EDITORIAL – Drone Operations – it was just a question of time…

Drones… a rediscovered word… in the 21st century, and one that is subject with much consternation in the airspace we fly in. Synonyms will include, Unmanned Aircraft Systems (UAS), Remotely Piloted Aircraft (RPA), Quadcopters, amongst others. The versatility and ease of use of these machines with virtually no piloting skills, can lead to troublesome operations, with many amateur operators using these for aerial work and photography, without due regard or understanding of airspace management.

The potential for problems (not just conflict with aircraft traffic) is big. Regulation doesn’t wait to work out what the death rate is before creating rules, and the risk to public safety and privacy is significant. The paparazzi have been the first to jump on the UAS bandwagon, and they of course as we all know disregard rules as the norm.

It is unfortunate that Civil Aviation Authorities world-wide are not getting to sensible legislation fast enough on how to integrate UAS into civil airspace, the systems coming onto the market now are becoming very cost effective and easy to use, that virtually anybody can operate one, and this puts legitimate manned aviation at risk.

The question is how to speed up legislation, how to identify legitimate operators to work with, how to licence and train, and over arching how to educate Joe Public on the use of a drone, and the rules that would need to apply.

Drones are here to stay… they can do many of things better, faster and cheaper than full size aircraft, thus best we find a way to share the sky and respect each other.
ICAS 2014
29th Congress of the International Council of the Aeronautical Sciences (St Petersburg, Russia)
By Madeleine Combrinck

The International council of the Aeronautical Sciences (ICAS) was founded by Theodore von Karman in the mid-fifties as a non-government non-profit scientific organization. The aim of the council is to encourage the free international exchange of information on aeronautical research and technology.

ICAS currently serves as an international support organization to representative aeronautical engineering professional societies, affiliated societies and associated organization and through members in more than 30 countries.

The intention is to provide regularly scheduled events and publications that enable a better understanding of engineering science and practices and an improved level of cooperation among aeronautical engineering professionals from around the world.

The main objectives of ICAS are stated as:
- Facilitate the exchange of ideas, information and understanding about the body of aeronautics knowledge among the international community so that important research can proceed rapidly.
- Expose the international research community to challenges and issues through lectures by leading experts in aeronautics and its technologies.
- Engage young people in the global aeronautical community through special events and prizes.
- Create a vibrant international network that produces increased understanding, appreciation and tolerance among participants.
- Provide global recognition for key leaders and researchers in aeronautics through several prestigious awards.

The 29th Congress of the International Council of the Aeronautical Sciences (ICAS) was held in St. Petersburg, Russian Federation, on 7-12 September 2014. This was hosted by the Central Aerohydrodynamic Institute (TsAGI). The congress was very well organized and well attended by 725 delegates from 34 countries. The student contingent made of 154 of the total delegate number. The organizing committee received 983 proposals for papers and poster presentations of which more than 500 were published in the conference proceedings. Nine (9) South African citizens from Armscor, CSIR DPSS, the University of Witwatersrand, the University of Pretoria and South African Airways attended the conference.
The South African contingent was very well-received by their Russian counterparts and a number of discussions on possible combined projects was held. This bodes well for the future of Russian-South African collaborations especially since funding is available under the BRICS partnership agreements.

Such agreements are already in place between the Russian Foundation for Basic Research and the National Research Foundation. This will bring new opportunities for student exchanges between South Africa and Russia.

The tone of the conference was set by the ICAS President, Murray Scott and was centralized around international collaboration with a strong humanitarian component. The Russian-Ukrainian crisis was at the forefront of world news in the weeks leading up to the conference and lead to uncertainty if the conference would continue.

As such, Murray Scot sent out an email to the international aeronautical community stressing the importance of coherence during trying times:

As we are all well aware, our industry has suffered terrible tragedies in recent times in Mali, Taiwan, Ukraine, the Indian Ocean and elsewhere, with the MH17 disaster being the most appalling of all. The deficiencies and misuse of our aeronautical technologies, on which we work so hard for the benefit of humanity, are at the forefront of the World at this time. It is therefore even more critical than ever for the ICAS community to come together in the spirit of von Kármán to “facilitate collaboration in aeronautics”, as has occurred biennially ever since 1958.

It was evident that a number of people did cancel their attendance in protest in spite of the moving communication from the ICAS president. The conference did however proceed without visible difficulties as enough standby speakers were available to fill the presentation slots of the speakers that withdrew. A minute of silence was observed during the opening ceremony for all the souls that lost their lives in aircraft accidents as a result of recent events.

The Daniel & Florence Guggenheim Memorial Lecture was given by Prof. Sergey Chernyshev from TsAGI. He discussed the Aeronautics Challenges and New Opportunities for International Cooperation.

An overview of the early days of collaboration between Russia and the Western world was given. Two of the founding fathers of modern fluid mechanics, Ludwig Prantl and Theodor von Karman both collaborated with TsAGI from the late 1920’s to 1930’s. During the Cold War Russia, then USSR, was isolated from the West, but in spite of this collaboration with ONERA continued in the 1960’s.

After the end of the Cold War the relationship between ONERA and TsAGI continued and technical exchanges with the United States of America took place on a regular basis. Russian and China are continuing to host combined student workshops and facilitate student exchanges.
The International Forum for Aviation Research (IFAR) was established in 2008 and through this initiative Russia interacts regularly with, amongst others, Western counterparts to conduct research on global technical challenges such as emission and noise control, safety and security and efficient operations.

The current challenges that have been identified centres around the topics researched by IFAR. It is predicted that aerospace traffic will increase with 400% by 2030. Therefore subjects such as safety, emission control, noise reduction and accident reduction must be addressed in advance.

A roadmap was discussed for the next ten years. A significant amount of resources has been made available by the government of the Russian Federation for research and development activities related to the aerospace industry.

Over the next 10 years $6 Billion is available of which $200 million has been set aside for collaboration. The current topics for collaborations include, but are not limited to new aircraft configurations, new engine concepts, new materials and new sub-systems. Other areas address green emissions and low supersonic boom. The overall aim will be to develop technology demonstrators that will raise the current technology readiness levels of prototypes.

In light of the research activities planned, one can but hope for a speedy resolution of the ongoing conflicts in the Baltic region since the unrest is currently to the detriment of scientific progress and as such humanity.

After this lecture the conference proceeded with the sessions as indicated on the program. The social program was very well organized and left enough room for networking and appreciation of St. Peters burg culture, art and architecture. On the last night a conference banquet and delegates enjoyed that hospitality of the Russian people. A number of awards were handed out at the banquet. The top two places for best student awards went to South African citizens.

The student award for best student went to Marius-Corné Meijer from the University of Witwatersrand for his paper on Aeroelastic Prediction for Missile Fins in Supersonic Flows.

In this paper the development of a zero-order aeroelastic prediction method for plate-like structures in supersonic flows was outlined. Local piston theory used with computationally inexpensive aerodynamic methods was strongly coupled to a simple finite element code for plates to produce a partitioned-solver aeroelastic prediction tool.
The application of the prediction tool to the flutter of a cantilevered plate in supersonic flow was validated by computational fluid dynamics and by experimental data in literature. The zero-order prediction method was shown to produce accurate results for a fraction of the computational cost of high-fidelity analysis. A brief review of piston theory was also given.

Second place went to Elizna Miles from the Council for Industrial and Scientific Research for her paper on Optimal Control Surface Mixing of a Rhomboid Wing UAV. This paper presented an overview of the work conducted as part of the design of a control system for a miniature Unmanned Aerial Vehicle (UAV) with a rhomboid wing configuration. The techniques used to design the control allocation and mixing used on the UAV when flying it without artificial stability or control augmentation is provided.

The objective of the control mixing was to enable a pilot to operate the UAV as a normal model aircraft during flight testing and as a backup mode should any sensor failures occur later in the flight test program. Although this type of mixing would be straightforward on a conventional airframe, the rhomboid wing configuration has several unique characteristics that complicate the modelling and design process.

The resulting mixers also form part of the inner control loops for more sophisticated control modes such as stability augmentation and automatic flight control. The design process made extensive use of mathematical optimization, which is discussed in detail in this paper.

The highlight of the conference was most definitely when a special message recorded from the International Space Station was played to the delegates. The astronauts each recorded a short message wishing the success of the conference.

This message - ISS to Earth - brought a unique perspective to the delegates. Scientific research is not about an individual’s search for relevance in life. It is not about a research group’s search for recognition. It is not about a single nation’s search to maintain dominance. It is about a greater good and a better life for all human beings, present and future. One small step for man, one giant leap for mankind. Davai!

The top student awards went to Marius-Corné Meijer (1st place) and Elizna Miles (2nd Place), a real achievement for South Africans.
The Aeronautical Society of South Africa awarded the prestigious Neels van Niekerk award to Prof Japie van Wyk at a ceremony at the Nacht Wagt restaurant in the Overberg on Heritage day recently.

The Neels van Niekerk Award is bestowed on individuals in the South African Aerospace community who have made a significant contribution to Aerospace Engineering in their career.

The ceremony was held as part of the International Society of Air Breathing Engines Conference Board Dinner, a society that Prof van Wyk attended on behalf of South Africa as National member for 1976 until leaving the CSIR in 1991. He was instrumental in assisting with the drafting of that organisation’s constitution which was formally adopted in 1983.

Heritage day was the perfect occasion to celebrate Prof Van Wyk’s “Lifetime Contribution to Research and Education in the Field of Aeronautical Engineering”. Prof van Wyk has played a major role in creating the infrastructure and capabilities that characterise the country’s unique capabilities in the Aeronautical field. One of his first jobs at the CSIR was to manage the commissioning of the High Speed Wind Tunnel and he went on to take leading roles in support of the development of the XH-1 Alpha helicopter which led to the Rooivalk, ACE All Composite Trainer and the Apartment APA 350 gas turbine development as well as the funding, contracting and commissioning of the Transonic Medium Speed wind Tunnel at the CSIR.

These career achievements make him the South African equivalent of a Frank Whittle or George Lewis. After leaving the CSIR he continued to work part time at the then Rand Afrikaans University, something he had done since 1973 and joined the University of Johannesburg full time in 2000 to pass on his legacy to a new generation. To quote his CV: “Glory to the Almighty God for a rich, enjoyable and fruitful career. I would like to share the experience and knowledge with Engineering students and Engineering Universities.”

Prof Japie van Wyk was presented with a certificate and a trophy of the APA350 Gas Turbine commemorating his contribution by Dr Glen Snedden, the current national representative to ISABE (International Society of Air Breathing Engines) on behalf of the AeSSA and South Africa.
Western Cape Chapter
By Dr. Alan Nelson

A new member in the Western Cape joined, Frank Mclean who is also the Chairperson of the Western Province Model Flying Club, and will be involved in furthering young persons development in Aeronautics.

The Young Falcons Academy introduces learners to various fields in Aviation, including Air Traffic Control, Engineering, Flying, Navigation and Technology, and I have had the opportunity to participate in some of their activities at Ysterplaat AFB.

May I take the opportunity to congratulate the Ysterplaat team on the fine job you are rendering to these learners. I was particularly impressed with the neatness of their dress, the discipline manner in which they are performing in, and most noticeable, the enthusiasm with which they are undertaking their tasks.

Furthermore, the way in which Maj. Grobbelaar was presenting the OHS and Technical material, was very professional.

Finally, I had the opportunity to spend some time with Barry in the workshop. He has done a great job in making the workshop a clean and user friendly environment. Well done.
University of Johannesburg Awards Evening
By Colin Butler

The University of Johannesburg held their awards evening on the 24th of October.

I had the fortitude of adjudicating the posters made by students as part of their final year, and handing over the awards for best project & poster. Dr Anton Maneschijn now represents Aeronautical subjects at the University and supervised the project work.

The winners of the project award and poster went to Hlologelo Kekana and Kgotsso Rapusoane.
University of Witwatersrand Awards Evening

The University of Witwatersrand held their awards afternoon on the 20th of November 2014.

Dr Igle Gledhill was on hand to hand over the prizes on behalf of the AeSSA to two students, Suriah Subiah for the best Aeronautical Poster, and Matthew Yoko for the best Aeronautical Project presentation.
Hydrogen South Africa (HySA) Systems, The National Aerospace Centre, and Airbus to research use of fuel cells for commercial airliners

By Linden Birns

A new chapter has been opened in the quest to make commercial air transport more environmentally and economically sustainable, with the agreement by Airbus and South Africa’s National Aerospace Centre to jointly fund research by Hydrogen South Africa (HySA) into the application of fuel cells on airliners.

The initial three-year project, which will be undertaken by HySA Systems Competence Centre at its University of the Western Cape research facility, was launched in Cape Town on the 2nd September 2014.

With demand for air transport doubling every 15 years, the global airline industry will require nearly 30,000 new aircraft (over 100 seats) by 2032. Simultaneously, the dual factors of high jet fuel costs and industry commitments to halve 2005 CO2 emissions levels by 2050 are driving the search for alternative solutions to fossil-fuel based propulsion and energy sources.

With this in mind, Airbus has identified hydrogen fuel cells as a future, emissions-free substitute to small gas turbine engines called Auxiliary Power Units (APUs), which are used for generating on-board electrical power and heat while the aircraft is on the ground. Almost every airliner designed and built since the advent of jet travel in the 1950s, has been equipped with an APU, which is located in the tapered tail cone section of the rear fuselage. Replacing the fossil-fuel powered APUs with hydrogen fuel cells would help achieve the goals of emission-free and low-noise aircraft operation.

“HySA Systems Director, Professor Bruno G. Pollet, said that “although fuel cell technology for land vehicles has rapidly matured, the new research with Airbus and the National Aerospace Centre is aimed at gaining an understanding of how hydrogen fuel cells could perform over an aircraft’s service life while subjected to the harsh and rapidly changing climatic and environmental regimes that commercial jetliners operate in”.

Philip Haupt, Director of the National Aerospace Centre (NAC) said “hydrogen fuel cells technology is set to become a game-changer in aerospace and a number of other fields. This project provides global visibility of South Africa’s expertise in the field. In addition, by leading the project that will further the understanding and maturation of hydrogen fuel cell technology, South Africa will be able to place its
advanced manufacturing sector in a prime position to take advantage of the inevitable opportunities that will emerge”.

Besides emission-free and low-noise aircraft operation, fuel cells would reduce the overall weight of aircraft, leading to lower fuel burn and operating costs together with further reduced carbon emissions during flight. As by-products, hydrogen fuel cells could enable aircraft to generate their own water supplies. They would also have a safety benefit through their ability to generate inerting gas used to reduce flammability levels in aircraft fuel tanks and for suppressing any cargo hold fires.

Fuel cells, because they do not have any moving parts, are less maintenance intensive than conventional APUs. They could also potentially replace heavy batteries and conventional fuel tank inerting systems. In doing so they would reduce the weight and fuel consumption of fuel cell-equipped aircraft.

Airbus has already performed test flights involving fuel cells to power individual emergency power systems, the knowledge and technology maturation is still on its way to reach a level to permit the complete replacement of the electrical power systems with a multi-functional fuel cell.

The project with HySA Systems Competence Centre will go some way to closing that gap. It is being undertaken at postgraduate level and will identify the factors influencing fuel cell performance, ageing and monitoring and will then consider how these could be adopted for use in aircraft.

Airbus is the world’s leading commercial aircraft manufacturer whose customer focus, commercial know-how, technological leadership and manufacturing efficiency have propelled it to the forefront of the industry. Airbus’ modern and comprehensive product line comprises highly successful families of aircraft ranging from 100 to more than 500 seats.

About HySA
Hydrogen South Africa Systems Competence Centre is located at the University of the Western Cape in South Africa.

In a bid to increase South Africa’s research efforts in Hydrogen and Fuel Cell Technologies (HFCT) and create job opportunities as well as intellectual property rights, the Department of Science and Technology (DST) developed the National Hydrogen and Fuel Cells Research, Development and Innovation Strategy (Hydrogen South Africa, acronym HySA), a 15-year programme approved by the Cabinet in May 2007.
The department established three Centres of Competence under HySA, which are hosted by the country’s leading universities and science councils. The University of the Western Cape (UWC) is host to the Hydrogen Systems Integration and Technology Validation Centre of Competence (HySA Systems) at the South African Institute for Advanced Materials Chemistry (SAIAMC).

The HySA Strategy is being implemented in the context of the DST’s various innovation strategies, the Department of Mineral Resources (DMR)’s minerals beneficiation strategy and the Department of Energy (DoE)’s integrated resource plan and the Department of Trade and Industry (the dti)’s industrial development strategies. For further information about HySA, please visit: http://dx.doi.org/10.1016/j.ijhydene.2013.11.116

**About the National Aerospace Centre (NAC)**

The NAC was established by the Dept. of Trade and Industry in 2006 to engage with government, industry, academia and research institutions, locally and internationally, to promote competitiveness through research in South Africa’s aerospace sector and to develop skills and talent within it. The NAC is hosted at the University of the Witwatersrand and has a well-established national, continental and international footprint, with scholarship and research relationships with 9 local universities and over 20 domestic and international partner companies and sector mechanisms.

**Fuel Cell Theory In A Nutshell**

*Electricity Through “Cold” Combustion*

A fuel cell is a device that transforms chemical energy from a fuel – such as hydrogen – into electricity through a chemical reaction with oxygen or another oxidizing agent.

By applying such a “cold” combustion process, the only waste is water, heat and oxygen-depleted air – which would contribute to reductions in emissions and noise when applied aboard an airliner.

Water produced from this process also can be used by the aircraft’s water and waste systems, reducing the amount of water an aircraft would need on board. This would contribute to reduced weight, which could further decrease fuel consumption and emissions.
This year three Universities (Wits, Tuks & UJ) entered and two individualists also participated.

All the teams managed to complete at least one official 4-leg speed run with most of the teams completing all three attempts.

One pilot broke his model early in the competition and only managed to fly after the competition was officially concluded - and then he flew three very quick runs, the fastest would have placed him third overall.

Wits entered 4 teams each from a different academic year (2nd, 3rd, final and post-grad) which bodes well for their competitiveness for future events.

There was one entry from UJ who was unlucky not to complete all three attempts as he would have placed amongst the top competitors.

Tuks entered four teams and posted the four top scores winning the overall competition.

The standard of models was definitely higher than previous years and I have had an expression of interest from the Cape for a competition to be held there next year.

All in all a very successful day.
Pioneering Across Africa – Vintage Style
Submitted by Keith King, original article by Selene Brophy

Cape Town - The imagination is a powerful thing. And more often than not it is the source of splendid new ideas, dreams or plans.

Thinking about a solo mother-continent-crossing adventure in a biplane, called the Spirit of Artemis, conjures up scenarios laced with a typical Out of Africa filter. It also seems to have a nice, go-getter ring to it, don’t you think? A solo, biplane adventure! That is until I chatted to Tracey Curtis-Taylor.

This British vintage plane pilot will be undertaking the re-enactment of Mary Heath’s historic 1928 first solo flight across the African continent, from Cape Town to London, at the end of the month. But who was Mary Heath, you may be wondering?

Old-school cool
Well besides pioneering the above flight in an open-plane, let’s just say Mary Heath was so cool that Amelia Earhart bought her original plane from the flight.

The Cape Town To Goodwood website goes on to say that at the end of the 1920’s, Heath was one of the most famous women in the world, living a life of firsts.

“Having spent two years as a dispatch rider and an ambulance driver during the First World War, Heath pioneered women’s athletics in Britain (setting records in the javelin and the high jump in the process) and helped introduce women’s track and field to the Olympics.

Heath later switched her attention to flying and became the first woman in Britain to receive a commercial pilot’s licence; the first woman in the world to become an airline pilot and parachute from a plane; and then in 1928, the first person (male or female) to fly solo from South Africa to the United Kingdom.
I asked Curtis-Taylor which part of the journey she was most looking forward to and she enthusiastically recounts how Heath did a semi-controlled crash near Bulawayo, after suffering heat stroke due to pro-longed sun exposure and how she cannot wait to visit the crash site. Clearly, Curtis Taylor’s soft Sophia-Lauren-like features belie a somewhat determined inner-spirit.

Taking on this extreme journey, in a plane designed in the early 1900s, with a top speed of 95mph (about 150kph) and an operating ceiling of 10 000 feet (about 3 048m), seems second nature for Taylor-Curtis, who also happens to be the first female pilot based at the the prestigious Shuttleworth collection of Vintage Planes in Biggleswade, Bedfordshire.

Mary Heath is quoted as saying, “When we are very young, we look for adventure and long for it, but it is generally only when we are grown-up that we are able to have it - and often then do not make use of our opportunities”.

I started thinking about the sources of inspiration for young minds across Africa, in particular for young girls and their role models or adventure opportunities.

According to Curtis-Taylor, there are a lot of women across Africa, striding forward to improve women’s rights, going unnoticed. And she plans to meet with many of them and use the historic re-enactment to drum up awareness around what they are doing and inspire adventure. It is at this point that Curtis-Taylor starts waxing lyrical about the Downing Street initiative known as The Great Campaign to promote Britain overseas, one of the sponsors of her exciting journey.

She explains how Mary Heath’s pioneer route formed part of Britain’s great aviation history and in fact became the “Imperial airways route that opened up the continent for industry and empire”. I couldn't help thinking she really shouldn't mention too much of this in Bulawayo. The inspiration she was aiming to incite was a noble enough cause.

*Spirit of Artemis*

*A celebration of the pioneering aviators*
The run up to IASSA 2014 is in full swing, abstracts have been submitted and the programme has been released. Registrations are now also open, details to be found on the website www.iassa.org.za. Please advertise to colleagues and acquaintances.

IASSA 2014 will take place at the Irene Country Lodge, Irene on 24 & 25 November 2014.

IASSA 2014 is proudly convened by the Aeronautical Society of South Africa (AeSSA) and the Flight Test Society of South Africa (FTSSA) and incorporates the Technical Aerospace and Unmanned Systems Conference (TAUSC).

IASSA brings together the full spectrum of aerospace engineers, academics, researchers, students and industry leaders in South Africa and their international counterparts and provides a forum free of marketing presentations dedicated to the exchange of ideas and discussions of recent advances in aerospace engineering and related technologies from a scientific as well as an industrial applications point of view.

IASSA is the leading forum for the sharing of developments in aerospace technology and fostering networking and partnering.