

National Aeronautics and Space Administration



Langley's Green Activities

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Langley Green Activities

Green Technology

- *GHG Measurement Sensor Development*
- *Green Energy Technologies*
- *Geo-Engineering*
- *Aircraft Fuel/Emissions*
- *Aircraft Biofuels/Reduced Emissions*
- *Nano-material Development for Lightweight Structures*
- *Reduced Aircraft Noise*
- *Efficient Airspace Management*

Rev. Tech Challenges

- *Go Beyond/Addition to Decadal Survey (e.g., Methane, Hydrogen Sulfide)*
- *Study Structural Nanotubes*
- *Investigate reduction of GHG Concentrations*
- *Geo-Engineering to Mitigate Global Warming*

Mid-Term Opportunities

- *Respond to Decadal Survey*
- *Investigate High Efficiency*
 - *Thermoelectrics*
 - *Wind Power*
- *Investigate Ultra-high L/D and Biofuels*
- *Low-Energy Nuclear Energy*

Sustainability

- *Reduce resource usage*
- *Maximize LEED Efforts*
- *Emphasize Affirmative Procurement*
- *Continue Ongoing Environmental Mgmt System implementation and P2/Sustainability Program Initiatives*

Green Today

- *Write LaRC Green Research History*
- *Perform Integration for all LaRC Green Efforts*
- *Interface with other NASA Centers*
- *Engage LaRC Employees*
(*“Green Bag” lunches, @LaRC Suggestions, Researcher articles, lecture series, etc....*)

Langley CO₂ Mitigation Group

16 members

- ❖ Multi-disciplined
- ❖ Representing new business, aeronautics (aerodynamics), materials and structures, atmospheric science, physics, sensors, systems engineering and systems analysis

Ames, Glenn and Langley Inter-center Potential Collaboration Topics List

- ❖ Windmills/wind energy
- ❖ Morphing and meta materials non-image optics
- ❖ Photovoltaic
- ❖ System Engineering
- ❖ Alternative fuels
- ❖ Institutional Improvements
 - Alternate management
 - Green buildings
 - Environmental and water management
 - Recycling, carbon foot print
 - Geo-thermal

Ames, Glenn and Langley Inter-center Potential Collaboration Topics List (Cont'd)

- ❖ Spaceborne Solar Reflectors
- ❖ Climate Sensors
- ❖ Fuel Cells (including membranes)
- ❖ Seminars/training integrate schedule
(Green roof lecture at LaRC will have interest at Ames)
- ❖ Marine/lake oxygenation
- ❖ Thermo-electric

Ames, Glenn and Langley Inter-center Potential Collaboration Topics List (Conc'd)

- ❖ Tele-presence
 - Low-energy, improved methods for telework
 - Development of a 21st Century lab and collaborative work environments
 - Technologies for virtual presence and virtual meeting spaces
 - Human factors analysis of usability, productivity and efficacy of these new technologies
 - Deployment of prototype systems by NASA

- ❖ Solar Thermal

- ❖ Advanced Transportation (Langley, Glenn and Ames)

Green Aviation

- ❖ ARMD established the ISRP (Integrated Systems Research Program) and formulation of the first project ERA (Environmentally Responsible Aviation) is underway with leadership by Fay Collier of LaRC.
- ❖ ARMD is currently restructuring the Airspace Systems Program to place primary focus on concepts and technology development and transfer or acceptance of those technologies by stakeholders/customers.

Langley has representation on both planning teams: ISRP and Airspace Systems, with a Principal Investigator (Faye Collier) leading the ERA planning and key Personnel participating in Airspace replanning.

Green Aviation – Energy

- ❖ New program focus in ERA
 - Engines
 - Noise
- ❖ Will likely see partnerships develop either regionally or with other agencies
- ❖ Aero can act as platform validator of promising energy technologies for aero applications (engines)
- ❖ Partnered with FAA's Continuous Low Emissions, Energy and Noise (CLEEN) program
 - Emission reduction
 - Noise reduction technologies
- ❖ Alternative Fuels – including biofuels, as promoted by the FAA's Commercial Aviation Alternative Fuels Initiative (CAAIFI), and the recent FAA grant to the X Prize Foundation to spur development of renewable aviation fuels and technologies.

Green Aviation – Environment

❖ Atmospheric pollution

- Technologies that reduce sulphur oxide emissions, a major contributor to acid rain
- Advanced engine technologies with emphasis on combustion, onboard electronics and hybrid drivers
- New power-trains based on alternative and renewable fuels, including fuel cells and hydrogen
- Innovative low mass materials and structures

❖ Recycling

- Develop integrated technologies that are economically viable for both metal and plastic components
- Enable safe, clean and efficient recycling of all manner of vehicle

❖ Noise pollution

- Active and passive cost-effective noise control
- Minimizing the negative effects of noise
- Objective measurement of noise annoyance

Atmospheric Science and Remote Sensing

- ❖ Remote sensing of atmospheric composition and chemistry from spacecraft and aircraft
- ❖ In-situ measurements of atmospheric composition and chemistry
- ❖ Measurements of clouds and aerosols from space
- ❖ Measurements of shortwave and longwave radiation from spacecraft and aircraft
- ❖ Measurements of clouds and their radiative properties from spacecraft and aircraft
- ❖ Measurements of the global radiative budget from space
- ❖ Monitoring of atmospheric ozone from space
- ❖ Langley Atmospheric Science Data Center (ASDC) for archiving all atmospheric measurements
- ❖ Develop and apply atmospheric models on local, regional and global scales
- ❖ Develop the technology for the next generation of remote sensing instrumentation

Mitigating Global Warming (Langley's Revolutionary Technical Challenges: Planetary and Geo-engineering)

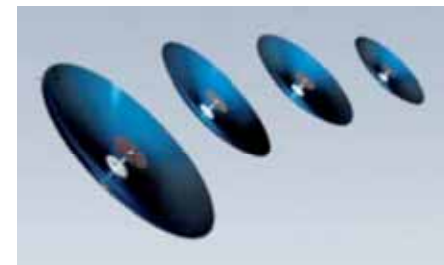
In general, geo-engineering for global warming mitigation falls into one of two main categories:

- (1) Reducing the amount of incoming solar radiation that the surface of the Earth receives
- (2) Removing greenhouse gases like carbon dioxide from the atmosphere and transferring it to long-lived reservoirs, thus, increasing outgoing Earth-emitted longwave thermal radiation

Mitigating Global Warming

Solar Radiation Engineering

- ❖ Increase the reflectivity or albedo of the Earth's surface to reflect more incoming solar radiation, e.g., more reflective crops
- ❖ Cloud seeding to increase cloud reflectivity
- ❖ Production and release into the stratosphere aerosols to absorb/reflect incoming solar radiation
- ❖ Techniques to enhance the reflectivity of clouds to reflect back to space more incoming solar radiation
- ❖ Solar reflectors or space mirrors in Earth orbit to reflect incoming solar radiation back to space



Mitigating Global Warming

Greenhouse Gas Reduction

- ❖ Planting more trees or engineering “artificial” trees to sequester more CO₂ out of the atmosphere into the biosphere
- ❖ Fertilization of the world’s oceans with iron to enhance the sequestration of atmospheric carbon dioxide by CO₂-eating ocean plankton
- ❖ Biomass energy with carbon dioxide capture and storage
- ❖ Destroying carbon dioxide and other greenhouse gases in the atmosphere



