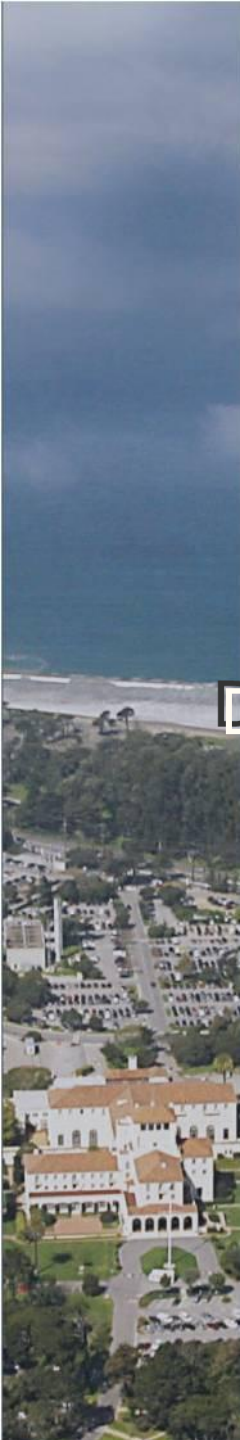
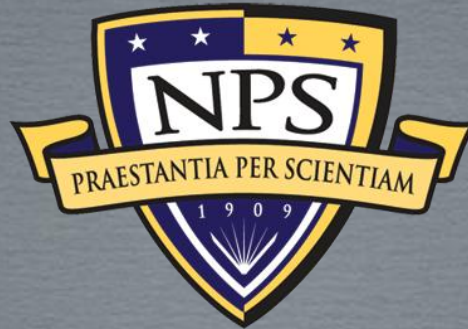


Delivering Smartphone Capabilities to the Battlefield

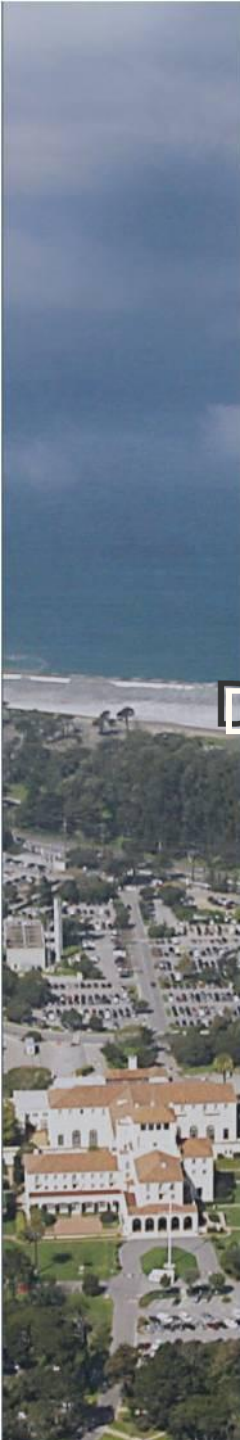
Josh Dixon, Capt./USMC
Naval Postgraduate School





Delivering Smartphone Capabilities to the Battlefield

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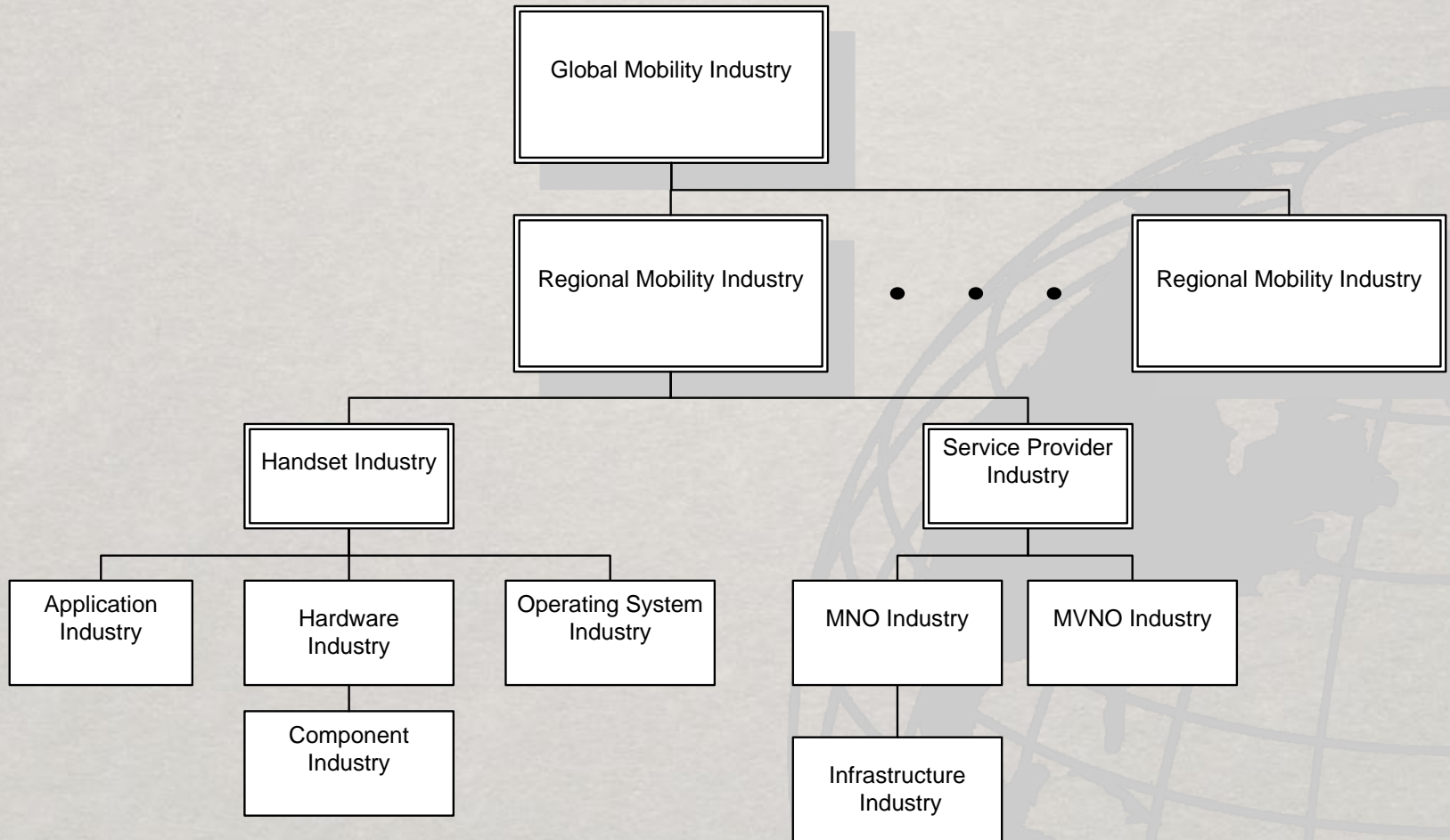


- Overview of the Environment, Industry, and Technology
- Proposed Concepts
 - Handset
 - Service
 - Infrastructure
- Cost Savings





Industry Overview



COTS GOTS



TRADE
OFF

Motorola i1
(MIL-STD 810F)

BlackBerry
(Curve 8900)

General Dynamics
(Sectera Edge)

No military security specifications built
into design

\$Millions spent annually in procurements
(estimated quantity in the thousands)

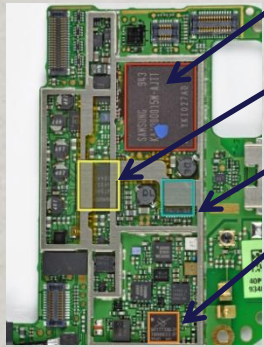
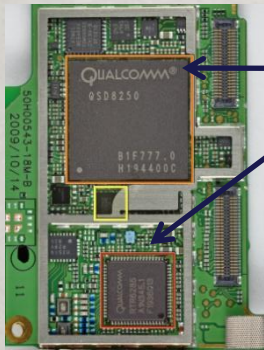
\$150 - \$3900 - \$4000



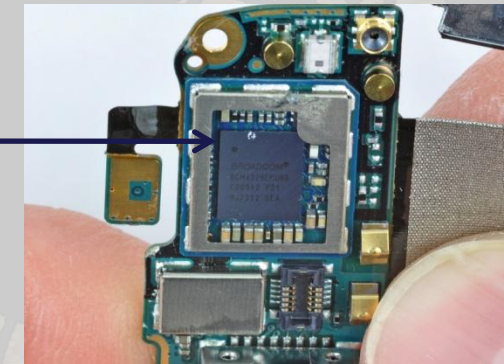
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Handset Cost (drivers)



Component	Manufacturer	Description	Price
Baseband Processor	Qualcomm	1GHz CPU, 600MHz Digital Signal Processor	\$ 30.50
RF Transceiver	Qualcomm	RF Transceiver (ZIF, Quad-Band GSM/EDGE, Tri-Band WCDMA/HSDPA)	\$ 2.50
Display	Samsung Mobile Display	Display (3.7" AM-OLED)	\$ 23.50
Touchscreen	Synaptics	Touchscreen Assembly (Capacitive Multitouch)	\$ 17.50
Memory	Samsung Semiconductor	Multichip Package (4Gbit NAND Flash + 4Gbit Mobile Double Data Rate (DDR) DRAM)	\$ 20.40
Power Management	Qualcomm	Power Management IC (w/ integrated USB transceiver)	\$ 2.50
Power Management	Texas Instruments	Integrated Power Management IC & Li-Ion Charger	\$ 1.20
Power Amplifier	Skyworks & Others	4 Power Amplifier Modules	\$ 2.20
Bluetooth/WLAN	Broadcom	Bluetooth/WLAN/FM Transmitter/Receiver (802.11a/b/g/n, Bluetooth V2.1+EDR, 65nm)	\$ 8.20
Electrical		Misc. Electrical Components (Small IC's, Discrete Semiconductors, Passives, etc.)	\$ 16.30
Camera		Camera (5.0 MP Auto focus)	\$ 12.50
MicroSD Card		MicroSD Card (4GB)	\$ 8.50
Electro-Mechanical		Misc. Electronmechanical Components, PCB's	\$ 14.10
Mechanical		Misc Mechanical Components	\$ 6.20
Battery		Battery (1400mAh, 3.7V)	\$ 5.25
Mechanical		Main Enclosure Housing (Machined Aluminum Unibody)	\$ 2.80



Avg. wholesale*: **\$323.07**
 Avg. retail (2 year plan)*: **\$179.00**

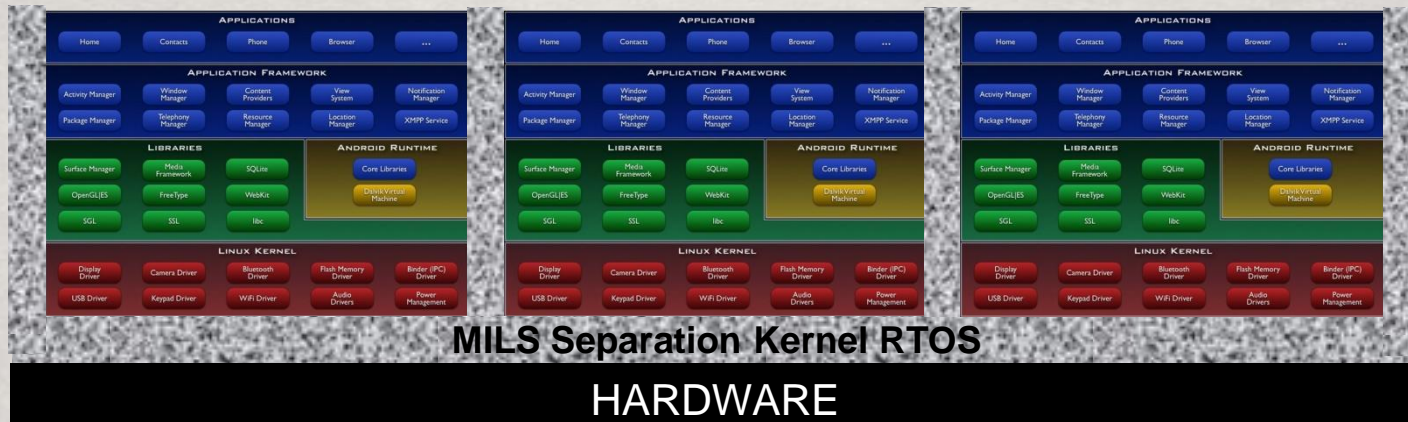
Total Estimated Cost: \$ 174.15

*images from www.ifixit.com
 *cost figures from www.isuppli.com
 **according to ABI Research Firm (as of June 2010)

Personal

NIPRNET

SIPRNET



Limitations

- Virtualization delays
 - Mitigated through multiple processors
 - Hardware virtualization vice software
- Added cost

Advantages

- Higher level of assurances
- Run multiple instances of COTS Operating Systems
- Separate OS from hardware
- Trusted applications receive dedicated resources

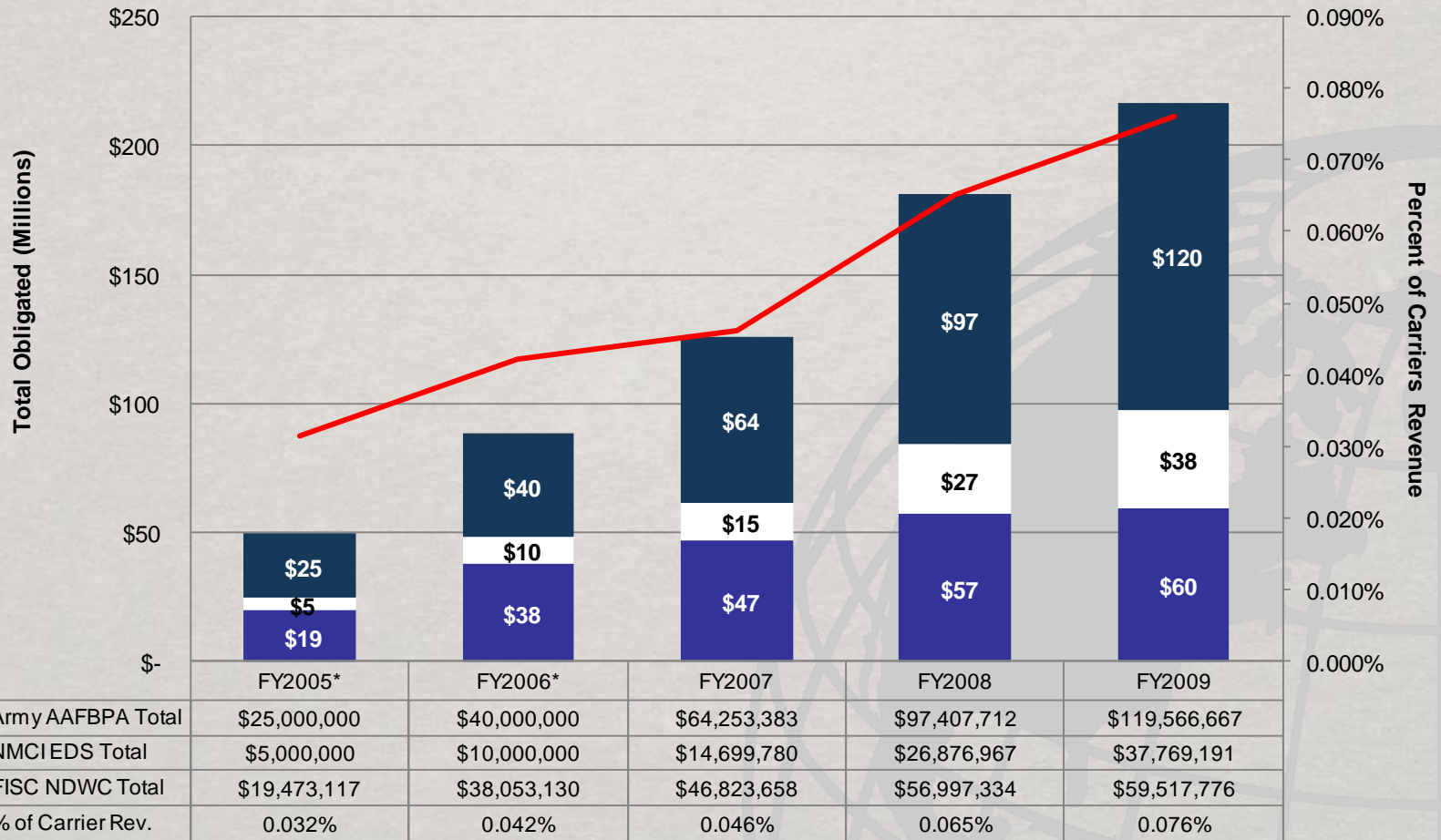


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DoD Wireless Procurements



* FY2005-06 – AAFPA and NMCI data estimates based on trends

**commercial market trend line referencing carriers combine revenue as reported on annual financial records

***procurement data derived from the federal procurement data system (public access)



MVNO Concept

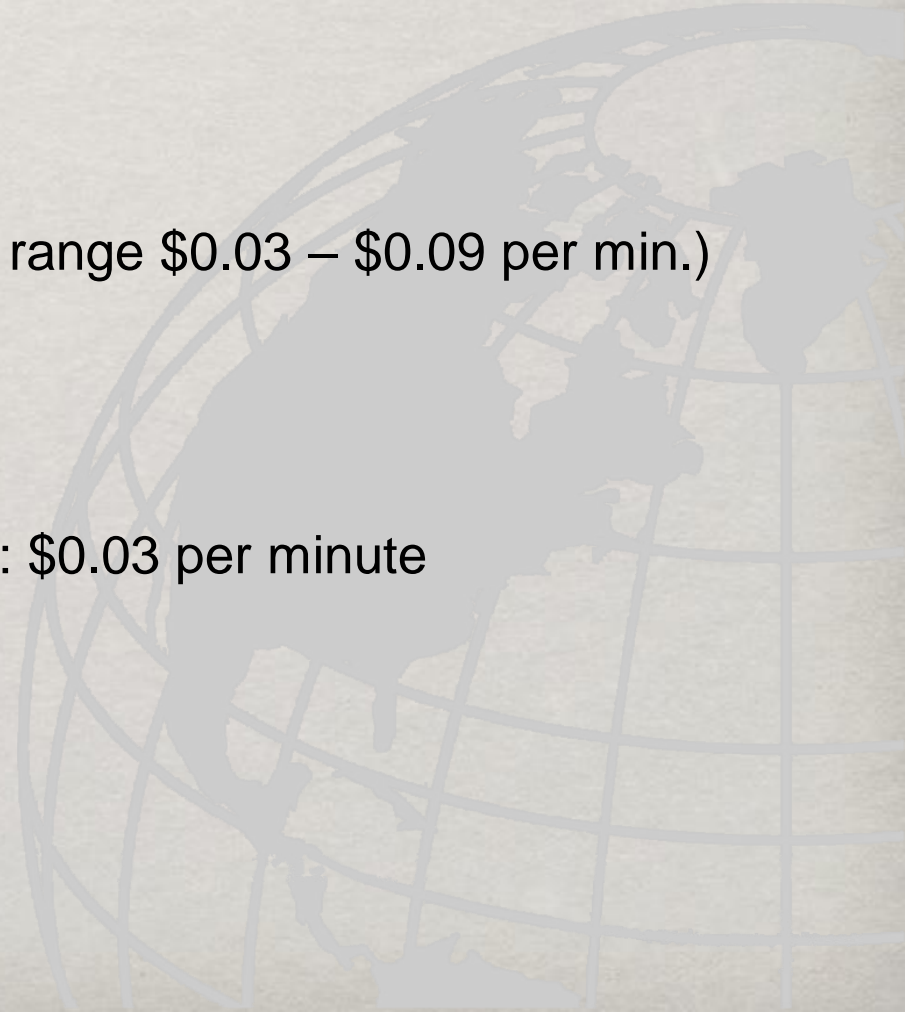
- DoD (domestic) voice cost (calculate per minute rate)

Average: \$0.06 per minute

Std. Dev.: \$0.03 (majority of plans range \$0.03 – \$0.09 per min.)

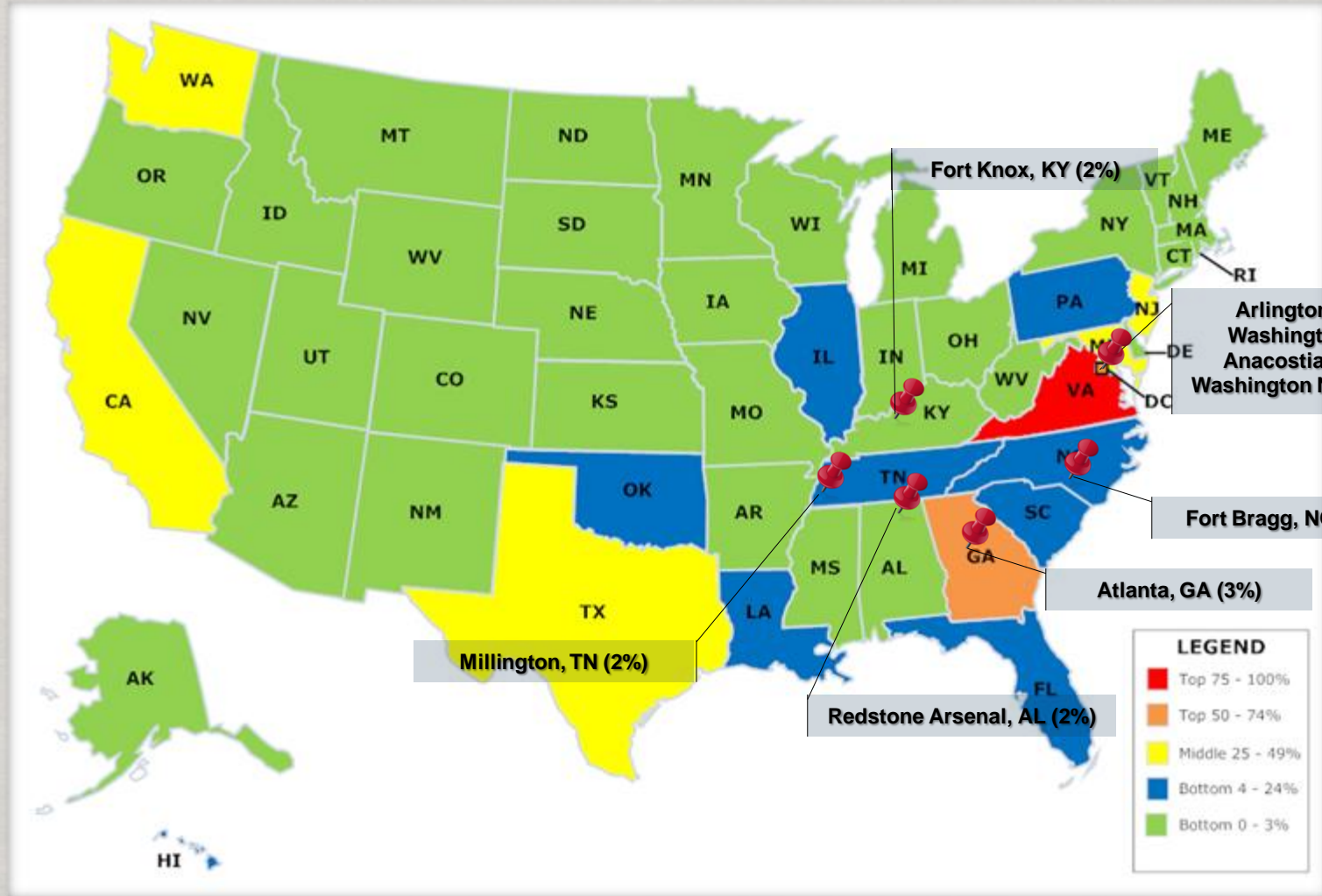
- Carriers cost

Roaming Cost (FCC 2009 Report): \$0.03 per minute





DoD Cost per Region FY09





Spectrum Trade-off

Sell-Off Spectrum and Lease Back

Cost to government

- Cost to lease spectrum
- Loss of dedicated spectrum
 - Lower capacity (smaller channels)

Maintain Spectrum

Cost to government

- No fiscal expenses
- Opportunity Cost (Gov't)
 - revenue from selling spectrum
 - commercial industry builds around spectrum
 - shared R&D burden
 - standards built around spectrum



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Tethered Solutions

Requirement - Integrate MILS Separation Kernel

USB Dongle

- Limitations
 - USB Host
 - Limited Mobility
 - Power Inefficiencies
- Advantages
 - No commercial signal emissions
 - Low Cost
 - Shorter procurement timeline



Sleeve

- Limitations
 - Added hardware to handset
 - Procure sleeve hardware for each handset (customized per phone model)
- Advantages
 - Transmit across military signals
 - Potential for Type 1 encryption module or Suite B client
 - Low Cost in comparison



Lockheed Martin (MONAX)



Wireless Solutions

Requirement - Integrate MILS Separation Kernel

Secure (Encryption) WiFi

- Limitations
 - Added hardware
 - Not LPD/LPI/LPE signal
- Advantages
 - Operates on a non-licensed band
 - Provides suite B link encryption
- Cost (\$6-8K per squad)



Commercial cellular (fixed cites)

- Limitations
 - High opportunity cost for concentrated areas
 - Coverage gaps
 - Reoccurring usage cost
 - Not LPD/LPI/LPE signal
- Advantages
 - Preexisting network (no setup, maintenance/support)
 - Shared cost burden with commercial market



**images from vendors website

Cost (avg. monthly service cost \$25 - \$30 per user)*

*Current cost (\$60 - \$70 per user)

Mobile Base Stations (Tactical design)

- Limitations
 - Higher Cost (limited market)
 - Scalability
 - Not LPD/LPI/LPE signal
- Advantages
 - Ruggedized
 - All-in-one Solutions
- Cost
 - Equipment: \$15K – \$250K+ (6 – 80 simultaneous users)
 - Frequency lease: \$5K – \$6K



SiRRAN
(NOMAD-EX 2G/3G)



LGS Innovations
(TacBSR 2G) (RDN 4G)



Ericsson Federal
(QuicLINKs 3G)

Modified Tactical Radio (host cellular signal)

- Limitations
 - High Cost
 - Not LPD/LPI/LPE signal
 - Modifications not on roadmap
- Advantages
 - No added hardware for infrastructure

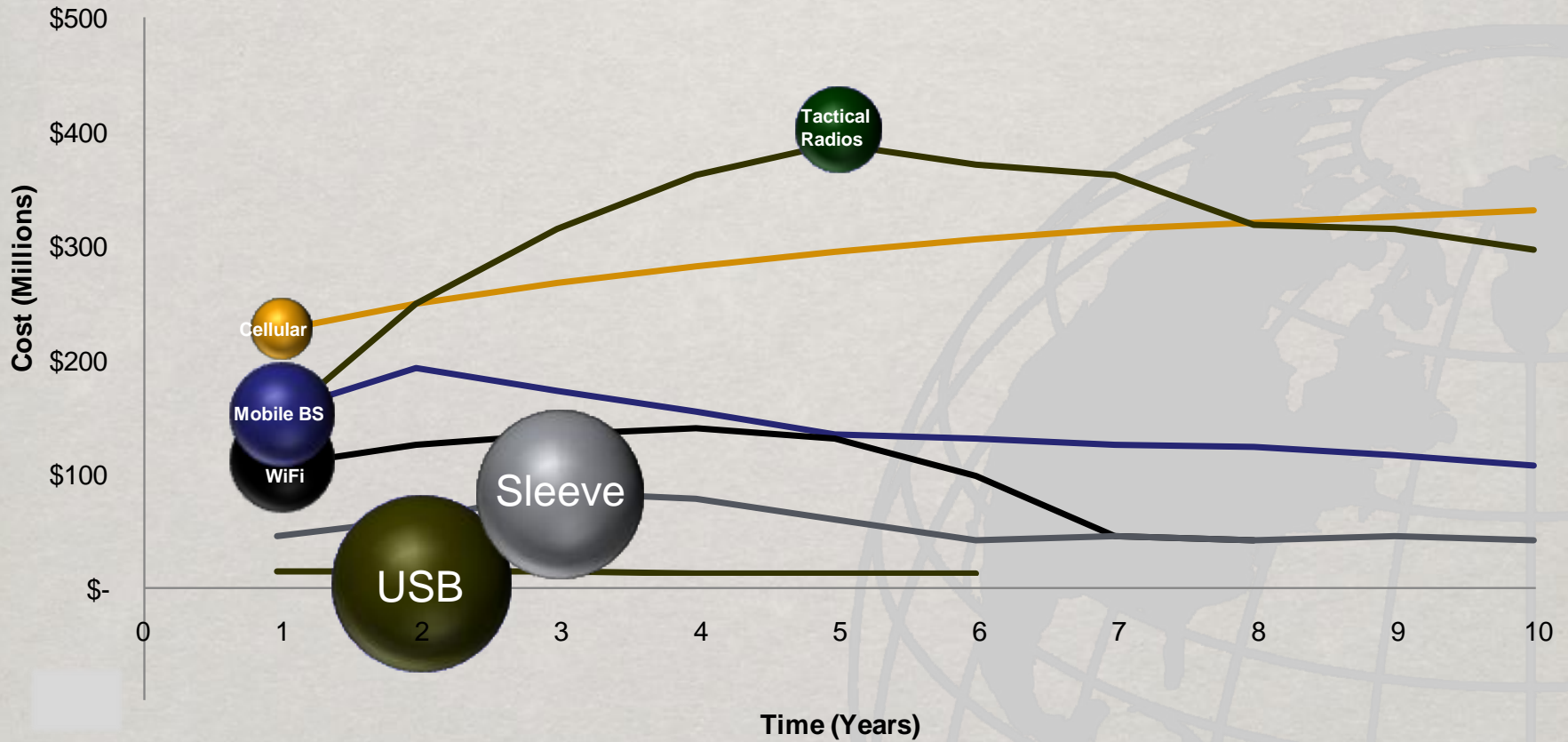


General Dynamics (JTRS HMS)



Infrastructure Security Trade-off

SIZE = LEVEL OF SECURITY





- ~~Overview of the Environment, Industry, and Technology~~
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 - ~~Service~~
 - ~~Infrastructure~~
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Estimated Current Cost

Secure Comms Cost

- Service
 - $1500 \times \$70 \times 12 = \1.25 Million
- Handset
 - $1500 \times \$3000 = \4.5 Million
- Infrastructure
 - \$750 Thousand
- R&D
 - \$50 Million

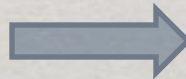
Total: \$56.5 Million annually

Unsecure Comms

- Service
 - $280K \times \$70 \times 12 \text{ mo} = \240 Million
- Handset/Data Cards
 - \$600 Thousand

Total: \$240.6 Million annually

\$2.56B NPV (rough estimate 10 yrs)





Proposed Savings

- Spectrum
 - $165 \times \$5000 \times 12 = 10$ Million
- Leased / Owned Infrastructure
 - $165 \times 50 \text{ K} = 50$ Million
- Handset
 - $450\text{K} \times \$300 = 135$ Million
(hardware and software cost)
- Service
 - $140\text{K} \times \$30 \times 12 \text{ mo} = 50$ Million
- R&D
 - 25 Million

Total: \$270 Million annually

Current Cost

- \$2.56 B (280K users)

Proposed Cost

- \$2.16 B (450K users)

Savings: \$400MM (across 10 yrs)

Increased Coverage

Increased Capability



Questions

- Overview of the Environment, Industry, and Technology
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 - Service
 - Handset
 - Infrastructure
- Cost Savings

A large, faint, light-colored globe is positioned in the background on the right side of the slide. It shows the outlines of continents and latitude/longitude lines.

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