Global Xpress

Global Mobile Broadband
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Global Xpress (1/2)

- US$1.2 billion global broadband network
- Boeing contracted to build three Inmarsat-5 satellites
- First launch 2013, with global coverage in 2014
- Lifetime of 15 years
- Complements our L-band services
Global Xpress (2/2)

THE NEW STANDARD IN MOBILE SATELLITE COMMUNICATIONS

High Performance
- Smaller and more advanced
- Standard 60cm performance*:
  - 50Mbps downlink
  - 5Mbps uplink
- Performance increases with 1m

Affordable
- Lower cost service
- Lower cost terminals
- Lower cost install/training

Reliable
- Dual satellite constellations
- Global Ka-Band network
- Global L-Band Network for backup
- Inmarsat quality standards, end-to-end

* Performance on aero terminals will vary
Elements of the Global Xpress Network

END-TO-END QUALITY AND RELIABILITY

User Oriented Terminals

- Choose from multiple manufacturers in most markets
- Designed around unique needs of user platforms
- One-touch installation – “Power up and get online”

Robust Ground Infrastructure

- Fully redundant Satellite Access Stations
- Reliable Inmarsat global network
- Embedded security features
The Satellite Network

FLEXIBLE, GLOBAL SERVICE DELIVERY

Global Coverage
- Three geo-stationary satellites
- 89 fixed beams per region
- 72 transponder pair capacity
- Designed for mobility

High Capacity Overlay
- Six steerable beams per region
- Additional capacity for:
  - High traffic regions
  - Response to global events

Dual Constellation Network
- Single, seamless offering
- Strategic overlap with Inmarsat-4
- Resilient, all-weather solution
System Architecture

**Global Xpress (GX), Inmarsat 5 (I-5)**
- 3 Geo Ka-band (satellites AOR, IOR, POR)
- Global coverage via 89 fixed spot beams (40 MHz ea) per I-5
- 6 steerable high capacity spot beams per I-5
- Fully operational in 2014

**Satellite Access Stations (SAS)**
- 6 SAS sites supporting global coverage and site diversity
- DVB-S2, multi-carrier MF-TDMA system
- QoS, multicast, IPv4/v6, dynamic routing, web acceleration, beam switching
- Security via AES-256, FIPS 140-2

**GX SAS Sites**
- Americas
- Europe
- Asia

**GX Markets**
- Government
- Maritime
- Aeronautical
- Energy & Enterprise

**GX User Terminals**
- Terminal sizes from 30 cm to 1 m+
- Variants for GX markets
- Multiple vendors via 3rd party development kits
Global Xpress dual SAS design

- Two GX SAS sites in each ocean region
- Physical separation of hundreds of miles
- Automatic switchover
- Virtually eliminates SAS outages
Two Unique and Complementary Ka Payloads (1/2)

Global Service Beams

- Unique global broadband access
- 50/5Mbps typical user throughput
- Up to 72 active beams per satellite
- Seamless broadband mobile roaming
- Open standards equipment, seamless handover
- Performance automatically optimizes to conditions
Two Unique and Complementary Ka Payloads (2/2)

High Capacity Beams

Steerable overlay addresses hot-spots
Responsive to surges caused by world events
Serves growing high density markets (energy, aero)

Interoperability with global beams
Higher gain for most efficient bandwidth use
Transparent handover of commercial services
Global Xpress Spectrum

Global payload

User Uplink: 29.5 - 30.0 GHz
User Downlink: 19.7 - 20.2 GHz
Feeder Uplink: 28.0 - 29.5 GHz
Feeder Downlink: 18.2 - 19.7 GHz

High Capacity Payload

User Uplink: 29.0 - 29.5 GHz
User Downlink: 19.2 - 19.7 GHz
Feeder Uplink: 27.5 - 28.0 GHz
Feeder Downlink: 17.7 - 18.2 GHz

Why Ka-band?

➢ 2.5 GHz of available spectrum
➢ Includes 2x500 MHz of spectrum exclusive to satellite
➢ Fewer operational satellites – simplify coordination
➢ L-band can be used to improve availability
“Earth Stations on Mobile Platforms” (ESOMPs): Refers to earth stations operating in FSS networks, with characteristics similar to FSS earth stations but on a mobile platform.

ITU-R Report ITU-R S.2223

ETSI harmonised standard (EN 303 978) for Ka-band ESOMPS

CEPT is developing new ECC Report and ECC Decision

Administrations are developing national authorisations for ESOMPs
Global Xpress User Terminals

- Uses adaptive coding and modulation to maintain link in rain-fade
- Maximum data rates: 5 Mbit/s uplink, 50 Mbit/s downlink for 60 cm (other terminals higher or lower)

<table>
<thead>
<tr>
<th>Maritime</th>
<th>Aero</th>
<th>Land-based</th>
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</thead>
<tbody>
<tr>
<td>1m</td>
<td>60cm</td>
<td>Class A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Class B</td>
</tr>
<tr>
<td>Antenna Size (cm)</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>Antenna Structure</td>
<td>reflector</td>
<td>reflector</td>
</tr>
<tr>
<td></td>
<td>17x70</td>
<td>30</td>
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<tr>
<td></td>
<td>asymmetric</td>
<td>symmetric</td>
</tr>
<tr>
<td></td>
<td>reflector</td>
<td>reflector</td>
</tr>
<tr>
<td></td>
<td>asymmetric</td>
<td>Flat panel/reflect</td>
</tr>
</tbody>
</table>
The forward link is based on DVB-S2 ACM

The return link uses MF/TDMA

MODCODs are changed in real time, per terminal depending on current reported signal to noise

Adapts to current link conditions, trading excess link margin for increased throughput
Satellite Air Interface Overview (2/2)

• Return channel is broken into multiple carriers.
• Satellite Terminals will be assigned slots (TDMA) into the carriers depending on:
  • QoS/Queue size
  • Terminal (EIRP) characteristics
  • Channel (fade) characteristics
## GX Summary and Major Business Milestones

### Setting the new standard in mobile communications: Speed, affordability and reliability

<table>
<thead>
<tr>
<th>Major Milestone/ Deliverable</th>
<th>Plan</th>
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<tbody>
<tr>
<td>Satellite access station sites under contract for 1\textsuperscript{st} satellite</td>
<td>Completed</td>
</tr>
<tr>
<td>Four terminal vendors under contract</td>
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<td>Satellite critical design review</td>
<td>Completed</td>
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<tr>
<td>Terminal and ground station critical design review</td>
<td>Completed</td>
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<tr>
<td>Ground station site construction starts</td>
<td>Completed</td>
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<tr>
<td>Terminal and ground station final design review</td>
<td>Q3 2012</td>
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<tr>
<td>First user terminal acceptance testing completed</td>
<td>Q1 2013</td>
</tr>
<tr>
<td>Secure sufficient authorisations in footprint of first satellite</td>
<td>Q2 2013</td>
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<tr>
<td>1st I5-satellite launched</td>
<td>Q2 2013</td>
</tr>
<tr>
<td>3rd -I5-satellite launched</td>
<td>Q2 2014</td>
</tr>
<tr>
<td>Global service ready</td>
<td>Q4 2014</td>
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</tbody>
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Questions

Thank you!

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