Agenda

1. Purpose & Background
2. Internal and External Drivers
3. Bilateral Sustainability Report Comparison
4. NASA’s Sustainability Metrics
5. Future Collaboration
6. Summary
Purpose

Compare and contrast sustainability metrics of core metrics effective for the design, development and improvement of space systems & associated infrastructure
NASA Facilities
Driver - Evolution of Environmental Requirements

CUMULATIVE NUMBER OF LAWS AND EXECUTIVE ORDERS

YEAR

Air Multiple
Chemical Management Natural/Cultural Resources Endangered Species Other (White Points)
Energy Transportation Land/Waste Water

Future Programs
Apollo Shuttle
This graph illustrates the change in global surface temperature relative to 1951-1980 average temperatures. The green error bars represent the uncertainty on measurements. Source: NASA
In Since FY 1995, NASA’s energy use is down 12% and unit costs are up 73%.

We are buying less energy yet still spending more.
Partial List of Materials and Processes of Concern

- Trichloroethane
- Precision Cleaning and Cleanliness Verification Processes Requiring ODSs (HCFC 225 and HCFC 225g)
- TPS and Cryoinsulation Containing ODS (HCFC 141b)
- Chromate Primers
- Cadmium Plating
- Hexavalent Chromium Conversion Coating
- Paint Strippers Containing Methylene Chloride
- Lead Based Solid Film Lubricants
- Paints Containing Perchloroethylene
- High-Level Volatile Organic Compound (VOC) Coatings
- Alkaline Cleaners Containing Hexavalent Chromium
- Hazardous Air Pollutant (HAP) Inks
- Methyl Ethyl Ketone
- Materials and Products Containing Perfluoroalkyl Sulfonates
- Materials Containing Brominated Flame Retardants
- Materials Requiring Perfluorooctanoic Acid (PFOA)
Drivers: Minerals and Metals

- Rare Earth Elements
- Conflict Metals
- Supply Chain Security
- Mini Workshop on Rare Earth Elements and Conflict Metals to ESA/ESTEC
NASA’s Sustainability Policy

NASA's sustainability policy is to execute NASA’s mission without compromising our planet’s resources so that future generations can meet their needs.

Sustainability also involves taking action now to provide a future where the environment and living conditions are protected and enhanced and in that future NASA will have the resources it needs to perform its Mission.

NASA is committed to the intent of Executive Order 13514.

NASA is integrating sustainability principles and methods into existing systems, processes and decision-making, influencing both long-term planning and short-term actions.

Sustainability is becoming part of NASA culture.
EO 13514 required NASA to prepare and submit to CEQ and OMB a multi-year Strategic Sustainability Performance Plan.
Example Format of Bilateral NASA/ESA Sustainability Report

Sustainability Success Stories

• Environmental
• Economical
• Societal

ESA and NASA Common Core Metrics

• Energy Intensity
• Renewable Energy Usage
• Green House Gases

Collaborative Activities

• Materials and Processes
• Launch Services
• Development of Additional Partnerships
ESA and NASA Common Core Metrics

- Energy Intensity
- Renewable Energy
- Green House Gases

![Graph showing NASA's Renewable Energy Progress](image-url)
ALL NASA - Energy Intensity (BTU/GSF)

- NECPA & EO 13423 Goal (Effectively 3% per year)
- Actuals
- Q1 Rolling Avg

Fiscal Year (Date Marks End of Fiscal Year)
### NASA FY2010 GHG Emission By Scope

<table>
<thead>
<tr>
<th>Scope</th>
<th>MtCO2e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope 1 GHG Emissions</td>
<td>284,753.1</td>
</tr>
<tr>
<td>Scope 2 GHG Emissions</td>
<td>1,062,360.4</td>
</tr>
<tr>
<td>Scope 3 GHG Emissions</td>
<td>144,405.7</td>
</tr>
<tr>
<td>Anthropogenic GHG Emissions (All Scopes)</td>
<td>1,491,519.2</td>
</tr>
<tr>
<td>Biogenic GHG Emissions</td>
<td>254,154.4</td>
</tr>
</tbody>
</table>

#### Data Label Key (Quantity; Percentage)

- **Quantity** - of Emissions in MtCO2e
- **Percentage** - of Anthropogenic GHG Emissions

Scope 1 GHG emissions originate directly from NASA-owned sources, Scope 2 GHG emissions result indirectly from purchased energy and Scope 3 GHG emissions result indirectly from sources that are external to NASA but relate to Agency activities.

Biogenic GHG emissions come from the use of natural sources, such as wood (biomass) or ethanol (biofuel). These emissions are not “man-made,” or derived from fossil fuel combustion.
Green House Gas Reduction
Scopes 1 + 2

![Graph showing emissions (MtCO2e) from FY08 to FY20 with Scope 1+2 (Target) and Scope 1+2 (Actual)]
Green House Gas Reduction
Scope 3

![Graph showing emissions reduction over fiscal years (FY) from FY08 to FY20. The graph illustrates the comparison between Scope 3 (Target) and Scope 3 (Actual) emissions, with a noticeable decrease in actual emissions over the years.](image-url)
NASA - Water Intensity (GAL/GSF)

- EO 13423 Goal (2% per year)
- Actual
- Q1 Rolling Avg

Fiscal Year (Date Marks End of Fiscal Year)

Gallons per Gross Square Foot

- 2007: 90.00
- 2008: 85.00
- 2009: 80.00
- 2010: 75.00
- 2011: 70.00
- 2012: 65.00
- 2013: 60.00
- 2014: 55.00
- 2015: 50.00
Core NASA & ESA Strategic Sustainability Performance Metrics

Potential Future Core Metrics

• Water Intensity
• Solvent Usage
• Recycling
• Hazardous Material Use Reduction
• Conflict Metals Use Reduction
• Economic
• Social Responsibility
Summary

- NASA sharing common goals with International Partners
- Improving sustainability performance is a key shared value
- Improvements can be shared for improved value and lower impacts to stakeholders
- Multiple Drivers
  - Materials and Processes: Effectiveness and Obsolescence
  - Climate change
  - Regulatory changes
  - Societal imperatives
  - Economic realities
- Comparison of performance metrics provides actionable data for decision-makers