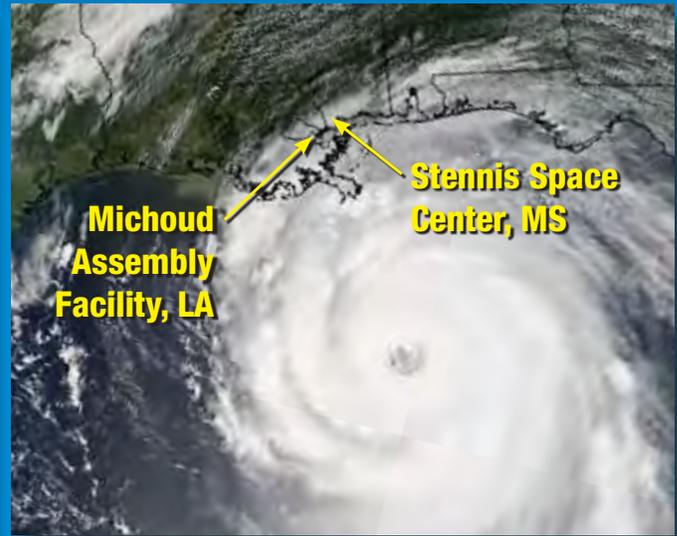




2013 NASA Climate Risk Management Plan and Report – Update

NASA is currently experiencing impacts from a changing climate...

Wallops Flight Facility, VA



Kennedy Space Center, FL



Johnson Space Center, TX



and is applying its risk management process to identify risks and possible adaptation strategies.

2013 NASA Climate Risk Management Plan & Report

This is NASA's first update of its Climate Risk Management Plan & Report following issuance by the Council on Environmental Quality of "Implementing Instructions for Federal Agency Adaptation Planning" in March 2011, stating that each agency will include initial adaptation plans as part of their 2012 Strategic Sustainability Performance Plan submission.

This transmittal includes:

- ✓ NASA's ***Climate Risk Management Plan***, a forward looking document responding to section 8(i) of Executive Order 13514;
- ✓ Appendix 1, NASA's ***Climate Risk Management Report***, containing supporting documentation to the Plan, status reports, and examples of how NASA supports other efforts, aligning with section 16 of Executive Order 13514; and
- ✓ Appendix 2, which contains other information relevant to these efforts, such as descriptions of voluntary standards utilized by NASA during this process.

The table below provides an overview of these documents and their contents.

Overview – NASA's Climate Risks Management Documents		
Component	Description	Remarks
Climate Risk Management Plan		
	I. Introduction II. Strategic Analysis III. Risks IV. Opportunities V. Management Actions VI. Future Outlook VII. Governance	Executive Order 13514, section 8(i). <i>A forward looking document.</i>
Appendix 1. Climate Risk Management Report		
	1. Overview 2. Status of CEQ Deliverables 3. Graphic: From Risk to Resilience 4. NASA Actions to Better Understand Climate Risks and Opportunities 5. NASA Actions to Address Climate Risks and Opportunities 6. Accomplishments: July 2012 - June 2013	Supporting documentation to Climate Risk Management Plan
	<i>NASA Actions Supporting the:</i> 7. National Adaptation Strategy 8. National Recommendations 9. Interagency Climate Change Adaptation Task Force's "Guiding Principles" 10. Interagency Climate Change Adaptation Task Force's "Flexible Framework"	Executive Order 13514, section 16. Documents showing how NASA supports other efforts.
Appendix 2. Other Useful Information		
<i>Annex #</i>	<i>Description</i>	<i>Remarks</i>
<i>Annex 1</i>	Important Questions	See Endnote #2.
<i>Annex 2</i>	Measuring Progress and a Phased Approach to Adaptation	See Section VI.4 and Endnote #25. Description of an existing voluntary standard to measure progress.
<i>Annex 3</i>	Climate Disclosure Standards Board (CDSB) Content Requirements for Climate Risks	See Endnote #1. Brief summary of content requirements from an existing climate risk disclosure standard, partly incorporated into NASA's Climate Risk Management Plan.
<i>Annex 4</i>	NASA Crosswalk of 2012 CEQ Guidance for Adaptation Plans	Crosswalk of CEQ's Guidance (issued February-March 2012) and NASA's climate risk management documents.
<i>Annex 5</i>	Discussion of Public Comments on NASA's Climate Risk Management Documents	No public comments were received. Describes features of NASA's Climate Risk Management Documents.

2013 NASA Climate Risk Management Plan:

Managing Climate Risks & Adapting to a Changing Climate

- I. Introduction
- II. Strategic Analysis
- III. Risks
- IV. Opportunities
- V. Management Actions
- VI. Future Outlook
- VII. Governance

I. Introduction

NASA's Climate Risk Management Plan addresses section 8(i) of Executive Order (EO) 13514 – “[E]ach agency Plan shall: ... evaluate agency climate-change risks and vulnerabilities to manage the effects of climate change on the agency's operations and mission in both the short and long term.”

As a research organization tasked with expanding knowledge of the Earth and its systems, NASA is applying its preeminent expertise in climate science to help manage the risks to NASA mission success posed by climate change impacts. Climate change impacts are of concern because many Agency assets are located along America's coasts, where sea level rise and increased frequency and intensity of high water levels associated with storms are expected, and in areas where long-term changes in precipitation and temperature are expected to impact potable water supplies. While climate change is a global phenomenon, impacts are being and will be felt at all scales. NASA recognizes that integrating climate change adaptation into installation planning is a local activity.

NASA's approach to climate risk management has three unique innovations:

- Advancing adaptation research and toolsets to equip stakeholders to better understand and manage climate risks nationwide;
- Assigning climate risk management to its field installations as ‘laboratories’ to spur community-based responses; and
- Partnering its Earth science experts with institutional stewards to test and improve the utility of its research to manage climate risks.

NASA presents its climate risks and vulnerabilities in a voluntary risk disclosure format, utilizing a plan structure recommended by the Climate Disclosure Standards Board's (CDSB) “Climate Change Reporting Framework,”¹ and guided by a set of ‘Important Questions’ intended to help executives assess and understand the strategic and risk management implications of climate change for their organization's operations, performance and future².

Please note: NASA voluntarily discloses its climate risks and climate vulnerabilities, subject to national security and International Traffic in Arms Regulations (ITAR) restrictions.

II. Strategic Analysis

In keeping with CDSB's Climate Change Reporting Framework, NASA examined whether its long-term and short-term strategic objectives, roles and responsibilities could be compromised by climate risks. The following strategic documents were reviewed.

- National Aeronautics and Space Administration Authorization Act of 2010 - authorizes NASA's programs for fiscal years 2011 through 2013 and contains statutory objectives.³
- National Space Policy of the United States of America (2010) - expresses the President's direction for the Nation's space activities and articulates the President's commitment to reinvigorating U.S. leadership in space for the purposes of maintaining space as a stable and productive environment for the peaceful use of all nations, including NASA's role.⁴
- U.S. Space Transportation Policy (National Security Presidential Directive (NSPD) #40, 2005) - establishes national policy, guidelines and implementation actions for U.S. space transportation programs and activities to ensure the Nation's ability to maintain access to and use space for U.S. national and homeland security, and civil, scientific, and commercial purposes.⁵
- 2011 NASA Strategic Plan (NASA Policy Directive 1001.0A) - outlines the long-term goals of the agency and how the goals will be accomplished over the next decade or more.⁶
- 2012 National Strategy for Global Supply Chain Security - established the U.S. Government's policy to strengthen the global supply chain to protect the interests of the American people and enhance our Nation's economic prosperity.⁷

NASA's analysis concludes that there is potential for a changing climate to impact some of NASA's strategic objectives in six categories:

- Assured access to space (launch facilities);
- Assured operations of space assets (including the operational human aspects);
- Ground systems (including IT, communication, and data systems);
- Test facilities (including research, development & demonstration facilities);
- Training facilities; and
- Supply chain.

These categories represent combinations of assets – physical infrastructure, land and natural resources, and the staff that operate, use and manage them – that can be impacted by various events, such as extreme heat events, drought or inland and coastal flooding. These types of events could compromise or interrupt particular assets for short or long time periods. Fortunately, NASA's risk management process helps identify risks to mission and assets to ensure the Agency has plans and strategies in place to address disruptions.

III. Risks

“Adaptation is fundamentally a risk-management strategy.”⁸ From an organizational and cultural perspective, a risk management approach is broadly accepted within NASA as it has a relatively sophisticated and mature enterprise risk management framework based both in policy and procedures.⁹

This section describes NASA's short term and long term climate risks and NASA's method to identify risks and opportunities.

III.1 Short-Term and Long-Term Climate Risks

NASA anticipates short-term risks to result from extreme weather and climate events. These events include heat waves, precipitation, wind, flooding, and drought, each of which will become more difficult to manage because of changes in event intensity, duration, and frequency.

Over a longer time horizon, NASA anticipates a continuation of extreme weather and climate event challenges experienced in the short-term, possibility exacerbated because of longer term gradual trends such as sea level rise and increased average temperatures. Item 3 in **Appendix 1** depicts the conclusions regarding NASA climate hazards, current and expected impacts, and risk categories for the arid, coastal and temperate regions where NASA Centers and facilities are located.¹⁰

III.2 NASA's Enterprise Risk Management Framework

As noted above, NASA is accustomed to identifying and managing risks. Using NASA's enterprise risk management framework, NASA has engaged in multiple efforts, starting in August 2005, to characterize the current and potential risks of climate variability and climate change.

NASA's Enterprise Risk Management Framework is part of NASA's “Internal Control”¹¹ required by the Government Accountability Office (GAO)¹² and the Office of Management and Budget (OMB)¹³. The Agency uses its Enterprise Risk Management Framework¹⁴ (referred to as the “Active Risk Manager” or ARM) to manage risks.

IV. Opportunities

NASA sees two opportunities to conserve resources in its approach to address climate risks: using an integrated strategy and pooling resources.

NASA chooses to manage risks in an integrated rather than parallel or serial manner, so adapting to climate risks is integrated into existing management processes. This approach does not require additional resources to set up a new program, allows the Agency to make the most of limited resources (skills, time, and money,) and also helps avoid the unforeseen (usually negative) consequences of un-coordinated independent initiatives.

Because resource constraints are on the rise, acting alone is rarely an option for a small Federal agency. NASA actively seeks out best practices and expertise from within and without. NASA seeks to build relationships with others because they help us all leverage strengths and fill gaps.

Building external relationships with others in the form of partnerships, alliances and coalitions has become standard practice for NASA, with particular value in managing climate risks. It is standard practice for NASA’s climate science community and for NASA’s community of institutional managers to establish relationships with academia, other government agencies, private sector firms and public sector entities.

One of NASA’s strengths in managing climate risks comes from the internal NASA relationship and collaboration between NASA’s climate science community and NASA’s institutional managers. As a result of this relationship, NASA supports NASA climate scientists at most of its Centers in doing applied climate science and providing advice to the NASA Center institutional managers. One productive result of these relationships has been awareness of grant opportunities within and beyond NASA, including Research Opportunities in Space and Earth Sciences (ROSES)¹⁵ and Strategic Environmental Research and Development Program (SERDP)¹⁶ and collaborating with others to propose strategic projects.

V. Management Actions

Following sections explaining NASA’s methods for mainstreaming climate risk management, its framework for action, and NASA’s management approach for managing climate risks, this section describes NASA’s climate risk workshops and long-term and short-term strategies to address climate change. This section also contains information regarding NASA’s targets to reduce GHG emissions and performance against those targets.

V.1 Mainstreaming and Integrating Climate Risk Management

Since 2005, NASA has strived to integrate climate risk management into existing NASA policies, procedures, programs and projects. There was at that time and is today, a great desire not to create another “program” solely to address NASA’s management of climate risks, but rather to integrate climate risk management into existing NASA organizational-management structures and systems. Moreover, after 2009, E.O. 13514’s Federal Climate Change Adaptation Task Force emphasized a strong desire for “mainstreaming climate change adaptation” efforts. NASA’s perspective is that “mainstreaming” means institutionalizing climate risk management within NASA organizational-management structures and systems

V.2 NASA’s Framework for Action – Program Logic Model

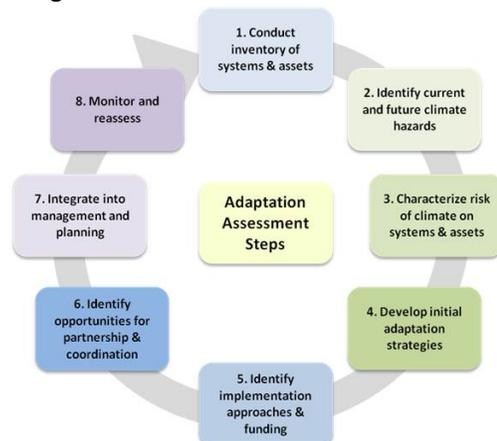
Since 2009, NASA has had a framework for action, or program logic model. Originally, this framework was developed for New York City by NASA Goddard Institute for Space Studies (GISS). NASA-GISS’s program logic model has been modified and customized into a process with eight components to meet NASA’s own internal organizational-management needs and demands.

The eight components are:

1. Conduct inventory of systems and assets
2. Identify current and future climate hazards
3. Characterize risk of climate on systems and assets
4. Develop initial adaptation strategies
5. Identify implementation approaches and funding
6. Identify opportunities for partnership and coordination
7. Integrate into management and planning
8. Monitor and reassess

Figure 1 depicts the iterative nature of the approach NASA follows to characterize risk, integrate risk management into planning, assess results, and adjust as appropriate.

Figure 1. NASA’s Framework for Action



V.3 NASA's Management Approach

To identify, characterize and manage climate change risks, NASA's strategy is to: 1) make data and NASA's climate science experts available to NASA's institutional stewards, 2) hold a series of interactive workshops utilizing successfully tested methodologies for adaptation planning, and 3) integrate climate considerations into existing management plans and decision making processes. NASA's approach also emphasizes several preferred actions, listed in **Figure 2**.

Figure 2. The NASA Way – Preferred Actions for Managing Climate Risks

- Inspiring through a vision for the future to engage, unify, and serve as beacon for the way forward
- Governing always demands an "Enterprise Risk Management" approach, but especially in austere times
- Leading through actively searching for and applying the "Best Science Available" and "Best Management Practices" (not "re-inventing the wheel" at the taxpayer's expense)
- Iterating its management processes to incorporate emerging climate science
- Integrating into existing programs and processes; not creating new programs or initiatives (they usually fail as "flavor of the month")
- Communicating with an emphasis on Risk Communication of climate science information for a clear and consistent message
- Engaging the creative energy of others at the field facilities and reaching outside the Center's "fence line" to local stakeholders
- Leveraging partnerships: governmental entities, private sector, and academia
- Fostering Science, Technology, Engineering & Math (STEM) learning opportunities to provide the leadership experience for next generations that will ensure the world preeminence of US aerospace technologies

V.4 Climate Risks Workshops

Leveraging NASA's expertise and knowledge of interagency climate efforts, the Office of Strategic Infrastructure (OSI) is partnering with NASA's Earth Science Division to develop and implement a systematic approach to identifying, characterizing, and managing local and regional risks associated with climate change. Guided by OSI, NASA climate scientists are coordinating with site specific NASA Center institutional stewards through a series of workshops to help NASA Centers and their communities:

- Identify and characterize risks and opportunities of current and future climate on the systems, assets and capabilities that support NASA's mission;
- Begin to integrate climate considerations into short and long term strategic planning and existing management plans and processes; and
- Partner with others on shared risks and strategies.

These workshops are based on methodologies successfully implemented by New York City planners. The New York City Panel on Climate Change (NPCC), co-chaired by Cynthia Rosenzweig, Ph.D., leader of the Climate Impacts Research Group at NASA's Goddard Institute for Space Studies (GISS), developed and tested adaptation planning tools and methodologies to help varied stakeholders identify climate vulnerabilities and generate strategies for building resilience. The NPCC was convened by Mayor Bloomberg to help "develop a framework and tools to assist the City create a risk-based response to climate change that is grounded in state-of-the-art science information."¹⁷

NASA uses a refined version of this adaptation framework. In addition to considering built systems as did New York City, NASA integrates natural and workforce/community systems for a fuller sense of the vulnerabilities and potential adaptations. Diverse external participants (neighboring organizational and issue-based stakeholders) join onsite leadership and staff, all enriched with locally-relevant research. Guided by local NASA and external leadership, and facilitated by experienced professionals, participants work systematically through the eight-step process, charting progress into supporting templates during three-day workshops. The first process steps define and characterize vulnerabilities to current and projected climate variables. Later steps prioritize these vulnerabilities, brainstorm possible responses for the most serious, and plan for integrating adaptations into existing work systems and processes (planning, designing, investing, operating, and communicating).

Workshop planners recognized two key elements of success: conveying the science face to face, and extending it beyond the workshops to workplaces, homes, and anywhere a community interacts. In collaboration, NASA's scientists and institutional stewards transformed a basic scientist-to-scientist briefing into a purposeful "climate conversation" between scientists and non-scientists at its workshops. Extending the conversation beyond the workshop involved creating a "stand alone" document (credible without a scientist to deliver it) to convey the issues, observed local trends, scientific basis for projections, and the projected future in the most accessible language and format practical. Therefore, climate information handouts developed for each workshop are distributed and shared with internal and federal, state, and local community stakeholders. The series of handouts received an award of Excellence in the International Summit Awards of the Society for Technical Communications as the series "demonstrates an exceptional understanding of technical communication principles."

Workshops are tailored to equip institutional staff with a grasp of the best available science, and to honor an underlying approach to sustainability: NASA's application of "think globally, act locally" is "Develop policy globally, manage locally, and integrate everywhere and at all times."

V.5 Long-Term Climate Risks Strategy

NASA's goal is climate resilient Centers. Remaining proactive, applying NASA's scientific expertise and products, and focusing on integration, enables NASA, over the long term, to incorporate climate risks into decision-making and planning, and create innovative, sustainable and flexible solutions for NASA Centers. NASA's long-term strategy to address climate risks is portrayed in NASA's Policy Statement – Adapting to a Changing Climate¹⁸ and is reflected in the preferred actions in **Figure 2**. Successful execution of the policy relies on NASA Center support – the place where NASA's operations and mission are accomplished, as well as knowledge sharing and partnering with others.

V.6 Short-Term Climate Risks Strategies

The following subsections are examples of how NASA is trying to preserve mission capabilities, and include a) NASA's climate science efforts, b) NASA actions for FY 2014 to better understand climate change risks and opportunities; c) NASA actions for FY 2014 to address climate change risks and opportunities. The latter two actions are summarized briefly below, with more detail provided in **Appendix 1**, using CEQ's recommended format. An accomplishments list of activities from July 2012 through June 2013 is also included in **Appendix 1**.

V.6.a. NASA Climate Science Actions

- ROSES (Research Opportunities in Space and Earth Sciences). NASA Earth Science continues to support, through its grant program, climate science research and applications investigations relevant to NASA Centers and their communities. This grant program supports NASA Center climate scientists and other science researchers in the surrounding community. This effort is important because climate change effects and extreme weather events have site-specific impacts, some of which are unique to the locality.
- NASA's Climate Adaptation Science Investigator (CASI) Workgroup was initiated to engage NASA climate modelers, scientists, engineers, and institutional steward to explore climate impacts and adaptation strategies for NASA installations. The group has expanded to include non-NASA CASI members and continues to look for opportunities to work jointly with the institutional side. NASA Science Program Managers continue to support CASI through monthly telephone conference meetings and an annual progress conference.

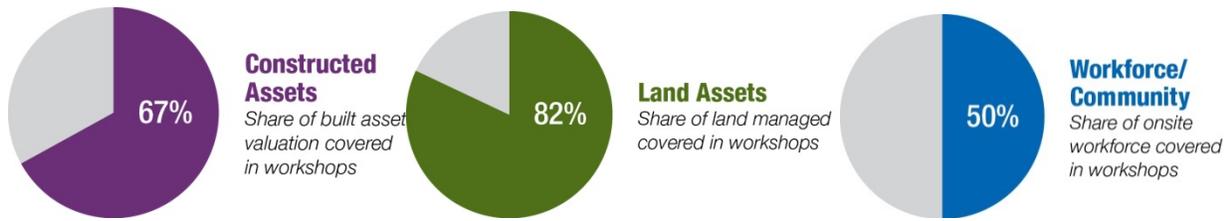
V.6.b. NASA Actions to Better Understand Climate Change Risks & Opportunities

Through calendar year 2013, NASA's voluntary, site-specific climate risk workshops will have provided greater understanding of climate-associated risks to approximately 67% of NASA's constructed assets in Current Replacement Value (CRV) terms, 82% of its land managed, and 50% of its onsite staff (**Figure 3**).

- *Climate Risks Workshops at NASA Centers*. NASA will continue its climate risk workshop process at one NASA installation in FY 2014, with preparations including downscaled local climate

projections, a handout introducing the issues, context, and data, and interactions with local institutional stewards to ensure a sustainable, value-oriented process.

Figure 3. NASA’s Climate Risk Workshop Progress



V.6.c. NASA Actions to Address Climate Change Risks & Opportunities

- *Interagency Forum on Climate Change Impacts & Adaptation.* NASA continues to support this knowledge network, which it founded and leads together with the Army Corps of Engineers. Sharing knowledge about the best available climate science and management practices, the Forum has included over 100 presentations over seven years, linking people from numerous federal agencies with common interests and spurring common efforts and activities.
- *NASA Kennedy Space Center Dune Vulnerability Activities.* NASA Kennedy Space Center’s Dune Vulnerability Team continues to wage its battle against beach and sand dune erosion as the sand dunes are the physical protection barrier for NASA’s Launch Pads 39A and 39B from the sea. Further, beach dunes are habitats for a number of threatened and endangered species. Recent impacts from Hurricane Sandy have exacerbated the conditions along Launch Complex 39. The Dune Vulnerability Team has undertaken several efforts to protect and restore the beach dunes and received funds to complete design of an engineering “solution” to the erosion problems along with preparation of an Environmental Assessment under NEPA to address this solution. Options including construction of the three mile long secondary/inland dune, and/or secondary dune and beach nourishment. The completion of the design and Environmental Assessment is set for August 2013. Emergency funding was received to implement a “band aid” fix to damage created by Hurricane Sandy. This includes removal of the railroad along the shoreline and construction of a 1.2 mile secondary dune, which will commence in November 2013.

V.7 NASA GHG Emission Reduction Targets and Performance

Goal 1 of NASA’s Strategic Sustainability Performance Plan (SSPP) is devoted to its GHG emission reduction targets and performance against those targets.¹⁹ NASA continues to outperform its GHG emission reduction targets in FY 2012 from baselines established for FY 2008:

- Scope 1 and 2 GHG emissions. Tracking with required energy reductions, NASA **achieved 19.1% reductions versus an FY 2020 target of 18.3%.**
- Scope 3 GHG emissions. Including Scope 3 renewable energy project hosting credits, NASA **achieved 15.2% reductions versus an FY 2020 target of 12.6%.**

NASA GHG emission reduction targets reflect: identified reductions in energy use and intensity; reduced use of fossil fuels and increased use of alternative fuels in fleet vehicles; increased application of green building applications and sustainable design; and innovative energy technologies and funding strategies which promote conservation and renewable energy use. NASA also hosted a third-party operated renewable energy project at KSC (NASA retains neither the renewable energy produced nor the associated renewable energy credits (RECs)) for which NASA earned “Scope 3 percentage points” so that its overall Scope 3 reduction is 15.2%. By exceeding its emission reduction goals now rather than in 2020, NASA contributes a greater overall environment benefit.

VI. Future Outlook

The Climate Disclosure Standards Board’s Climate Change Reporting Framework provides an opportunity for an organization to include information about “trends and factors related to climate change that are likely to affect management’s view of the organization’s strategy or the timescales over which achievement of the strategy is typically planned.”²⁰

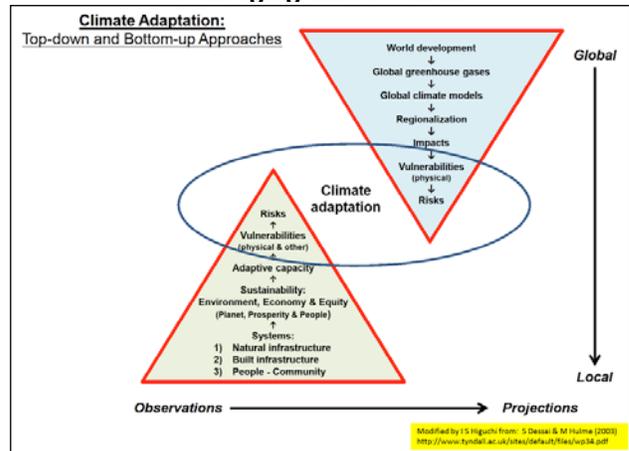
NASA has identified four trends and factors that may affect its climate risk identification and adaptation strategies as well as its method of measuring progress:

- VI.1 Integrating top-down and bottom-up approaches
- VI.2 Flexible adaptation pathways
- VI.3 Risk factors
- VI.4 Measuring Progress and Phased Approach to Adaptation

VI.1 Integrating Top-Down and Bottom-Up Approaches

As NASA’s process to manage climate risks matures, the Agency has recognized the importance of a balance between leadership-directed (top-down) and grass-roots (bottom-up) approaches. Consistent with external research (Figure 4), NASA leadership brings focus to emerging concerns such as a changing climate, while local participation can more fully identify vulnerabilities, vet the viability of potential adaptation approaches and incorporate sustainability principles into its adaptation strategies. In 2009, NASA’s first Climate Risks Adaptation workshop was a top-down, Agency-wide starting-point. While leadership continues its policy coordination and resourcing roles, subsequent Climate Risks Adaptation workshops have been site-specific, locally-led initiatives.

Figure 4. Top-down and Bottom-up Elements of Managing Climate Risks



VI.2 Flexible Adaptation Pathways

The best available science changes over time and with better understanding of likely changes, site-specific adaptation must also evolve; rather than simplistic absolute tolerances of risk, the Agency’s policies, actions and risk tolerances must be reconsidered and revised on a dynamic basis. NASA is still seeking specific examples from other organizations of flexible adaptation pathways that illustrate how to incorporate this concept into its adaptation strategies.

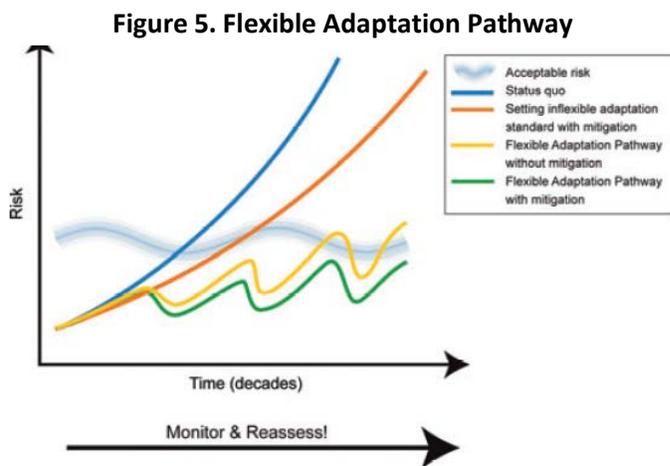


Figure 5 illustrates this concept using the scales of ‘risk’ and ‘time’.²¹

VI.3 Risk Factors

From a business management perspective, several factors characterize business trends and risks. Relevant research by Lash & Wellington²² identified six categories to consider when evaluating climate risks:

- Supply chain risk
- Litigation risk
- Physical risk
- Regulatory risk
- Product and technology risk
- Reputational risk

Given NASA’s systematic risk management culture, it already considers many of these issues, but there are many opportunities to broaden our awareness in these respects. Supply chain risk and litigation risk are of particular concern because 80% to 90% of NASA’s annual budget is spent via acquisitions. NASA environmental staff recently explored climate risk concerning new acquisition trends related to supply chain risks and litigation risks. These evolving areas deserve monitoring, and some of the today’s novel aspects may become common place tomorrow. As the new climate science area of “human attribution” matures,²³ terms like “Force Majeure” and “Act of God” clauses in agreements merit reconsideration.

VI.4 Measuring Progress and Phased Approach to Adaptation

As expressed in Section D. of the “Federal Framework for Climate Change Adaptation Planning,” in CEO’s “Support Document,”²⁴ organizations should consider a phased approach and use metrics performance to measure their accomplishments. NASA is applying an existing voluntary standard – National Indicator (NI) 188, which focuses on processes rather than outcomes in recognition that adaptation is an emerging field, as shown in Figure 6.²⁵ Appendix 2 contains a more detailed discussion.

Figure 6. Measuring Progress to Adaptation (A Phased Approach)

	2012	2013	2014	2015	2016	2017	2018	REMARKS
LEVEL 1: Getting Started								
1.1 Initial Planning								
1.2 Engage Stakeholders & Community								
1.3 Scoping Resources								
1.4 Baseline Identification								
1.5 Develop Strategic Vision								
LEVEL 2: Impact Assessment								
2.1 Leadership & Commitment to Public								
2.2 Understand Vulnerability								
2.3 Significant Identify Impacts								
2.4 Project Planning								
2.5 Monitoring Future Impacts								
LEVEL 3: Risk Assessment								
3.1 Impact Assessment								
3.2 Risk-Based Priorities								
3.3 Identify Priority Actions								
3.4 Implement Actions								
3.5 Integrate Stakeholders & Partners								
3.6 Monitor Mission Aspects								
3.7 Monitor Adaptation Measures								
LEVEL 4: Comprehensive Action Plan								
4.1 Develop Adaptation Action Plan								
4.2 Embed Risks into Decision Making								
4.3 Implement Adaptation Responses								
4.4 Support Stakeholders & Partners								
LEVEL 5: Implementation, Monitor & Review								
5.1 Monitor Implementation Plan								
5.2 Monitor Performance of Actions								
5.3 Review & Update Plan								
KEY								
	= Not started							
	= Initiated or Incomplete							
	= Mature or Completed							

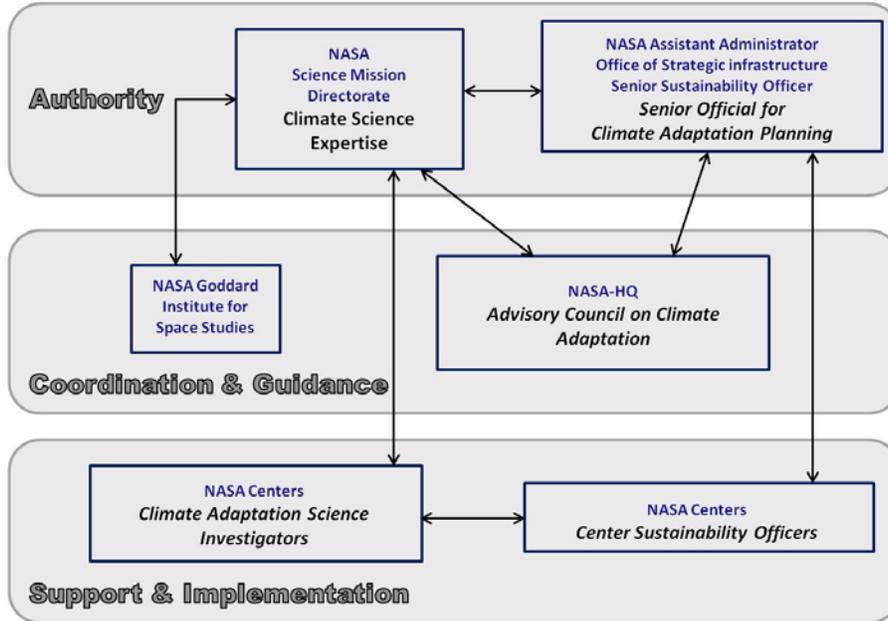
VI.5 Monitoring and Review

As shown in Figure 6 above, NASA has initiated efforts in “Level 5: Implementation, Monitor & Review.” Upon completion of “Level 5,” NASA will have developed an Agency framework for evolving climate risk management. In order for NASA to maintain this framework into the future, NASA will implement a management system approach, a management-process generically referred to as a “plan-do-check-act cycle” for continual improvement.

VII. Governance

NASA organizes its climate risk management as illustrated in **Figure 7** and described in the accompanying narrative.

Figure 7. NASA Governance: Climate Risk Management & Adaptation



VII.1 Senior NASA Official for Climate Change Adaptation Planning

The Senior NASA Official for Climate Change Adaptation Planning is the Assistant Administrator, Office of Strategic Infrastructure. This official is responsible for developing, reviewing and updating NASA’s Climate Risk Management Plan and implementing the required climate change adaptation planning actions. Additionally, the official has the authority to manage, oversee and report on NASA’s implementation of climate change adaptation planning to NASA’s Administrator and the Council on Environmental Quality and coordinate with and distribute NASA’s Climate Risk Management Plan to the Center Sustainability Officers and others within the Agency. This official is also the Agency’s Senior Sustainability Officer.

Based on workshop feedback and key lessons learned from other Agencies and organizations, the Office of Strategic Infrastructure is already making policy changes to ensure appropriate consideration for climate change adaptation in future master planning efforts, construction of facilities projects, energy projects, environmental management systems, and permitting.

VII.2 NASA Science Mission Directorate

The NASA Science Mission Directorate, and especially its Earth Science Division, supports basic and applied research on the Earth system and its processes. Primary efforts are to characterize, understand, and improve predictions of the Earth system, including climate change. The Earth Science Division pursues the application of its climate data, new scientific knowledge, and predictive capabilities to aid in planning and management actions. NASA participates actively in the Interagency Climate Change Adaptation Task Force, with NASA scientists and applications specialists on the Task Force, as well as on three of the Workgroups. NASA’s Earth Science Division personnel are also actively involved and leading the efforts to

produce the 2013 National Climate Assessment report through the Interagency National Climate Assessment Task Force and the International Panel on Climate Change.

VII.3 NASA Headquarters Advisory Council on Climate Adaptation

The Advisory Council on Climate Adaptation supports the Senior NASA Official in implementing efforts and activities. The Advisory Council comprises members from NASA's Office of Strategic Infrastructure and NASA's Science Mission Directorate. The Advisory Council's work teams are responsible for drafting proposed Agency policy and direction, and implementing the day-to-day NASA Headquarters efforts and activities related to climate adaptation.

VII.4 NASA Center Sustainability Officers

In addition to most serving as their Center's Director of Operations, NASA's Center Sustainability Officers provide leadership and direction for implementation and coordination of sustainability and climate adaptation activities, establish Center level targets, and monitor their performance and progress. Quarterly video-conferences enable the Center Sustainability Officers to share successes and lessons learned with each other and NASA's Senior Sustainability Officer.

VII.5 Goddard Institute for Space Studies Climate Scientists

NASA's Goddard Institute for Space Studies climate scientists provide NASA-wide advice to the Senior NASA Climate Official and are responsible for coordinating the efforts and activities of NASA's Climate Adaptation Science Investigators Working Group. GISS climate scientists are instrumental in providing computation climate modeling and downscaling information usable at the Center level.

VII.6 Climate Adaptation Science Investigators Working Group

Members of NASA's Climate Adaptation Science Investigators Working Group conduct research projects and provide advice to their Center on local climate science matters. Climate adaptation efforts and activities are science-based, and so these individuals have an important role in local implementation. These individuals are commonly referred to as NASA Center "Embedded Climate Scientists."

¹ Climate Disclosure Standards Board's (CDSB) "Climate Change Reporting Framework – Edition 1.0," September 2010, <http://www.cdsb.net/climate-change-reporting-framework/>. This is a voluntary standard. The use of this voluntary standard is consistent with OMB Circular A-119 "Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities." NASA's use of this standard is proactive and is consistent with the action by the U.S. Securities and Exchange Commission (see the "Commission Guidance Regarding Disclosure Related to Climate Change," 17 CFR Parts 211, 231 and 241; (8 February 2010)). Other indications of this climate risk disclosure trend are the American Institute of Certified Public Accountants' (AICPA) (9 December 2009) press release "AICPA and World Accounting Bodies Call for Single Standard for Climate Change Reporting," and the Industrial Economics, Inc. (28 April 2008) report for the U.S. Environmental Protection Agency titled "Preliminary Summary of Financial Accounting Standards for Environmental liabilities, Intangible Assets and Climate Change Risk." Annex 3 summarizes the Standard.

² J Desjardins & A Willis (Chartered Accountants of Canada) (2009) "Climate Change Briefing: Questions for Directors to Ask" <http://www.cica.ca/focus-on-practice-areas/governance-strategy-and-risk/directors-series/director-briefings/item28951.pdf> Copy of the questions is provided in Appendix 2, Annex 1.

³ National Aeronautics and Space Act of 2010, 51 USC Sec. 20101 et seq (http://www.nasa.gov/offices/ogc/about/space_act1.html)

⁴ National Space Policy of the United States of America (http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf)

⁵ National Security Presidential Directive (NSPD) #40: U.S. Space Transportation Policy (<http://www.fas.org/irp/offdocs/nspd/nspd-40.pdf>)

⁶ NASA Policy Directive (NPR) 1001.OA: 2011 NASA Strategic Plan (http://nodis3.gsfc.nasa.gov/npg_img/N_PD_1001_000A_/N_PD_1001_000A_.pdf)

⁷ The National Strategy for Global Supply Chain Security, released in January 2012, established the U.S. Government's policy to strengthen the global supply chain to protect the interests of the American people and enhance our

Nation's economic prosperity

(http://www.whitehouse.gov/sites/default/files/national_strategy_for_global_supply_chain_security.pdf). One-Year Update on the Implementation of the National Strategy for Global Supply Chain Security

(http://www.whitehouse.gov/sites/default/files/docs/national_strategy_for_global_supply_chain_security_implementation_update_public_version_final2-26-131.pdf)

⁸ National Research Council (2010) *Adapting to the Impacts of Climate Change*, at page 124.

⁹ As an example see NASA Procedural Requirement (NPR) 8000.4A "Agency Risk Management Procedural Requirements"

¹⁰ Results from NASA-wide Climate Change Impacts & Adaptation Workshop at Kennedy Space Center, July 2009.

¹¹ NASA Policy Directive (NPD) 1200.1E "NASA Internal Control"

¹² See GAO (1999) "Standards of Internal Control in the Federal Government" ("Green Book"); and GAO (August 2001) Internal Control Management and Evaluation Tool (GAO-01-1008G).

¹³ OMB Cir A-123 "Management's Responsibility for Internal Control."

¹⁴ NASA Procedural Requirement (NPR) 8000.4A "Risk Management Procedural Requirements".

¹⁵ <http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId={AEF75D0F-2272-7DE7-D52A-295B47C8F5CF}&path=open>

¹⁶ <http://www.serdp.org/>

¹⁷ Remarks by Mayor Bloomberg in Forward to *Climate Change Adaptation in New York City; Building a Risk Management Response*, page 1.

¹⁸ <http://www.nasa.gov/sustainability>

¹⁹ <http://www.nasa.gov/agency/sustainability>

²⁰ "Climate Change Reporting Framework – Edition 1.0," pg 21, September 2010. <http://www.cdsb.net/climate-change-reporting-framework/>

²¹ Flexible adaptation pathways. Image from: New York Panel on Climate Change. 2010. *Climate Change Adaptation in New York City: Building a Risk Management Response*. C. Rosenzweig & W. Solecki, Eds. Prepared for use by New York City Climate Change Adaptation Task Force. *Annals of the New York Academy of Sciences*. 2010. New York, NY 354 pp. (See page 30; adapted from City of London, "The Thames Estuary 2010 Plan." April 2009.)

²² J Lash & F Wellington (March 2007) "Competitive Advantage on a Warming Planet," in *Harvard Business Review*

²³ R A Kerr (25 November 2011) "Humans are Driving Extreme Weather, Time to Prepare," in *Science*

²⁴ Implementing Instructions for Federal Agency Adaptation Planning, Support Document -

http://www.whitehouse.gov/sites/default/files/microsites/ceq/adaptation_support_document_3_3.pdf

²⁵ National Indicator (NI) 188 is about 'planning to adapt to climate change.' The indicator is a key driver for local action on adaptation. It measures progress on assessing and managing climate risks and opportunities, and incorporating appropriate action into local authority and partners' strategic planning. The indicator is 'process-based' rather than outcome focused to recognize that adaptation is an emerging field. Progress on this target is measured via a self assessment with each local authority reporting a level of preparedness they have reached from level 0 to level 4." <http://www.yourclimate.org/pages/ni-188-guidance>

Appendix 1. 2013 NASA Climate Risk Management Report

1. Overview

NASA Climate Risk Management Report: Table of Contents	
Report Section	Remarks
1. Overview	Supporting documentation to Climate Risk Management Plan
2. Status of CEQ Deliverables	
3. Graphic: From Risk to Resilience	
4. NASA Actions to Better Understand Climate Change Risks and Opportunities	
5. NASA Actions to Address Climate Change Risks and Opportunities	
6. Accomplishments: July 2012-June 2013	
NASA Actions Supporting the:	Executive Order 13514, section 16.
7. National Adaptation Strategy	Documents showing how NASA supports other efforts.
8. National Recommendations	
9. Interagency Climate Change Adaptation Task Force's "Guiding Principles"	
10. Interagency Climate Change Adaptation Task Force's "Flexible Framework"	

2. Status of CEQ Deliverables

CEQ Submittal Schedule: Deliverables	NASA Status
1. Establish an agency climate change adaptation policy and mandate <ul style="list-style-type: none"> (#1) By March 15, 2011, each agency shall identify an agency climate change adaptation planning point of contact for the <i>Implementing Instructions</i>. (#2) By May 15, 2011, each agency shall issue an agency-wide policy statement signed by the head of the agency that commits the agency to climate change adaptation planning. 	Completed
2. Increase understanding of how the climate is changing (N/A) During 2011, each agency shall participate in Council on Environmental Quality sponsored climate change adaptation planning workshops to increase agency understanding of how the climate is changing and share information within the agency about how climate change impacts the agency.	Completed
3. Apply understanding to agency mission and operations <ul style="list-style-type: none"> (#3) By June 3, 2011, each agency shall submit responses to (CEQ) guiding questions. (#5) By September 30, 2011, each agency shall submit an initial draft high-level analysis of agency vulnerability to climate change. (#6) By March 2012, each agency shall complete a final high-level analysis of agency vulnerability to climate change. 	Completed
4. Develop, prioritize, and implement actions <ul style="list-style-type: none"> (#4) By September 30, 2011, each agency shall identify three to five priority adaptation actions to be implemented in FY 2012. (#7) By June 4, 2012, each agency shall submit an agency climate change adaptation plan. 	Completed
5. Evaluate and Learn (N/A) During 2011, each agency shall participate in Council on Environmental Quality sponsored climate change adaptation planning workshops and share lessons learned with other agencies.	Completed



FROM RISK TO RESILIENCE

NASA's Assessment Framework for Addressing Climate Change Impacts and Adaptation

NASA Centers are located throughout the country and are expected to experience a range of climate change hazards.

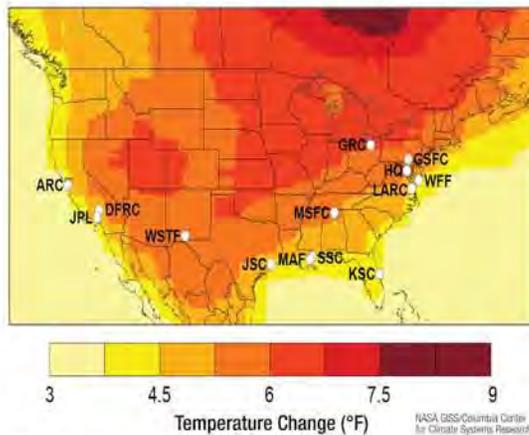
In July 2009, 63 NASA employees, including climate scientists and institutional stewards, gathered at Kennedy Space Center to explore questions such as:

- What is the state of the science and how can it be used to address NASA's needs?
- What are the potential risks to NASA institutional capabilities?
- How does NASA incorporate these risks into its risk management system?
- How can the climate science and operational communities work together to make sustainable infrastructure and asset investment decisions?



For the Workshop, the attendees were divided into three groups based on climate zones – arid, temperate, and coastal.

Projected Temperature Change (°F), 2080s minus 1980s, A1B Emissions Scenario*



* A1B scenario, one of several developed by the IPCC, assumes high CO₂ levels for first half of the 21st century, followed by a gradual decrease in emissions after 2050

Arid – Dryden Flight Research Center (DFRC), White Sands Test Facility/Goldstone (WSTF/GS), Jet Propulsion Lab (JPL)

Temperate – Glenn Research Center (GRC), Goddard Space Flight Center (GSFC), Headquarters (HQ), Marshall Space Flight Center (MSFC)

Coastal – Ames Research Center (ARC), Kennedy Space Center (KSC), Johnson Space Center (JSC), Wallops Flight Facility (WFF), Langley Research Center (LaRC), Stennis Space Center (SSC)

Vulnerabilities from climate change that may impact mission.

Results:

Key Climate Hazards	Potential Impacts
More frequent and extreme high temperatures and humidity	Increased risk of heat-related ailments among outdoor workers; higher cooling costs; damage to buildings
More frequent and intense droughts, seasonal shifts in water cycle	Reduced water availability, higher water costs, salt water intrusion; ground water changes
More intense precipitation events	More frequent flooding of low-lying indoor and outdoor areas
Sea level rise	Loss of useable land; inundation of coastal ecosystems
More frequent and intense coastal flood events	Coastal erosion; safety implications for surrounding communities
Extreme weather	High heat index
Fewer freeze events	Less damage to some types of outdoor infrastructure

Risks

			
Facility Systems at risk	Capabilities at risk	Personnel and Community at risk	Environment at risk
Communications	Launch facilities	Health and safety of workers	Threatened and endangered species
Information networks	Space operations	Health and safety of families and individuals in the community	Pollution and contamination
Power grid – maintenance and operations costs	Astronaut training		Wetland losses
Transportation	Test facilities		Wildfires
Additional stress on aging buildings	Laboratory facilities		

Possible Adaptation Strategies

Shift scheduling of outdoor activities
Reduce environmental impacts (carbon, energy, water)
Elevation or shielding of key equipment
Water conservation and more water reuse
Dune replenishment, coastal barriers
Consider using NASA facilities as a refuge during emergencies

Proposed NASA personnel roles in adaptation planning

Climate Scientists – develop and distribute climate change projections for each NASA site

Facilities Managers – increase coordination among groups within NASA

Environmental Managers – increase site specific coordination by forming Climate Change Work Group of cross-functional Stakeholders

Other Considerations in Planning Mitigation and Adaptation Strategies:

- Coordinate with neighboring communities
- Define and characterize role of commercial partnerships in mitigating impacts
- Continuously update climate change data to minimize uncertainties
- Match design life to projected conditions
- Revise the current infrastructure planning range of 20 years to 40-80 years

Improvements in Collaboration

- If the NASA climate science community is 'embedded' with the facilities community and master planners, decision-making will be more responsive to climate changes
- An improved understanding of the timing and degree of climate change will lead to better facilities
- Improved communication between Regional, Site-Specific, and Inter-Site personnel will accelerate adaptation

4. Actions to Better Understand Climate Risks & Opportunities

NASA Climate Risks Workshops

Actions (FY 2014) to better understand climate change risks and opportunities

ACTION TO BETTER UNDERSTAND*: NASA Climate Risks Workshops

Each agency Adaptation Plan should identify the actions the agency will continue or initiate in FY 2014 and beyond to better understand climate change risks and opportunities to its mission, programs, and operations.

o Examples of potential actions include assessing vulnerability; monitoring impacts of or responses to climate change; scientific, social, economic, or behavioral research or analysis; modeling, projection or exploration of climate change scenarios; studies targeted around specific geographic areas, sectors, programs, or operations; development of decision support tools; etc.

*EO 13514; Sec. 20. General Provisions. (a) This order shall be implemented in a manner consistent with applicable law and subject to the availability of appropriations.

<u>CEQ Guidance Narrative</u>	<u>NASA Action Narrative</u> <u>"To better understand"</u>	<u>NASA Remarks</u>
(1) <u>Action Description</u> : Briefly define the agency action, including whether the action is a continuation of an existing effort or a new action.	Continue NASA's climate risk workshop process at one NASA Center, with preparations including downscaled local climate projections, a handout introducing the issues, context, and data, and interactions with local institutional stewards to ensure a sustainable, value-oriented process.	Information used in handout publication
(2) <u>Agency Lead</u> : Identify the lead component, office, or position responsible for action development, implementation, monitoring, evaluation, and oversight. The agency may choose to identify additional supporting entities.	Olga Dominguez, Agency Sustainability Officer and Assistant Administrator, Office of Strategic Infrastructure.	
(3) <u>Risk or Opportunity</u> : Identify the climate change risks or opportunities the action is designed to better understand.	Risk: Temperature, likelihood/frequency of extreme weather/flooding/drought events, etc.	
(4) <u>Scale</u> : Identify the scale of the planned action (global, national, regional, local).	Local and regional	
(5) <u>Timeframe</u> : Identify (at minimum) the fiscal years the action is expected to be started and completed.	Complete workshop in FY 2014	
(6) <u>Implementation Methods</u> : Describe the approach for implementing this action, including key milestones.	Will apply NASA's well-tested methodology of large-group intervention, drawing from Agency and external climate and institutional stewardship expertise.	See B B Bunker & B T Alban (1996) <u>Large Group Interventions: Engaging the Whole System for Rapid Change</u> ; also see page 42 "Reframing" at URL: http://nws.chem.uu.nl/research/risk/NWS-E-20093.pdf
(7) <u>Performance</u> : Describe what metrics will be used to measure performance (metrics may be qualitative or quantitative).	Workshop conducted.	
(8) <u>Inter-governmental Coordination</u> : Where appropriate, identify any needs for interagency coordination across Federal, state, tribal, or other partners to advance this action.	Local stakeholders will have access to the information and are indeed sought out as partners to enable the strongest workshop outcomes.	
(9) <u>Resource Implications</u> : Where appropriate, identify expected resource implications of this action (whether the action can be accomplished using existing resources, will require redirecting resources or realigning personnel, etc.).	Existing NASA resources will be used; follow-on implications to be integrated within existing institutional and mission management systems and processes.	
(10) <u>Challenges/ Further Considerations</u> : Where appropriate, explain challenges and/or further considerations in meeting milestones or performance targets on this action.	None unless current or FY14 budgets are significantly curtailed.	
(11) <u>Highlights of Accomplishments to Date</u> : Where appropriate, identify and describe specific ongoing projects or initiatives to highlight as successes or challenges. If available, include economic benefits and measured progress toward performance targets.	Leveraging its leadership in climate science, NASA's workshop process has been used extensively both at other NASA sites and with external organizations such as the City of New York.	

5. Actions to Address Climate Change Risks & Opportunities:

NASA Kennedy Space Center (KSC) Dune Vulnerability Team Activities

Actions (FY 2014) to address climate change risks and opportunities

ACTION TO ADDRESS:* NASA Kennedy Space Center (KSC) Dune Vulnerability Team Activities

Each agency Adaptation Plan should identify the actions the agency will continue or initiate in FY 2014 and beyond to address climate change risks and opportunities to its mission, programs, and operations.

o Examples of potential actions include pilot activities; formal integration of adaptation into activities, policies, or programs; specific modification to programs, operations, or assets; capacity building (including process, governance, training, staffing, etc.); sharing of best practices; coordination with Federal and external partners; etc.

*EO 13514; Sec. 20. General Provisions. (a) This order shall be implemented in a manner consistent with applicable law and subject to the availability of appropriations

<u>CEQ Guidance Narrative</u>	<u>NASA Action Narrative</u> <u>"To address"</u>	<u>NASA</u> <u>Remarks</u>
(1) <u>Action Description</u> : Briefly define the agency action, including whether the action is a continuation of an existing effort or a new action.	NASA Kennedy Space Center Dune Vulnerability Activities. NASA Kennedy Space Center’s Dune Vulnerability Team continues to wage its battle against beach and sand dune erosion as the sand dunes are the physical protection barrier for NASA’s Launch Pads 39A & 39B from the sea. Further, beach dunes are habitats for a number of threatened and endangered species. Recent impacts from Hurricane Sandy have exacerbated the conditions along Launch Complex 39. The Dune Vulnerability Team has undertaken several efforts to protect and restore the beach dunes and received funds to complete design of an engineering “solution” to the erosion problems along with preparation of an Environmental Assessment under NEPA to address this solution. Options including construction of the three mile long secondary/inland dune, and/or secondary dune and beach nourishment. The completion of the design and Environmental Assessment is set for August 2013. Emergency funding was received to implement a “band aid” fix to damage created by Hurricane Sandy. This includes removal of the railroad along the shoreline and construction of a 1.2 mile secondary dune. Construction is to commence in November 2013.	
(2) <u>Agency Lead</u> : Identify the lead component, office, or position responsible for action development, implementation, monitoring, evaluation, and oversight. The agency may choose to identify additional supporting entities.	J Shaffer at NASA KSC	
(3) <u>Risk or Opportunity</u> : Identify the climate change risks or opportunities the action is designed to address.	Risk: Storms and wave actions create erosion of beach	
(4) <u>Scale</u> : Identify the scale of the planned action (global, national, regional, local).	Local – Cape Canaveral	
(5) <u>Timeframe</u> : Identify (at minimum) the fiscal years the action is expected to be started and completed.	Continuing effort to manage the risk	
(6) <u>Implementation Methods</u> : Describe the approach for implementing this action, including key milestones.	1) Scientific studies to better understand the local situation; 2) actions to re-build dunes	
(7) <u>Performance</u> : Describe what metrics will be used to measure performance (metrics may be qualitative or quantitative).	Requires continuous monitoring of the situation. Continuous monitoring can include: health of dune, wave action impacts, beach erosion or progress toward engineering “solution.”	
(8) <u>Inter-agency Coordination</u> : Where appropriate, identify any needs for interagency coordination across Federal, state, tribal, or other partners to advance this action.	US Fish & Wildlife, US Air Force, University of Florida, and others	
(9) <u>Resource Implications</u> : Where appropriate, identify expected resource implications of this action (whether the action can be accomplished using existing resources, will require redirecting resources or realigning personnel, etc.).	On-going resources as appropriate are being applied to the problem	
(10) <u>Challenges/ Further Considerations</u> : Where appropriate, explain challenges and/or further considerations in meeting milestones or performance targets on this action.	No long term fix is apparent to the situation funding to complete shoreline restoration “reassigned”.	
(11) <u>Highlights of Accomplishments to Date</u> : Where appropriate, identify and describe specific ongoing projects or initiatives to highlight as successes or challenges. If available, include economic benefits and measured progress toward performance targets.	Design for shoreline restoration completed. NEPA completed, Biological Assessment completed.	

Co-chairing Interagency Forum on Climate Change Impacts & Adaptations

Actions (FY 2014) to address climate change risks and opportunities

ACTION TO ADDRESS:* Co-chairing Interagency Forum on Climate Change Impacts & Adaptation

Each agency Adaptation Plan should identify the actions the agency will continue or initiate in FY 2014 and beyond to address climate change risks and opportunities to its mission, programs, and operations.

o Examples of potential actions include pilot activities; formal integration of adaptation into activities, policies, or programs; specific modification to programs, operations, or assets; capacity building (including process, governance, training, staffing, etc.); sharing of best practices; coordination with Federal and external partners; etc.

*EO 13514; Sec. 20. General Provisions. (a) This order shall be implemented in a manner consistent with applicable law and subject to the availability of appropriations

<u>CEQ Guidance Narrative</u>	<u>NASA Action Narrative</u> <u>"To address"</u>	<u>NASA Remarks</u>
(1) <u>Action Description</u> : Briefly define the agency action, including whether the action is a continuation of an existing effort or a new action.	Forum meetings are for sharing best practices and state of climate science. The Forum is a continuation of existing effort.	
(2) <u>Agency Lead</u> : Identify the lead component, office, or position responsible for action development, implementation, monitoring, evaluation, and oversight. The agency may choose to identify additional supporting entities.	NASA co-chair for Forum is S Higuchi, NASA-HQ, Office of Strategic Infrastructure, Environmental Management Division	US Army Corps of Engineers co-chair is W. Goran
(3) <u>Risk or Opportunity</u> : Identify the climate change risks or opportunities the action is designed to address.	Opportunity – knowledge network to provide up to date information	
(4) <u>Scale</u> : Identify the scale of the planned action (global, national, regional, local).	National – nation-wide participation (East Coast to West Coast)	
(5) <u>Timeframe</u> : Identify (at minimum) the fiscal years the action is expected to be started and completed.	On-going effort	
(6) <u>Implementation Methods</u> : Describe the approach for implementing this action, including key milestones.	Presentations from 3 subject matter experts; plus updates on literature searches and events	
(7) <u>Performance</u> : Describe what metrics will be used to measure performance (metrics may be qualitative or quantitative).	Number of participants and diversity of entities represented	
(8) <u>Inter-agency Coordination</u> : Where appropriate, identify any needs for interagency coordination across Federal, state, tribal, or other partners to advance this action.	Open to all stakeholders interested in climate change impacts and adaptation	
(9) <u>Resource Implications</u> : Where appropriate, identify expected resource implications of this action (whether the action can be accomplished using existing resources, will require redirecting resources or realigning personnel, etc.).	Combination of government employees and contractor support.	
(10) <u>Challenges/ Further Considerations</u> : Where appropriate, explain challenges and/or further considerations in meeting milestones or performance targets on this action.	Diminishing funding available for contractor support	
(11) <u>Highlights of Accomplishments to Date</u> : Where appropriate, identify and describe specific ongoing projects or initiatives to highlight as successes or challenges. If available, include economic benefits and measured progress toward performance targets.	Over 100 presentations given; over 60 participants per meeting; East toWest Coast participants; wide diversity of entities represented.	

6. Accomplishments: July 2012 - June 2013

Accomplishments List <i>July 2012 through June 2013</i>				
Accomplishment	Date (If applicable)	Significance to NASA	Supports National Guiding Principles for Adaptation Planning*	REMARKS
1) NASA-Kennedy Space Center: Dune Vulnerability Team	On-going	Protecting NASA's launch facilities	#2, #3, #4, #5, #6, #7	
2) NASA Earth Science Directorate and NASA Goddard Institute for Space Studies: Climate Science	On-going	Providing the best available science to NASA's Centers and facilities	#3, #4, #5, #7	
3) NASA-HQ Office of Strategic Infrastructure: co-sponsor of Interagency Forum on Impacts & Adaptation	On-going	Spin-In to NASA best practices and lessons learned from others	#3, #4, #5, #7	Forum is co-sponsored with U.S. Army Corps of Engineers
4) NASA Stennis Space Center (SSC) Climate workshop	October 2012	Internal capacity building for using best available science and for risk management	#1, #2, #3, #4, #5, #7	Stakeholders from outside of NASA-SSC participated
5) NASA Wallops Flight Facility (WFF) workshop	November 2012	Internal capacity building for using best available science and for risk management	#1, #2, #3, #4, #5, #7	Stakeholders from outside of NASA-WFF participated
6) Federal Facilities Council event	January 2013	Sharing best available science, best practices, and lessons learned	#3, #4, #5, #7	
7) National Research Council/Federal Facilities Council/Physical Hazards and Hazard Mitigation Committee	On-going	Community of Federal agencies building capacity together	#3, #4, #5, #7	
7) (EPA/CEQ) Federal Communities of Practice a. Drought & Climate Change: <i>co-chair</i> b. Monumental Core, Washington, D.C.: <i>member</i> c. Precipitation (IDF Curves and Climate Change): <i>chair</i>	On-going	Community of Federal agencies building capacity together	#3, #4, #5, #7	
* NATIONAL GUIDING PRICIPLES FOR ADAPTATION PLANNING: #1: Integrated approaches #2: Prioritize the most vulnerable #3: Use best available science #4: Build strong partnerships #5: Apply risk-management methods and tools #6: Apply ecosystem-based approaches #7: Maximize mutual benefits #8: Continuously evaluate performance				

7. NASA Actions Supporting the National Adaptation Strategy

NASA actions supporting the National Strategy - Six Elements (Required by EO 13514 section 16)			
Element	2013 Actions	2014 Planned Actions*	Remarks
1) Science inputs to adaptation decisions and policy	2013 NASA-GISS current climate science; 2013 NASA CASI network activities	2014 NASA-GISS update climate science; 2014 NASA CASI network activities	CASI network and ROSES program support local climate science needed by NASA Centers
2) Communications and capacity-building	2013 Interagency Forum activities; 2013 NASA Center Workshops; 2013 Workshop Handouts; 2013 Federal Facilities Council (workshop) Activity	2014 Interagency Forum activities; 2014 NASA Center Workshop; 2014 Workshop Handout	
3) Coordination and collaboration	a) Seeking out stakeholders: 2013 Interagency Forum, 2013 Center Workshops, b) Establishing partnerships: 2013 Center Workshops, 2013 Federal Facilities Council activity	a) Seeking out stakeholders: 2014 Interagency Forum; 2014 Center Workshop, b) Establishing partnerships: 2014 Center Workshop	
4) Prioritization	Prioritization based on combination of: a) risk management considerations – 2013 KSC dune vulnerability team project activities b) multiple “wins” criteria: climate adaptation, disaster management, sustainability – 2013 KSC dune vulnerability team project activities	2014 KSC dune vulnerability team project activities	
5) Flexible framework	See below – “Flexible Framework for Adaptation Planning”	N/A	
6) Evaluation	See Annex 8. “Measuring Progress and Phase Approach to Adaptation”	N/A	
* Subject to the availability of resources (see EO 13514 section 20 (a))			

The National Adaptation Strategy – Six Elements
Referenced in “Progress Report of the Interagency Climate Change Adaptation Task Force,” March 16, 2010. For complete text, see http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100315-interagency-adaptation-progress-report.pdf
1. Science Inputs to Adaptation Decisions and Policy. In making recommendations toward a national strategy, the Task Force may recommend approaches for coordinating, developing, distributing and integrating science, from physical to socioeconomics, into all aspects of adaptation. Managers and planners need to understand how to best access and take advantage of science as improvements are made to guidance, standards, and best practices. Integrating science into the decision-making process will allow us to confront uncertainty about future outcomes with improved information about risks and opportunities.
2. Communications and Capacity-building. A key communications goal is to build awareness and engage relevant stakeholders in developing adaptation approaches and ensuring the success of adaptation efforts. Additional capacity also will be required at multiple levels, within and outside of local, State and Federal governments, which will be essential for sustained adaptation and resilience. The Task Force may develop recommendations on communicating climate change impacts, adaptation, and resilience and on building capacity within the U.S. government, including prioritizing opportunities for additional training and resources.
3. Coordination and Collaboration. Adaptation to climate change and building resilience will require collaboration and coordination between U.S. government entities. It is also critical to engage local stakeholders, including States, Tribes, local governments, the private sector and non-government institutions. A formal approach, with clear processes and facilitation, is required to ensure that this coordination and collaboration occurs. The Task Force may develop recommendations for structuring the national adaptation strategy within the Federal government and for increasing and improving coordination and collaboration across the government and with partners.
4. Prioritization: Since climate change has multiple impacts and resources are limited, it will be critical to identify priority areas for a coordinated government response. The Task Force may consider and make recommendations on how to identify priorities; this discussion of how to identify priorities could include such criteria as the presence of co-benefits and resource needs for the areas. Combined with the structural elements of a national adaptation strategy, these priorities will require coordinated planning, and in some cases, collaborative actions. The Task Force has begun work on several areas that may require a coordinated government response, and is developing recommendations for water resource management and for international adaptation and resilience.
5. A Flexible Framework for Agencies. U.S. government agencies and entities need a consistent but flexible framework to understand, analyze, and respond to climate change challenges and opportunities. Adapting to climate change and building resilience requires planning within and across agencies. There is no single planning approach appropriate for all agencies, but each should use a consistent framework to facilitate coordination across agencies and allow agencies to leverage common tools and methods. This flexible framework will help agencies identify and address climate vulnerabilities and opportunities and build resilience to climate change.
6. Evaluation. Adaptation to climate change and building resilience must come with a commitment to dynamic engagement, iterative understanding of results, and rigorous evaluation. Though the evidence base for many stressors influenced by climate change is established, assumptions and models for implementation and evaluation have to change as scientific knowledge increases and the climate continues to change. Also, lessons learned and information collected in one effort may contain useful lessons for others. Adaptation plans must allow for a “feedback” mechanism, whereby new information, lessons learned, and modified priorities can be incorporated into ongoing adaptation processes. Evaluation and lessons learned will help provide clear guidance for decision-making that enhances adaptation and resiliency. The Task Force may develop recommendations on how to evaluate the success of adaptation and resilience building efforts.

8. NASA Actions Supporting the National Recommendations

NASA actions supporting the National Recommendations (Required by EO 13514 section 16)			
Goal Area - Recommendations	2013 Actions	2014 Planned Actions*	Remarks
1) Encourage and mainstream adaptation planning across the Federal Government	2013 Interagency Forum; 2013 Federal Facilities Council activity; 2013 NASA Center Workshops – invited Federal guest participants	2014 Interagency Forum; 2014 NASA Center Workshop – invited Federal guest participants	
2) Improve integration of science into decision making	a) 2013 Interagency Forum b) 2013 NASA Center workshops	a) 2014 Interagency Forum b) 2014 NASA Center workshop	
3) Address key cross-cutting issues	2013 New York City climate adaptation efforts		Working with communities
4) Enhance efforts to lead and support international adaptation	NASA/C3P: 2013 International Workshop on Environment & Alternate Energy (Greenbelt, MD) emphasis on climate risks	NASA/C3P: 2014 International Workshop on Environment & Alternate Energy	
5) Coordinate capabilities of the Federal Government to support adaptation	2013 Federal Facilities Council (workshop) activity		
* Subject to the availability of resources (see EO 13514 section 20 (a))			

National Goals - Goal Area Recommendations

Referenced in “Progress Report of the Interagency Climate Change Adaptation Task Force: Recommended Actions in Support of a National Climate Change Adaptation Strategy,” October 5, 2010. For complete text, see

<http://www.whitehouse.gov/sites/default/files/microsites/ceq/Interagency-Climate-Change-Adaptation-Progress-Report.pdf>

- 1. Encourage and Mainstream Adaptation Planning across the Federal Government** – *Climate change will challenge the mission, operations, and programs of nearly every Federal agency. Ensuring that the Federal Government has the capacity to execute its missions and maintain important services in the face of climate change is essential.*
 - Implement adaptation planning within Federal agencies
 - Employ a flexible framework for agency adaptation planning
 - Use a phased and coordinated approach to implement agency adaptation
- 2. Improve Integration of Science into Decision Making** – *Access to integrated, interdisciplinary science is critical to understanding potential climate change impacts, and informing the development, implementation, and evaluation of response strategies.*
 - Create a “roadmap” of existing Federal science efforts that inform and support adaptation
 - Prioritize activities that address science gaps important to adaptation decisions and policies
 - Build science translation capacity to improve the communication and application of science to meet the needs of decision makers
 - Explore approaches to develop an online data and information clearinghouse for adaptation

3. Address Key Cross-Cutting Issues – *The breadth of certain climate change impacts creates challenges that cut across the jurisdictions and missions of individual Federal agencies. Addressing these issues will require a collaborative approach along with coordination and partnerships at the local, state, Tribal, and regional levels. The Task Force focused on an initial set of cross-cutting issues and recommends the following actions:*

Improve water resource management in a changing climate

- Strengthen data and information systems for understanding climate change impacts on water
 - Improve water-use efficiency to reduce climate change impacts
 - Develop a national action plan to strengthen climate change adaptation for freshwater resources
- Protect human health by addressing climate change in public health activities**
- Enhance the ability of Federal decision makers to incorporate health considerations into adaptation planning
 - Build integrated public health surveillance and early warning systems to improve detection of climate change health risks
 - Promote resilience of individuals and communities to climate-related health risks

Build resilience to climate change in communities

- Ensure relevant Federal regulations, policies, and guidance demonstrate leadership on community adaptation
- Integrate adaptation considerations into Federal programs that affect communities

Facilitate the incorporation of climate change risks into insurance mechanisms

- Explore a public/private partnership to produce an open-source risk assessment model

Address additional cross-cutting issues

- Develop a strategic action plan focused on strengthening the resilience of coastal, ocean, and Great Lakes communities and ecosystems to climate change
 - Develop a strategy for reducing the impacts of climate change on the Nation’s fish, wildlife, and plant resources and their habitats
- ’Pursuant to Congressional direction, development of a national plan to address fish, wildlife, and plant resources is already underway.*

4. Enhance Efforts to Lead and Support International Adaptation – *Climate change poses risks and opportunities that are important to many of the U.S. Government’s international development, security, and diplomatic priorities. Climate change adaptation should be a core consideration in the design and implementation of U.S. foreign assistance activities. Agencies should enhance collaboration to support international adaptation objectives.*

- Develop a Government-wide strategy to support multilateral and bilateral adaptation activities and integrate adaptation into relevant U.S. foreign assistance programs
- Enhance collaboration on adaptation among international development, national security, and technical support agencies
- Engage global development partners and the private sector to promote knowledge sharing and coordinate investments

5. Coordinate Capabilities of the Federal Government to Support Adaptation – *The Federal government should improve coordination of its science, services, and assessments to better support stakeholders.*

- Build and maintain strong partnerships to increase responsiveness of Federal government activities to support local, state, and Tribal needs
- Develop regional climate change adaptation consortia among Federal agencies
- Establish performance metrics for evaluating Federal adaptation efforts

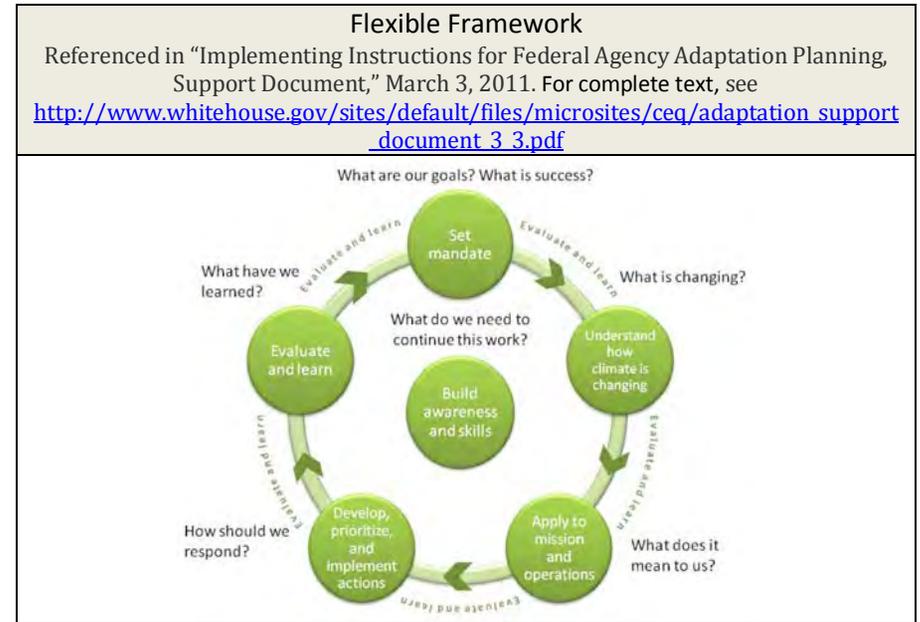
9. NASA’s Actions Supporting Guiding Principles for Adaptation Planning

NASA actions supporting the Guiding Principles for Adaptation Planning (Required by EO 13514, Instructions I.(A)(2) b)			
Principle	2013 Actions	2014 Planned Actions*	Remarks
1) Adopt integrated approaches			
2) Prioritize the most vulnerable	Enterprise Risk Management: ARM #3345 Natural Catastrophic Events –on-going management activities	Enterprise Risk Management: ARM #3345 Natural Catastrophic Events – 2014 on-going management activities	Enterprise Risk Management: ARM #3345 Natural Catastrophic Events – includes global warming
3) Use best-available science	2013 NASA-GISS current climate science; 2013 NASA CASI network current local climate science	2014 NASA-GISS update climate science; 2014 NASA CASI network update local climate science	
4) Build strong partnerships	2013 US Army Corps of Engineers & NASA co-sponsor and co-chair Interagency Forum	2014 US Army Corps of Engineers & NASA co-sponsor and co-chair Interagency Forum	
5) Apply risk-management methods and tools	Enterprise Risk Management: 2013 Climate Risk Management Plan	Enterprise Risk Management: 2014 Climate Risk Management Plan	Climate change has been managed as a NASA risk since 2005
6) Apply ecosystem-based approaches	2013 KSC dune vulnerability team project activities – vsea turtles	2014 KSC dune vulnerability team project activities – sea turtles	Maintaining habitat of beach dunes for threatened and endangered species (sea turtle) has been priority concern at KSC.
7) Maximize mutual benefits	Joint effort between OSI Environmental Management Division and NASA GISS. Multiple “wins”: 2013 green roof (climate adaptation (heat wave) & sustainability (reduce energy need))	Joint effort between OSI Environmental Management Division and NASA GISS. Multiple “wins”: 2014 green roof (climate adaptation & sustainability)	NASA released a fact sheet in July 2012 detailing efforts to research, use, and improve upon the concept of "green roofs" - urban rooftops covered with vegetation.**
8) Continuously evaluate performance	See Appendix 2. “Measuring Progress and a Phased Approach to Adaptation”	N/A	
* Subject to the availability of resources (see EO 13514 section 20 (a))			
** http://www.nasa.gov/agency/sustainability/greenroofs.html			

Guiding Principles for Adaptation Planning
Referenced in “Implementing Instructions for Federal Agency Adaptation Planning, Support Document,” March 3, 2011. For complete text, see http://www.whitehouse.gov/sites/default/files/microsites/ceq/adaptation_support_document_3_3.pdf
1. Adopt integrated approaches. Climate change adaptation strategies should be integrated into core policies, planning, practices, and programs.
2. Prioritize the most vulnerable. Adaptation plans should prioritize helping people, places, and infrastructure that are most vulnerable to climate impacts. They should also be designed and implemented with meaningful involvement from all parts of society. Issues of inequality and environmental justice associated with climate change impacts and adaptation should be addressed.
3. Use best-available science. Adaptation should be grounded in best-available scientific understanding of climate change risks, impacts, and vulnerabilities. Adaptive actions should not be delayed to wait for a complete understanding of climate change impacts, as there will always be some uncertainty. Plans and actions should be adjusted as our understanding of climate impacts increases.
4. Build strong partnerships. Adaptation requires coordination across multiple sectors, geographical scales, and levels of government and should build on the existing efforts and knowledge of a wide range of stakeholders. Because impacts, vulnerability, and needs vary by region and locale, adaptation will be most effective when driven by local or regional risks and needs.
5. Apply risk-management methods and tools. A risk management approach can be an effective way to assess and respond to climate change because the timing, likelihood, and nature of specific climate risks are difficult to predict. Risk management approaches are already used in many critical decisions today (e.g., for fire, flood, disease outbreaks), and can aid in understanding the potential consequences of inaction as well as options for risk reduction.
6. Apply ecosystem-based approaches. Ecosystems provide valuable services that help to build resilience and reduce the vulnerability of people and their livelihoods to climate change impacts. Integrating the protection of biodiversity and ecosystem services into adaptation strategies will increase resilience of human and natural systems to climate and non-climate risks, providing benefits to society and the environment.
7. Maximize mutual benefits. Adaptation should, where possible, use strategies that complement or directly support other related climate or environmental initiatives, such as efforts to improve disaster preparedness, promote sustainable resource management, and reduce greenhouse gas emissions including the development of cost-effective technologies.
8. Continuously evaluate performance. Adaptation plans should include measurable goals and performance metrics to continuously assess whether adaptive actions are achieving desired outcomes. In some cases, the measurements will be qualitative until more information is gathered to evaluate outcomes quantitatively. Flexibility is critical to building a robust and resilient process that can accommodate uncertainty and change.

10. NASA Actions Supporting the Flexible Framework for Adaptation Planning

NASA actions supporting the Flexible Framework for Adaptation Planning (Required by EO 13514, Instructions I.(A)(2) b)			
Framework Component	2013 Actions	2014 Planned Actions*	Remarks
1) Set mandate	N/A	N/A	NASA Policy Statement signed 18 May 2011
2) Understand how climate is changing	a) 2013 NASA-GISS; b) 2013 NASA CASI; c) 2013 Interagency Forum	a) 2014 NASA-GISS; b) 2014 NASA CASI; c) 2014 Interagency Forum	On-going efforts by NASA GISS, NASA CASI, Interagency Forum
3) Apply to mission and operations	Stennis Space Center Workshop Wallops Flight Facility Workshop	2014 NASA Center Workshop	On-going capacity building efforts in conducting site specific workshops, joint effort between NASA scientists and NASA institutional managers.
4) Develop, prioritize, and implement actions	Stennis Space Center Workshop Wallops Flight Facility Workshop		Since 2009, NASA has implemented recommended actions developed and prioritized in its workshops.
5) Evaluate and learn	See Appendix 2 – “Measuring Progress and a Phased Approach to Adaptation”	N/A	
6) Build awareness and skills	2013 Interagency Forum; Stennis Space Center and Wallops Flight Facility Workshop; Federal Facilities Council (workshop) Activity	2014 Interagency Forum; 2014 NASA Center Workshop	On-going efforts through Interagency Forum, climate workshops climate handouts
* Subject to the availability of resources (see EO 13514 section 20 (a))			



Appendix 2: Other Useful Information

<i>Annex #</i>	<i>Description</i>	<i>Remarks</i>
<i>Annex 1</i>	Important Questions	See Endnote #4 in Climate Risk Management Plan.
<i>Annex 2</i>	Measuring Progress and a Phased Approach to Adaptation	See Section VI.5 and Endnote #28 in Climate Risk Management Plan. Description of an existing voluntary standard to measure progress that NASA is using.
<i>Annex 3</i>	Climate Disclosure Standards Board (CDSB) Content Requirements for Climate Risks	See Endnote #3 in Climate Risk Management Plan. Brief summary of content requirements from an existing climate risk disclosure standard, partly incorporated into NASA's Climate Risk Management Plan.
<i>Annex 4</i>	NASA Crosswalk of 2012 CEQ Guidance for Adaptation Plans	Crosswalk of CEQ's Guidance (issued February-March 2012) and NASA's climate risk management documents.
<i>Annex 5</i>	Discussion of Public Comments on NASA's Climate Risk Management Documents	No public comments were received. Describes features of NASA's Climate Risk Management Documents.

Annex 1. Important Questions



Climate Change Briefing

WRITTEN BY
Julie Desjardins, CA
Alan Willis, CA

QUESTIONS FOR DIRECTORS TO ASK

Library and Archives Canada Cataloguing in Publication

Desjardins, Julie, (date)

Climate change briefing : questions for directors to ask.

Written by Julie Desjardins and Alan Willis.

ISBN 978-1-55385-428-9

1. Climatic changes—Economic aspects—Canada. 2. Industrial management—Environmental aspects—Canada. 3. Climatic changes—Risk assessment—Canada. I. Willis, Alan II. Canadian Institute of Chartered Accountants III. Title.

HC79.E5D4637 2009

658.4'083

C2009-903553-7

Copyright © 2009

Canadian Institute of Chartered Accountants

277 Wellington Street West

Toronto, ON M5V 3H2

Printed in Canada

Disponible en français

Appendix 1: Summary of Questions for Directors to Ask

Following are some questions that directors may wish to consider asking themselves and management, as the case may be, in carrying out their oversight role regarding the business implications of climate change.

General

1. What are the climate change issues that are reasonably likely to impact the company's business and operations in the foreseeable future?
2. What are the magnitude, sources and nature of the company's current and anticipated greenhouse gas emissions?

Risks

3. What is management's plan, if any, for responding to physical risks to the company arising from climate change? What strategies, if any, has management developed to address input shortages or disruptions in its supply chain due to adverse weather events or climate changes affecting suppliers?
4. What is management's assessment of how the company will or could be impacted by existing or potential government regulations in key jurisdictions in which it operates?
5. What is management's evaluation of the reputational risks that may influence key stakeholders (e.g. customers, employees, suppliers, governments or communities) related to the company's approach to dealing with climate change issues?
6. What is management's assessment of and response to the possibility of actions regarding climate change, whether by non-governmental organizations, foreign or domestic governments, activist investors, lobbyists or other parties, which might impact the company, its operations or its reputation?
7. What is management's assessment of the possibility of current or future nuisance, negligence, disclosure or other legal actions against the company arising from climate change related actions or inactions?

Strategy

8. What is the potential impact, if any, of climate change on the company's strategic plans under possible adaptation and mitigation scenarios? What timeframes were assumed or considered in developing such scenarios?
9. What innovation and technology opportunities, if any, has management investigated to reduce greenhouse gas emissions and gain competitive advantage?
10. What GHG emission reduction targets has management set, if any, and how challenging are they? Does management track and report progress against these targets?
11. How does the company's climate change strategy compare to that of key competitors?
12. How may climate change impact any merger, acquisition and divestiture plans and decisions?

Financial Performance and Condition

13. What has been, and is likely to be, the impact of climate change issues on revenues, expenditures and cash flows?
14. What impact, if any, could climate change issues have on the company's financial condition and liquidity?

External Reporting

15. What assessment has management made of the materiality to investors of information about climate change issues? Are disclosures made in the MD&A and/or financial statements consistent with this assessment?
16. How do the company's mandatory and voluntary public disclosures about climate change compare with those of competitors?
17. How has management ensured that information reported on corporate websites or in voluntary reports (e.g. corporate sustainability reports, Carbon Disclosure Project survey responses) is consistent with that provided in government filings and continuous disclosure filings with securities regulators?

Systems and Controls

18. How has management ensured that it is gathering reliable and timely greenhouse gas emissions and other climate change information for internal management purposes as well as for disclosures to capital markets and governments?

Governance

19. How does the company's executive compensation system support the integration of climate change issues into decision making and performance throughout the organization?
20. As a board, what governance structure have we established to enable us to appropriately oversee the management of climate change issues?

ANNEX 2. Measuring Progress and Phased Approach to Adaptation

As expressed in Section D. of the “Federal Framework for Climate Change Adaptation Planning,” in CEQ’s “Support Document,” organizations should consider a phased approach and use performance metrics to measure their accomplishments. NASA is applying an existing voluntary standard – National Indicator (NI) 188 Planning to Adapt to Climate Change, which focuses on processes rather than outcomes in recognition that adaptation is an emerging field. Developed in England, NI 188 is about ‘planning to adapt to climate change.’ The indicator is a key driver for local action on adaptation. It measures progress on assessing and managing climate risks and opportunities, and incorporating appropriate action into local authority and partners’ strategic planning. Progress on adaptation is measured via a self assessment with each local authority reporting a level of preparedness they have reached from level 1 to level 5.¹

This annex describes initial thinking about potential use of this standard, and includes three sections: A) Background; B) Introduction to NI 188, its performance levels, its purpose, and an overview of the performance achievement levels; and C) Initial Assessment of NASA’s Achievement against NI 188 performance levels.

A. Background

A.1 Phased Approach and Measuring Progress: Process Based Indicator

As expressed in Section D. of the “Federal Framework for Climate Change Adaptation Planning,” in CEQ’s “Support Document²,” organizations should consider a phased approach and use performance metrics to measure their accomplishments (Table 1.) In addition, there is a need for “measurable goals and performance metrics” (Table 2.) Consistent with these two needs, it is appropriate to use a “process based” indicator, as opposed to an “outcome based” indicator, to measure performance. A process based indicator of performance recognizes the difficult of an entity-wide climate adaptation program to initially specify outcomes because climate risks are local in character and are usually uniquely related to an entity’s strategic mission and goals.

Table 1. A Phased Approach*

“Federal agencies will need to take a phased approach to integrate adaptation planning into their programs and operations. As leadership and staff acquire and expand their knowledge of climate change and its impacts, agencies can assess how these impacts may affect their mission, programs, and operations. Once agencies have a greater understanding of global and national climate change trends and their implications, they can conduct a more detailed assessment of how their mission, priority programs, and operations may be impacted and identify specific program and project-level actions to prepare for and respond to climate change. While the *Implementing Instructions* are focused at high-level, agency-wide planning, the framework design supports planning efforts at both the agency- and project-level.

The *Implementing Instructions* establish a foundation for agencies to set measurable goals and commitments in the future, including: (1) more refined assessments of the vulnerabilities and opportunities created by climate change; and (2) specific adaptation actions to minimize risk and capitalize on these opportunities. Federal agencies are at different stages of adaptation planning. Some agencies may have already initiated actions required in the *Implementing Instructions*. These agencies are encouraged to undertake more detailed vulnerability assessments and implement specific actions to further incorporate adaptation into their programs, policies, and operations. However, all agencies are still required to meet the actions specified in the *Implementing Instructions*.

Agencies are also encouraged to participate in project-level (local to regional scale) adaptation planning activities, either within the agency or through interagency cross-cutting issue working groups. Undertaking project-level adaptation activities will build awareness of the importance of adaptation and improve understanding of the adaptation planning process among agency staff and advance the next phase of agency-wide adaptation planning efforts.”

* EO 13514, Support Document III.D.2

¹ NI-188 Planning to Adapt to Climate Change” (see “Adapting to Climate Change: Guidance notes for NI 188,” version 1.8: 22 March 2010) <http://www.yourclimate.org/pages/ni-188-guidance>

² Implementing Instructions for Federal Agency Adaptation Planning, Support Document - http://www.whitehouse.gov/sites/default/files/microsites/ceq/adaptation_support_document_3_3.pdf

Table 2. Measurable Goals and Performance Metrics*
<p>“The Task Force concluded that “agencies should identify measures to incorporate climate change-related considerations into existing agency planning processes, including the development of measurable goals and performance metrics to guide adaptation efforts and assess whether efforts are achieving desired outcomes.” Regular evaluation of the success of the Federal Government in directly implementing and supporting adaptation efforts is crucial for continuously refining and improving adaptive approaches. An iterative agency evaluation process will allow adaptation plans, priorities, and actions to be revised as necessary if desired outcomes are not being achieved or if undesired consequences are occurring. While performance metrics are not required by the <i>Implementing Instructions</i>, agencies should adopt measurable goals and performance metrics for climate change adaptation.”</p>
<p>* EO 13514, Support Document III.D.3</p>

A.2 Voluntary Standard: “NI 188 Planning to Adapt to Climate Change”

Federal agencies are authorized and encouraged to use “Voluntary Standards” to avoid the expense of developing a Federal standard where an adequate “Voluntary Standard” already exists (OMB Circular A-119.) While conducting a literature search, NASA staff located NI 188 and after reviewing the standard, found this process based indicator standard to satisfy the criteria for a “phased approach” and for “measurable goals and performance metrics.” NASA is exploring the use of NI 188 as an existing voluntary standard that is adequate and acceptable to meet NASA’s needs, subject to some minor modifications.

B. Introduction: NI 188 Adapting to Climate Change

Tables below provide introductory information about the NI 188 Standard.

B.1 Levels of Performance

TABLE 3. The Levels of Performance*
<p>Entities will report the level of preparedness they have reached against the levels of performance, graded 5 to 1. A lower number represents further progress made in planning to adapt. Each entity will have set its targets for the level to be reached next. The levels are:</p> <ul style="list-style-type: none"> Level 1 Getting started Level 2 Public commitment and impacts assessment Level 3 Comprehensive risk assessment Level 4 Comprehensive action plan Level 5 Implementation, monitoring and continuous review
<p>* “Adapting to Climate Change: Guidance notes for NI 188,” version 1.8: 22 March 2010</p>

B.2 Purpose of the Standard

Table 4. Purpose of the Standard*
<p>To ensure entities are sufficiently prepared to manage climate risks to their mission and achieve their strategic goals. Included in managing mission risks, are risks related to the public, local communities, local infrastructure, businesses and the natural environment from a changing climate. Entities should make the most of new opportunities.</p> <p>The indicator measures progress on assessing and managing climate risks and opportunities, and incorporating appropriate action into the entity and partners’ strategic planning.</p> <p>The impacts might include increases in flooding, temperature, drought and extreme weather events. These could create risks and opportunities such as: increased damage to buildings from storms, impacts on local ecosystems and biodiversity, changing patterns of disease, impacts on planning and the local economy and public health.</p>
<p>* “Adapting to Climate Change: Guidance notes for NI 188,” version 1.8: 22 March 2010</p>

B. 3 Overview of the Performance Achievement Levels

Table 5. Overview of NI 188*								
Level	Leadership	Partnership	Assess Current Situation	Assess Future Risks	Initiating Action	Action Plan	Implementation	Monitoring and Review
1	Designate lead officer Initiate process for managing climate risks		Initiate process of identifying climate risks		Governance structure			
2	Public commitment to manage climate risks Ensure good communication within entity	Communicate to partners and stakeholders potential climate risks	Risk assessment of significant vulnerabilities	Ass how risks may change in future	Policy Statement			
3		Engage partners and stakeholders in assessing climate risks	Comprehensive risk-based assessment of current vulnerabilities Identify priority risks	Comprehensive risk-based assessment of future vulnerabilities Identify priority risks	Identify response to priority risks		Start implementing adaptation efforts in some priority areas	
4	Climate risk part of decision making	Engage partners and stakeholders in managing climate risks				Develop a comprehensive Plan for managing climate risks	Implementing adaptation efforts in all priority areas	
5							Implement Comprehensive Plan	Continual monitoring and review of progress and objective
* "Adapting to Climate Change: Guidance notes for NI 188," version 1.8: 22 March 2010								

C. Initial Assessment of NASA’s Achievement against NI 188 Performance Levels

Each of the following tables contains a description of the performance elements and NASA’s initial assessment of its status, with remarks.

Level 1 - Getting started*			
The entity has begun the process of assessing the potential threats and opportunities across its property, goods and services (for example, flood and coastal resilience plans, emergency planning, community risk strategies) and has identified and agreed the next steps to build on that assessment in a systematic and coordinated way.			
Element	Narrative	NASA Status	Remarks
1.1: Initial Planning	create an outline plan with key steps and elements for the journey to developing the adaptation action plan linking to the calendar of mainstream business and the indicator targets	On-going	2012 NASA Climate Risks Management Plan
1.2 Engagement of Community, Stakeholder and Key partners	to begin the engagement of others in the process of developing an adaptation action plan	On-going	NASA-HQ: Interagency Forum NASA-KSC: Dune Vulnerability Team NASA Centers: workshops
1.3 Scoping Needed Resources	to begin to identify the personnel, resources and procedures and training necessary to start the long-term process of developing a comprehensive adaptation strategy	On-going	NASA Centers: workshops
1.4 Baseline identification	To undertake a high level analysis and review of how adaptation, weather and climate information are currently reflected in existing plans and strategies	Completed	NASA completed a high level vulnerability analysis
1.5 Supplementary Aim: Developing a strategic vision	Supplementary Aim: start the process of expressing a vision for creating a well adapting entity that is linked to its Sustainability Strategy	Completed	NASA's Policy Statement NASA Centers: CSOs
* "Adapting to Climate Change: Guidance notes for NI 188," version 1.8: 22 March 2010			

Level 2 - Public commitment and impacts assessment*			
The Entity has made a public commitment to identify and manage climate related risk. It has undertaken a local risk-based assessment of significant vulnerabilities and opportunities to weather and climate, both now and in the future. It can demonstrate a sound understanding of those not yet addressed in existing strategies and actions (e.g. in land use planning documents, flood and coastal resilience plans, emergency planning, community risk strategies). It has communicated these potential vulnerabilities and opportunities to the entity's organization units and other partners and has set out the next steps in addressing them.			
Element	Narrative	NASA Status	Remarks
2.1 Including other expertise, Leadership and Public Commitment	to demonstrate the leadership role of the entity by making a public commitment (among the local community, partners) to respond to the threats and opportunities of a changing weather and climate	On-going	NASA Policy Statement and NASA Center workshops FFC: workshop Hampton Roads: workshop
2.2 Understanding current vulnerability	to develop an understanding of current vulnerability to weather, including extreme weather events	On-going	CASI High level vulnerability analysis Workshops
2.3 identifying some significant potential impacts from future weather and climate	to identify significant potential impacts associated with future weather and climate, particularly those that are not adequately addressed by existing policies	On-going	NASA-GISS CASI Workshops
2.4 sharing the workload and ongoing project planning	to ensure that relevant managers / stakeholders are aware of these and other potential impacts, and are preparing to address them	On-going	NASA Centers: CSOs
2.5 Supplementary Aim: monitoring future impacts	Supplementary Aim; to develop and maintain a monitoring system to collect information on the impacts of weather events, particularly recording the impacts on the entity's mission and strategic goals	On-going	CASI NASA-HQ OSI

* "Adapting to Climate Change: Guidance notes for NI 188," version 1.8: 22 March 2010

Level 3 - Comprehensive risk assessment*			
The Entity has undertaken a comprehensive risk based assessment of vulnerabilities to weather and climate, both now and in the future, and has identified priority risks for its mission and strategic goals. It has identified the most effective adaptive responses and has started incorporating these in strategies, plans, partnerships and operations (such as planning, flood management). It has begun implementing appropriate adaptive responses in some priority areas. In its role as a leader managers have started working with stakeholders encouraging identification of major weather and climate vulnerabilities and opportunities that affect the local objectives			
Element	Narrative	NASA Status	Remarks
3.1 Comprehensive assessment of potential impacts	To ensure that the entity now has a comprehensive assessment of climate threats and opportunities across its operations for specified periods in the future	On-going	Kim T.
3.2 The risk-based assessment revealing priority issues	To identify using a risk-based method, preferably already employed by the entity, the priority risks that need to be considered	On-going	ARM
3.3 Identify priority actions	To establish methods and procedures for identifying adaptation options and develop some priority actions	On-going	Sea level policies
3.4 Implement priority actions	To begin to implementing some priority actions which will include both 'practical adaptation actions' and 'building adaptive capacity'	On-going	KSC dunes
3.5 integrate local stakeholders and partners	To encourage activity among local stakeholders and partners to undertake risk based assessments of their significant vulnerabilities and opportunities	On-going	CSO's presentations
3.6 Supplementary Aim; monitor new mission aspects	Supplementary Aim; To introduce arrangements for monitoring other mission aspect in order to be aware of any new risks	On-going	Supply chain
3.7 Supplementary Aim; monitor effectiveness of early adaptation measures	Supplementary Aim; To introduce arrangements for monitoring the effectiveness of adaptation measures as they become exposed to the increasing extremes of the changing weather	On-going	Supply chain
* "Adapting to Climate Change: Guidance notes for NI 188," version 1.8: 22 March 2010			

Level 4 - Comprehensive action plan*			
The Entity has embedded climate impacts and risks across council decision making. It has developed a comprehensive adaptation action plan to deliver the necessary steps to achieve the existing objectives set out in management strategies, plans, investment decisions and partnership arrangements in light of projected climate change and is implementing appropriate adaptive responses in all priority areas. This includes leadership and support for stakeholders in taking a risk based approach to managing major weather and climate vulnerabilities/ opportunities across the wider local area.			
Element	Narrative	NASA Status	Remarks
4.1 Developing a comprehensive Adaptation Action Plan	To develop a comprehensive adaptation action plan which sets out the necessary steps to achieve objectives in the light of projected climate change	On-going	
4.2 Embedding climate risks into decision making	To ensure that a consideration of changing climate impacts and risks is embedded into all the entity's decision making	On-going	NPD, NPR, sea level
4.3 Implementing adaptation responses	To implement appropriate adaptation responses to the priority issues identified in the comprehensive risk assessment.	On-going	Wallops and KSC Beach erosion
4.4 Supporting stakeholder and partner organizations	To ensure that the entity is supporting the stakeholders and partner organizations in managing changing climate risks across the wider local area.	On-going	CSO's presentations
* "Adapting to Climate Change: Guidance notes for NI 188," version 1.8: 22 March 2010			

Level 5 - Implementation, monitoring and continuous review*			
The Entity and stakeholders are implementing the comprehensive adaptation action plan across the local area, and there is a robust process for regular and continual monitoring and review to ensure progress with each measure and updating of objectives. The Entity and stakeholders are taking appropriate adaptive responses.			
Element	Narrative	NASA Status	Remarks
5.1 Monitoring implementation of plan	To ensure that there are robust systems for monitoring and reporting the implementation of the Adaptation Action Plan including the roles of all partners	Initiated and on-going	CSO's presentations
5.2 Monitoring performance of adaptation actions	To establish robust systems for monitoring, against the objectives of the plan, the performance of adaptation measures undertaken in the delivery of the Adaptation Action Plans, including the actions of all partners.	Initiated and on-going	CSO's presentations
5.3 Review and updating of plans	To ensure that all relevant adaptation plans are reviewed and updated at appropriate intervals in the light of their performance, changing circumstances and objectives and the latest climate change projections.	Initiated and on-going	2012 NASA Climate Risk Management Plan and Report
* "Adapting to Climate Change: Guidance notes for NI 188," version 1.8: 22 March 2010			

Annex 3. Climate Disclosure Standards Board (CDSB) Content Requirements for Climate Risks

STANDARD: CLIMATE RISKS		
I. DISCLOSURE CONTENT REQUIREMENTS (Chapter 4) – Aligns with NASA’s Climate Risks Management Plan contents		
Strategic Analysis Risks	Opportunities Management Actions	Future Outlook Governance
II. CHARACTERISTICS OF DECISION USEFUL INFORMATION (Chapter 3)		
<u>Fundamental Characteristics:</u> 1. Relevance 2. Faithful Representation	<u>Enhancing Characteristics:</u> 1. Comparability 2. Timeliness 3. Understandability 4. Verifiability	<u>Constraining Characteristics:</u> 1. Materiality 2. Benefits should justify cost of providing the information
III. REPORTING FRAMEWORK REQUIREMENTS (Chapter 2)		
DETERMINATION: An entity shall determine the disclosure to be made according to the categories of disclosure content that are of value to investors and a process that involves a thorough assessment of how climate risk has actually affected or has the potential to affect the entity’s strategic objectives	PREPARATION: Disclosures shall be made on a consistent basis and shall include the information that is necessary to maximize its value to investors	PRESENTATION: Disclosures shall be presented and communicated so as to make them useful for investors
CONTENT: Disclosures shall take account of the content requirements	FUTURE PROSPECTS & PAST PERFORMANCE: Disclosures shall enable investors to assess the future prospects of the entity as well as its past performance	FORM OF PRESENTATION: Disclosures shall be clear and straightforward
INVESTOR PERSPECTIVE: Disclosures shall focus on investors as the primary users of information	REPORTING PERIOD: Information shall be provided on an annual basis for the same period covered by the SSPP document or for a period of twelve months ending in that period	POSITION OF INFORMATION: Information shall be reported in a place and in such a way as to explain the links between the entity’s strategy, operations and climate risks and climate impacts
MANAGEMENT PERSPECTIVE: Disclosures shall bring to bear management’s view of the entity’s strategy and objectives	ORGANIZATIONAL BOUNDARY: Disclosures shall be made for the group of sub-entities for which the SSPP is prepared	PERFORMANCE MEASURES AND INDICATORS: The entity shall disclose performance measures and indicators used by management to manage and to track progress against climate risk management related targets
REGULATORY PERSPECTIVE: Disclosures shall comply with regulatory requirements for reporting or disclosures of climate risk related information. Where there is conflict between these voluntary standard requirements and regulatory requirements, the regulatory requirements shall be applied and the nature and effect of the conflict disclosed	STATEMENT OF CONFORMANCE: Disclosures shall include a statement of conformance. In cases where full conformity has not been possible because of the entity’s particular circumstances, the statement of conformance shall identify those requirements with which it has not been possible to conform, in whole or in part, together with an explanation of the relevant circumstances, information about the entity’s stage of conformance and its plans for full application of the requirements (See III.A.4 and III.C.5)	COMPARATIVE ANALYSIS: Disclosures shall explain changes in approach and changes in results from year to year
	STANDARDS, POLICIES AND ENTITY’S BOUNDARY USED FOR PREPARING INFORMATION: The statement of conformance shall include details of standards, policies and entity’s boundary used for preparing information and confirmation that the standards, policies and entity’s boundary have been used consistently from one reporting period to the next	SEGMENTATION: Disclosure shall be consistent with the entity’s SSPP. Therefore if the SSPP include segment information, disclosures about climate change (greenhouse gas mitigation and risk management adaptation) shall also reflect that segmentation
* Climate Disclosure Standards Board (September 2010) “Climate Change Reporting Framework – Edition 1.0”		

**ANNEX 4. Crosswalk of CEQ’s Guidance Items*
and
NASA’s Climate Risk Management Documents**

*CEQ Guidance: “Preparing Federal Agency Climate Change Adaptation Plans” (29 February 2012), in accordance with Executive Order 13514

Adaptation Plan Elements	
CEQ Guidance Narrative	Location within document
The elements listed in this section <u>should</u> be included in each agency’s Adaptation Plan. Agencies may provide more detailed information or additional elements as appropriate to agency mission, programs, operations, policies, and planning needs.	N/A
While the Adaptation Plan <u>should focus on agency-level actions</u> to understand <u>and</u> address climate change risks and opportunities, agency components or offices should be included in plan development and identified in the document where agency actions apply to those components. Actions to understand <u>or</u> address specific climate change impacts <u>should</u> be coordinated across relevant components or offices and, where appropriate, with other Federal agencies. Each agency <u>should also submit</u> with the Sustainability Plan any publically-available climate change adaptation plans or <u>related documents</u> developed by its components or offices.	Climate Information Handouts used at <i>Climate Risks Workshops</i> at four Centers were uploaded into OMB MAX
1. Policy framework for climate change adaptation Each agency Adaptation Plan <u>should</u> :	
CEQ Guidance Narrative	Location within document
Clearly state the agency’s vision, goals, and strategic approaches for managing the effects of climate change on its mission, programs, and operations in FY 2013 and beyond. This policy framework should reflect and align with the agency’s climate change adaptation policy statement prepared as part of the June 2011 Sustainability Plan submission, and any subsequent analysis and planning.	Section V, Management Actions Policy Statement: posted http://www.nasa.gov/sustainability
Identify the senior agency official, office, or other entity responsible for the Adaptation Plan’s development, implementation, and evaluation.	Section VII, Governance.
2. Agency Vulnerability: Analysis of climate change risks and opportunities Each agency Adaptation Plan <u>should</u> identify and describe risks and opportunities to the agency’s mission, programs, and operations from climate change in both the short and long term.	
CEQ Guidance Narrative	Location within document
Mission, program, and operational areas to consider include (but may not be limited to): o Assets (e.g., equipment, facilities, other long-term investments, etc.) o Operations (e.g., agency activities, operations management (including water and energy use), financial management, public demand for agency services, etc.) o Health and safety (e.g., workplace health and safety, welfare of employees and communities served, public health, healthy communities, exposure to natural disasters, etc.) o Natural and cultural resources (e.g., forestry, and fisheries, natural resource management, environmental protection, oceans and coasts, water resources, cultural and heritage resources, etc.) o Security (e.g., military and national security, homeland security, disaster preparedness, etc.) o Infrastructure and support systems (e.g., communications, transportation, energy, water, flood protection, etc.) o Economic activities (e.g., agriculture, resource development, trade, financial and commodity markets, urban and rural development, recreation and tourism, science and technology, international development, etc.) o External coordination (e.g., interaction with state, local, tribal, territorial governments, international relations, etc.)	<ul style="list-style-type: none"> • Section II, Strategic Analysis • Section III, Risks • Section IV, Opportunities • Appendix 1: Item 3 – Graphic: From Risk to Resilience
Direct and indirect effects of climate change (both short term and long term) to consider include (but may not be limited to): o Temperature shifts (e.g., mean and extreme air temperatures, temperature fluctuations and variability, heat waves, water temperatures, etc.; associated impacts to sea ice, snowpack, permafrost, natural systems, etc.) o Hydrological/precipitation changes (e.g., amount, intensity, and seasonality of precipitation, hydrologic regimes, etc.; associated impacts to evaporation and evapo-transpiration, stream flows, lake levels, salinity, storm water runoff, etc.)	<ul style="list-style-type: none"> • Section II, Strategic Analysis • Section III, Risks • Section IV, Opportunities • Appendix 1: Item 3 – Graphic: From Risk to Resilience

<ul style="list-style-type: none"> o Changes in intensity, timing, and location of extreme events (e.g., hurricanes, floods, droughts, windstorms, wildfires, landslides, etc.) o Sea level rise (e.g., storm surge, coastal inundation, saline intrusion, erosion, etc.) o Other changes associated with climate change: (e.g., humidity, wind patterns, large scale atmospheric circulation, ocean circulation, etc.) 	
3. Process of agency adaptation planning and evaluation	
Each agency Adaptation Plan <u>should</u> briefly describe the agency's process to:	
CEQ Guidance Narrative	Location within document
Explore and identify climate change vulnerabilities (including methodologies, information used, and processes)	<ul style="list-style-type: none"> • Section II, Strategic Analysis • Section III, Risks • Section V, Management Actions • Section VII, Governance • Appendix 1: Item 6
Identify and prioritize actions to better understand or address risks and opportunities, and implement those actions.	<ul style="list-style-type: none"> • Section V, Management Actions • Appendix 1: Items 4 and 5
Monitor or evaluate the implementation and success of climate change adaptation actions, including how the agency will adjust activities as new information becomes available.	<ul style="list-style-type: none"> • Section VI. Future Outlook • Appendix 2: Annex 2
Distribute the Adaptation Plan to regional and field personnel, if appropriate.	Section VII, Governance
Review and update the Adaptation Plan.	Section VII, Governance
4. Programmatic activities	
Each agency Adaptation Plan <u>should</u> briefly describe how the agency will:	
CEQ Guidance Narrative	Location within document
Assess and build needed capacity and organizational structures within the agency in order to effectively assess agency specific climate change risks and opportunities and implement appropriate adaptation actions.	<ul style="list-style-type: none"> • Section V, Management Actions • Appendix 1: Item 4 • Appendix 1: Item 6
Integrate climate change adaptation into appropriate policies, programs, and operations over time, including strategic and/or sustainability planning initiatives.	<ul style="list-style-type: none"> • Section IV, Opportunities • Section VII, Governance • Appendix 1: Item 6
Collaborate and share adaptation science and planning information with other Federal agencies at the national, regional and local scale.	<ul style="list-style-type: none"> • Section V, Management Actions • Strategic Sustainability Performance Plans http://www.nasa.gov/sustainability
Coordinate adaptation planning with related efforts among state, local, tribal, and territorial partners.	<ul style="list-style-type: none"> • Section V, Management Actions • Strategic Sustainability Performance Plans http://www.nasa.gov/sustainability
Engage in efforts to coordinate climate change science and adaptation planning at regional levels (e.g., through RISAs, CSCs, LCCs, etc.), if appropriate. Where such science coordination is currently ongoing, Agencies should work together to identify and describe the process in their respective Plans.	<ul style="list-style-type: none"> • Section V, Management Actions • Section VII, Governance • Strategic Sustainability Performance Plans http://www.nasa.gov/sustainability
5. Actions (FY2013) to <u>better understand</u> climate change risks and opportunities	
CEQ Guidance Narrative	Location within document
Each agency Adaptation Plan <u>should</u> identify the actions the agency <u>will continue or initiate in FY 2013</u> and beyond to <u>better understand climate change</u> risks and opportunities to its mission, programs, and operations. <ul style="list-style-type: none"> o <u>Examples of potential actions</u> include assessing vulnerability; monitoring impacts of or responses to climate change; scientific, social, economic, or behavioral research or analysis; modeling, projection or exploration of climate change scenarios; studies targeted around specific geographic areas, sectors, programs, or operations; development of decision support tools; etc. 	Appendix 1: Item 4
6. Actions (FY2013) to <u>address</u> climate change risks and opportunities	
CEQ Guidance Narrative	Location within document
Each agency Adaptation Plan <u>should</u> identify the actions the agency <u>will continue or initiate in FY 2013</u> and beyond to <u>address climate change</u> risks and opportunities to its mission, programs, and operations. <ul style="list-style-type: none"> o <u>Examples of potential actions</u> include pilot activities; formal integration of adaptation into activities, policies, or programs; specific modification to programs, operations, or assets; capacity building (including process, governance, training, staffing, etc.); sharing of best practices; coordination with Federal and external partners; etc. 	Appendix 1: Item 5

ANNEX 5. Public Comments on NASA's Climate Risk Management Documents

NASA received no comments on its 2012 Climate Risk Management Plan & Report. NASA carefully crafted its documents, relying on existing disclosure standards, OMB Circulars, and accepted business approaches. These are outlined in the table below.

Features of NASA's Climate Risk Management Documents – Carefully Crafting a Plan		
Feature	References	Remarks
1) "Climate Risk Management"		a) Private sector disclosure terminology of 'climate risks' b) Above term includes a 'changing climate'
2) Cover shows NASA's exposure		Risk Communication; teaching cover
3) Standardize content outline	Climate Disclosure Standards Board – voluntary standard	OMB Circular A-119 – voluntary standards
4) Statutory authorization	Federal Managers' Financial Integrity Act	<i>Safeguard property and other assets against loss</i> ; "material weakness" process
5) Enterprise Risk Management (ERM) approach	NASA risk process	a) Business management approach b) OMB Circular A-123 – internal control program (risk assessment component)
6) Spectrum of "risks" discussed	Securities & Exchange Commission climate disclosure includes a range of listed risks (17 CFR 211, 231 & 241)	Business management approach – Las & Wellington (2007) "Competitive Advantage on a Warming Planet" <u>Harvard Business Review</u>
7) Includes "Greenhouse Gases"	Climate Disclosure Standards Board	Respectful of Carbon Disclosure Project – voluntary approach
8) Performance Indicator	"NI-188" for Climate Adaptation – voluntary standard	OMB Circular A-119 – voluntary standards
9) "Plan" separate from "Report"	Disclosures are forward looking	Plan is "forward looking"