

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Small Launchers: concepts and operations (7)

Author: Mr. Jean-Francois Pitot de la Beaujardiere  
University of KwaZulu-Natal (UKZN), South Africa, pitot@ukzn.ac.za

Ms. Fiona Leverone  
University of KwaZulu-Natal (UKZN), South Africa, 207503331@ukzn.ac.za

Mr. Michael Brooks  
University of KwaZulu-Natal (UKZN), South Africa, brooks@ukzn.ac.za

Prof. Lance Roberts  
University of KwaZulu-Natal (UKZN), South Africa, roberts@ukzn.ac.za

RECENT ADVANCES IN SOUTH AFRICA'S PHOENIX HYBRID SOUNDING ROCKET  
PROGRAMME

**Abstract**

Despite having an active space science research community, South Africa and indeed Africa, is currently reliant on international agencies for the provision of sounding rocket launch services in the absence of an indigenous sounding rocket programme. The high cost and logistical difficulties associated with foreign launch campaigns have consequently stunted domestic research activities in a number of important areas. In response to this void in local capacity, the University of KwaZulu-Natal's School of Mechanical Engineering initiated the Phoenix Hybrid Sounding Rocket Programme at the start of 2010, under its Aerospace Systems Research Group. The Phoenix Programme aims to develop a series of commercial sounding rockets capable of meeting the payload delivery requirements of the South African scientific community. In addition, the programme seeks to develop local research capacity in hybrid rocket propulsion, vehicle design and flight dynamics modelling. Work is currently underway on the development of the Phoenix-1A; a technology demonstration launch vehicle capable of carrying a 5 kg payload to an altitude of 10 km. The Phoenix-1A will be powered by a nitrous oxide / paraffin wax hybrid rocket motor; a lab-scale version of which has been successfully test fired. The vehicle, motor and supporting subsystems are presently at an advanced state of design. The Phoenix-1A, whose inaugural test flight is scheduled for March 2012, is a precursor to a much larger vehicle, the Phoenix-2A, which will be designed to nominally deliver a 5 kg payload to 100 km altitude. The current paper seeks to provide a progress update on the Phoenix Programme. In addition, preliminary design parameters for the Phoenix-2A launch vehicle, derived on the basis of custom-developed hybrid rocket motor and flight dynamics simulation codes, are presented and discussed.