Rocketry, the student way
Overview

• Student organization
• Based at TU Delft
• About 90 members
• > 100 rockets flown
• Design, Construction, Test, Launch ➔ All done by students
Goal

• Design, build, and fly rockets
• Support educational rocketry projects
• Apply theoretical knowledge

• Be the first student team to reach the space
History

• 2001: founded
• 2006: first CanSat launcher
• 2009: Stratos I altitude record (12.3 km)
• 2012: first hybrid rocket flown

• 2015: Stratos II+ launch
Stratos I – Altitude Record

- Launched March 19th, 2009
- Kiruna, Sweden
- 12,284 meters
- Two-staged rocket
- Real time telemetry
- Sounding rocket
- Nosecone recovery
Stratos II+

DARE

Map showing the location of Camping Doñana in Spain.
Projects

Delft Aerospace Rocket Engineering

- SRP
- Engine Development
- Electronics
- Scientific Balooning Team

- Stratos
- ACT
- I&B
- Acquisition Team

- Solid Propulsion
- Hybrid Propulsion
- Liquid Propulsion
- Cryogenic Team
- Capsule Team
- Electronics
- Propulsion Team
Plan of attack!

1. Electronics
2. Scientific Ballooning Team
3. Liquids team
4. Infinity and Beyond (I&B)
5. Safety Board
6. Advanced Control Team (ACT)
7. Capsule and Recovery Team
8. Cryogenic Team
9. Acquisition Team
What do we do?
What do we do?
Who can join?

1 or 2 people with hobby/professional experience

Requirements

Experience in

- Circuit design (Altium)
- Programming (C++ / ASM / VHDL)
- Software development (C++ / Java)
electronics@dare.tudelft.nl
• Golden Age of Ballooning
What is GAB?

- High altitude ballooning
- Atmospheric sounding
- Testbed for telemetry and flight electronics
- "Balloon satellites"

Low level ballooning

- Wind sounding & trajectory estimations
What is GAB?
Past endeavours

- Designed & built a balloon based wind sounding system for launchdays
Future plans

- Fly higher, send balloons to the stratosphere
- Global balloon challenge?
How to join

- Talk to me
- Send me an email: R.M.Werner@student.tudelft.nl
The Liquid Team: Deimos

• Started in the year 2003, restart 2008
• **Team** of currently 8 people
• **Liquid propellant** rocket engine
• First successful static test: 2012
• Planned full engine firing in **November 2015**
The Liquid Team

Deimos

Previous Motor:

Deimos M:
Max Thrust: 250 N
Max Isp: just shy of 200 s
Mass flow: 120 g/s
Test video
The Liquid Team

Deimos

Current Motor: Deimos F
Max Thrust: 1100 N
Max Isp: just shy of 210s
Mass flow: 655 g/s
Deimos flight engine development

- **Next steps**: 1. Subsystem/engine tests
  2. Flying Rocket (Deimos F)

- Rocket based on the CanSat V-7.3/7.4
- Launch: Summer 2016
Deimos flight engine development

• After launch: Design Optimization
• Active cooling
• Injector Redesign
• Throttling
• Cooperation with Cryogenics team
• *Insert your awesome idea here*
Who are we?

• Newest group within
• Currently 5 members
What do we focus on?

- Alternative rocketry!
Current project?

- Autorotation recovery system!
Interested? Contact us!

• Email us!

ibalternativerocketry@gmail.com
Advanced Control Team (ACT)
ACT History and Objective

• Founded in 2013, setting up a baseline for an actively stabilized Cansat Launcher V7.

• Design and launch of the first actively stabilized rocket of DARE

• “Develop an inherently safe actively stabilized rocket system for the purpose of suborbital flight research within DARE.”

• Advantages of active rocket stabilization:
  • Reach higher altitudes
  • Reduce the footprint (i.e. ground track)
  • Reduce influence of gusts
V7S: ACT Hardware Overview

CanSat V7 with Stability Augmentation System (SAS)
Past ACTivities

• Design of Stability Augmentation System
  • SAS implemented in CanSat V7 → V7S
  • DARE minor 2013-2014

• Windtunnel Experiment
  • SAS and V7S functionality at subsonic speeds (~70 m/s)
  • Manual canard control
  • August 2014

• Flight Tests
  • CanSat V7 with ACT sensor module + BlackBox
  • May and June 2015
What does the ACT do now?

- **Stratos Payload**
  - Data trajectory data acquisition
  - October 2015

- **Gearing system for canards**

- **Simulations of V7S-T**

- **Finalizing the flight computer**
  - Redesigning Flight Computer Board
  - Finalizing the firmware

- **Launch**
  - Launch of first actively stabilized rocket of DARE!
  - November 2015
Future ACTivities

DARE next-gen actively stabilized rockets

- New project after November’s launch
  - Supersonic canards
  - Improve flight control algorithms
  - Implement new IMUs
  - ACT + Capsule Team + Solid Six

“Develop a supersonic technology demonstrator for future DARE space flight, within a year with multiple DARE sub-teams, including active stabilization and high speed recovery.”

- Actively stabilized launch into Space
  - Stratos III…
What does the ACT need…?

ACT NEEDS YOU!

- Software Engineer [2x]
  - Trajectory simulations
  - Flight Control algorithms
  - Affinity with (object oriented) programming

- Electrical Engineer [1x]
  - Interest in PCB design
  - Microcontroller programming

- Aerodynamics Engineer [1x]
  - Canard design
  - Supersonic aerodynamics
  - CFD is preferred

- Mechanical Engineer [1x]
  - Canard mechanism
  - Electronics bay mounting
  - FEM is preferred
ACT members selection procedure

• Requirements
  • Apply for at least one year (Nov 2015 – Nov 2016)
  • Work at least 6 hours per week (@lab or @home)

• Process
  • Apply for one of the engineering opportunities
  • Send motivation letter to act@dare.tudelft.nl
  • Interview after selection
Interested…?

Contact:
Nick van den Dungen
act@dare.tudelft.nl
Team Leader Advanced Control Team
Capsule & Recovery
Past
Present

- From Stratos II to Dare team.
- Roughly 12 members.
- Finishing touches for Stratos II+.
- Launch campaign.
Future

- Stratos III R&D
- 1 Year project
- Supersonic rocket
- Multiple Teams

https://youtu.be/gDNDQQLx1JE?t=703
Future and you?

• Looking for members with interest in:
  • Design
  • Simulations
  • Manufacturing
  • Testing
  • Parachutes
  • Structures
The Cryogenic Project
Powering the Giant Leap
Reasons

1. World wide interest in LOX/CH4 engines
   1. Performance
   2. Reusability
   3. Cost

2. Next step for DARE
   1. Higher performance
   2. Long burntimes
   3. Non-toxic

3. Very challenging thesis project
   1. Potential beyond paper study
   2. Great stepping stone to commercial applications
Organizational challenges

1. Supervisory approval
2. Manpower
3. Relevant experience
4. Work location
5. Test location
6. Partners
7. Funding & materials
Initial planning

10 kN class development engine

1. Similar thrust magnitude as DHX-200 Aurora
2. Pressure fed for simplicity
3. High design safety margins

1. Plan formed beginning 2015
2. Start October 2015
3. Finalize August 2016
Technical challenges

1. Cryogenic feed system design
2. Cryogenic safety
3. Regenerative cooling
4. Injector design
5. Combustion stability
6. Additive Manufacturing
Progress

- Feedsystem Architecture
Progress

- Test Facility
Progress

• Cooperation with CIRA
Progress

- Cryogenics Safety Training
Progress

- Measurement and Control System
Conclusion

Looking for 1 Person
Experience in Measurement and Control
Preferably experience in Labview
Acquisition Team
No Bucks, No Buck Rogers
Sponsor Acquisition Team

Why

- Projects require large budgets
- Rockets need unique facilities
- Significant logistics cost
- Growing ambitions
- University does not pay for all of that
- Hence we need to attract more external funding/support
Sponsor Acquisition Team

How

- Small team
- Assisting external relations
- Calling companies
- Preparing proposals/contracts
- Organizing sponsor events
- Organize company visits
Sponsor Acquisition Team
Who

- 2 to 4 persons
- Pro-active attitude
- Around 8 hours of work per week
- Partially during office hours
How to join?

• Talk to the team you are interested in
  ➢ Give them your email
  ➢ Interview
  ➢ Paperwork 😞