SatNOGS: Satellite Networked Ground Stations

...

Dan White, AD0CQ

SatNOGS NETWORK

SatNOGS DB

SatNOGS CLIENT

SatNOGS GROUND STATION

LibreSpaceFoundation.org

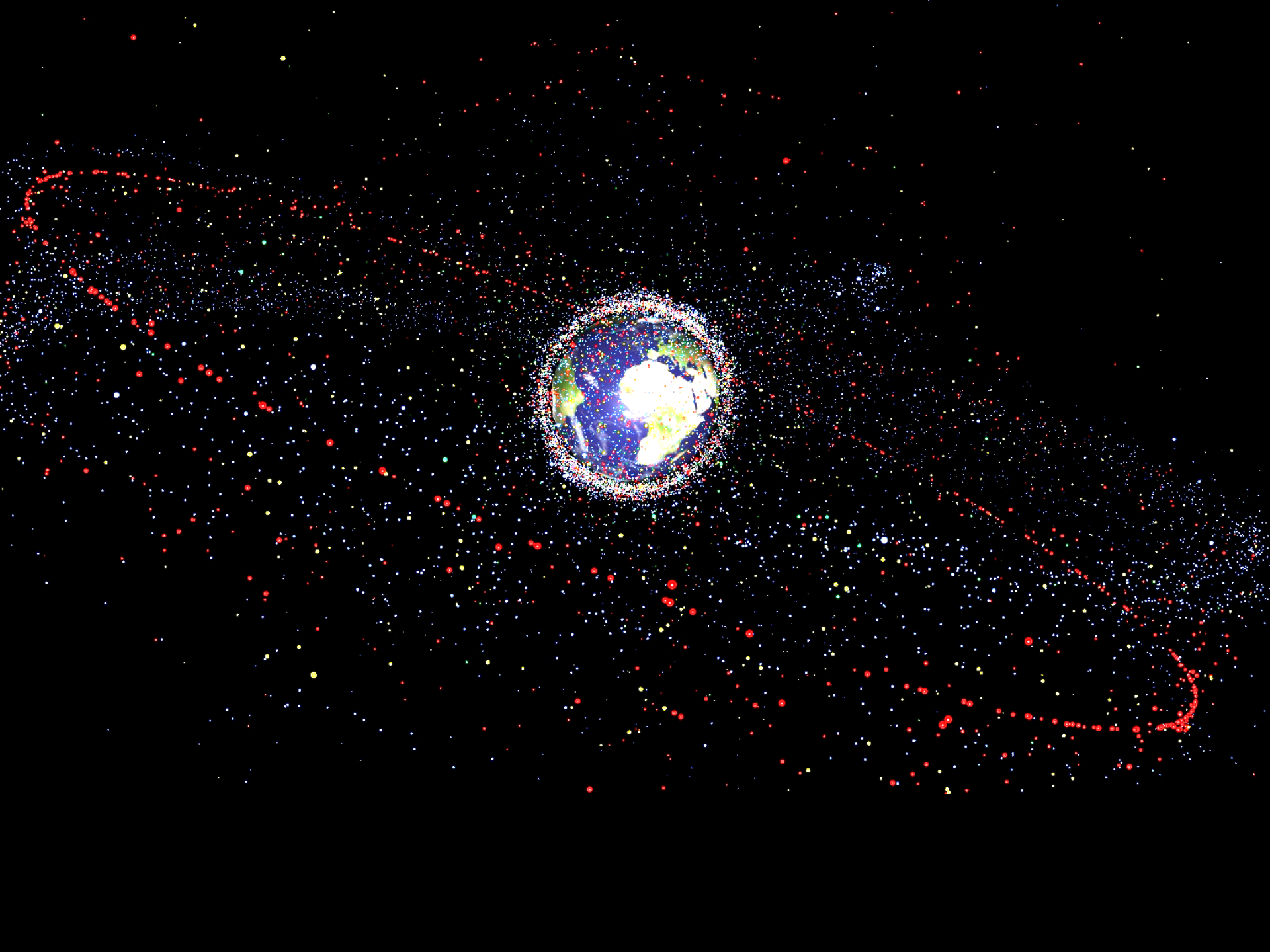
Athens, Greece

Ioannis Giannelos, Agisilaos Zissimatos,
Eleytherios Kosmas, Dimitrios Papadeas,
Pierros Papadeas, **Matthaios Papamathaiou**,
Nikolaos Roussos, **Vasileios Tsiligiannis**,
Ioannis Charitopoulos

community.satnogs.org

Corey Shields KB9JHU, Bloomington IN

Some of you are here!

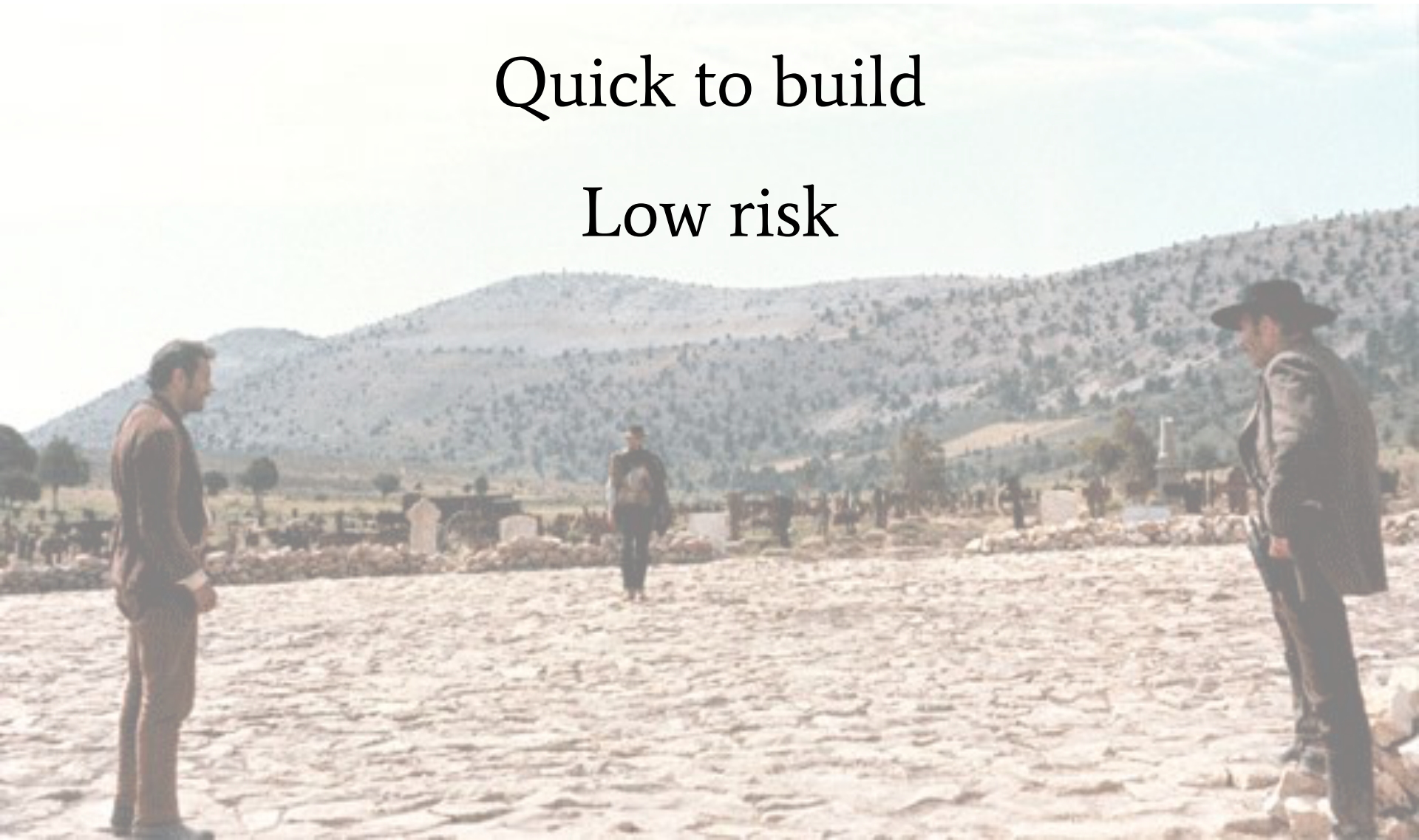


CubeSats in Low Earth Orbit

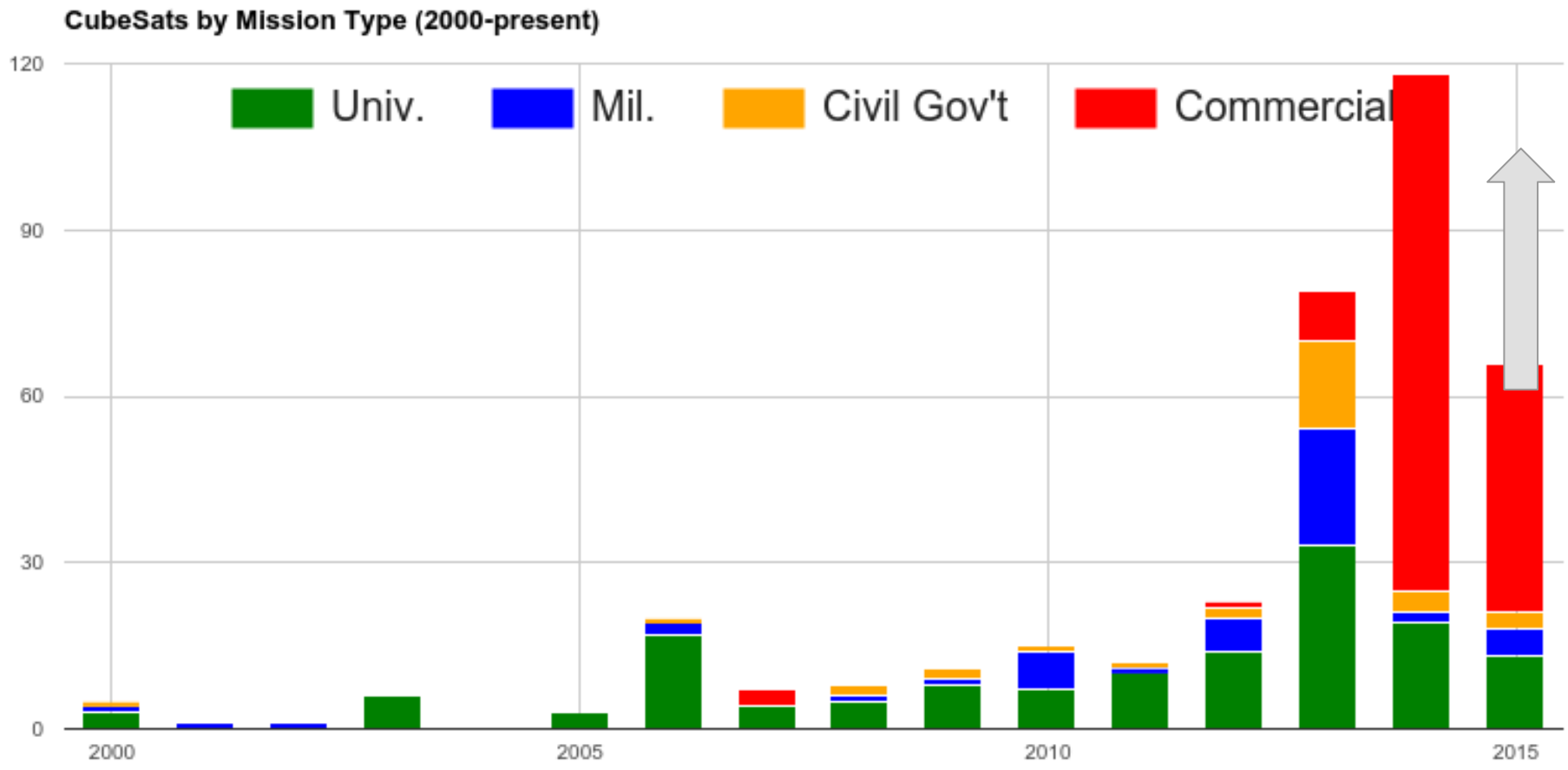
"Cheap" to launch -> rapidly decreasing

Quick to build

Low risk



CubeSat launches to mid-2015



[Chart created on Sat Oct 10 2015 using data from M. Swartwout]

CubeSats in Low Earth Orbit

10 minutes over horizon

3× / day

low power / bandwidth

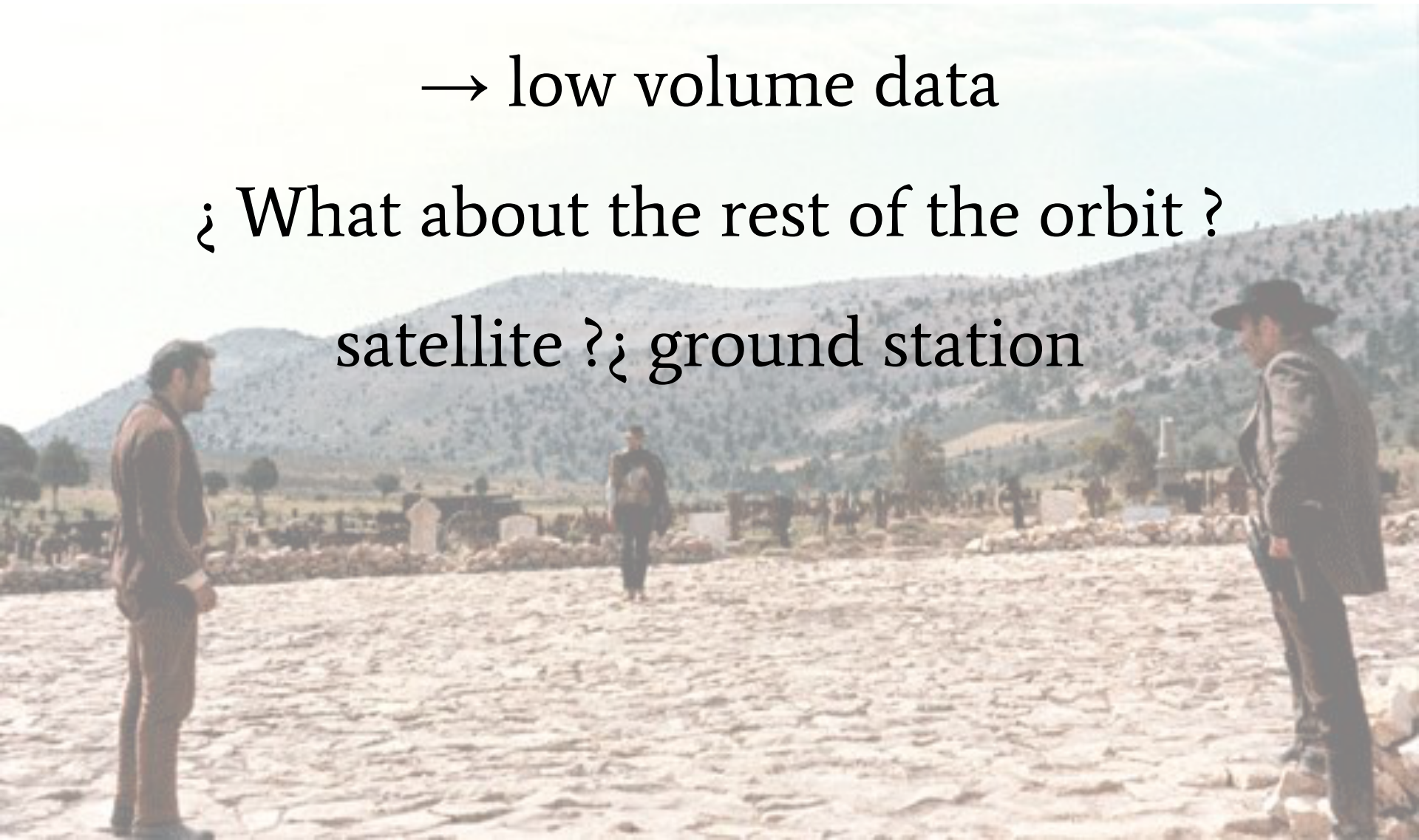
CubeSats in Low Earth Orbit

this is 2% downlink duty cycle

→ low volume data

¿ What about the rest of the orbit ?

satellite ?¿ ground station

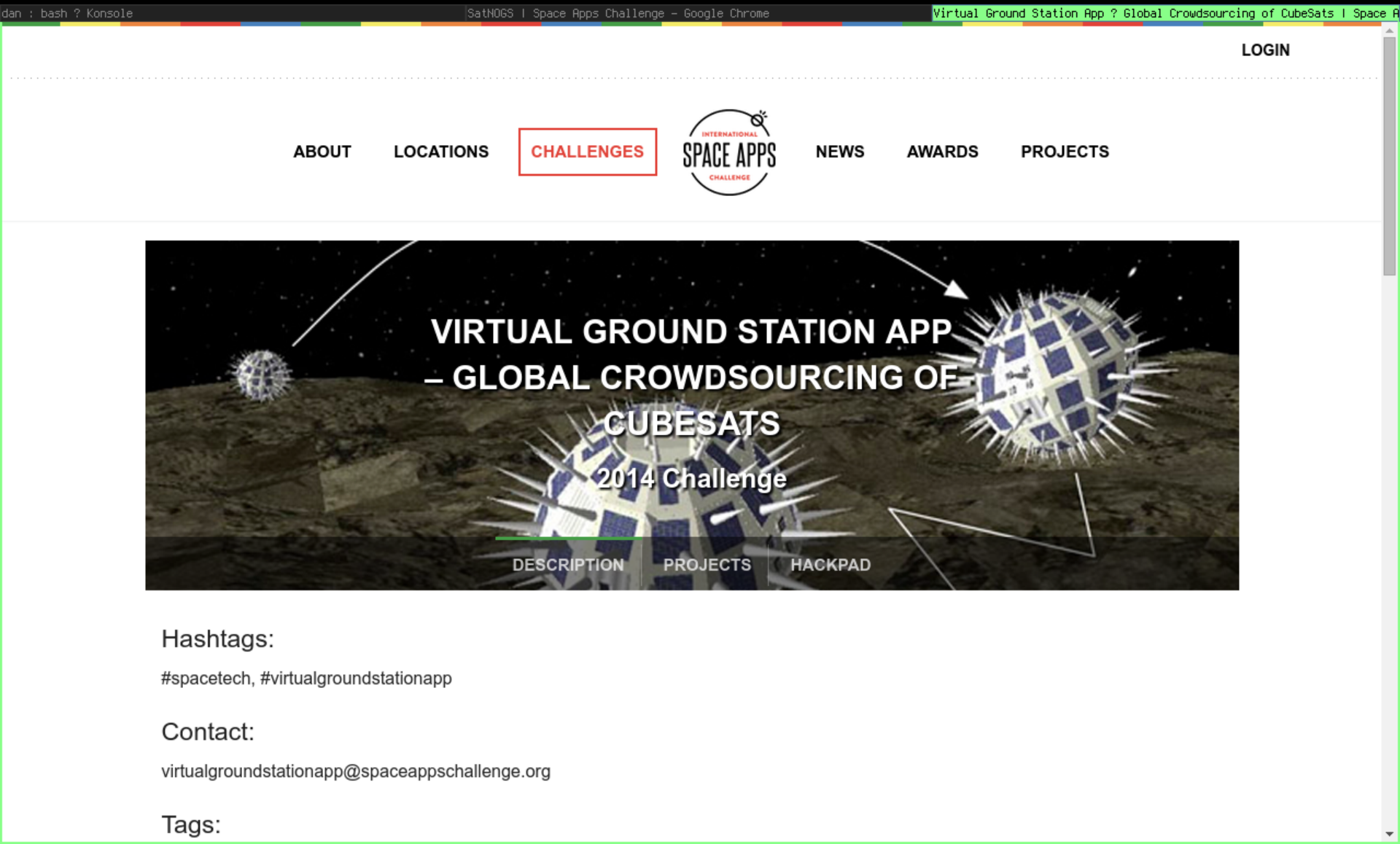


By our powers combined, . . .

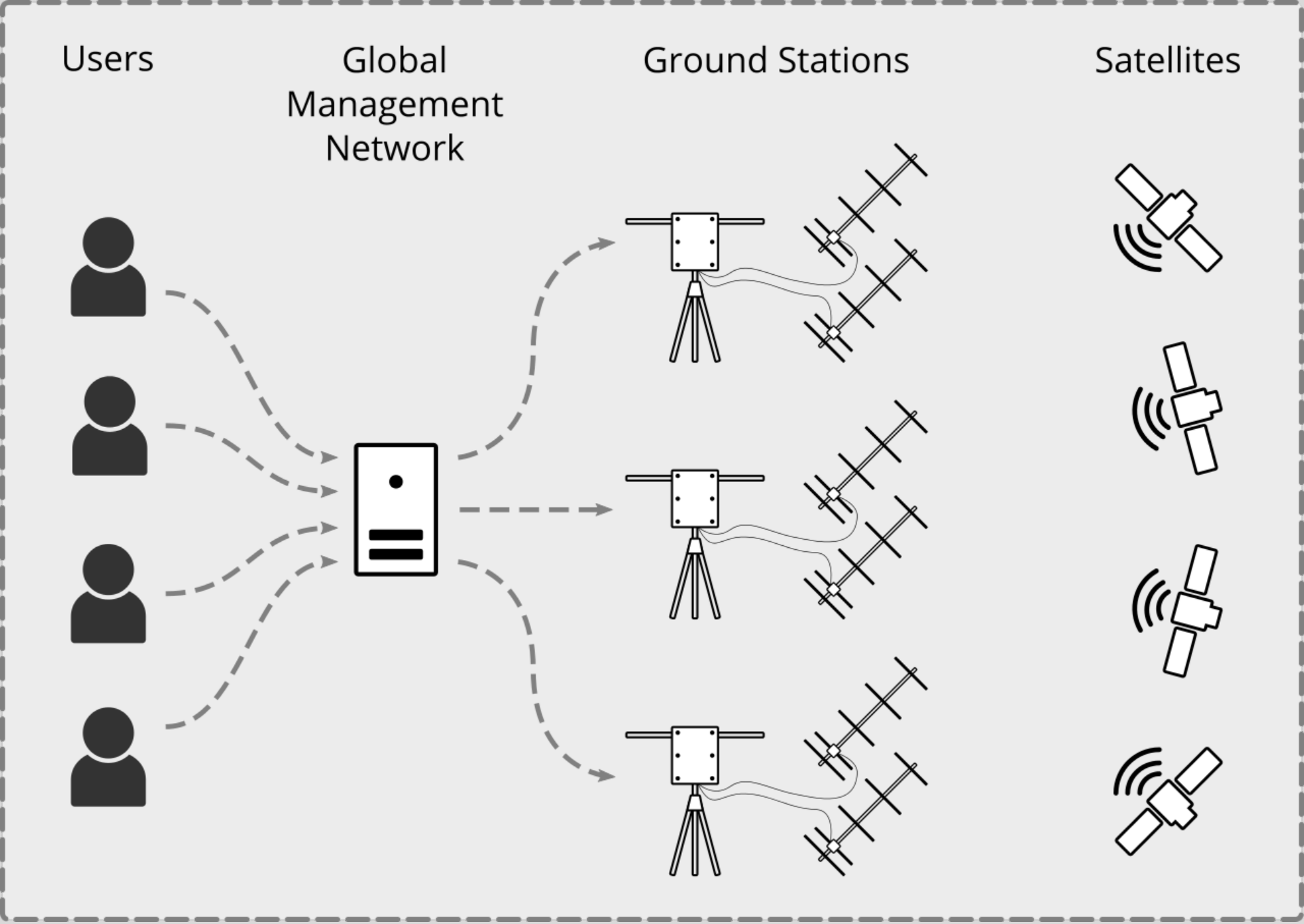
from: captainplanet.me

Group from: hackerspace.gr

2014 Space Apps Challenge - People's Choice Finalist



2014 Hackaday Prize

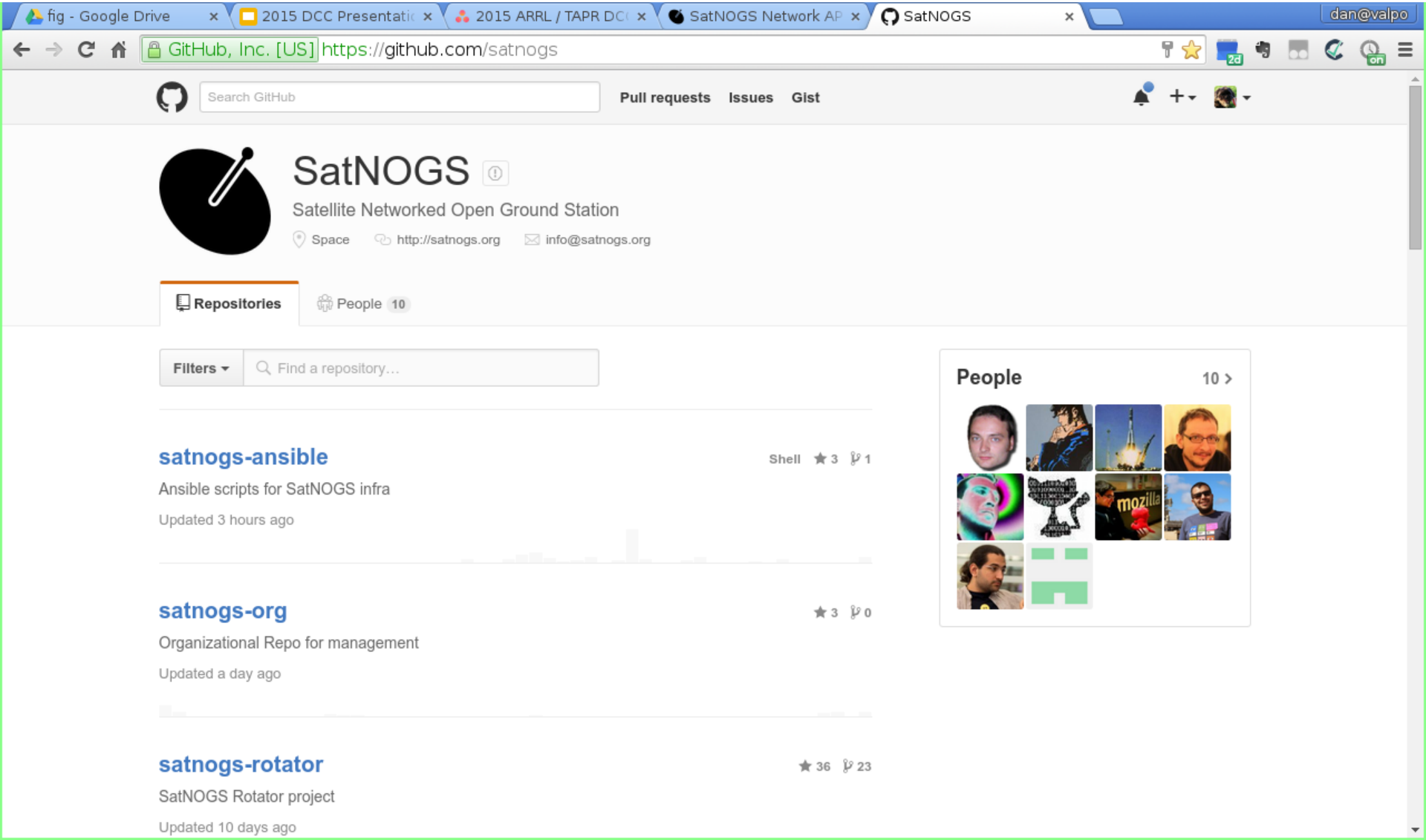

Users
Global Management Network
Ground Stations
Satellites

SatNOGS NETWORK

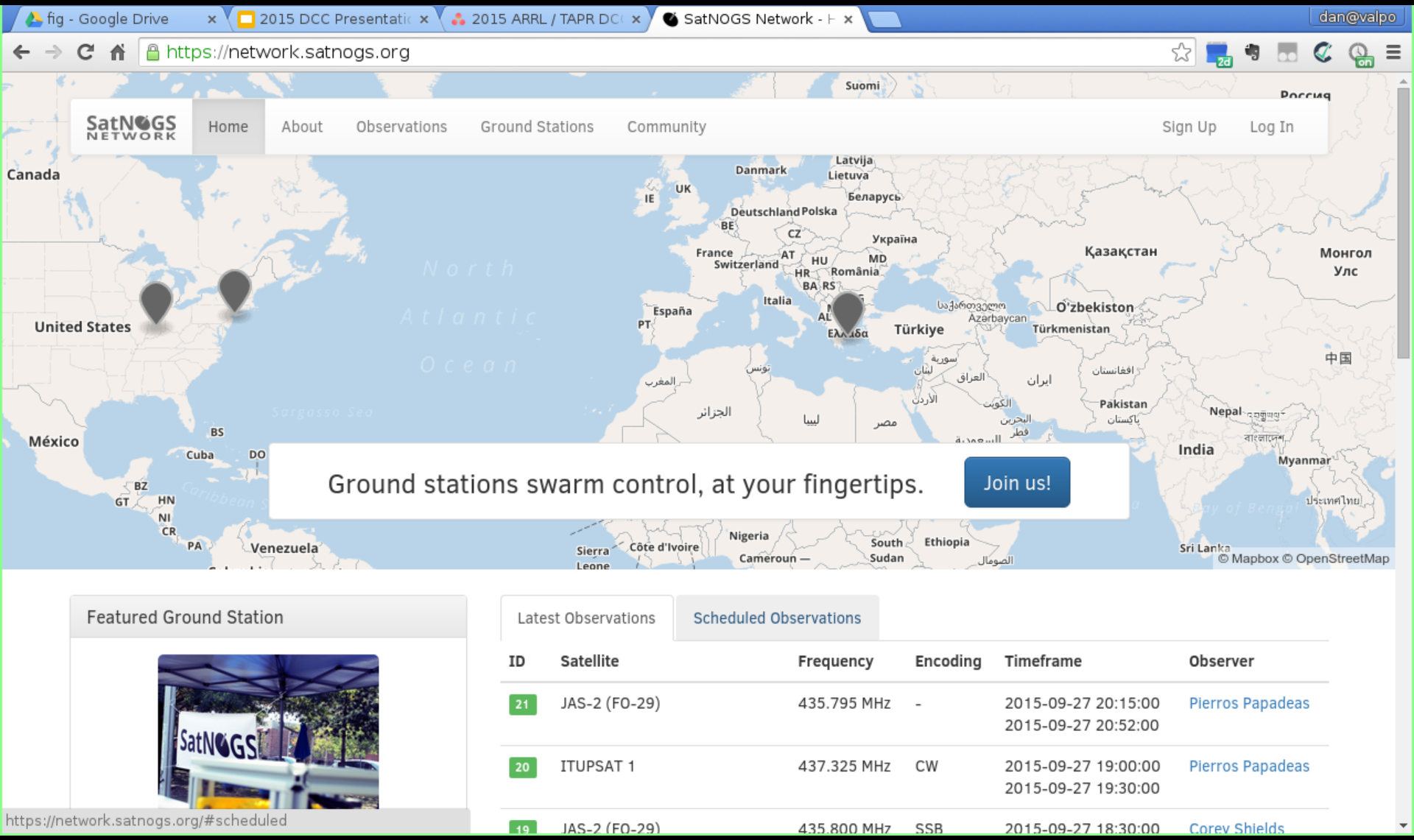
SatNOGS DB

SatNOGS CLIENT

SatNOGS GROUND STATION



SatNOGS Network



SatNOGS Network

Web server - Python: Django, requests, +more

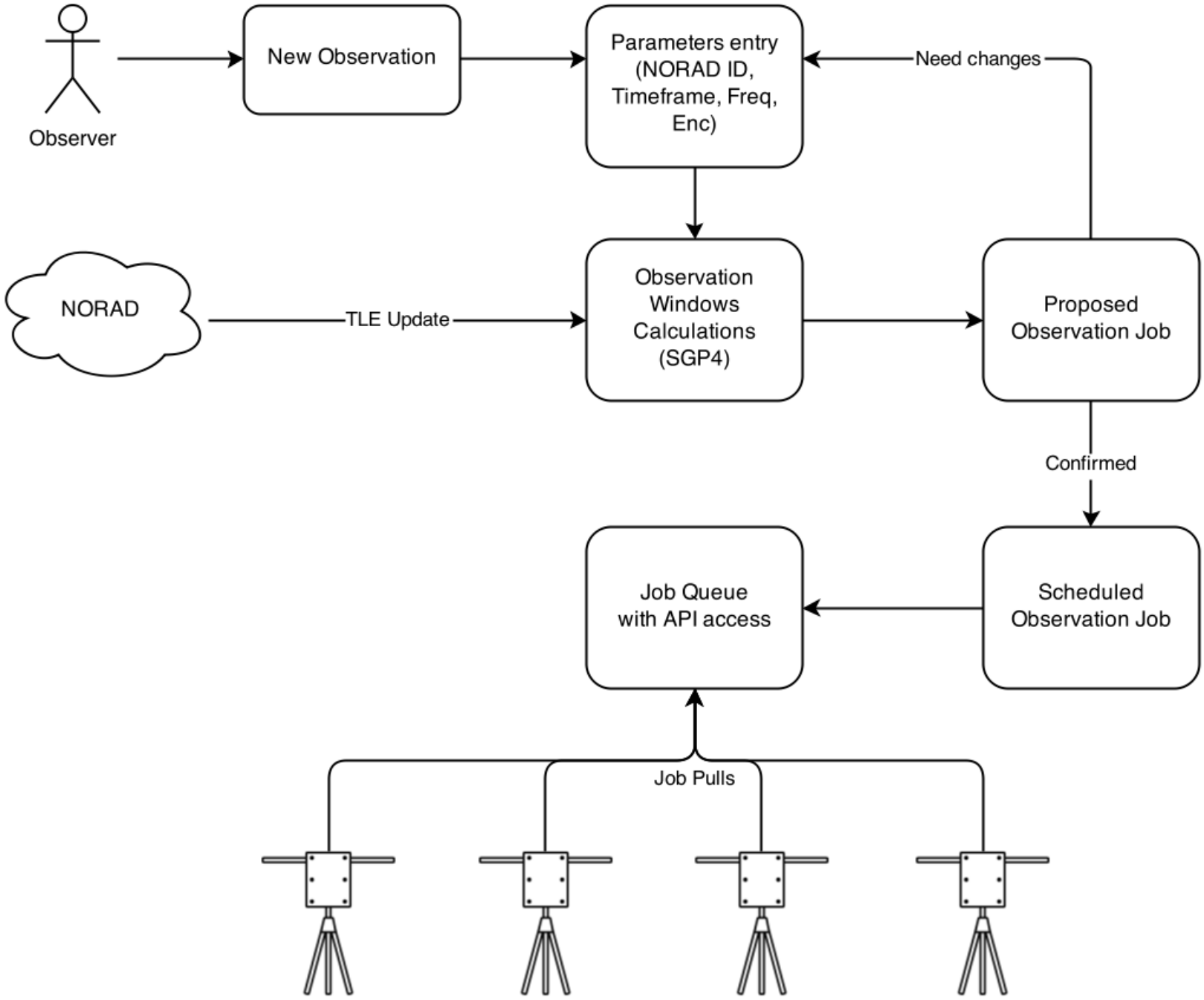
github.com/satnogs-network

- **Observers** schedule **Observations**
  - Satellite + transmitter
  - Time window of interest

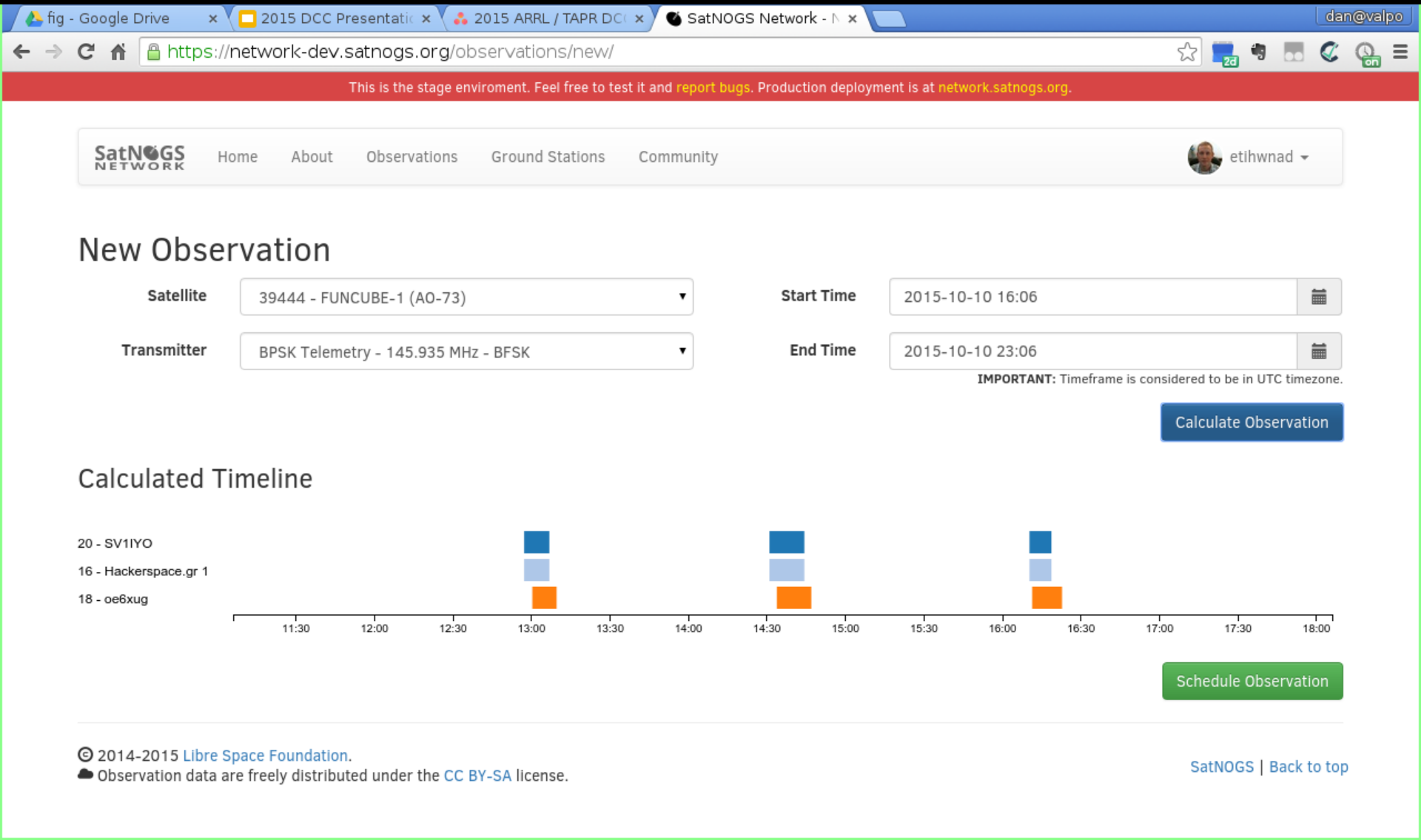
SatNOGS Network

Web server - Python: Django, requests, +more

- **Network** (the server) finds available and visible ground stations
  - Creates a **Job** for each station


Observer
New Observation
Parameters entry (NORAD ID, Timeframe, Freq, Enc)
Need changes
NORAD
TLE Update
Observation Windows Calculations (SGP4)
Proposed Observation Job
Confirmed
Job Queue with API access
Scheduled Observation Job
Job Pulls

SatNOGS Network



SatNOGS Network Web server

Python: Django, requests, +more

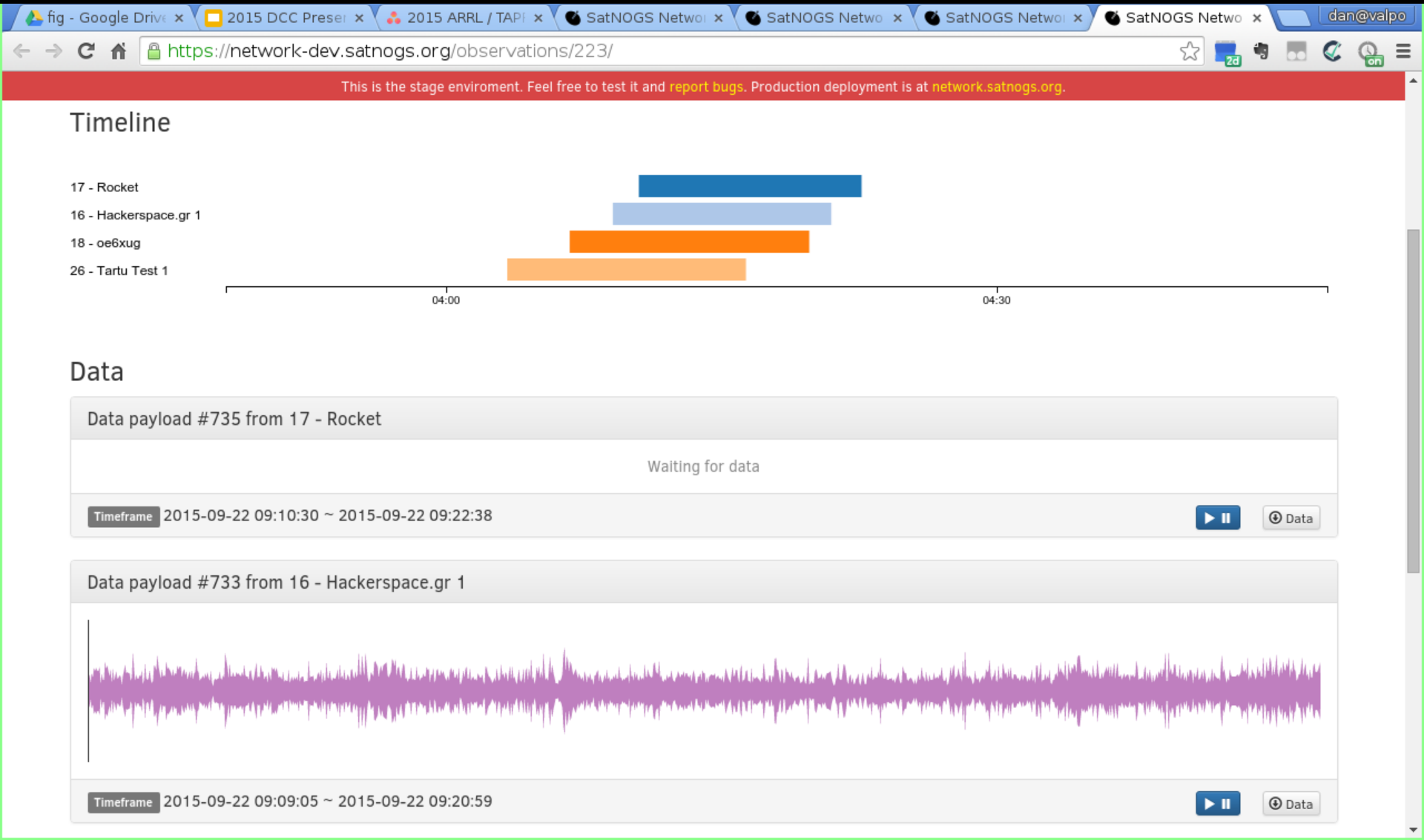
```
HTTP 200 OK
Content-Type: application/json
Vary: Accept
Allow: GET, HEAD, OPTIONS
```


```
[
    {
        "id": 788,
        "start": "2015-10-12T02:10:01Z",
        "end": "2015-10-12T02:18:11Z",
        "ground_station": 18,
        "tle0": "BEESAT",
        "tle1": "1 35933U 09051C   15282.12865753  .00000385  00000-0  98729-4 0  9998",
        "tle2": "2 35933  98.4227  42.6629 0005953  14.2858 345.8506 14.55715956320639",
        "frequency": 436000000
    },
    {
        "id": 787,
        "start": "2015-10-12T00:28:03Z",
        "end": "2015-10-12T00:42:12Z",
        "ground_station": 18,
```


Ground Stations execute jobs

- Upload received signal to **Network**
- **Observation** available for all via web / API

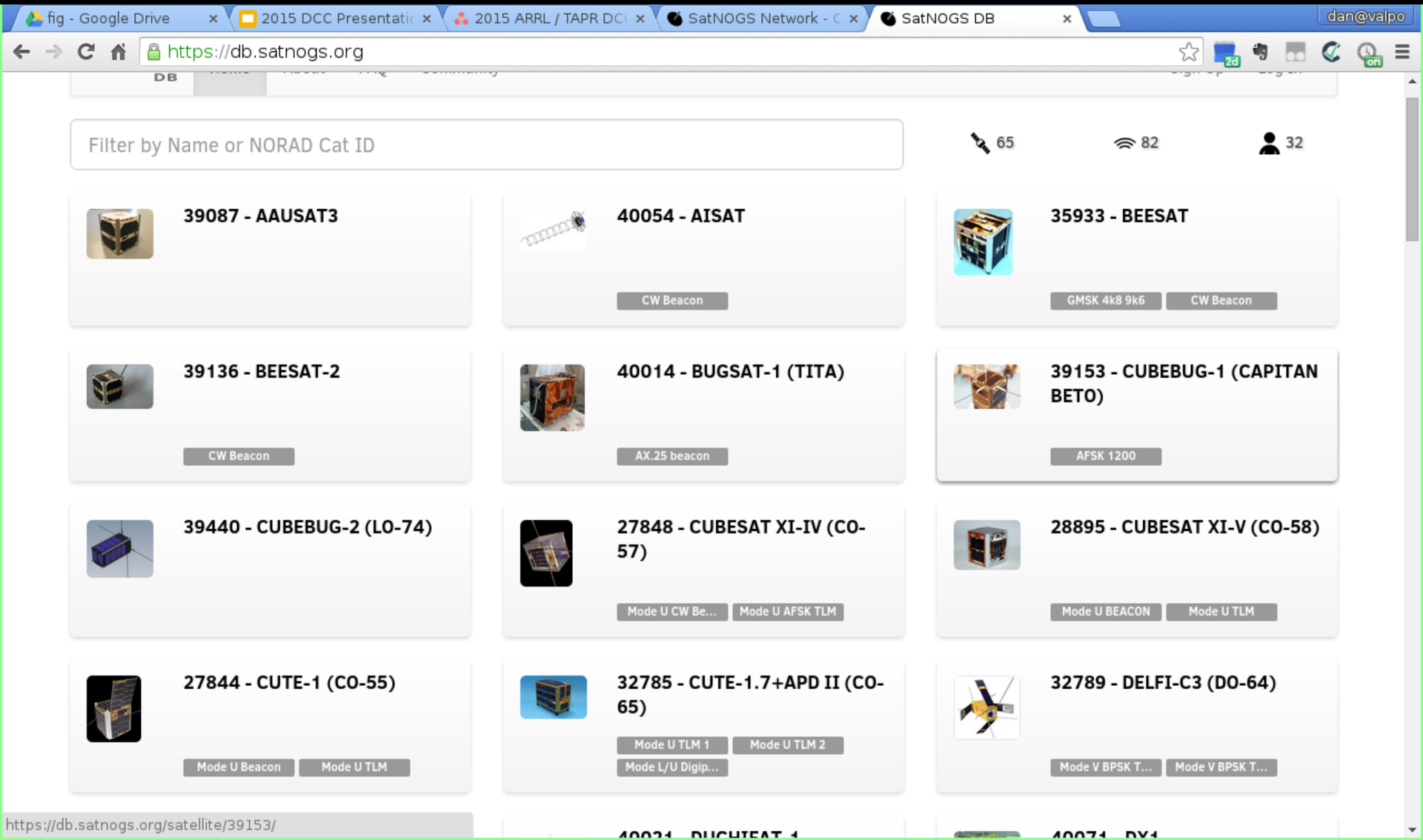
SatNOGS Network



SatNOGS DB

Central place for sat TLEs, TX, mode.

JSON API



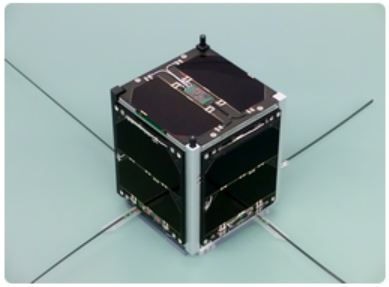
SatNOGS DB

SatNOGS DB - Sugge ×

https://db.satnogs.org/satellite/39444/

SatNOGS DB Home About FAQ Community etihwnad

39444 - FUNCUBE-1 (AO-73)



Suggest New Transmitter

Mode U/V Linear

Alive	True
Invert	True
Uplink Low	435.130 Mhz
Uplink High	435.150 Mhz
Downlink Low	145.950 Mhz
Downlink High	145.970 Mhz

CW Beacon

Alive	True
Mode	CW
Downlink Low	145.815 Mhz

BPSK Telemetry

Alive	True
Mode	BFSK
Invert	True
Downlink Low	145.935 Mhz

SatNOGS Client

The software which runs at the ground station.

- Pulls **Jobs** from the **Network**
- Waits for **Job** start time
- Controls receiver - RTL2832U - based, *any*
  - Band, doppler
- Sends commands to rotator
  - Easycomm → use your own !

SatNOGS Ground Station

The Hardware

SatNOGS NETWORK

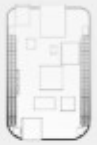
No Network Connectivity

Commercial Software

SatNOGS CLIENT

Gpredict & Gqrx

Raspberry Pi

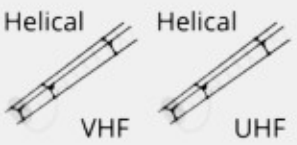


Beaglebone Black

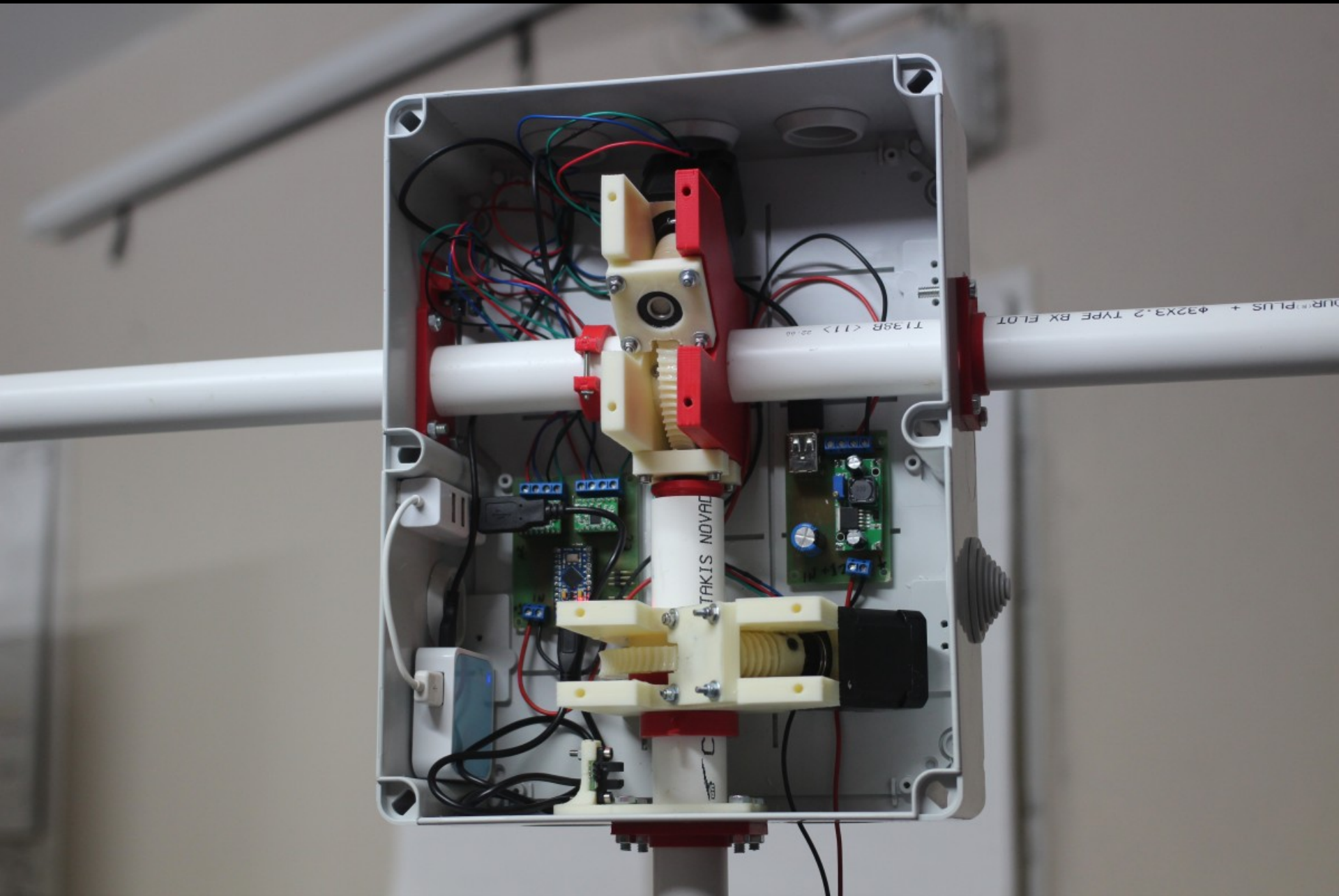
Odroid U3

Commerical Rotator

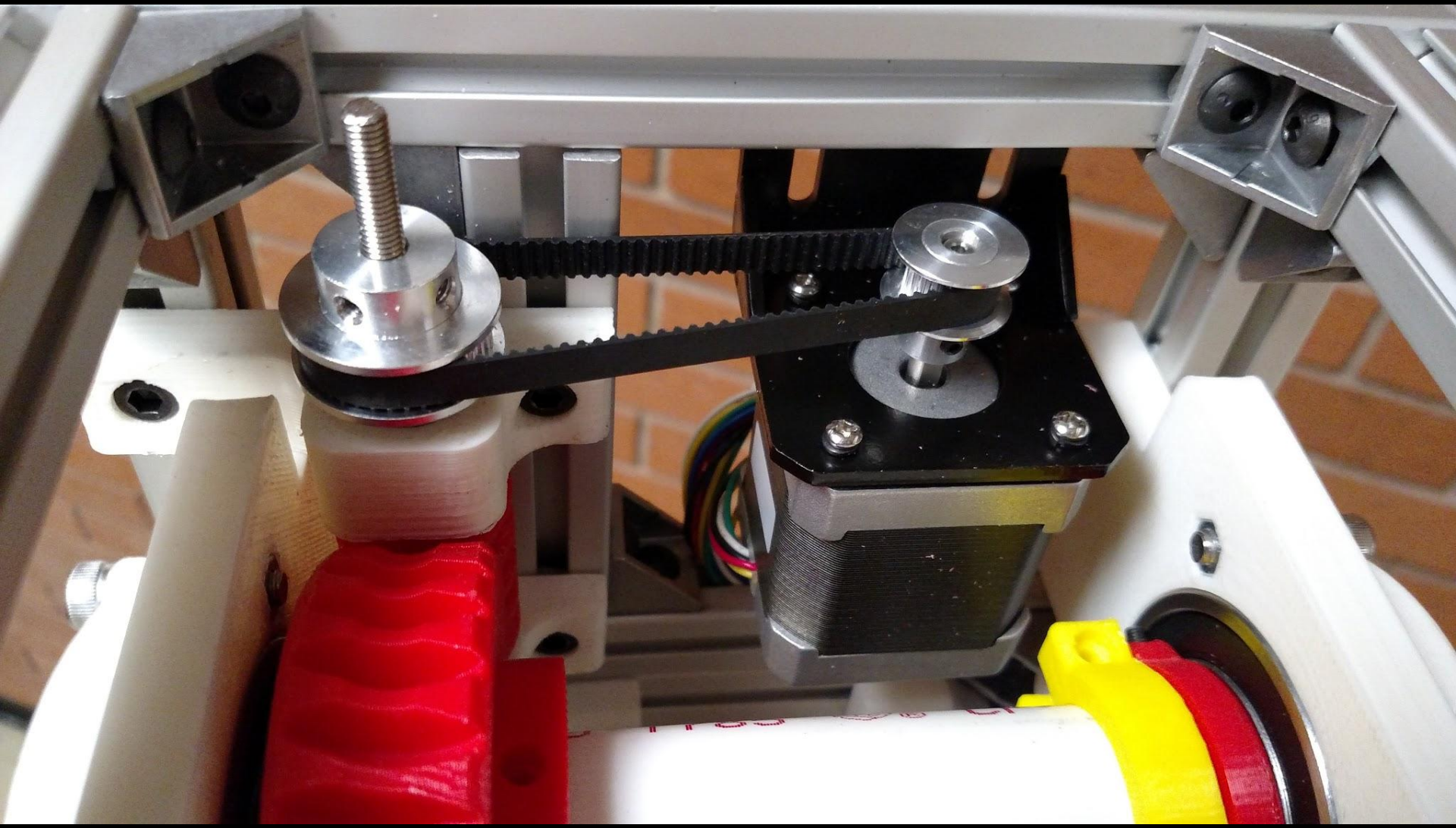
SatNOGS v2 Ground Station



SatNOGS Ground Station - v2



SatNOGS Ground Station - v3



Receivers

RTL2832u dongle - software ready

Yours via CAT

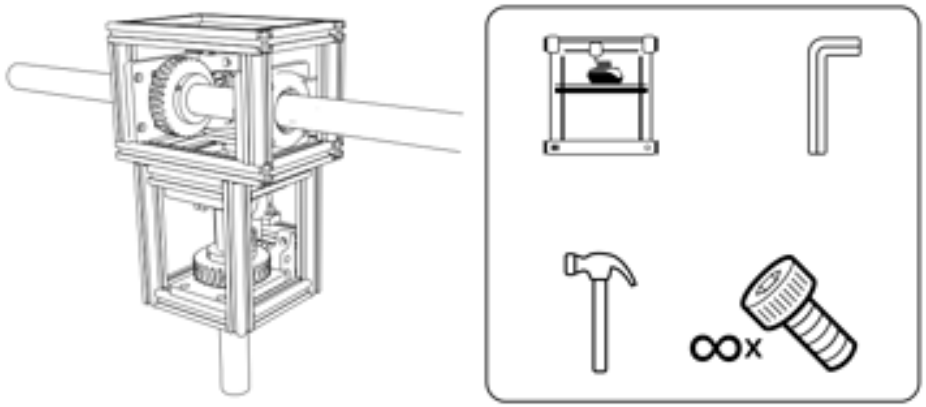
HackRF

Ettus

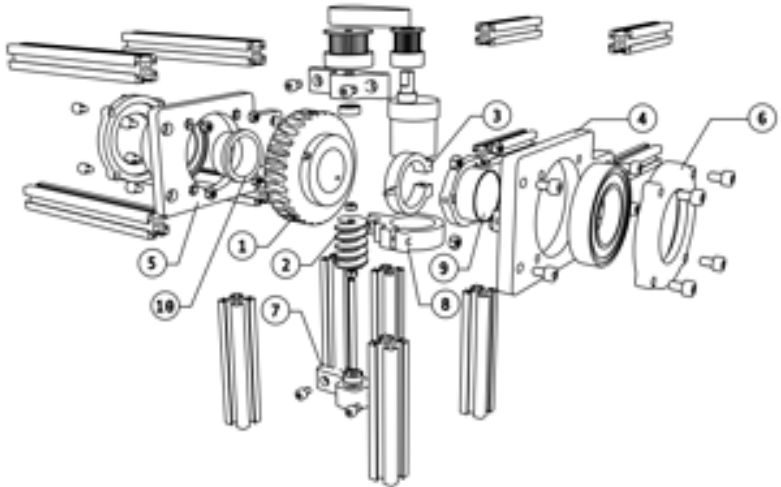
manthos

If SatNOGS was designed from a carpenter somewhere in the Scandinavian peninsula... 😄

SJATNÖGS



1.



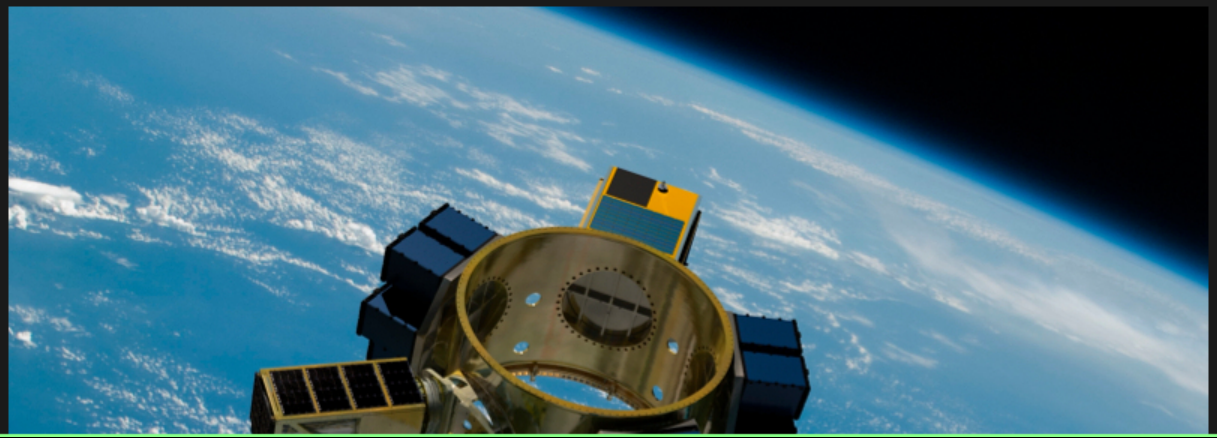
dan : bash ? Konsole
2015 ARRL / TAPR DCC - Google Drive - Google Chrome
Original Hackers? New Satellite in Orbit | Hackaday - Google Chrome
Original Hackers' New
dan@valpo
hackaday.com/2015/10/10/original-hackers-new-satellite-in-orbit/

ORIGINAL HACKERS' NEW SATELLITE IN ORBIT

by: Rud Merriam

No comments

October 10, 2015

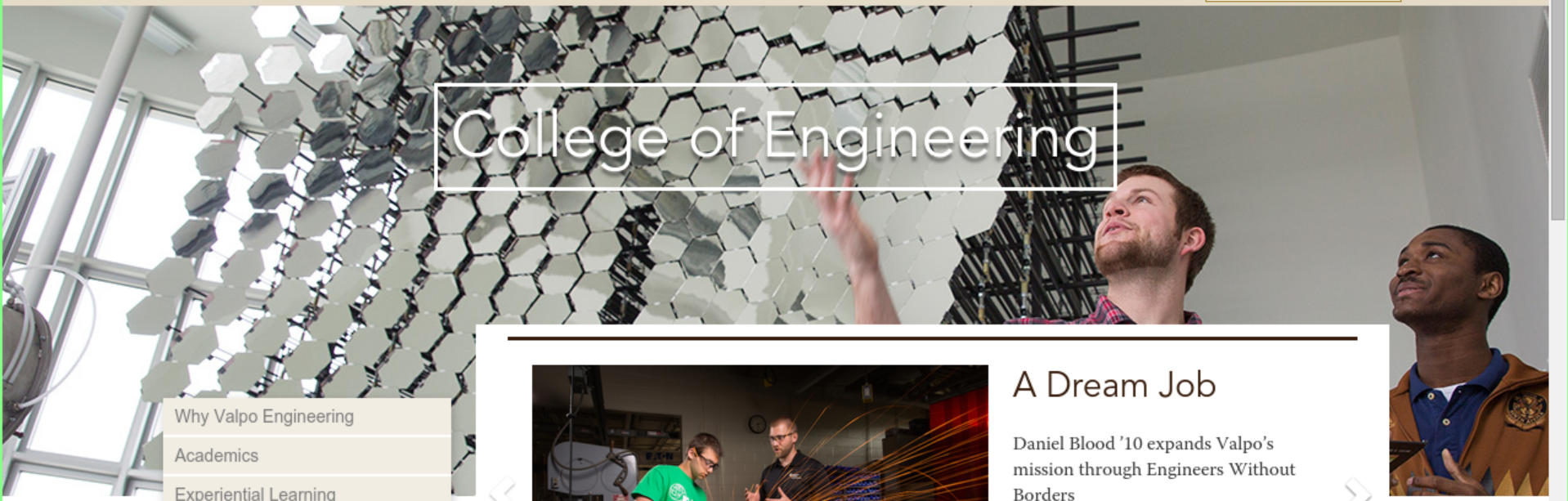


valpo.edu

APPLY TO VALPO | GIVE TO VALPO

VALPARAISO UNIVERSITY

ABOUT | ACADEMICS | STUDENT LIFE | ADMISSION | ATHLETICS | THE ARTS | ALUMNI | RESOURCES | Search Valpo...



- Why Valpo Engineering
- Academics
- Experiential Learning
- Faculty
- Facilities
- Apply
- About the College
- Grants

A Dream Job

Daniel Blood '10 expands Valpo's mission through Engineers Without Borders

Learn More >

Valparaiso University's College of Engineering

and

INTRODUCTION TO MICROCONTROLLERS &

www.valpo.edu/news/2015/07/09/a-dream-job-daniel-blood-10-expands-valpos-mission-through-engineers-without-borders/

First time hearing SO-50

Fox-1A LilacSat-2

Hands-on engagement

The next generation →
(it's not me)

FM capture theory + reality

Doppler shift

Future ground station ??

Valpo' dual-pol radar

Az: 360° / 10 s

satnogs.org

community.satnogs.org

github.com/satnogs

#satnogs on freenode IRC

valpo.edu • dan.white@valpo.edu