ROYAL AERONAUTICAL SOCIETY
LOUGHBOROUGH BRANCH

9 June 2020
Group Design Project Presentations
Loughborough University
Department of Aero and Auto Engineering

Due to the Covid-19 lockdown procedures in place nationwide this report is based on presentations conducted on-line. RAeS Branch thanks the Loughborough University Department of Aero and Auto Engineering for their invitation to 'attend' as each team gave their presentation to tutors and were aware of our presence. As this was an assessment meeting we were not eligible to pose questions.

This procedure involved six teams who had worked on a diverse range of projects, As ever, innovative designs that were commercial or military, manned or unmanned, used a variety of power sources, and were operable in the earth's atmosphere or throughout the solar system. Each team had a 20 minute period to present their design, and to answer questions from the university's departmental staff. Had it been the scheduled joint meeting this report would usually refer to student/audience reactions. Only a brief account is possible here.

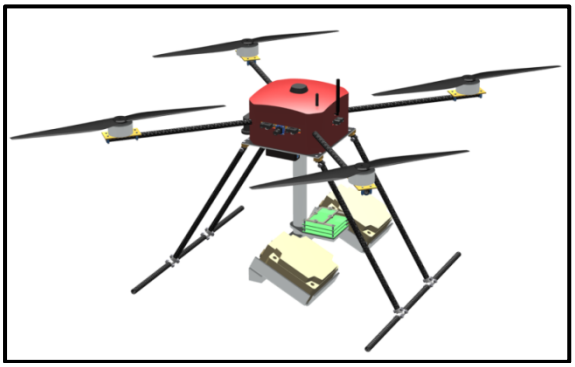
EVOLVE Human powered aircraft

The team described configuration, material and propulsion options, and ensured that the design was transportable. They promoted a balance of efficiency and practicality in their overall summary, and could claim, with good reasoning, a viable and credible design.

Design team description pre presentation

Human Powered Aircraft (HPA), the first of which flew in 1961, necessitate innovation and efficient design. The Evolve HPA is a new aircraft, designed to be manufactured at Loughborough University. The aircraft can be disassembled into sections with a maximum length of 6m, allowing it to be stored and transported in a standard Slingsby T21b glider trailer. The design of the Evolve HPA is sufficiently defined to begin manufacture immediately. The aircraft is capable of competing in the Formula Flight Competition it was designed for and is assessed as being capable of entering the Human Impulse Cup with little or no modification.

MAP MAKER Aerial Mine Protection and Clearance System



This was a practical assessment of a vital and dangerous task – mapping minefields using current and cost-effective technology. The team set sensible objectives and presented justified effectiveness criteria. Their solution is likely to win interest in industrial and military quarters.

Design team description pre presentation

Project Mine Mapper is a state of the art aerial mine detection and clearance system. A quadrotor UAV uses Sythetic Aperture Radar (SAR) and Hyperspectral cameras to detect landmines up to a depth of 20cm below the ground by identifying the materials and comparing to the surrounding soil. A UGV can then calculate and traverse a safe path through the minefield to spray a paint path for the human deminer to follow and mark each suspected landmine with a physical flag. This system improves the safety of traditional demining operations by remotely identifying targets from a safe distance whilst also increasing the area covered per year by 196%.

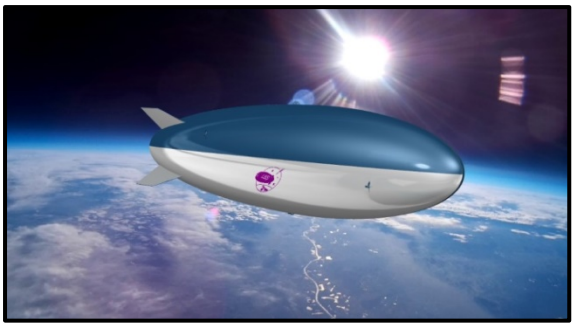
VAULT VA400 Short haul airliner

The specification is well justified, and in design terms has been addressed very well. They specified folding wing tips, and rightly focussed on airport compatibility as well as operational performance. As an on-looker with a finger in this pie for several years, to me this design has well balanced properties, and is a credible configuration (much better than any I have seen doodled!) Airports desire small stand sizes: i.e.: compatible with B737/ A320. I regard these students as well prepared for an argument that will rage in their careers.

Design team description pre presentation

Over the past 20 years, the aviation industry has seen an increase in the number of people travelling by air, both internationally and domestically. The increasing demand has created a need for low cost airlines as well as affordable flight fares, particularly over shorter distances. This has resulted in further aviation growth in regions previously less dependent on short haul flights, requiring an aircraft optimized for the high-volume traffic to capitalize on short intraregional routes. Vault Aerospace is proud to introduce the VA400, a low-cost solution that will ease congestion and eliminate the need for low capacity aircraft. It outperforms its long-range competitors by offering a lower cost per seat mile, at 10.74¢, without sacrificing crucial pressurization cycles. The VA400 is designed to specifically address airport congestion by accommodating a high capacity of passengers while maximizing the number of compatible gates and minimizing turnaround time

STRATOSPACE High altitude pseudo satellite

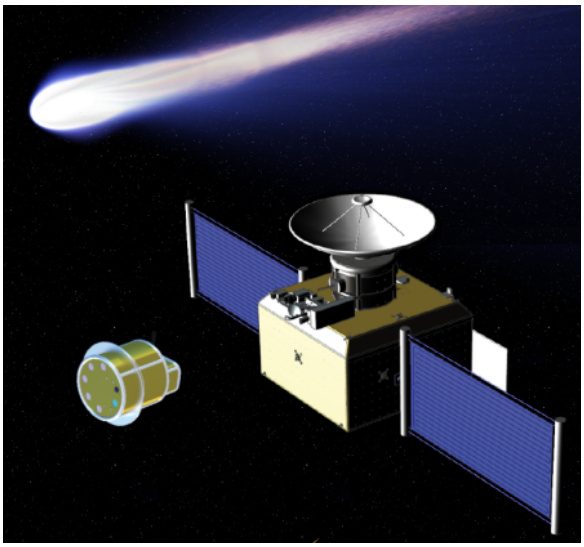


This is innovative - 'pseudo-satellite' is a new expression. As a substitute for a satellite it is justifiable on technical, economic and service requirements. The specification and detail discussed suggested this is a well-balanced technical design. It will be interesting to see if a project of this kind can compete on economic terms with the lower-cost satellite launch operations now being demonstrated.

Design team description pre presentation

The Loughborough Stratospace Horus is a Semi-Rigid, Lighter-Than-Air Airship. Designed to fill the role of a High-Altitude Pseudo Satellite (HAPS), it operates at a cruise altitude of 20,000m. Horus is designed to conduct observation missions using both visual and infrared cameras and a synthetic aperture radar, as well as act as a communications relay between satellites and ground networks. Power is provided through a solar array and unitised regenerative hydrogen fuel cells, and drive comes from four thrust-vectored all electric propulsors. Horus is designed to provide flight durations of one year, without needing to land or be refuelled, and is able to transit to any point on the globe within three weeks. The platform has an overall length of 160m, and a mass of 14 tons without ballast.

GLASIES – Comet Interceptor (fast catch mission)



As the project was aligned to an ESA mission requirement there were well-defined mission objectives. The presentation provided clear descriptions of mission stages, and related them to the elements of their design. There was room to be innovative, and the design as presented was logical and well justified. It was clear that credible work was completed, and described issues involved so well.

Design team description pre-presentation

Upon ESA's call for a fast class mission, GLACIES has pursued a space venture to intercept an interstellar comet. These comets have had no close encounters with stars and thus their surface compositions remain intact when compared to other comets. Between 2030 and 2037, GLACIES aims to launch its spacecraft known as the Mothership on an intercept trajectory with a detected interstellar comet. Twenty-four hours prior to interception, a smaller spacecraft housed within the Mothership will be released, travelling at a faster speed and reaching a closer distance to the comet in order to release five small impactors which will collide with the comet and breach its outer surface. Both craft will subsequently produce images of the impact and the Mothership will proceed to flyby through the comet's coma tail. If fuel reserves remain, a secondary mission to a periodic comet will commence.

TALON Future theatre Lift aircraft

This was a very innovative approach to NATO requirements for tactical support several decades hence. The aerodynamic design traded design parameters and demands for extreme performance appropriately. The most notable design feature was a 'split by-pass turbofan' propulsion solution, which might (or might not) have been the best solution – but at the point in time it is a sensible evolution from the current baseline. It was a credit overall that the team could envisage and promote this unique design.

Design team description pre-presentation

The X-53 Talon is envisaged as the pioneering tactical airlifter at the forefront of the USAF and wider NATO fleets from 2050. An ability to deliver to unprepared airstrips of field lengths shorter than 250m, even in hot elevated conditions, corresponds to completing tactical deployments currently only operated by rotorcraft. This achievement is possible at a design payload of 25,000kg, across a mission radius in excess of 1800 nautical miles, far beyond the capabilities of any rotorcraft. Talon cruise speed is 0.65M at an altitude of 30,000ft; far superior operational ability than all rotorcraft. The elite performance of the X-53 is powered by the Extreme-Lift Generation System. Comprised of a bespoke embedded split-bypass turbofan engine, which supplies a duct and plenum system to deliver a maximum lift coefficient of 4.6 via a network of hot and cold blown flaps.

Session notes by Mike Hirst