

RECORD TYPE: PRESIDENTIAL (TRP NOTES MAIL)

CREATOR: James A. Dorskind ("James A. Dorskind" <JDorskind@doc.gov> [UNKNOWN])

CREATION DATE/TIME:13-MAY-1998 23:46:40.00

SUBJECT: DoC Report -- current version

TO: Lisa J. Levin (CN=Lisa J. Levin/OU=WHO/O=EOP [WHO])
READ:UNKNOWN

CC: Victoria ("Victoria=Kader%ExSec%OSEC"@doc.gov [UNKNOWN])
READ:UNKNOWN

CC: Anita McNamee (Anita McNamee <AMcNamee1@doc.gov> [UNKNOWN])
READ:UNKNOWN

CC: edl (edl%ExSec%OSEC@doc.gov [UNKNOWN])
READ:UNKNOWN

TEXT:

Please note: The Secretary has not yet seen and signed this report.

There may be an additional item or two to add, and I will let you know tomorrow if there are any changes. Thanks. jd

May 13, 1998

MEMORANDUM FOR ERSKINE BOWLES

FROM: William M. Daley

SUBJECT: Report for May 18, 1998 - May 22,
1998

I. HOT ISSUES

Secretary Daley's European Trip: From May 17-22, Secretary Daley will be in Europe.

On May 17, the eve of the U.S.- EU Summit, the Secretary will host

the

U.S. Transatlantic Business Dialogue (TABD) dinner in London. The State Department asked that the Secretary use this opportunity to elicit TABD's direct involvement to create a private sector working group to explore best business practices for Cuba. (Pursuant to our April 11 Understanding with the EU on the Libertad Act, we are committed to developing binding disciplines on investment in properties expropriated in a manner inconsistent with international law and to address questions of conflicting jurisdiction, including sanctions.)

At the U.S.-EU Summit, the Secretary will co-chair the Trade Ministerial with USTR Barshefsky.

On May 19, the Secretary will accompany POTUS to Geneva for a speech at the World Trade Organization.

The next day, Secretary Daley will travel to Berlin to participate in events marking the 50th anniversary of the Berlin Airlift, accompanying POTUS and meeting with German Economics Minister Rexrodt.

On the evening of May 22, Secretary Daley will host a reception aboard DOC's RONALD H. BROWN, a state-of-the-art research vessel, for dignitaries attending the Lisbon World Expo '98 as part of the Year of the Ocean activities. Following the Lisbon port of call, the ship will continue its work on the Ocean Atmosphere Carbon Exchange Series project in the Eastern Atlantic.

El Niño Update: The National Oceanic and Atmospheric Administration

(NOAA) recently completed a technical report on the El Niño winter of 1997-98. The report includes information on severe weather events (e.g., California flooding, the northeast ice storm, Florida tornadoes), national maps of temperature and precipitation, satellite images of some storm systems, and records set during the winter months. The report found that, for the United States overall, this winter was the second warmest and seventh wettest of the past century.

NOAA representatives briefed staff members of the Maine Congressional delegation on last January's ice storms, considered the worst ever to cripple Maine and New Hampshire. The storm caused power outages and loss of heat and water for more than a week.

IMF Update: On May 13, the Secretary emphasized the importance of IMF funding in remarks before members of Congress and others at a meeting of the Congressional Economic Leadership Institute.

II. KEY DEPARTMENT NEWS

Secretary Announces Initiatives to Solve Year 2000 Problems: On May 11, Secretary Daley announced that the National Institute of Standards and Technology's Manufacturing Extension Partnership (MEP) centers around the country are stepping up efforts to help smaller manufacturers avoid Year 2000 computer problems. The Secretary made the announcement at an information technology worker shortage town hall meeting in Rockville, MD.

Secretary Daley Announces Initiative to Build Insurance Markets in Developing Economies: On May 6, Secretary Daley announced the new \$2.2 million public/private partnership between the federal government and the U.S. insurance industry to promote the development of open and competitive insurance markets in the emerging economies of Africa, Asia, Latin America, Eastern Europe, and the countries of the former Soviet Union.

Solar Activity Impacts Earth: On May 2, all high-frequency radio communications on the day-lit side of Earth failed for several minutes due to particles from a large solar flare. The National Oceanic and Atmospheric Administration's (NOAA) solar wind monitoring system on NASA's Advanced Composition Explorer (ACE) satellite provided 30 minutes warning of this geomagnetic activity. NOAA notified DOE, NASA, the Nuclear Regulatory Commission, satellite companies, power industry, and others and provided critical early information about the potential extent and impact of this geomagnetic activity. The New York Power Pool expressed its appreciation to NOAA, noting they avoided serious equipment damage due to NOAA's space weather warnings.

U.S.- EU Mutual Recognition Agreement (MRA) Negotiations: The U.S. and EU are preparing for a May 18 signing of the MRA, regarding product testing, although formal implementation of the MRA might be delayed past July 1.

Proposed Revision of Special 301 Process: After consultations with industry, agreement has been reached to produce a three-category list (priority foreign country, priority watch list, and watch list) in next

year's report -- dropping the "other observations" category. Efforts will focus on enhancing a continuous IPR dialogue with foreign government officials throughout the year. The International Intellectual Property Alliance, Motion Picture Association of America, and Recording Industry Association of America have welcomed this initiative and have pledged to continue to provide comprehensive country submissions.

U.S.-EU Trade Initiative: Based on recent European decisions, both sides are now seeking a more modest, pragmatic proposal under the framework of the New Transatlantic Agenda. Commerce International Trade Administration staff submitted the Department's position on trade initiatives with the EU to USTR and a U.S. Government draft text was transmitted to the British and the European Commission.

APEC Trade Liberalization: Commerce International Trade Administration and USTR staff are revising the USG approach to the APEC Early Voluntary Sectoral Liberalization Initiative. The USG is now considering consolidating agreement among the like-minded economies (Australia, Canada, Hong Kong, New Zealand, and Singapore) while continuing discussions with the more reluctant economies.

U.S. Computer Companies Seek Market Share in China: Several U.S. computer companies, including America Online, Netscape Communications, PowerQuest, and Storage Computer Corporation, are participating in the U.S. Computer Industry Trade Mission to Hong Kong, Shenzhen, Guangzhou, Shanghai, and Beijing, China.

301 Investigation into Korea's Market Access Barriers: On May

13-14,

International Trade Administration staff will participate in negotiations with the Government of Korea on market access barriers facing the U.S. auto industry in Seoul. Each of the Big Three representatives and their trade association, AAMA -- the American Automobile Manufacturer Association -- reiterated their unified support for pursuing negotiations under the 301 case.

United States-Azerbaijan Export Control Legal Technical Forum: The Bureau of Export Administration's Non-proliferation Export Control Cooperation Team is holding an Export Control Legal Technical Forum during May 11-15, in Washington, D.C. This forum is designed to assist the Azerbaijani delegation draft an export control law.

Market Impact Committee Mid-Year Meeting: On May 12, Bureau of Export Administration (BXA) staff and representatives from State, will co-chair the mid-year meeting for the National Defense Stockpile Interagency Market Impact Committee (MIC). BXA will review the disposal of stockpile materials by the Defense Department National Stockpile Center to ensure that disposals have not caused, and are not expected to cause, any undue disruption to the usual markets for these materials.

Defense Trade Barriers Meeting: In conjunction with Defense and U.S. embassies in Europe, the Bureau of Export Administration and the International Trade Administration developed a draft report and inventory of trade barriers for U.S. defense industry sales to European markets. On May 12, the Aerospace Industry Sector Advisory Committee discussed the

paper and forwarded it to Secretary Daley. This is in part a response to a European Defense Industry Group report regarding U.S. barriers to European defense exports to the United States.

Missile Export Control Seminar: Germany will host an Export Control Seminar, sponsored by the Missile Technology Control Regime (MTCR), on May 19-21 in Berlin. This expert-level seminar will focus on export controls and economic cooperation from both a government-to-industry and a government-to-government perspective. It is part of the MTCR's outreach program to non-MTCR countries. Bureau of Export Administration (BXA) staff will provide presentations on "catch-all" controls, brokering, and transfers of intangible technology.

Industrial Capabilities: Bureau of Export Administration (BXA) staff will give a presentation at the annual Army Industrial Base Conference on May 20 in College Park, Maryland. BXA's presentation will focus on the status of its high performance explosives and propellants assessments as well as a number of other industrial base activities of interest to the Army.

Export Control Presentation on the Threat from Ballistic Missiles: On May 8, Under Secretary William Reinsch addressed the Commission to Assess the Ballistic Missile Threat to the United States. The Commission is chaired by former Secretary of Defense Donald Rumsfeld, who was recently appointed to the post by the Director of Central Intelligence under the National Defense Authorization Act of 1997. Reinsch briefed the nine-member group on the challenges the Department faces when balancing export control issues and international competitiveness.

US-China Nonproliferation Discussions: During the week of May 4, the United States and China held nonproliferation discussions in Washington, D.C. Assistant Secretary for Export Enforcement Amanda DeBusk joined other senior USG officials in meetings with Chinese Vice Foreign Minister Zhang. Among the issues discussed was a Memorandum of Understanding on end-use visits to verify that high technology exports are used as stated in Chinese civilian facilities.

Nuclear Fuel License for China: The Bureau of Export Administration (BXA) is reviewing the first license application from a U.S. company to export nuclear fuel to China.

PNGV-Daimler/Chrysler Merger: The Partnership for a New Generation of Vehicles and USCAR, the research consortium of the Big 3 automakers, must determine how they will treat Chrysler in the wake of its proposed merger with Daimler Benz.

Intelligent Manufacturing System Program: On May 11, the National Institute of Standards and Technology announced that it will coordinate U.S. participation in a new international research effort called MISSION, approved by the multilateral Intelligent Manufacturing Systems Program. The research aims at "modeling and simulating environments for designing, planning, and operating globally distributed enterprises."

NOAA-K Polar Orbiting Environmental Satellite Launch: The latest satellite in the Polar Orbiting Environmental Satellite (POES) series,

NOAA-K, was launched from Vandenberg Air Force Base in California on May 13 at 8:52 am PDT. NOAA-K is the first in a series of five satellites with improved imaging and sounding capabilities that will operate over the next 12 years. The satellite also carries search and rescue instruments that are used internationally in locating ships and aircraft in distress.

National Research Council (NRC) Data Buoy Report: Following a decline in funding from other agencies and numerous constituent and Congressional inquiries, NOAA asked the NRC to conduct a study to evaluate the value of the data buoy network for weather services and to recommend a cost-effective strategy for an optimum network. The NRC has completed its review and will release a report on May 14. Highlights of the NRC study include a recommendation that a core network of data buoys be established and maintained.

Annual Bowhead Whale Hunt to Begin: Eskimo whaling captains are set to begin the annual subsistence bowhead whale hunt off the North Slope of Alaska as the whales begin their spring migration. A combined harvest of 67 whales has been allocated each year to United States and Russian villages and the total number of whales taken for years 1998 through 2002 may not exceed 280. We expect that, as in the past, the annual hunt will generate national press and vocal opposition from animal rights organizations.

Florida Quality Award: On May 28-31, the National Institute of Standards and Technology National Quality Program Director Harry Hertz will present the Florida Quality Award during the 1998 Florida Sterling Quality conference. Hertz will lead a workshop entitled "Lessons Learned from the First Decade of Baldrige."

Baldrige Quality Award: June 1 is the deadline for final company applications for this year's Malcolm Baldrige National Quality Award competition.

Economic Development Administration (EDA) Grant Activity: During the week of May 4-8, EDA approved 4 projects for a total cost of \$1.3 million, including \$697 thousand to Kansas City for infrastructure construction work.

Economics and Statistics Administration's (ESA) economic indicators:

ESA releases the following economic indicators during the period May 13 - 20:

5/13: Advance Retail Sales: April 1998

5/14: Manufacturing and Trade: Inventories and Sales: March 1998

5/19: Housing Starts and Building Permits: April 1998

5/20: U.S. International Trade in Goods and Services, March 1998 (Joint Bureau of Economic Analysis/Census release)

III. AGENCY WORK ON PRESIDENTIAL INITIATIVES

Cuba Policy Update: On May 13, the State Department plans to announce the steps that will be take to implement the President's statement of March 20 on expanding the flow of humanitarian aid to Cuba. In accord with the President's statement, direct humanitarian flights to Cuba will be resumed, the export licensing procedures for selling medicines and medical supplies will be streamlined, and remittances to family members in Cuba will be reinstated. The Bureau of Export Administration (BXA) has export control jurisdiction over flights and medical sales. BXA will publish a notice in the Federal Register and put guidelines on its Web site.

High-Tech Worker Event: On May 11, Secretary Daley and Deputy Secretary of Labor Kitty Higgins were joined by Senator Sarbanes and Rep. Morella in an Information Technology Town Hall Meeting in Montgomery County. The forum brought together representatives from business, academia, employee organizations, and state and local governments. They discussed ways to ensure that the country's workforce has the necessary information technology skills.

Meeting with Chinese Premier Zhu Rongji: Under Secretary for Economic Affairs Robert Shapiro returned from his trip to Asia with Councilfor Economic Affairs (CEA) Chair Janet Yellen. In Beijing, Shapiro and Yellen discussed the Asian financial crisis and China's plans for economic reform with Premier Zhu Rongji and other Chinese officials. They also met with leading Chinese economists, the head of the Shanghai Stock Exchange,

and the chairman of the Hong Kong Currency Board.

U.S.-China Energy and Environment Cooperation Initiative: The U.S.-China Energy and Environment Cooperation Initiative, announced during the 1997 Presidential Summit as the First Pillar of Infrastructure Cooperation between the U.S. and China, held its second working level meeting on May 11 to discuss the oil and gas forum, project finance, and several technical cooperation agreements. On May 6, Deputy Assistant Secretary for Basic Industries Michael Copps briefed industry representatives on the accomplishments of this initiative.

Encryption Update: BXA staff briefed the inaugural meeting of the Estonia-US Economic Bilateral Working Group on Encryption and High Performance Computer Export Controls on May 11.

On May 14, in Dallas, Texas, three BXA staff members will host the first full day workshop on encryption held as part of BXA's export seminar program. The workshop will provide participants a complete overview of U.S. encryption policy and licensing procedures and specific guidance on submitting license applications and the review process.

International Fishing Agreements: On May 19, the House Resources Subcommittee on Fisheries Conservation, Wildlife, and Oceans will hold a hearing on proposed Governing International Fishery Agreements (GIFAs) with Latvia and Poland. National Marine Fisheries Service Deputy Administrator Dave Evans is scheduled to testify.

E-Commerce Hearing: The House Commerce Committee has begun a series of Committee and Subcommittee hearings on electronic commerce issues. It

is anticipated that DOC's General Counsel Andy Pincus will be invited to testify at a May 21 hearing regarding a bill sponsored by Rep. Eshoo to promote the use of digital signatures.

IV. NOTABLE CONGRESSIONAL ACTIVITY

Nomination Hearing: The Senate Commerce Committee held a May 5 hearing on the nomination of Deborah K. Kilmer to be Assistant Secretary for Legislative and Intergovernmental Affairs. The hearing went well, with Chairman McCain stating his hope to move the nomination to the floor in the near future.

Minority Business Economic Forum: On May 4, the Secretary joined Sen. Hollings and Rep. Clyburn at an economic forum for minority businesses in Columbia, South Carolina. The Secretary also toured the local Census office, which is currently conducting one of three dress rehearsals of the Decennial Census.

Implementation of the President's Humanitarian Program for Cuba: During the week of May 4, an interagency delegation consulted with members of Congress on the Administration's plans to implement the President's program to enhance U.S. humanitarian aid to Cuba. The consultations were designed to obtain Congressional suggestions to improve the proposed implementation plans, regulation revisions, and industry guidelines.

Third Generation Wireless Standards: On April 22, Representative Morella sent Secretary Daley and Assistant Secretary Irving letters requesting information about the Department's involvement in the standard-setting process for the third generation wireless standards at the International Telecommunication Union. The Secretary and Mr. Irving replied to Representative Morella, with Mr. Irving's response addressing

the substantive issues on the Department's behalf. The letters were delivered to Representative Morella on May 6.

Appropriations Committees Approve First Set of Weather Office

Closures: On

May 6, the National Oceanic and Atmospheric Administration (NOAA) received approval from the House and Senate Appropriations Committees to proceed with a first set of 80 weather office closures. A Federal Register notice will appear shortly. NOAA is currently reviewing the next set of proposed weather office closures (47 offices) that have been approved by the Modernization Transition Committee as part of the weather service modernization and restructuring.

NOAA's Maritime Constituents Host Technology Demonstration: On

May

14 several commercial interests will host a Capitol Hill navigation technology briefing and demonstration designed to help congressional staff understand the importance of NOAA's services to the marine navigation community.

NOAA Testifies on Dungeness Crab Legislation: On May 7, the House Resources Fisheries Conservation, Wildlife and Oceans Subcommittee held a hearing on Dungeness crab legislation. This bill would legislatively grant the three Pacific Coast states the authority to manage Dungeness crab out to the 200 mile Exclusive Economic Zone of the United States. David Evans, Deputy Assistant Administrator for Fisheries, testified for NOAA in support of the bill.

Math and Science: On May 12, National Institute of Standards and Technology physicist and Nobel Prize winner William Phillips co-hosted with

Representative Edele Bernice Johnson a cable program that focused on what the country should do to encourage youth to study math and science.

Fastener Issues: On May 13, National Institute of Standards and Technology Director Ray Kammer will meet with staffers from the Senate Subcommittee on Science, Technology and Space on fastener issues relating to the automotive industry.

Census 2000: On May 5, the Census Subcommittee held a hearing on "Oversight of the 2000 Census: Revisiting the 1990 Census."

International Satellite Reform Legislation: On May 6, the House passed the Communications Satellite Competition and Privatization Act. The bill promotes competition and privatization in the satellite industry.

Inquiry from House Commerce Committee: Representative Bliley, Chairman of the House Commerce Committee, and Representative White sent a letter to the Secretary requesting information about the Department's and the National Telecommunications and Information Administration's (NTIA) involvement in a number of electronic commerce issues. The Secretary's response was delivered to Chairman Bliley on May 6.

Madrid Protocol: On May 5, the House passed the "Madrid Protocol Implementation Act." The bill would implement the Protocol, which would permit a U.S. trademark owner to file for registration in any number of member countries by filing a single standardized application with the U.S. Patent and Trademark Office (PTO). Actual U.S. accession is dependent on resolution of a voting rights issue with the European Commission.

WIPO Copyright Treaties: On May 6, Senate Judiciary Committee

Chairman Hatch introduced the "Digital Millennium Copyright Act." The bill reflects agreements reached between copyright owners and Internet service providers, electronics manufacturers and others on a wide range of issues. Chairman Hatch wants to move the bill "swiftly to passage."

Patent and Trademark Office Patent Fees: On May 6, the House Judiciary Committee approved the "United States Patent and Trademark Office Reauthorization Act, Fiscal Year 1999," as amended by the Courts and Intellectual Property Subcommittee. The bill would adjust FY 1999 patent fees upward to compensate for the expiration of the patent fee surcharge at the end of FY 1998.

Database Protection: On May 12, the House is scheduled to consider the "Collections of Information Antipiracy Act."

Trademark Law and Plant Treaties: On May 13, the Senate Foreign Relations Committee will hold a hearing on a number of Treaties, including the Trademark Law Treaty and the International Convention for the Protection of New Varieties of Plants.

V. SECRETARY'S SCHEDULE

May 14

Meet with Mayor of Grand Forks, ND, regarding last year's flood assistance

Remarks to Africare Ambassadors

Meet with Vice President Mills of Ghana

May 15

Remarks to press concerning trip to Europe
Attend press lunch hosted by Business Week

May 18

Participate in U.S.-EU Summit in London

May 19

Accompany POTUS to Geneva for WTO speech

May 20

Attend Berlin Airlift Event with POTUS and Minister Rexrodt

May 21

Europe TBD

May 22

Travel to Lisbon for Year of the Ocean event

VI. SUB-CABINET SCHEDULE

Deputy Secretary Robert Mallet:

May 15-22: Travel to Africa to participate in the World Economic Forum's Southern Africa Conference and participate in meetings in Namibia, South Africa and the Ivory Coast.

Under Secretary for Export Administration William A.

Reinsch:

May 18: Travel to London to speak at a conference

sponsored by
SMi Ltd on the future of NATO defense technology exchange.

Under Secretary for Oceans and Atmosphere D. James Baker:

May 14-20: Lead U.S. delegation to the International
Whaling
Commission annual meeting, Muscat, Oman.

May 21-23: Attend with Secretary Daley the World Expo -
Year of
the Ocean activities in Lisbon, Portugal.

Acting Under Secretary for Technology Gary R. Bachula:

May 14: Attend Othmer Gold Medal Luncheon in honor of
former
Under Secretary Mary Good in New York, NY.

May 18: Chair a symposium on U.S.-Japan cooperation in
civil
industrial technologies in

Ann Arbor, Michigan, and meet with the Big Three
automakers.

Assistant Secretary for Oceans & Atmosphere Terry D.
Garcia:

May 21: Attend reception for Jack Elrod (author of Mark
Trail)

at House of Representatives, Washington, D.C.

National Institute of Standards and Technology Director Ray

Kammer:

May 18: Featured speaker at the Federation of Materials Societies "Maximizing Return on U.S. Research and Development" conference.

Census Bureau Acting Director James F. Holmes:

May 19: Present a speech on "Census 2000 and Local Communities" at the 52nd Annual Conference of the International Institute of Municipal Clerks in Mobile, AL.

May 21-22: Participate as a panelist on employer datasets at the International Symposium of Linked Employer-Employee Data in Arlington, VA.

VII. MEDIA COVERAGE

Secretarial

Secretary's Visit to Columbia, South Carolina: On May 4, Secretary Daley visited Columbia, SC, highlighting a Manufacturing Extension Partnership success story, Boozer Lumber Company. Local television news covered the event and aired a story.

Dedication of the Ronald Reagan Building: On May 5, Secretary Daley

gave remarks at the Dedication of the Ronald Reagan building. The event was carried live on C-SPAN and was covered in all major newspapers.

USA Today Breakfast Meeting: On May 7, Secretary Daley met with reporters in Roslyn, Virginia, at a breakfast organized by USA Today. The Financial Times ran a story on his remarks regarding IMF funding.

Business Council Meeting: On May 9, Secretary Daley gave a speech to the Business Council meeting in Williamsburg, Virginia. Prior to the speech, the Secretary met with reporters. Reuters ran a story on his remarks regarding the effects on the American economy of an expected surge of imports from Asia.

Trade Mission to Ireland: Secretary Daley's upcoming trade mission to Ireland was cited in an Agence France Presse article.

Sub-Cabinet

NOAA's Forecasting Effectiveness Recognized: On May 8, the National Geographic television special "Storm of the Century" aired on NBC. The special examined the well-forecast Superstorm of March 12-14, 1993, its impact, and the public's response.

Tsunami Exhibit in Hawaii: On May 9, the National Weather Service Pacific Region and Pacific Tsunami Warning Center sponsored an exhibit at

the Ewa Beach Limu Festival -- an event hosted by the Ewa Beach, HI, business community. The event attracted several hundred local residents and was covered by local media.

Algal Blooms in the News: National Public Radio ran a four-part series on harmful algal blooms May 4-7. It mentioned NOAA's Coastal Ocean Program's Ecology and Oceanography of Harmful Algal Blooms (ECOHAB) research program and also interviewed several ECOHAB researchers.

Jim Dorskind

Director, Executive Secretariat

Office of the Secretary, U.S. Department of Commerce

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RECORD TYPE: PRESIDENTIAL (TRP NOTES MAIL)

CREATOR: James A. Dorskind ("James A. Dorskind" <JDorskind@doc.gov> [UNKNOWN])

CREATION DATE/TIME: 19-MAY-1998 23:11:44.00

SUBJECT: Apparently the problem is that the doc. is too long--

TO: Lisa J. Levin (CN=Lisa J. Levin/OU=WHO/O=EOP [WHO])

READ: UNKNOWN

CC: edl (edl%ExSec%OSEC@doc.gov [UNKNOWN])

READ: UNKNOWN

TEXT:

This is much as I can send in one document; the rest follows in another document.

May 19, 1998

MEMORANDUM FOR ERSKINE BOWLES

FROM: Jim Dorskind for
Secretary William M. Daley

SUBJECT: Report for May 25 - May 29, 1998

I. HOT ISSUES

Economic Sanctions Announced Against India: On May 13, the President announced sanctions against India under section 102 of the Arms Control Export Act, also known as the Glenn Amendment. On May 15, Under Secretary Aaron and Under Secretary Reinsch met with 200 business representatives to discuss the impact of India sanctions on the business community. Representatives from Treasury, OPIC, State, AID, EXIM, TDA, and Agriculture also participated. DOC's International Trade Administration has established a Sanctions Hotline and is preparing an interagency contact list and a Frequently Asked Questions sheet to be posted on its website. Under Secretary Aaron also held a meeting on the sanctions' impact with Enron, the largest U.S. investor in India.

Response to India's Nuclear Tests: The recent nuclear weapons tests in India have triggered an interest in the National Oceanic and Atmospheric Agency's (NOAA) Hysplit capability. The Department of Defense and the Comprehensive Test Ban Treaty Organization's International Data Center have adopted the NOAA's dispersion forecast model to predict the path of any radioactive materials emitted into the atmosphere as a result of India's nuclear tests. So far, there is no evidence of a significant leak to the atmosphere.

Mexican Beer Labeling Issue: Following a May 7 meeting between Secretary Daley and Mexican Secretary of Commerce Blanco, Blanco's deputy, Mexican Under Secretary Jaime Zabudovsky, provided oral assurances on May 13 to Under Secretary Aaron that the problem would be resolved. Miller beer is now being exported across the border; Stroh's reports that it still faces obstacles (linked to Mexico's labeling requirements), but this

situation should be resolved in the next two weeks. On May 18, Stroh's received its trademark for "Schaefer Light," which should expedite the resumption of "Schaefer Light" exports.

Secretary Daley in Europe May 17 - May 22:

Secretary Daley and USTR Barshefsky co-chaired the Trade Ministerial with the EU in London. The Secretary urged his European colleagues to match our sanctions on India, to keep up the pressure on India while preventing the Indians from switching to alternate suppliers. Secretary Daley also hosted a U.S. TransAtlantic Business Dialogue dinner on May 17, to elicit TABD's direct involvement to create a private sector working group to explore best business practices for Cuba. (Pursuant to our April 11 Understanding with the EU on the Libertad Act, we are committed to developing binding disciplines on investment in properties expropriated in a manner inconsistent with international law and to address questions of conflicting jurisdiction, including sanctions.)

Secretary Daley also accompanied President Clinton to the second World

Trade Organization ministerial meeting in Geneva, May 18-20, with May 19 reserved for a celebration of the 50th anniversary of the GATT system. Later in the week, the Secretary will participate in events commemorating the 50th Anniversary of the Berlin Airlift on May 20 at the International Aerospace Exhibition (ILA '98) in Berlin.

Emergency Response to Mexican Fires: Large fires burning on the Yucatan Peninsula are emitting a smoke cloud that is seriously affecting Florida, Texas, and other states. The National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory's (ARL) HYSPLIT modeling capability is being used extensively by state authorities and researchers to help manage the crisis. The Environmental Protection Agency (EPA) requested assistance from NOAA's Hydrometeorology Prediction Center to forecast wind trajectories over Mexico and into the United States.

El Niño Update: On May 27, NOAA plans to provide a wrap-up of the 1997-1998 El Niño event and its effect on the Nation's weather patterns. Secretary Daley is expected to kick-off the press conference, which will take place at the National Press Club, with remarks about the impact of El Niño on the economy.

IMF Update: Nothing new to report.

II. KEY DEPARTMENT NEWS

Secretary Daley Announces Initiative to Build Insurance Markets in Developing Economies: In a keynote address before the 52nd annual International Insurance Day Luncheon in New York, Secretary Daley announced the formation of the International Insurance Technical Assistance

Partnership (IITAP). The IITAP program is a \$2.2 million public-private partnership between the USG and the U.S. insurance industry. The USG contribution to the partnership is USAID matching funding of approximately \$1.1 million and Department of Commerce management. The partnership's mission will be to promote the development of open and competitive insurance markets in emerging economies, thereby creating commercial opportunities for U.S. insurance providers.

U.S.-Japan Enhanced Initiative on Deregulation: On May 15, President Clinton and Prime Minister Hashimoto announced at Birmingham, England, this year's impressive accomplishments under the Enhanced Initiative on Deregulation and Competition Policy. Japan has committed to undertake a package of substantial deregulatory measures in telecommunications, medical devices and pharmaceuticals, financial services, housing, and structural issues (distribution, transparency, and government practices). Commerce leadership in the medical device and pharmaceuticals sector has yielded a package of far-reaching deregulatory measures which should promote faster introduction of innovative, cost-effective American products into Japan's market.

Defense Trade Advocacy Success in the United Arab Emirates: On May 12, Vice President Gore and United Arab Emirates (U.A.E.) Crown Prince Khalifa bin Zayed Al Nahyan announced the selection of the Lockheed Martin F-16 as the winner of the U.A.E. advanced fighter competition. This program will provide up to 80 F-16 aircraft worth \$8 billion. This is considered to be the last major international fighter competition this century and has been the number one priority defense trade advocacy project pursued by the USG. Lockheed Martin estimates that the project will generate directly 100,000 man-years of employment. USG advocacy has included former Secretary Brown, Secretary Daley, Vice President Gore, and President Clinton.

High-Tech Worker Event: On May 11, Secretary Daley joined Senator Sarbanes and Rep. Morella for an Information Technology Town Hall Meeting in Montgomery County, MD. Representatives from business, academia, employee organizations, and state and local governments came together to discuss ways to prepare the country's workforce with the necessary information technology skills. At this event, the Secretary announced that the National Institute of Standards and Technology's Manufacturing Extension Partnership (MEP) centers around the country are stepping up efforts to help smaller manufacturers avoid Year 2000 computer problems. This was the first in a series of four events announced by the Administration in January to discuss these issues.

Semiconductor Industry Measurements: On May 26, the National Institute of Standards and Technology (NIST) will release the first major study ever done of measurement-related costs in the U.S. semiconductor industry. The report by a NIST contractor is a milestone in economic

analyses about a particular industry's costs in acquiring the measurement capability needed to compete globally and the corresponding portion of industrial investment that NIST has the opportunity to leverage. The study indicates a current annual investment rate of about \$3 billion, with expenditures expected to grow at 15 percent annually and reach \$5.5 billion in 2001.

Grand Forks Flood Recovery: On May 14, Mayor Pat Owens and 30 businesses and civic leaders from Grand Forks, North Dakota, met with Secretary Daley and Assistant Secretary for Economic Development Singerman to express their appreciation for Economic Development Administration (EDA) grants after the floods of 1996. The EDA grants were catalysts for much of the private/public partnership for rebuilding.

Technical Working Group Meeting: There will be a Technical Working Group (TWG) meeting on May 20 to review the current Wassenaar controls in Category 9--propulsion systems, space vehicles, and related systems. Industry, the Departments of Commerce, Defense, and State and the Arms Control and Disarmament Agency will be participating. The TWG will be reviewing all of the gas turbine engine related entries for possible future action.

Defense Trade Advocacy - EUROSATORY Defense Trade Show: On June 1, Bureau of Export Administration (BXA) staff will speak about BXA's defense trade advocacy program at a conference organized in Paris by the Association of the U.S. Army. Among the audience will be the 80 U.S. industry exhibitors at the EUROSATORY defense trade show, the world's largest land defense exhibition. BXA has managed the advocacy program for these exhibitors in conjunction with embassy-based Defense and Commercial Service staff. There are competitions of \$5 billion to \$7 billion underway for U.S. companies for tanks, air defense systems, and vehicles that will receive advocacy during this show.

Defense Industry Merger and Consolidation Panel: On May 21, Bureau of Export Administration (BXA) staff will speak at the University of Maryland in a Department of Defense-sponsored Industrial Capabilities Conference. The focus will be on the industrial base impact of defense industry mergers on industrial planning. The BXA presentation will also highlight initiatives with NATO and the European Union that address assurance of supply issues arising from globalization, merger activity, and associated technology transfers.

Proposal for U.S./China Satellite Development: China Aerospace Corporation has issued a request for proposals for cooperation with China in designing and manufacturing large satellite platforms similar to current U.S. state of the art communications satellites. All four major U.S.

manufacturers are interested in this program, as are the three major European manufacturers. This transaction would require a transfer of satellite design and production data and would be under Department of State jurisdiction. Since State has been unwilling to license such exports in the past, the U.S. parties are developing alternative proposals that are strong on hardware exports with minimal "goals" for subsystem development and manufacturing in China.

Deemed Export Outreach: In response to recent press coverage regarding increasing employment of high-skilled foreign workers in the United States, the Bureau of Export Administration (BXA) will be mailing letters to a number of companies that frequently hire foreign workers. We are notifying them of possible obligations they may have under the Export Administration Regulations. The letters will remind recipients of the "deemed export rule," that a transfer of technical data to a foreign national in the United States may be deemed an export and require BXA authorization, and offer various services to assist employers in understanding and complying with the requirements.

BXA Team Travels to China: During the week of May 26, the Bureau's Chief Counsel and an Export Enforcement officer will travel to China to meet with Chinese officials to discuss end-use verification visits for products such as high performance computers exported to China under license.

US-Northern Ireland Joint Board: DOC staff will convene a May 29 Belfast meeting of the US-Northern Ireland Joint Board -- an advisory body to DOC and the Northern Ireland Industrial Research and Technology Unit under our MOU on Technology Cooperation with Northern Ireland. DOC staff will also meet in Dublin with the Irish government about the RADIANT program (Research and Development Ireland and North America) which is funded by the International Fund for Ireland to discuss an electronic commerce network to facilitate R&D cooperation under the RADIANT program.

Nuclear Reactor: On May 26, the National Institute of Standards and Technology (NIST) plans to announce in a NIST Update item that NIST has demonstrated the feasibility of a new method for evaluating microstructural changes in nuclear reactor power vessels exposed to radiation. The Nuclear Regulatory Commission wants to use the technique to help keep older reactors safely in service.

Weather Office Closure Notice: On May 12, the National Oceanographic and Atmospheric Administration (NOAA) published a final certification notice for the consolidation and/or automation and closure of 80 Weather Service Offices (WSOs) in the Federal Register. The National Weather Service will now begin closing the designated offices.

NOAA-15 Satellite Successfully Launched: The latest satellite in the Polar Orbiting Environmental Satellite (POES) series, NOAA-15, was launched from Vandenberg Air Force Base in California on May 13. NOAA-15 will replace NOAA-12, launched in May 1991. NOAA-15 is the first in a series of five satellites with improved imaging and sounding capabilities that will operate over the next 12 years.

Natural Disasters Planning: NOAA representatives attended the May 15 strategy session of the Federal Emergency Management Agency's Project Impact in Chicago. This Project focuses on creating communities that are better able to withstand future disasters.

U.S. Navy and NOAA Survey Civil War Battleship MONITOR: The United States Navy and NOAA will carry out a state-of-the-art laser line scanner survey of the MONITOR site in early June. The MONITOR, which was the first fully iron-clad battleship, sunk during the Civil War and presently lies in 230 feet of water 16 miles southeast of Cape Hatteras, NC. With the help of NOAA, the Navy's NR-1 submarine will generate images of the MONITOR and its surroundings. This information will be used to develop a detailed plan to stabilize the historic ship's hull and recover selected historical artifacts.

Coho Salmon: The National Marine Fisheries Service (NMFS) received a 60 day notice of intent to sue for the protection of coho salmon under the Endangered Species Act (ESA) from Redwood Coast Watersheds Alliance and Coast Action Group. Also named as codefendants in the notice are the California Department of Forestry, Louisiana-Pacific Corporation, and California Department of Fish and Game. The organizations intend to file an action to enjoin the take of coho salmon (central California coast and southern Oregon/northern California coasts) that is occurring and will occur as a result of Louisiana-Pacific Corporation's timber operations in northern California.

Texas Shrimp Association, et al. v. Daley: A suit was filed in United States District Court challenging final regulations implementing an amendment to the Gulf of Mexico Shrimp Fishery Management Plan. Effective May 14, the regulations required shrimpers to use Bycatch Reduction Devices (BRDs) in their trawl nets. In their complaint, the plaintiffs allege that the regulations violated the Magnuson-Stevens Fishery Conservation and Management Act, Regulatory Flexibility Act, and the Administrative Procedure Act. They claim that the National Marine Fisheries Service used faulty science that seriously underestimated the economic impacts of the BRD requirement and that the agency unfairly burdened shrimpers in favor of red snapper fishery.

Texas Tornadoes Disaster Survey Assessment Report: On May 20,
NOAA

will release the service assessment team report on a series of tornadoes that struck central Texas in May 1997. Overall, the National Weather Service (NWS) provided warnings in sufficient time for people to take action; however, there are a number of management recommendations to be implemented in response to issues identified in the Austin/San Antonio office operations. A local briefing in Texas for emergency managers and the media is planned for May 20. NWS will also conduct a briefing for Congressional staff.

Public Service Announcements (PSA) for NOAA Weather Radio: The Vice President videotaped two PSAs on the use of NOAA Weather Radio, which will be available for the opening of hurricane season on May 28. NOAA expects to have Deputy Secretary Mallet announce the availability of the PSAs during the hurricane season press conference, on May 27, in Florida.

Global Record Heat Continues in 1998: Preliminary data from NOAA's National Climatic Data Center (NCDC) show that the Earth's mean surface temperature has been at record levels from January through April 1998. The United States had about normal mean temperatures for April, but precipitation was at near record levels. NOAA is working with the Office of Science and Technology Policy to include an announcement of these record temperatures in an upcoming Vice Presidential speech.

Large Area Artificial Reefs Concern Navigators: NOAA's Marine Chart Division continues to address the issue of controversial artificial reef sites (e.g., sunken ships around which reefs are growing) in the Florida coastal areas. Several reefs are sited in missile test areas, severely compromising vessel traffic safety. To raise awareness of this issue, NOAA experts provided a briefing for interested parties.

Recreational Nautical Chart Focus Group Meeting: On May 14-15, NOAA staff attended the Recreational Nautical Chart focus group held at Mote Marine Laboratory in Sarasota, FL. At the meeting, there was a brainstorm session to address how the NOAA chart products might be improved to better serve the needs of recreational boaters and environmental managers.

Navigation Conference to be Hosted at NOAA: On May 22, a conference entitled: "Navigating the Uncertain Waters of the 21st Century: The Role of New Technologies in Building a Reliable and Secure Maritime Infrastructure" will be held at the NOAA Auditorium in Silver Spring, MD.

SHOALS Demonstration Flight: On May 19, at a signing ceremony for a partnership between the Navy and the Army Corps of Engineers for the Scanning Hydrographic Operational Airborne Lidar Survey (SHOALS) program,

the NOAA Aircraft Operations Center helicopter flew a demonstration flight out of Mobile, AL. The flight demonstrated the SHOALS mapping technology to Navy officials.

Final Regulations for Data Collection Systems Published: On May 6, the final regulations on the use of the NOAA Satellite-based Data Collection Systems (DCS) were published in the Federal Register. The regulations will become effective on June 5.

National Weather Service (NWS) Forecasters Participate in International Tropical Cyclone Workshop: Meteorologists from the National Hurricane Center in Miami and the Central Pacific Hurricane Center in Honolulu were among more than 100 delegates attending the Tropical Cyclone Workshop held in Haikou, China.

Discussions with Canada on the Radarsat-2 Mission: On May 12, Canadian Space Agency (CSA) representatives visited Washington to provide a briefing to the National Air and Space Agency and NOAA on the RADARSAT-2 program. RADARSAT-2 is a Canadian government/industry partnership to provide diverse environmental monitoring applications.

Economic Development Administration (EDA) Grants: During the week of May 11-15, EDA approved 13 projects for a total cost of \$11.8 million.

Economics and Statistics Administration Economic Indicators Release Dates:

5/28: Gross Domestic Product, 1st quarter 1998 (preliminary), and Corporate Profits, 1st quarter 1998 (preliminary)

5/29: Personal Income and Outlays: April 1998

6/01: Value of New Construction Put in Place: April 1998

6/02: Gross State Product, 1993-96 (BEA)

6/02: New One-Family Houses Sold and For Sale: April 1998

6/03: Housing Completions: April 1998

6/04: Manufacturers' Shipments, Inventories, and Orders:

April
1998

III. AGENCY WORK ON PRESIDENTIAL INITIATIVES

Northern Ireland Trade Mission Delegation Announced: Secretary William M. Daley announced the participants for the business delegation that will accompany his Secretarial Trade Mission to Northern Ireland and the Border Counties. Eighteen companies will be represented from a variety of fields, including aerospace, environmental technology, medical technology and pharmaceuticals, software, telecommunications and information technologies, agriculture and food processing, and consumer goods.

Meeting with PRC Ambassador Li Zhaoxing: Commerce has been working with other USG agencies and the private sector to develop potential initiatives in the areas of aviation, housing, and insurance that could be announced during the Presidential summit in June in China. U/S for International Trade Aaron met with PRC Ambassador Li on May 13 to press for commercial announceables prior to the Summit. While acknowledging the success of several American companies involved in recent project competitions, the Under Secretary urged swift consideration on a number of pending deals in the energy, aviation, insurance, and telecommunications sectors, among others. Under Secretary Aaron provided Li with a courtesy copy of Secretary Daley's letter to Aviation Minister Chen, proposing closer U.S.-China cooperation in the aviation sector as a Summit announceable.

Encryption Update: On May 20, the Interagency Working Group (IWG) on cryptography policy will meet to discuss implementation of the "autolist," a vehicle to streamline the licensing process by not referring export license applications for autolist items to the other agencies for review. Commerce has faxed IWG members a final version

of the autolist, along with administrative procedures on how it will be implemented and updated. The IWG will also consider Commerce's proposal to allow autolist processing of strong recovery-capable products when exported to U.S. subsidiaries and banks.

IV. NOTABLE CONGRESSIONAL ACTIVITY

U/S Aaron Testifies On China Trade Policy: On May 14, U/S Aaron testified on China trade policy before the House Commerce Subcommittee on Telecommunications, Trade, and Consumer Protection. After summarizing his recent dialogue with Chinese leaders and his trade mission to China and the Hong Kong SAR, the Under Secretary shared his views on the strategic choice China must make in its reform efforts and on likely commercial developments in the lead up to the Summit.

Satellite Exports to China: House International Relations and National Security Committee staffs have requested a meeting the week of May 18 to discuss the scope of their document requests on certain satellite export licenses to China. Also, the Senate Governmental Affairs Committee has scheduled a hearing on satellite exports to China for May 20 -- no Commerce witness has been requested. In addition, there have been numerous Chinese-related amendments, including satellite amendments, filed on the House DOD reauthorization bill. There are also two amendments regarding the status of Hong Kong that would affect its export control status.

Immigration Policy: On May 18, the Senate passed the Hatch/Abraham bill that would temporarily increase the H-1B visa cap for non-immigrant workers. The Administration has indicated that, without specific reforms (requiring efforts to recruit Americans and commitments not to replace Americans with H-1B visa holders), the Secretary of Labor would recommend a veto of the bill. The House Judiciary Committee did not proceed to mark up Rep. Smith's House bill, which includes the Administration's proposed reforms of the H-1B program, but does not include any additional support for training.

House Budget: Chairman Kasich circulated a draft budget document that included dismantlement of the Commerce Department. Commerce provided talking points and background to OMB Director Raines, and Secretary Daley made calls to members of Congress.

Technology Transfer Bill: On May 13, the House Science Committee met to consider HR 2544, introduced by Rep. Morella. The bill was amended during markup to incorporate all of the principal changes suggested by the Commerce-lead Interagency Working Group on Technology Transfer. A letter submitted by Commerce on behalf of the Administration prior to the hearing also expressed the desire to continue working with

the committee to ensure the Tauscher amendment to the bill, calling for executive branch review of the Cooperative Research and Development Agreement approval process, does not unduly complicate that process.

International Satellite Reform Legislation: On May 6, the House passed the Communications Satellite Competition and Privatization Act. The bill, sponsored by Commerce Chairman Bliley and by Rep. Markey, ranking Telecommunications Subcommittee member, rewrites the Satellite Act of 1962, which established the current global satellite communications system. The bill moves to privatize the two international satellite groups, INTELSAT and Inmarsat, to encourage competition in the global market. Senate Communications Subcommittee Chairman Burns is expected to introduce international satellite reform legislation in the coming weeks. However, there does not seem to be consensus within the Senate Commerce Committee on a companion bill.

GAO Review of International Science and Technology Agreements: On May 14, Commerce staff met with GAO officials to discuss the costs associated with international Science and Technology (S&T) agreements and the types of international S&T activities undertaken by Commerce. GAO is gathering facts and will go back to the House Science Committee for further guidance on the types and quantity of information needed in its upcoming study.

Database Protection: On May 19, the House is expected to consider the "Collections of Information Antipiracy Act," under suspension of the rules. The Administration has not taken a position on the bill.

Copyright Infringement: On May 21, the House International Relations Subcommittee on International Economic Policy and Trade will hold a hearing on protecting intellectual property in the music and film industries, at which DOC's Patent and Trademark Office will testify.

Senate Resolution on Commercial Whaling: On May 8, the Senate unanimously adopted resolution urging the NOAA-led United States delegation to the annual meeting of the International Whaling Commission (IWC) in Oman to oppose the resumption of commercial whaling and "scientific whaling."

Commerce Named as Member of Advisory Commission on Drought Emergencies: On May 6, Commerce was named as one of 16 members of a National Drought Policy Commission by the House Transportation and Infrastructure Committee.

NOAA Testifies on Algal Blooms and Gulf of Mexico Hypoxia: On May 20, Assistant Secretary for Oceans and Atmosphere Terry Garcia testified before the Senate Subcommittee on Oceans and Fisheries. His testimony focused on the Harmful Algal Bloom Research and Control Act of 1997 and the issue of hypoxia in the Gulf of Mexico, which has created a "dead zone," void of normal marine plant and animal species.

V. SECRETARY'S SCHEDULE

May 18-22

In Europe to participate in U.S.-EU Summit, World Trade Organization meetings in Geneva, event to commemorate the 50th anniversary of the Berlin Airlift with German Economics Minister Rexrodt, and Year of the Ocean event in Lisbon, Portugal.

May 26

Meeting with Census 2000 Advisory Committee member Ann Azari (Mayor of Fort Collins, CO).

Attend NEC Meeting on Corporate Merger Activity.

Meeting with Reverend John P. Minogue, President of DePaul University.

May 27

Meeting with Ed Noha, Chairman of CNA Financial Corporation

Meeting with Stephen Brown, Chairman and CEO of John Hancock Insurance

May 28

Luncheon Speech to Executive Club of Chicago.

VI. SUB-CABINET SCHEDULE

Deputy Secretary Robert Mallet:

May 15-22: Attend the World Economic Forum Southern Africa Conference and participate in meetings in Namibia, South Africa, Angola, and the Ivory Coast.

Under Secretary for Export Administration William A. Reinsch:

May 28: Speak to the Export Controls Committee of the American Electronics Association, in Washington, D.C.

Under Secretary for Oceans & Atmosphere D. James Baker:

May 28: Attend Pre-Hurricane Season Press Conference at Tropical Prediction Center, Miami, FL.

Assistant Secretary for Oceans & Atmosphere Terry D. Garcia:

May 26: Attend Edwards Dam Signing Event, Augusta ME.

May 27-29: Attend meetings on the Mid-Columbia HCPs, Tribal Visits, and Salmon Recovery, Puget Sound area, WA.

Assistant Secretary for Economic Development Phillip Singerman:

May 26-28: Speak at the Seattle Regional Office annual conference in Las Vegas, NV.

May 28-29: Speak at the Austin Regional Office annual conference in New Orleans, LA.

Assistant Secretary for Communications and Information Larry

Irving:

May 28: Address to Harvard Conference on Internet and Society,
Cambridge, MA.

Minority Business Development Agency Director Courtland Cox:

May 18: Deliver remarks and participate in an MOU signing ceremony
with the Burger King Corporation (BKC) to increase minority franchise and
purchasing opportunities at BKC's Diversity Action Council meeting in El
Paso, Texas.

VII. MEDIA COVERAGE

Secretarial

US-EU Summit in London: Secretary Daley is in Europe this week to
attend the US-EU summit in London, the anniversary celebration of the WTO
in Geneva, a commemorative event marking the anniversary of the Berlin
Airlift, and to participate in the inauguration of the US pavilion at the
Lisbon Expo 98, which is dedicated to the Year of the Ocean. All of these
events are generating or are expected to generate substantial media
coverage.

Helms-Burton Legislation: Dow Jones filed a story on May 18
suggesting that the United States and the EU were close to a deal on the
Helms-Burton legislation, which penalizes European countries for doing
business with Cuba. The story mentions that Commerce Secretary William
Daley, interviewed by the BBC, said that US negotiators have been in close
contact with the Hill to ensure that a deal would be acceptable to
Congress. Daley also noted that whatever was agreed between the US and the
EU in London would still need to be approved by individual EU countries.

Corporate Mergers: Secretary Daley has been named to a "top level
intra-agency committee to review the recent wave of corporate mergers, to
ensure that consumers and competition do not suffer from the trend," The
Financial Times reported on Thursday, May 14, 1998.

Encryption Bill: The New York Times carried a story on May 13 on
a
new encryption bill introduced in the Senate. The article mentioned
Secretary Daley's concern that American software companies are conceding
ground to foreign competitors.

Manufacturing Extension Partnership Network: Industry Week
carried a
story on May 12 on Secretary Daley's announcement that the Manufacturing
Extension Partnership network, under the National Institute of Standards
and Technology, will be holding seminars to help manufacturers with their
Year 2000 problems. The Associated Press also filed a story on the same

topic.

Sperling Breakfast Press Conference: At the Sperling Breakfast on May 13, Secretary Daley answered a broad range of questions from the press. The Financial Times correspondent attending the breakfast wrote an article on the Secretary's response to sanctions imposed on India by the Clinton Administration.

Sanctions on India: On May 14, USA Today published a story on the sanctions imposed on India by the United States. Secretary Daley was cited as saying that \$10 billion in projects are at risk. Reuters, New York Times, The Wall Street Journal, and other news services all cited the Secretary in their stories on the sanctions.

RECORD TYPE: PRESIDENTIAL (TRP NOTES MAIL)

CREATOR: James A. Dorskind ("James A. Dorskind" <JDorskind@doc.gov> [UNKNOWN])

CREATION DATE/TIME:15-JUL-1998 22:11:49.00

SUBJECT: DoC Weekly -- note Secretary has not yet seen this. Thx.

TO: Lisa J. Levin (CN=Lisa J. Levin/OU=WHO/O=EOP [WHO])
READ:UNKNOWN

CC: Jon P. Jennings (CN=Jon P. Jennings/OU=WHO/O=EOP [WHO])
READ:UNKNOWN

CC: edl (edl%ExSec%OSEC@doc.gov [UNKNOWN])
READ:UNKNOWN

CC: Jim Doyle (Jim Doyle <JDoyle@doc.gov> [UNKNOWN])
READ:UNKNOWN

CC: Victoria Kader (Victoria Kader <VKader1@doc.gov> [UNKNOWN])
READ:UNKNOWN

TEXT:
July 15, 1998

MEMORANDUM FOR ERSKINE BOWLES

FROM: Secretary William M. Daley

SUBJECT: Report for July 20 - July 26, 1998

I. HOT ISSUES

Florida Fires: State and Federal agencies have asked the National Weather Service (NWS) to increase its support of crews fighting the forest fires in Florida. Incident Meteorologists (IMETs) from several NWS regions are providing on-site weather support for Florida fire fighters. The NWS Southern Region Headquarters has established a 24-hour Fire Support Center, which will remain in operation until the fires are out. Southern Region staff have also established a dedicated web page, which contains satellite imagery and radar data covering the threat areas, specific fire weather forecasts for the state, long-range weather outlooks, status of fire weather staffing, and incident situation reports.

NWS personnel from the National Headquarters, Southern Region Headquarters, Climate Prediction Center, and the Hydrometeorological Prediction Center provided a weather briefing to members of the White House Press Corps in preparation for the President's July 9 visit to Florida fire sites.

Florida Fireworks Ban: Hours before the Independence Day holiday, the National Climatic Data Center (NCDC) was contacted by the U.S. Forest Service (USFS) to provide weather summaries for the past several months for Florida. The USFS was involved in a successful effort to uphold a ban on the selling of fireworks in Florida over the Independence Day holiday. An association of fireworks distributors and manufacturers had requested an emergency hearing to have the ban lifted. The NCDC responded by sending drought indices, temperature, and precipitation data for Florida's climate divisions, plus other current and historic information relative to Florida's climate.

IMF Update: Nothing to report.

II. KEY DEPARTMENT NEWS

Secretary Daley's Visit to Connecticut: On July 13, Secretary Daley spoke before the Middlesex Chamber of Commerce in Connecticut. The Secretary's speech highlighted the importance of Connecticut exports nationally and locally. The Secretary also toured NQ Environmental, Inc., and discussed how the Export Assistance Center has helped the company succeed.

U.S.-EU Cooperation on TEP and China: On July 7, Secretary Daley met with Sir Leon Brittan, EU Vice President for External Relations, to discuss the U.S.-EU Transatlantic Economic Partnership (TEP) initiative, China's WTO accession process, advancing the Transatlantic Business Dialogue, and specific issues related to industrial fasteners and metric labeling. Secretary Daley and Vice President Brittan agreed that it was important to proceed quickly with the TEP, and Secretary Daley suggested the development of a set of commercially valuable deliverables in time for the U.S.-EU Summit in November.

Meetings with African Ambassadors: Secretary Daley met with Ambassador Chemai of Kenya, and Deputy Secretary Mallet met with Ambassador Sempala of Uganda. Both meetings dealt with the Africa trade legislation and plans for the Secretary's Africa commercial development mission in September, which will focus on convening a regional dialogue with his counterparts and the private sector.

Commerce Support for Vice President's Visit to Russia and Ukraine: DoC staff are developing trade and investment briefing information for Vice President Gore's meetings with Ukraine President Kuchma on July 22 and Russian Prime Minister Kirenko on July 24.

Preparations for Gore-Mbeki Binational Commission Meeting: DoC staff are working with the Vice President's Office on preparations for the U.S.-South Africa Binational Commission meeting in August. The two vice presidents intend to deal specifically with trade issues. Secretary Daley chairs the U.S. side of the binational Business Development Committee.

OECD Anti-Bribery Agreement: During the week of June 29, DoC staff attended meetings of the Organization of Economic Cooperation and Development Working Group on Bribery in Paris. While the overall results were generally disappointing, many countries have made progress toward ratifying and implementing the Antibribery Convention. Nine countries have submitted the Convention to their legislatures for ratification, while

eight countries have submitted draft legislation. Most countries anticipate meeting the December 31 deadline for entry-into-force set by ministers last year.

Free Trade Area of the Americas (FTAA) Business Facilitation Measures: DoC and USTR have requested the private sector to help identify key business facilitation measures in the FTAA. The USG has prepared a priority list, which will be the focus of the next Trade Negotiations Committee meeting, to be held December 2-3 in Suriname.

Honduras' Trade Benefits Restored: The USG recently published a Federal Register Notice announcing the restoration of Caribbean Basin Initiative and Generalized System of Preferences benefits to Honduras, which had been partially withdrawn since April for intellectual property rights (IPR) violations, specifically television broadcast piracy. DoC staff will continue to work closely with other agencies and U.S. industry to monitor Honduras's protection of IPR. DoC staff will also work with the Government of Honduras to complete the bilateral IPR agreement and to ratify the already signed Bilateral Investment Treaty.

Commitment to Haiti: From July 13-16, Under Secretary for International Trade Aaron is visiting Haiti to highlight the USG commitment to helping Haiti improve its commercial environment and to stress the critical role the private sector and government will play in the recovery process. The Under Secretary announced a number of DoC deliverables, including the posting of a Senior Commercial Officer in Port au Prince, and he will scout possible events/deliverables for the First Lady's trip planned for the end of September.

Polish Prime Minister Visit: On July 10, Under Secretary for International Trade Aaron met with the Polish Economic Minister and reinforced the importance of our dialogue with Poland regarding EU accession. He encouraged the Polish government to adopt the pending product liability legislation. The Polish Minister assured him that the legislation would be passed in the next several months.

U.S. Agenda in Europe: From July 9-14, Assistant Secretary for Market Access and Compliance Patrick Mulloy met with French, Austrian, and Organization for Economic Cooperation and Development (OECD) officials and participated in U.S.-EU Senior Level Group events. Meetings with French and Austrian government officials focused on commercial issues, such as approval of genetically modified organisms, preparations for introduction of the euro, and telecom licensing. Meetings in Austria addressed priorities during its EU Presidency, which runs through December 31. OECD meetings focused on the Antibribery Convention, the October E-Commerce Ministerial in Ottawa, and the Muenster Process.

Governor of North Carolina Trade Mission to China: Assistant Secretary for Trade Development Michael Copps met with officials from the Office of the Governor of North Carolina to discuss the state's September

1998 trade mission to China. Copps and staff provided guidance on sectors being considered (telecommunications, energy, transportation, chemicals, and banking) and gave an assessment of our current bilateral relationship.

First Meeting of the BDC Banking and Financial Services Subgroup Held
in Moscow: On July 1-2, Deputy Assistant Secretary for Services Everette James led a delegation of U.S. insurance experts in roundtable discussions with Russian experts at the inaugural session of the U.S.-Russia Business Development Committee's Subgroup on Banking and Financial Services. At the meeting, James announced a \$750,000 technical assistance program for the Russian insurance market under the International Insurance Technical Assistance Partnership announced by Secretary Daley in May.

Massachusetts v. Daley: On June 24, Chief Judge Joseph Tauro of the District of Massachusetts signed an order granting the plaintiff's motion to declare the portion of the Scup Regulatory Amendment, which provides for a state by state summer period allocation of scup, null and void. In a supporting memorandum, Judge Tauro rejected National Oceanic and Atmospheric Administration's use of data from the base period of 1980-1989 as arbitrary and capricious. Judge Tauro did, however, reject the plaintiff's argument that the agency has an affirmative duty to collect relevant information before agency action is undertaken.

Russian Tanker Injures Puerto Rican Coral Reef: On June 21, the 679-ft Russian oil tanker M/V KAPITAN E. EGOROV ran aground approximately one mile off the southern coast of Puerto Rico. The National Oceanic and Atmospheric (NOAA) HAZMAT office immediately provided trajectory and resources-at-risk information. A trajectory analysis determined that the released oil could threaten the coral reef northwest of the grounding site, as well as the Punta Verraco area. The oil might also threaten mangroves in the western arm of Bahia de Guayanilla. The vessel was removed from the grounding site during the early morning of June 25 with no discharge of oil. A biologist for the Commonwealth of Puerto Rico inspected the site and reported substantial areas of crushed coral reef structure. The commonwealth seized the KAPITAN E. EGOROV pending negotiation of a letter of undertaking. NOAA's Damage Assessment and Restoration Program has been asked to provide technical expertise to assess physical injury to the reef.

Potential Failure of GOES-9 Momentum Wheels: On July 6, GOES-9 began experiencing dangerously high levels of current and temperature on its remaining momentum wheel. On July 7, following a teleconference with the National Aeronautics and Space Administration and Space Systems/Loral, GOES-9 was returned to the V2 wheel configuration in an attempt to reduce the temperature and current levels. The operation was performed without incident and is undergoing Image and Navigation Registration recovery.

Both momentum wheels have reached regimes, which have resulted in failure on other Space System/Loral spacecraft. Engineers are working to return the on-orbit spare spacecraft, GOES-10, to full operation by early next week.

Severe Fire Season in Brazil: On July 1, National Environmental Satellite, Data, and Information Service staff participated in an interagency meeting to discuss the recently concluded U.S. Government site visit to Brazil to prepare for the upcoming fire season (July to November).

The meeting focused on an incoming cable from Brazil, which reported on the visit and summarized Brazil's request for assistance during the upcoming fire season. In assisting Brazil, the U.S. remote sensing system will rely on fire products from National Oceanic and Atmospheric Administration's Polar-Orbiting Operational Environmental Satellites Advanced Very High Resolution Radiometer, Geostationary Operational Environmental Satellites, and Defense Meteorological Satellite Program, Operational Linescan Sensor.

Arctic Research Expedition: A team of scientists from East Carolina University just completed a two and a half month expedition in the Chukchi Sea. The research program is funded by several agencies, including the National Oceanic and Atmospheric Administration's National Undersea Research Program (NURP). During the expedition, the Coast Guard Cutter POLAR SEA cut a path through the Arctic ice and provided openings to the seafloor for a variety of sampling equipment, including an underwater robot provided by NURP. Researchers collected bacteria, which will be used in a search for new drugs for combating a range of diseases.

U.S. Sanctions on the Export of Dual-Use Goods to India and Pakistan:

The Bureau of Export Administration is working with an interagency group to develop the lists to be published of Indian and Pakistani government and private entities involved in nuclear, missile, and military activities. Entities on these lists will be subject to a stiff export control policy.

Pastors for Peace to Visit Cuba: On July 6, a Bureau of Export Administration (BXA) representative attended an interagency meeting to discuss U.S. Government actions toward an expected late-July Pastors for Peace visit to Cuba. The meeting was chaired by Treasury's Office of Foreign Asset Control (OFAC). This will be the eighth visit to Cuba by Pastors for Peace. The group is opposed to the U.S. embargo on Cuba and seeks to provoke the U.S. government by exporting varied goods to Cuba in violation of exporting requirements of the Departments of Commerce and Treasury. The group has stated in its literature that it plans to export, among other items, Pentium computers to support mobile libraries. The group plans to depart for Mexico on July 20. U.S. Customs will make a non-confrontational inspection of the goods at the U.S.-Mexico border. Blatant export control violations will be referred to the Justice

Department for prosecution. As was the case with prior Pastors for Peace trips, BXA has delegated export control responsibility to OFAC because of its overriding jurisdiction on this matter.

U.S.- China Export Control Cooperation. On July 6, the Bureau of Export Administration hosted an interagency roundtable and licensing demonstration for a visiting Chinese delegation comprising government export officials. Representatives from the Departments of Commerce, Defense, Energy, and State briefed the Chinese officials on dual-use export licensing practices, dispute resolution, and commodity classification. The Chinese officials also attended BXA Update '98 conference sessions in Washington, D.C.

Experimental Program to Stimulate Competitive Technology: On July 14, the Technology Administration (TA) began soliciting proposals for grant awards under the Experimental Program to Stimulate Competitive Technology (EPSCoT), focused on 18 states and Puerto Rico, which have historically been under represented in USG research and development awards. The Request for Proposals will appear in the Federal Register and the TA's website. Approximately \$1.6 million is available for 1998, and TA anticipates the award of four to six grants.

Export Database: On July 6-8, the National Technical Information Service launched its new "Prohibited Parties Database" at the Bureau of Export Administration Update '98 conference. Using a single keyword search, the new feature allows users to screen export orders before shipment against the government's four "prohibited party" lists.

U.S.-Korea Agreement: Technology Administration (TA) staff are working on the renewal of the U.S.-Korea Science and Technology Framework Agreement. The State Department is relying on TA staff to analyze and draft a response to new intellectual property language suggested by the Koreans. Although scheduled to expire this month, the agreement will likely be extended for six months while renewal negotiations continue.

Daimler-Benz/Chrysler Merger: Recent reports indicate that the Daimler/Chrysler merger will be completed by mid-September. As requested by the Office of the Vice President, the DoC Office of the General Counsel has initiated a multi-agency review of the legal ramifications the merger may have on the USG/industry Partnership for a New Generation of Vehicles.

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July 22

-- Meeting of the National Conference of State Legislators in Las Vegas

July 23-24

-- Travel to UtahVI. SUB-CABINET SCHEDULE

Deputy Secretary Robert L. Mallett:

July 16:Attend Washington Government Relations Group Reception

Attend National Conference Dinner Dialogue Meeting

July 17:Meeting with National Institute of Standards and Technology
Summer Undergraduate Research Fellows

Chair Diversity Council Meeting

July 20:Meeting with Ambassador Veiccoh Nghiwete from Namibia

July 21: Attend Census Regional Directors' Meeting in Boston,
Massachusetts

July 22:Give remarks at the 23rd Annual National Oceanic and
Atmospheric Administration Fish Fry Event
Celebrating the
Year of the Ocean

Under Secretary for International Trade David Aaron:

July 13-16: Meetings with President Preval and other officials
regarding economic development in Haiti

Assistant Secretary for Import Administration Robert LaRussa:

July 27-31: Review of the antidumping order on tomatoes from
Mexico, in
Mexico City

Under Secretary for Oceans and Atmosphere James Baker:

July 25-29: Deliver Commemorative Speech and participate in other
activities at the International Ocean Symposium 1998

Assistant Secretary for Oceans and Atmosphere Terry Garcia:

July 21-26: Lead the U.S. Delegation at the U.N. Food and
Agricultural
Organization Meeting in Rome, Italy

Under Secretary for Economic Affairs Robert Shapiro

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Boston,
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Under Secretary for Technology Administration Gary Bachula (Acting):

July 16: Participate in the Great Lakes Industrial
Technology
"GLITECH" Quarterly Advisory Board Meeting in Cleveland, Ohio

Assistant Secretary for Telecommunications and Information Larry Irving:

July 27: Address Future Shock Anniversary Forum, Marina
del Rey,
California

July 29: Address National Association of Regulatory Utility
Commissioners, Seattle, Washington

July 30: Speak on "Civil Rights Issues in Communications
Law,"
National Bar Association Convention, Memphis, Tennessee

Commissioner of Patents and Trademarks Bruce Lehman:

July 24-25: Speak at the Center for Advanced Study and Research on
Intellectual Property High-Tech Protection Summit, Seattle, Washington

July 31: Speak to a group of 17 professors from Germany, the Czech
Republic, Hungary, and Bulgaria in Crystal City, Virginia.

VII. MEDIA COVERAGE

Secretarial Coverage:

Meeting with USA Today Editorial Board: On July 13, Secretary Daley

met with USA Today editorial board to discuss the importance of the census debate and to persuade them to editorialize on the subject. He also discussed various trade issues.

Interviews at Update '98: During the Bureau of Export Administration's Update '98 conference, Secretary Daley and Under Secretary for Export Administration William Reinsch spoke with reporters about a variety of issues, including high performance computer standards, encryption, sanctions, and general trade policy. The reporters covering Update represented the following news organizations: Reuters, Associated Press, the Washington Post, the New York Times, Bureau of National Affairs, the Washington Trade Daily, the Washington Tariff and Trade Letter, Inside U.S. Trade, and the Federal News Digest.

Census 2000: On July 9, Secretary Daley, and Acting Census Director James Holmes announced that the Census 2000 dress rehearsal was on track. The announcement was carried by several news services and major newspapers, including the Washington Post, the Washington Times, and local newspapers in cities where the dress rehearsals are being carried out. Census 2000 Dress Rehearsals are currently underway in Sacramento, California, Menominee County, Wisconsin, and in Columbia, South Carolina, and 11 surrounding counties.

Fast-Track Legislation: On July 7, Reuters carried a story in which it reported: "A senior Clinton administration official suggested...that congressional Republicans were playing politics by pushing for a vote on fast-track trade legislation before the November elections." The story referred to Secretary Daley. The Secretary was quoted as saying "I don't see that (fast-track), from our perspective, is a good thing to move forward at this point."

Privacy: The Wall Street Journal carried an article in July entitled "The Future of the Net: Don't Sacrifice Freedom for 'Privacy'" by Solveig Singleton, who is director of Information Studies at the Cato Institute. Ms. Singleton challenged Secretary Daley's warning that if companies do not protect their customers' privacy, then Washington will step in. The Secretary is quoted "I don't want to hear any griping or moaning if that happens."

Ms. Singleton stated that "danger to privacy and other rights is best

restricted by limiting the power and scope of government, not by limiting the freedom of businesses to trade information."

China Sanctions: On July 9, the Journal of Commerce carried an article entitled "Daley takes the offensive against sanctions." The article reported that the success of the President's China trip has spurred the Commerce Secretary to take on Congress over "ineffective" sanctions.

Sub-cabinet coverage

Florida Fires: ABC Good Morning America, ABC Nightline, NBC radio, NBC News with Tom Brokaw, and the Orlando Sentinel covered stories on the National Weather Service Incident Meteorologists providing support to the fire-fighting efforts in Florida.

Climate Summary Press Event: On July 14, Deputy Secretary Mallett and National Oceanic and Atmospheric Administration (NOAA) staff participated in a press briefing hosted by the White House on the climate extremes over the past 6 months. The press event focused primarily on data collected and analyzed by NOAA's National Climatic Data Center in Asheville,

North Carolina. In addition, they released a Special Climate Summary prepared by NOAA's Climate Prediction Center.

Private Sector Initiative on Encryption: On July 12-13, the Washington Post and Wall Street Journal ran stories announcing a new initiative by a consortium of encryption and computer manufacturers to gain U.S. Government approval on encryption products that create a "clear zone" at the server, which would give law enforcement officials an opportunity to view the plain text of communications. The consortium indicated that it will apply to the Bureau of Export Administration for export approval of these products.

High Tech Exports: Steve Hedges of the Chicago Tribune interviewed Under Secretary for Export Administration Reinsch on general issues affecting high technology exports. After his July 8 testimony before the Senate Governmental Affairs Committee, Reinsch spoke with Bob Greenberger of the Wall Street Journal, Jeff Gerth and Eric Schmit of the New York Times, Tony Cappacio of Bloomberg News, and Bill Gertz of the Washington Times. The two New York Times reporters are working on an investigative piece on China and satellites.

WorldTec: The July issue of Export Today magazine featured the National Technical Information Service's new online subscription service, WorldTec.

Partnership for a New Generation of Vehicles Forum: An article in the July 8 issue of Detroit News featured a Partnership for a New

Generation of Vehicles forum on Capitol Hill and quoted Acting Under
Secretary for Technology Gary Bachula.

-----Jim Dorskind
Director, Executive Secretariat
Office of the Secretary, U.S. Department of Commerce
Ph: 202-482-3934 Fax: 202-482-4576 jdorskind@doc.gov

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TEXT:
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The following is a HEX DUMP:

July 15, 1998

MEMORANDUM FOR ERSKINE BOWLES

FROM: Secretary William M. Daley

SUBJECT: Report for July 20 - July 26, 1998

I. HOT ISSUES

- **Florida Fires:** State and Federal agencies have asked the National Weather Service (NWS) to increase its support of crews fighting the forest fires in Florida. Incident Meteorologists (IMETs) from several NWS regions are providing on-site weather support for Florida fire fighters. The NWS Southern Region Headquarters has established a 24-hour Fire Support Center, which will remain in operation until the fires are out. Southern Region staff have also established a dedicated web page, which contains satellite imagery and radar data covering the threat areas, specific fire weather forecasts for the state, long-range weather outlooks, status of fire weather staffing, and incident situation reports.

NWS personnel from the National Headquarters, Southern Region Headquarters, Climate Prediction Center, and the Hydrometeorological Prediction Center provided a weather briefing to members of the White House Press Corps in preparation for the President's July 9 visit to Florida fire sites.

- **Florida Fireworks Ban:** Hours before the Independence Day holiday, the National Climatic Data Center (NCDC) was contacted by the U.S. Forest Service (USFS) to provide weather summaries for the past several months for Florida. The USFS was involved in a successful effort to uphold a ban on the selling of fireworks in Florida over the Independence Day holiday. An association of fireworks distributors and manufacturers had requested an emergency hearing to have the ban lifted. The NCDC responded by sending drought indices, temperature, and precipitation data for Florida's climate divisions, plus other current and historic information relative to Florida's climate.
- **IMF Update:** Nothing to report.

II. KEY DEPARTMENT NEWS

- *Secretary Daley's Visit to Connecticut:* On July 13, Secretary Daley spoke before the Middlesex Chamber of Commerce in Connecticut. The Secretary's speech highlighted the importance of Connecticut exports nationally and locally. The Secretary also toured NQ Environmental, Inc., and discussed how the Export Assistance Center has helped the company succeed.

- **U.S.-EU Cooperation on TEP and China:** On July 7, Secretary Daley met with Sir Leon Brittan, EU Vice President for External Relations, to discuss the U.S.-EU Transatlantic Economic Partnership (TEP) initiative, China's WTO accession process, advancing the Transatlantic Business Dialogue, and specific issues related to industrial fasteners and metric labeling. Secretary Daley and Vice President Brittan agreed that it was important to proceed quickly with the TEP, and Secretary Daley suggested the development of a set of commercially valuable deliverables in time for the U.S.-EU Summit in November.
- **Meetings with African Ambassadors:** Secretary Daley met with Ambassador Chemai of Kenya, and Deputy Secretary Mallet met with Ambassador Sempala of Uganda. Both meetings dealt with the Africa trade legislation and plans for the Secretary's Africa commercial development mission in September, which will focus on convening a regional dialogue with his counterparts and the private sector.
- **Commerce Support for Vice President's Visit to Russia and Ukraine:** DoC staff are developing trade and investment briefing information for Vice President Gore's meetings with Ukraine President Kuchma on July 22 and Russian Prime Minister Kirenko on July 24.
- **Preparations for Gore-Mbeki Binational Commission Meeting:** DoC staff are working with the Vice President's Office on preparations for the U.S.-South Africa Binational Commission meeting in August. The two vice presidents intend to deal specifically with trade issues. Secretary Daley chairs the U.S. side of the binational Business Development Committee.
- **OECD Anti-Bribery Agreement:** During the week of June 29, DoC staff attended meetings of the Organization of Economic Cooperation and Development Working Group on Bribery in Paris. While the overall results were generally disappointing, many countries have made progress toward ratifying and implementing the Antibribery Convention. Nine countries have submitted the Convention to their legislatures for ratification, while eight countries have submitted draft legislation. Most countries anticipate meeting the December 31 deadline for entry-into-force set by ministers last year.
- **Free Trade Area of the Americas (FTAA) Business Facilitation Measures:** DoC and USTR have requested the private sector to help identify key business facilitation measures in the FTAA. The USG has prepared a priority list, which will be the focus of the next Trade Negotiations Committee meeting, to be held December 2-3 in Suriname.
- **Honduras' Trade Benefits Restored:** The USG recently published a *Federal Register* Notice announcing the restoration of Caribbean Basin Initiative and Generalized System of Preferences benefits to Honduras, which had been partially withdrawn since April for intellectual property rights (IPR) violations, specifically television broadcast piracy. DoC staff will continue to work closely with other agencies and U.S. industry to monitor

Honduras's protection of IPR. DoC staff will also work with the Government of Honduras to complete the bilateral IPR agreement and to ratify the already signed Bilateral Investment Treaty.

- **Commitment to Haiti:** From July 13-16, Under Secretary for International Trade Aaron is visiting Haiti to highlight the USG commitment to helping Haiti improve its commercial environment and to stress the critical role the private sector and government will play in the recovery process. The Under Secretary announced a number of DoC deliverables, including the posting of a Senior Commercial Officer in Port au Prince, and he will scout possible events/deliverables for the First Lady's trip planned for the end of September.
- **Polish Prime Minister Visit:** On July 10, Under Secretary for International Trade Aaron met with the Polish Economic Minister and reinforced the importance of our dialogue with Poland regarding EU accession. He encouraged the Polish government to adopt the pending product liability legislation. The Polish Minister assured him that the legislation would be passed in the next several months.
- **U.S. Agenda in Europe:** From July 9-14, Assistant Secretary for Market Access and Compliance Patrick Mulloy met with French, Austrian, and Organization for Economic Cooperation and Development (OECD) officials and participated in U.S.-EU Senior Level Group events. Meetings with French and Austrian government officials focused on commercial issues, such as approval of genetically modified organisms, preparations for introduction of the euro, and telecom licensing. Meetings in Austria addressed priorities during its EU Presidency, which runs through December 31. OECD meetings focused on the Antibribery Convention, the October E-Commerce Ministerial in Ottawa, and the Muenster Process.
- **Governor of North Carolina Trade Mission to China:** Assistant Secretary for Trade Development Michael Copps met with officials from the Office of the Governor of North Carolina to discuss the state's September 1998 trade mission to China. Copps and staff provided guidance on sectors being considered (telecommunications, energy, transportation, chemicals, and banking) and gave an assessment of our current bilateral relationship.
- **First Meeting of the BDC Banking and Financial Services Subgroup Held in Moscow:** On July 1-2, Deputy Assistant Secretary for Services Everette James led a delegation of U.S. insurance experts in roundtable discussions with Russian experts at the inaugural session of the U.S.-Russia Business Development Committee's Subgroup on Banking and Financial Services. At the meeting, James announced a \$750,000 technical assistance program for the Russian insurance market under the International Insurance Technical Assistance Partnership announced by Secretary Daley in May.

- **Massachusetts v. Daley:** On June 24, Chief Judge Joseph Tauro of the District of Massachusetts signed an order granting the plaintiff's motion to declare the portion of the Scup Regulatory Amendment, which provides for a state by state summer period allocation of scup, null and void. In a supporting memorandum, Judge Tauro rejected National Oceanic and Atmospheric Administration's use of data from the base period of 1980-1989 as arbitrary and capricious. Judge Tauro did, however, reject the plaintiff's argument that the agency has an affirmative duty to collect relevant information before agency action is undertaken.
- **Russian Tanker Injures Puerto Rican Coral Reef:** On June 21, the 679-ft Russian oil tanker M/V KAPITAN E. EGOROV ran aground approximately one mile off the southern coast of Puerto Rico. The National Oceanic and Atmospheric (NOAA) HAZMAT office immediately provided trajectory and resources-at-risk information. A trajectory analysis determined that the released oil could threaten the coral reef northwest of the grounding site, as well as the Punta Verraco area. The oil might also threaten mangroves in the western arm of Bahia de Guayanilla. The vessel was removed from the grounding site during the early morning of June 25 with no discharge of oil. A biologist for the Commonwealth of Puerto Rico inspected the site and reported substantial areas of crushed coral reef structure. The commonwealth seized the KAPITAN E. EGOROV pending negotiation of a letter of undertaking. NOAA's Damage Assessment and Restoration Program has been asked to provide technical expertise to assess physical injury to the reef.
- **Potential Failure of GOES-9 Momentum Wheels:** On July 6, GOES-9 began experiencing dangerously high levels of current and temperature on its remaining momentum wheel. On July 7, following a teleconference with the National Aeronautics and Space Administration and Space Systems/Loral, GOES-9 was returned to the V2 wheel configuration in an attempt to reduce the temperature and current levels. The operation was performed without incident and is undergoing Image and Navigation Registration recovery. Both momentum wheels have reached regimes, which have resulted in failure on other Space System/Loral spacecraft. Engineers are working to return the on-orbit spare spacecraft, GOES-10, to full operation by early next week.
- **Severe Fire Season in Brazil:** On July 1, National Environmental Satellite, Data, and Information Service staff participated in an interagency meeting to discuss the recently concluded U.S. Government site visit to Brazil to prepare for the upcoming fire season (July to November). The meeting focused on an incoming cable from Brazil, which reported on the visit and summarized Brazil's request for assistance during the upcoming fire season. In assisting Brazil, the U.S. remote sensing system will rely on fire products from National Oceanic and Atmospheric Administration's Polar-Orbiting Operational Environmental Satellites Advanced Very High Resolution Radiometer, Geostationary Operational Environmental Satellites, and Defense Meteorological Satellite Program, Operational Linescan Sensor.

- **Arctic Research Expedition:** A team of scientists from East Carolina University just completed a two and a half month expedition in the Chukchi Sea. The research program is funded by several agencies, including the National Oceanic and Atmospheric Administration's National Undersea Research Program (NURP). During the expedition, the Coast Guard Cutter POLAR SEA cut a path through the Arctic ice and provided openings to the seafloor for a variety of sampling equipment, including an underwater robot provided by NURP. Researchers collected bacteria, which will be used in a search for new drugs for combating a range of diseases.
- **U.S. Sanctions on the Export of Dual-Use Goods to India and Pakistan:** The Bureau of Export Administration is working with an interagency group to develop the lists to be published of Indian and Pakistani government and private entities involved in nuclear, missile, and military activities. Entities on these lists will be subject to a stiff export control policy.
- **Pastors for Peace to Visit Cuba:** On July 6, a Bureau of Export Administration (BXA) representative attended an interagency meeting to discuss U.S. Government actions toward an expected late-July Pastors for Peace visit to Cuba. The meeting was chaired by Treasury's Office of Foreign Asset Control (OFAC). This will be the eighth visit to Cuba by Pastors for Peace. The group is opposed to the U.S. embargo on Cuba and seeks to provoke the U.S. government by exporting varied goods to Cuba in violation of exporting requirements of the Departments of Commerce and Treasury. The group has stated in its literature that it plans to export, among other items, Pentium computers to support mobile libraries. The group plans to depart for Mexico on July 20. U.S. Customs will make a non-confrontational inspection of the goods at the U.S.-Mexico border. Blatant export control violations will be referred to the Justice Department for prosecution. As was the case with prior Pastors for Peace trips, BXA has delegated export control responsibility to OFAC because of its overriding jurisdiction on this matter.
- **U.S.- China Export Control Cooperation.** On July 6, the Bureau of Export Administration hosted an interagency roundtable and licensing demonstration for a visiting Chinese delegation comprising government export officials. Representatives from the Departments of Commerce, Defense, Energy, and State briefed the Chinese officials on dual-use export licensing practices, dispute resolution, and commodity classification. The Chinese officials also attended BXA Update '98 conference sessions in Washington, D.C.
- ***Experimental Program to Stimulate Competitive Technology:*** On July 14, the Technology Administration (TA) began soliciting proposals for grant awards under the Experimental Program to Stimulate Competitive Technology (EPSCoT), focused on 18 states and Puerto Rico, which have historically been under represented in USG research and development awards. The Request for Proposals will appear in the *Federal Register* and the TA's website. Approximately \$1.6 million is available for 1998, and TA anticipates the award of four to six

grants.

- **Export Database:** On July 6-8, the National Technical Information Service launched its new "Prohibited Parties Database" at the Bureau of Export Administration Update '98 conference. Using a single keyword search, the new feature allows users to screen export orders before shipment against the government's four "prohibited party" lists.
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- Presentation of Certificates to Presidential Rank Awardees
- Meeting with D. Van Skilling, CEO of Experian
- Attend Dinner hosted by Secretary Albright for Mack McLarty at the State Department

July 20

- Briefing on Critical Infrastructure
- Attend Dinner with Civil Rights and Children's Group

July 21

- Meeting with Deputy Assistant Secretary for Environment Anne Alonzo

July 22

-- Meeting of the National Conference of State Legislators in Las Vegas

July 23-24

-- Travel to Utah

VI. SUB-CABINET SCHEDULE

Deputy Secretary Robert L. Mallett:

July 16: Attend Washington Government Relations Group Reception

Attend National Conference Dinner Dialogue Meeting

July 17: Meeting with National Institute of Standards and Technology Summer Undergraduate Research Fellows

Chair Diversity Council Meeting

July 20: Meeting with Ambassador Veiccoh Nghiwete from Namibia

July 21: Attend Census Regional Directors' Meeting in Boston, Massachusetts

July 22: Give remarks at the 23rd Annual National Oceanic and Atmospheric Administration
Fish Fry Event Celebrating the Year
of the Ocean

Under Secretary for International Trade David Aaron:

July 13-16: Meetings with President Preval and other officials regarding economic development
in Haiti

Assistant Secretary for Import Administration Robert LaRussa:

July 27-31: Review of the antidumping order on tomatoes from Mexico, in Mexico City

Under Secretary for Oceans and Atmosphere James Baker:

July 25-29: Deliver Commemorative Speech and participate in other activities at the
International Ocean Symposium 1998

Assistant Secretary for Oceans and Atmosphere Terry Garcia:

July 21-26: Lead the U.S. Delegation at the U.N. Food and Agricultural Organization Meeting in Rome, Italy

Under Secretary for Economic Affairs Robert Shapiro

July 21: Attend Census Regional Directors' Meeting in Boston, Massachusetts.

Under Secretary for Technology Administration Gary Bachula (Acting):

July 16: Participate in the Great Lakes Industrial Technology "GLITECH" Quarterly Advisory Board Meeting in Cleveland, Ohio

Assistant Secretary for Telecommunications and Information Larry Irving:

July 27: Address Future Shock Anniversary Forum, Marina del Ray, California

July 29: Address National Association of Regulatory Utility Commissioners, Seattle, Washington

July 30: Speak on "Civil Rights Issues in Communications Law," National Bar Association Convention, Memphis, Tennessee

Commissioner of Patents and Trademarks Bruce Lehman:

July 24-25: Speak at the Center for Advanced Study and Research on Intellectual Property High-Tech Protection Summit, Seattle, Washington

July 31: Speak to a group of 17 professors from Germany, the Czech Republic, Hungary, and Bulgaria in Crystal City, Virginia.

VII. MEDIA COVERAGE

Secretarial Coverage:

- **Meeting with *USA Today* Editorial Board:** On July 13, Secretary Daley met with *USA Today* editorial board to discuss the importance of the census debate and to persuade them to editorialize on the subject. He also discussed various trade issues.

- **Interviews at Update '98:** During the Bureau of Export Administration's Update '98 conference, Secretary Daley and Under Secretary for Export Administration William Reinsch spoke with reporters about a variety of issues, including high performance computer standards, encryption, sanctions, and general trade policy. The reporters covering Update represented the following news organizations: *Reuters*, *Associated Press*, the *Washington Post*, the *New York Times*, *Bureau of National Affairs*, the *Washington Trade Daily*, the *Washington Tariff and Trade Letter*, *Inside U.S. Trade*, and the *Federal News Digest*.
- **Census 2000:** On July 9, Secretary Daley, and Acting Census Director James Holmes announced that the Census 2000 dress rehearsal was on track. The announcement was carried by several news services and major newspapers, including the *Washington Post*, the *Washington Times*, and local newspapers in cities where the dress rehearsals are being carried out. Census 2000 Dress Rehearsals are currently underway in Sacramento, California, Menominee County, Wisconsin, and in Columbia, South Carolina, and 11 surrounding counties.
- **Fast-Track Legislation:** On July 7, *Reuters* carried a story in which it reported: "A senior Clinton administration official suggested...that congressional Republicans were playing politics by pushing for a vote on fast-track trade legislation before the November elections." The story referred to Secretary Daley. The Secretary was quoted as saying "I don't see that (fast-track), from our perspective, is a good thing to move forward at this point."
- **Privacy:** The *Wall Street Journal* carried an article in July entitled "The Future of the Net: Don't Sacrifice Freedom for 'Privacy'" by Solveig Singleton, who is director of Information Studies at the Cato Institute. Ms. Singleton challenged Secretary Daley's warning that if companies do not protect their customers' privacy, then Washington will step in. The Secretary is quoted "I don't want to hear any griping or moaning if that happens." Ms. Singleton stated that "danger to privacy and other rights is best restricted by limiting the power and scope of government, not by limiting the freedom of businesses to trade information."
- **China Sanctions:** On July 9, the *Journal of Commerce* carried an article entitled "Daley takes the offensive against sanctions." The article reported that the success of the President's China trip has spurred the Commerce Secretary to take on Congress over "ineffective" sanctions.

Sub-cabinet coverage

- **Florida Fires:** *ABC Good Morning America*, *ABC Nightline*, *NBC radio*, *NBC News with Tom Brokaw*, and the *Orlando Sentinel* covered stories on the National Weather Service

Incident Meteorologists providing support to the fire-fighting efforts in Florida.

- **Climate Summary Press Event:** On July 14, Deputy Secretary Mallett and National Oceanic and Atmospheric Administration (NOAA) staff participated in a press briefing hosted by the White House on the climate extremes over the past 6 months. The press event focused primarily on data collected and analyzed by NOAA's National Climatic Data Center in Asheville, North Carolina. In addition, they released a Special Climate Summary prepared by NOAA's Climate Prediction Center.
- **Private Sector Initiative on Encryption:** On July 12-13, the *Washington Post* and *Wall Street Journal* ran stories announcing a new initiative by a consortium of encryption and computer manufacturers to gain U.S. Government approval on encryption products that create a "clear zone" at the server, which would give law enforcement officials an opportunity to view the plain text of communications. The consortium indicated that it will apply to the Bureau of Export Administration for export approval of these products.
- **High Tech Exports:** Steve Hedges of the *Chicago Tribune* interviewed Under Secretary for Export Administration Reinsch on general issues affecting high technology exports. After his July 8 testimony before the Senate Governmental Affairs Committee, Reinsch spoke with Bob Greenberger of the *Wall Street Journal*, Jeff Gerth and Eric Schmit of the *New York Times*, Tony Cappacio of *Bloomberg News*, and Bill Gertz of the *Washington Times*. The two *New York Times* reporters are working on an investigative piece on China and satellites.
- **WorldTec:** The July issue of *Export Today* magazine featured the National Technical Information Service's new online subscription service, WorldTec.
- **Partnership for a New Generation of Vehicles Forum:** An article in the July 8 issue of *Detroit News* featured a Partnership for a New Generation of Vehicles forum on Capitol Hill and quoted Acting Under Secretary for Technology Gary Bachula.

RECORD TYPE: FEDERAL (TRP NOTES MAIL)

CREATOR: jdodge (jdodge@hq.nasa.gov@INET@LNGTWY [UNKNOWN])

CREATION DATE/TIME:18-AUG-1998 14:00:00.00

SUBJECT: EOS 2nd Phase Workshop

TO: Sarah G. Horrigan (Sarah G. Horrigan@EOP [UNKNOWN])
READ:UNKNOWN

TEXT:
Dear Sarah,

We in the Earth Science Office are very pleased that you will be able to come representing OMB to some of our workshop at the Tidewater Inn in Easton, MD during 24-26 Aug.

As I noted during our phone conversation, you would be able to gain a very good perspective concerning the new office strategic planning goals, emphases, and new methodologies if you were to attend the plenary session on Monday morning. There you would hear Ghassem Asrar's new philosophy for managing the Enterprise, the technology and mission development plans, and a proposed strategy for obtaining a good mix of sustained, global systematic observations along with the injection of new technology for measurement instrumentation, and some exciting new science options which will allow further understanding of the physical processes which underly the Earth's environmental interactions.

The afternoon of the first day would give you a good feeling for the scientific justification for these new missions. The Chairpersons will present the results from a six-panel discipline-oriented review that we conducted back in June. We have also compiled a booklet of their findings, and I have sent you an electronic copy for your review, entitled PanelRev.doc. Printed copies will be available at the meeting.

Attached to this e-mail are several documents: the logistics information package for the workshop, the summary of the scientific discipline panel priorities resulting from the first phase of this strategic planning exercise, and, finally, a nominal mission scenario document which will be presented at the beginning of the workshop. It was developed by Dr. Pierre Morel, Acting Director of our Research Division, and it is intended to illustrate what range of observational activities might be possible within current budgetary limitations. The workshop attendees will debate the proper mix of science, applications and operational prototype missions, their priorities in time, and the trade-offs which must be made in other parts of the program in order to accomodate a reasonable mission scenario over the next decade. They must, of course, also consider the

need for
 more economical missions, processing the data, and supporting the science
 investigations required to interpret it in ways which will provide the
 scientific
 understanding necessary to support future policy decisions.

Later in the week, on Wednesday, Aug. 26th, the panel of invited
 experts
 will meet in Executive Session and then share their conclusions with NASA
 and
 others waiting to hear their thoughts. We will also try to summarize their
 findings
 and make those available, as well. While you are very welcome to attend
 any or
 all of the workshop, I don't really know the schedule of when they might
 give us some
 feedback on Wednesday.

I hope that this information is useful to you in preparation for
 the
 workshop.

Sincerely,

Jim Dodge

===== ATTACHMENT 1 =====
 ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:

 Dr. James C. Dodge
 Global Data Integration and Validation
 Research Division
 Earth Science Enterprise
 NASA Headquarters
 Washington, DC 20546
 Tel. (202)358-0763
 FAX (202)358-2770
 e-mail: jdodge@hq.nasa.gov

===== END ATTACHMENT 1 =====

===== ATTACHMENT 2 =====
 ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:

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 20 Aug 1998 05:47:56 EDT
 Received: from Storm.EOP.GOV by PMDF.EOP.GOV (PMDF V5.1-9 #29131)
 with ESMTTP id <01J0TBW9JG5C000EEK@PMDF.EOP.GOV> for horrigan_s@al.eop.gov;
 Thu, 20 Aug 1998 05:47:27 -0400 (EDT)
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 by STORM.EOP.GOV (PMDF V5.1-10 #29131)
 with ESMTTP id <01J0R2QOFIVI000HQ5@STORM.EOP.GOV> for horrigan_s@al.eop.gov;
 Tue, 18 Aug 1998 14:15:20 -0400 (EDT)
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 (8.7.5/8.7.3) with SMTTP id OAA16484; Tue, 18 Aug 1998 14:14:39 -0400 (EDT)
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 X-Mailer: Windows Eudora Pro Version 3.0 (32)
 ===== END ATTACHMENT 2 =====

===== ATTACHMENT 3 =====
 ATT CREATION TIME/DATE: 0 00:00:00.00

TEXT:
 Unable to convert ARMS_EXT:[ATTACH.D22]ARMSZZ000Q3W2.002 to ASCII,
 The following is a HEX DUMP:

LOGISTICS AND ON-SITE SUPPORT INFORMATION

NASA Earth Observing System (EOS) Second Phase Planning Workshop Concepts for Science and Applications Missions in the Post-2002 Era

***August 24-26, 1998
The Tidewater Inn***

Welcome to the *NASA EOS Second Phase Planning Workshop*. The following information will provide general logistics and on-site support information that you may need during your visit to the Tidewater Inn. For your convenience, staff from Jorge Scientific Corporation (JSC) will be providing on-site support for panel review participants.

Meeting Location

The NASA EOS Workshop will be held at **The Tidewater Inn**, located in Easton, Maryland. Directions have been included. Specific information regarding the locations of discussion breakout groups will be available during registration the morning of Monday, August 24.

Hotel Accommodations/Reservations

A block of sleeping rooms has been reserved at the Tidewater Inn, 101 East Dover Street, Easton, Maryland for our out-of-town participants. You must contact the hotel directly at 410-822-1300 or 1-800-237-8775 to guarantee your reservation with a credit card number and confirm arrival and departure dates. **The deadline for making your reservation is no later than Monday, August 3, 1998.** Requests received after this date will be subject to space availability. *It is important to identify yourself as an attendee of the NASA EOS Workshop when you confirm your reservation.*

Air Transportation/Reservations

The Tidewater Inn is located approximately one hour from Baltimore-Washington International airport. In order to keep initial out-of-pocket costs to a minimum, it is recommended that meeting participants being reimbursed by JSC, contact Marie Duggan of Premier Travel to make travel reservations (airline, train, etc.) and to arrange prepaid tickets. Ms. Duggan can be reached at 1-800-321-9359, Monday through Friday, between the hours of 9:00 AM and 5:00 PM (Daylight Savings Time).

Ground Transportation and Directions

Due to the secluded location of this meeting, rental cars may be required for transportation to and from the airport/home/office. Detailed directions from surrounding areas are attached.

Travel Per Diem

Non-civil servant participants who have been approved in advance by NASA will be reimbursed for travel and per diem expenses through JSC. The maximum US Government Per Diem allowance for Easton, Maryland is \$168.00 per day (\$130.00 for lodging; \$38.00 for meals and

incidental expenses). Expense forms are enclosed for non-civil servants. Claims must be submitted within 30 days and include original receipts to avoid processing delays.

Meeting Support/Equipment

The NASA EOS support suite will be located on the first floor in the St. Michaels and Tidewater rooms. A copier and several PCs with printers will be available. We urge you to please use PC formatted disks for any additional work completed outside of the support suite during this meeting.

An overhead projector, screen and flipchart will be provided in each meeting room. Please contact me if you require any additional equipment.

Refreshments

A continental breakfast and afternoon refreshments will be supplied daily. The workshop will break each day where each individual will be responsible to purchase his or her own lunch. A list of options will be available at the Tidewater Inn.

Additional Information

Parking is available behind the Tidewater Inn along Mill Place Road.

If you have any questions regarding the above information, please feel free to contact me by telephone at 202-554-2775, or e-mail jennifer.o'leary@hq.nasa.gov.

Jennifer O'Leary
Jorge Scientific Corporation

*THE TIDEWATER INN
101 EAST DOVER STREET
EASTON, MD 21601
1-800-237-8775 OR 410-822-1300*

DIRECTIONS:

From the Baltimore-Washington International (BWI) Airport:

Take I-97 South to Rte. 50/301 East. Follow Rte. 50/301 across the Bay Bridge (\$2.50 toll). Continue on Rte. 50 East into Easton and turn right on Goldsborough Street. At second traffic light, turn left onto Harrison Street. The Tidewater Inn is on the left at the corner of Dover & Harrison Streets.

From Baltimore, Annapolis, and Washington, D.C.:

Take Rte. 50/301 across the Bay Bridge (\$2.50 toll). Follow Rte. 50 East into Easton and turn right on Goldsborough Street. At second traffic light, turn left onto Harrison Street. The Tidewater Inn is on the left at the corner of Dover & Harrison Streets.

From Virginia:

Take I-395N towards Washington, DC. Go to New York Ave (Rte. 50) and follow East.
OR
Take I-495N (Washington Beltway) to Rte. 50/301 East.

Take Rte. 50/301 across the Bay Bridge (\$2.50 toll). Follow Rte. 50 East into Easton and turn right on Goldsborough Street. At second traffic light, turn left onto Harrison Street. The Tidewater Inn is on the left at the corner of Dover & Harrison Streets.

From New York and New Jersey:

Take New Jersey Turnpike to Delaware Memorial Bridge to Rte. 13/301 South. Follow Rte. 301 South to Rte. 213 South and turn left onto Rte. 50 East. Follow into Easton and turn right on Goldsborough Street. At second traffic light, turn left onto Harrison Street. The Tidewater Inn is on the left at the corner of Dover & Harrison Streets.

From Philadelphia:

Take Rte. 95 South to Rte. 896 South towards Middletown (last exit in Delaware). Follow Rte. 896 to Rte. 301 South to Rte. 213 South and turn left onto Rte. 50 East. Follow into Easton and turn right on Goldsborough Street. At second traffic light, turn left onto Harrison Street. The Tidewater Inn is on the left at the corner of Dover & Harrison Streets.

===== ATTACHMENT 4 =====
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MESE MISSION SCENARIO FOR THE 2002-2010 PERIOD
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Introduction

The first strategic goal of the Earth Science Enterprise is to expand scientific knowledge of the earth system using the unique vantage point of space. To achieve this goal, the Enterprise recognizes that scientific progress results from a multiplicity of converging approaches. While the pursuit of Earth System Science would be impossible without the global coverage provided by space-based instruments, integrating knowledge from in situ and space observations is equally essential. This is the reason why NASA, in cooperation with other science-funding agencies, supports a balanced program of investigations based on satellite, airborne and surface measurements, as well as modeling and theoretical studies. This research strategy warrants thorough documentation and will be presented in a comprehensive, inter-disciplinary Science Implementation Plan under preparation by the ESE. The intent is to make this Plan available next year for review by the NASA Earth System Science and Application Advisory Committee (ESSAAC) and relevant bodies of the National Academy of Science/National Research Council (NAS/NRC).

At this stage, however, the Enterprise has immediate need for an effective roadmap for future flight missions beyond 2002, to guide:

Investments in basic scientific and application research;

Technology investments in preparation of future missions; and

Planning cooperative projects with potential commercial and international partners.

The primary focus of the ESE Post-2002 Mission Planning Workshop is to assess the nominal "mission scenario" presented below, and to explore planning options for future ESE flight missions during the period 2002-2010 following the completion of the first EOS mission series. The scenario was constructed on the basis of responses from the earth science community to a Request for Information (RFI) issued by NASA, and reflects the scientific priorities formulated by national and international scientific bodies (NAS/NRC, the World Climate Research Program, the International Geosphere-Biosphere Program).

The scenario also incorporates information about likely technical feasibility, estimated mission costs and projected funding levels. The Earth Science Enterprise intends to periodically refresh this planning process through similar consultations of the Earth system science and applications communities at appropriate intervals in the future.

The Request For Information Process

The Earth Science Enterprise (ESE) issued a formal RFI seeking new ideas for space-based investigations and earth observation mission concepts. The goal was to further develop the scientific measurement strategy initiated through the first series of EOS missions and take advantage of progress in instrument, spacecraft and information technology to pursue further scientific advances and demonstrate new applications within a lower cost profile. The RFI respondents were informed of the ESE desire to reduce the risk to overall program objectives from any single mission failure by developing smaller, less expensive missions, with a shorter implementation cycle from inception to launch. Smaller missions call for more focused mission objectives, targeting specific scientific questions that express continuing or emerging new research priorities in the next decade, beyond the anticipated achievements of the first series of EOS and Earth Probe missions. The RFI stated that the primary criterion for assessing the priority of new missions would be the significance of their scientific objective, and the maturity of technologies that would enable them.

One hundred responses were received.

ed. Step 1 in the RFI review process involved scientific reviews by six panels covering complementary domains of earth system science and applications:

Atmospheric Chemistry
 Atmospheric Climate Physics
 Global Water Cycle, Hydrology and
 Mesoscale Weather
 Ocean and Ice
 Land cover, land use and terrestrial ecosystems

Geodynamics and Geology

A survey of emerging science priorities by each of these disciplinary panels led to highlighting (or in some instances constructing from original proposals) 23 mission concepts that were recommended for further technical and cost assessment. The 23 mission concepts are described in the RFI Step 1 Briefing Book, together with a summary of science priorities identified by the Step 1 review panels. The Post-2002 Mission Planning Workshop constitutes the second and final step of the RFI review process.

The Enterprise distinguished, for programmatic purposes, three categories of future mission concepts:

EOS follow-on missions focusing on long-term continuity of critical earth system measurements within the initial scope of the Earth Observing System (EOS) program. Ten candidate mission concepts were considered in this category (Appendix 1). One additional systematic measurement concept (Earth magnetic field monitoring) was highlighted as scientifically meritorious but considered to be outside the scope of the EOS follow-on program. This measurement program is being pursued nevertheless on satellite missions of opportunity in cooperation with international partners (three upcoming missions are under development).

Earth Probe experimental missions focusing on discovery and process-oriented research. Seven candidate mission concepts were singled out by the Step 1 panel for the significance and scientific priority of their objectives (Appendix 2). These candidate missions constitute a representative sample of the new investigation concepts received in the RFI process, but certainly do not cover the full range of responses. These candidate experimental missions were subjected, for resource planning purposes, to the same technical feasibility and cost assessment procedure as the systematic measurement concepts above. The level of efforts envisaged by the Enterprise would support a suite of Earth Probe missions similar to the example presented, in addition to the on-going Earth System Science Pathfinder (ESSP) program of smaller PI-led experimental missions.

Operational instrument development projects to build new or more capable sensors for operational environmental satellite systems. Originally, six such candidate instrument demonstration projects were highlighted by the Step 1 review panels. One additional concept, promoted by NSF and the science community, was added for completeness (GPS atmospheric sounding).

□ Program Synthesis

1. Systematic Measurement Component

The first objective of NASA Earth Science Enterprise is to make good its commitment to the science community to maintain continuity of EOS measurements of critical earth system parameters, and deliver consistent time series of global measurements over a fifteen year period. The nominal plan of ESE is to meet this commitment within a level of resources about half of that invested in the implementation of the first EOS series. In order to achieve this goal, NASA intends firstly to promote, to the extent possible, the convergence of its global observation program with the National Polar-orbiting Operational Environmental Satellite System (NPOESS) program, to meet both research and operational application requirements. Further, NASA intends to promote, to the extent possible, cooperation with private sector and international partners to implement joint projects that can provide the required research-quality global observations. Last but not least, ESE will capitalize on infusion of advanced technologies to optimize instrument and platform design, in order to minimize new mission costs.

The first EOS series consists for the main part of ambitious multi-disciplinary satellite missions, each carrying complex instrument payloads and requiring on-going support by a complex data and information processing system (ESDIS). The EOS program also provides long-term support to science teams focused on developing algorithms and exploiting data from individual instruments for a multiplicity of science objectives and disciplines, as well as inter-disciplinary science investigations aiming to integrate the information from multiple instruments. The nominal plan mandates an evolution toward dedicated missions, each carrying a much simpler payload organized around a single primary instrument and focused on providing a specific measurement or coherent set of measurements. Fig. 1 shows how the nominal plan would fulfill the objective of measurement continuity beyond the first EOS mission series.

2. Discovery or Process-research Component

Based on the assumption made above for the implementation of the systematic measurement component, estimated costs of experimental mission concepts such as emerged from the RFI and projected ESE resource levels are consistent with the implementation of a multi-disciplinary Earth Probe program that would allow launching one medium-size (Taurus-class) mission per year beginning in 2004, and one smaller Earth System Science Pathfinder (ESSP) mission per year. The Enterprise will not, at this time, commit to a set program of discovery and process-research satellite missions that would be carried out through the next ten years. The intent is to solve

licit proposals for comprehensive mission designs that address a specific science question or a coherent set of questions. NASA will determine the sequence of scientific disciplines to be addressed by the Earth Probe program step by step, upon confirmation of scientific priorities by internal and external scientific bodies, taking into consideration technical and funding capabilities, and opportunities for international cooperation.

The nominal plan for the ESSP program, on the other hand, is to continue with solicitations open to all disciplines of earth science and application research. The intention is to continue implementation of the ESSP missions as PI-led projects, each executed within a very short (3-year) development cycle and a specified mission cost cap.

□3. Operational Instrument Development Component

Implicit in the resource planning strategy outlined above for systematic (EOS follow-on) measurements is the assumption that NASA will invest sufficient effort to enable the infusion of advanced technologies and instrument designs in operational global earth observation programs such as NPOESS and GOES.

Five instruments of common interest for earth system science and operational applications are currently being considered for integration in the next-generation polar-orbiting operational environmental satellite system (NPOESS). Of these, three are actively being considered by the NPOESS Integrated Project Office and the ESE to meet common or "converged" performance objectives: the Visible/Infrared Imager/Radiometer Suite (cloud/land and ocean surface imager), the infrared and microwave atmospheric sounder system, and the Ozone Mapper and Profiler Suite. Further plans are being developed for accommodation of the remaining two instruments: ocean surface altimeter (heritage: Topex/Poseidon and Jason-1 programs) and the earth radiation budget radiometer (heritage: CERES).

The procedure to achieve the desired convergence and establish effective arrangements for joint participation in the development of these prototype operational sensors is being worked at the present time. There is currently no established process for integration of long-term systematic earth system measurements in operational environmental monitoring programs. NASA stands ready to invest in the development and/or flight demonstration of advanced observing capabilities that meet operational needs as well as long-term earth science objectives, when such projects are supported by a commitment of responsible operational agencies to participate in the development of the new sensors and implement their transition to operational use. The Enterprise would have to find the necessary resources through re-ordering mission priorities in either one of the systematic measurement or discovery components of the nominal mission scenario, and through the New Millennium Program for demonstration of new measuring capabilities (part of the Enterprise investment in technology development).

The overall goal of the ESE is to integrate space-based measurements (from EOS follow-on program, Earth Probe missions, and flight demonstration projects such as the New Millennium Program), sub-orbital observations from aircraft, balloons and Uncrewed Aerial Vehicles, and field and modeling studies to address key scientific questions for understanding the earth system. The task of integrating the elements of the entire ESE program will rest primarily with the Office's Research Division. NASA intends to carefully examine the balance of its investments in systematic measurements (EOS follow-on), Earth Probe and Earth System Science Pathfinder missions, New Millennium projects and sub-orbital observations, consistent with the scientific themes and objectives identified for each future solicitation. The Enterprise looks forward to learning the recommendations of the Planning Workshop, as an essential step toward defining an optimal research and flight mission strategy for progress in understanding the Earth System.

□APPENDIX 1

SYSTEMATIC MEASUREMENT EOS FOLLOW-ON MISSIONS

Earth system science is dealing with a very complex dynamical system, governed by non-linear relations that can spontaneously generate variations of many time and space scales, from turbulent eddies to long-term changes in global ocean circulation. In addition, the system is subjected to a number of external forcing factors or changing boundary conditions. For lack of a capability to model and predict such external parameters (that may be controlled by inadequately known processes like total solar irradiance, or changed by human actions like deforestation), the only possible scientific strategy may be systematic observation of forcings and response, with the ultimate objective in mind of eventually linking one to the other. This is the fundamental reason why systematic observation and "climatological" data records play such an important role in this field of natural sciences.

The following represents a nominal mission plan for systematic measurement of atmospheric, oceanic and land variables that have been given highest scientific priority, from an earth system science perspective, by the Step 1 reviewers. The sequence is ordered along the timeline.

EOS-1:
Land Cover/ Land Use Inventory Program

The Land Cover and Terrestrial Ecosystem research program calls for systematic measurement of global land surface cover and land use changes, relying on a series of land imaging missions following on Landsat-7. The same information is also essential for a wide range of value-added applications. Each mission would carry one main instrument: multi-spectral (visible/near IR) imaging radiometer that provides global coverage with sufficient spatial resolution (~10-20m) to unambiguously identify the extent of different type of vegetation or other land cover, and sufficient frequency (revisit time ~ 15 days) to quantitatively assess seasonal & long-term changes in terrestrial biomass. The instrument concept could be based on the push-broom Advanced Land Imager design being tested on the New Millennium EO-1 demonstration mission, with the addition of appropriate coarse-resolution spectral channels for atmospheric corrections. Progress in detector array technology, especially performance at non-cryogenic temperature, and on-board processing of high data-rate outputs are the main technology drivers for further optimization.

The mission can be implemented on Taurus-class platforms carrying one main imaging instrument. Implementation of the first mission in the series would begin in FY'00 for launch in year 2004, five year after the launch of Landsat-7. NASA intends to carefully examine private sector initiatives in this domain as a means for acquiring the relevant scientific data sets through data purchase.

EOS-2: Climate Variability and Trend Mission

Most of what we currently know (or can infer) about the general circulation of the atmosphere and its thermodynamics is inferred from observations of the basic meteorological variables, atmospheric pressure, temperature, moisture and wind (mostly the first two quantities). This information is obtained from a multiplicity of sources, in situ measurements by balloon-borne radiosondes at some 800 stations around the world and global remote sensing by atmospheric sounders on operational polar environmental satellites. Currently, temperature and moisture profile data obtained from operational sounders suffer from significant weaknesses that make them less than ideally useful for atmospheric circulation analysis and forecasting (a large fraction of operational satellite sounder data is actually rejected by the more advanced data assimilation models). A decisive breakthrough is expected with the Advanced Infra-Red Sounder (AIRS), which is the first satellite sensor that can emulate the temperature and moisture measurement accuracy of radiosondes. It is expected that AIRS data will be available for the 5-year design life time of the PM-1 mission.

NASA is working closely with the NPOESS Project Office to enable similar temperature and moisture profile accuracy with the next-generation operational atmospheric sounder system that will be deployed on operational environmental satellites, beginning at the end of the next decade. The objective of the Climate Variability and Trend Mission, given high priority by atmospheric climate research, is to continue research-quality temperature and water vapor measurements during the interim period between the termination of PM-1 and the first NPOESS flight.

A single five-year bridging mission is being contemplated, using a dedicated platform launched by a Taurus vehicle. The nominal payload would consist of a second flight model of the AIRS instrument (built from existing spare parts) and an advanced microwave sensor incorporating the latest technology in microwave systems (Monolithic Microwave Integrated Circuits) that would replace the existing AMSU/MHS or HSB microwave sensors on operational NOAA satellites and the EOS PM-1 mission. Implementation of the mission would normally begin in FY'01 for a launch in 2005, five year after the launch of PM-1. Instrument development should effectively begin in FY'00, to take advantage of the existing industrial know-how.

EOS-3: Global Terrestrial and Oceanic Productivity Mission

The Land Cover and Terrestrial Ecosystem research program's second highest scientific priority calls for systematic global observation of biological productivity at 1-2 day intervals but coarser spatial resolution than mission 1 above. The oceanographic research community gives equally high scientific priority to systematic observation of changes in ocean color and inferred ocean primary productivity. Moderate resolution global image data are also essential for a broad range of applications supported by NOAA, from smoke cloud detection to fisheries.

NASA's nominal plan in this domain is the convergence of research and operational observation programs and eventual reliance on NPOESS and other global operational observing systems in the future. The NPOESS Integrated Operational Requirements for such observations actually encompass EOS science requirements and the NPOESS program is expected to provide this type of information from the last years of the next decade onward. A single five-year bridging mission is needed to continue acquiring moderate-resolution multispectral imaging radiometer data from a morning orbit during the interval between the AM-1 mission and the first NPOESS flight.

The nominal plan is to acquire a production model of an "Advanced Global Imager" (AGI) instrument derived from the Visible and Infrared Imager-Radiometer Suite currently under development for the NPOESS program and to fly the AGI on a dedicated Taurus-class platform. Implementation of mission would begin in FY'01 for launch in 2004, five year after the launch of AM-1. Should this approach not be feasible, the alternative plan could be fabricating a third model of the MODIS instrument, using existing spare parts. The contingency plan would need to be initiated in FY'00 in order

er to take advantage of existing industrial know-how for instrument fabrication

EOS-4: Total Solar Irradiance Monitoring Program

The source of the energy that drives all climate processes is radiation from the Sun, known as the "solar constant" or, since we know now that the Sun is a (mildly) variable star, Total Solar Irradiance. NASA and other space agencies have maintained an essentially continuous record of total solar irradiance variations since 1979. NASA has undertaken the development of a next-generation total solar irradiance monitor (TSIM), to be flown in 2001 on a scientific satellite mission of opportunity built by Canada (SciSat). The plan is to eventually rely on measurements planned by the NPOESS program, beginning at the end of the decade. NASA made sure that the specifications of TSIM meet NPOESS requirements for solar irradiance

In order to maintain the integrity of the total solar irradiance record, it is essential that successive TSIM missions provide sufficient overlap, since the stability (relative accuracy) of individual spaceborne radiometers is at least one order of magnitude better than their absolute calibration, and systematic differences between one instrument and the next are larger than the signal.

One solar irradiance monitoring mission needs to be scheduled to ensure measurement continuity, with implementation beginning in FY'01 for launch in 2005. The mission could be implemented on a small free-flying platform or as a guest instrument on space flights of opportunity. In the future, the nominal ESE strategy is to provide appropriate TSIM sensors for integration on selected NPOESS spacecraft and periodic intercomparison with a ground-calibrated reference radiometer embarked on the Space Shuttle.

EOS-5: Ocean Surface Wind Measurement Program

At the present stage of development, the highest priority for global ocean and polar sciences is the continuity of essential dynamical measurements: ocean surface topography (see below) and ocean surface wind. The nominal long-term ESE strategy of is to rely on global measurements provided by:

- Passive dual-polarization microwave radiometer on the NPOESS satellite series beginning at the end of the next decade.
- ASCAT active microwave scatterometer on the European METOP satellite series, beginning in 2003.

The acquisition of surface wind data, interrupted in 1997 as a result of premature shut-down of the NASDA/ADEOS satellite, will be resumed in late 1998 with the launching of the "QuickSCAT" recovery mission (using the first flight model of the new-generation Seawinds sensor developed by NASA), to be followed by the ADEOS-2 mission carrying the same Seawinds instrument in the time frame 2000-2003.

No further investment is planned beyond the ADEOS-2 mission which is expected to ensure measurement continuity until the European operational polar satellite system comes on line.

EOS-6: Ocean Surface Topography Mission

As indicated above, measurement of dynamic height of the mean ocean surface constitutes the highest scientific priority of global physical oceanography. NASA and the French space agency CNES cooperated to implement the very successful TOPEX/Poseidon ocean altimetry mission launched in 1992 and still operating nominally after six years. The US/French Jason-1 mission (to be launched in year 2000) will continue this key oceanographic measurement at the same or even better level of accuracy. The long-term NASA strategy with regards to ocean topography observation from space is eventually to rely on radar altimeter measurements from operational polar-orbiting satellites. The feasibility of achieving the required (centimetric) accuracy from low-altitude sun-synchronous polar orbit and correcting for solar tidal effects still poses unresolved scientific problems, that are expected to be resolved by the Jason-1 mission. Plans to proceed with the implementation of this measurement on NPOESS are being pursued and the nominal ESE plan is to provide Jason-class solid state radar altimeters for the first and other morning missions in the NPOESS series. (at the end of the next decade)

NASA plans to cooperate with international partners to implement an additional five-year bridging mission to acquire research-quality ocean altimetry data for the duration of the expected gap between Jason and the first NPOESS flight (end of the decade). The mission would be implemented on a dedicated platform launched by a SELV-B or a shared Delta launch vehicle. The nominal plan is to begin implementation in FY'02 for a launch in 2005, five years after Jason-1.

EOS-7: Stratospheric Composition Measurement Program

The foremost scientific problem in the field of atmospheric chemistry remains the stabilization and eventual recovery of the stratospheric ozone layer (Is the Montreal Protocol working as expected? Could other factors not yet recognized impair the recovery?). Considering that stratospheric chemistry is a relatively mature field, first priority for the discipline is monitoring the ozone distribution as a function of halogen concentration, trace gases and aerosols in the stratosphere.

A long-term systematic stratospheric composition measurement program would focus on accurate (inasmuch as possible, self-calibrating) observation of a relative

ly limited selection of precursor and reservoir species at the minimum sampling rate allowing reliable detection of trends. Measurement methods of choice are solar occultation radiometry or spectrometry, and atmospheric limb emission radiometry. In order to achieve adequate geographic coverage, the program will require the deployment of a 2-spacecraft constellation in (1) sun-synchronous and (2) inclined (-50-60) orbits.

EOS-7.1 The sun-synchronous component could be implemented on dedicated Taurus-class platforms. Implementation of the first mission in the series would begin in FY'03 for launch in late 2007, five years after EOS-CHEM.

EOS7.2 The preferred option for implementation of the inclined-orbit component is a succession of attached payloads on the International Space Station. A minimum of two, ideally three identical instruments would be needed (to allow for in-flight replacement and refurbishment). Instrument fabrication would be concentrated in a 2-3 year period (FY'02-04 in the nominal plan).

EOS-8. Topography and Surface Change Mission

Topography of the land surface is a fundamental geophysical parameter that influences the interaction between the atmosphere, hydrosphere and solid earth, and is a key observable for assessing natural hazards such as floods, coastal storm surges, landslides, etc. Changes in topography provide information on crustal strain necessary to understand the physics of solid earth and may provide precursor signal to impending natural hazards such as earthquakes and volcanic eruptions. Detailed topography of the polar ice sheets also yields critical information on ice flow dynamics and, indirectly, the changing mass balance of the ice sheets.

The solid earth and polar science community place high scientific value on repeat synthetic aperture radar (SAR) mapping of land and ice surface, especially the implementation of a tandem SAR mission that would allow the best possible interferometric reconstruction of global topography (comparable in principle to, but more precise than, the Shuttle Radar Topographic Mission in 1999). Emerging applications in the domain natural hazard reduction provide a strong incentive to maintain essentially continuous SAR coverage of the earth through the next decade. Significant periods of overlap between successive missions would allow implementing bistatic radar interferometry.

NASA intends to carefully examine private sector investments in the area of global SAR observation, beyond its first free-flying SAR mission planned in the early 2000 time frame, and plans to acquire the needed scientific data through data purchase whenever possible. Cooperation with international partners is also an open possibility to ensure observation continuity.

EOS-9: Global Precipitation Mission

The global water cycle and hydrologic sciences are the scientific focus of the effort to understand and predict the impact of climate change on weather events, river flow and water resources. The discipline recognized that global rainfall distribution is the most crucial information required to progress toward quantitative knowledge of the water cycle and arguably the most accessible hydrologic quantity for satellite remote sensing. Among several possible techniques, passive and active (radar) microwave measurements from low earth orbit is the most mature and reliable approach.

Precipitation is associated with mesoscale weather systems that display considerable spatial and temporal variability. For this reason, high sampling frequency is essential to estimate total rainfall reliably: a sampling interval of three hours or less is required. On this account, the mission requires the deployment of a constellation of spacecraft in staged polar orbits. The minimal concept is to fly only one "master" rainfall-measuring satellite carrying both active (Precipitation Radar) and passive (Microwave Radiometer/Imager) sensors, and a number of "drone" satellites carrying only the passive microwave sensor. In view of the continued operation of two DMSP spacecraft equipped with SSM/I microwave radiometers, only two drones would be needed to complete the constellation.

The master satellite mission could be implemented on a dedicated Taurus-class platform, while the drones would be smaller free-flying spacecraft, launched together on a Taurus or similar vehicle. The nominal plan would begin implementation in FY'04, aiming for launch in year 2007 four years after the ATMOS-A (TRMM follow-on) mission planned by NASDA.

EOS-10: Polar Altimetry Mission

The principal question of polar climate science is the detection of changes in ice sheet dynamics and mass balance. For this purpose, systematic precision topography measurements of the Greenland and Antarctic ice sheets are needed at appropriate intervals. The first measurement will be provided by the Icesat mission (launch date: 2001) as part of the first EOS series. A repeat mission around 2010 would be appropriate, using either one of two alternative techniques that may be developed as part of ESE focused technology program (precision lidar and synthetic-aperture radar altimeter).

The mission, similar in principle to Icesat would be implemented on a dedicated Taurus-class platform, beginning in FY'06 for launch in 2009.

APPENDIX 2

EXPERIMENTAL PROCESS RESEARCH-ORIENTED MISSIONS

Progress toward more fundamental understanding of the earth system, closer to first physical, chemical or biological principles, will primarily be based on process-oriented research or discovery projects aiming to collect an adequate but certainly not comprehensive global sample to characterize observable phenomena over the full global range seasonal and geographic conditions for the duration of a single, one-of-kind Earth Probe mission (typically 3-5 years). Such exploratory or process-oriented research missions can be thought of as the discovery component of the ESE flight program. They respond to the recommendation of the National Academy of Science/National Research Council in favor of an innovative program of focused research satellite projects addressing sharply defined science questions.

Exploratory missions may entail high scientific and technical risks, as investigators try break into new fields of investigation, attack unsolved scientific questions with the resources of most advanced technologies. It would be premature to envisage a pre-determined ten-year program of experimental missions that would ignore prospects for new scientific ideas, new technological advances and unforeseen science breakthroughs. From this perspective, it is best to select each new experimental mission through a solicitation process open to a range of competing projects, immediately before implementation, following a practice pioneered in the Earth System Science Pathfinder program.

On the other hand, it is essential to correctly gauge the scope of the exploratory mission program that would optimally balance the systematic measurement program, and thereby define the most effective research strategy for the Enterprise. For this purpose, NASA applied the same scientific evaluation, technical feasibility and cost assessment procedures to both systematic measurement and discovery mission concepts. The set of candidate missions described below is comprised of the experimental mission concepts that emerged as particularly promising in the Step 1 review. This set should be considered as illustrative of the discovery missions that could be implemented in response to scientific priorities emerging in the next ten years, and does not suggest a particular implementation order. Several among these mission concepts have already been considered by partner agencies abroad and would therefore be good candidates for joint cooperative projects.

The following candidate missions were all highlighted by Step 1 reviewers as addressing the highest scientific priorities in their respective disciplines. This set of candidate missions by no means represents the variety of meritorious exploratory research concepts that have been presented in the RFI process, nor the diversity of new proposals that may emerge in the future from regular Announcements of Opportunity or the next program-wide RFI. The ordering of the candidate missions listed below does not reflect a judgment of scientific priority, and the actual Earth Probe mission program of the Enterprise remains to be determined by successive solicitations and a competitive selection process.

EX-1: Tropospheric Chemistry Research Mission or Missions

Tropospheric chemistry is generally taken as the emerging priority, the next frontier of global atmospheric chemistry research. While ozone is a relatively minor constituent of the troposphere, chemical processes involving ozone are specially important because they reflect the oxidizing power (and cleansing effect) of the troposphere. Another essential research topic is the long-range transport and diffusion of pollutants from surface sources, and the global atmospheric impacts of large-scale pollution from emerging industrial nations.

Observation of tropospheric chemical/dynamical processes in the troposphere faces two challenges: the need for sufficient vertical resolution to identify the layered structure of pollutants transported by atmospheric circulation and the need for adequate temporal resolution to resolve diurnal cycling and fast emission events. The latter requirement is ideally fulfilled by observation from geostationary orbit which, however, is generally lacking in vertical resolution within the troposphere. Differential absorption lidar and other active sounding systems operating from low earth orbit can ideally meet the requirement for vertical resolution, but only provides relatively sparse sampling. The Step 1 review panel for Atmospheric Chemistry concluded that, given a choice between vertical resolution and high sampling frequency, the former has the highest potential for discovery. This scientific judgment is reflected by the scientific priority given to a number of promising measurement concepts in low earth orbit. This is the model adopted to estimate the scope of an space-based exploratory research program for tropospheric chemistry.

The scientific discovery potential of global tropospheric chemistry justifies at least one and ideally two experimental missions during the period of reference. Each would be a one-time mission on a Taurus-class spacecraft, carrying a payload limited to a small number of sensors (to be determined by selection of competing comprehensive mission proposals). The instrument payload could include passive and active (e.g., tunable differential absorption lidar) sensors to observe ozone, CO, and precursor species as well as pollutant emitted by surface sources (SO₂, hydrocarbons, etc.).

EX-2: Aerosol Radiative Forcing Research Mission

A high visibility

issue in climate change studies is the impact of natural and anthropogenic aerosols on the radiative balance of the planet. One possible strategy for investigating this problem is based on monitoring trends in the global distribution of stratospheric and tropospheric aerosols. Two candidate systematic observation missions listed in Appendix 1 address this objective (measurements of solar occultation by stratospheric aerosol and solar radiation backscatter by tropospheric aerosol).

Nevertheless, the diversity of aerosol origin, composition and optical properties, and the complexity of the physics of radiation scattering and absorption by aerosol and ice/water particles are so overwhelming that conclusive findings can only be expected from considerably more sophisticated and penetrating observations. It is essential, in particular, to resolve the vertical layering of aerosol distribution in order to backtrack tropospheric transport and identify the source of the material. The instrument payload that could provide this information would be organized around a backscatter lidar with a range of smaller complementary sensors (polarimeter, multi-directional radiometer, etc.) to characterize the size, shape and optical properties of aerosol and (optically thin) cloud particles. An aerosol radiative forcing research mission could be accommodated on a small or medium-size (Taurus-class) spacecraft.

EX-3: Cloud-Radiation Feedback Research Mission

After water vapor, clouds are the next largest contributors to the planetary greenhouse effect (about 30 W/m²). Altogether, the net radiative impact of clouds on the planetary radiation balance is negative (of order - 20 W/m²) and highly variable. The cloud response to changing climatic conditions is the largest source of uncertainty in model simulations of climate and climatic variations, to say nothing of the essentially unknown indirect radiative forcing of aerosols or condensation nuclei through a modification of cloud particle size and optical properties. Understanding and modeling cloud processes with adequate quantitative accuracy remains the most vexing problem of climate physics, despite decades of research in cloud physics and the incipient introduction of cloud micro-physical processes in specialized "cloud resolving models" and future general circulation models. One principal reason is the lack of sufficient (global) observational data to reflect the diversity of weather phenomena and climatic regimes in which clouds are embedded. Understanding cloud-radiation feedback in the context of climate change is the frontier of atmospheric radiation research.

Effective observing tools to resolve the diversity of cloud systems and the complexity of cloud optical properties are only now becoming available: backscatter lidar, cloud profiling radar operating in the millimeter wave range, precipitating cloud profiling radar operating in the centimeter wave range, visible, IR and sub-millimeter radiometers or spectrometers. Considering the complexity of the problem and the diversity of observing tools that can resolve some but certainly not all aspects of this problem, no single cloud-radiation research mission can be singled out as uniquely effective, but several candidate concepts appear thoughtful and scientifically promising.

Any such mission would be organized around a cloud profiling radar and lidar system (which only can provide the required vertical resolution and detect overlapping cloud layers), with complementary passive sensors focused on the same atmospheric column (actually co-boresighted). The spatial variability of cloud is such that the benefit of multiple sensor observation would be compromised if co-registration was lost. A state-of-the-art cloud-radiation feedback research mission would be a relatively ambitious project, requiring a medium-size spacecraft and a multiple instrument payload (to be determined by selection of competing comprehensive mission proposals). This particular candidate mission has been studied in depth by at least two partner agencies and would therefore be a good candidate for a joint cooperative project.

EX-

4: Soil Moisture and Ocean Salinity Observing Mission

Soil moisture, a component of ground water storage, is the state variable that represents the terrestrial hydrologic system on time scales relevant to flood forecasting, evapotranspiration and impacts on vegetation (water stress). Soil moisture integrates precipitation and evaporation over periods of days to weeks and introduces a significant element of memory in the atmosphere/land climate system. There is strong climatological and modeling evidence that the fast recycling of water through evapotranspiration and precipitation is the primary factor in the persistence of wet or dry summer anomalies over large continental regions. On this account, soil moisture is the most significant boundary condition that controls summer precipitation over the central US and other large mid-latitude continental regions, and essential information to initiate seasonal predictions. Precise in situ measurements of soil moisture are available but each value is only representative of a small area.

Remote sensing, if achievable with sufficient accuracy and reliability, would provide truly meaningful wide-area soil wetness or soil moisture data for macroscale hydrological studies and climatic anomaly prediction over large continental regions. The most mature technique, low-frequency passive microwave radiometry, would also allow measuring Sea Surface Salinity (SSS). Salinity measurement would be invaluable to close the planetary water budget over the oceans and gather quantitative information of the pre-conditioning of surface waters that controls deep water formation in the north Atlantic.

The SSS measurement does impose a challenging requirement on the sensitivity (signal/noise ratio) of spaceborne passive microwave radiometers.

For these reasons, the measurement of soil moisture (and ocean salinity) must be considered experimental and, for this reason, was only the second priority of the Hydrology and Global Water Cycle discipline. Developing an effective soil moisture r

remote sensing system based on passive radiometry requires the deployment of very large antennas (or realization of a correspondingly large synthetic aperture) in order to achieve meaningful spatial resolution (of order ~ 10 km or less) at the relatively low microwave frequencies (L-band or lower) that can penetrate moderately dense vegetation. The objective of an experimental soil moisture/ocean surface salinity measurement mission would be a five-to-three year demonstration of an advanced low-frequency dual-polarization passive microwave radiometer or combined active/passive system in low earth orbit (to be determined by selection of competing mission proposals). This mission could easily be accommodated a Taurus-class spacecraft.

EX-5: Time-Dependent Gravity Field Mapping Mission

Measuring the time-varying component of the gravity field is a totally different "remote sensing" method that provides a unique insight in mass redistribution within the earth system, including climate effects such as ground or surface water storage, changes in the oceanic circulation, tectonic motions and post-glacial rebound, and other processes. The concept of using temporal variations in the gravity field to monitor mass redistribution has already been demonstrated, using various time series of geodetic and gravimetric data. The Earth System Science Pathfinder GRACE mission will extend this proven capability to harmonics above 100. There are strong expectations from both the Solid Earth Science community and global oceanography community that the GRACE mission (launch 2001) will be a pathfinder for a powerful new method to investigate geophysical and geodynamic phenomena.

If this breakthrough is achieved, further technological advances are clearly in sight that will allow at least one order of magnitude improvement in the sensitivity of the method, thus expanding the range of scientific applications. Knowledge of the geoid is a limit to the scientific utility of sea-surface topography data for dynamic oceanography at shorter length scales. Advanced satellite-to-satellite tracking in low Earth orbit would allow significant refinements of the shape of the geoid down to 50-100 km scales, comparable to the scale of ocean eddies (allows applying altimetric observations nearer to continental margins to characterize coastal currents). In addition, directly detecting changes in total water column mass would allow computing the mean geostrophic flow or Sverdrup circulation.

In view of the fundamental importance of earth gravity data, the oceanic, polar and geodynamic disciplines would place this measurement in their top two or three scientific priorities for long-term systematic observation of fluid and solid earth. On the other hand, the required technology (satellite-to-satellite laser interferometry) is definitely a technical challenge, so that the measurement concept must still be considered experimental. A discovery/demonstration mission would call for the launching of two essentially identical spacecraft on the same orbit by a single Taurus-class launch vehicle. Operational life time should be a minimum of five years. In view of a broad international interest in space geodesy, this experimental mission would be a likely candidate for an international cooperative project.

EX-6: Vegetation Recovery Mission

Understanding the carbon cycle is essential to assessing future changes in the atmospheric concentration and greenhouse effect of carbon dioxide. A major component of this cycle is net ecosystem productivity in terrestrial temperate and boreal ecosystems, which integrates the regrowth of previously disturbed landscapes, carbon dioxide fertilization, and the result of nitrogen deposition. Quantifying the first of these effects is critical to understanding the response of the carbon cycle to human perturbations.

For this reason, the Land Cover and Terrestrial Ecosystems discipline places high priority on a disturbance recovery mission, that could be flown in the late 2000's time frame. The main instrument would be a steerable lidar altimeter system, based on technological evolution of the ESSP Vegetation Canopy Lidar mission (to be launched in year 2000). The purpose of the mission would be to sample specific terrestrial biosphere targets that have been subject to major disturbances, like clear-cutting or fires. The scientific objective is to characterize the recovery of above-ground biomass in those areas. A complementary visible-near IR imager would provide information on recovery of grasslands and semi-arid ecosystems. Altogether this experimental mission could be implemented on a small Pegasus-class spacecraft and continue for 3-5 year lifetime.

X-7: Cold Land Processes Research Mission

Over large regions (e.g. the interior of North America and Eurasia) and high altitude mountainous areas, much of the annual precipitation contributing to streamflow occurs in the form of snow during the winter months. Snow accumulation is a major storage term that strongly impacts the seasonal cycle of runoff. The freeze-thaw status of the soil surface determines the partitioning of precipitation or snowmelt between runoff and infiltration. The high albedo of snow-covered terrain results in large contrasts in net radiation during the thaw period. Important scientific questions that come to mind are:
 How does the extent of snow and frozen ground affect atmospheric climate?
 Can snow water equivalent be quantified from remote sensing data with sufficient accuracy to improve hydrologic forecast?
 Could these factors be measured accurately enough to identify meaningful climatic trends?

Snow water equivalent and the extent of frozen ground have not been adequately measured from space, due to limitations in spatial resolution of passive microwave instruments and the poor sampling frequency achievable with existing spaceborne imaging radar systems.

A promising, but technically challenging measurement concept is based on applying active SAR imaging techniques at relatively coarse spatial resolution (of order ~ 1 km) to detect freezing conditions on the ground, the extent & amount of snow, and probably various vegetation properties. Coarse resolution could allow a wider swath and short repeat cycle (~ 3 days). This experimental mission could be implemented on a dedicated Taurus-class platform in low altitude sun-synchronous orbit. The primary payload would be a 2-polarization, coarse resolution SAR system at L-band or lower frequency. A much lower data rate than that of conventional (qualitative) SAR imaging systems would be expected to compensate for the technical challenge of measuring signal intensity with extreme accuracy.

APPENDIX 3

PROTOTYPE OPERATIONAL INSTRUMENT DEVELOPMENT

Several mission concepts, aiming to develop and demonstrate new sensors which were really intended for deployment on operational observing satellite systems, were highlighted by the Step 1 review panels as particularly significant for their scientific disciplines. It has been long recognized that earth system science relies heavily on information and climatological records acquired and archived by operational environmental agencies (for a variety of applications). This is especially true in the field of physical climatology, since most of what is currently known about the earth climate is derived from climatological records compiled from weather observations. Thus, improvements in the capabilities of operational observing systems (especially polar satellites that provide global coverage) are often essential for the progress of earth system science.

On the other hand, there is currently no established process for identifying joint scientific and application priorities for operational sensor developments, nor for transition from scientific and technical development to the procurement of new operational instruments and their accommodation on operational satellite systems. The development and flight demonstration of specific prototype operational instruments is not explicitly included in the nominal mission plan but could be accommodated by re-ordering flight program priorities in the Enterprise's EOS follow-on program, ESSP program and New Millennium program. NASA is seeking active participation of relevant user agencies in the definition, development and transition to operational use of new advanced instruments that meet ESE long-term science objectives as well as operational application requirements. The following is a list (no priority order implied) of instrument concepts that were discussed in the RFI process or otherwise brought to the attention of the Enterprise:

OP-1: Advanced Microwave Sounder

The current operational microwave sounder suite, including AMSU-A (two boxes) and MHS, has a total mass of 160 kg. The utilization of new Monolithic Microwave Integrated Circuit (MMIC) technology would permit substantial weight reduction for the same functionality and/or the substitution of new cloud-clearing channels that would better support the retrieval of precision temperature/moisture soundings in combination with a companion IR sounder. NASA has studied the feasibility of applying MMIC technology to upgrading the current microwave sounders, as part of the Integrated Multispectral Atmospheric Sounder (IMAS) project, and has significantly progressed in the development of MMIC technology for the relevant frequencies. Upgrading the existing microwave sounder suite on operational satellites would not materially enhance the quality of retrieved products but would lead to substantial reduction in recurrent costs, by virtue of eliminating duplicate subsystems and facilitating accommodation on satellite platforms.

OP-2: Tropospheric Wind Sounder

Global measurement of tropospheric wind has been widely heralded as potentially the most significant contribution satellite remote sensing could make to the existing global meteorological observing system (World Weather Watch). Direct measurement of horizontal wind vectors in clear air has been demonstrated using lidar from the ground and from aircraft, based on determination of the wind-induced Doppler shift in the backscatter signal. Two competing techniques are envisaged:

Coherent detection Doppler lidar system, which is the most sensitive and potentially most accurate technique, but works only in atmospheric layers where sufficient density of scattering particles exists (aerosols). The technique requires development of a unique laser transmitter technology.

Incoherent detection Doppler lidar system, which is less sensitive but operates uniformly in clear air (works with both Mie scattering from aerosol particles and Rayleigh scattering from air molecules). The technique can utilize a widely used type of laser transmitter.

The ES is preparing a demonstration of the first technique (coherent detection) on a Space Shuttle flight in 2001 (SPARCLE project).

OP-3: GPS Constellation for Atmospheric Sounding

Measurement of the phase-delay occurring in the propagation of GPS signals near the limb of the atmosphere allows inferring dry air density, temperature and pressure as a function of geopotential height in the region where the concentration of water molecules remains negligible. Below this level, the same technique allows estimating water vapor concentration, provided reasonably accurate temperature information can be obtained from other sources. Altogether, the technique is a completely different approach to atmospheric sounding and would, in principle, provide practically drift-free temperature information throughout the upper troposphere and lower stratosphere, as well as an unmatched vertical resolution. Further refinements are also conceivable to extend the domain of application of this and related microwave limb sounding methods.

NASA has made substantial investments in the development of relevant spaceborne GPS receiver technology, as well as software for flight equipment operation and data processing. NASA has also undertaken constituting an experimental GPS constellation by furnishing GPS equipment to scientific satellite missions of opportunity developed by international partners. It is expected that this international system will deliver a sufficient number of GPS soundings per day to carry out a meaningful test of the impact of this type of data on the quality of global weather forecast (although only in a delayed or "hindcast" model).

A further initiative, co-sponsored by UCAR and the Taiwanese Academy of Sciences would launch a constellation of 8 dedicated micro-satellites allowing real-time collection of raw GPS measurements and delivery of temperature/moisture profile data to weather forecasting centers in time for insertion into the operational analysis and prediction system. NASA may support this initiative in a variety of ways, including the operation of the required fiducial GPS network on the ground, and data processing.

OP-4: Advanced Geostationary Sounder

One of the two principal sensors on Geostationary Operational Environmental Satellites (GOES) operated by NOAA is an IR atmospheric sounder of relatively conservative design and technology. The sensor allows repeated soundings at very short time intervals over specific regions of interest (where rapid weather development is being observed). However the lack of vertical resolution in the lower and mid-troposphere, where rapid weather development actually occurs, reduces the usefulness of frequent soundings for the purpose of numerical weather prediction. This deficiency could be overcome by a new sounder instrument using state-of-the-art technology (in particular, advanced IR detector arrays and mechanical cryogenic cooling systems). Dynamical meteorology supports the expectation that AIRS-grade temperature and moisture soundings at high spatial and temporal resolution would bring a significant improvement in the ability to forecast mesoscale weather systems and, in general, assist with severe storm warning.

OP-5: Volcanic Ash and Gas Emission Mapping Mission and Advanced Geostationary Earth Imager

The visible and IR imaging radiometer on the current GOES series is a new instrument design that delivers images of the earth disc with unprecedented spatial and temporal resolution. Nevertheless, several improvements are envisaged, such as augmenting the number of spectral channels and further increasing spatial resolution. These upgrades would be justified by a multiplicity of operational applications of geostationary imager data, from tornado warning to fire detection to tracking ash clouds from volcanic eruptions.

OP-6 : Special Event Imager

The "Special Event Imager" concept (SEI) is a steerable high-resolution imager that could be pointed to stare at occasional or predictable regional events that vary within a time span of hours rather than days. The SEI is being promoted by the biological oceanography community as well as operational users as a desirable addition to the standard payload of GOES satellites. In addition to numerous applications from wildfire assessments to algal bloom monitoring, the SEI could provide invaluable ocean color change information to capture coastal phenomena that are dependent upon tidal effects.

OP-7 : Geostationary Lightning Mapper

Electrical charges that cause lightning strikes are created by rapid ascending motions associated with strong convective storms. There is evidence that instantaneous mapping of lightning strikes over the disc of the earth from geostationary orbit would enhance the ability to judge the strength of developing storm cells and forecast the likelihood of tornadoes and severe downdraft. The strike rate can also be related in a semi-quantitative manner to convective precipitation. Altogether, a geostationary lightning mapper holds considerable attraction for weather forecasters, but the scientific significance of such observations from one or two geostationary satellites does not match the scientific interest of global lightning distribution data obtained by the NASA-provided lightning detection sensor on TRMM.

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SUMMARY OF DISCIPLINE PANEL REVIEWS
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RESPONSES CONCERNING MISSION CONCEPTS
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Science

Research Division
Office of Earth

NASA Headquarters

Aug. 5, 1998

SCIENCE-BASED PRIO
RTITIES FOR POST-2002 FLIGHT MISSIONS

ATMOSPHERIC CLIMATE
PHYSICS

Summary of
Step 1 Mission Concept Reviews
July 1998

SCIENCE-BASED PRIORITIES FOR
EOS POST-2002 FLIGHT MISSIONS
ATMOSPHERIC CLIMATE PHYSICS

Atmospheric Climate
Physics Panel - Overall Science Priority

Summaries of the four mission concepts considered by the Atmospheric Climate Physics Panel are presented here in order of their scientific priority. The two highest priority mission concepts are research missions needed to make progress in understanding radiative forcing and feedback processes which have significant impact on the Earth's climate. The two lower priority mission concepts are monitoring missions for the continued systematic measurement of Earth system state variables and solar forcing. The state variables, in a sense, are the system response to forcing and feedbacks. The following table outlines the science priority, question addressed, and priority reasoning for the four concept missions:

Priority	Science Question	Mission
1	Radiation Forcing by Aerosols	Of all of the radiative forcing processes affecting climate, aerosols have the largest uncertainty in the magnitude of their contribution and their spatial and temporal dependence. Global measurements of aerosol optical properties require an extraordinary complement of dedicated space-borne remote sensing instruments.
2	Cloud Radiative Feedback	The magnitude of cloud radiative forcing of climate is second only to water vapor. Dramatic changes in cloud radiative feedback are governed by subtle changes in the environment including aerosols. A dedicated space-borne mission including active and passive sensors is required.
3	Variability and Trends in Basic Climate Variables	Monitoring During the period of time following EOS PM-1 and NPOESS, a continuation of space-borne measurements of atmospheric temperature, moisture and TOA radiation fluxes is required.
4	Variability in Solar Radiative Forcing	Monitoring During the period of time following TSIM and NPOESS, a continuation of space-borne measurements of solar irradiance is required.

Q1. First Science Question: Radiation Forcing of Climate by Aerosols

Arguably the most pressing scientific issue presently identified for climate change studies is the unknown radiative forcing caused by atmospheric aerosols. Natural variations of aerosols, especially due to episodic eruptions of large volcanoes, are recognized as a significant climate forcing, that is, a factor that alters the planetary radiation balance and thus may cause a global temperature change. In addition, there are several ways in which human activities are altering the amount and geographic distribution of atmospheric aerosols, and thus possibly affecting climate. Climate forcing due to changing aerosol concentration and properties, include both the direct radiative forcing by aerosols and the indirect radiative forcing caused by effects of changing aerosols on cloud properties. These climate forcings due to changes of aerosols are not determined well, especially in the case of aerosols produced through human activity. Indeed, aerosols are one of the greatest sources of uncertainty in interpretation of climate change of the past century and in projection of future climate change.

The large uncertainty that aerosols introduce in our understanding of climate change is illustrated by the Intergovernmental Panel on Climate Change published in Climate Change 1994: Radiative Forcing of Climate Change. Furthermore, the National Research Council has recommended a research plan in its Aerosol Radiative Forcing and Climate Change which also contains background material that is useful in establishing the rationale for the present NRA. [this paragraph may not be needed]

To understand the direct radiative impact of aerosols on climate, measurements are needed of the variation of the spatial (horizontal and vertical) distribution of aerosol, expressed by the optical thickness or mass concentration. Also required is knowledge of aerosol absorption, scattering, size distributions and compositions. These properties may have important diurnal variations. Frequent global measurements of the variation of the aerosol spatial distribution and some key properties are only achievable by Earth observations from space.

The atmospheric physics panel under the EOS post-2002 process have separated the measurements to address the first science question by focusing primarily on direct radiative forcing and the second science question to focus on cloud radiation feedback processes, as well as aerosol indirect radiative forcing. This approach has been taken in order to most efficiently limit the number of measurements to be made from a single space platform.

Aerosol
Radiative Forcing Research Mission

The first priority for the discipline is

therefore a one-time (~ 5 year duration) experimental or discovery mission to characterize aerosol distribution within a sufficient number of independent atmospheric columns (nevertheless a relatively discrete sample of the whole atmosphere) with sufficient vertical resolution (~ 250-500m) to deduce the aerosol origin and therefore likely composition. The mission would be launched in polar sun-synchronous orbit or a drifting inclined orbit (TRMM orbit) to sample different solar illumination conditions. The core payload would include:

- DIAL LiDAR (H2O): vertical distribution of water vapor and aerosol backscatter Heritage: LITE, LASE.

Multi-angle, Multi-spectral, Radiometer/Polarimeter: As the A-band, this instrument works in synergy with the lidar back scattering profile of aerosols. Derives estimate of aerosol particle size, optical depth and single scattering albedo which is independent of the A-band retrieval. Heritage: POLDER, MISR.

Nadir viewing Oxygen A-band High Resolution Spectrometer: When combined with lidar provides aerosol visible optical depth and single scattering albedo and asymmetry parameter. Heritage: MERIS

Broadband Solar and Thermal Infrared Radiometer: Provides highly accurate SW and LW top of atmosphere fluxes (1% or better calibration) to act as an integral constraint on deriving radiative flux profiles. Heritage: CERES.

2. Second Science Question: Radiation Feedback in Climate by Clouds

Radiation transfer is the primary process that determines the Earth's climate as well as its sensitivity to anthropogenic and external forcing. This transfer is principally governed by water in three physical forms: atmospheric water vapor, liquid clouds, and ice clouds. General circulation models, climate models, and cloud process-resolving models are progressing toward ever more detailed explicit formulation of cloud and aerosol microphysical/macrophysical properties and their impact on radiative fluxes. However, global data are sorely needed to validate the simplified physics represented in these models against observation.

Due to the large time and space variability of atmospheric water and clouds, and the non-linear relationship between these factors and radiative fluxes, it is not legitimate to relate global statistics of cloud and water vapor with equally broad scale estimates of radiative fluxes: simultaneous observations in essentially the same column of air are needed. By simultaneous is meant within a few minutes and within 1 to 2 kilometers. These observations are needed over a sufficient sample to accurately characterize the diversity of cloud and meteorological conditions found in the atmospheric circulation. In the simplest terms, the cloud feedback loop involves three processes:

- Atmospheric State determine Cloud Properties,
- Cloud Properties determine Diabatic Heat Fluxes and Moisture Fluxes
- Heat and Moisture Fluxes modify the Atmospheric State.

Neither of processes 1 or 2 is known to within an order of magnitude of the accuracy needed to predict future global change. In many cases even the sign of a feedback is unknown. We briefly summarize the existing observational challenges to resolving these feedback loops, and then suggest how most of these challenges can be overcome with a combination of new and existing space-based instruments. Because clouds are at the heart of both the energy cycle and the hydrological cycle in the Earth System, they represent the most important but also the most difficult observational challenge.

Global Atmospheric State estimates for temperature and humidity profiles should improve significantly with the 4-D assimilation of AIRS/AMSU/HSB data on the EOS-PM spacecraft, as well as the later equivalent capability being designed for NPOESS. Major remaining observational problems pertinent to the cloud modeling problem are expected to be:

- Vertical velocities (convergence/divergence)
- Profiles of cloud and ice condensation nuclei (related to aerosol loading and composition)
- Temperature inversions and boundary layer depth measurements
- Very high vertical resolution water vapor measurements

For Cloud Properties, TRMM, EOS-AM, EOS-PM, and ADEOS will greatly improve our understanding of clear-sky and single layer cloud systems, especially for water clouds. But there will be several cloud properties which are expected to be highly uncertain with currently planned and existing space-based cloud data:

- Cloud Ice Water Path (factor of 5 to 10 uncertainty for thick ice clouds)
- Ice Cloud Particle Size (factor of 2 to 5 uncertainty especially for thick ice clouds)
- Cloud Ice Particle Scattering Asymmetry Parameter (factor of 2 uncertainty in conversion of ice cloud optical depth to cloud albedo for thin to moderately thick ice clouds)
- Cloud Thickness and Cloud Base Altitude (factor of 2 uncertainty)

All Multi-layered
cloud properties (roughly half of all cloud cases)
Cloud vertical aspect ratio
and its effect on cloud albedo

As concerns Heat and Moisture Fluxes, TRMM and EOS-AM/PM will greatly advance the state of the art. Several heat and moisture fluxes, however, will remain highly uncertain:

Broadband downward LW flux
at the surface for all multi-layered cloud cases (roughly half of all clouds: regional uncertainties up to 20 W/m²)
Broadband LW heating rates within the atmosphere for all multi-layered cloud cases (roughly half of all clouds: zonal mean uncertainties up to 25% in the LW heating rate)
The effect of the unknown cloud properties listed above on cloud shortwave (SW) albedo.
Global precipitation
and therefore latent heat fluxes
Sensible heat fluxes (high latitudes and winter mid latitudes)

Cloud/Radiation Feedback Research Mission

The second priority for the discipline is a one-time (duration ~ 5 years) experimental or discovery mission to measure atmospheric profiles of cloud and aerosol physical properties, optical properties, as well as latent and radiative fluxes as a function of local atmospheric conditions and weather systems. These vertical profiles will be primarily along the ground-track of the satellite, with a few of the instruments providing the larger scale context of the cloud and/or aerosol field within 100 km of the ground track. The nominal 5-year mission in either sun-synchronous or high inclination precessing orbit in order to allow sufficient sampling of poorly understood and measured polar cloud systems. Over a 5-year mission, roughly 800,000 independent cloud systems would be sampled. As proposed, there is a substantial benefit in flying this mission in formation with a precipitation mission which would provide the cloud radar and TMI-class passive microwave data, and/or with an EOS-PM type mission which would provide IR Spectrometer, broadband radiometer, cloud imager, and TMI-class passive microwave. An alternative to the EOS-PM type mission would be the NOAA N mission. This mission could also fly in formation with the Aerosol Radiative Forcing mission.

The key measurements would include:

Dual Polarization Backscatter Lidar :
aerosol and cloud overlap profiles for optical depths less than about 5, cloud particle phase, boundary layer depth). Ultimately a water vapor DIAL lidar can add high vertical resolution water vapor profiles. Heritage: LITE, GLAS, LADE,

Dual Frequency Cloud Profiling Radar (94, 14 GHz): cloud layering for optical depths > 5, rainfall, latent heat. Heritage: TRMM 14 GHz, aircraft and surface 94 GHz radar, CloudSat)
Passive Microwave (low frequency): Cloud Liquid Water Path, precipitable water vapor, surface wind speed, and assist cloud radar for precipitation. 19, 23, 37, and 85 GHz. Heritage: TMI, SSMI, AMSR.

Sub-millimeter Microwave or Far-Infrared Radiometer: cloud Ice Water Path and particle size for thick ice clouds (optical depths > 5). Heritage: MLS, Airborne Cloud Ice Radiometer. Requires passive microwave water vapor channel observations such as those on MHS.

Nadir viewing Thermal Infrared Spectrometer/Sounder:
Ice water path and particle size for optical depths < 5 when combined with lidar cloud height. Heritage: IRIS, AIRS.

Nadir viewing Oxygen A-band High Resolution Spectrometer: when combined with lidar provides ice aerosol visible optical depth and single scatter albedo, ice particle asymmetry parameter, and effect of cloud aspect ratio on scattering photon path length distribution. Heritage: MERIS.

Multi-angle, Multi-spectral, Radiometer/Polarimeter: As with the A-band, and, this instrument works in synergy with the lidar back scattering profile of aerosols and clouds. Derives aerosol particle size estimate, as well as aerosol optical depth and single scatter albedo which is independent of the A-band retrieval. Also may have ability to provide some ice particle habit information. Heritage: POLDER, EOSP, MISR.

Broadband Solar and Thermal Infrared Radiometer: Provides highly accurate SW and LW top of atmosphere fluxes (1% or better calibration) to act as an integral constraint on deriving radiative flux profiles. Works in synergy with lidar/radar cloud layering data for LW radiative flux profiles from surface to TOA. Using two broadband channels in the solar split at 0.7 μ m, then provides 1% calibration for visible cloud optical depth. If contains both broadband LW and 8-12 μ m window, then also provides calibration standard for infrared window spectral channels and cloud emissivity. Heritage: CERES.

Simple Visible Infrared Imager: Provides cloud field context: cloud fraction, optical depth, and cloud temperature for a 500 km swath. Horizontal cloud optical depth field allows matching of any differing sized radiometer fields of view at nadir. Minimum capability is 500m spatial resolution for two spectral bands: visible and infrared window.

3. Third Science Question: Variability

& Trends in Basic Climate Variables

Aerological Variables

The principal "greenhouse gas" which moderates the amount of longwave radiation transfer to space is water vapor. While reasonably accurate climatological information on the distribution of water vapor in the lower layers of the troposphere exist over land and (balloon sonde hygrometry), current knowledge is much more sketchy for the upper troposphere and the full troposphere over the ocean.

The distribution of water vapor in the troposphere is highly variable in space (coherence length ~ 50 km) and time (time constant ~ 1 hour), and generally strongly dependent upon mesoscale weather events such as fronts and convective cells. For this reason, no single measuring technique can serve to characterize the distribution of this essential atmospheric constituent on all relevant time- and space scales. The most precise and complete remote sensing information has been obtained by a combination of IR and microwave spectrometer/radiometers that constitute "atmospheric sounder systems" on meteorological satellites. The latest and most advanced entry in this domain is the AIRS + AMSU sounding system on EOS PM-1.

Precision temperature and moisture sounding is essential to the study and prediction of the global water cycle, its variability and its response to climate change. Current General Circulation Models (GCMs) have a rather poor representation of the hydrological cycle. As an example, many GCMs treat moist convection by parameterization schemes that describe the average effects of a large number of small-scale convection events. These schemes have been shown to produce very different temperature lapse rates, water vapor distributions and climate feedbacks. Current GCMs are not yet capable of providing accurate description of the transport of the water cycle such as the variability of the recycling rate of the hydrological cycle or the trends and variations in the upper tropospheric component of the water vapor. The basic properties of many of these transport processes can be determined directly from satellite data. Thus, enhancing the quality of retrievals of global atmospheric temperature and moisture vertical structure is requisite to improving the accuracy of GCMs as well as providing information for climate research and weather applications.

Accurate temperature and moisture information are also important for studies of both short-term and long-term processes in the atmosphere. The same measurements that improve the accuracy of the fast components of the Earth system, such as forecasting of precipitation, will also improve the accuracy and usability of data assimilation products such as surface fluxes which are indispensable for understanding changes in the slower components of the Earth. Like the AIRS - AMSU - HSB instrument combination on the EOS PM-1 satellite, the next generation sounders should provide accurate measurements of the atmospheric temperature and moisture under all weather conditions and in the presence of clouds in the fields of view. The spectral resolution, radiometric accuracy and low noise-equivalent-radiance characteristics of the AIRS instrument should be maintained by the instruments chosen for the EOS post-2002 mission.

Radiation Variables

Satellite measurements of longwave and shortwave TOA radiation fluxes, as well as the derived clear sky fluxes and cloud radiative forcing, are widely used as validation checks for GCM simulations because computed TOA fluxes integrate a number of model processes and provide a convenient diagnostic check against measured quantities. These model quantities or model computations include: water vapor distribution, cloud distribution and optical properties, ice/liquid phase prescriptions, and radiation transfer in clear and cloudy atmospheres. Regional comparisons of GCM simulated and measured TOA flux quantities provides emphasis on specific regionally dependent processes.

In addition to GCM validation, satellite derived TOA radiative fluxes may be used for studies of long term trends and their relationship to other climate variables (although no such trend has been identified so far within the uncertainty of the measurement). The last CERES instrument is planned for the EOS PM-1 payload. Continued measurement of broad-band TOA radiative fluxes would require additional deployment of one or several CERES instruments to cover the period from 2006 to the first NPOESS launch. The mission should overlap EOS-PM-1 and NPOESS C1 by at least 6 months to allow intercalibration of instrument data records. An explicit discussion of the priority of this particular measurement relative to other climatological observations, for the specific purpose of detecting global climate change, remains to be presented.

□ (3.a) Variability & Trends in Aerological Quantities Mission

The EOS post-2002 mission envisioned will extend the high precision atmospheric temperature and water vapor record initiated with EOS PM-1, at least over the interim period after the termination of PM-1 and the launch of the first spacecraft in the operational NPOESS series. This objective is considered very important to identify any significant trend over a full 10-year period (such as drying of the upper troposphere by increased convective activity, as posited by Lindzen), to provide essential background aerological data for cloud and aerosol process studies, and characterize the weather systems in which these processes take place.

This EOS post-2002 mission designed to contribute to long-term systematic observations of basic atmospheric parameters, could be implemented by flying copies of the AIRS and AMSU-A instruments presently being built for EOS PM-1 (alternatively, an advanced version of the PM-1 microwave sounder using new microwave technology could be considered). The orbit would be polar sun-synchronous. The nominal payload would include:

Atmospheric Infrared Sounder: Repeat flight of the EOS AIRS instrument provides high accuracy and high spectral resolution sp

ectro-radiometry covering nearly 2400 bands in the infrared and visible ranges: 3.7 - 15 μ m and 0.4 - 1.0 μ m. These ranges have been specifically selected to make the measurements of temperature and humidity, among other products.

Advanced

ed Microwave Sounding Unit -A: Repeat flight of the AMSU-A instrument provide temperature profiles from the Earth's surface to a 43-kilometer altitude, total column water vapor content, and an indication-of-rainfall using 15 channels in the frequency range of 23 to 89 GHz.

(3.b) Advanced Technology Microwave Sounder under Demonstration Mission

The development of high-performance Monolithic Microwave Integrated Circuit (MMIC) technologies for the microwave frequency domain is useful for atmospheric temperature, moisture and cloud sounding has made it very attractive to combine in a single integrated unit the capabilities of existing operational sensors AMSU-A and B (or HSB). The development and flight demonstration of a prototype instrument that meets operational application needs, in addition to NASA long-term earth science objectives, could be given priority in the Enterprise's plan if supported by an active participation of the user agency for instrument development, demonstration and transition to operational use.

Advanced Technology Microwave Sounder: MMIC technology used in an advanced technology version of AMSU-A and B. AMSU-B (EOS HSB), is a 5 channel humidity sounder operating in the frequency range of 150 to 183 GHz. Heritage: AMSU-B, HSB.

(3.c) Variability & Trends in TOA Radiative Fluxes Mission

Broadband Solar and Thermal Infrared Radiometer: Repeat flight of the EOS CERES instrument provides a continued record of accurate SW and LW top of atmosphere fluxes (1% or better calibration) to act as an integral constraint on deriving radiative flux profiles. An advanced broadband instrument using two broadband channels in the solar split at 0.7 μ m, would provide 1% calibration for visible cloud optical depth. Heritage: CERES.

4. Fourth Science Question: Secular Changes in Solar Radiative Forcing

Monitoring total solar irradiance, the solar radiant flux density at the mean Earth-Sun distance, has been a science goal for more than a century. At any time in Earth's history the Earth's climate has been significantly determined by the absolute magnitude of the total solar irradiance (TSI) and the complex forcings and feedbacks found in the climate system. The first long-term solar monitoring instrument in space utilized an electrically self-calibrating cavity sensor, part of the Earth Radiation Budget (ERB) experiment on the Nimbus 7 spacecraft. The ERB database, beginning in late 1978 and continuing to early 1993, is the longest currently available. Unambiguous evidence of TSI variability was first detected in the highly precise results of the Active Cavity Radiometer Irradiance Monitor (ACRIM I) experiment on NASA's Solar Maximum Mission (SMM) in 1980. The mutually corroborative function of the ACRIM I and ERB results has played an important role in verifying TSI variability on the solar activity cycle time scale.

The precision TSI climate database is currently being sustained by two experiments; namely, (1) the UARS/ACRIM II, launched in 1991 and the (2) the Differential Absolute Radiometer (DIARAD) on the European Space Agency's (ESA) Solar Heliospheric Observer (SOHO)/Variability of Solar Irradiance and Gravity Oscillations (VIRGO), launched in late 1995. NASA planned TSI experiments are EOS/ACRIM (October, 1999) and the Total Solar Irradiance Mission (December, 2001). The major concern in sustaining the long term TSI database is in providing overlap between successive members of the series. Failure to provide adequate overlap between these experiments could result in a loss of relative precision in the long-term TSI database. A key objective of the post-2002 EOS missions is to provide sufficient overlap with the TSIM mission and to provide continuity with equivalent or better precision and accuracy to the measurements made previously.

The NPOESS climate workshop recently indicated the need for spectral measurements to provide solar radiation quantities more physically relevant for climate. The workshop specifically pointed out the value of spectral measurements at 200-300 nm and 1500 nm. Spectral measurements of these two wavelength bands have been incorporated in the design of the TSIM mission to be launched in December, 2001 and will continue through the time period of the post-2002 EOS missions to be considered here. The post-2002 total solar irradiance missions will continue the precise total solar irradiance data record measured by NASA funded spaceborne instruments since 1979 until the NPOESS systems are available. NASA's interest in continuing total solar irradiance measurements is in considering the effect of this variability on the Earth's climate.

Total Solar Irradiance Monitoring Program

This program will include the planned TSIM (expected to be launched in Dec., 2002), to be followed by at least two subsequent free-flyer missions. The nominal plan is currently for NPOESS to systematically include a TSI instrument on one of its operational satellites, beginning at the end of the next decade.

Total Solar Irradiance and Spectral Components: Repeat flight of the TSIM payload which consists of an total solar irradiance, active cavity radiometer, and spectral instruments sensitive to 200 - 300 nm and 1600 nm. Heritage: ACRIM, TSIM.

□

SCIENCE-BASED PRIORITIES FOR POST-2002 FLIGHT MISSIONS

ATMOSPHERIC CHEMISTRY

Summary of
Step 1 Mission Concept Reviews
July 1998
□
Research-Driven Priorities for
Post-2002
Atmospheric Chemistry Missions

The Leading Questions

In the last two decades an integrated program of space, aircraft, balloon, and ground-based measurements has established that the chemical composition of the atmosphere is changing and that some of the changes, such as the buildup of chlorofluorocarbons (CFCs) and of carbon dioxide are the result of human activities. In the case of CFCs and other halogen containing substances, it has been further established that such long-lived compounds are lifted into the stratosphere, broken down by solar ultraviolet radiation, and become the sources of highly reactive chlorine and bromine atoms, which catalytically deplete the earth's protective layer of stratospheric ozone.

In response to these findings, the nations of the world have placed limits on the emissions of halogen-containing chemicals whose concentrations are now beginning to decrease in the lower atmosphere. Within the next decade they will decrease in the stratosphere, which will result in less depletion of stratospheric ozone. A major challenge of atmospheric chemical research in the coming decade is to follow this process and to ensure that no unexpected problems with stratospheric ozone arise from the CFC substitutes and growing use of other halogen compounds or from climate changes traceable to human activities that could affect stratospheric chemistry.

Buildup of stable, long-lived gases such as carbon dioxide, methane, and nitrous oxide underlies the greenhouse gas phenomenon and is a forcing factor in radiation balance. More reactive gases, such as carbon monoxide and ozone, also play an important role in this phenomenon. Understanding the chemistry of these gases, most of which occurs in the troposphere, is another major focus of global atmospheric chemistry research.

Apart from the role of these reactive gases in global radiation balance, there is another important issue surrounding them. As the developing and emerging nations, particularly in Asia and Latin America, grow in population and economic activity, emissions of pollutant gases, such as CO and the oxides of nitrogen that largely control tropospheric ozone, will undoubtedly increase enormously. The effects of this growing atmospheric pollution on a global scale are not well predicted because natural processes that both emit gases into the atmosphere and remove human pollutants through photochemistry are not well characterized. Understanding and predicting these effects will be a frontier area of atmospheric research for the next decade and beyond. It is a global scale problem that lends itself particularly well to the use of space observations and correlative and complementary in situ measurements.

Given the current status of knowledge of stratospheric and tropospheric chemistry and expected scientific return from current and planned space measurements (UARS, TOMS, SAGE, and the instruments on the planned CHEM satellite), a series of measurements with smaller instruments that will incorporate advanced technology can be identified for the post CHEM era with the new NASA paradigm of smaller, focused missions.

For stratospheric chemistry global measurements of total ozone and ozone vertical distributions will be the principal long-term requirement as the ozone layer recovers in response to the Montreal Protocol limitations on halogen-containing chemicals. To track cause and effect, measurements will be needed of several key chemical species that are involved in the chemistry of ozone depletion or that are chemical tracers of atmospheric transport. Measurements of the aerosol content of the stratosphere will define volcanic influences on stratospheric chemistry. Direct measurements of source gases such as CFCs, hydrochlorofluorocarbons (HCFCs), and hydrofluorocarbons (HFCs) will also be a long term need.

For tropospheric chemistry global scale measurements of ozone as a function of altitude are key requirements from both a climate impact and a global pollution perspective. The ozone concentration levels in the troposphere are controlled to a large extent by concentrations of oxides of nitrogen which originate mostly in the lower troposphere. Long term measurements of oxides of nitrogen will be needed to track cause and effect relationships between tropospheric

zone and pollution growth. Measurements of carbon monoxide concentrations as a function of altitude and geographic location will be valuable as a pollution indicator and a tracer for tropical overturning. Natural fluxes of key tropospheric chemicals into the atmosphere from both land and water will be a key input to global chemical models. It will also be important to determine the extent to which changing atmospheric aerosol concentrations will modify tropospheric chemistry.

Can we understand and predict how atmospheric composition is changing?

The studies undertaken to achieve this general scientific objective will answer three specific questions that are certain to be at the center of public environmental concerns regarding the changing chemical composition of the earth's atmosphere during the first few decades of the next century:

Is the Montreal Protocol working as expected to stop ozone depletion in the stratosphere by manmade chemicals, and are there any threats not yet recognized that require additional attention and action?

How can space observations contribute to better detection and characterization of regional to super-regional air pollution and assist in dealing with control issues that transcend state and even national borders?

To what extent is industrial and urban pollution distributed globally and what will be the global atmospheric consequences of large-scale pollution as emerging economies greatly increase their use of fossil fuels?

□
1. Stratospheric Chemistry Mission

Background

Following the measurements of UARS and CHEM the RFI panel recommends that future stratospheric chemistry measurements should focus on (1) the anticipated recovery of the ozone layer following the projected decreases in anthropogenic halogen (chlorine and bromine) and (2) climate feedbacks associated with the changes in upper tropospheric and lower stratospheric ozone and water vapor.

Science Questions

(1) How is ozone changing as anthropogenic halogen levels decrease? What is the change in the concentrations of trace gases and aerosols in the stratosphere? What are the possible feedback mechanisms connecting ozone depletion and climate change?

Measurement

Requirements: stratospheric ozone, temperature, aerosols/polar stratospheric clouds (PSCs), water vapor, dominant species in the Cl_y, Br_y, and NO_y families, CH₄, N₂O, HF, and spectrally resolved UV in the 200-400 nm region. There are three basic stratospheric latitude regions which are relatively well-mixed - the tropics, mid-latitudes, and polar regions. The unequivocal detection of stratospheric recovery will require measurements over a long period of time (for at least 10 years starting in 2006) at high vertical resolution in each of these regions.

(2) What are the changes in upper tropospheric/lower stratospheric water vapor, temperature and ozone in response to greenhouse gas increases and decreasing concentrations in ozone depleting substances?

Measurement Requirements

: Ozone, temperature, and water vapor in the lower stratosphere and upper troposphere at 1-2 km vertical resolution in the presence of clouds and aerosols.

Mission Concept

To meet the requirement of systematic measurement of stratospheric trace gases, the highest scientific priority is the development of a 10 year data record which builds on the measurements made by SAGE I, II, III, ATMOS, as well as UARS, ENVISAT, and CHEM instruments. To meet the 10 year continuity requirement, we propose an observing system comprised of an Attached Payload a long-duration platform (the International Space Station) and a series of overlapping, shorter-duration (~4 year) free-flyer missions.

Fulfillment of the measurement requirements listed above suggests a mission that utilizes occultation instruments on two spacecraft, one in polar sun-synchronous orbit and one in mid-inclination orbit. The advantage of occultation measurements is their self-calibration and high vertical resolution. The mid-inclination instruments measure mid-latitude and tropical trace gases and aerosols, while the polar platform makes measurements at high latitudes. The core instruments envisioned are visible/near infrared radiometer and IR Fourier Transform Spectrometer (FTS) systems. The mid-inclination system should continue the current plan to attach a SAGE III instrument to the International Space Station (ISS). We recommend that the SAGE instrument be accompanied by an ATMOS-type system for monitoring the additional trace gases discussed above. One of the advantages of flying on the ISS is that it provides a long-duration platform and the opportunity for instrument replacement.

The polar spacecraft would have the same core measurement objectives. However, we suggest that visible occultation measurements of stars could provide additional profiles, especially during polar night. Because of

orbital geometry, the FTS-IR occultation system would have reduced spatial coverage in the polar orbit. Thus, an emission system with high vertical and horizontal resolution might be considered as an alternative. An emission system would provide a greatly augmented capability of measuring radicals and other trace gases globally. Such an emission system needs to have demonstrated long-term calibration. The emission system must also provide the required upper tropospheric and lower stratospheric water vapor and ozone measurements in the presence of clouds to meet the second science objective. If the emission instrument cannot provide the demonstrated long-term calibration or measurement suite, then a copy of the selected ISS FTS-IR instrument should also be flown aboard the polar orbiter.

Either the ISS or the polar mission should include an instrument capable of monitoring spectrally resolved solar UV irradiance. Because of the less contaminated environment around the polar orbiter and the sensitivity of short wavelength observations to contamination, we expect that such an instrument would be better attached to the polar platform. We also emphasize the importance of the mid-inclination ozone and aerosol observations. Should it become clear that the ISS cannot provide the needed platform for these observations, then an alternative scenario for deployment of mid-inclination occultation-based ozone/aerosol observations in the visible/near IR must be developed.

Mission Summary

Mid-Inclination (51.5 degrees, ISS, 2002-2010)

Visible/near IR solar occultation instrument on the ISS (begins in 2002 with a SAGE III instrument). Implementation if the IR solar occultation FTS instrument is required to become operational after the completion of the EOS-CHEM mission.

Polar Sun-Synchro-
nous (~2006-)

Visible/near IR solar/stellar occultation instrument
Emission spectrometry instrument for ozone, water vapor, trace constituents in upper troposphere and lower stratosphere.
Solar UV Spectral Irradiance (~200 - 400 nm) measurement.
IR solar occultation FTS instrument (if needed)

2. Tropospheric Chemistry Mission(s)

Background

Ozone is one of the most important gas phase minor constituents of the troposphere. Its importance stems from three principal roles:

- 1) as a greenhouse gas it plays a major part in radiative forcing
- 2) ozone is a key oxidant in tropospheric photochemistry. Ozone photolysis is one of the principal sources of OH, which is the most important radical intermediate in the photochemical degradation of anthropogenic and biogenic hydrocarbons
- 3) as a photooxidant, ozone is responsible for acute and chronic health problems in humans and contributes to the long-term destruction of plant and animal populations.

Science Questions

The key science questions for a proposed tropospheric chemistry mission in the post-first series time frame include the following:

- 1) What is the distribution of ozone in the global troposphere? Ozone distributions are affected by the distribution of precursor gases, solar radiation, and by transport processes. Existing sonde and aircraft data are exceedingly sparse. Measurements show a high degree of vertical stratification. Vertical distributions of tropospheric ozone are strongly affected by transport from the stratosphere, regional sources such as biomass burning, urban and regional pollution, and atmospheric circulation on scales ranging from hundreds of meters (vertically) to hundreds of kilometers (horizontally).
- 2) What are the spatial and temporal distributions of the key precursor species for the photochemical formation and destruction of ozone? These include nitrogen oxides (NO_x) = NO + NO₂, CH₄, and nonmethane hydrocarbons, including higher alkanes and olefins of both biogenic and anthropogenic origin. Like ozone, NO_x has both stratospheric and tropospheric sources, whereas hydrocarbons are produced exclusively in the troposphere. Both precursor families are subject to the same transport processes which cause the high degree of spatial heterogeneity as observed with ozone but are much more difficult (in general) to measure from space.

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Mission Concept

This mission is envisioned as a process study, rather than a long-term systematic measurement challenge. The CHEM satellite will provide the first global data set on distribution of tropospheric ozone. The RFI panel suggests that the key remaining questions in the post CHEM time period will be process-related. Tropospheric ozone is expected to show considerable stratification and fine structure in horizontal distribution that will contain important information on the factors that control overall tropospheric ozone distribution. Resolution of this vertical and horizontal structure will require superior vertical and horizontal resolution of the measuring instrument. Such improvement is anticipated in the next several years through the development, for example, of a space-based laser system that could be deployed for ozone measurements. Advances in other measurement techniques are also possible that would enable higher resolution ozone measurements from space. Development of these possibilities should be a major technological focus with the eventual goal of achieving understanding of tropospheric ozone processes, especially at higher vertical and horizontal resolution than will be possible with the CHEM payload.

The high vertical and horizontal resolution measurements of tropospheric ozone will need to be accompanied by measurements of ozone chemical precursors, tracers for atmospheric transport, and indicators that will help to trace the sources of the precursors. While high resolution would be extremely valuable for these measurements as well, it may not be achievable because of the low concentrations involved. Lower vertical resolution measurements to accompany the higher resolution ozone measurements would be very valuable in analyzing the processes involved in controlling ozone distributions.

This mission will address what will undoubtedly be a major issue in global change research related to atmospheric chemistry during the next several decades. The growth of emerging economies around the world will certainly increase the load of pollutant gases in the atmosphere. This will have major implications on the concentrations of climate forcing gases in the troposphere and on the ability of the troposphere to cleanse itself of pollution through oxidation of major pollution gases.

Measurement Requirements:

Ozone: The high degree of heterogeneity in observed ozone distribution leads to the following specifications for global measurements:

Vertical Resolution: 1-2 km
Horizontal Resolution: 100 km
Temporal Resolution: 12 hours
Precision/Accuracy: 10%/10%

NOx (NO or NO₂):
Vertical Resolution: 5 km or better
Horizontal Resolution: 100 km or better
Temporal Resolution: 1 day
Precision/Accuracy: 10%/10% better than 50 pptv

NOy (e.g. HNO₃):
Vertical Resolution: 5 km or better
Horizontal Resolution: 100 km or better
Temporal Resolution: 1 week or better
Precision/Accuracy: 10%/10%

Hydrocarbons other than Methane (e.g. H₂CO):
Measurement technology for hydrocarbon remote sensing from space is extremely limited. Only H₂CO (UV-visible) and possibly a few others, such as C₂H₆, C₂H₂, (CH₃)₂CO (infrared) can be measured as a tropospheric column average. CO should be measured as a tracer of combustion-related sources.

Instrument Heritage

TES (thermal IR emission); TOMS, GOME (solar UV/Vis backscatter radiometry); LITE (space-based Lidar for active remote-sensing of cloud and aerosol). No heritage for active remote-sensing of chemical composition from space.

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SCIENCE-BASED PRIORITIES FOR POST-2002 FLIGHT MISSIONS

HYDROLOGY & MESOSCALE WEATHER

Summary of
Step 1 Mission Concept Reviews
July 1998
□ SCIENCE-BASED PRIORITIES FOR POST-2002 FLIGHT MISSIONS

GLOBAL WATER CYCLE, HYDROLOGY & MESOSCALE WEATHER

1. First Science Question: Global Precipitation

Global hydrology is the study of the movement and storage of water on or near the land surface, in the atmosphere, and its transport to the oceans. Some elements of the global water cycle are amenable to remote sensing. Precipitation is an especially important component of both the land surface and atmospheric water balances globally. Furthermore, over most land areas of the globe, it exerts the dominant control on the surface water balance (in part ular, evapotranspiration and runoff), and indirectly, on the partitioning of net radiation into latent and sensible heat at the land surface. Precipitation is intimately linked with small-scale weather systems and orography, or even micro-scale processes in rain clouds. Consequently, rainfall is highly variable in time and space. At the land surface, the space-time variability of precipitation interacts with land surface characteristics (topography, soil properties, and vegetation) to determine the nature of the runoff response, i.e., partitioning of precipitation into infiltration and runoff.

Precipitation is especially difficult to measure either at the surface (e.g., from gage networks or surface radar) or from space. In situ networks are inevitably coarse relative to the scales of precipitation variability, and estimation of precipitation from surface radar is complicated by terrain blockage, ground clutter, range dependencies of the transformations from radar reflectivities to precipitation rates, and other technical factors. On the other hand, remote sensing of precipitation from space is effectively a diagnostic of the distribution of large ice particles or water drops within clouds (in the case of active or passive microwave sensors) or cloud top temperature (in the case of infrared sensors). Therefore, remote sensing cannot provide a direct estimate of rainfall reaching the ground. Nonetheless, early results from TRMM confirm that spaceborne radar can provide reliable estimates of surface precipitation rates. In fact, because the TRMM radar is able to resolve the vertical structure of water and ice particle sizes, it is being used on an experimental basis for calibration of surface precipitation radar.

In consideration of the fact that precipitation is the primary driver of land surface hydrological processes, as well as a controlling input to the fresh water balance of the ocean, the Step 1 Review Panel placed its highest priority on acquiring hydrologically useful measurements of global precipitation for a representative period of at least 5 years. The interpretation of hydrologically useful is to be sub-diurnal temporal resolution, and spatial resolution of the order of the decorrelation distance for intense precipitation events (arguably ~10 km as a compromise between convective and stratiform precipitation).

Global Precipitation Measurement Program

While the long-term objective is really to acquire a continuous record through systematic global measurement of precipitating clouds, it was agreed that a single 5-year intensive measurement period during the next decade would constitute a major step forward in promoting continent and global-scale hydrological research, and providing a quantitative basis for global water cycle studies. The value of the mission for surface hydrology would be particularly high in those areas of the globe most deficient in surface observations notably Africa, South America, and much of Asia.

The mission would require launching a constellation of at least 5 satellites in staged orbits carrying:
a multi-frequency, dual polarization wave radiometer of performance comparable to TMI on the Tropical Rain Measuring Mission or ASMR on PM-1 and,
A narrow-swath precipitation imaging radar (ideally two-frequency 14 GHz and 35 or 95 GHz) on one of the 5 satellites.

The deployment of a constellation of satellites in low Earth orbit was judged to be the most promising approach achievable with the current state of the art. Consideration was given to an alternative use of sensors in geostationary orbit, possibly in combination with radiometers in low altitude orbit. It was the panels conclusion that current (and expected, within the next decade) spatial resolution limitations would preclude this option. Meeting the scientific requirements of the mission. It was also noted that the low altitude constellation could include two already existing operational satellites in staged orbits (SSM/I microwave radiometer deployed by the DMSP)

2. Second Science Question: Space-Time Variability of Soil Moisture and Its Impact on Climate

Soil moisture (in the unsaturated zone, as compared to groundwater, which refers to the saturated subsurface) is the most active component of moisture storage over the land areas of the globe. It is an indicator of the state of the terrestrial hydrologic system on time scales relevant to flood forecasting, and a predictor of evapotranspiration due to its control on transpiration from vegetation (water stress) and exfiltration from bare soil. Near-surface soil moisture integrates precipitation and evaporation over periods of days to weeks and therefore introduces a significant element of memory in the atmosphere/land surface climate system. The fast recycling of water through evapotranspiration and precipitation over large continental regions causes the persistence of wet or dry anomalies during summer. Precise measurements of soil moisture can be obtained in situ but such measurements are only representative of a small area. Remote sensing, if achievable

with sufficient accuracy and reliability, would provide essential wide-area coverage for macroscale hydrological studies and climatic anomaly prediction over large continental regions.

Experimental Global Soil Moisture Measuring Mission

The second priority for the discipline is therefore to develop effective remote sensing of soil moisture from space, using microwave sensors at relatively low frequencies (L-band or lower) in order to sense the ground surface under light to moderate vegetation cover. The objective of this experimental mission would be a 5-year demonstration of an advanced low-frequency dual-polarization imaging microwave radiometer in low earth orbit. A large real or synthetic aperture antenna will be essential in order to achieve a ground resolution of ~10 km, which would be compatible with the spatial resolution of the proposed global precipitation mission. Development of a suitable antenna system is the primary technological advance required for this mission.

3. Third Science Question: Mesoscale Weather Systems

Strong mesoscale weather systems (convective cells, fronts and squall lines, tropical storms and hurricanes) play a disproportionate role in rainfall production and strongly affect the hydrological cycle. Many weather and climate questions involve the most highly variable components of the Earth system - clouds, water vapor, aerosols, precipitation, fires, volcanoes, chemical constituents, surface temperature, among others. Observational systems, such as geosynchronous satellites, that fully observe these processes with fine time resolution can address many fundamental science questions that are difficult or impossible to answer from observations at a time resolution of once or twice per day as provided by low earth orbit satellites, notwithstanding their higher spatial resolution.

Improving the knowledge of mesoscale weather systems dynamics and thermodynamics is an important scientific goal for climate research, and a primary objective for applied weather research (e.g., US Weather Research Program) and operational weather forecasting. Because of the short time-scales that characterize the development of weather systems, observations must be conducted from geostationary orbit in order to achieve high sampling rates. The overall science goal in this area is to improve the understanding of physical, chemical and dynamical processes in the Earth's atmosphere and at the planet's surface. The more specific goals are to:

- 1) Advance our understanding of rapidly evolving phenomena and diurnal processes in the Earth's atmosphere and at the planet's surface.
- 2) Understand the role of these above processes in global and regional energy, water and constituent cycles and their impact on climate variations.
- 3) Apply this knowledge to the development of advanced space instruments, missions and techniques for operational monitoring and forecasting of significant and hazardous weather.

NASA-supported sensor technology developments could yield considerable improvement in the availability of operational environmental observing programs to characterize mesoscale weather and weather forecasting. The development and flight demonstration of prototype instruments that meet operational application needs, in addition to NASA long-term earth science objectives, could be given priority in the Enterprise's plan if supported by an active participation of the user agency in the instrument development, demonstration and transition to operational use. The currently known projects that are relevant to the domain of mesoscale weather include the following:

(3.a) Advanced Geostationary Sounder Demonstration Mission

Advances in IR detector array technology and long-life mechanical cooling system has made it possible to envisage the development of an absolutely calibrated, imaging Fourier Transform Spectrometer that could provide high vertical and horizontal resolution atmospheric soundings from geostationary orbit.

(3.b) Geostationary Lightning Imager Demonstration Mission

The technique for selective imaging of intra-cloud and cloud-to-ground lightning has been successfully demonstrated by the Lightning Imaging Sensor on TRMM. A similar technique could be applied from geostationary orbit to provide continuous coverage of a large fraction of the visible earth disc and measurements of lightning strike rates in individual storm systems. It has been shown that the strike rate in a particular convective cell is closely related to the vertical velocity of the core, the formation of large ice particles and, ultimately, the rainfall rate. Thus, a geostationary lightning imaging system could provide important support in

g information to estimate convective rain over the whole or part of the western hemisphere.

(3.c) Tropospheric Wind Sounder Demonstration Mission

Direct measurement of tropospheric wind (from Doppler shift measurement in lidar backscatter signal from aerosols and/or air molecules) would bring a major improvement in our ability to observe divergent motions in the atmospheric flow as well as rapid mesoscale weather development. The purpose of the mission, following the Shuttle flight demonstration of one of the two possible Doppler lidar systems (SPARCLE), is to demonstrate the operation of a tropospheric wind-finding Doppler lidar system in space over a meaningful time period (3 years or more).

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Fourth Science Question: Surface Water Flow and Storage

River discharge is one of the three primary elements of the land surface hydrological cycle, and the primary mechanism by which fresh water moves from the land surface to the oceans. Although many river basins are instrumented to provide reliable daily (or better) river discharge data, such information is lacking for a large fraction of the world's river basins, including many of the world's largest rivers (either because discharge measurements are lacking altogether or because they are not made available to the scientific community). Development of a comprehensive global river discharge network by precision altimetry measurements of river stage from space would constitute a major improvement of spatial homogeneity of basic hydrologic data worldwide and would facilitate global modeling of surface hydrological processes.

Experimental Surface Water Measuring Mission

The third priority identified by the discipline is to observe the stage (hence discharge) of major rivers and storage volumes in lakes and wetlands, by precision altimetry. It is anticipated that roughly 5-10,000 locations globally would be identified with sufficient open water widths (> 300-500 m) to facilitate altimetric measurements. All-weather capability would be essential to achieve an overall repeat objective of less than one week (roughly the hydrologic response time of the smallest rivers that could be effectively observed). The all-weather requirement dictates the use of radar (vs. lidar) systems. Depending on the type of sensor selected, the proposed surface water mission might be compatible with the Icesat/GLAS follow-on mission. However, a second unique requirement is the need for relatively frequent observations (revisit interval < 7 days) at the same locations. This probably would require that the instrument be pointable.

5. Fifth Science Question: Land Surface Cold Hydrological Processes

Cold climate processes (snow accumulation and soil freeze-thaw cycle) strongly affect the short term dynamics of hydrologic phenomena at the scale of river basins and climatic land-atmosphere feedbacks at continental scales. Outstanding science questions related to these phenomena are:
How does the extent of snow and frozen ground affect climate?
Could these factors be measured accurately enough to identify meaningful climatic trends?
To what extent can snow and frozen ground information deduced from remote sensing data improve hydrologic forecasts?

Cold Hydrologic Processes Research Mission

The fourth priority for the discipline is to test the ability of active SAR imaging switchable from fine (< -100 m) resolution to a relatively coarse spatial resolution (> -500 m). The fine resolution would be applicable to estimation of the water equivalent of moist snowpack over relatively small areas, while the coarse resolution would be used over large interior continental areas. At the coarse resolution, the mission objective would be to detect freezing and thawing of the ground, as well as the extent & amount of snow on the land surface (snow water equivalent). The mission would call for a dedicated satellite in polar sun-synchronous orbit, carrying a low frequency (L-band or lower) SAR with low spatial resolution (~1 km) but covering a large swath (~1000 km or more) in order to allow a short re-visit time (~2 days).

MISSION DESCRIPTIONS

Global Precipitation Mission

Background

Precipitation is the primary driver of the land surface hydrological system. The dynamics of precipitation, along with surface solar radiation, are the primary determinants of the partitioning of net radiation into latent and sensible heat at the land surface. Knowledge of the variability of precipitation at spatial scales of the order of the size of storm cells, and time scales of the order of the duration of storms (meaning spatial scales of order ten kilometers and time scales of order several hours) is essential in understanding the controls exerted by the land surface on weather and climate. Current numerical weather prediction models are not able to predict precipitation well, particularly the intensity of convective rainfall and its spatial distribution. Furthermore, there has not been much improvement in representing the physical mechanisms of precipitation and precipitation heating over the last decade, notwithstanding advances in computational design that have improved the spatial resolution of most models. No data set based on in situ observations exists globally that approaches the space-time resolution requirements relevant to the land surface.

surface system. From a practical standpoint, remote sensing offers the only reasonable option of developing globally coherent precipitation data sets that can be used to diagnose the performance of coupled land-atmosphere models, and to force off-line macroscale hydrological models capable of predicting and reconstructing surface moisture and energy fluxes over the land areas of the globe.

Science Questions

- (1) How well do coupled land-atmosphere-ocean models and four dimensional data assimilation schemes represent physical characteristics of precipitation?
- (2) What is value of diabatic heating information obtained from remotely sensed precipitation for physical initialization of numerical weather prediction models?
- (3) What is value of remotely sensed precipitation for initialization of mesoscale and global scale numerical weather prediction models given inability of current models to properly distribute convection and gauge its intensity?
- (4) What is value of remotely sensed precipitation for determining space-time characteristics of extreme precipitation events, and can missions of relatively short duration provide useful information about long-term changes in space-time distribution of extreme events?

Mission Summary

Objective: Obtain estimates of space-time distribution of precipitation over land areas of globe.
 Resolution: 10-km spatial resolution; 3-hour temporal resolution
 Mission duration: Five years.
 Space system configuration: Mother satellite inclined to 65 deg. carrying a precipitation radar and passive microwave imager; 4 or more "drone satellites" on 55 deg inclined orbit or polar orbit, carrying a passive microwave imager only. SSM/I measurements from DMSP could substitute for Drone measurements.
 New Technology

Radar and passive microwave radiometer technology exists; thinned array antenna for 10.7 GHz-only.
 Drone radiometer requires innovation, as does meeting under 30 million cost target for individual Drone satellites.

Soil Moisture Measurement Mission

Background:

Soil moisture is arguably the measurable variable that best indicates the state of the terrestrial hydrologic system. The partitioning of incident precipitation into infiltration and runoff is essentially dependent on surface soil moisture. Soil moisture at rooting depth usually controls evapotranspiration during the growing season, and indirectly the partitioning of incident solar radiation into latent and sensible heat. Therefore, it has important implication for atmospheric models, both at short-term (weather) and seasonal and inter-annual time scales (climate). Soil moisture plays a critical role in the establishment of vegetation patterns and processes, how the terrestrial hydrologic system links the physical climate system to the biogeochemical cycle. Unlike many other variables, there are no conventional alternatives to providing soil moisture measurements at regional to global spatial scales. At present, research results have demonstrated the importance of soil moisture within the physical climate system and the readiness of both the remote sensing measurement technology and retrieval algorithms.

Science Questions:

Given that soil moisture measurements are available at regional to continental scales, the following science questions can be addressed:

Is there a feedback mechanism between soil moisture and atmospheric circulation that can be verified?

Do climate and weather prediction models accurately represent the land surface partitioning of precipitation into infiltration and runoff? Recent PILPS results have shown that poor parameterization of the soil moisture dynamics (infiltration, base-flow drainage and evaporation) significantly influence the partitioning of incoming radiation into sensible, latent and ground heat fluxes, and the storage of soil heat.

To what extent can weather prediction be improved by the assimilating soil moisture observations? And does this vary seasonally and for different global locales? Results by ECMWF (for the central portion of the US during July 1993) seems to indicate that substantial improvements are possible.

Mission Summary:

Objective:

Global mapping mission for soil moisture.

Resolution: 10 km.

Repeat: 3-day rep

eat

Orbit: Near-polar, sun synchronous (6 am/6 pm equatorial crossing time).

D

uration: 5-year

Other: Compatible with a global salinity mission (instrument could retrieve ocean salinity if suitable signal/noise ratio can be realized.)

New Technology:

Continued development of antenna technology will be required
(to increase spatial resolution below 50 km), instruments technology existing

Advanced Geostationary Sounder Measurement Mission

Background:

Because of the cost and technology limitations which existed a decade ago, EOS terminated the Geosynchronous Platform component of the EOS earth science observing program. The importance of the geostationary orbit for a research satellite is its unique ability to observe the time continuity of both surface and atmospheric phenomenon. This high time sampling rate allows monitoring of fast processes such as cloud systems, severe storms (e.g. hurricanes and severe thunderstorms), and systematic observations of the Earth's diurnal cycles. This mission would utilize an infrared sounder for determination of temperature and humidity profiles, but would be compatible with other geostationary measurements. New technologies could include large focal plane arrays, mechanical coolers, lightweight composites, and solid state lasers. Rapid data processing systems allow high spectral resolution measurements from geostationary orbit to be developed and implemented for a reasonable cost.

Science Questions

Are changes occurring in rapidly evolving phenomena and diurnal processes in the Earth's atmosphere and at the planet's surface, and if so, how do those changes in fast processes affect long-term climate?

Can satellite-based observations of mesoscale weather phenomena provide useful information for mitigation of natural disasters?

Mission

Concept:

GeoLab is a single geostationary satellite carrying one or more spectrometers capable of achieving continuous spectral coverage between 0.5 and 15 microns with high resolving power ($1/D\lambda = 10,000$). Two general sampling scenarios are envisioned: (a) meteorological sounding using 1 cm⁻¹ resolution for a 3,000 km region with a 1.5 minute dwell time, and (b) multi-spectral imaging (50 cm⁻¹ resolution for a 10,000 km region with a 0.15 min. dwell time. Atmospheric chemistry measurements would also be feasible. Spatial resolution is 20 km for the first mode, and 4 km for the imaging mode (1 km at 0.5 mm). Signal to noise performance will be determined by the coverage and resolution tradeoffs selected by the investigator. The geosynchronous platform is moveable in orbit so that it can be stationed over different equatorial longitudes to enable global observations. Sufficient fuel would be available (50 kg) to allow 25 changes of 90 degrees longitude over the 5 year life of the mission, with one month to accomplish each satellite change in longitude. Expected regional and seasonal study areas would include tropical biomass burning regions, ENSO events, mid-latitude severe storms, hurricanes, and the Indian monsoon.

New Technology Required

Investigation of optimal data downlink: through orbiting communication satellites or direct transmission to ground antennas. Detector arrays (Si, InGaAs, and HgCdTe) are currently available.

TROPOSPHERIC WIND SOUNDER DEMONSTRATION MISSION

Background:

Doppler wind lidar is the leading (if not only) concept for direct measurement of global scale troposphere wind fields with spatial resolution and accuracy needed to significantly impact numerical weather prediction. A mission is needed to demonstrate an intermediate, free-flyer instrument with accompanying data analysis and assimilation, which would be intermediate between SPARCLE and an operation concept.

Science Benefits:

Numerical

weather prediction capabilities would be improved in the following areas:

Fluxes through Boundary layer into free troposphere
Transport calculations, Particularly for water vapor
Ageostrophic dynamics

Mission Concept:

Global-scale measurements of horizontal wind field, with high vertical resolution throughout the troposphere and lower stratosphere, using a direct measurement technique rather than inferences from mass fields are a major need of numerical weather models. Particular needs exist in the tropics, due to scarcity of data and lack of geostrophic equilibrium and the Southern Hemisphere due primarily to scarcity of direct measurement data.

A demonstration wind lidar mission on a free-flyer, either polar orbit of high inclination orbit, will advance the instrument technology, the data analysis algorithm sophistication, and the NWP data assimilation sophistication. The mission should employ scanning optics for swath coverage of at least 500-km width, with either a continuous conical scan or step-stored conical scans.

The measurement objectives would be to provide vertical resolution of 1 km in free troposphere, and <500m in boundary layer, with <100 km horizontal resolution. Wind measurement accuracy would be +/- m/s in lower troposphere, +/- 2-3 m/s in mid and upper troposphere. Spatial sampling strategy would address the representative uncertainties in order to avoid turbulence and spatial structure as a dominant source of uncertainty. The utilization of adaptive sounding resolution and selective targeting should be encouraged.

Mission Summary

High-Inclination orbit (symbol 179 \f "Symbol" \s 11 60 degrees)
 Doppler wind lidar, scanning optics for symbol 179 \f "Symbol" \s 10 500 km swath width
 Mid-term flight (~ 2004-2005)
 Detection technique: baseline coherent detection using aerosol backscatter, but allow for potential breakthroughs using non-coherent detection and molecular Rayleigh backscatter

SURFACE WATER MONITORING MISSION

Background:

River discharge is one of the three primary modes by which fluxes of moisture occur at the land surface. Although it is typically measured via in situ methods for small to moderate streams in the developed world, the discharge of many/most of the world's major rivers is not monitored at all, and/or is not available to the scientific community in a timely manner. River discharge is an integrator, and is would be extremely useful as a diagnostic for climate and weather prediction models, were it available in near real time. Furthermore, river discharge is an important driver of ocean circulation. Also, changes in moisture stored in inland water bodies may be comparable to interannual soil moisture storage change on a global basis, and is certainly a regionally important component of the surface water balance.

Science Questions

Can stream discharge be observed operationally from satellite sensors?

Can the seasonal and interannual changes in storage of moisture at and near the land surface be documented over large river basins? Are these storage changes properly accounted for in weather and climate models, and if not, what are the implications for prediction of land-atmosphere moisture fluxes?

What are the implications of observed seasonal and interannual variability of freshwater fluxes on ocean circulation and salinity? Are the effects of these variations properly represented in the current generation of coupled land-ocean-atmosphere models?

What is the extent of the variation of seasonally inundated areas in the flood plains of the major world rivers? What are the implications of variations in the extent of inundated areas for the flux and storage of carbon and nutrients. Human health?

Mission Summary:

A pointable radar altimeter would be required to determine stage (hence discharge) at ~5000 pseudo-station locations on major world rivers, with overpass repeat less than 7 days. The instrument would also be targeted to observe stage of ~1000 of the world's largest lakes and other inland water bodies.

Repeat: 7 day
 Orbit: 660 inclination
 Duration: 3-5 years
 Other: vertical resolution of altimeter required ~2 cm over open water (e.g., large lakes); 5 cm over rivers; assumed footprint 300-500 m.

New T

technology:

Altimeter would need to be steerable, for repeat to same pseudo-station locations.

LAND SURFACE COLD PROCESSES MISSION

Background:

Cold sea son processes (snow extent, water equivalent, and soil freeze thaw status) strongly affect the short term hydrologic dynamics at river basin scales, and land-atmosphere feedbacks at continental scales. For instance, in the interior of North America and Eurasia, and in high altitude mountainous areas, much of the annual precipitation contributing to streamflow occurs as snow during the winter months. This storage strongly affects the seasonal cycle of runoff. The freeze-thaw status of the soil surface determines the relative amounts of incident snowmelt and precipitation that contribute to runoff as opposed to infiltrating, and differences in albedo between snow-covered and snow-free areas result in large contrasts in net radiation during the thaw period. Nonetheless, snow and frozen ground are not currently well measured in space and time, due to limitations in spatial resolution of passive microwave instruments, and temporal resolution and other limitations of radar.

Science Questions:

How do the spatial extent of frozen ground and snow influence land-atmosphere feedbacks at regional and continental scales? How well are those feedbacks captured in numerical weather prediction and climate models?

Can the seasonal extent of frozen ground be monitored accurately enough by remote sensing to provide a useful indicator of climate change?

Can remote sensing provide information about the extent of snow and snow characteristics and the extent of frozen ground that could improve hydrologic forecasts used in the operation of water resource systems?

Mission Summary:

Two-frequency (L-band, X band) dual polarization SAR switchable from scan (~1 km resolution) mode over large interior continental areas with modest relief to moderate (sub 50 m) resolution over mountainous areas, for estimation of snow extent, water equivalent, and soil freeze-thaw state.

Repeat: ~3 days
Orbit: sun-synchronous
Duration: 3-5 years

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SCIENCE-BASED PRIORITIES FOR POST-2002 FLIGHT MISSIONS

OCEAN & ICE

Summary of
Step
1 Mission Concept Reviews
July 1998
□
SCIENCE-BASED PRIORITIES FOR POST-2002 FLIGHT MISSIONS
OCEAN & ICE

1. First Science Question - Understanding and Predicting Climate

The oceans provide thermal inertia, significant meridional heat transport, and spatially/temporally varying heat storage in the climate system. They also serve as vast potential sources and sinks of compounds critical to important biogeochemical and physical processes. The oceans are thus a fundamental component of the Earth's climate system. Interannual to multi-decadal climate prediction requires the ability to forecast the state and dynamics of the oceans. Oceanic prediction, in turn, requires continuous global observations of the oceans' dynamic, thermodynamic, and biogeochemical states (for model initialization and validation); measurements of the external forces that drive oceanic variability; and development of accurate ocean forecast models. The broad r

ange of time and space scales associated with climate-critical ocean processes requires systematic ocean observations with high spatial resolution and global coverage over a continuous range of time scales, from hours and days (for diurnal, coastal, and mesoscale eddy processes) through decades (for basin-scale upper ocean circulation and to provide a statistically robust description of seasonal-to-interannual processes and for processes such as meridional overturning/deep water formation, secular sea-level changes, and biogeochemical cycling).

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ASA and international programs/missions over the last two decades have demonstrated the ability to acquire scientifically useful measurements of sea surface height using radar altimeters, all-weather vector winds from microwave scatterometers, and cloud-free sea-surface temperature from infrared radiometers. These measurements are planned to be acquired in the first phase of EOS. The Panel noted that improved understanding and prediction of seasonal to interannual climate required systematic, consistent, simultaneous acquisition of these measurements continuously over at least a 15-20 year time period, as well as improvements in their accuracy and sampling characteristics. The Panel thus recommended (in priority order) the following measurement program in the post-2002 period to address the question of understanding and predicting climate.

(1.a) Ocean Surface Topography Program

The first priority expressed by the discipline is the continuation of systematic, accurate ocean surface altimetry measurements, following the lead of French/US TOPEX/Poseidon and Jason projects. In 1992, a group of international experts identified three critical climate issues that could be addressed scientifically using precision altimeter measurements (Koblinsky et al., 1992): determination of upper ocean circulation and associated heat transports; observation and monitoring of long-term-mean sea level change; and observation and monitoring of polar ice sheet variability. (Further discussion of polar ice sheet measurements are postponed to the second science question below.)

The capability of spaceborne radar altimeters to measure ocean topography and allow estimation of upper ocean currents has been demonstrated by the US Seasat (1978) and Geosat (1985-89) missions and the ongoing joint U.S./French TOPEX/POSEIDON mission (1992-present). Although the measurement principle is straightforward, quantitative determination of the climatically important mass and heat transports in the upper ocean requires measurement of sea-surface topography with 1 cm accuracy coupled with appropriately accurate measurements of the geoid, knowledge of open-ocean tides, and information on atmospheric surface pressure.

The global coverage of satellite altimetry makes it a powerful approach for monitoring the long term variations in sea level. (The conventional approach using tide gauges suffers from serious sampling problems and requires averaging over several decades of data to obtain a reliable sea level trend.) It has been demonstrated that systematic drifts in mean sea level measurements by satellite-borne altimeters can be reduced to the required ~ 1 mm/year level by supplementing the spaceborne measurements with a network of 20-30 well distributed, and well surveyed (by GPS) tide gauges.

The scientific utility of the ongoing TOPEX/POSEIDON and planned Jason-1 (to be launched in May, 2000) missions results in part from their unique emphasis on mission design (e.g. orbits chosen to minimize aliasing of tidal errors into climatically critical annual time scales) as well as the accuracy, precision, and spatial/temporal resolution of the measurements. Acquisition of the required multi-decadal, consistent data set will thus require flights of similarly well designed missions meeting the stringent science requirements on or about 2004 (Jason-2) and 2009.

(1.b) Ocean Surface Wind Program

The second highest priority of the Panel was continuation of a global, multi-decadal data set of all-weather surface vector winds over the ocean. Continuous, global, consistent, and systematic measurements of near-surface vector winds are essential for the understanding and predicting ocean circulation and air-sea exchanges of energy, momentum, and chemicals. Wind stress represents the largest single momentum source to the oceans; variable wind stresses cause horizontally divergent Ekman transports leading to vertical mass fluxes and the large scale pressure gradients that drive upper ocean currents. Spatially extensive surface vector wind measurements have been shown to increase the accuracy of atmospheric general circulation models, and they are critical to the estimation of large scale upper ocean circulation and air-sea fluxes (since fluxes are sensitive to the small-scale geometry of the sea surface, which in turn is strongly influenced by wind stress magnitude).

Numerical model studies have shown that wind forcing variations with small spatial and temporal scales can cause significant changes in large-scale, low frequency ocean circulation; in addition, the relatively rapid wind variations require similarly high resolution measurements to avoid aliasing the observations (leading to systematic errors in the characterization of low frequency, large-scale wind forcing). Thus, while the overall coverage and length of the surface vector wind measurement set is dictated by climate scales, the sampling strategy must resolve the high frequency, small-scale variations present in the true wind field. Investigations by the NOAA operational community and the oceanographic research community indicate that multiple, broad-swath spaceborne vector wind instruments in coordinated orbits are required to achieve the necessary sampling.

As with radar altimetry, NASA pioneered the measurement of all-weather surface vector winds by dual-swath Ku-band microwave scatterometry with the Seasat scatterometer in 1978 and

d the NSCAT instrument on the Japanese/U.S. ADEOS mission (1996-97). The ESA ERS-1 and ERS-2 missions carried single-swath, C-band scatterometers, although it has been demonstrated that the inherent accuracy of the C-band measurements is lower than for the Ku-band instruments (especially for wind direction at wind speeds below 5 m/s). Recent theoretical and experimental work indicates that vector winds (both speed and direction) may be measured using polarimetric multi-frequency microwave radiometers. NPOESS and the US Navy are investigating the potential of spaceborne radiometers for vector wind measurement, and plans call for deployment of polarimetric radiometers in NPOESS starting in ~2009. As with altimetric sea level and active scatterometer vector wind measurements, the scientific utility of the measurements for investigation of climate issues depends critically on the accuracy of the measurements over the full range of environmental conditions (including wind speed and cloud cover). Quantitative characterization of the promising passive microwave approach over the full range of conditions has not been conducted.

Prior to 2003, NASA plans to establish a global, accurate, high spatial resolution surface vector wind measurement set with the flights of the SeaWinds scatterometer instruments on the QuikSAT spacecraft (launch 11/98) and ADEOS-2 (launch mid-late 2000) missions. ESA and EUMETSAT plan to fly a dual-swath, C-band scatterometer on their future polar-orbiting METOP environmental satellite system beginning in the middle of the next decade. Although the C-band system has lower measurement accuracy than the NASA Ku-band scatterometers, the joint flight of dual-swath C- and Ku-band instruments could provide the required frequent, extensive sampling. The Panel thus recommends the flight of follow-on, broad-swath, Ku-band scatterometer instruments for the period 2005-2010 (following the ADEOS-2 mission and bridging the gap before NPOESS) to preserve the necessary multi-decadal time series and ensure simultaneity with the altimetric measurements discussed above. The choice of active Ku-band scatterometers or passive, multi-frequency polarimetric radiometers for the continued measurement of all-weather surface vector winds for climate studies will be contingent on the quantitative accuracy demonstrated by spaceborne vector wind radiometers.

(1.c) Experimental Precision Gravity Mapping Mission

Knowledge of the geoid limits the scientific utility of altimetric measurements of sea-surface topography at shorter length scales. The EGM-96 model, considered the state-of-the-art, has an error that becomes larger than oceanographic signals at scales (half-wavelength) shorter than about 1000 km. The GRACE Pathfinder (ESSP) mission will provide precise definition of the geoid on scales down to ~300 km, as well as measuring the time-dependent components of the gravity field for oceanic, hydrologic, and geodynamic research, using satellite-satellite tracking in low Earth orbit. Nonetheless, climate studies require that the altimeter-based estimates of ocean transport have errors that are no more than 10% of the oceanic signal. Since oceanic scales down to the Rossby radius of deformation (~20 km) are important, even GRACE will not provide the geoid measurements that are ultimately required.

Subject to the outcome of GRACE, further refinements can be introduced by using a lidar satellite-to-satellite ranging system that could improve the accuracy of the method by a factor ~10, leading to further refinement of the shape of the geoid (allows applying altimetric observations nearer to continents and characterizing coastal currents) as well as directly detecting changes in total water column mass (equivalent to a bottom-mounted pressure gauge; allows computing the total column geostrophic flow or Sverdrup circulation). In view of the importance of this fundamental measurement, the discipline made this mission one of its top three choices for one-time experimental missions (the others being surface salinity and precise polar altimetry).

2. Second Science Question: Ice Sheet Mass Balance

The NASA Polar Research program includes studies of the formation, transport and melting of sea-ice, and the mass balance of the Greenland and Antarctic ice sheets.

Sea-ice drastically modifies the optical properties of the ocean surface and absorption of radiant energy from the Sun. Sea-ice also insulates the atmosphere from the underlying ocean and drastically affects the heat flux from the ocean to the atmosphere, leading to extreme cold surface temperatures and polar-specific atmospheric circulation patterns. Last but certainly not least, the formation of sea-ice (and brine rejection), its transport under the combined influence of ocean currents and wind, and its subsequent melting is a major factor in the fresh water balance of the ocean, the formation of deep water and, ultimately, the world ocean circulation. NASA and other agencies observation programs (passive microwave imaging radiometers; active microwave scatterometers) provide on-going global-scale measurements to support the study of sea-ice processes in the context of climate research. In addition, existing and future SAR systems in orbit will continue to provide occasional but essential high-resolution image data to characterize sea-ice on process scale.

The multiplicity of processes that govern the mass balance of the polar ice sheets constitute a major research goal for the study of long-term climate change and prediction of impacts on global mean sea-level. NASA is initiating a major research program in this field, relying on occasional global mapping of ice sheet texture and topography (using spaceborne interferometric SAR observations for Canada's RADARSAT and similar future programs) and a first precision topographic mission using lidar altimetry (ICESat/GLAS).

Precision Polar Altimetry Program

Establishing the existence of significant trends in the mass balance and kinematics of the polar ice sheets is obviously a long-term systematic measurement program which does not, however, require continuous measurement. The primary objective of the program will therefore be a repeat survey of the polar ice sheets, hopefully with improved accuracy, five to ten years after the completion of the first Icesat mission. The mission would double as a demonstration of altimetric measurement of the stage of large rivers and surface water bodies over continents (see Global Water Cycle and Hydrology). The project would involve a dedicated spacecraft carrying one of two possible precision steerable altimeters: lidar altimeter (heritage: GLAS / IceSat) or a "focused beam" radio-altimeter.

3. Third Science Question: Ocean Primary Production and the Carbon Cycle

The primary production of oceanic biomass is a major factor in the global carbon cycle and a governing factor in the atmospheric CO₂ balance. Although ocean primary production is considered to be in steady-state on time scales of a few years, the final sequestering of carbon by the ocean in the form of dissolved inorganic carbon and carbon rich sediments controls the long-term balance of available carbon in the earth system. Biological processes in the upper water column, specifically photosynthetic carbon fixation carried out by the microalgae, affect the near-surface equilibrium and fast exchanges of carbon with the atmosphere. The equilibrium concentration of atmospheric CO₂ would be one half to one-third of the present-day levels if photosynthetic production would proceed at the optimal rate allowed by available nutrients (and 2-3 times higher if there was no photosynthesis at all).

In addition to the interactions between ocean biogeochemistry and climate, the productivity of the ocean (and especially the coastal zones) sets the fundamental limit on the amount of fish that can be harvested. Thus there is renewed interest in the complex linkage between productivity and fisheries, and on the impact of human activities in the coastal zone.

The concentration of chlorophyll in the upper ocean layer can be deduced from relatively small contrasts in ocean color. While absolute calibration of such contrast measurements carried out with different instruments may be a challenge, easily observable fast space-time variations provide valuable insight into the dynamics of primary production and the processes that control it. Such ocean color measurements will be provided more or less systematically by a number of satellite missions and operational programs, including ESA/ENVISAT, NASDA/ADEOS-2, NASA/EOS AM-1 and PM-1, and eventually NPOESS (beginning around 2009).

(3.a) Global Ocean Color Mapping Program

This program calls for a gap-filling mission to extend the global observation of ocean color at moderate spatial resolution, initiated with SeaWiFS and EOS/AM-1 & PM-1 MODIS records. (See the "Low Resolution Land Surface Imaging and Ocean Color Mission" proposed under Land Cover and Terrestrial Ecosystems below).

(3.b) Special Event Imager Demonstration Mission

A pointable multispectral imager using a large focal plane detector array and a filter wheel (Special Event Imager) has been proposed as a desirable addition to the standard payload of the GOES satellites. In addition to numerous operational applications ranging from wildfire assessments to algal bloom monitoring, the SEI could provide invaluable information (given appropriate detector performance to achieve the required high signal-to-noise ratio) to capture coastal phenomena that require high temporal resolution.

The "Special Events Imager" as proposed would focus on areas where high temporal resolution is required to resolve the effects of the diurnal and semi-diurnal tides. The present design calls for 10-12 spectral bands with 300 m resolution. The area viewed in any image would be about 300 km x 300 km. Images of an event can be refreshed every 10 minutes allowing high temporal resolution of rapidly changing conditions. Coastal ocean applications would include oil spills, river plumes, storm flooding, hurricanes, and support of process-oriented field work. The development and flight demonstration of a prototype instrument that meets operational application needs, in addition to NASA long-term earth science objectives, could be given priority in the Enterprise's plan, if supported by an active participation of the user agency in instrument development, demonstration and transition to operational use.

4. Fourth Science Question: Sea Surface Salinity

Despite the fact that oceanographers are well aware of the importance of salinity in ocean stratification and circulation, its distribution and variability are relatively poorly known compared to temperature primarily because the measurement both in situ and from space is much more challenging than temperature measurement. Remote sensing of ocean surface salinity has been demonstrated from aircraft and recent technological improvements and modeling studies suggest that this capability can now be demonstrated from spacecraft. Measurement of surface salinity from space to the accuracy

uracy of 0.1 PSU would revolutionize our thinking about the marine hydrologic cycle. Three primary scientific objects are seen for sea surface salinity remote sensing:

- 1) Improving seasonal to interannual [e.g. ENSO] climate prediction
s: This involves the effective use of SSS data to initialize and improve the coupled climate forecast models, and to study and model the role of freshwater flux in the formation and maintenance of barrier layers and mixed layer heat budget in the tropics.
- 2) Improving ocean rainfall estimates and global hydrologic budgets: Precipitation over the ocean is still poorly known and relates to both the hydrologic budget and to latent heating of the overlying atmosphere. The "ocean rain gauge" concept shows considerable promise in reducing uncertainties on the surface freshwater flux on climate time scales, given SSS observations, surface velocities and adequate mixed layer modeling.
- 3) Monitoring large scale salinity events: This may include ice melt, major river runoff events, or monsoons. In particular, tracking interannual SSS variations in the Nordic Seas is vital to long time scale climate prediction and modeling. High latitude SSS variations influence the rate of oceanic convection and poleward heat transport. These measurements will also be the most technically challenging because of the SSS accuracy needed and relatively weaker radiometric signature at low sea temperatures.

Experimental Sea Surface Salinity Mapping Mission

This program calls for an experimental mission to demonstrate the capability to monitor sea surface salinity using L-band and S-band radiometry. Progress toward satellite systems has been hindered by the need for both large antenna aperture and low noise systems to attain the necessary SSS retrieval accuracy. Technological advancements have reached a stage of maturity that these issues can be addressed at the forefront of today's technology. The objective of the mission would be to an overall tropical ocean SSS error budget of 0.1-0.2 PSU over spatial resolution of 25-100 km with temporal resolution of 1 week to 1 month.

Conclusion: Summary Statement on Mission Priorities

The Ocean & Ice Panel clearly gave top scientific priority to the maintenance and continuity of space-based measurements of sea-surface topography, vector surface winds, and ocean color. Each of these measurements are expected eventually to "converge" with planned NPOESS measurements, although a number of significant scientific and methodological questions remain to be solved with regard to the accuracy, coverage, consistency, and utility of the planned NPOESS data (e.g. aliasing of tidal signals by altimeters in polar orbit, accuracy of passive vs. active microwave sensing of vector winds, etc.). Given NASA's EOS investment and successes in initiating the global, high quality measurement sets, and the requirement for consistent and accurate data sets spanning multiple missions (and including both research and operational missions), the Panel recommended that these convergence issues be identified and addressed urgently.

Three experimental missions were rated by the Ocean and Ice Panel as the next level of priority - the Sea Surface Salinity Mapping Mission, the Precise Polar Altimetry Mission and the Precise Gravity Mapping Mission. An Advance Ocean Color Mission was also considered by the panel at lower priority and subsequently dropped from present consideration.

The mission concept was judged by the Ocean and Ice Panel to be a high priority Applications-oriented mission - the Special Events Imager.

□
Altimetry Mission

Science Questions:

What is the impact of ocean circulation on climate and climate variability? In particular, how do surface currents respond to the time-varying atmospheric forcing? to radiative forcing? Are there long-term changes in sea level? in geostrophic currents? in heat storage and transport?

Mission Concept: Continuing long-term measurements over the same ground-track of the sea surface height derived from radar altimetry. The first mission would be Jason-2, which is a follow-on to the Jason-1 (launched in 2000) and TOPEX/Poseidon (T/P) missions. This mission would cover the period 2003-2006. Beyond 2006, a free-flyer Jason-3 mission is suggested for NPOESS.

Candidate Instruments: Dual frequency radar altimeter (5.3 and 13.6 GHz) flown with a 3-frequency microwave radiometer (18.7, 23.8, and 34 GHz for Jason 1) for determination of the water vapor signal. In addition, one or more satellite tracking systems are required.

Measurement Strategy: The orbit should be the same as that of Jason: 66 degree inclination, 1336 km altitude, 10-day repeat frequency. See the mission concept (#16) for details.

New Technology: Reduced weight and cost.
t. Improved knowledge of the geoid would be derived from the GRACE and GRACE follow-on missions.

Mission Type: M = long term measurements

Heritage: Sea
sat (1978); Geosat (1985-89); TOPEX/POSEIDON (1992-); Jason-1 (2000-); Also:
ERS-2, GFO, ENVISAT (1999-)

Relevant RFI Responses: 16 (Fu), 52 (Watkins)

☐

Scatterometry Mission

Science Questions:

#1. Can we understand and predict how ocean circulation is responding to surface wind forcing? How is ocean heat storage and transport affected by wind-mixing.

#2. Can we understand and predict how marine ecosystems respond to wind forcings (vertical mixing and upwelling)?

#3. Can we understand and predict how air-sea gas exchanges will be affected by wind forcing?

Mission Concept: Continuous observation of the vector surface winds over the global ocean to provide forcing fields for ocean circulation. Other applications include: El Nio prediction, Asian monsoon prediction, forcing of Rossby waves, gyre-fluctuations, Ekman pumping and subduction, vertical mixing and upwelling for phytoplankton productivity, storm prediction, numerical weather prediction, and wave forecasting.

Candidate Instruments: A SeaWiFS-class Ku-band scatterometer with 25-km spatial resolution. For a complete description refer to the Freilich (#18) mission concept.

Measurement Strategy: Sun-synchronous orbit, ~800 km altitude, 2-day repeat coverage. It is assumed that concurrent measurements of sea-surface height and sea-surface temperature will be provided by other missions. (See Freilich for details).

New Technology: Fly simultaneous multi-frequency passive microwave radiometer with incidence angles of 45 or 65 deg. to investigate the feasibility of determining vector winds from passive microwave techniques as planned for NPOESS.

Mission Type: M = long term measurements; P = process studies (if combined with observations of physical and biological properties from other missions).

Heritage: NSCAT on ADEOS-I (1996-97); SeaWiFS on QuikScat (1998-); SeaWiFS on ADEOS-II (2000-)

Relevant RFI Responses: 18 (Freilich), 34 (Liu)

☐ Ocean Color Mission

Science Questions:

Can we understand and predict how phytoplankton biomass and productivity are changing in response to climate and environmental change?

Can we understand and predict how the ocean biological pump affects the carbon dioxide concentration, and the concentration of other trace gases in the troposphere?

Mission Concept: Continuing long-term measurements of phytoplankton chlorophyll derived from water-leaving radiance at the global scale.

Candidate Instruments: Follow-on SeaWiFS (as a dedicated mission) or the AGI (scaled down MODIS)

Measurement Strategy: Sun-synchronous orbit, wide-swath sensor with approx. 10 spectral bands in the visible and near infrared, 10-20 nm bandwidths, 1 km resolution, 2-day repeat coverage.

New Technology: Improved signal to noise

Mission Type: M = long term measurements; P = process studies (if observations of physical properties such as sea surface temperature and vector winds are available from other missions).

Heritage: CZCS (1978-86)
; SeaWiFS (1997-); MODIS (1999-)

Relevant RFI Responses:

1 (Abbott), 39 (Murphy), 79 (Yoder), 13 (Falkowski)
□Surface-Air Interface Mission [later redefined as a Surface Salinity Mission]

Science Questions:

Can we understand and predict how the climate system is affected by air-sea exchanges and transport of momentum, heat, and freshwater? What feedback mechanisms exist between surface fluxes and climate?

Can we understand and predict how marine ecosystems respond to changes in the upper-ocean vertical structure brought about by air-sea fluxes of momentum, heat, and freshwater?

Can we understand and predict how atmospheric composition is affected by air-sea fluxes, in particular fluxes of carbon dioxide and other trace gases?

Mission Concept: Advanced technology required to observe simultaneously fluxes of momentum, heat, gases, and freshwater across the air-sea interface. Momentum flux is derived from the vector winds (scatterometer); surface skin and bulk temperatures are derived from the IR radiometer, and salinity from the dual-frequency passive microwave measurements. Air-sea gas exchange requires knowledge of the gas transfer coefficient which is parameterized from sea surface (skin) temperature and surface wind speed. The fluxes of momentum and freshwater affect the vertical structure of the upper ocean, which in turn affects the distribution of heat, light, and nutrients within the upper mixed layer.

Candidate Instruments: Rotating, 10-m diameter, lightweight mesh antenna flown with an active microwave scatterometer, IR radiometer, and dual-frequency (L and S band) passive microwave radiometer. See concept by Liu et al. (#34) for details.

Measurement Strategy: Sun-synchronous orbit, 600 km altitude, with 6 am/6 pm equatorial crossing times, and 3-day repeat coverage.

New Technology: 10-m mesh antenna technology developed with a 2-year Instrument Incubator Program study to be ready for a post-2002 launch.

Mission Type: P = process studies; E = exploratory.

Heritage: NSCAT and SeaWinds, AMSR, AVHRR, and ESTAR.

Relevant RFI Responses: 34 (Liu); 18 (Freilich); #16 (Fu); #31 (Lagerloef)

□Advanced Polar Altimetry Mission

Science Questions:

Can we understand and predict changes in ice-sheet topography, and its relationship to mass-balance changes on interannual to decadal time scales? Can we understand and predict large-scale ice dynamics, freshwater flux into the ocean, and sea-level variability, and the relationship of these to climate change? (Note: a laser altimeter would provide the additional capability to address climate and atmosphere issue pertaining to cloud structure and aerosols).

Mission Concept: The mission objective is to obtain detailed 3-dimensional profiles of the large ice sheets at intervals not exceeding 5 years. An advanced altimeter is recommended for the 2008 time frame whose configuration (laser vs. radar) will depend on the outcome of the EOS GLAS mission scheduled for launch in 2001, and planned tests of advanced radar altimeters. In addition, a SAR interferometric mission is required to retrieve freshwater flux across the ice-sheet margins, and a passive microwave mission is required to obtain ice sheet emissivities, and to continue observations of sea-ice concentration and extent. It is assumed that the SAR and passive microwave missions will be conducted during the post-2002 time frame. Furthermore, a GRACE or GRACE follow-on mission is required to remove the isostatic rebound signal from observed changes in surface topography.

Candidate Instruments: Johns Hopkins University Applied Physics Lab (JHU/APL) delay/Doppler advanced microwave radar altimeter. Or a follow-on to the Geoscience Laser Altimeter System (GLAS) developed by NASA-Goddard and the University of Texas.

Measurement Strategy: Non-sun-synchronous 183-day repeat at an altitude of 600-800 km, fixed mean perigee near the North Pole, and 94-98 deg. inclination.

New Technology: Delayed/Doppler post-processing required for the JHU/APL advanced radar altimeter, and advanced LIDAR capability required for GLAS follow-on.

Mission Type: M = long term measurements based on upcoming E = exploratory missions.

Heritage: Seasat, Geosat, TOPEX/POSEidon for the radar altimeter; Wallops Airborne LIDAR and GLAS on the ICESAT-1 2001 mission.

Relevant RFI Responses: 42 (Raney), 57 (Zwally)

☐Advanced Gravity Mission

Science Questions:

Can we understand and predict how climate change is affecting the time-varying surface and deep-ocean circulation? and how changes in circulation affect the climate system?

Mission Concept:

Measurements of the time-varying gravity field for multiple applications. Time-varying ocean geoid is important for understanding deep-ocean circulation. These measurements would be a valuable complement to the ongoing and advanced altimetry missions.

Candidate Instruments: GRACE follow-on.

Measurement Strategy: Satellite-to-satellite laser tracking. Pairs of small (100-300 kg) satellites flying in a 350-500 km polar orbit.

New Technology: Use of laser interferometric system for improved accuracy (compared with K-band microwave used by GRACE mission). Possible employment of drag-free mode in which thrusters continually fire to keep the spacecraft centered about the accelerometer proof mass.

Mission Type: M = long term measurements.

Heritage: GRACE (ESSP Mission)

Relevant RFI Responses: 52 (Watkins)

☐Special Events Imager Mission (Applications Oriented)

Science Questions:

Can we understand and predict how coastal and estuarine ecosystems response to tidal forcing and natural seasonal-to-interannual variations in river discharge? Can we understand how changes in land cover and land use affect coastal and near shore ecosystems? Can we understand how pollutants or nutrients carried by rivers and by atmospheric circulation affect near shore/coastal ecosystems?

Mission Concept: Multispectral imaging system onboard a geostationary platform would provide ocean surface reflectance measurements with high temporal resolution (every 15 minutes) and 300-m spatial resolution. The imager would view a selected region of size 300 x 300 km where a special event is being studied or observed. Special events might include a river discharge (flood), harmful algal bloom, hurricane land-fall, oil spill, or other coastal event. There are also applications for viewing land events such as forest fires and floods.

Candidate Instruments: Special Events Imager would have 10 spectral bands in the visible and near infrared. It can achieve SeaWiFS-level signal-to-noise and SeaWiFS or MODIS algorithms can be adapted to use with this instrument.

Measurement Strategy: Sensor flown on a geostationary platform. There is a possibility to fly this sensor on the GOES N platform but the decision will need to be made in the fall of 1998.

New Technology: Improved spectral, spatial, and radiometric resolution for a geostationary imager.

Mission Type: E = exploratory/demonstration; P = process studies.

Heritage: SeaWiFS (1997-); MODIS (1999-)

Relevant RFI Responses: 4 (Brown)
☐ Advanced Ocean Color Mission

Science Questions:

Can we understand and predict how the community structure of marine ecosystems is changing in response to climate and environmental change?

Can we understand and predict how the community structure of marine ecosystems affects the chemical composition of the atmosphere?

Mission Concept: Improved capability to differentiate functional groups of phytoplankton, and to study their photosynthetic or physiological state by observing solar-stimulated chlorophyll fluorescence. Fluorescence per unit chlorophyll is an index of physiological state. Chlorophyll will be derived from reflectance in the blue-green spectral region. Chlorophyll fluorescence will be derived from the red fluorescence peak centered at 680 nm. A signal-to-noise of order 1200 is required for wavelengths > 670 nm.

Candidate Instruments: Hyperspectral imager.

Measurement Strategy: Sun-synchronous orbit, wide-swath sensor with approx. 200 spectral bands in the visible and near infrared (345-800 nm), 2 nm bandwidths, 1 km resolution, 2-day repeat coverage.

New Technology: Improved signal to noise, higher spectral resolution, onboard data processing for compression and product derivation may be necessary. Algorithms derived from NEMO experience.

Mission Type: P = process studies

Heritage: CZCS (1978-86); SeaWiFS (1997-); MODIS (1999-). Also, COIS (Navy hyperspectral sensor onboard NEMO satellite focused on coastal studies to be launched in 2000; COIS will have 30-60 m resolution; will not provide global coverage)

Relevant RFI Responses: 1 (Abbott), 13 (Falkowski), 79 (Yoder)

SCIENCE-BASED PRIORITIES FOR POST-2002 FLIGHT MISSIONS

LAND COVER/LAND USE & TERRESTRIAL ECOSYSTEMS

Summary of
 Step 1 Mission Concept Reviews
 July 1998
☐
 SCIENCE-BASED PRIORITIES FOR POST-2002 FLIGHT MISSIONS FOR LAND-COVER/LAND-USE CHANGE AND TERRESTRIAL ECOSYSTEMS

Background

The major terms representing the anthropogenic perturbation to the carbon cycle include a major net flux to the atmosphere (ca. 1.6 GtC/yr) from land-use change in the tropics. There is also a flux of approximately the same magnitude that is attributable to net ecosystem productivity in terrestrial temperate and boreal ecosystems. The latter flux is thought to be apportioned to a combination of regrowth of previously disturbed landscapes, carbon dioxide fertilization, and the result of nitrogen deposition. The net global flux into the oceans is calculated to be ca. 2.0 GtC/yr. In addition, there is substantial interannual variation in each of these fluxes, apparent from the interannual variability in the fraction of anthropogenic carbon that remains airborne, from satellite observations of deforestation in the

the tropics over the past decade, and in model simulations of the response of the biosphere to climatic factors.

Quantifying these fluxes is critical to understanding the overall response of the carbon cycle to human perturbation, and also to understanding the rate of increase in radiative forcing of the climate system, since CO₂ accounts for most of the anthropogenically-driven increase in forcings.

Understanding the carbon cycle thus provides a framework for considering three major scientific issues that can be addressed with remote sensing data:

Understanding the rates and locations of land-cover change, sampled at appropriate spatial and temporal scales (the accounting problem).

Understanding the processes associated with biological productivity (productivity).

Understanding the rates and degree to which landscapes recover from both anthropogenic and natural disturbance (disturbance).

Understanding the carbon cycle is not the only important topic to understand in ecology. Perturbations to the nitrogen cycle, for example, are equally important, and interact strongly with changes in carbon because of numerous biogeochemical and physiological feedbacks. Likewise, understanding the biological sources and sinks of trace gases other than CO₂ continues to be a critical topic. The loss of biological diversity and the potential consequences of climate variability and change provide similarly critical research areas. However, each of these issues interacts with the issues raised by the carbon questions through their links to productivity, land-cover change, and the response of systems to disturbance. Therefore, understanding changes in carbon provides both a significant focus for the productive use of remotely sensed data as provided by NASA's programs and an opportunity for the scientific community to investigate a wide variety of ecologically important topics.

First Science Question: Accounting for Land-Cover Change

Land-cover change must be measured with sufficient spatial resolution to determine accurately the amount of change, its location, some diagnosis of its cause, and with sufficient temporal resolution to address interannual variability. This requires observations with spatial resolution on the order of no more than a few tens of meters, with spectral characteristics that provide continuity with the existing Landsat observations.

The review panel recommended the following option as a high priority for repeated, systematic measurements:

Land-Cover Inventory Mission (Landsat-Next)

This science issue calls for a series of missions that would provide systematic measurements of land-cover change. The spatial resolution required would be on order 10-30m, with multispectral information in the VIS/NIR parts of the spectrum. Orbital repeat time with a single orbiter would continue to be in the 16 day range. This Landsat-class mission, with a next-generation sensor on it, including sufficient bands for atmospheric correction, would be flown with mid-morning overpass time, in the current Landsat orbit. New technology would be used to cut down on the size and complexity of the instrument and mission. Launch would be in the 2004-5 time frame, with a nominal mission life of 5 years. Documentation of changes around the globe on a seasonal basis would be the primary objective. However, it is recognized that these data would also provide an enormous amount of information for a wide variety of scientific issues, as identified above. In addition, the spectral information on vegetation on physiological status would receive new attention due to the availability of seasonal time-series. The Advanced Land Imager on the EO-1 mission provides one model for an instrument design, although others may be feasible.

Second Science Question: Understanding Biological Productivity

Observations that are necessary to parameterize process models for biological productivity must be maintained globally, with relatively high temporal resolution (1-2 day repeat times). These may have lower spatial resolution than the observations above, from 250 m to 1 km. The combination of relatively coarse-spatial resolution but finer temporal resolution than that required for land-cover inventories provides greater strength for understanding the processes that regulate biological productivity within and between seasons. It also provides a way to investigate disturbances, such as fires, which occur on short time-scales, and which therefore can be missed entirely by missions with long repeat times.

The review panel recommended the following option also as a high priority for repeated, systematic measurements:

Ecosystem Productivity Mission

This science issue also calls for a continued sequence of measurements that provide systematic measurements of many of the important parameters that regulate biological productivity of terrestrial ecosystems. The requirements are for systematic low or moderate resolution

on mapping (~ 250-500m) of the global vegetation cover and phenological state, with frequent repeat observations (revisit time ~ 1-2 days) in order to capture relatively rapid changes (~ 1 week) that may occur during the growth season.

Spatial resolution, revisit time, and spectral information required are anticipated to be very similar to the specifications for MODIS, but the anticipation is that the technological implementation of the sensor would be more advanced.

The number of bands could be reduced somewhat from MODIS, but would still include sufficient information for atmospheric correction. Overpass time would continue to be mid-morning. Launch would be in the 2004-5 time frame, with a nominal mission life of 5 years. Ultimately, these measurements should become part of the operational suite of measurements sponsored under the future operational system (NPOESS). However, a gap-filling mission is required to bridge the time between the expected lifetimes of MODIS on EOS AM-1/PM-1 and the launch of the first NPOESS platform equipped with the new Visible and Infrared Imaging Radiometer Suite (VIIRS) under development (~ 2009). It is expected that NASA could procure an early VIIRS flight model for this purpose.

Third Science Question: Recovery from Disturbance

As noted above, the rates of disturbance of various types and especially the recovery of ecosystems to those disturbances constitute one of the major uncertainties in the terrestrial carbon budget. Observations to track both the occurrence and recovery from major disturbances (e.g. fire, insect infestations, deforestation, clear-cutting) are therefore critical to understanding the overall rates of exchange of carbon between the terrestrial surface and the atmosphere. Such observations would also have important implications for understanding the biophysical linkages between the terrestrial surface and local and regional climate.

The review panel thus recommended the following option as a high priority for a one-of-a-kind, scientific exploration mission:

Ecosystem Recovery from Disturbance Mission

The disturbance recovery mission could be flown in the 2007-9 time frame, with either one or two primary instruments. The first, which was thought to be critical, would be a lidar based on technological evolution from the VCL instrument. However, instead of the survey mission implicit in the VCL ESSP mission, this mission would be a sample return, whose targets would be areas of the terrestrial biosphere that had been subjected to major disturbances. The mission goal would be to characterize the recovery of those areas in terms of above-ground biomass. The second instrument on this platform would be an imager, perhaps similar to the geostationary imager in terms of spectral coverage, that would provide information on recovery for those areas in ecosystems for which the lidar might not be especially useful, e.g. grasslands and semi-arid ecosystems.

Fourth Science Question: Instantaneous Coupling of Terrestrial Ecosystems and the Atmosphere

The ability to determine the instantaneous coupling of terrestrial processes and the atmosphere on diurnal time-scales is important because of the sensitivity of the terrestrial processes controlling productivity to changes in atmospheric conditions. Results from field campaigns such as BOREAS also demonstrate the importance of understanding this coupling to weather prediction.

An option for analysis as a one-of-a-kind scientific exploration mission was proposed:

Ecosystem-Atmosphere Diurnal Cycle Mission: A geostationary staring mission should be explored, possibly to be flown in the 2005-6 time frame, with a sensor optimized for NDVI-type measurements, but with spectral capability extending into the thermal IR (perhaps several channels) to ensure that information on fire occurrence and intensity could be gathered on a diurnal basis. This need not be a free-flyer, but could involve the development of an instrument that could become part of the GOES series, or other geostationary platforms (e.g. private communications satellites). Nominal mission life would be approximately 5 years.

Additional Missions of Importance to Ecological Science and Applications

The RFI panel additionally discussed a category of missions and measurements, which may be characterized as being of broad interest and of potential importance to terrestrial ecology and applications. Within this discussion, several ideas arose, which might ultimately be developed for ESSP-like proposals, or for joint ventures with commercial partners.

Exploratory Research Missions:

There was considerable interest on the panel for OSE to consider missions that are truly exploratory in nature, i.e. that did not necessarily focus on a single, specific research topic, but that sampled the Earth in new and unique ways that might reveal previously unexpected insights. Two concepts in particular emerged from this discussion. One was the notion of flying a coarse resolution (1 km) SAR, perhaps in C or L band, with a swath sufficient to give a 1-2 day global repeat time. This would sample the Earth in a manner that was consistent with AVHRR/MODIS, and which has never been attempted with current SAR missions. Such a mission could be a free-flyer, or this could be a mode that might be incorporated in a LightSAR concept. Some scientific issues are already known to which such a mission might contribute: quantifying seasonal inundation patterns in the tropics, and freeze-thaw dynamics in the boreal zone, for example. However, the real benefit might come from fusion of the SAR data with optical data from MODIS and its descendants.

A second exploratory mission that was discussed was the possibility of flying a hyperspectral imager. It was the general consensus that there were currently many interesting possibilities for analyzing hyperspectral data from space, but that there has not yet been articulated a single scientific question for which these data would provide the major critical missing information. Since general interest remains relatively high, however, there was certainly sentiment to continue investigating opportunities for providing hyperspectral data.

Approaches to Improve Revisit Times:

Several responses coalesced on a potential solution to one of the major problems of remote sensing of the Earth from low Earth orbit: relatively infrequent revisit times, or alternatively, revisit times that were compromises between scientific arenas. Obviously, geostationary orbits are one way to address this problem. However, this solution introduces another level of complexity in instrument design, not to mention the cost of boosting platforms into geostationary orbit. An alternative approach for investigation is to build many replicates of relatively inexpensive instruments that have been optimized for a particular observation, for example optimized for fire detection, or Vegetation Index measurements. Copies of these optimized instruments would then be flown on as many flights of opportunity as possible, so as to ensure that observational opportunities would be maximized. This idea could be developed in both an Instrument Incubator environment, for the instruments themselves, and then perhaps explored as a joint venture with other governments or commercial launches. There was some considerable interest in this concept from an applications perspective, since the limitations introduced by infrequent revisit times are among the problems that many commercial data providers are attempting to overcome.

Regionally Specific Missions:

Several responses suggesting optimizing missions for phenomena according to regions, e.g. optimizing a mission for detecting freeze-thaw regimes in boreal ecosystems, or optimizing a mission for fire detection and recovery in boreal forest. Without necessarily addressing these specific ideas, the panel was generally interested in the concept of optimizing missions for specific regions, given the constraint that the problems to be investigated were of broad significance.

The Importance of Being Thorough

Several responses to the RFI advocated the use of multi-angle remote sensing, à la MISR. The panel generally thought that while such data may well be of interest and scientific importance, its critical nature was difficult to demonstrate at this time. There was a relatively strong consensus that before NASA pushed very hard to continue such multi-angle measurements from a terrestrial perspective, that the community should analyze the EOS data sets.

The panel expressed a similar thought with respect to thermal multi-spectral measurements. Such measurements were part of many responses to the RFI, but the community has not expressed a strong consensus on exactly what the scientific needs are. Experience with ASTER data should enable a much stronger case to be made, outside of the geological applications, where the utility of such data are already quite clear.

Similarly, the general issue of advocating thorough analysis of the currently planned measurements received a lot of attention. The panel was consistent in its opinion that many issues in the final planning of mission concepts, instrument and mission design, and implementation could be most efficiently addressed by ensuring that current data sets be thoroughly investigated. Part of that investigation should include an emphasis on data fusion, i.e. understanding the additional scientific benefits to be gained from simultaneously combining measurements from sensors having very different, but complementary capabilities, e.g. SARs and optical measurements.

Finally, the panel expressed its strong opinion that the ultimate scientific success of any and all of these missions concepts depended critically on the continuing support of the research and analysis program. It was viewed to be important for sponsoring campaigns and fundamental research investigations that lead to new mission concepts, that validate the data and scientific products from existing flight missions, and for exploring the scientific issues that will define the OSE programs of the future. The panel also expressed its strong opinion that the RFI process must result in additional interactions with the scientific community to ensure that there is strong scientific consensus on mission scenarios for OSE in the post-EOS era. There is considerable doubt that all the important ideas have come forward yet, and much community discussion and debate must be held on even those that have come forward.

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SCIENCE-BASED PRIORITIES FOR POST-2002 FLIGHT MISSIONS

SOLID EARTH SCIENCE &
NATURAL HAZARDS

Summary of
Step 1 Mission C
Concept Reviews
July 1998

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SCIENCE-BASED PRIORITIES FOR POST-2002 FLIGHT MISSIONS
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SOLID EARTH/NATURAL HAZARDS AND APPLICATIONS PANEL

1. First Science Question

on: Variations in the Earth's potential fields as a measure of change on the surface and interior

The panel recommends a systematic program to observe temporal variations in Earth's potential fields, with highest priority given to the gravity field. The polar/oceans panel has also recommended continued gravity observations from space because of their unique contributions to oceanography and integrated measurement of polar ice mass. The value of gravity field measurements is well described by the National Research Council (NRC) Report "Satellite Gravity and the Geosphere" published in 1997. A main point of this report is that the time-varying gravity field is the unique quantity which reflects mass redistribution within the earth system, including weather and climate effects, oceanic circulation, tectonics, post-glacial rebound, and other processes. The concept of using temporal gravity variations to monitor such mass redistribution has already been demonstrated for spherical harmonic (SH) components of the gravity field up to degree and order 2, using time series of geocenter variations, polar motion, length of day, and LAGEOS nodal precession rate. The Earth System Science Pathfinder mission GRACE will extend this proven capability to above SH degree 100, and provide experience in required satellite technology and data processing. The panel recommendations are for continued observations to begin near the end of the GRACE mission.

Understanding the fluid dynamo processes by which planetary and stellar magnetic fields are generated has long been recognized as one of the grand challenges of science. The Panel recommends that a continued program of observations of the magnetic field be part of the post-2002 plan, given the fundamental scientific interest in this problem, and the emerging ability to interpret the data by numerically modeling magnetic dynamo processes. Magnetic field studies are suitable for cooperative efforts with the Office of Space Science, and with international partners. A program of continued observations is recommended to follow the international magnetic missions now scheduled through 2005.

(1.a) Temporal Variation of the Gravity Field (systematic measurement)

The science goal to use gravity to monitor mass redistribution in the earth over a variety of time scales calls for systematic measurement of the field for an extended time period. GRACE is the prototype mission concept for this purpose, but other concepts have been developed in the past. One satellite pair, like GRACE, may be insufficient to temporally sample the variable gravity field, and a multi-satellite program may be called for, an issue that GRACE should help determine.

(1.b) Magnetic Field Mission (systematic measurement)

Planned launches of SUNSAT and Oersted in 1998, and SAC-C and CHAMP in 1999 should provide high quality magnetic field observations through 2005. All these missions are at near-polar inclinations, and roughly in the same altitude range of 4-700 km. In order to separate internal (core and crust) from external (electric current) contributions, systematic measurement from polar orbit, plus additional observations at a variety of inclinations and altitudes are called for. Using the technical advancements achieved for the Danish Oersted satellite (non-magnetic star camera, compact spherical fluxgate magnetometer) plus evolutionary developments, a modest cost Magnetic Mapping Package (MMP), like that being built for SAC-C, could be made available for domestic and international flights of opportunity to achieve the desired goals.

2. Second Science Question

on: Topography and surface change

High precision observations of topography and surface deformation from space have been demonstrated with interferometric SAR, and other techniques. These observations provide the boundary condition for Earth's interaction with the hydrosphere and biosphere, allow observation and mitigation of natural hazards, and contribute to understanding erosion, tectonics, and other processes which control the evolution of the landscape. Understanding and mitigation of natural hazards such as flooding, coastal erosion, volcanoes, landslides, and earthquakes can benefit from both topography and surface deformation data having high precision and spatial resolution.

The Panel identified two components needed to address this science area. The highest priority is to observe changes in elevation, with 30-100 m. post spacing, with millimeter-level accuracy (along the line of sight), using radar interferometry. For the foreseeable future, the requirement will be for study areas of interest, rather than for systematic application to the entire globe. The second priority is to determine surface elevation (bare earth - below the canopy level) with 1 to

10 meter post spacing, at a vertical accuracy at the 1-2 m level. Again, for the foreseeable future, digital elevations models with this resolution and precision will be required for selected study areas, rather than the entire globe.

(2.a) Interferometric SAR surface deformation (systematic measurement)

The prototype mission concept is LightSAR. The Panel recommends that in the post-LightSAR period this should be a systematic measurement available for science and natural hazard studies. Technical requirements for measurement of surface deformation in the presence of vegetation include L band full polarimetry, split spectrum and water vapor radiometer for path-delay compensation, and rapid revisit capabilities. A pair of satellites flying in complementary orbital planes would provide vector components of surface deformation.

(2.b) High resolution topography (ESSP-type mission)

The Shuttle Radar Topography Mission (SRTM) will provide a near-global digital elevation model, for the first time, in a common (GPS) coordinate system. The Panel noted that data with higher resolution and accuracy than SRTM could be obtained by a number of techniques, including radar interferometry or laser altimetry. An experimental mission using laser altimetry, for example, could prove the concept and lay the groundwork for a future commercial system.

3. Third Science Question: Natural hazards and applications

The panel examined two areas which have both scientific and natural hazard importance, volcanic eruptions and severe storms. Volcano-related observations from space can contribute both to science and public safety through improved understanding of eruption processes and monitoring of eruptions, plumes, and ash deposition. Space-borne measurements will contribute to understanding geologic controls on eruption processes and recurrence intervals, trigger mechanisms of final eruptions, and thermal history of eruptions. Monitoring of post-eruptive plumes and ash deposits offer the opportunity to provide aircraft warning of plume hazards, observe damage to the surface, and predict the potential for lahars. Observations of volcanic sulphur dioxide, surface temperature change, plume ash concentration and tracking, and ash deposit mapping are called for in a volcano satellite.

The panel considered the hazard-related aspects of severe storms. There is a need for improvement in the forecast accuracy of tropical cyclones over the current 1% skill at predicting landfall of a tropical cyclone within 60 miles at 72 hours before the event. This skill is likely to be improved by combining a suite of observations from geostationary orbit, including moisture and temperature soundings, surface winds, lightning frequency, and other quantities. The panel assigned a lower priority, relative to the volcano satellite. As a candidate for an operational system, this could eventually be operated by NOAA or another agency. An advanced geostationary imager/sounder also appears in the recommendations of another panel.

(3.a) Volcano Satellite (demonstration mission)

The mission concept includes sulphur dioxide outgassing observations at the volcano, ground temperature measurements, plume sulphur dioxide and ash content and tracking, and hyperspectral mapping of ash deposits on the ground, from geostationary orbit, or, for high latitudes, Molniya orbit. The NASA contribution could be a demonstration mission on a single geosynchronous satellite. A global volcano monitoring program might involve 3-4 geosynchronous satellites plus 3 satellites in Molniya orbit, and instruments on polar orbiting satellites.

(3.b) Severe Storms Research Mission (demonstration mission)

The time-critical nature of severe storms and hazard warning requires a geosynchronous satellite. The imager instrument would require approximately 18 bands to aid in the improved determination of convective cloud and water vapor distribution. An advanced sounder for improved vertical resolution of temperature and moisture fields will be important, and a lightning sensor will serve to monitor convective activity. This concept is identical to concept (3.a) identified by the Panel on Hydrology and Mesoscale Weather.

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RECORD TYPE: FEDERAL (TRP NOTES MAIL)

CREATOR: Charlie Murray (Charlie Murray@4=BEP@5=OSEC PBE@3=GOV+COMM.BAN@2=ATTMAIL@1=US@MRX@LNGTWY [UNKNOWN])

CREATION DATE/TIME: 1-SEP-1998 17:30:00.00

SUBJECT: fwd: NESDIS ISSUES: 2000 Budget

TO: Lisa A. Gaisford (Lisa A. Gaisford@eop [UNKNOWN])
READ:UNKNOWN

TEXT:
fyi

Original Text

From: Doug Namian@MB@E, on 9/1/98 4:52 PM:

To: Charlie Murray@BEP@OSEC PBE

Cc: Scott B. Gudes@UnSec@NOAA, Susan B. Fruchter@PSP@NOAA, Robert

Winokur@MHub@NESDIS, Greg Withee@MHub@NESDIS, Gary Davis@MHub@NESDIS, Paul

F. Roberts@Dir@OFA, Kathy Adams@Budget@OFA

CHARLIE: Here is the status of the various questions Lisa asked in her
August 31 E-Mail. Please pass this info on to her:

1) The NESDIS answers to her previous questions were sent to NOAA
OFA this a.m. You should have them today.

2) NASA is in the process of making adjustments to their POP'S.
The
SAO will do their best to have their crosswalks complete by Sept. 11th.
However, it will depend on receipt of NASA information.

3) Dr. Baker has sent a letter to the NASA Administrator laying
out
the NOAA position on LANDSAT. I'll FAX you a copy to give to Lisa.

4) You and I will have to start working on setting up hearings
with
Lisa on NPOESS, LANDSAT, Geostorms, and the POES & GOES programs.