

FISO Telecon

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# Technologies feeding small satellite revolution

- Space Segment Moore's law
- Launch Segment containerization
- Ground Segment cloud processing, on the horizon...

SN

#### Man Behind Moore's Law Bankrolling Cubesat Mission

by Peter B. de Selding — April 21, 2015



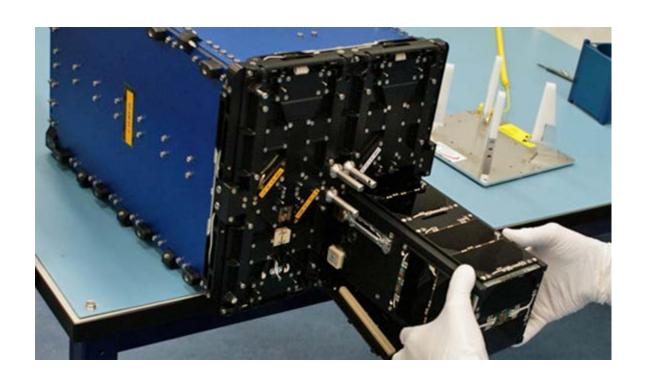
UKube-1. Credit: Archibald photography

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PARIS — Clyde Space of Scotland will build two 4-kilogram cubesats to be launched in 2017 to study ocean color worldwide in a mission financed by a private U.S. foundation, Glasgow-based Clyde

#### **Containerized Launch!**

- Protects primary satellite from small satellite
- Reduces complexity of "Coupled Loads"
- Enables integration very late in rocket integration flow
- Breaks the one rocket = one satellite equation



**C** www.spaceflight.com/schedule-pricing/



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Launch | Networks | Systems

|              |                             |              | Containerized |             |             | Satellite Class |        |        |        |        |
|--------------|-----------------------------|--------------|---------------|-------------|-------------|-----------------|--------|--------|--------|--------|
| Date<br>(CY) | Orbit                       | Туре         | 3U            | 6U          | 12U         | 50 kg           | 100 kg | 150 kg | 200 kg | 300 kg |
| Q2 2015      | 600-830 km circular,<br>SSO | Russian      | SOLD<br>OUT   | SOLD<br>OUT | SOLD<br>OUT | SOLD            | SOLD   | SOLD   | SOLD   | SOLD   |
| Q3 2015      | 450×720 km circular,<br>SSO | US           | SOLD<br>OUT   | SOLD        | SOLD<br>OUT | SOLD            | SOLD   | SOLD   | SOLD   | SOLD   |
| H2 2015      | 400 km circular, 51.6°      | US/ISS       | SOLD<br>OUT   | SOLD        | SOLD<br>OUT | SOLD            | SOLD   | SOLD   | SOLD   | SOLD   |
| H2 2015      | 700 km circular, SSO        | European     | Υ             | Υ           | Υ           | Υ               | N      | N      | N      | N      |
| H1 2016      | 500-600 km circular,<br>SSO | Confidential | Υ             | Υ           | Υ           | Y               | Υ      | Υ      | Y      | Υ      |
| H1 2016      | 600 km circular, SSO        | European     | Υ             | Υ           | Υ           | Υ               | Υ      | Υ      | Υ      | Υ      |
| H1 2016      | 510 km circular, SSO        | Russian      | Υ             | Υ           | Υ           | Υ               | Υ      | Υ      | Υ      | Υ      |
| H1 2016      | 400 km circular, 51.6°      | US/ISS       | Υ             | Υ           | Υ           | Υ               | N      | N      | N      | N      |
| H2 2016      | 600 km circular, SSO        | European     | Υ             | Υ           | Υ           | Υ               | Υ      | Υ      | Υ      | Υ      |
| H2 2016      | 400 km circular, 51.6°      | US/ISS       | Υ             | Υ           | Υ           | Υ               | N      | N      | N      | N      |
| Q4 2016      | 500km, 44°                  | US           | Υ             | Υ           | Υ           | Υ               | N      | N      | N      | N      |

#### **SHERPA** – The Rideshare Cornerstone





Cloud processing dramatically lowers cost of "satellite ground segment", especially in first year for startups

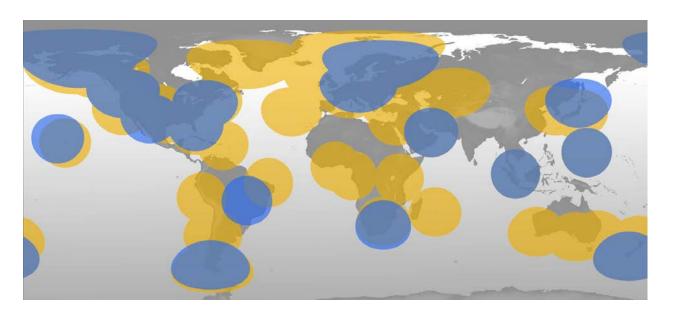
|   | On-premise: | 5  | Cloud        | Savings \$ |    | Saving %    |  |
|---|-------------|----|--------------|------------|----|-------------|--|
| Year 1  | 39,347.18   | \$ | 3,766.80 \$  | 35,580.38  | \$ | 90%         |  |
| Year 2  | 9,063.19    | \$ | 3,766.80 \$  | 5,296.39   | \$ | 58%         |  |
| Year 3  | 9,063.19    | \$ | 3,766.80 \$  | 5,296.39   | \$ | 58%         |  |
| Year 4  | 9,063.19    | \$ | 3,766.80 \$  | 5,296.39   | \$ | 58%         |  |
| Year 5  | 39,347.18   | \$ | 3,766.80 \$  | 35,580.38  | \$ | 90%         |  |
| Year 6  | 9,063.19    | \$ | 3,766.80 \$  | 5,296.39   | \$ | 58%         |  |
| Year 7  | 9,063.19    | \$ | 3,766.80 \$  | 5,296.39   | \$ | 58%         |  |
|   |             |    |              |            |    |             |  |
| Total:  | 124,010.31  | \$ | 26,367.60 \$ | 97,642.71  | \$ | <b>79</b> % |  |
| Please note that inflation is not factored into these results |             |    |              |            |    |             |  |

http://www.sherweb.com/blog/total-cost-of-ownership-of-servers-iaas-vs-on-premise/



#### SPACEFLIGHT NETWORKS

Spaceflight Networks is building a best in class global communications network for small spacecraft



Projected operational sites in 2019









# The Big Bet: Global, Real-Time Market Intelligence...

... NEED <u>PERSISTENT</u> SURVEILLANCE AND COMMUNICATIONS!

(SOUND FAMILIAR?)



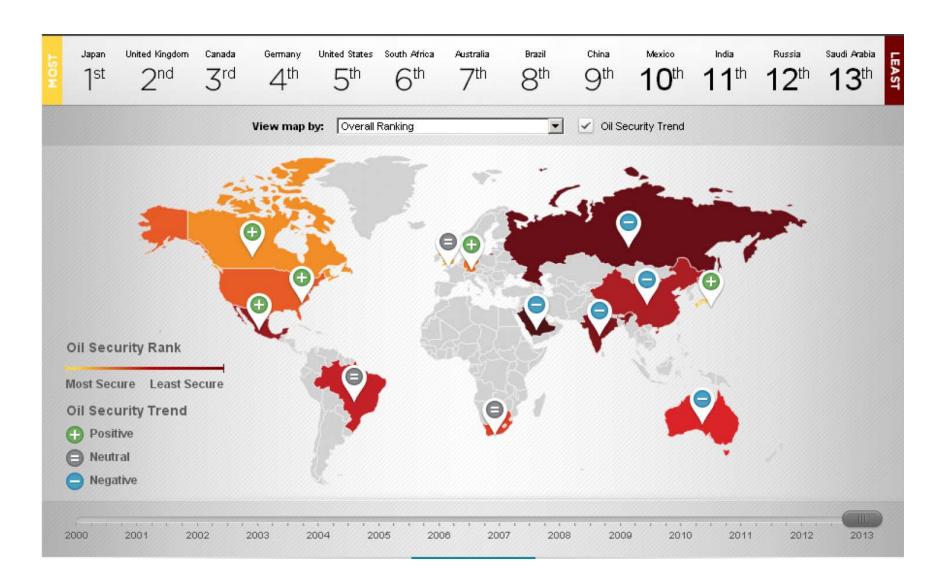
#### **USE CASE (1/3)**

#### Refinery in Baytown Texas

Energy / Oil – Financial services companies and competitors can track corporate or global oil supplies in real time



#### **Monitoring Oil Security...**

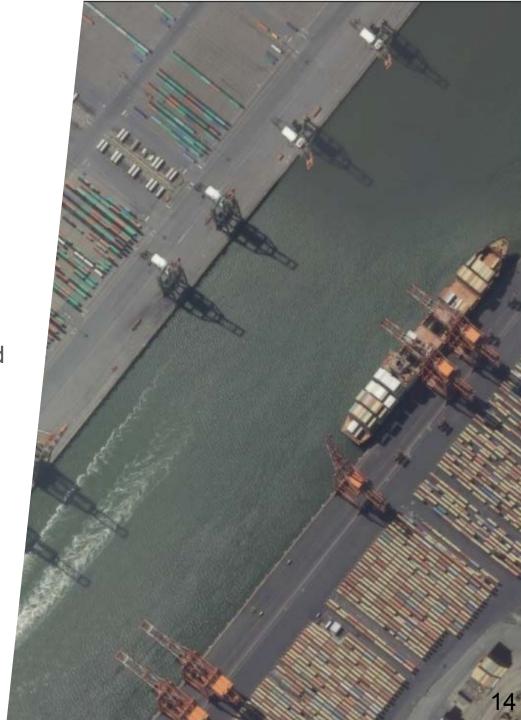


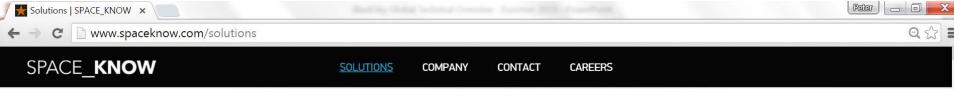


#### **USE CASE (2/3)**

#### Port of New York

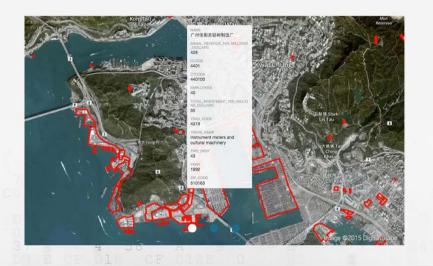
Logistics – Analysis, verification and optimization of logistics infrastructure including global real time monitoring





#### SATELLITE MANUFACTURING INDEX (SMI)

Spaceknow "Satellite Manufacturing Index" (SMI) monitors over 6,000 industrial facilities all across China from space imagery and uses proprietary algorithms to measure level of manufacturing activity. Spaceknow has analyzed over 2.2 billion individual satellite observation points for this report corresponding to an area of 0.5 million square kilometers spanning the time period of last 14 years.



ONE-POINT ACCESS CHANGE DETECTION OBJECT DETECTOR INTELLIGENCE SATELLITE MANUFACTURING INDEX (SMI)



#### **USE CASE (3/3)**

#### Fresno California Agricultural Area

Agriculture – Monitoring and verification of large areas for crop health and rapid damage assessment from weather induced events.



# SPACEFLIGHT INDUSTRIES

Enabling access to space Redefining global intelligence

#### CORPORATE OVERVIEW

Spaceflight Industries is comprised of two synergistic lines of business that are leaders in an emerging \$100B market opportunity.



Revolutionizing access to space to fuel the global intelligence revolution.



Operating the unifying platform and analytics infrastructure to understand the planet in real time.

#### **KEY STATISTICS**

- Founded in 1999
- Headquartered in Seattle, WA with office in Herndon, VA
- 130 Employees
- \$50MM 2016E revenue
- ~100% CAGR 2013-2016
- \$292MM contracted backlog

#### REFERENCE INVESTORS

- Mithril Capital Management
- RRE Ventures
- Vulcan
- Razor's Edge Ventures
- In-Q-Tel



# SPACEFLIGHT HAS TRANSFORMED COMMERCIAL ACCESS TO SPACE

Pioneered the first commercial spaceline – buy seats, not rockets

- Continuing to break launch records: over 90 satellites launched to date, 150 satellites in backlog
- Purchased the first dedicated rideshare SpaceX
   Falcon 9
- Opened the Indian PSLV rocket for commercial customers
- Contracted to fly the first commercial spacecraft to the Moon
- Awarded the first (and only) US Government GSA contract for commercial launch services







① www.spaceflight.com/schedule-pricing/



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Launch | Networks | Systems

#### SCHEDULE & PRICING

Spaceflight is the only rideshare provider to offer published commercial pricing. List pricing is based upon satellite volume, mass, and orbit destination. For satellite constellation deployment options, or launch needs outside of this pricing table, please contact us with your mission requirements.

|                 | Containerized |         |         | Satellite Class |         |          |          |          |          |          |          |
|-----------------|---------------|---------|---------|-----------------|---------|----------|----------|----------|----------|----------|----------|
| Payload Type    | 3U            | 6U      | 12      | 50 kg           | 100 kg  | 150 kg   | 200 kg   | 300 kg   | 450 kg*  | 750 kg*  | 1000 kg* |
| Length (cm)     | 34.05         | 34.05   | 34.05   | 80              | 100     | 100      | 100      | 125      | 200      | 300      | 350      |
| Height/Dia(cm)  | 10.00         | 10.00   | 22.63   | 40              | 50      | 60       | 80       | 100      | 150      | 200      | 200      |
| Width(cm)       | 10.00         | 22.63   | 22.63   | 40              | 50      | 60       | 80       | 100      |          |          |          |
| Mass(kg)        | 5             | 10      | 20      | 50              | 100     | 150      | 200      | 300      | 450      | 750      | 1000     |
| Price - LEO     | \$295         | \$545   | \$995   | \$1,750         | \$3,950 | \$4,950  | \$5,950  | \$7,950  | \$17,500 | \$22,000 | \$28,000 |
| Price - GTO     | \$650         | \$995   | \$1,950 | \$3,250         | \$5,950 | \$6,950  | \$7,950  | \$9,950  | CALL     | CALL     | CALL     |
| Price - GSO/LLO | \$995         | \$1,990 | \$3,250 | \$6,500         | \$9,950 | \$12,950 | \$15,950 | \$19,900 | CALL     | CALL     | CALL     |

Prices shown are in thousands of dollars (USD) for 2017 missions.

Prices shown are standard list prices and do not account for launch specifics.

Standard payment structure

Schedule & Pricing

Payload Users Guide

Mission Resources

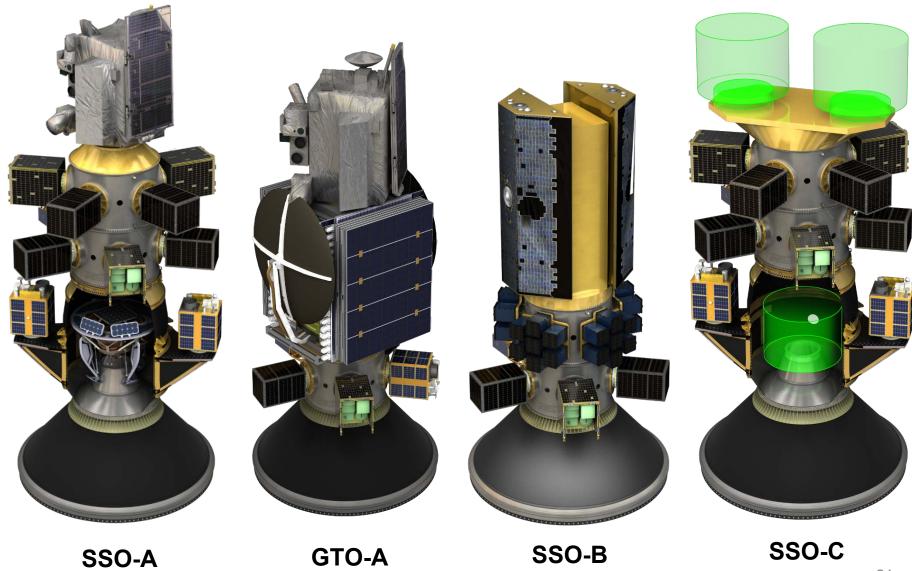
#### **Latest News**

Pathfinder-1 paves the way for BlackSky's 60-satellite constellation to deliver high-resolution, affordable satellite imaging SEATTLE – Sept. 26, 2016 – Spaceflight Industries, a next-generation space company enabling access to space...

Read More

#### SPACEFLIGHT

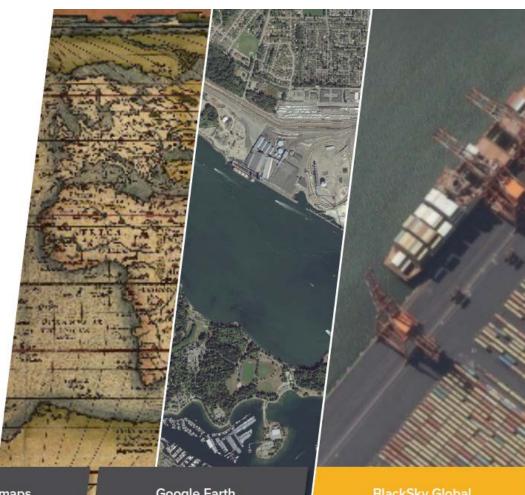
#### **DEDICATED RIDESHARE**





#### BLACKSKY IS CATALYZING A GEOSPATIAL REVOLUTION

We have built a multi-sensor global intelligence platform—the first "Bloomberg Terminal for Space"—that allows our customers to observe and understand our planet in near real time.



Paper maps prior to 2005

Update Frequency: Decades Primary Application: Navigation Google Earth 2005-Present

Update Frequency: Months/Years
Primary Application: Mapping/Directions

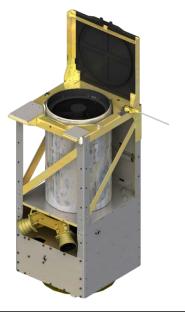
BlackSky Global Activity Based Intelligence

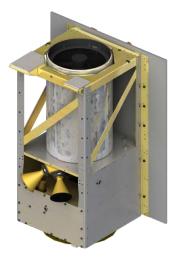
Update Frequency: Hours/Days
Primary Application: Global Understanding

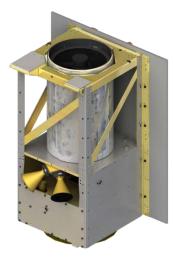
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#### SPACEFLIGHT

#### SPACECRAFT ROADMAP







|                      | Pathfinder Block 1 | Global Block 2        | Global Block 3 |
|----------------------|--------------------|-----------------------|----------------|
| Spacecraft Mass (kg) | 48 kg              | 55 kg                 | TBD            |
| Resolution (GSD)     | 1.00 m             | 1.00 m                | TBD            |
| Aperture (cm)        | 24 cm              | 24 cm                 | TBD            |
| Bands                | 4<br>RGB           | 4<br>Pan, RGB         | TBD            |
| Imaging Mode         | Stills             | Stills / Video (1fps) | TBD            |
| Images Per Day       | 20                 | 1000                  | TBD            |

Z3

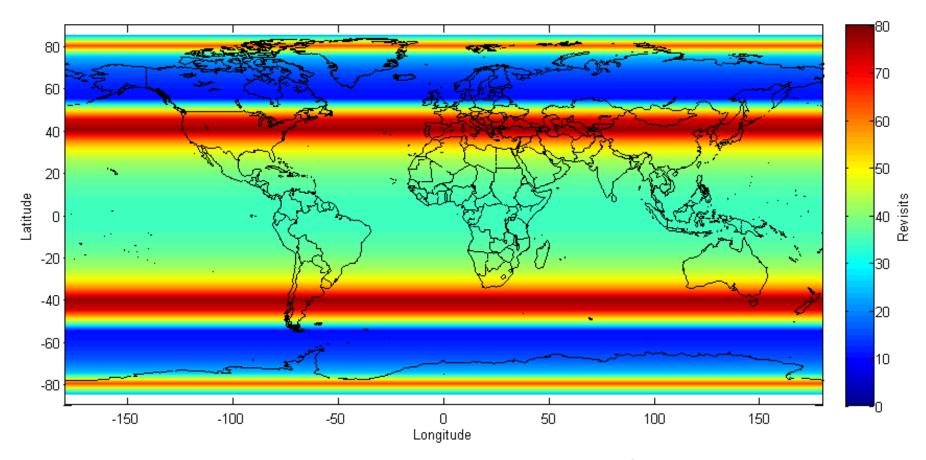


# THE ABILITY TO UNDERSTAND THE GLOBAL POPULATION IN REAL TIME





#### **REVISIT PERFORMANCE**



Revisits per day with 60 spacecraft



#### BLACKSKY'S GLOBAL INTELLIGENCE PLATFORM PROVIDES TIMELY & AFFORDABLE UNDERSTANDING OF OUR PLANET

State of the Art:

Digital Globe

\$2500 / image

Call center ordering

4 wks for delivery



Our Approach:

BlackSky

\$90 / image

Web / app ordering

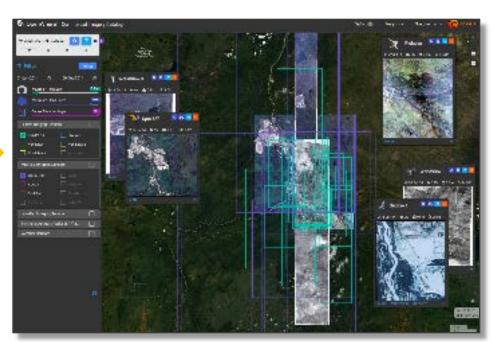
90 min for delivery



# A UNIFYING PLATFORM TO VIEW AND UNDERSTAND MULTIPLE DATA STREAMS

GeoSpatial Content and Taskable Sensors Customer Oriented Unifying Global Intelligence Platform







#### **BLACKSKY PLATFORM SERVICES**

#### Content

#### Multi-Source Content

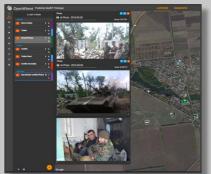
- Visible Imagery
- Radar Imagery
- AIS (ship tracking)
- ADS (airplane tracking)

### On-Demand Data

- On-Demand Imaging
- Persistent Surveillance

#### Insights





#### Activity Monitoring

- Conflict Events
- Humanitarian Events
- Supply Chain Events

## Site Monitoring

- Port Monitoring
- Pipeline Monitoring
- Border Monitoring

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# Questions?

