up to enlighten youngsters about careers in science and engineering. Demand has been high--engineers are needed to go to local schools for a one-hour presentation. Please contact Joshua Rudin at 602.369.6487 for more information.

THE UNIVERSITY OF ARIZONA ANNOUNCES:

The 33rd Annual Reliability Testing Institute provides coverage of how to implement and manage the Design-for-Reliability process through testing, to implement an integrated Reliability & Maintainability Engineering management strategy, learn a practical approach to attain the high Reliability goals demanded nowadays, to improve our worldwide competitive posture by creating more Reliable products through thorough testing, to determine the useful life of our products, and more. Dr. Dimitri B. Kececioglu and 10 speakers from 10 sponsoring industries will take part in expertly covering the subject matter of this Institute. For more information, please the contact information below.

The 45th Reliability Engineering and Management Institute provides all engineers, particularly Reliability Managers and Engineers, Product Assurance Managers and Engineers in government and Industry, with a working knowledge of Reliability Engineering Theory and Practice, Mechanical Reliability Prediction, Reliability Testing and Demonstration, and more. Dr. Dimitri B. Kececioglu and 10 speakers from 15 sponsoring industries will take part in expertly covering the subject matter of this Institute. For more information, please the contact information below.

THE 33rd ANNUAL APPLIED RELIABILITY TESTING INSTITUTE
May 7-10, 2007

THE 45th ANNUAL RELIABILITY ENGINEERING
AND MANAGEMENT INSTITUTE
November 12-15, 2007

Clarion Hotel, Tucson Airport
6801 S. Tucson Blvd.
Tucson, Arizona 85706
520-746-3932 or 800-526-0550

Registration Fee: \$1500 Proceedings Cost: \$50

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Please peruse his website at: <http://www.u.arizona.edu/~dimitri>



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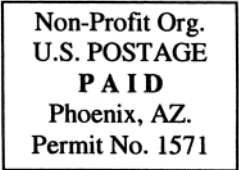
**ARIZONA-NEVADA SECTION:
Meeting Schedule**

April 19	- Unmanned Little Bird
May 17	- Global Warming
June	- No Presentation, Summer Hiatus

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