NASA's Path to Green Improving Infrastructure & Mission Success

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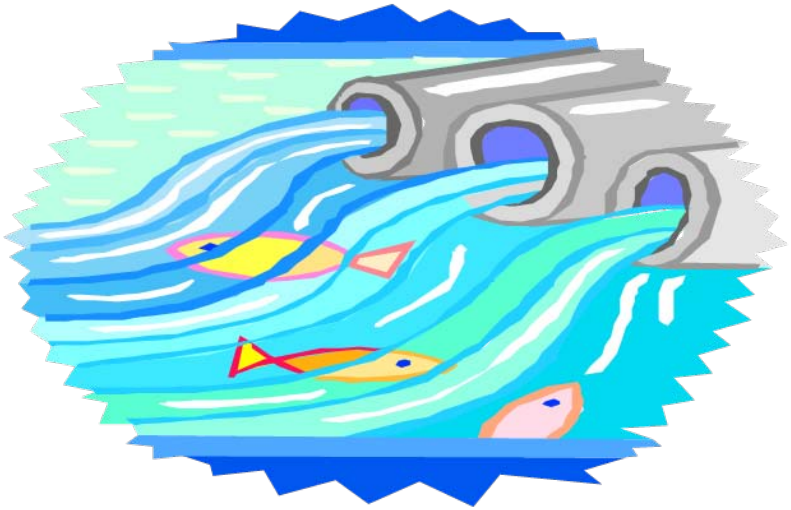
I arrived at NASA Headquarters in 1990

- NASA's environmental program was 2 years old
- Environmental was a Branch in the Maintenance Group
- Employees hired had to be transferable to facility or maintenance (I was the first non engineer hired)
- The program was in turmoil - being done by mission directorates, centers, projects, & individuals without consideration of Agency and Mission requirements or precedence setting

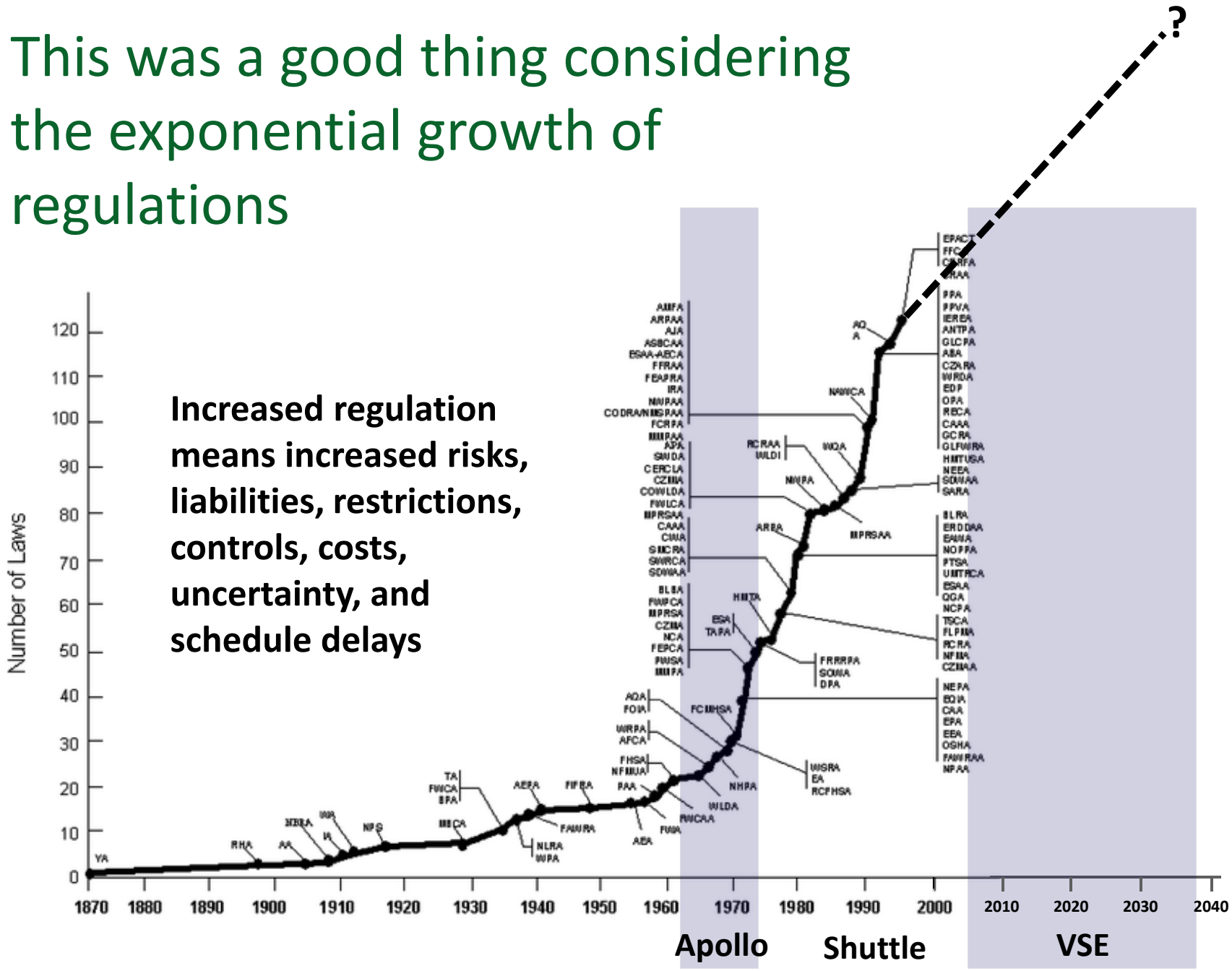
NASA, like most organizations, started with a core compliance program

The First Step – Unifying Agency Policy

- To meet the legal requirements & Executive Orders
  - operate in compliance
  - clean-up the past
  - prevent pollution
  - become energy efficient



This was a good thing considering the exponential growth of regulations

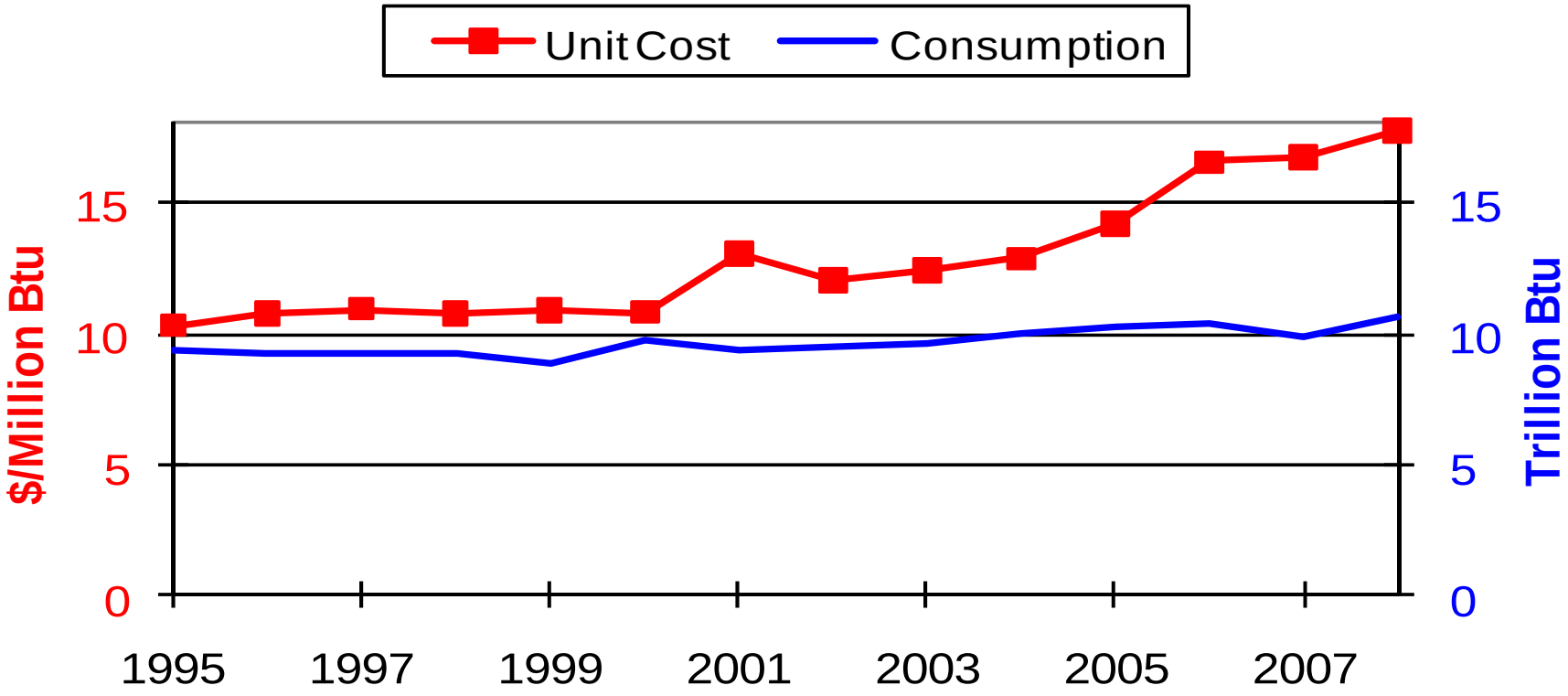


Source: J. A. Cusumano, New Technology for the Environment, Chemtech, 1992, 22(8), 482–489

NASA employees got involved

Buying Green Online
Greening Government
E-Procurement of Office Supplies

Conserving energy



- Rising energy unit costs erodes available funding for mission
- $167M NASA facility energy cost in FY 2008
- Trend: Buying less yet spending more
- Since FY 1995, use down 12% of BTU per sq ft & unit costs is up 72%

Next Step –
Protecting Human Health & the Environment

- Looking beyond compliance
  - About 80 civil servant across 14 sites so strict compliance was not doable
- Understanding the intent behind the laws and regulations
  - Pushed NASA to out of the box thinking
  - Creating internal and external partners
- Externally NASA became known as an environmental leader
- Internally we avoided costs and protected mission

We started building greener facilities

MARSHALL STAR
Serving the Marshall Space Flight Center Community
Sept. 29, 2005

Marshall's Building 4600 wins 'energy saver' award

Building 4600, located at the intersection of Martin and Rideout roads, has been selected by the U.S. Department of Energy as a showcase facility for energy and water efficiency.

By Sanda Martel

The first building completed in a planned Marshall Center engineering complex has been designated a "Federal Energy Saver Showcase" by the U.S. Department of Energy.

Building 4600, located at the intersection of Martin and Rideout roads, was designed and built according to efficient energy and water principles, making it eligible for registration with the U.S. Green Building Council for Leadership in Energy and Environmental Design (LEED)® — a voluntary, consensus-based national standard for developing high-performance, sustainable structures.

New Partners

- Air Force Space Command….
- Europe – ESA – Portugal….

esa

AIR FORCE SPACE COMMAND

Partnering Leverages Lessons Learned = Consideration of Greener Solutions

- Teaming with similar organizations within EU to share lessons learned – ESA: materials obsolescence, ground support operations, sustainable design – Portugal: wind technology, no-lead solder, non-chromate primers
- Supporting material database development – include environmental attributes
- Cosponsoring Green Engineering Masters Forum with Office of the Chief Engineer
- Greater frequency of institutional and environmental risk analysis being included in programs and projects
  - institutional/regulatory issues are addressed early in project development minimizing cost and schedule delays

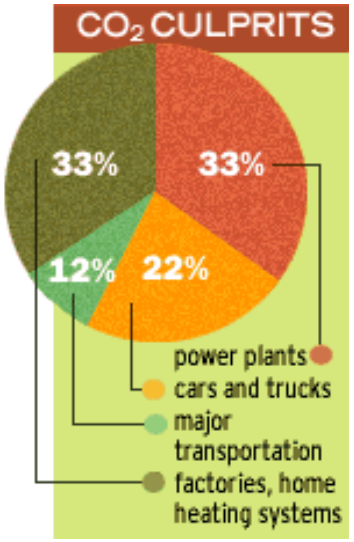
Then Environmental Learned the Language of Mission RISK

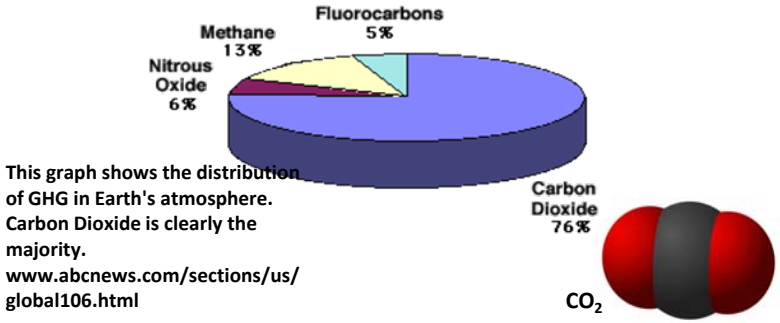
Risk Identification

NASA Programs and Projects

Infrastructure

New Regulations/Opportunities = Centers Look & Operate Differently





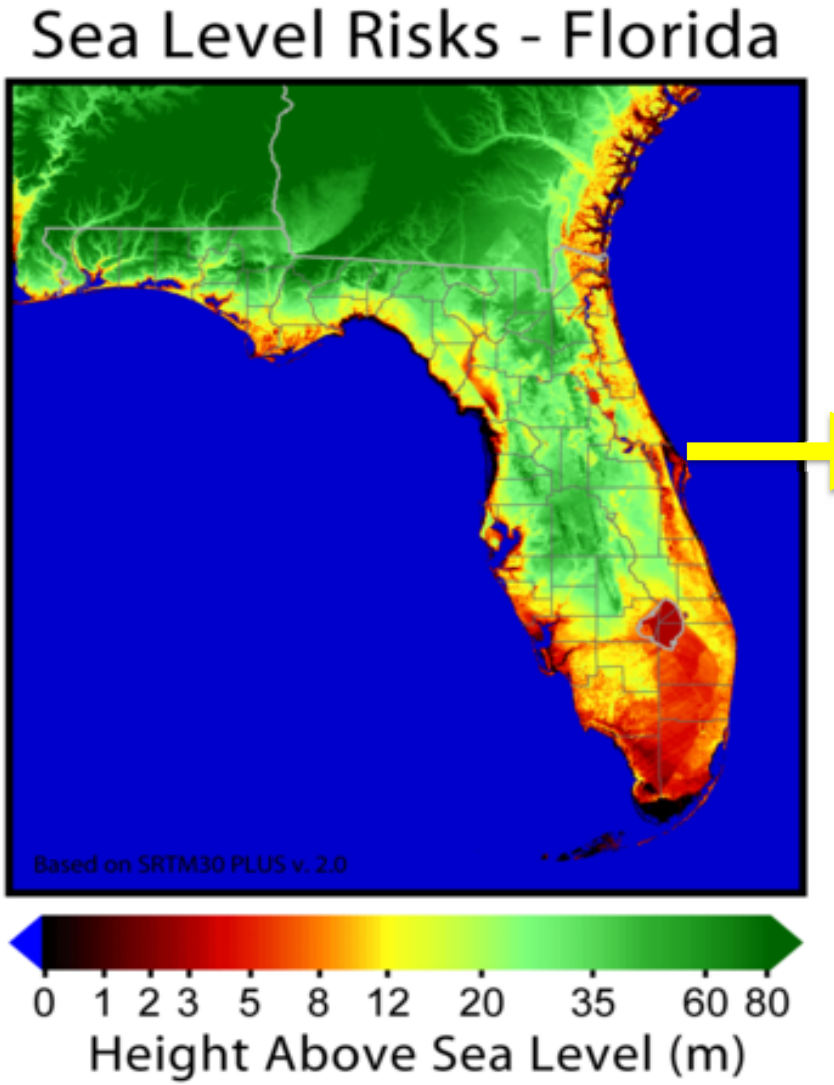
This graph shows the distribution of GHG in Earth's atmosphere. Carbon Dioxide is clearly the majority.
www.abcnews.com/sections/us/global106.html

- New requirements for Green House Gas management
  - Energy effectiveness needed vs. efficiency
- External reporting requirements will expanded data collection
  - Yielding opportunities for creative/sustainable/green thinking and solutions
- External reduction goals will require changes leading to creative and effective options
  - Projected reductions necessitate solutions beyond “low hanging fruit” to green engineering and out of the box thinking
  - The need to balance gains to meet external goals - mission risk and limited resources leads to creative greener solutions

New Regulations = Opportunities

- Opportunities to think outside the box – to understand intent and achieve a different set of results
- Understanding that how we measures affects what we do:
  - Reduction in BTU per square foot leads to “tried and true” solutions (compact fluorescent) that yields efficiency – reduction in the cost of energy can yield a different solution (a wind mill) leading to effectiveness
  - Controlling/monitoring storm water runoff contaminants (storm water ponds and treatment systems) vs. improving and increasing habitat/environment for animals and humans (green roofs and permeable parking lots)

Climate Change
Risk to Mission and Infrastructure



Impact from Nor'easter

We'll Soon be Making More Energy at NASA Centers

- KSC Solar Photovoltaic System
- December 13, 2007: NASA/KSC and Florida Power & Light (FPL) entered into a Memorandum of Understanding (MOU)
- Approximately 10 MW generation capacity on 60 acres

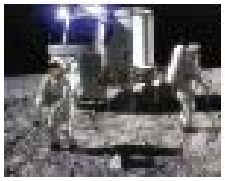
Our greenest building yet

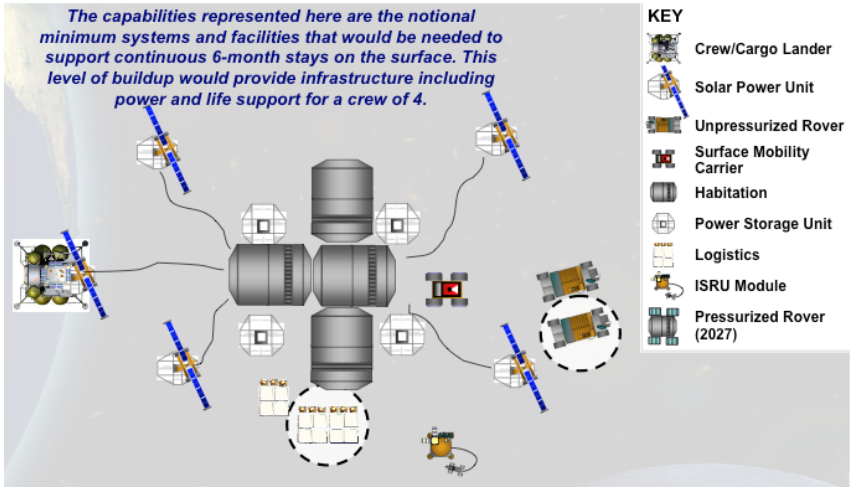
Sustainability Base at ARC

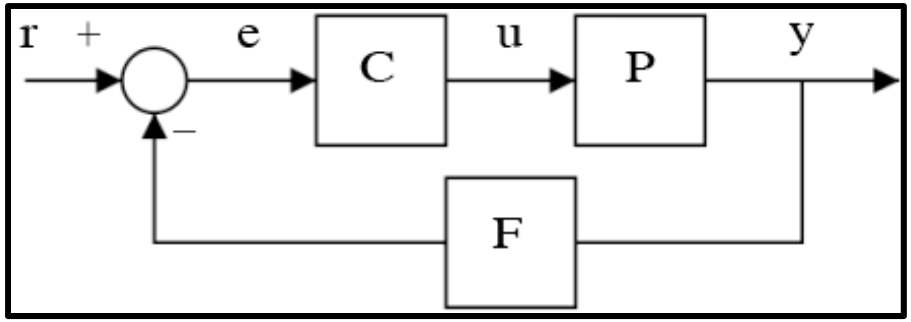
- Net zero energy consumption
- Will use 90% less water
- 50,000 sq ft of collaborative space
- Solar and geothermal used
- Sited to capture breezes & shade
- Use intelligent control systems
- Use cool evening air as a thermal reservoir

Future - NASA Centers will be Different

Use of Close Loop Designs







Key Lessons Learned

1. Environmental regulations are constantly increasing - green house gases, climate change, emerging contaminants – turn this into a creative opportunity.
2. Core compliance programs needs to be done via meeting intent (protect human health and the environment) vs. strict compliance
3. Understand that supporting mission activities comes first. If you can't meet mission needs and requirements, it does not matter how green or sustainable it is.
4. **Be consistent, inclusive and persistent – if you have a good idea "NO" is not acceptable – repackage using the language and framework of your intended audience.**