# THE RIGHT STUFF!

## by Leon Liebenberg

→ *View from the C-130's rear-fresh air at 15,000 ft altitude, and a Cheetah fighter plane!*

***Grade 11 and 12 school learners were challenged in 2005 to generate their own designs of an unmanned combat air vehicle (UCAV). Seven adjudicators (i.e. five engineers; one school-teacher; and one representative from the sponsors) selected 20 finalists from 252 excellent entries, based on the learners' conceptual designs, a written essay on UCAVs, and academic and other achievements. As reward for these 20 learners' entries, they were invited to attend the prestigious four-day Space and Aviation Camp, arranged by the University of Pretoria's Department of Mechanical and Aeronautical Engineering, with assistance of five sponsors.***

The Camp comprised of the following unique activities:

• Lectures by world-renowned specialists where the following topics were covered: aerodynamics; aeronautical engineering; computational fluid dynamics; space travel; and space medicine. Each cadet was supplied with a set of course notes for future reference. Active lecture participation by cadets was demanded, and cadets were tasked with having to make calculations, notes, and to comment on various aspects covered during the lectures. Each of the lectures was complimented by a practical or by a tutorial session that included the following: subsonic wind tunnel demonstrations and airfoil flow analysis; problem-solving sessions using advanced computational fluid dynamics software, where the airflow around a real aircraft wing was computer-simulated; live engine demonstration of a Mirage F1 fighter plane, retrofitted with a more powerful Russian Mig-29 engine by South African aeronautical engineering giant, Aerosud. The cadets were also subjected to air pressures and low-ogygen levels experienced at 20,000-feet altitude, using a hypobaric chamber at the Institute for Aviation Medicine. The cadets were also spun in a centrifuge to an acceleration of three and a half G's, simulating stresses that a fighter pilot's body (and his/her) plane are subjected to during flying manoeuvres.

• Denel Aerospace Systems opened its doors for an entire afternoon to the cadets, and the intracacies of designing, manufacturing and testing an unmanned aerial vehicle (UAV) were explained by top engineers. The cadets had the unique opportunity to control the latest generation of locally manufactured UAV's.

• The South African Air Force's aircraft test and maintenance facilities were visited. Aircraft design and manufacturing details were provided, and structurally-stripped military planes were investigated. Cadets were also explained how vibrations are induced in fixed and rotary wing aircraft, and how these vibrations affect both the plane and the pilot (and passengers). Cadets participated in a demonstration of the effect of natural frequency on the body (specifically, one's eyes).

• The highlight of the 2005 Camp was the flight in a C-130 military cargo plane. The plane flew to Makhado and was intercepted by two Cheetah fighter planes. The two fighter jets simulated in-flight refuelling by flying extremely close behind the C-130 aircraft at an altitude of 15,000 feet. What made this spectacle so unique, was that the rear cargo door of the C-130 was opened to make for unobstructed viewing of the two following Cheetahs!

• Group working skills were also practiced, by dividing the group of cadets into two squadrons. Each squadron had to conceive, design, build, and test a pressurised air-water rocket, by customising two-litre plastic cooldrink bottles. The cadets also had to design and make their own devices to measure their rockets' altitudes; they only had one hour to complete each of the activities, and the results were amazing: simple sextants using protractors to measure altitudes; and rocket Coke bottles flying as high as 40 metres when pressurised to 800 kilopascal by a bicycle pump!

• The Camp culminated with the cadets receiving their wings from Major General Otto Schür, Director Combat Systems of the SA Air Force. The cadets also received certificates of attendance from the Head of the Department of Mechanical and Aeronautical Engineering, Professor Josua Meyer.

• Wesley Basson from Trinityhouse High won the High Flyer award for his overall achievements, i.e. the cadet that was rated as being the most probable to excel in an engineering career based on his/her academic, cultural, and other achievements, combined with the appraisal of the cadet's performance in the Space and Aviation Challenge activities: leadership during all Camp activities; participation in, and group-working skills during all Camp activities (including peer group appraisal); and design excellence of his/her initial unmanned combat aerial vehicle.

*For information about the Space and Aviation Challenge, log on to www.me.up.ac.za/space, or send an e-mail to Challenge coordinator, Professor Leon Liebenberg.*

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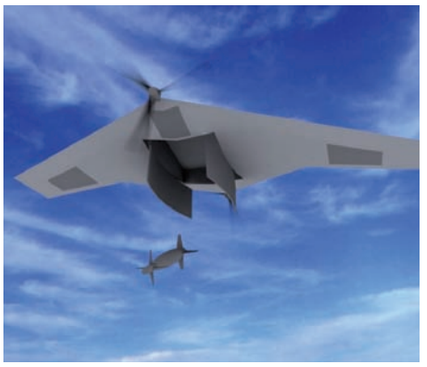
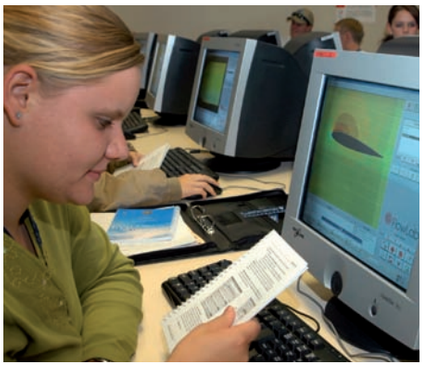
→ *PTO*

# 2005 SPACE AND AVIATION CHALLENGE


→ *The cadets got the opportunity to see how UAV's are designed and built, and also got the chance to control a UAV simulator.*

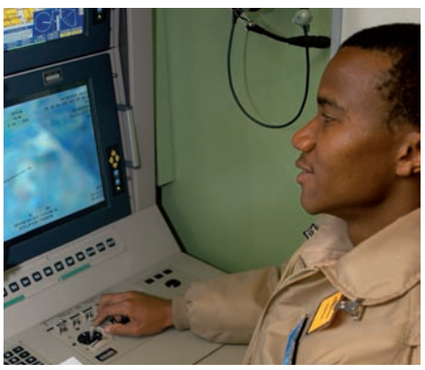


→ *Herman Hendriks of Waterkloof High in Pretoria designed this UCAV.*



→ *Janine Buitendag (Willowridge High) busy simulating the flow around a subsonic airfoil.*

Pictures by Leon Liebenberg



→ *At the controls of a UAV, Tsheko Ramantshane, student counsellor.*

→ *Tamsin Schoenst (Rand Park High) measuring a rocket's altitude with a sextant-like device that was designed and built in less than an hour.*


→ *Wesley Basson won the High Flyer award for overall performance during the Challenge, and for his apparent potential of being an excellent engineer. (Wesley here receives his wings from Major General Otto Schür).t Wesley is currently a first year mechanical and aeronautical engineering student at the University of Pretoria.*

→ *Cadets, prior to flight in a C-130.*

*"We are truly entering a new world in the new century. To meet the challenges, we need great minds and vivid imaginations. We need scientists and astronauts to make the journeys into space. We need writers and historians to tell the tale, and poets and dreamers to give us the inspiration for the trip. We need engineers to apply our new knowledge, to help us turn scientific data into everyday, life-enriching technology. The more we learn in space, the more we benefit from its exploration. Our journeys into space have already helped us live beter lives on earth."*
***- John Glenn**, NASA Astronaut*