National Oceanic and Atmospheric Administration’s Advisory Committee on Commercial Remote Sensing (ACCRES)

Carissa Christensen, CEO BryceTech
Virtual Spring Meeting, April 27-28, 2021
Case Study: Remote Sensing Services

- Continued investment and innovation driven by interest in business intelligence products using satellite imagery and powered by advances in data analytics and artificial intelligence
- Maturing early stage firms working to build commercial customer bases, increasingly targeting government customers
- New capabilities being introduced: RF mapping, CH₄ emissions monitoring, and hyperspectral

Operational includes initial deployment through full capacity
Criteria for inclusion are satellites on orbit, announced funding, signed launch contract/agreement, or NOAA license. Other systems considered: ADASPACE, Aistechn, Alba Orbital, Bluefield, Canon, ConstellR, EOS SAR, Harris Corp., Horizon Technologies, Hypersat, Inovor, iQPS, ISIS, Karten Space, Kawa Space, LP Labs, Loft Orbital, Mino Space, OHB Italia, Orbital Sidekick, Orora Tech, Pixxel, Qian Sheng, Reaktor Space, Satbyul, Sat Revolution, Scanway, Sen, Smart Satellite, Spacefab.us, Space Systems Engineering, Spacety, Space Time, Synspectre, Trident Space, UnseenLabs, VEOWARE, XpressSAR, ZeroG Lab, Zhumaii Orbita


<table>
<thead>
<tr>
<th>Sensor Description</th>
<th>Number of Satellites</th>
<th>Target Total Mission Duration</th>
<th>Generating Revenue (GR), Start-up no/some revenue (SU)</th>
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<tr>
<td>Optical (MS), radar</td>
<td>15</td>
<td>150-2,200</td>
<td>GR</td>
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<td>Radar</td>
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<tr>
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<td>SU</td>
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<td>150</td>
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<td>50</td>
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</table>
Start-up Space Investment in Earth Observation and Analytics Companies

$25B
Start-up Space Investment
2015 – 2020

$3.3B

Earth Observation
Satellite Operators

Geospatial Analytics
Companies

Launch Companies

Communications
Satellite Operators

Navigation
Other

Ground Equipment
In-Space Services
Manufacturing

51%
25%
9%
4%
5%
2%
1%
1%

The recent rise of special purpose acquisition companies (SPACs) has improved capital access, provided exit opportunities.

- **Announcement Date:** 2/18/2021
- **Expected Closing Date:** Q3 2021
- **SPAC:** Osprey Technology Acquisition Corp.
- **Capital Raised:** $450M
- **Valuation:** $1.5B

- **Announcement Date:** 3/1/2021
- **Expected Closing Date:** Q3 2021
- **SPAC:** NavSight Holdings Inc.
- **Capital Raised:** $475M
- **Valuation:** $1.6B
Relative Sizes of Satellites

- **SkySat**: Planet, 120 kg
- **Dove**: Planet, 5 kg
- **OneWeb**: OneWeb, 150 kg
- **O3b**: SES O3b, 700 kg
- **Sentinel 2b**: ESA, 1,130 kg
- **WorldView-3**: Maxar (DigitalGlobe), 2,800 kg

**Telstar 19V**: Telesat, 7,070 kg
Spacecraft Launched 2010 – 2020

- Starlink + OneWeb
- Other Smallsats
- Small (601-1,200 kg)
- Medium (1,201-2,500 kg)
- Intermediate (2,501-4,200 kg)
- Large (4,201-5,400 kg)
- Heavy (5,401-7000 kg)
- Extra Heavy (7,000+ kg)

Number of Spacecraft Launched

- 2010: 37
- 2011: 39
- 2012: 52
- 2013: 130
- 2014: 195
- 2015: 173
- 2016: 126
- 2017: 338
- 2018: 328
- 2019: 263
- 2020: 265

Starlink and OneWeb

All other smallsats
Spacecraft launched and total upmass 2010 – 2020

4,094
Spacecraft launched 2010 – 2020

~4,223,000kg
Total upmass 2010 – 2020

Smallsats represent 74% of spacecraft launched, only 8% of total upmass
Share of Smallsats by Application Excluding OneWeb and Starlink, 2010 – 2020, ≤600 kg

- Remote Sensing
- Communications
- Other/Unknown
- Technology Development
- Scientific
All Smallsats, Largest Operators, ≤600 kg

- ~55% of smallsats launched 2010 – 2020 operated by 4 operators
- Remaining ~45% operated by 499 operators
- SpaceX’s large number of Starlink spacecraft deployed in 2020 (833) significantly impacts the dataset

3,009 Smallsats Launched 2010 – 2020

- 46%
- 35%
- 15%
- 4%
- All other smallsats

All other smallsats
83% of commercial smallsats launched 2010 – 2020 are operated by 5 companies.

Remaining operators with more than 5 satellites:

<table>
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<tr>
<th>#</th>
<th>Operator</th>
<th># of Smallsats</th>
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<tr>
<td>6</td>
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<td>15</td>
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<td>16</td>
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</table>

✓ = Remote sensing

Commercial Smallsats, Largest Operators, ≤600kg