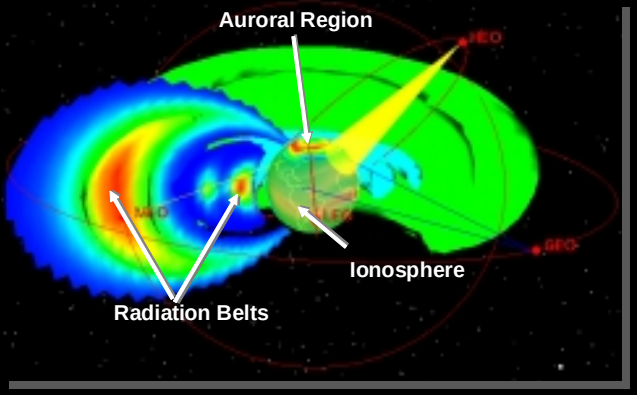
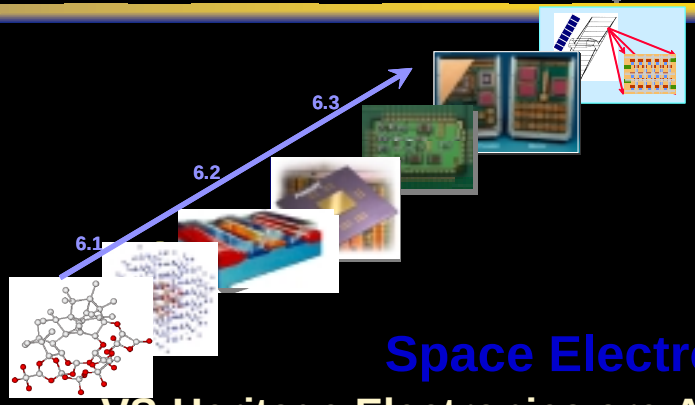

AFRL Space Technologies
4 Mar 04
Colonel Neil McCasland
Director, Space Vehicles
Air Force Research Laboratory

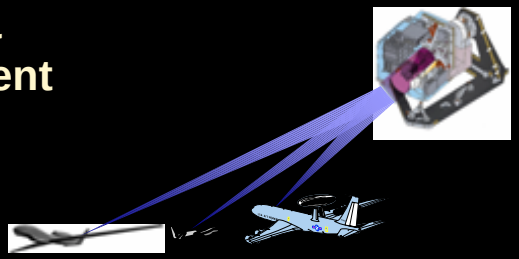
Space Technologies
for Air Force Capabilities



Space Weather
Specifying, Forecasting & Mitigating Space Environment Hazards to DoD Systems



Space Electronics
VS-Heritage Electronics are Aboard All DoD Operational Satellites

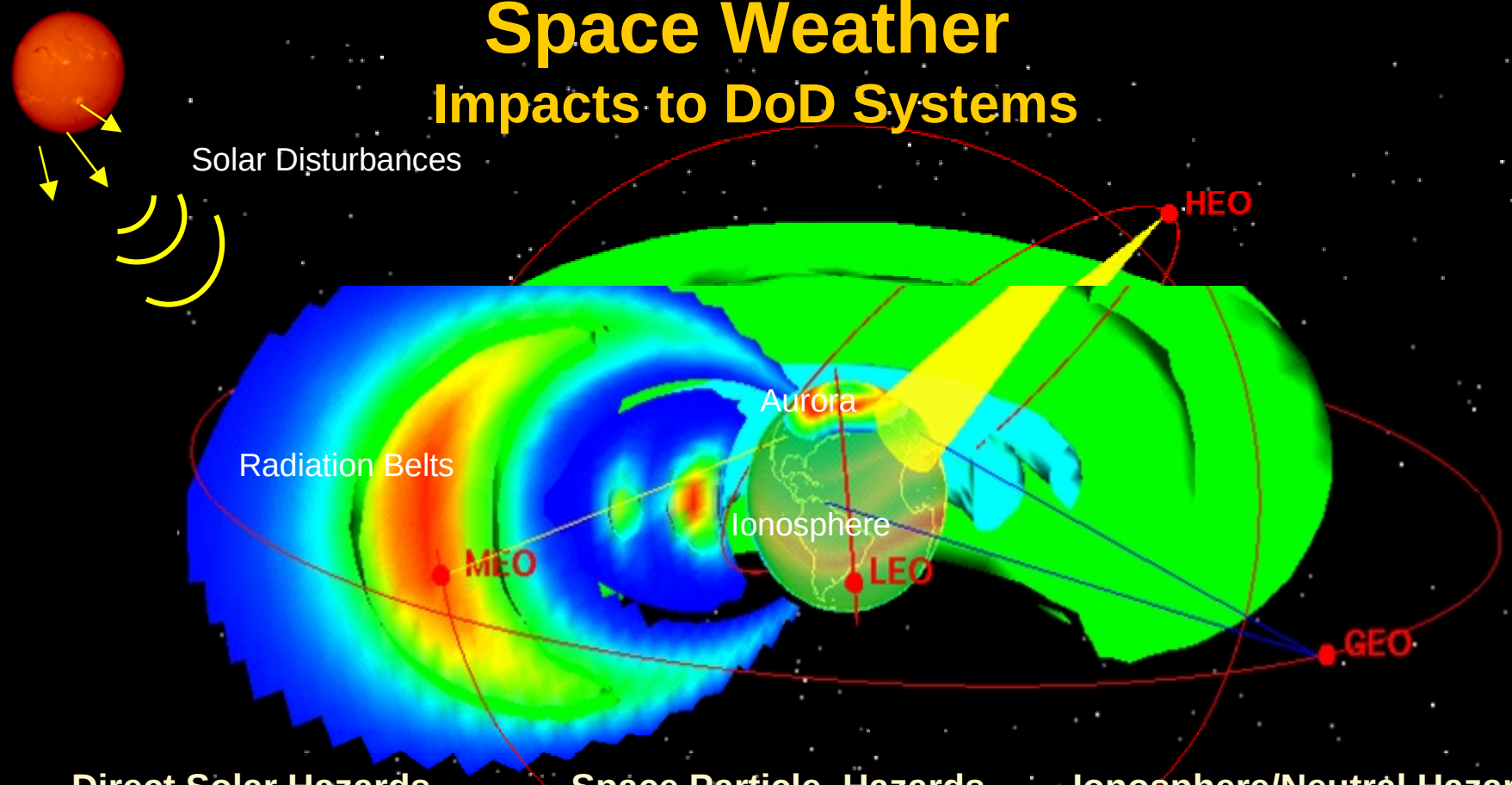


Space Communications
Broadband Comm Support for High Data Rate Users

Space Power
VS-Heritage Solar Cells Aboard 95% of DoD Operational Satellites

Space Structures
VS Structures Technology on EELV & Minotaur Launch Vehicles

Space Weather
Impacts to DoD Systems



Direct Solar Hazards

- Radio, optical and X-ray interference
- Solar energetic particle dose degradation and detector clutter
- Radiation dose to humans at high altitudes

Space Particle Hazards

- Radiation degradation and electronics upsets
- Surface and internal charging / discharging
- Thin film and coating degradation

Ionosphere/Neutral Hazards

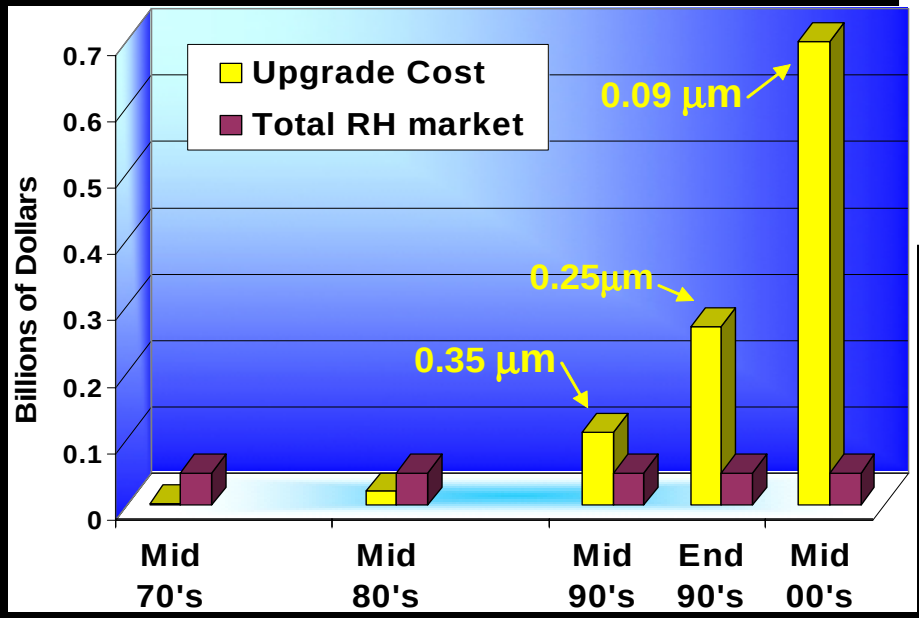
- Communication/Navigation link degradation and outage
- Surveillance clutter
- Tracking & geolocation error
- Satellite Drag

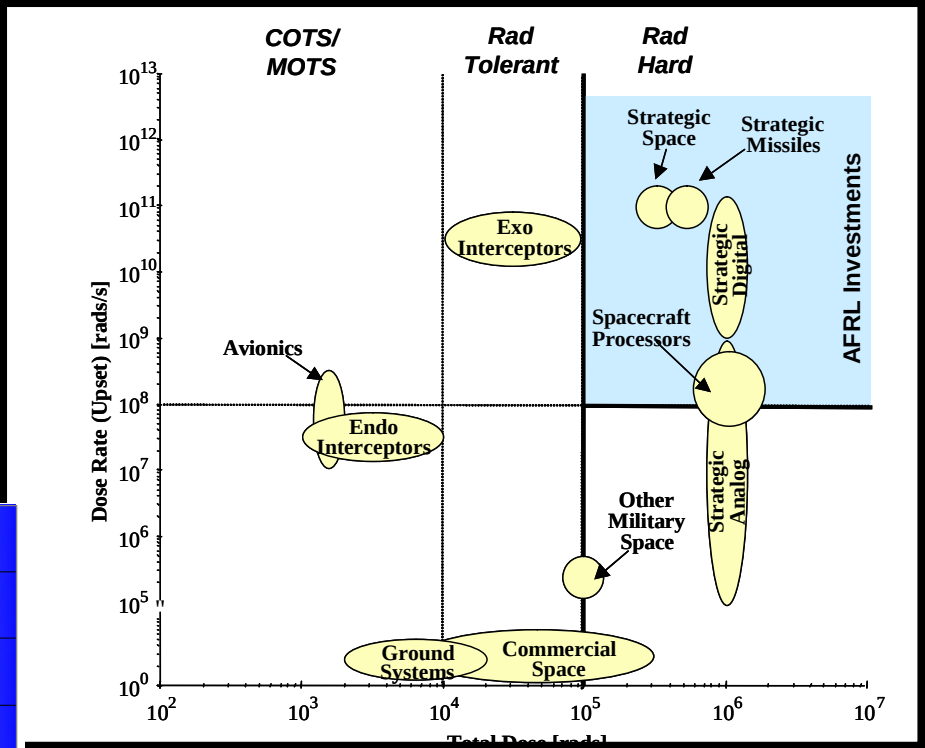
Space Electronics

Environment

- DoD space systems operate in a harsh radiation environment
- We develop cost-effective solutions to military-unique requirements

Commercial electronics won't work!





Infrastructure

- Manufacturing cost grows exponentially -- New fabs cost $3B+
- Takes 30 yrs to amortize one dedicated rad hard manufacturing plant

Dedicated fabs not sustainable

Space Power

SS/Loral LS1300 (17 kW)

Lockheed A2100AX (15 kW)

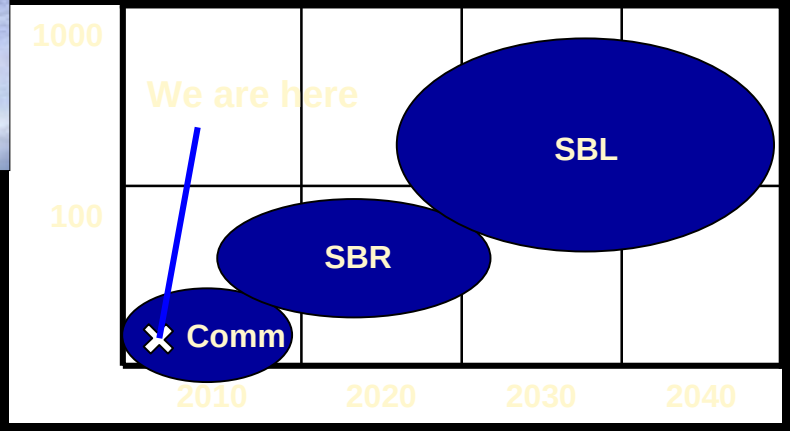
Power is a limiting factor for nearly every space application

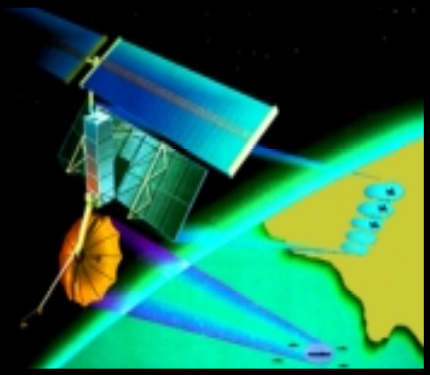
Current Power Ceiling ~19 kW – Array Mass & Volume Limitations

Space Station (78 kW) (Multiple Launches)

Boeing HS702 (17 kW)

Space-Based Radar & Communications Drive Power Requirements

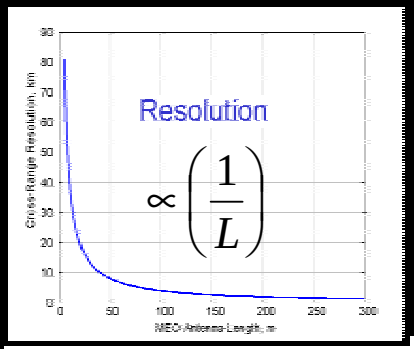


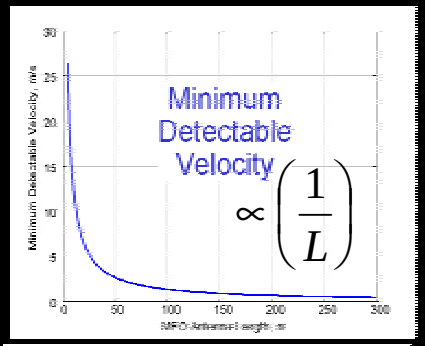


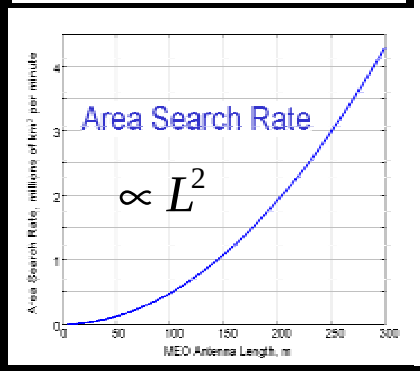
Space Structures

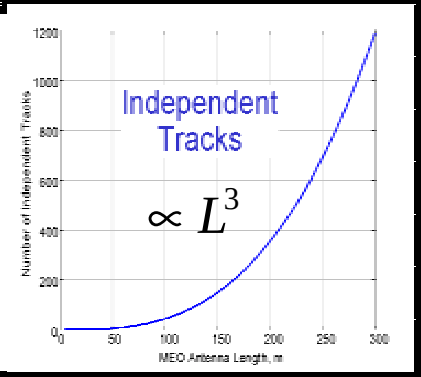
Aperture Size

Example: Effect on SBR performance



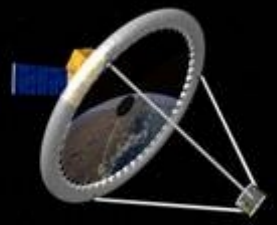


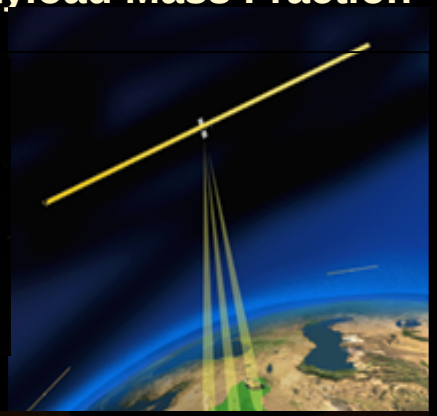


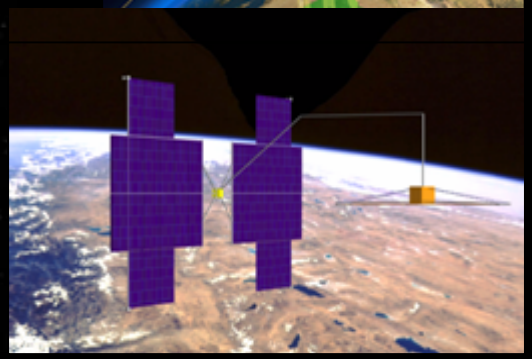


System Weight

Parasitic Mass/Payload Mass Fraction







Lightweight, High Packaging Efficiency Structures Critical to Communications and Remote Sensing!

Space Communications

Circa 2000

- Circuit switched
- Unconnected, separate services
- Limited support for small terminals
- Low protected capacity

Strategic EHF Comms

Milstar

Wideband SHF Protected Comms

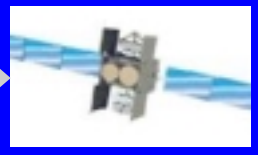
DSCS

Wideband L, C, Ku, Ka-band Comms

Commercial

Circa 2005

AEHF

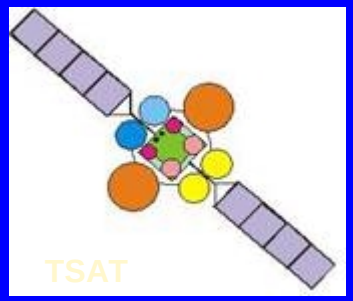


WGS

Commercial

Circa 2015

- Internet-like transport with interconnectivity and cross-banding
- Support for small, mobile terminals
- High protected capacity



TSAT

WGS

Commercial

AEHF

APS

- Mix of packet and circuit switched capacity
- Adaptive links for channel conditions – built-in protection
- High bandwidth trunks/circuits
- Support for small user terminals
- Integrated EHF, SHF, Ka band services

Summary

- AFRL leads the way in space technology
  - New affordable means for reusable access
  - Smaller, cheaper, more capable payloads
- Partnership counts!
  - Collaboration with NASA is strong and growing
- Need attention to assure tomorrow's talent pool