



# **NASA Manufacturing Supply Chain Sustainability Issues**

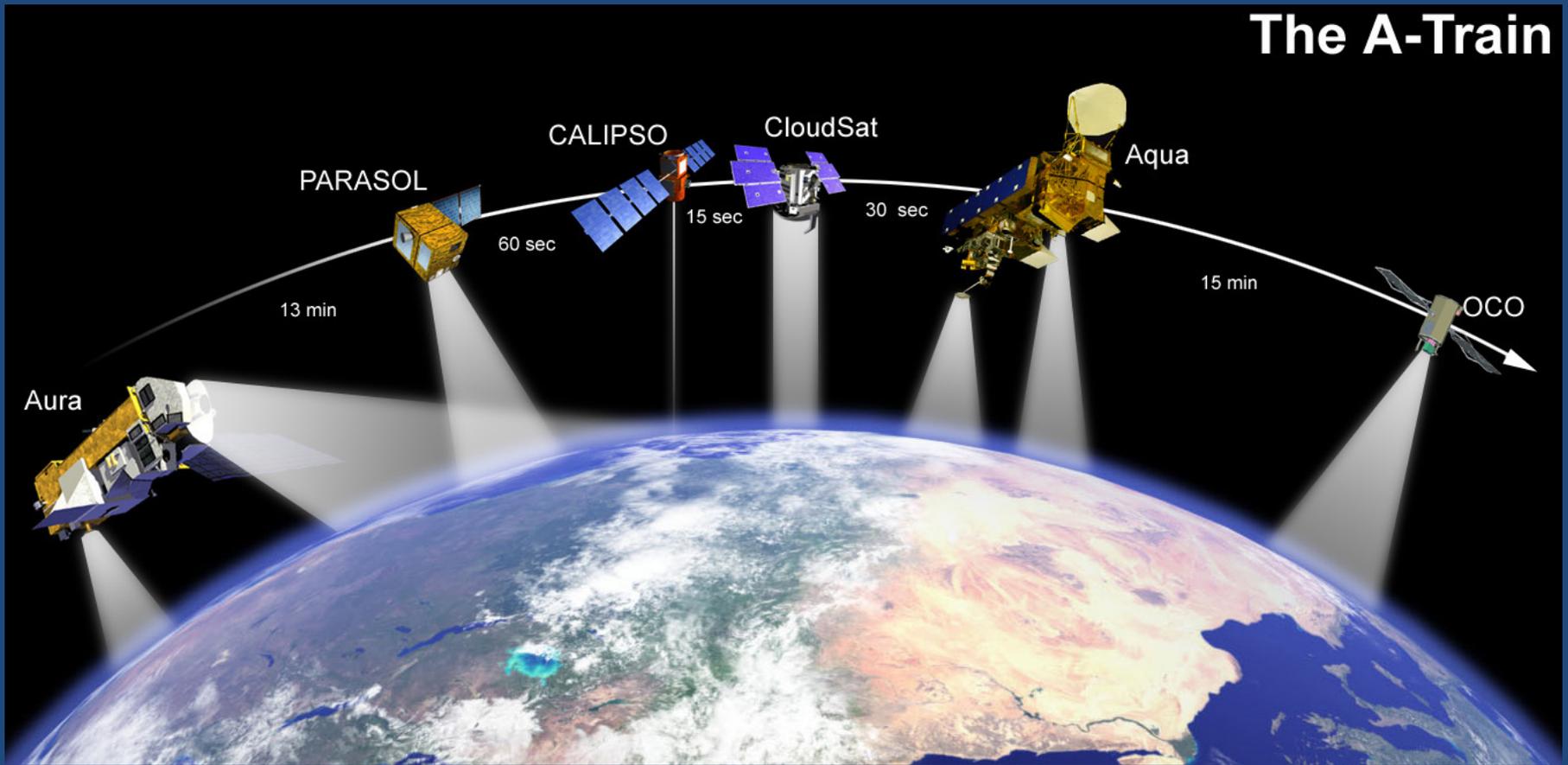
**Presented to  
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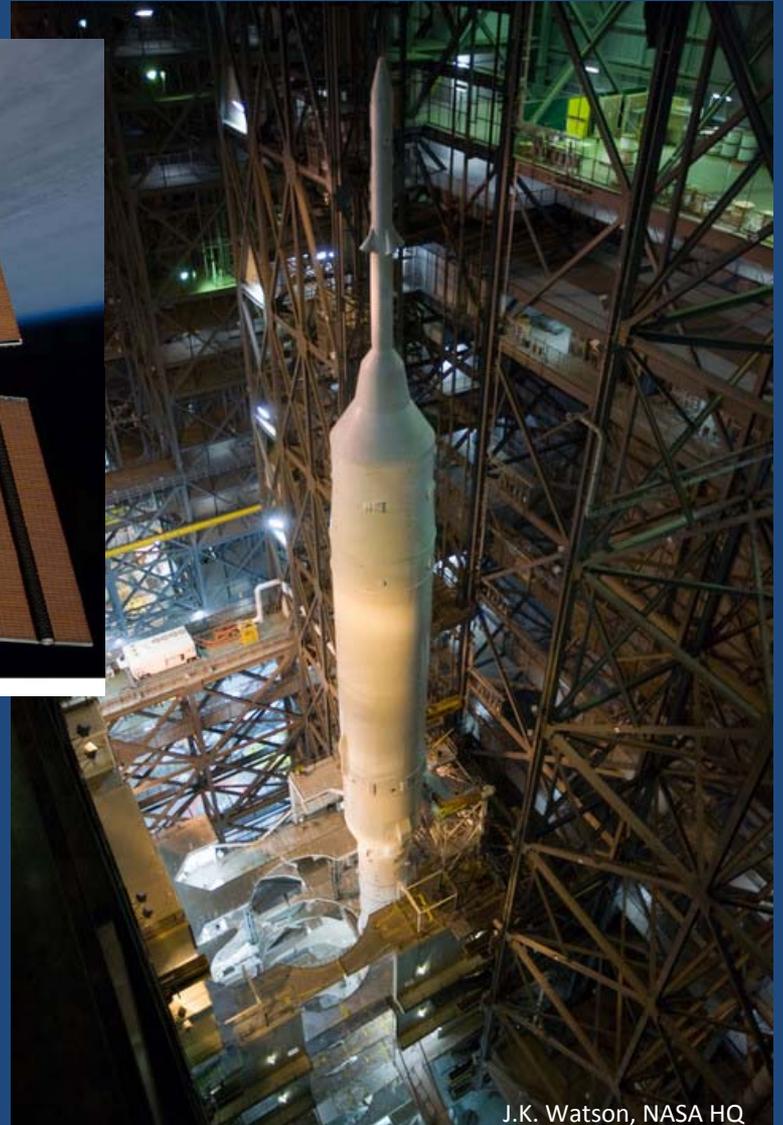
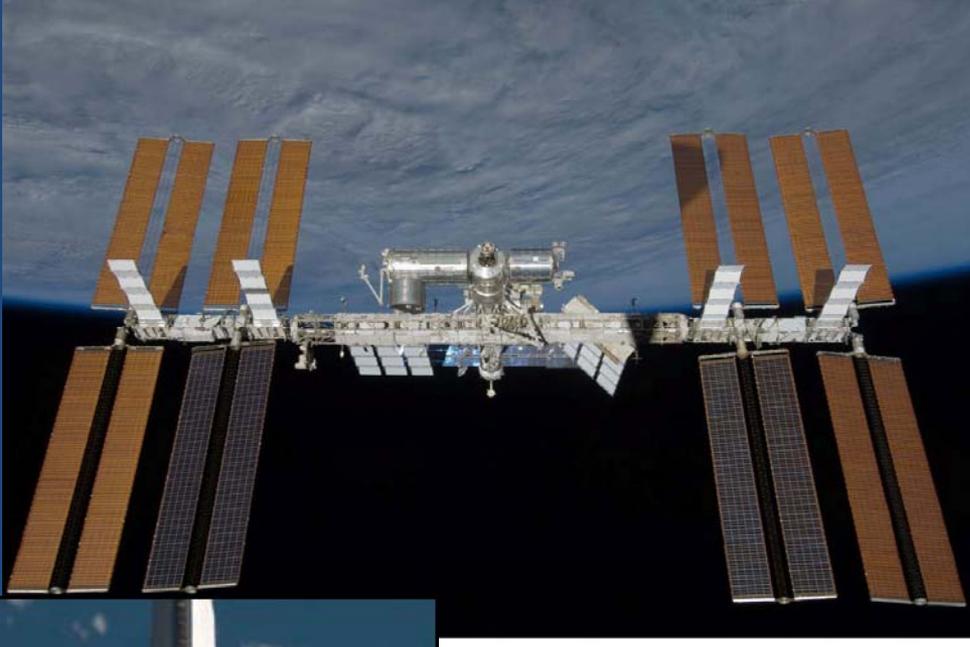


# NASA's Product Line





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# Challenges

- **New Executive Order**

*NASA will have to report Scope 3 emissions:*

- includes emissions from NASA's supply chain
- Department of Energy will provide guidance on methodology

- **National Science Board recommendation\*:**

*Provide a leading example by adopting sustainable energy measures and analyses throughout the U.S. Government*

- Encourage all Federal agencies to become exemplars for deploying sustainable energy technologies. **These practices should be adopted throughout the U.S. Government supply chain.**

\* National Science Board, "**Building a Sustainable Energy Future: U.S. Actions for an Effective Energy Economy Transformation**", August 3, 2009, pg. 9.

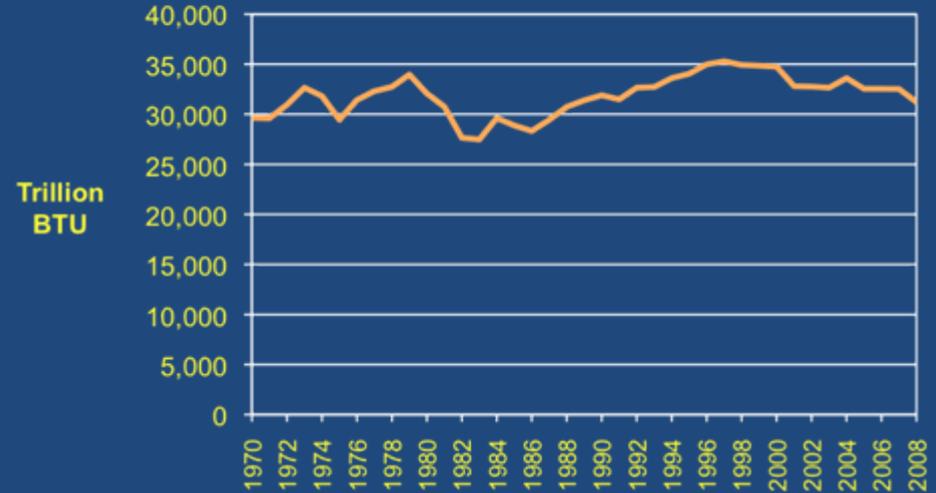


# Industrial Energy Consumption

### Total Energy Consumption

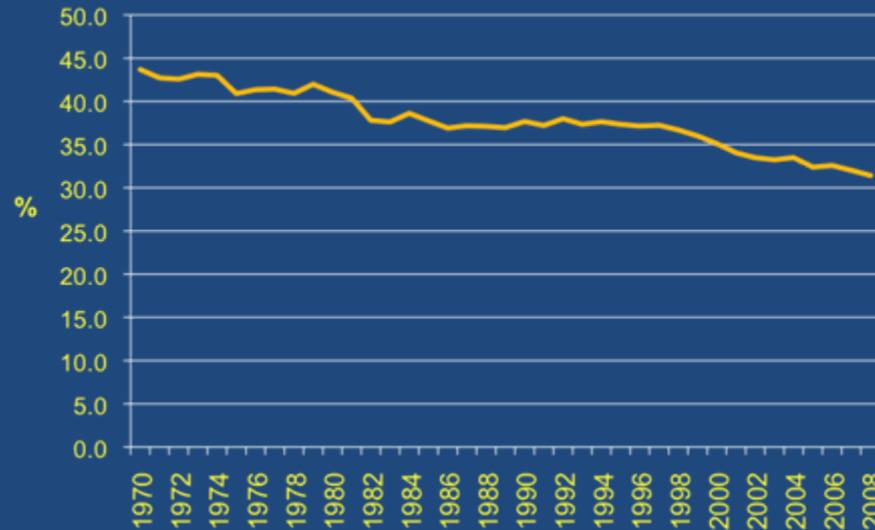


### Industrial Energy Consumption



(Total = Residential + Commercial + Transportation + Industrial)

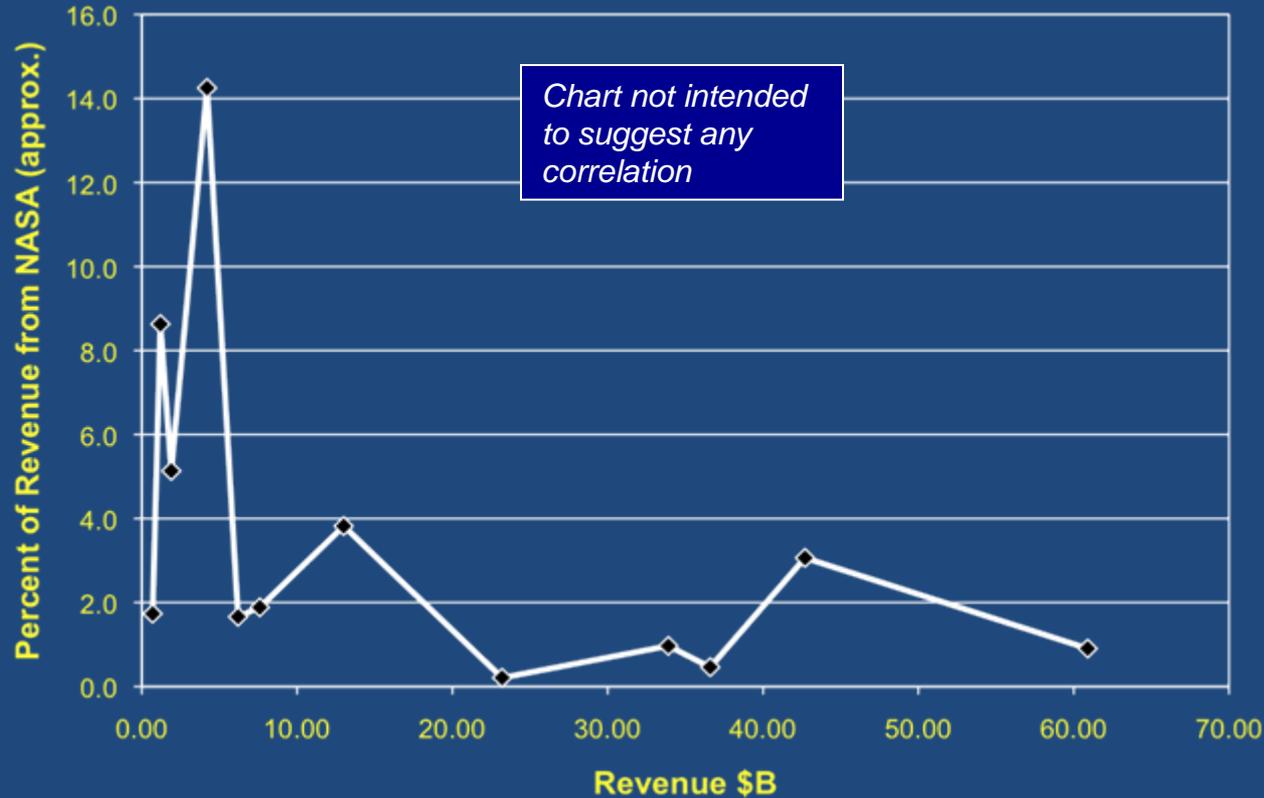
### Industrial Energy - % of Total Energy



Data source: Table 2.1a, Annual Energy Review 2008, Report No. DOE/EIA-0384(2008), Release Date: June 26, 2009



# Leveraging Opportunity



12 corporations  
\$232B cumulative revenue\*  
\$3.95B from NASA (1.7%)\*

\$257B 2008 total sales of U.S. aerospace products and parts\*\*

Aerojet General Corp.  
Orbital Sciences Corp.  
Teledyne Brown, ATK  
Hamilton Sundstrand  
Ball Aerospace  
Pratt & Whitney Rocketdyne  
Raytheon, Northrop Grumman  
Honeywell, Boeing  
Lockheed Martin

\*Data sources: NASA Annual Procurement Report - Fiscal Year 2008 and corporate annual reports

\*\*Data source: Flight Plan 2009: Analysis of the U.S. Aerospace Industry, International Trade Administration, U.S. Dept. of Commerce



# NASA Industrial Base Sustainability Issues

- **Definition of quantitative indicators to determine a baseline and measure progress towards goals – DoE guidance**
  - **Meaningful**
  - **Summable**
  - **Readily available data**
    - **No / minimal impact**
    - **Existing data**
- **Defining boundaries and a baseline (2008 per EO)**
- **Definition and quantification of sustainability goals (e.g. energy use reduction, GHG reduction, water use reduction)**
- **Defining success (e.g. X% reduction from baseline on defined schedule)**
- **Allocation of goals into the supply chain and integration of supply chain contributions to achievement of goals**
- **Tracking benefits to the bottom line**



# Going Forward

- **Identification of mechanisms for encouraging our prime contractors to accept the defined goals and to flow them down through their supply chain**
- **Determine best approach to have most effective influence**
  - **Work through procurement process?**
  - **Invoke new standards for energy management?**
- **Find mechanisms for collaboration – with contractors, with other Government agencies**
- **Provide assistance in achieving the defined goals – information, coordination, other resources**
- **Development of manufacturing technologies with reduced footprint**



# Electron Beam Freeform Fabrication (EBF<sup>3</sup>) Technology

- **Rapid metal fabrication process**
  - Use as-built or with small amount of final machining
  - Material properties equivalent to wrought products
- **“Green” manufacturing**
  - Minimal waste products, low consumables
  - Efficient use of energy and feedstock
- **Buy-to-fly ratios**
  - Conventional fabrication by machining – 20:1
  - EBF3 additive manufacturing – 2:1

*Courtesy of Karen M. Taminger,  
NASA – Langley Research Center*

