

C2C IN SPACE EXTENSION OPPORTUNITIES

WATER ROCKETS



C2C in Space:

Extension Opportunities **Water Rockets**

Introduction

Water rockets have been a source of entertainment and education for many years. First starting in the 1960's where water rocket toys were made in Germany and the United States and then exported all over the world.

Water rocketry is a truly attractive subject for students. Water rockets can arouse and develop their curiosity, which can extend the horizon of their learning and experience. It is a low cost, hands-on science activity that demonstrates how real engineering challenges and scientific principles can be addressed using the simplest of materials.

The concepts of rocketry can be easily incorporated into the MARS Exploration Design Challenge by undertaking the Satellites in Space module and using water rockets to deploy OzeSat to collect scientific data. It is recommended that to understand the advanced principles of rocket construction and launch phases, that rocketry is used as an extension opportunity.



Rocketry Concepts

Water rocketry is an excellent way to introduce the understanding of motions and forces in Physical Science due to the physics involved in the construction and launch phases. For instance, there are many factors that contribute to the development of a stable and reliable rocket. Some of these factors include:

- **The determination of centre of mass** or centre of gravity (C.G.) and centre of pressure or centre of thrust and their relationship.
- **Fin size, shape, number, location and angle. Impulse thrust force and time and fuel/propellant mass and velocity** are also important factors to be determined.
- **The quantity (mass)** or proportion of water and the **level pressurization** is also very critical to the performance of the rocket.
- Relative calculations include: **surface area** of a **cylinder, sphere, cone,** and **triangle**

Design Challenges

The Asia-Pacific Regional Space Agency Forum (APRSAF) Space Education and Awareness Working Group, promote the use of water rocket to teach science and mathematics. APRSAF was established in 2004 with one of the aims to provide education and training opportunities in

space science and technology. The working group currently consists of 17 countries, including Australia, that compete in local and annual international water rocketry competitions. Refer to APRSAF Water Rocket Event Rules for conditions of entry.



Fig 1 & 2. APRSAF 17th Water Rocket Event held at VSSEG: Water rocket competition.

There are no restrictions on the rocket or launcher design that can be used for the local competitions. Students can consider the variation in

performance between different rocket and launcher designs. For international competitions, launcher specifications and rocket materials are provided.



Entrants into the international APRSAF competition comprises of the winning student from each state that demonstrates the ability to build and launch a water rocket to hit a 4m diameter target at a range of 60m, with personal attributes to represent Australia. The winning teacher is the one who

can demonstrate innovation in the use of water rockets to teach science and shows intention to participate during the APRSAF Water Rocket Event; 2 day teacher workshops, in the interest of advancing science teaching both within their school and wider education community.

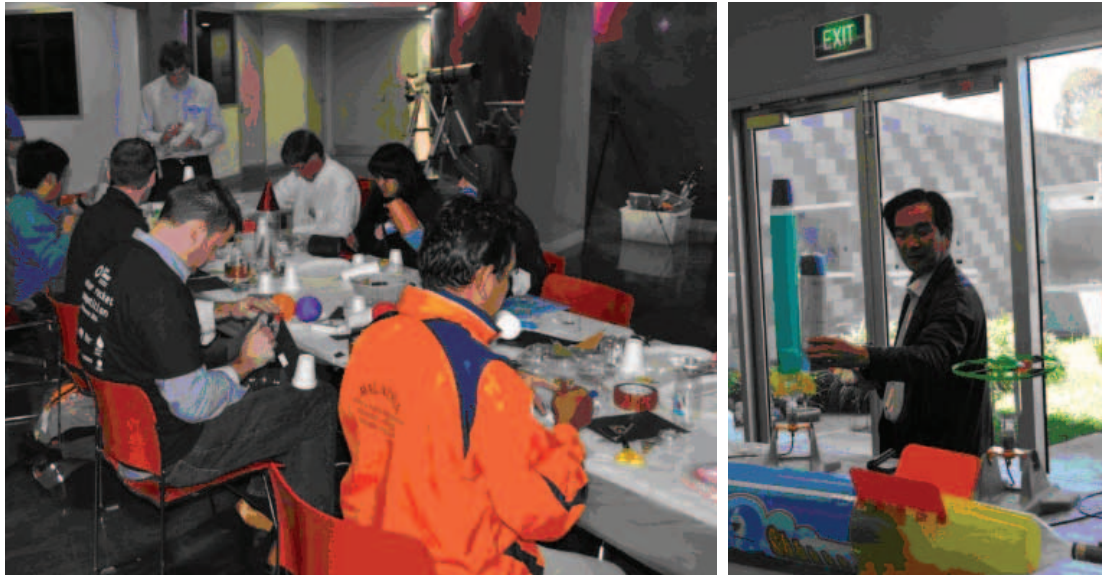


Fig 3 & 4. APRSAF 17th Water Rocket Event held at VSSEC: Water rocket teacher workshops

For more information about Water Rockets

The Victorian Space Science Education Centre (VSSEC) in conjunction with the Asia Pacific Regional Space Agencies Forum has created a wiki to provide

a place to share ideas and information from anyone with an interest in using water rockets in education.

- Water Rocket Wiki

<http://www.vssec.vic.edu.au/vssec-interactive/wikis/>

- Water Rockets – Educator's Manual
- Japan Aerospace Exploration Agency

http://wiki.vssec.vic.edu.au/waterrockets/images/0/07/Educator%27s_Manual_%28English%29.pdf

- APRSAF Water Rocket Event

<http://www.vssec.vic.edu.au/events/competitions/aprsaf-water-rocket-event-and-educators-workshop/>