

CuSEDS meeting #3 held October 12, 2010

Agenda:

1. Official notice of membership fees due next meeting (\$5)
2. Presentation – Gilles Messier – Hybrid Rocket Research
3. Update – Moonbuggy Project
4. Presentation – Matt Cross – European Student Moon Orbiter Project
5. Presentation – Natasha Jackson – Canadian Satellite Design Challenge
6. Executive matters – attempt to fill VP events position

### **PRESENTATION - Gilles Messier (Aero IV) – Hybrid Rocket Research**

CHRRP (Carleton Hybrid Rocket Research Project)

Solid (fuel mixed with oxidizer in solid form) – cheaper, but no throttling

Liquid – fuel and oxidizer stored separately, throttling

Hybrid Rocket Engines – Solid fuel, liquid oxidizer

Oxidizer is throttled, flows into solid fuel chamber, erodes fuel off sides

TNT potential of 0 – very safe

Built engine last summer for under \$400

Nitrous oxide + candle wax mixed with coal

Exhaust went supersonic

Mission of CHRRP

To establish a program @ CU for researching and refining hybrid rocket engine technology, thereby contributing to the state of the art of affordable spaceflight and enhancing the engineering curriculum

2010 Goals

- funding
- construct a prototype test-bed engine and test stand
- conduct test firings and perfect firing data collection techniques

Progress

Nitrous oxide handling equipment

Metal for engine and stand

\$450

2010 tasks

Write proposals for funding

Design engine and test stand

Perform optimization calcs

Find prices for additional materials and equipment

Order materials, equipment

Machine and assemble engine, test stand

Find test site

Arrange transportation to test site

Research Topics

Fuel composition

Geometry optimization/injector design

Aerospike nozzles

Staged combustion hybrid engine

Fuel grain changes as combustion uses up fuel

Fuel mix is constant with staged combustion

Modular launch system

Rather than building rockets for each application, build a modular system that could be used for any situation (size, shape variable)

Individual thrust unit – mass produce

Arrange in any configuration desired

Enveloped hybrid engine

Rather than having fuel tank behind, wrap it around the combustion chamber (fuel grain)

This would have a regenerative cooling cycle heat would radiate out through the chamber walls into the oxidizer, and would then go back out through the exhaust – must check if this will cause the oxidizer to explode

Sub-teams:

PR/funding

Logistics/purchasing

Research planning

Design/Analysis

Everyone: Manufacturing

October 31: funding

Dec 17 complete preliminary design

Jan 15 finalize designs, order

Feb 1 construction

March 15 finish construction

build

### **UPDATE - Moonbuggy project**

Well on schedule

Getting final design up and running within ~2 weeks

Pro/E model shown

Construction will begin soon

### **PRESENTATION - Matt Cross (CU grad student) – European Space Agency - European student moon orbiter project**

ESA

Research and industrial activities in relation to space

Launch vehicle activities

Mission ops

ESA astronaut corps

3.6 billion euros / year

Semi autonomous from government involvement

18 member states

Handful of European cooperating states

1 Canada

Doesn't replace national agencies

Canada has been a cooperating states since '79

Loosely involved in ESA's predecessors since 1968

10% of CSA annual budget goes to ESA

ROI is ~1.2-1.3

Allows Canadians to participate, be employed

ESA education office

Based at ESTEC (euro space tech research centre) in Netherlands

Opportunities:

Conferences

Full sponsorships for numerous students to attend IAC, COSPAR

Include stop over at ESTEC

Workshops

Education training, miscellaneous on-site workshops, project specific workshops

Sponsorship to attend NASA academy, ISU, and alpach Summer school

Internships, Traineeships (through HR)

Hands on projects

Cansats

Undergrad

Fit all necessary satellite subsystems into a pop can

Dropped from rocket or balloon, must land safely

Must perform certain mission

CubeSats

Grad

Launch opportunities and tech support

Cubesat workshop

Drop/Spin your Thesis

Grad

Provides micro / hyper gravity condition for related thesis research

Fly your thesis (parabolic flight opportunities)

Eg AstExbehavioiur of granular material under shear stress, aim of using for design of future asteroid sample return missions

REXUS / BEXUS (Rocket/balloon expts for uni students)

Rocket: 100km alt

Balloon: 35 km altitude, 2-5 hour duration

Tech support workshops

GENSO (Global Education Network for Satellite Operation)

Auspices of ISEB

Goal of global coverage for LEO university CubeSats

Only 1 in North America (California)

Micro Satellite Program

SSETI express, YES-2 (Launched)

ESEO – 2012

ESMO 0 2013/2014

What is ESMO

First student mission to the moon  
Third mission in education satellite programme  
Mission objectives  
    Place it in lunar orbit  
    Acquire images of the moon from a stable lunar orbit and transmit to earth  
    Perform Scientific measurements  
Launch: secondary payload into GTO  
Launcher: TBC  
Year: 2013  
Mission phases:  
LEOP (1 month)  
Lunar transfer (3 months)  
Payload ops (6 months)  
Spacecraft: 250kg wet mass, 11 kg payload capacity, 3 axis attitude stabilization  
Subsystems: MON/MMH Bipropellant propulsion system & LEON2 processors (ESA)  
Avionics, structure, thermal, payload  
Mission control: university control centre, SCOS2000 software, ESOC flight dynamics software  
Objective: provide images of the moon upon request to high schools  
LunaNet  
Demonstrate communication protocols to establish "Lunar Internet"  
Lunette Sub-satellite (cancelled)  
Global gravity field mapping of the moon to 10mGal accuracy including far-side

CanSat – broken into groups, getting a feel for what they will be doing  
Working with robotics club  
Carletonrobotics.com – click on CanSat page

### **PRESENTATION - Natasha Jackson – Canadian Satellite Design Challenge**

Competition to design and build a small operational satellite , will be tested  
Under 15 kg – likely a CubeSat  
Defined by a scientific research initiative  
We will be cooperating with other faculties to define this initiative and the mission parameters  
2010 – Sep-Dec – Team forming, orientation  
Now to end of april 2011 – spacecraft design course or study  
Jan 2011 – competition officially begins  
Sep 2011 – preliminary design review  
Jan 2012 – critical design review (go/no-go)  
2012 until Sep – Assembly, Integration & Test  
Sep 2012 – Assembly Integration & test (vibrational, vacuum)

Benefits:  
Industry standard software  
Satellite Tool Kit (Satellite Mission Modelling/Analysis)  
Solidworks (3D solid modelling)  
NE NASTRAN (advanced finite element analysis)

FEMAP (Heat Transfer Simulation, analysis)

Participate in every step of satellite development process

Collaboration and networking with experienced industry participants (MDA, AGI, Magellan, Manitoba Aerospace, HB McMillan, GeoCentrics, APPSpace)

Learn about:

Sat comm. And tracking

Attitude determination and control

Data handling

Electrical systems

Structures and thermal analysis

Tasks:

Recruiting: physics club, robotics club

Needed: compu systems, electronics, comm., Mech/Aero, systems, assorted sciences

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Check out [www.geocentrix.ca](http://www.geocentrix.ca)

**EXECUTIVE POSITION EMPTY - Attempt to fill VP events position - tabled**