CubeSat-based Search and Rescue Mission

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Introduction

2400 events	Maritime 52%	On Land 27%	Aviation 21%

- Thousands of incidents relayed to satellites (SARSAT network) yearly
- Imaging can help to better assess the nature of these emergency situations
- Resolutions $\in [1, 1.5\text{m}]$ could significantly upgrade current networks

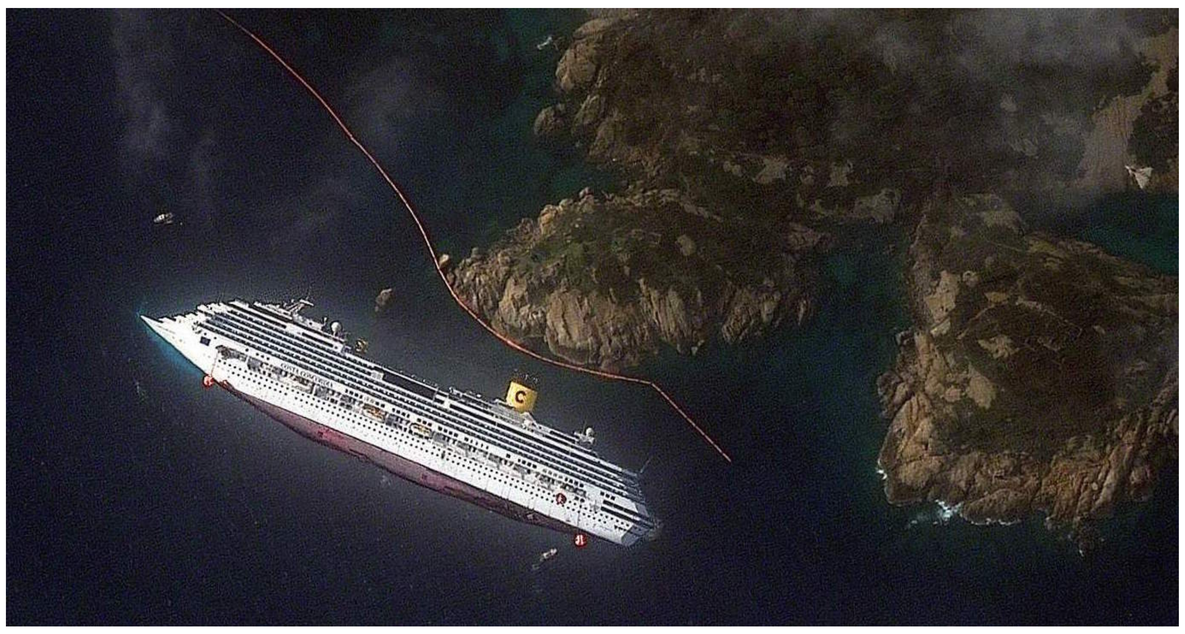
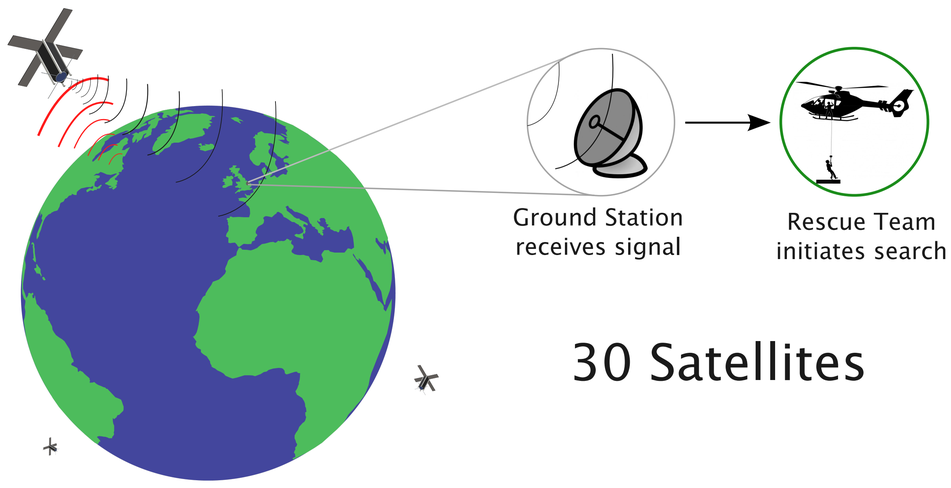


Figure 1: Costa Concordia cruise ship after it sank in Italy. Courtesy of DigitalGlobe.

Proposal – SAR CubeSat Constellation



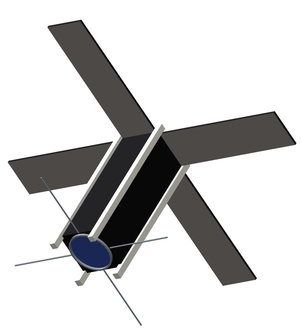
- a constellation of 30 small satellites that works synchronously with the SARSAT network
- At a low altitude (100 – 200 km), each spacecraft would still have a considerable field of view and short revisit time ⇒ reduced response times
- reduced size and costs allows more frequent recycling and upgrades

CubeSat Prototype

Student-led team developing a cost effective prototype to model the behaviour of a single CubeSat.

Mission

- detect and locate distress signals
- orientation capabilities for image capture
- transmit image to ground station
- duration: 2 – 5 months
- very low Earth orbit (100km – 200km)



Objective

- demonstrate the operation of a single satellite in the SAR Constellation
- test distress signals will be sent to prove the effectiveness of the system

Prototype Specifications

Form Factor	3U (30cm x 10cm x 10cm) CubeSat
Structure	CFRP panels and aluminium frame
ADCS	reaction wheels and magnetorquers
Power	deployable solar array
Camera	catadioptric lens system (1.5m spatial resolution)

Communications Systems

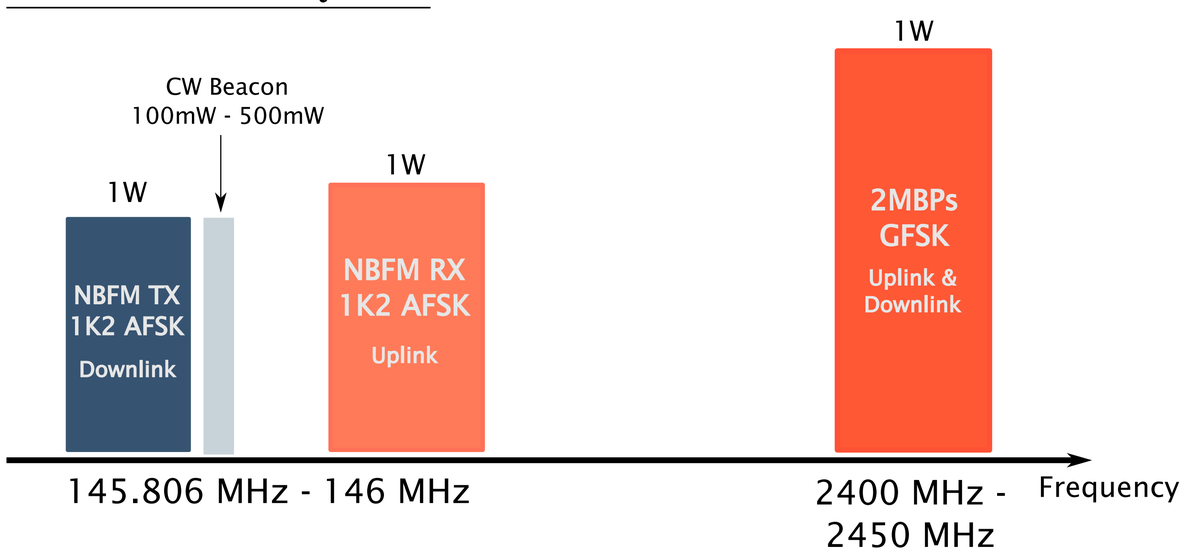


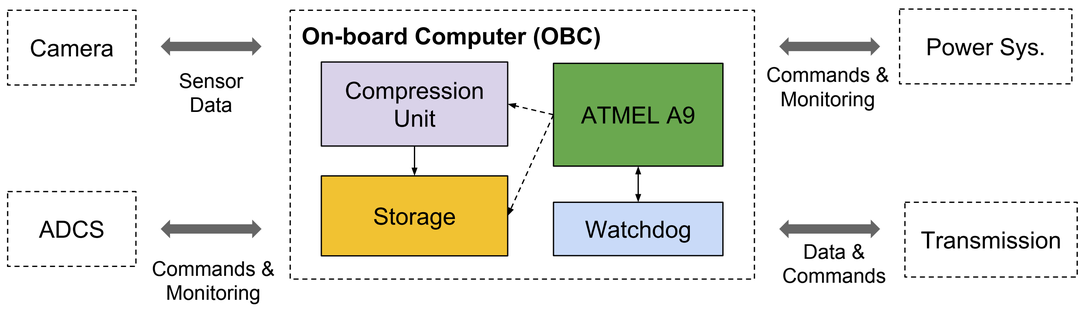
Figure 2: C&C Uplink and Downlink. HT Datalink. The ground station will be located in London.

Attitude Determination & Control Systems

- After separating from the P-POD, magnetometers and magnetorquers will be used for detumbling and stabilizing.
- When in-orbit attitude is attained, magnetometers, magnetorquers and reaction wheels for stabilization around one axis (in conjuction with Earth sensors) will maintain the CubeSat pointing nadir.
- The imaging mode will activate the sun sensors along with the Earth sensors and reaction wheels to achieve an accuracy of $0.1°$.

On-Board Computer

Command & Data	Atmel SAMA5D3, ARM Cortex-A5
Image Compression I	Gumstix Overo EarthStorm
Image Compression II	Spartan 6 / Artix 7 / Zynq 7000
Other	Dual SD Cards, Watch Dog circuit



Conclusion

- By adding imaging capabilities to the current space search and rescue networks, their effectiveness and responsiveness could be dramatically improved.
- Our concept, with its highly upgradable and renewable constellation would be able to perform these tasks at a very low-cost.
- The satellite under development will demonstrate the potential of this idea.
- At the same time, this project introduces space and its industry to many students for the first time.