

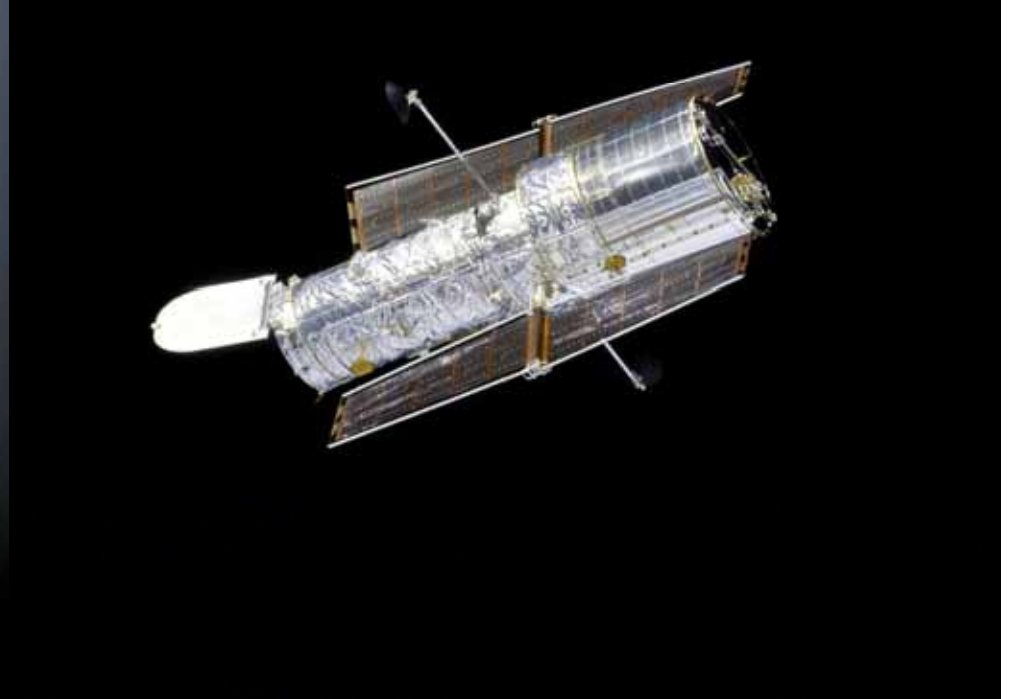
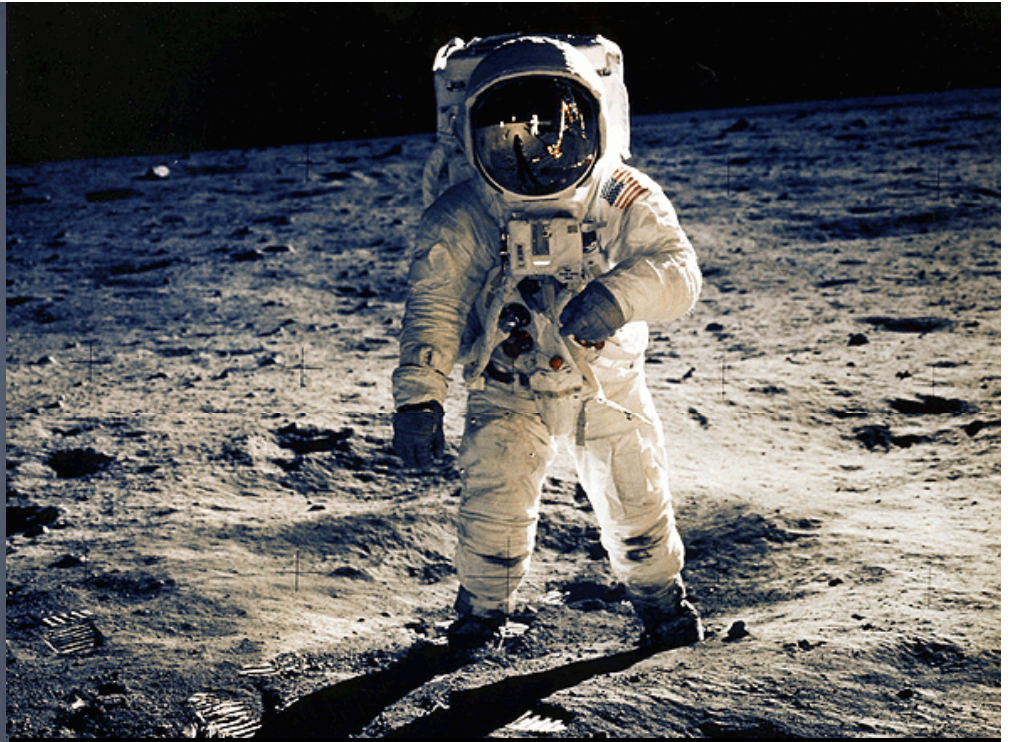
An Overview of Commercial Space Markets

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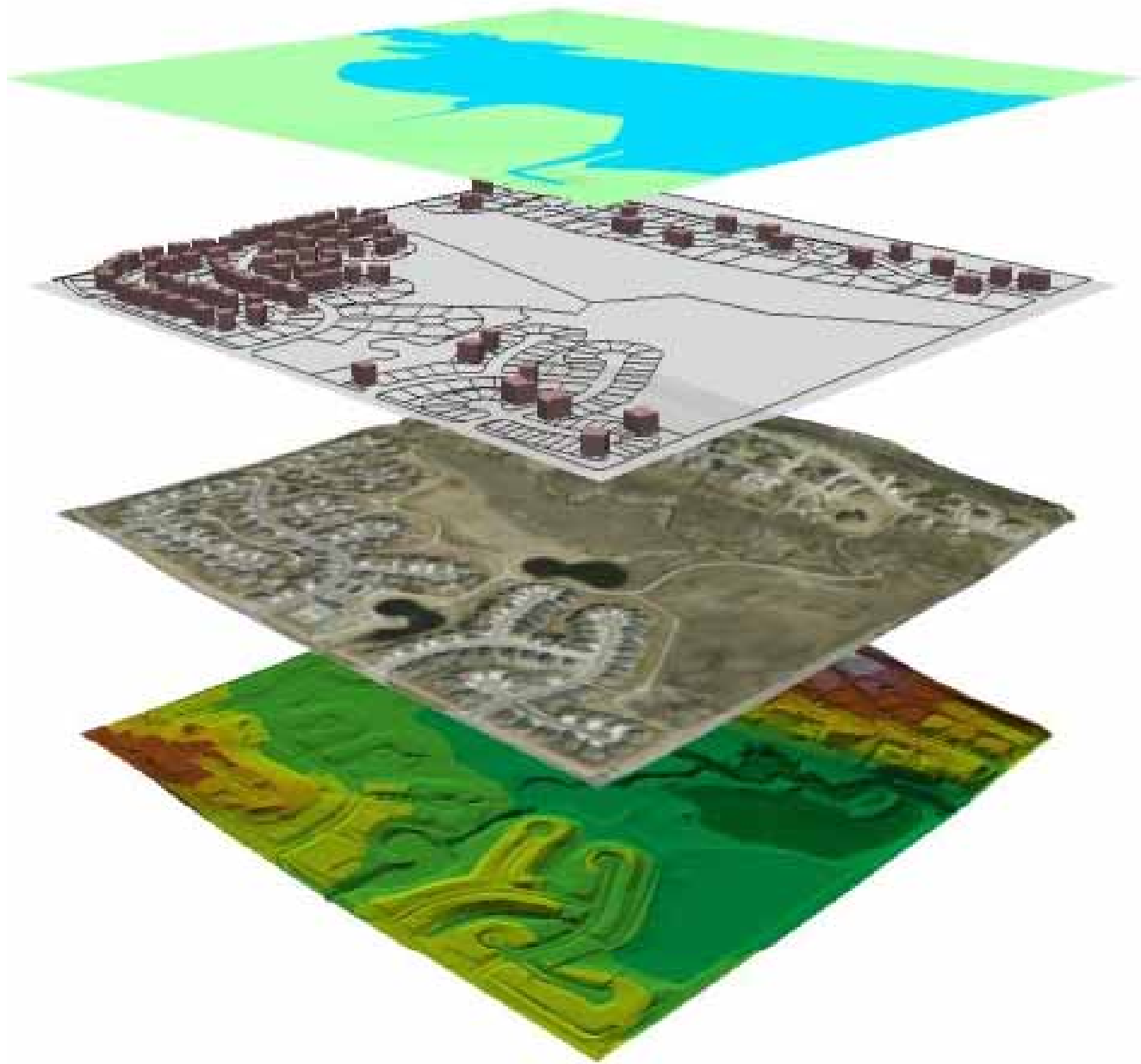












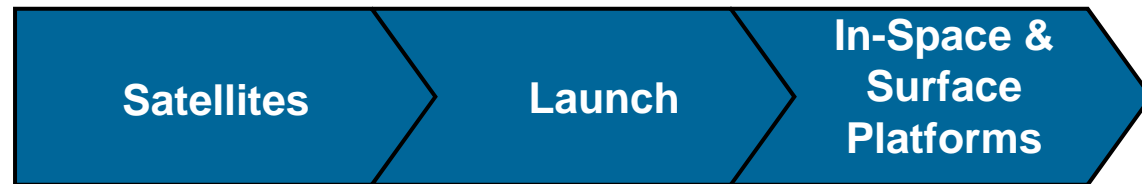


Themes

- Space is not a destination
- Space is an enabler for a variety of business verticals
- Space accelerates and expands business verticals by providing new, disruptive ways of doing business
 - Faster
 - Cheaper
 - Better
- Governments can catalyze and accelerate space related businesses
- Infrastructure is a precursor to space-related applications

**-Commercial Space Market Segments-
Space is an enabler: it enhances existing market verticals.**

Infrastructure



Applications

| | | |
|-------------------------|-------------------------------|----------------------|
| Healthcare | Earth Observation | Science Research |
| Media and Entertainment | Navigation and Communications | Governance |
| Energy and Mining | Defense | Transport Operations |

Today's Case Studies



- **Commercial space companies can loosely be defined as Infrastructure Providers, Operators, and Service/Application Providers.**
- **The new NASA direction will potentially help commercial space development**
- **Governments can be key catalysts in commercial space development**

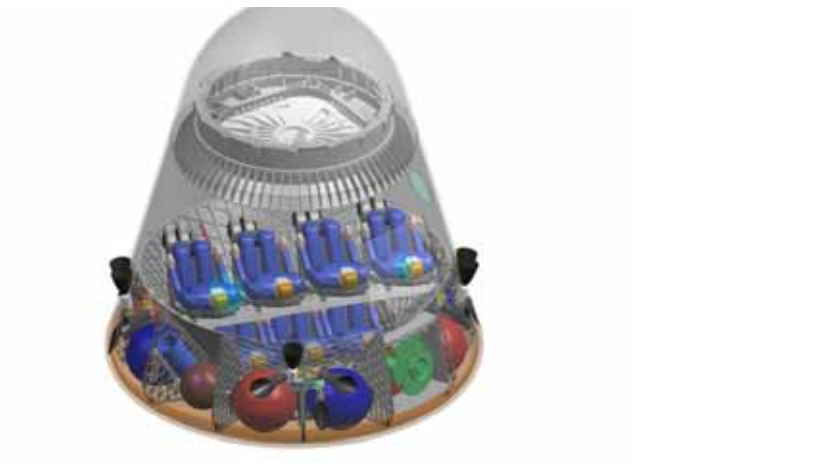
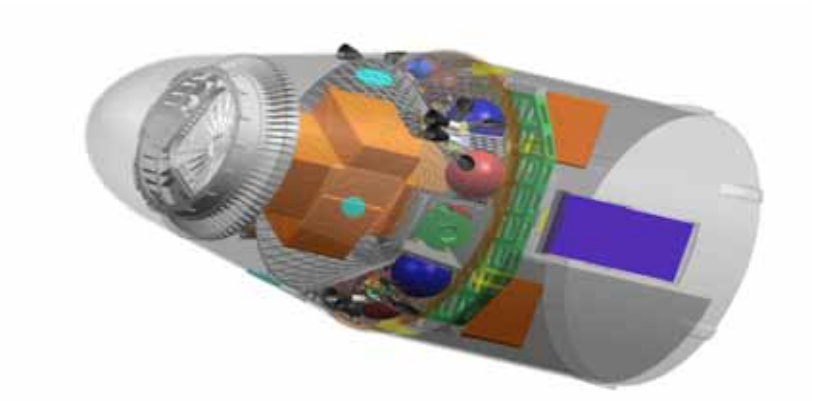
SPACEX

- Founded by Elon Musk in 2002.
- Self funded -- over \$100m.
- The Founder's Fund \$20m.
- DFJ, March, 2009
- Services
 - Orbital rocket launch (Falcon 1, Falcon 9)
 - Crew Vehicle up to 7 passengers (Dragon)

SPACEX

- Falcon 1 – first* privately financed orbital launch vehicle.
- Aided significantly by DARPA, which bought the first 2 launches.
- First 3 did not achieve orbit (failure or not?).

SPACEX



SPACEX

- August 2006, received \$278m from NASA for COTS.
- December 2008, won a Commercial Resupply Services (CRS) contract.
- Guarantees NASA missions worth minimum US\$1.6 billion for resupplying the ISS.
- Contender for future NASA contracts to carry U.S. astronauts to and from ISS.

SPACEX

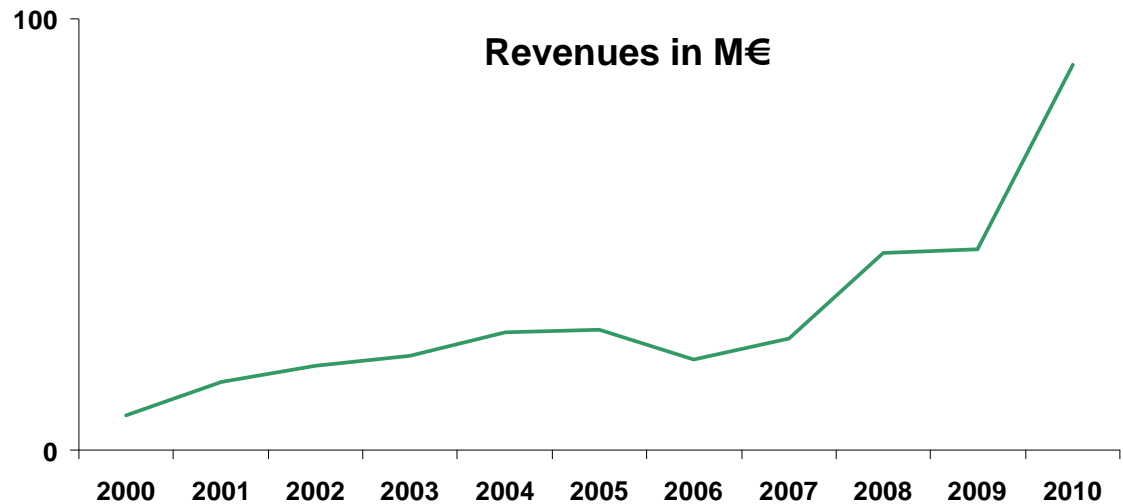
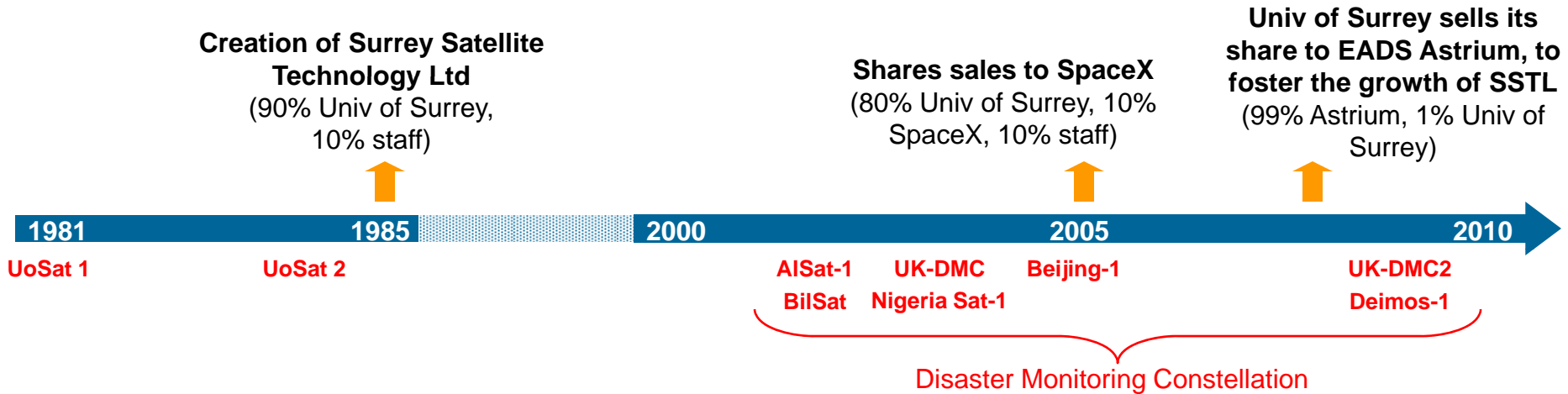
- 3 additional test flights of the Falcon-Dragon system planned by the end of 2010.
- List price for a Falcon 9 launch is around \$50m, compared with \$138m or more for an Atlas 5.
- Currently waiting for the Air Force to sign off on Falcon 9's flight termination system.
- Falcon 9 first launch sometime around NOW.

SPACEX



Surrey Satellite Technology Ltd

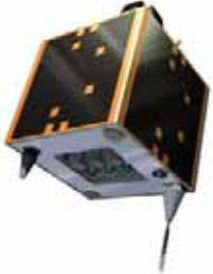
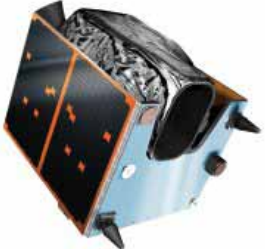
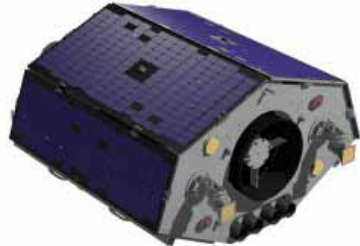
From University to active Commercial Company



Changing the Economics of Space



Rapid-response small-satellites built from advanced terrestrial technology

| SSTL-100 Constellation Spacecraft for large coverage medium-resolution (22 m) | SSTL-150 High-performance operational missions (5 m) | SSTL 300 Agile Precision Surveillance (2 m) |
|--|--|--|
| <ul style="list-style-type: none"> • Mapping • Agricultural monitoring • Flood monitoring • Water quality • Fire hazard detection • Disaster monitoring • Relief Agency support | <ul style="list-style-type: none"> • Surveillance • Multi-angle measurements • National and urban mapping • Agricultural monitoring • Precision farming • Security • Orthographic mapping | |
|  |  |  |

HERITAGE : Flight proven - low risk
RESULTS : All projects fixed price, delivered on-time and on-budget
SUCCESS : Very high mission success
CUSTOMERS : Variety of customers including many “blue chip” operators

Disaster Monitoring Constellation

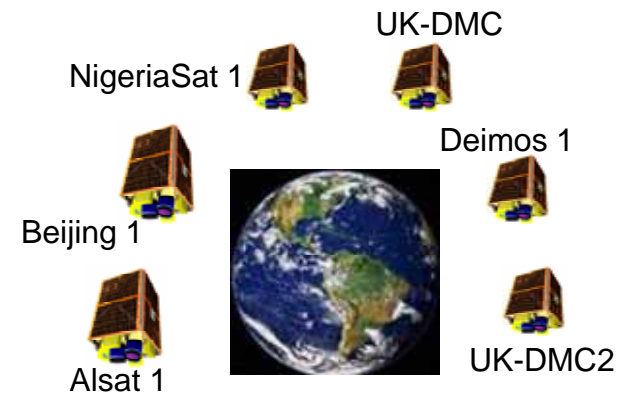
A Unique International Partnership Combining National Objectives, Humanitarian Aid and Commerce...



- Each satellite is independently owned and controlled by a separate nation, but all satellites have been equally spaced to provide daily imaging capability
- All DMC Members agree to provide 5% of capacity free for daily imaging of disaster areas, and this data is channelled to aid agencies
- DMC Members are interested in encouraging the use of DMC data for scientific and commercial applications



The Consortium

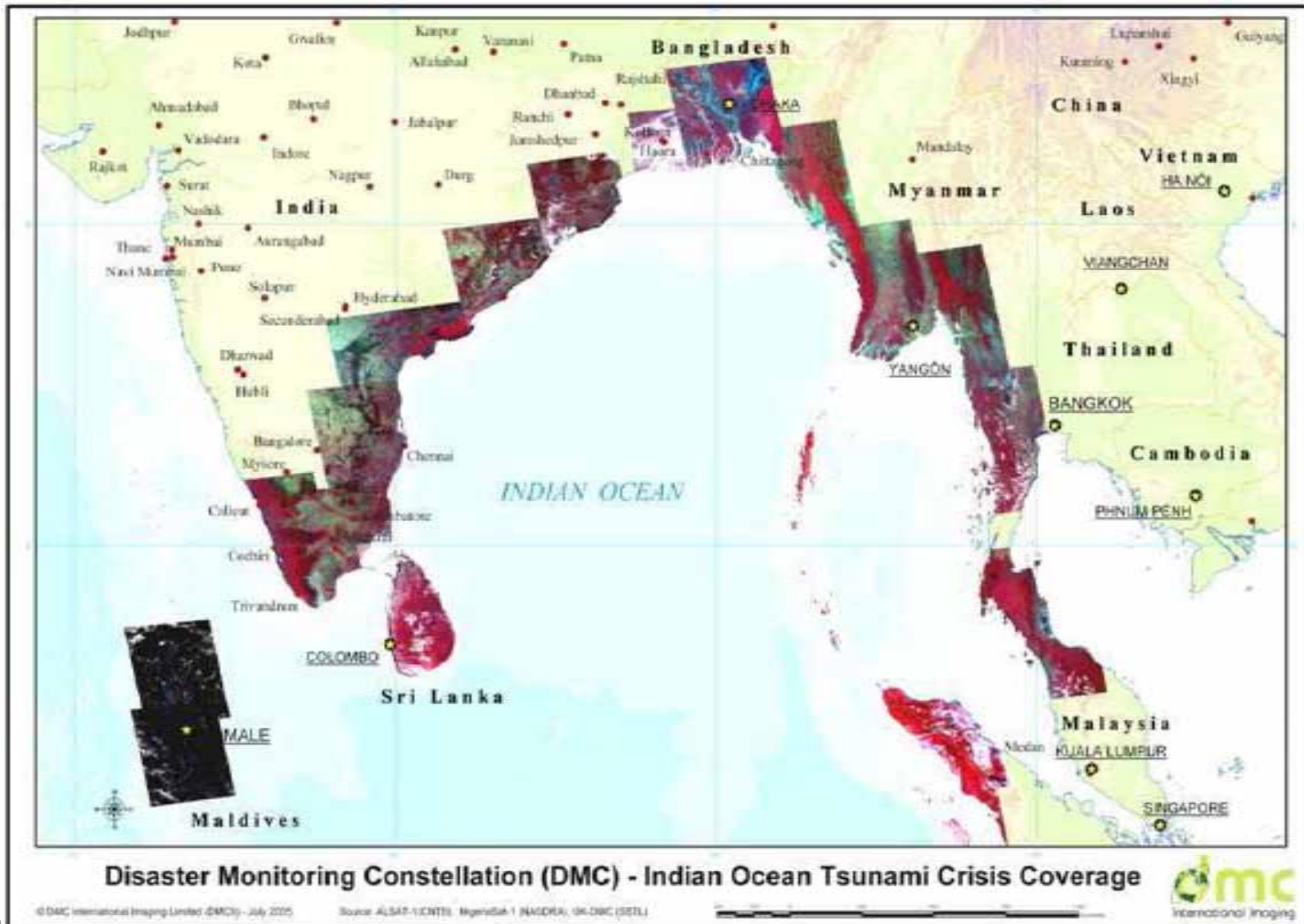


The Constellation



Applications;
Commercial, Government and Humanitarian

Boxing Day Tsunami (December 26, 2004)



DigitalGlobe Overview



DigitalGlobe is a leading global provider of commercial, high-resolution, world imagery products and services.



Source: Digital Globe

DigitalGlobe History



- 1992 Land Remote Sensing Policy Act allowed private companies to enter the satellite imaging business
- First license granted to DigitalGlobe under this Act
- Private and corporate funding was utilized
- A few launch failures ensued
- 2001: Launched its first satellite
- 2002: Started relationship with Google
- 2003: \$500M US government contract
- 2009: NYSE IPO, Ticker symbol: DGI. Generated \$26M in cash for the company.

Source: Digital Globe

DigitalGlobe Customers



Consumer

Logos for consumer customers: Google, Microsoft, GARMIN, NOKIA, LOWRANCE, NAVTEQ, map SOLUTE, Bushnell, Vodafone, Tele Atlas, and verizon wireless.

Defense & Intelligence

Logos for Defense & Intelligence customers: Germany, Japan, South Korea, Israel, Taiwan, NSA (National Security Agency), DoD (Department of Defense), DoS (Department of State), and DHS (Department of Homeland Security).

International Civil Government

Logos for International Civil Government customers: FDA (U.S. Food and Drug Administration), NOAA (National Oceanic and Atmospheric Administration), USDA (U.S. Department of Agriculture), USGS (United States Geological Survey), and various international government agencies.

Source: Digital Globe

DigitalGlobe Satellites



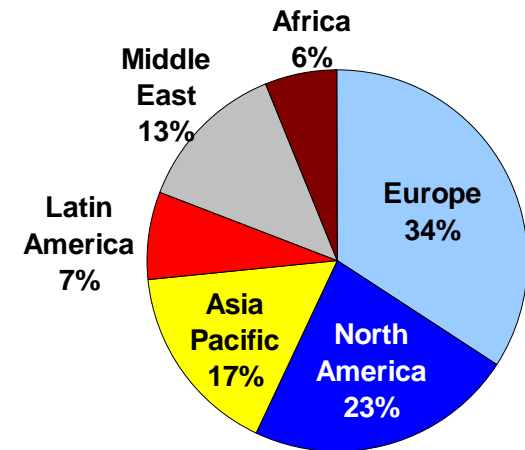
The company has three orbiting satellites collect over 500 million square kilometers of imagery per year. The surface area of the earth is 510 million square kilometers.

Source: Digital Globe

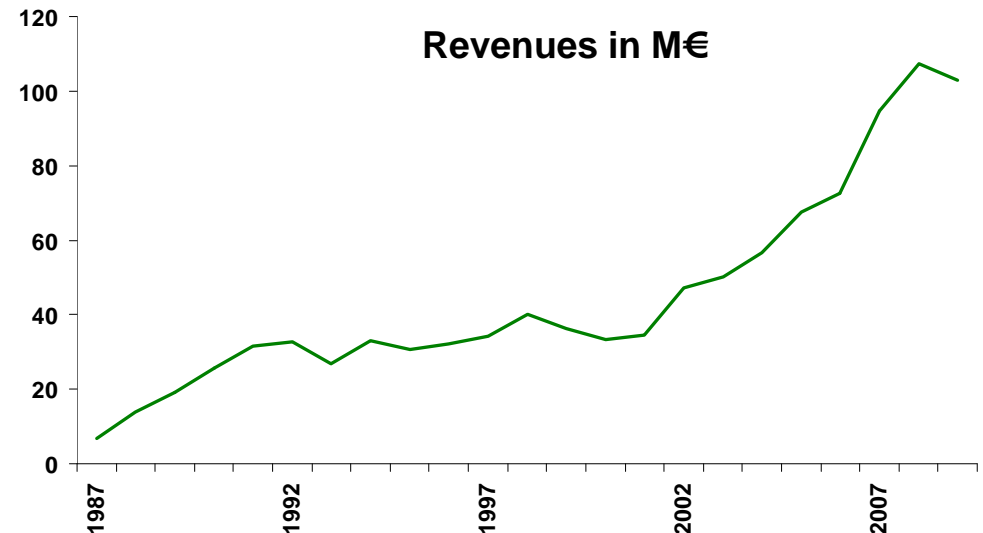
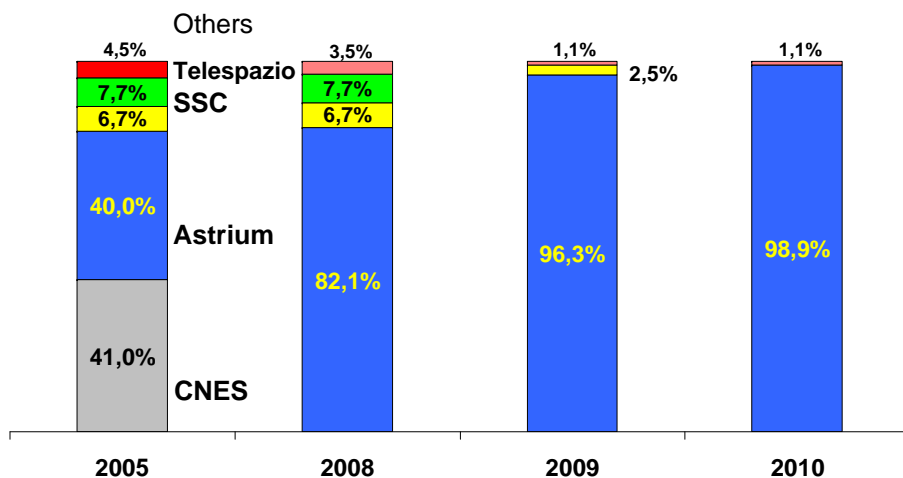
Spot Image: from space agency subsidiary to global private commercial company



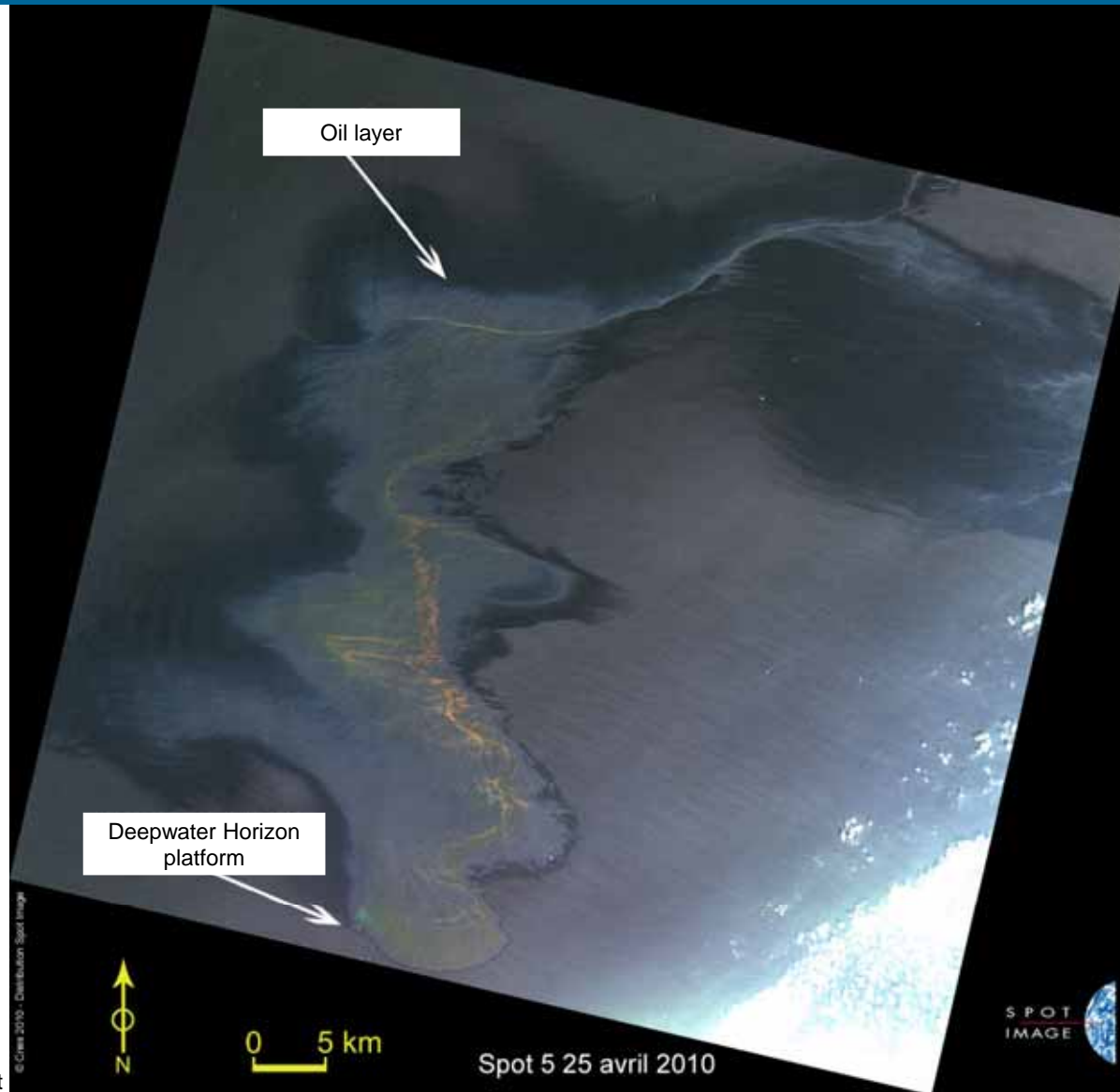
- Creation by CNES in 1982 to manage commercial sales of Spot data
- Aggressive commercial development worldwide
- Shareholding evolution towards private involvement : now 99% owned by EADS Astrium
- New Spot family (Spot 6 and 7) fully funded by private sector, EADS Astrium



Shareholding

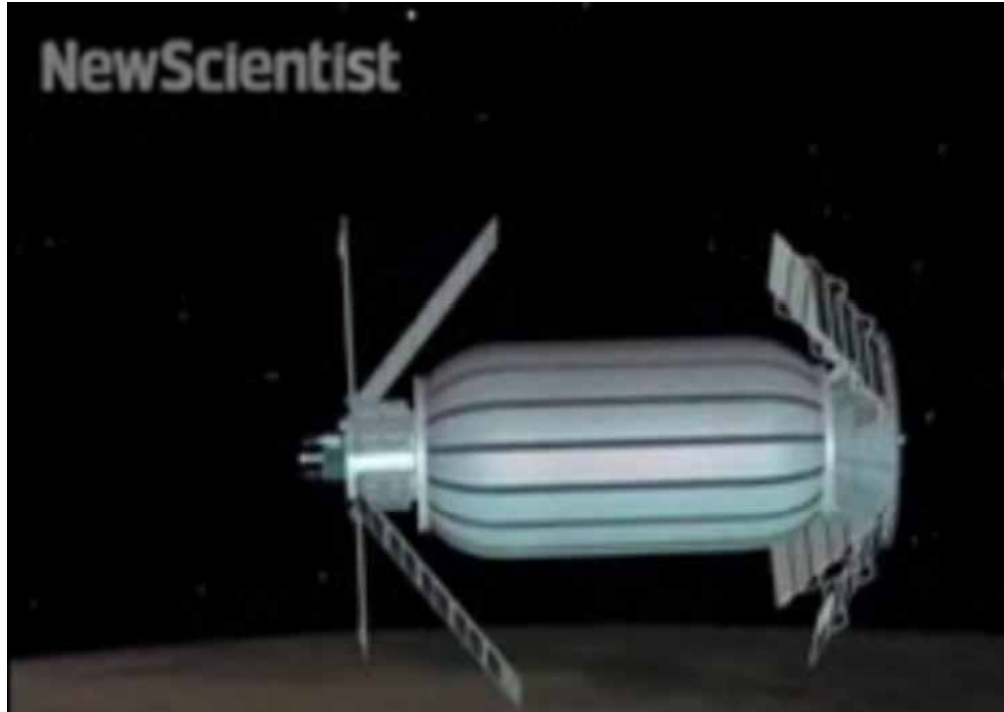


Louisiana Oil Spill





- **Bigelow Aerospace** - Pioneering work on expandable space station modules.
- Founded by Robert Bigelow in 1998.
- Originally licensed expandable space module technology from NASA after cancellation of ISS TransHab project in the late 1990s.



Sundancer
not inflated



Sundancer
Inflated



BA 330



- Funded in large part by Bigelow's fortune from Budget Suites of America.
- By 2010, Bigelow had invested \$180m.
- Prepared to fund Bigelow Aerospace with about \$500m through 2015.



NASA Returns

- **“making inflatable space-station modules to make roomier, lighter, cheaper-to-launch spacecraft”**
- **“considering connecting a Bigelow expandable craft to the ISS to (test) life support, radiation shielding, thermal control and communications capabilities”**



- Bigelow reserved a 2014 launch on the SpaceX Falcon 9 rocket.
- The Falcon 9 can launch either Sundancer or BA 330 module.
- Talking with Lockheed Martin to potentially contract launch services on its Atlas V - 401 vehicle.



The Future

- February, 2010 Bigelow said "We as a company have lunar ambitions ... and we also have Mars ambitions . . ."
- Proposed private Moon Base with three BA 330s.
- Space station at Lagrange point L1.





Conclusions

- **With the new NASA direction and other catalysts, the scope of government involvement has become more broad.**
- **Commercial space companies are creating an ecosystem of businesses, accelerating growth in the industry.**
- **There are different ways to become a commercial space success.**
 - **Billionaire-backed**
 - **Government backed**
 - **University/space agency backed**
 - **Traditional start-up**