ViaSat’s Global Ka-Band Constellation and Commercial SATCOM Applicability for Australia

Presented by:

Craig Miller
Vice President, Chief Technical Officer
ViaSat Government Systems

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Contents

› **ViaSat**: *Who* we are and *What* we do

› **ViaSat-3 Constellation**: *What* it is and what it can do for Australia

› **Hybrid Networks**: *Why* they’re needed and *How* to employ them
ViaSat: Who We Are

A Vertically Integrated Technology and Communications Services Provider Poised to Become a Truly Global ISP

End-to-End Technology

Link-16 LOS Crypto Modems BFT Multiband Terminals Fixed/Nomadic Terminals

Global Broadband Services

Exede™ Internet, Portable, Maritime, Aero

Worldwide Ku/Ka Network – Now Worldwide HCS Ka Network – 2021

Network Management SA Services

Specialized Space/Cyber Services

Worldwide Ku & Ka Networks Worldwide MPLS Network Cyber Security/Defense Protected SATCOM

HCS HD & 4K ISR
ViaSat: Who We Are

ViaSat’s Growing Presence in Australia and the Pacific

Australia Presence

» Canberra

» Sydney

» NBNCo Ground Segment

» Qantas Broadband Services

» Joint Project 2008 5B2 Ground Stations

» ViaSat-3 Asia-Pacific
  › Coverage
  › Ground Infrastructure
What is Happening

Private Sector SATCOM is Undergoing a Revolutionary, Exponential Transformation
Why it’s Happening

The Transition from Broadcast to Interactive Broadband has Revolutionized Wireless Communications...Twice
What is ViaSat-3

ViaSat’s Global Ka-Band Constellation

ViaSat-3 Constellation: 65°N to 65°S Global Coverage (3 Satellites) Launching in 2020-21, with More to Follow

Each Satellite:
» Terabit+ Capacity
» ~165,000,000 km2 coverage area (visible earth)
» 1000+ Ka-Band Spot Beams

Capacity/Frequency/Location Flexibility
» Provides BOTH high density capacity and large geographic coverage area
» Large bandwidths can placed in one location
» Very High Performance and Smaller Aperture Terminals
» Robust Mobility Services

Highly Resilient System Resistant to Interference in Multiple Dimensions
» Resistant to user uplink interference
» Interferer geolocation and excision
» Immune to gateway link disruption/interference/interception
» Can tolerate numerous gateway failures without performance degradation

ViaSat-3 Has 10 Times the Capacity of ViaSat-1…
…and Roughly 100 Times the Capacity of WGS/AEHF
Applicable to ADF

**Capability Exists to Address Future Capability Gap**

Source: ADF (CDRE Dave Greaves) - 2014
How Capacity Flexibility Enables New CONOPS

Capacity is Enabled by Frequency Re-use; Frequency Re-use Requires Interference Mitigation
Bandwidth is a Resource

Available Spectrum Enables Performance in Contested Environments

ViaSat-3 Class Satellite Networks Use the Entire ITU Ka-band Spectrum

» 3.5 GHz

» Frequency Hopping Waveforms

» Direct Sequence Spread Waveforms

» Frequency Agility
  › Avoid compromised channel segments

» Concentrate Bandwidth Where/How its Needed
  › 3.5-7 GHz of spectrum in one place

» Together These Features Enable
  › High Data Rates to Individual Users
  › Small / Low Power Terminals
  › Operations in Contested Environments
Resilience by Design

Beam Size/Flexibility Drives Anti-Interference Performance

Notional WGS Pacific Coverage*

ViaSat-3 Pacific Coverage

Blue: X-Band Earth Coverage
Red: X-Band Spot Beams
Green: Ka-Band Beams

*Source: Naval Postgraduate School, 7/29/2014
Inteferer Geolocation

Grid of Beams Architecture: Power Difference of Arrival

Yellow = -3 dB
Green = -15 dB
Orange = -18 dB
Blue = -21 dB
How this Kind of Innovation is Possible

A SATCOM Network is a System of Systems

Space Segment

Satellite Terminal (Modems / Antennas)

User Equipment
(Sensors, Cockpit Displays, Computers, iPads, iPhones, Cryptos, Routers, etc.)

Network Management

A Vertically Integrated Provider Can Take a Holistic Approach To Network Design

Terrestrial Networking
(Fiber Backhauls, Network Aggregation)

Gateways
(Antennas / Modems / Networking)
Why We Use a System of Systems Approach

Gateway Diversity Allows Capacity, Adds Resilience, Availability and Security

<table>
<thead>
<tr>
<th>Num Gateways</th>
<th>GW Availability</th>
<th>System Availability</th>
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<td>50.00%</td>
<td>93.7500%</td>
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<tr>
<td>4</td>
<td>70.00%</td>
<td>99.1900%</td>
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<tr>
<td>4</td>
<td>90.00%</td>
<td>99.9900%</td>
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<table>
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<th>Num Gateways</th>
<th>GW Availability</th>
<th>System Availability</th>
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<td>83.2228%</td>
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<td>50.00%</td>
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<tr>
<td>8</td>
<td>70.00%</td>
<td>99.9934%</td>
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</table>
Why We Use a System of Systems Approach

Gateway Diversity Allows Ground Segment Innovation

13 M Gateway Site

9 M VS-1 Gateway Site

4 M VS-2 SAN Site

VSAT-Like VS-3 SAN Site

Hundreds of SANs and Associated Fibre Network Represent a Significant Infrastructure Investment in Australia
How Vertically Integrated Networks Differ
Network Performance, Situational Awareness, Visualization, Management and Control in Real Time
Summary

Operational Effects of Advanced Private Sector Infrastructure

What it Does for the Warfighter

» Very High Capacity
  › Terabit Satellites, Multi-Terabit Constellation
  › Superior Capacity Economics

» Scalability/Flexibility
  › Mixed Capacity to a Large Number of Users
  › Surge Capacity
  › Fixed, Mobile, Airborne, Maritime, LEO
  › Small, non-traditional platforms
  › LPI/LPD Operations Possible

» Resilient Operations in Contested Environments
  › Operations in Vicinity of Near-Peer Jammers
  › Operations through Atmospheric Scintillation
  › Immunity to RF Teleport Monitoring
  › Resistance to Ground Infrastructure Disruption

» Interferer Geolocation

ViaSat Networks Serve Benign, Contested and Scintillated Environments
Hybrid Networks Provide Even More Capability

Hybrid Network Services Enable Layered Resilience, Improved Performance and Reduced Cost

- **Disaggregation**: Separate High value missions across multiple protected networks
- **Diversity**: Multiple networks, frequencies, operators; surrogate capabilities (SA, C2, PNT, BFT, etc.)
- **Distribution**: Routing on dozens of Government and hundreds of Commercial Networks; No single point of failure
- **Deception**: Missions operating overtly, covertly, or even wartime reserve modes across multiple networks
- **Protection**: Hardened and Heterogeneous Networks rapidly evolving to Threats and Market demands
- **Proliferation**: Missions spanning multiple Government and Commercial networks

› **Standardized Interface**: Where does the “Open Standard Interface” Live? Who Owns it?

› **Multi-Mode Terminals**: Waveform Compliance? Multi-Mode Terminals?

› **Network Management**: How Far into Each Network Does the Manager Reach?
How to Enable Hybrid Networks

Multi-Mode Terminals Maximize Performance, Resilience, and Economy

Other GEO Ku-band

WGS Mil Ka-band

Other GEO Ka-band

ViaSat Ka-band

MEO Ka-band

ViaSat pTRIA
How to Enable Hybrid Networks

A Standardized “Service Delivery Platform” Enables Network Management of Hybrid Communications Networks
Summary

Commercial Communications Resilient, Secure, Interoperable and Available

Assured Communications Networks Feature

Layered Resilience
1) Terabit Satellites, Multi-Terabit Constellation
2) Superior Capacity Economics
3) Mixed Capacity to a Large Number of Users
4) Surge Capacity
5) Fixed, Mobile, Airborne, Maritime, LEO
6) Small, non-traditional platforms
7) LPI/LPD Operations Possible
8) Operations in Vicinity of Near-Peer Jammers
9) Operations through Atmospheric Scintillation
10) Immunity to RF Teleport Monitoring
11) Resistance to Ground Infrastructure Disruption
12) Interferer Geolocation

Hybrid Networks Maximize Performance, Resilience, and Economy
1) Disaggregation, Diversity, Distribution, Deception, Protection, Proliferation
2) Multi-Network, Multi-Band Terminals
3) Network Based Open Standard Interoperability
4) Service Delivery Platform -- “Manager of Managers”
Backup
How Vertically Integrated Networks Differ

Rapid Response to Evolving Cyber Threat Environment

- ViaSat-3x
- User Data/Control Plane
- Redundant RF
- Satellite Access Nodes
- Redundant ViaSat Fiber
- ViaSat Data Centers
- Redundant ViaSat Fiber
- Internet

**Daily Telnet Attacks (Exede)**

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<thead>
<tr>
<th>Vendor</th>
<th>Number</th>
<th>Risk</th>
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<td>NetGear</td>
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<td>0.236</td>
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<tr>
<td>Belkin</td>
<td>343,375</td>
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<td>Cisco Linksys</td>
<td>273,797</td>
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<td>ViaSat</td>
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## ViaSat Satellite Services

### Capacity & Coverage Growth: 2016 to 2021

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- **2016**
- **2017**
- **2018**
- **2019**
- **2020**
- **2021+**
ViaSat Satellite Services

Capacity & Coverage Growth: 2016 to 2021
ViaSat Satellite Services

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- 2016
- 2017
- 2018
- 2019
- 2020
- 2021+
ViaSat Satellite Services
Capacity & Coverage Growth: 2016 to 2021
ViaSat Satellite Services

Capacity & Coverage Growth: 2016 to 2021

Adding ~1TBPS of Capacity Every ~6 Months thru 2027