

An aerial photograph of a large industrial port facility, likely an oil refinery or storage terminal. The facility is situated along a body of water, with a large area filled with numerous large, cylindrical oil storage tanks. Several large ships are docked at the piers, and the surrounding area includes various industrial buildings and infrastructure. The water is a deep blue, and the sky is clear.

Capacity Building & 21st Century Space

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Amsterdam, Netherlands

Berlin, Germany

PLANET

WORLDWIDE LOCATIONS



~500

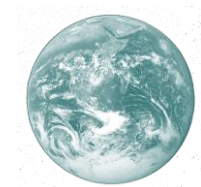
1/3

Employees World Wide
European Workforce



Planet.

- In-house design, build, & mass manufacture Satellite Systems
- Automated Mission Operations with dozens of our own Ground Stations
- Make Data activated to the web & accessible via a Platform for Analytics
- Mission One: Image the entire Earth every day, making change visible, accessible and actionable.



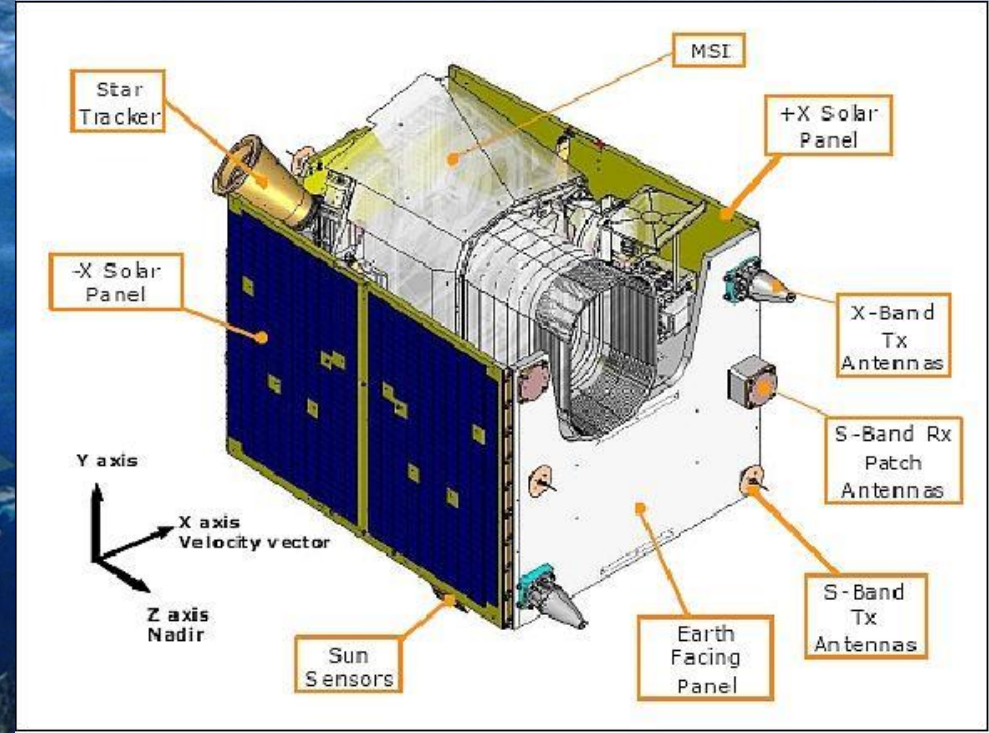
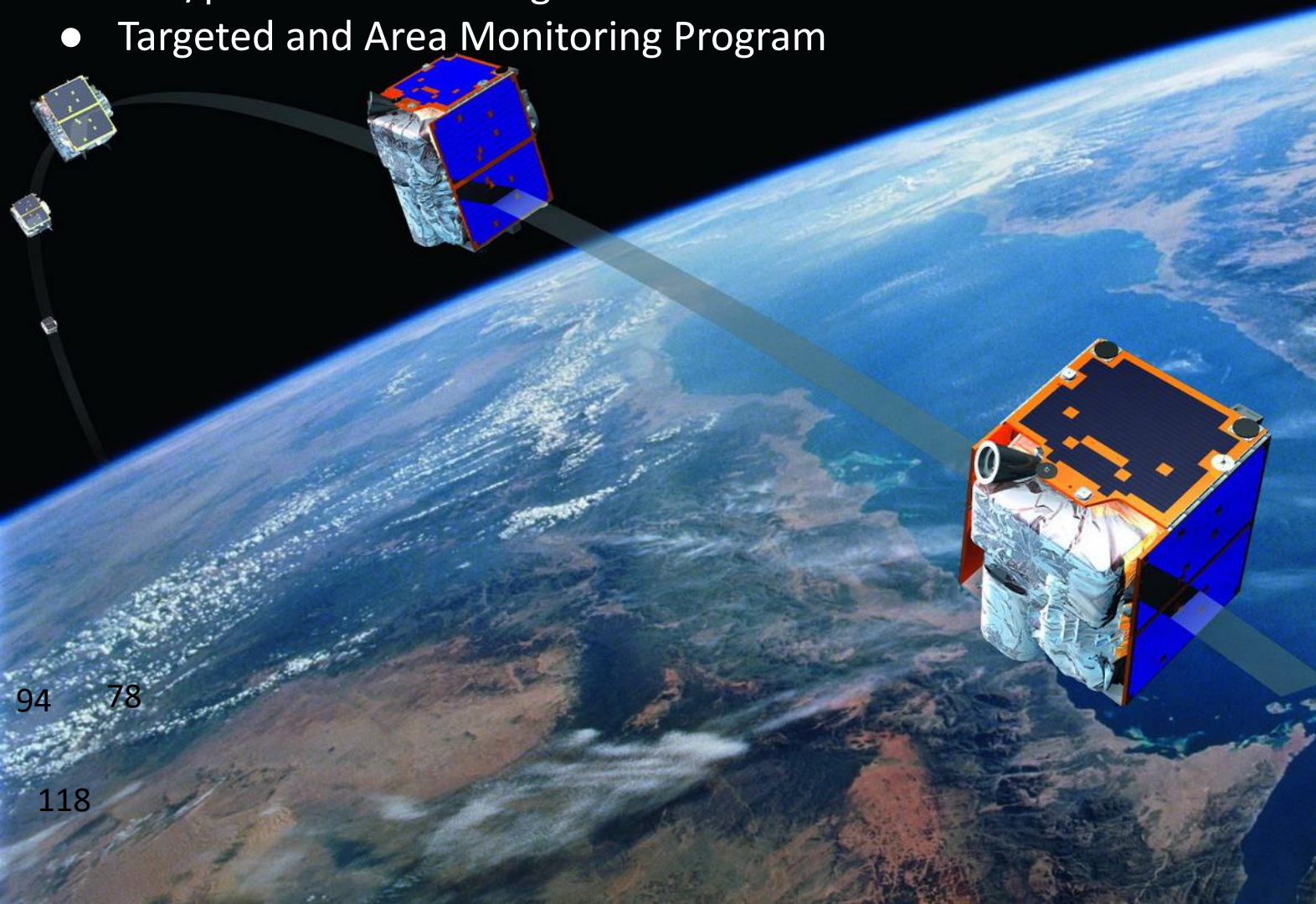
“Mission One”





RapidEye

- 5 Satellites
- Constellation Complete
- 5 m/px RGB NIR RedEdge
- Targeted and Area Monitoring Program



94 78

118



SkySat

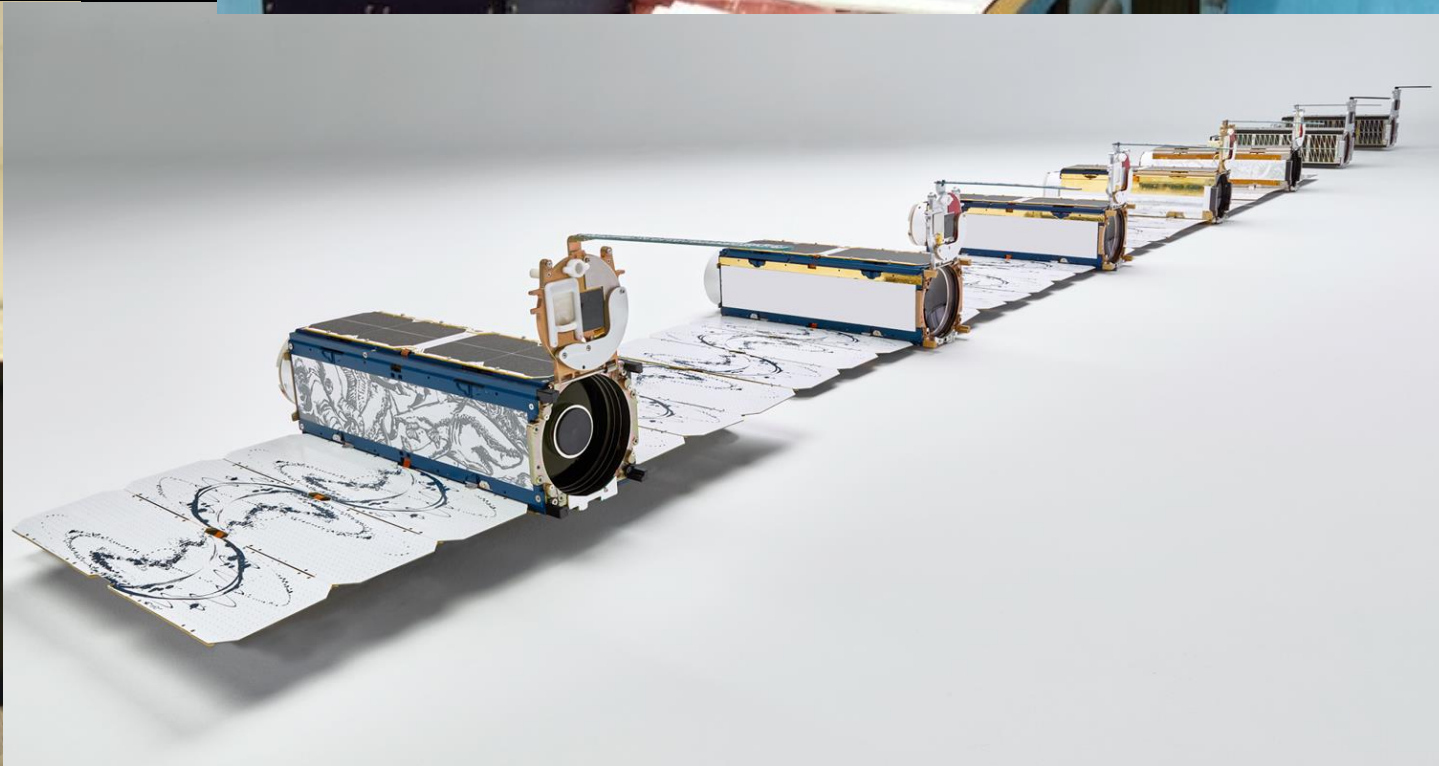
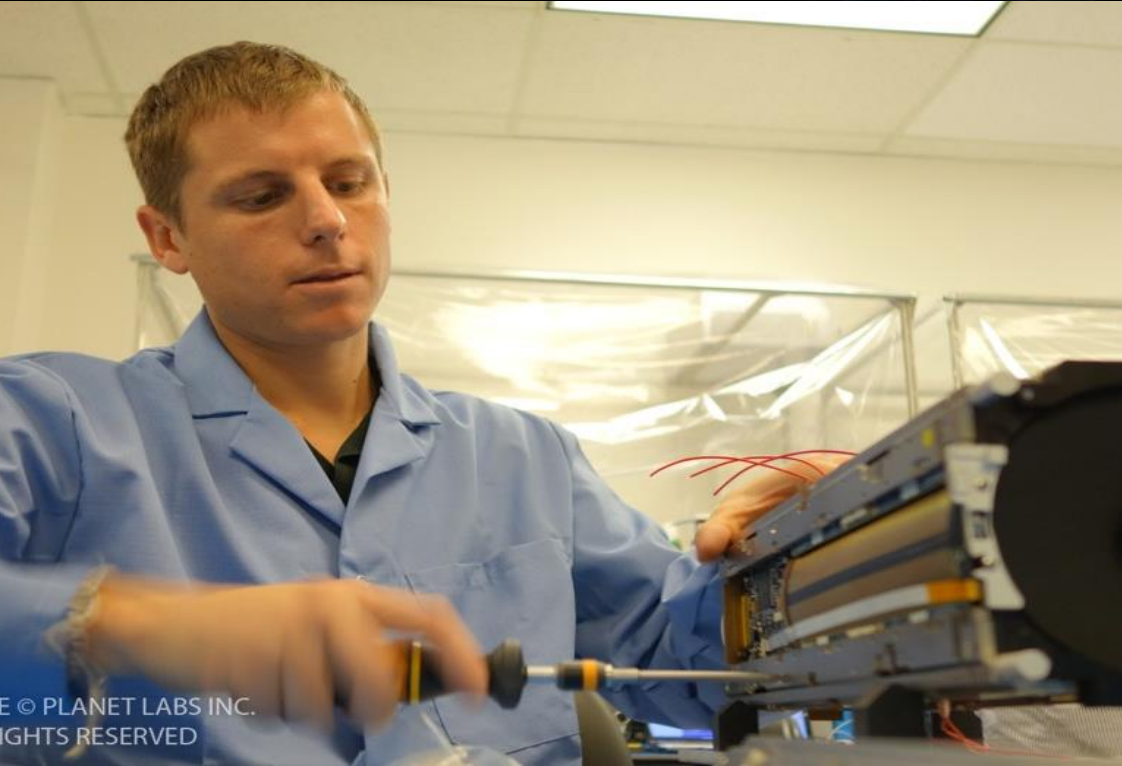
- 7 Satellites
- 6 more Satellites in SSO in Q4 2017
- 70-90 cm/px PAN, RGB NIR
- Targeted Monitoring Program
- Tasking & Video





DOVE

- 148 Satellites
- Constellation Complete
- 3.1 m/px RGB NIR
- Daily, Global Monitoring Program



- **14** successful launches of Doves in space
- **~300** satellites launched over the last ~4 years
- **3** launches remaining in 2017







OPPORTUNITY

Setup algorithm to check aircraft counts at all parking areas at multiple airfields to reveal patterns of aircraft movement.

Implement alert via text or email when aircraft reach pre-determined low and high thresholds set by users.



#6 (EO) – Web Geo

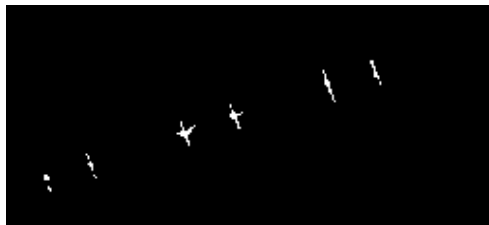




COUNTING AIRCRAFT

Hong Kong International Airport

02 MAR 2017



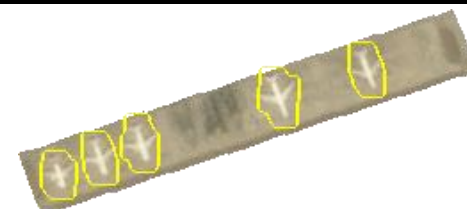
6 of 6 planes detected

05 FEB 2017



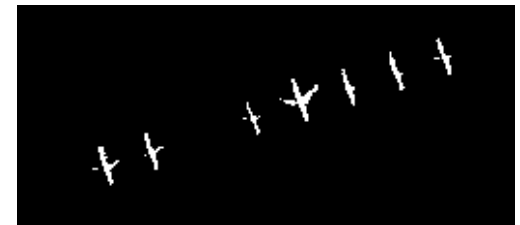
7 of 7 planes detected

12 FEB 2017



5 of 5 planes detected

16 FEB 2017



7 of 7 planes detected

#6 (EO) – Web Geo

SHIP DETECTION

Run the ship detection algorithm

```
In [4]: import json
from osgeo import gdal
import numpy
from skimage.segmentation import felzenszwalb
from skimage.segmentation import mark_boundaries
from skimage.measure import regionprops

# Prepare result structure
result = {
    "ship_count": 0,
    "ships": []
}

# Open image with gdal
ds = gdal.Open(sample_data_file_name)
xoff, a, b, yoff, d, e = ds.GetGeoTransform()

# Convert multi-channel image it into red, green and blue[, alpha] channels
red, green, blue, alpha = numpy.rollaxis(numpy.array(img), axis=-1)

# Mask: threshold + stops canny detecting image boundary edges
mask = red > 75

# Create mask for edge detection
skimage.io.imsave('output/mask.png', mask * 255)

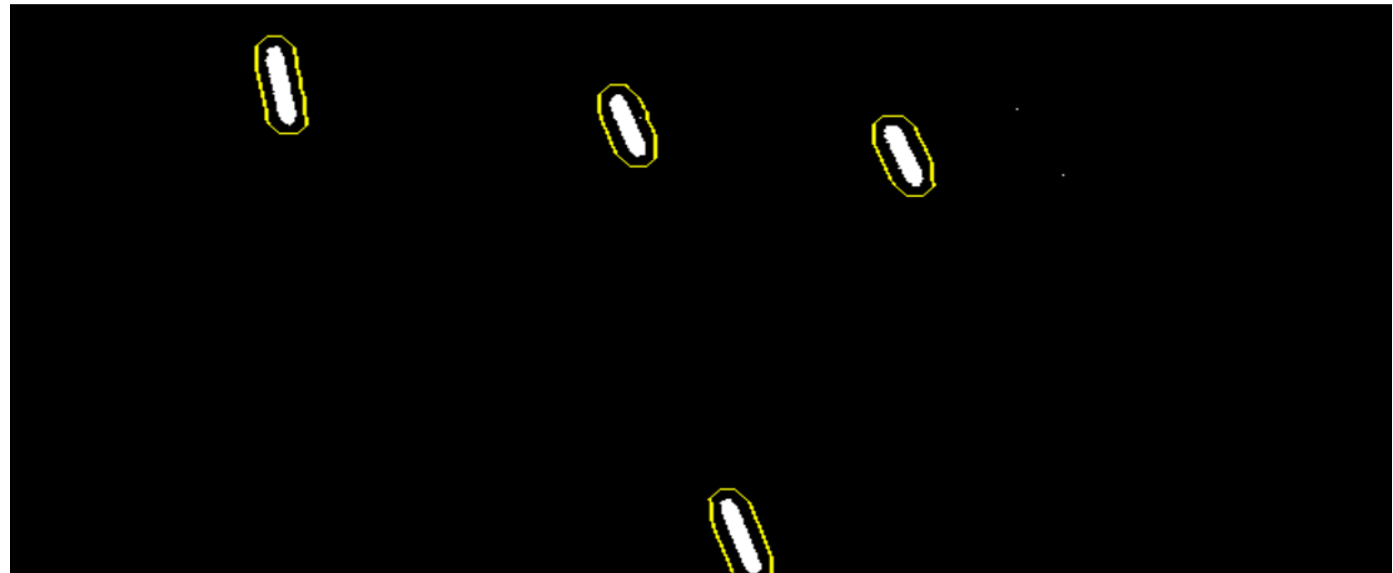
# Use Felzenszwalb algo to find segments
segments_fz = felzenszwalb(numpy.dstack((mask, mask, mask)),
                           scale=5000,
                           sigma=3.1,
                           min_size=25)

# Build labeled mask to show where ships were detected
segmented_img = mark_boundaries(mask, segments_fz)
skimage.io.imsave('output/mask_labeled.png', segmented_img)

# Count ships and save image of each boat clipped from masked image
for idx, ship in enumerate(regionprops(segments_fz)):
    # If area matches that of a standard ship, count it
    if (ship.area >= 300 and ship.area <= 10000):
        # Increment count
        result['ship_count'] += 1

        # Create ship thumbnail
        x, y = (int(numpy.average([ship.bbox[0],
                                   ship.bbox[2]])),
               int(numpy.average([ship.bbox[1],
                                   ship.bbox[3]])))
        sx, ex = max(x - 35, 0), min(x + 35, img.shape[0] - 1)
        sy, ey = max(y - 35, 0), min(y + 35, img.shape[1] - 1)
        img_ship = img[sx:ex, sy:ey]
        skimage.io.imsave('output/ship-%s.png' % str(idx + 1), img_ship)

# Get global coordinates from pixel x, y coords
lat = a * y + b * x + xoff
lng = d * y + e * x + yoff
```



COUNTING MOORED SHIPS

North Korea



Open Water Ships
Korean People's Navy Bases
[Logout](#)

Ch'o-Do

0 ships on 2017-02-21

New in last 5 days

Changjon

1 ships on 2017-02-21 (+1)

New in last 5 days

Munchon Up

1 ships on 2017-02-21 (+1)

New in last 5 days

Mayang Do

0 ships on 2017-02-21 (-1)

New in last 5 days

Wonsan

7 ships on 2017-02-21 (-3)

New in last 5 days

T'oejo-Dong

0 ships on 2017-02-21

New in last 5 days

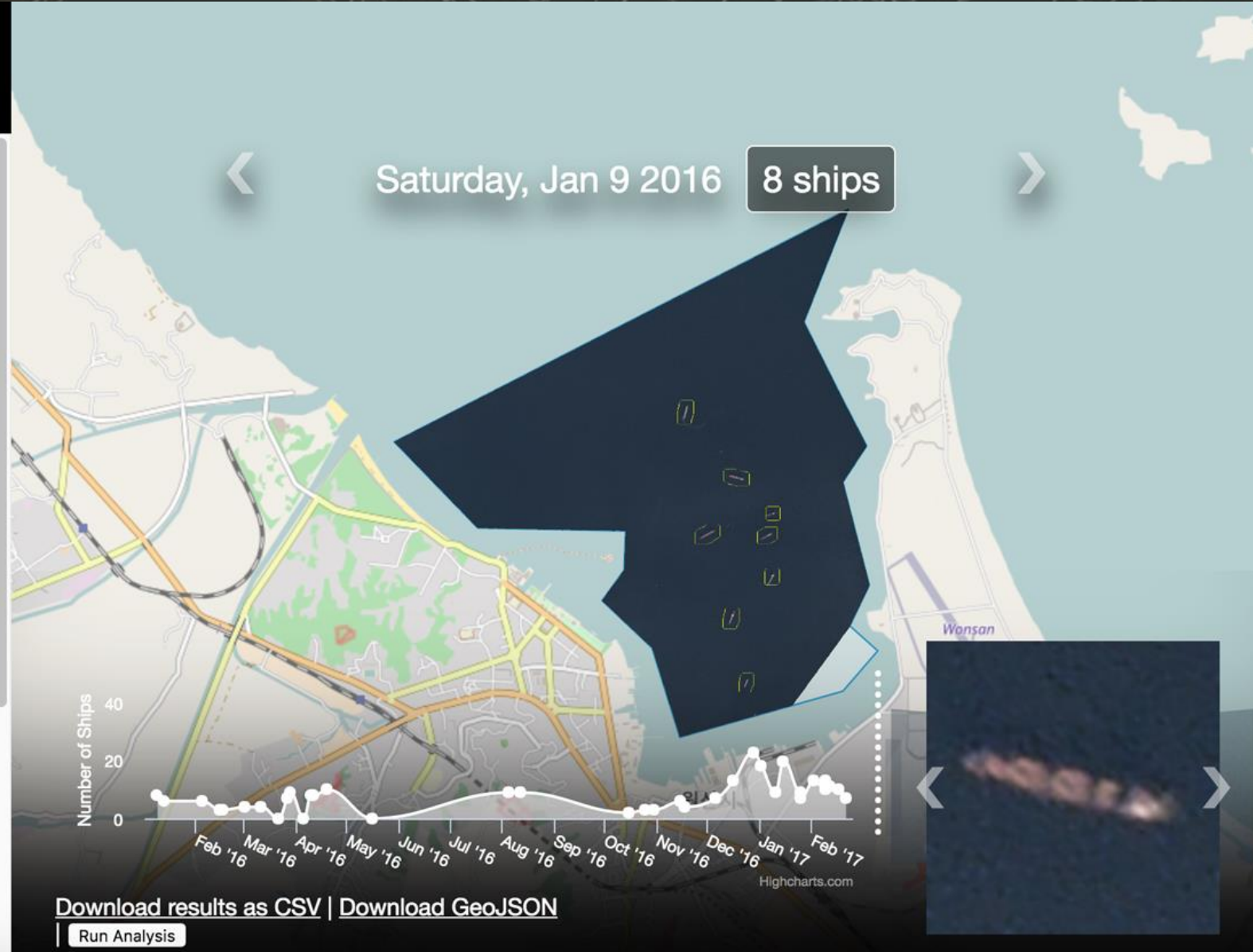
Sagon-Ni

0 ships on 2017-02-20

New in last 5 days

Pip'a-Got

0 ships on 2017-02-18 (-1)



PLANET
USE CASE

An aerial photograph of San Francisco, showing the dense urban grid of the city on the left and the San Francisco Bay on the right. The Golden Gate Bridge is visible, spanning the water. Several large cargo ships are docked at the piers along the waterfront. The text "21st Century Space" is overlaid in large white letters across the middle of the image.

21st Century Space

San Francisco, Dec 27 2016



3rd Wave of Space Activities

1. Dawn of Space Age – 1960s

- Space Race, Apollo, Cold War
- Government Dominated

2. International Coop & Commercial Telecom – 1990s

- ISS & International Flagship Missions
- Commercial Investment & Ventures; Largely unsuccessful

3. Commercial Near-Earth Space – 2020s

- New Entrants (countries, companies)
- Changing Role of Governments
- Commercial-first organizations



Decreased Barriers to Entry

1. Access to Space

- Secondary Payloads
- ISS
- Small Launch

2. Small Satellites

- Decreases launch cost & satellite cost
- Decrease development timeline & Increase risk

3. New Commercial Aerospace Services

- Can buy low-cost Satellites from vendors
- Can lease ground stations and mission control capabilities
- Allows new entrants (companies and governments) to create unique programs based on their goals

4. Increase Utility of Space Data

- Commodization of mobile phones
- Commodization of Big Data, Storage and Compute & Analytics
- New opportunities for in-situ data combinations
- New opportunities in developing countries with global datasets



THE CHANGING GOVERNMENT ROLE

- Encourage New Entrants rather than have Government programs 'compete' with Industry
- Establish leadership on what could be the Next, New Industry in 21st Century Space with forward leaning Policies & new Programs
 - Continue core industry & Flagship Mission programs
 - Fund High Risk, High Reward Demonstration Missions (~12 months start-to-finish)
 - Be a Solid, Second Customer and Buy Operational Commercial Services
- Invest in a predictable Regulatory Environment that has insight, oversight and foresight to this rapidly changing industry
 - Space Traffic Management & Space Debris
 - RF Spectrum
 - Data Protection Policies





CAPACITY BUILDING OPPORTUNITIES

Capacity Building Opportunities

1. Build a Small Satellite







Building a Satellite

- Can buy components and systems for a student / small company to get into space
- Leasing of ground stations and/or mission control allows for lower cost
- Recommendation: focus on the data analysis



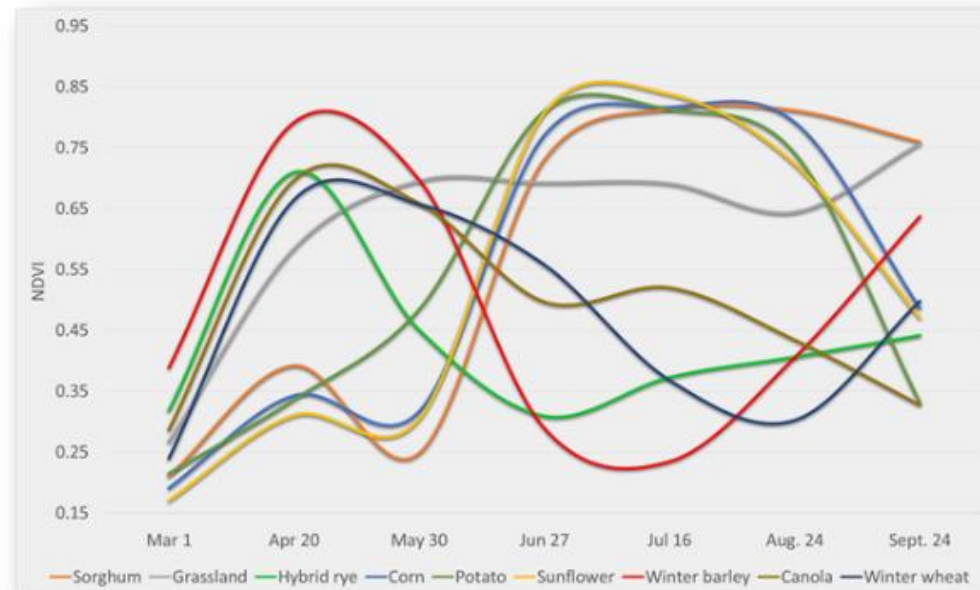
Capacity Building Opportunities

1. Build a Small Satellite
2. Combine Local Data and Expertise



CROP TYPE CLASSIFICATION

- Crop classification generally benefits from analyzing multi-temporal imagery within a growing season
- Allows for utilizing crop's different phenological development and thus the different spectral behavior



NDVI evolution of various crops

CROP TYPE CLASSIFICATION



Local Data is Key

- Data from Space is most valuable when it is classified with in-situ data on the ground
- Combining local government data with Earth Observation data can create much more accurate algorithms to power new applications.

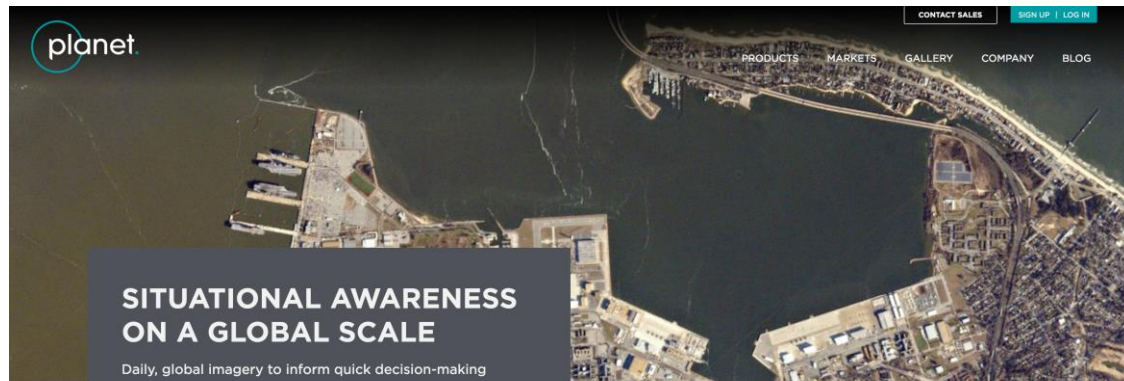


Capacity Building Opportunities

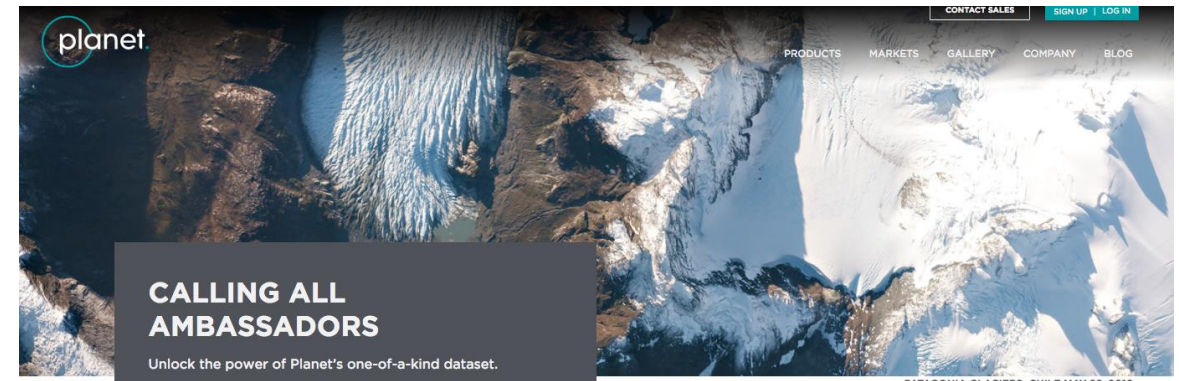
1. Build a Small Satellite
2. Combine Local Data and Expertise
3. Government to Empower Universities



Federal & Academic/ADP Program



UNDERSTAND OUR EVER-CHANGING
WORLD



GET ACCESS. MAKE DISCOVERIES.

Let our data power your next breakthrough. We're looking for innovative academics, researchers, scientists and nonprofit organizations to become a Planet Ambassador, and incorporate frequent, high resolution imagery into your next project. Over a six month period, Ambassadors gain access to our growing imagery archive within an area of geographic interest. Dig into the data, analyze new findings, and publish your results.

[APPLY NOW](#)



Governments to focus on University Capacity

- Universities can use free and open Earth Observation data and FOSS software to build new applications
- Governments can open their data and purchase commercial EO data and give a problem-set to local universities to build new applications
- Governments and Universities should encourage student entrepreneurs to commercialize their new applications.



Capacity Building Opportunities

1. Build a Small Satellite
2. Combine Local Data and Expertise
3. Empower Government and Universities
4. Focus on the Local and Regional Market





From Regional to Global

- With successful local data-driven products, entrepreneurs can expand regionally and team up with global organizations
 - Agriculture – from small-holder to large corporates
 - Risk & Insurance
 - Climate & Disaster Response
 - Natural Resources, Energy and Environment
 - National Development and SDGs
- Facilitates local Economic Development



Capacity Building Opportunities

1. Build a Small Satellite
2. Combine Local Data and Expertise
3. Empower Government and Universities
4. Focus on the Local and Regional Market
5. Leverage Global Development Programs



CARBON LOSS ESTIMATING

◀ 2016 ▶

CARBON EMISSIONS LOSS

■ CARBON IN 1,000 TONS MG



CARBON LOSS ESTIMATING

◀ 2016 ▶

CARBON EMISSIONS LOSS

■ CARBON IN 1,000 TONS MG

JUN. 15—AUG. 13



5,856



CARBON LOSS ESTIMATING

◀ 2016 ▶

CARBON EMISSIONS LOSS

■ CARBON IN 1,000 TONS MG

JUN. 15—AUG. 13



5,856

AUG. 13—25



18,276



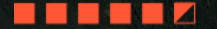
CARBON LOSS ESTIMATING

◀ 2016 ▶

CARBON EMISSIONS LOSS

■ CARBON IN 1,000 TONS MG

JUN. 15—AUG. 13



5,856

AUG. 13—25



18,276

AUG. 25—NOV. 11



105,168



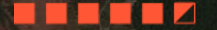
CARBON LOSS ESTIMATING

◀ 2016 ▶

CARBON EMISSIONS LOSS

■ CARBON IN 1,000 TONS MG

JUN. 15—AUG. 13



5,856

AUG. 13—25



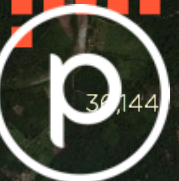
18,276

AUG. 25—NOV. 11



105,168

NOV. 11—DEC. 22



30,144

Capacity Building Opportunities

1. Build a Small Satellite
2. Combine Local Data and Expertise
3. Empower Government and Universities
4. Focus on the Local and Regional Market
5. Leverage Development Programs
6. Build Community & Convenings





A composite image showing a space station with large solar panel arrays on the left, a satellite in the center, and the Earth's horizon with clouds at the bottom. The background is the blackness of space.

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