

Originally Processed With FOIA(s):
S; 1999-0093-F

FOIA Number:
S

FOIA MARKER

This is not a textual record. This is used as an administrative marker by the George Bush Presidential Library Staff.

Record Group/Collection: George H.W. Bush Presidential Records
Collection/Office of Origin: Speechwriting, White House Office of
Series: Speech File Backup Files
Subseries: Chron File, 1989-1993

OA/ID Number: 13817
Folder ID Number: 13817-005

Folder Title:
Goddard Space Flight Center 6/1/92 [OA 7576] [2]

Stack:	Row:	Section:	Shelf:	Position:
G	26	22	5	7

THE WHITE HOUSE

WASHINGTON
28 May 1992

MEMORANDUM FOR DAVID DEMARAREST

THROUGH: DAN MC GROARTY
FROM: JEANNIE BUNTON
SUBJECT: GODDARD SPACE CENTER WALKTHROUGH

Event: Monday, 1 June 1992

On site: 2-3 P.M.; arrive Greenbelt from David [30 min]

Location: Goddard Space Center; Greenbelt, Md.

Two tiers:1 Tour building 7: POTUS walks by static displays and models relating to "Mission Planet Earth" -- visuals relate to ozone layer, deforestation, Earth observation system, oceanic circulation; no press; background: sci-fi; right out of James Bond as Mel put it [yes Mel was the lead today]

Tour building 10: POTUS photo opp with TOPEX satellite [joint project with France]:oceanography satellite to be launched sometime July 92; TOPEX/POSEIDON mission will define the surface height of world oceans with an accuracy and precision for studies of ocean circulation, variability of circulation and tides

2 Remarks in Auditorium [Building 8]:
Off Stage Announce at 2:45 p.m.; backdrop 14'X 14' photo of the planet earth [from Apollo 17]

Audience: 400 Goddard employees [civil service and contract]; dignitaries: EPA Administrator Bill Reilly; Cong. Connie Morella, Cong. Hoyer, Sen. Mikulski, NASA Admin. Dan Goldin; Goddard Center Dir. Dr. John Klineberg

Klineberg intro Goldin; Goldin intro POTUS

+++++Teleprompter ordered+++++

CONTACTS: LEAD - Mark Koro PRESS - Bobby Carr
TRIP - Patty Conrad WHCA - Debbie McGhee

GODDARD PIO - Jan Ruff (301) 286-6255
Assistant - Carl Polesky ext. 8982

① Cluster site w/ 3 highest students NASA

5m space environ

assemble space craft

engine, adaptation, auto down-apt, beam controller

star input mounts - ground antenna receiver

to environment

area manager - equip hand samples etc

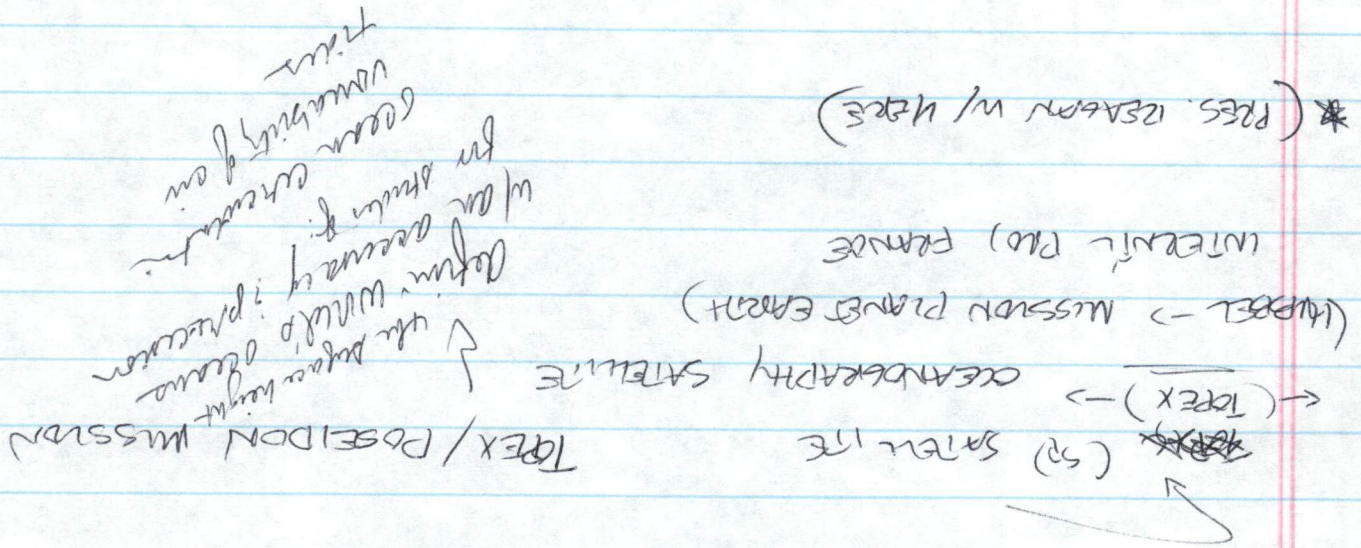
view hubic area team from across hall way

perme mock-up

light barrier from chamber in the wall

assembly, a fun-joy printer package

mountain view left window to the left



Will be from Camp David en route Goddard
30 min flight time

28 May 1992
Mark Core - lead
Bobby Carr - press
Debbie McDev - WHCA

PRE-ADVANCE/WALK-THRU QUESTIONNAIRE

EVENT: Goddard Space Center / RLV

DATE: Monday -

TIME: [2-3 pm] → Remarks 2:45 pm

LOCATION: Goddard Space Center [Greenbelt, Md.]
(GIVE DETAILS) Buildings 7, 8, 10

EXPECTED AUDIENCE: Personnel → Civil Service's Contract
(NUMBER AND COMPOSITION) employees * 400 of that employees
~ 450 people

PRESS COVERAGE:

DIAS PARTICIPANTS: TBD
EPA ADM REILLY (NASA DIES) (Sen. Mikulski, Hoyer) Cong. Morella
primarily
Gov. Schaeffer's office
PB officials

EXPECTED PARTICIPATION BY MEMBERS OF CABINET/CONGRESSIONAL/ADMINISTRATION:

Will be carried on
Closed circuit audio
NASA select

POTUS INTRODUCTION: [TBD] OSA → 2:38 pm

PERTINENT SPEECH TOPICS: RLV/ENVIRO
Talk prompter

REASON FOR EVENT: RLV

→ Walk - 1:30 PM
→ Sunday 3 pm

301-286-6255

Jan Ruff - PIO
① Tour
② Speech

PLEASE ATTACH PRE-ADVANCE/WALK-THRU CALL SHEET

TOUR SANPER/MISSION PLANET EARTH STATIC DISPLAYS
~ 20 MINUTES BLDG. 7 PHOTO OPP
AUDITORIUM BLDG. 8

(NO GIFTS) - IN THIS INSTANCE → NO BAND



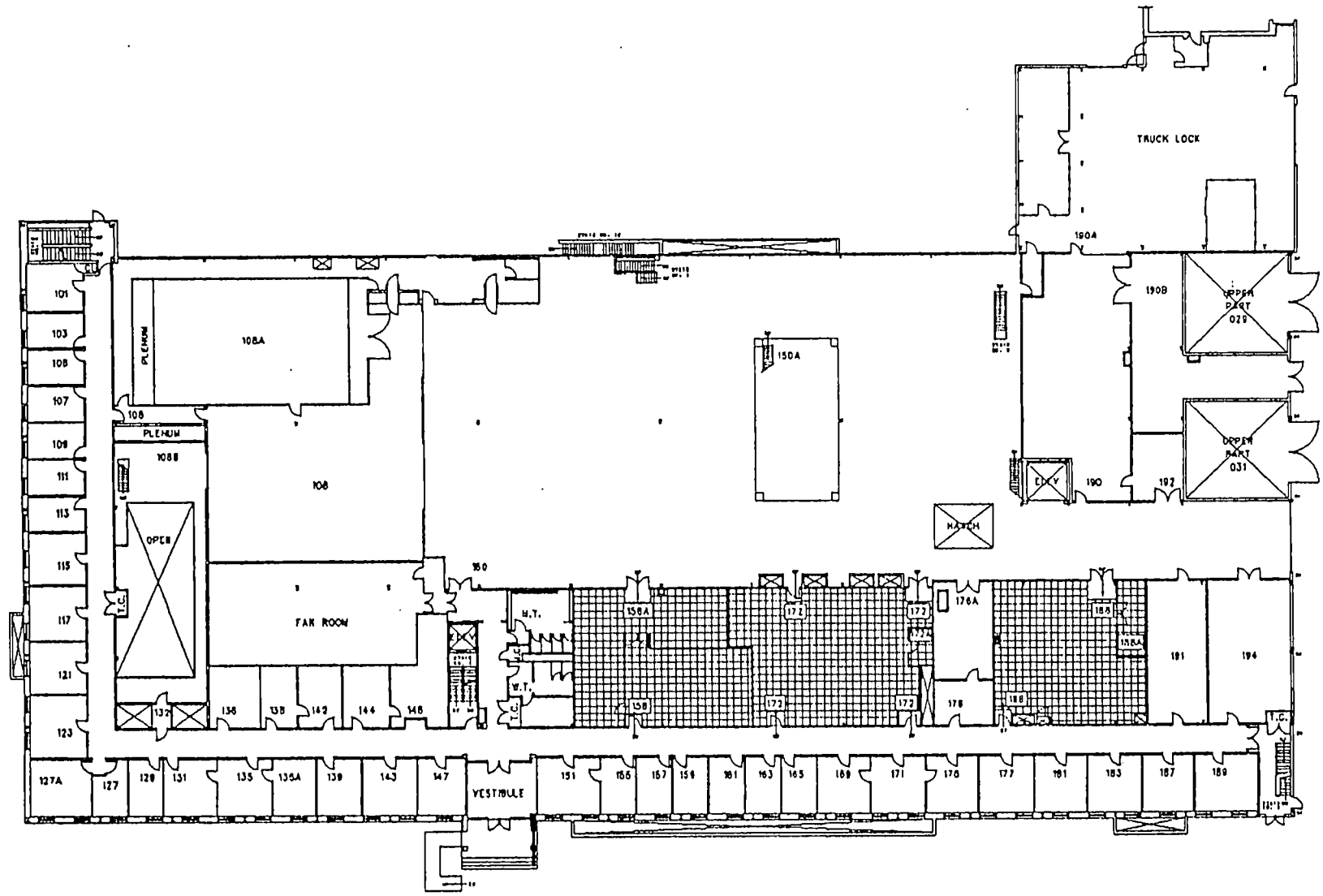
→ Carl Poleskey
8982

OFFICE OF PRESIDENTIAL ADVANCE CONTACT SHEET

Name	Office	Phone Number
Presidential Advance Office		202/456-7565
Presidential Advance Fax Number		202/456-2820
MEL WICKENS	PRES. ADV	202/456-7565
SUZANNE FAUIC	"	"
BOBBY CABER	PRESS LEAD	"
→ MARK KORO	WH ADVANCE LEAD	301-688-7834 W 301-964-1525 H
Ron Kaese	Chf. Health Safety & Security	{ 301 286-7442 W 301 948-5458 H
DAVID L. MOULTON	SECURITY DIRECTOR	{ 301 286-7666 Fax 301 286-7233 WK
JEFF ELLIOTT	NASA SELECT TV	{ 301 286-2923 FAX 301-849-1783 HM
		(301) 286-6146 FAX (301) 286-4524 HOME (301) 390-9281
Ray Mazur	Center Adm'n. Comm	(H) 301 8543417 (O) 301 286 5856 Fax (301) 286 7538
Joseph Stech	Asst Chf. for OR Oper.	7-10-15-29 W 301 286 5747 H 301 261 7858 Fax 301 286 8650
ALDA SIMPSON	SERVICES DIVISION BLDG 7/10/15/29	ASSOC CHIEF, ENGINEERING W 301-286-9888 H 301-776-7842 FAX 301-286-6916
ROSS SPRINGHAM	ASS'T BR HD CODE 754 FAC. OPERAT MANAGER 7-10-15-29	W 301-286-5145 HOME 301-572-4470 FAX 301-286-6916
Gary Hollis	US Secret Service (Lead)	W- 202 3954011 H 703 823 5185
BRAD BUTTS	NASCOM (GSFC)	W- 301-286-3266 H- 410-730-0296
John Miller	USSS/WFO	202-435-5100
ORLANDO PROCHERVA	USSS/TSD	202-395-4004
Wallace NiBlack	White House Comm Agency	202-757-5514 W 301 286 2281
Judith A. Fortier	GSFC Health Safety	H 800 272 4115 W- 301-286-9361
PHILIP TAPPER	GSFC HEALTH & SAFETY EMERGENCY RESPONSE	H-410-995-1417
CAL OIXON	HMX-1 (MARINE ONE ADV)	(703) 640-2364/2209
Joanna Burton	Speechwriting	202-456-7756 PHONE Home 6218 Fax 703-519-0611
Tana Rosenblatt	Assisting Press Lead	202-225-2542 WK 703-549-2067 hm.

Goldman Center dir; Dr. John Klineberg
Mr. Goldman → POTUS



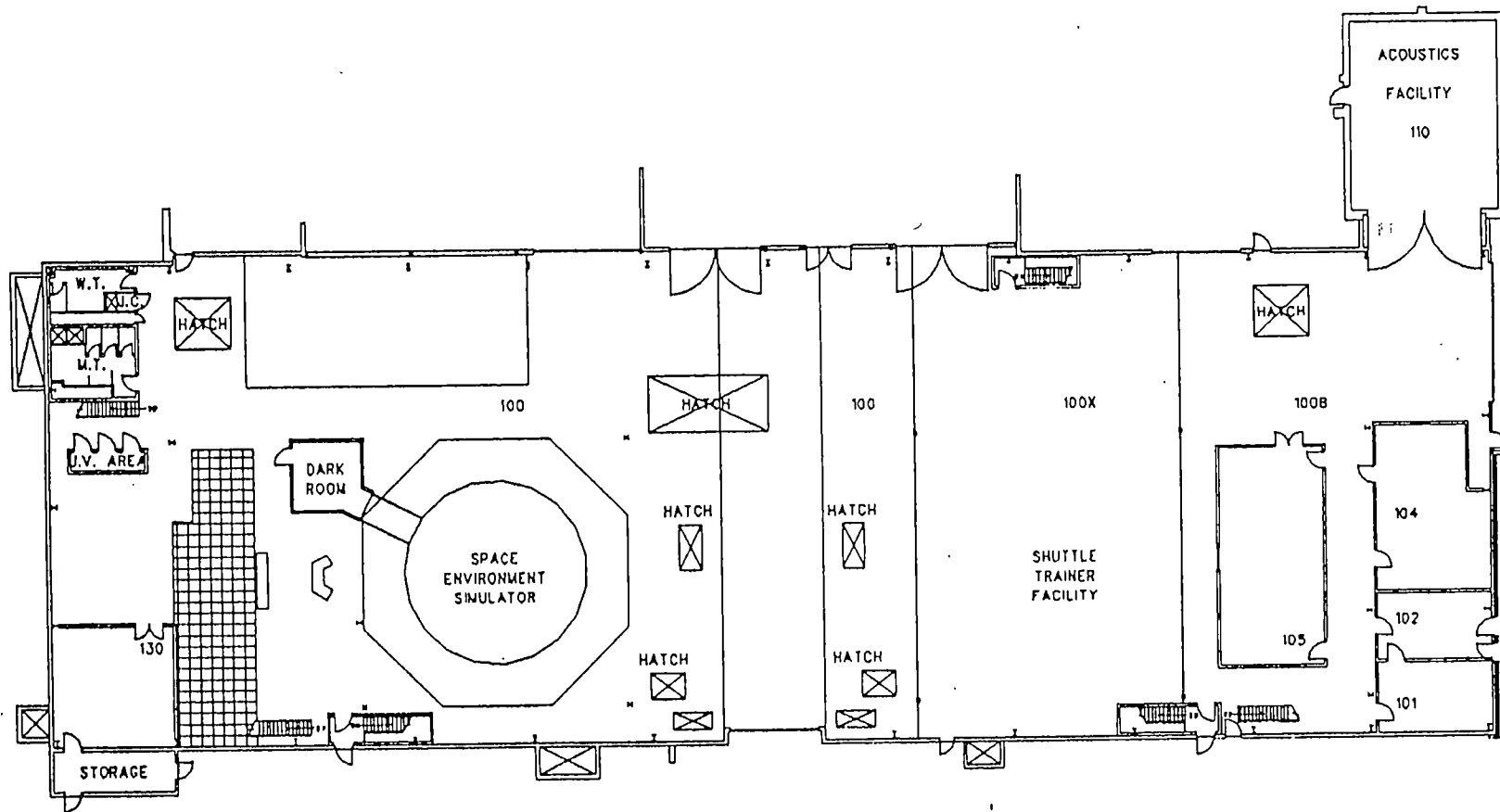


NORTH



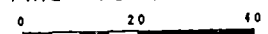
BUILDING 7
FIRST FLOOR PLAN

0 30 60
 GRAPHIC SCALE IN FEET
 NOVEMBER 1990



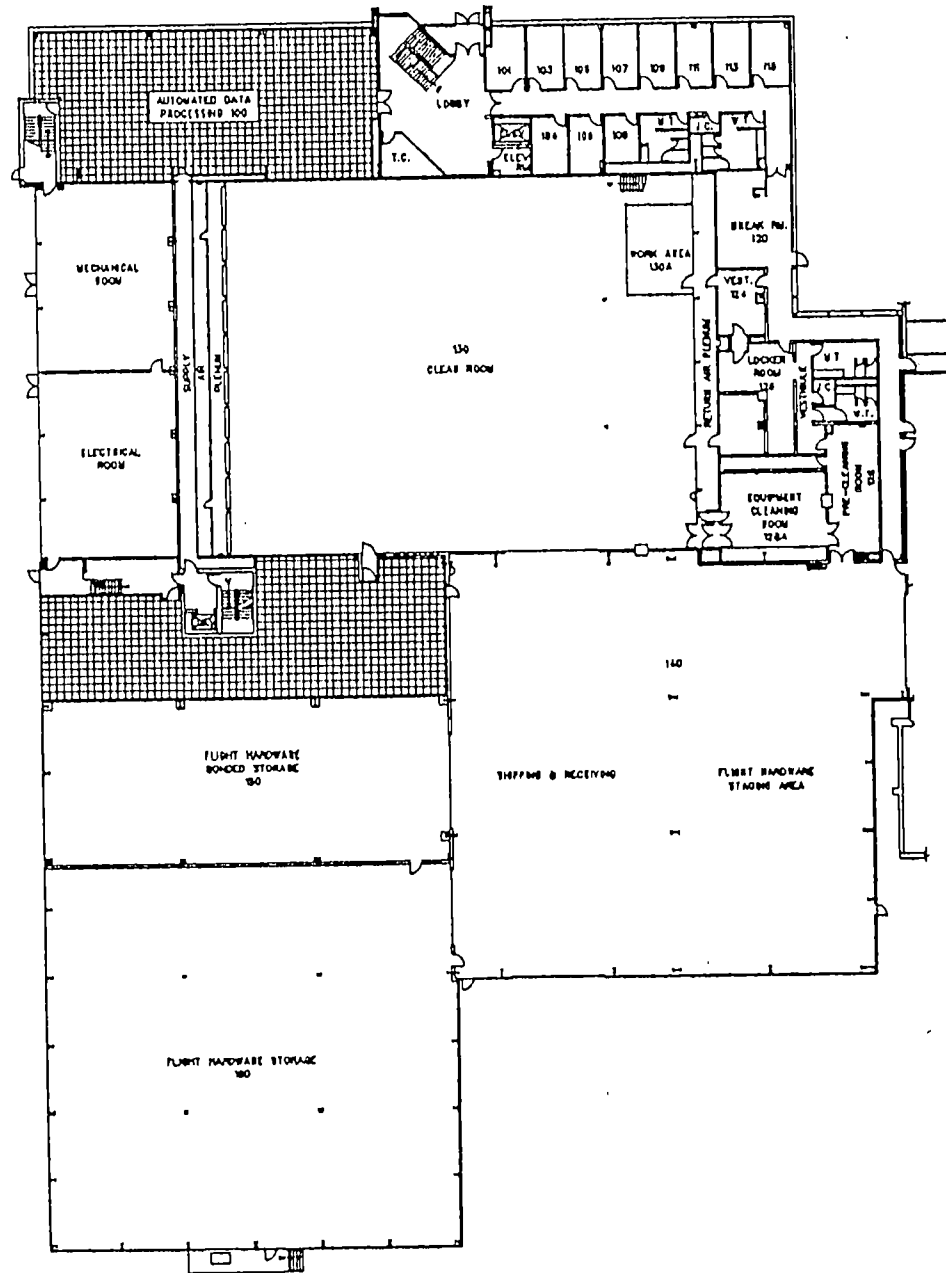
NORTH

**BUILDING 10
FIRST FLOOR PLAN**



GRAPHIC SCALE IN FEET

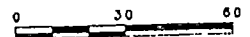
NOVEMBER 1990

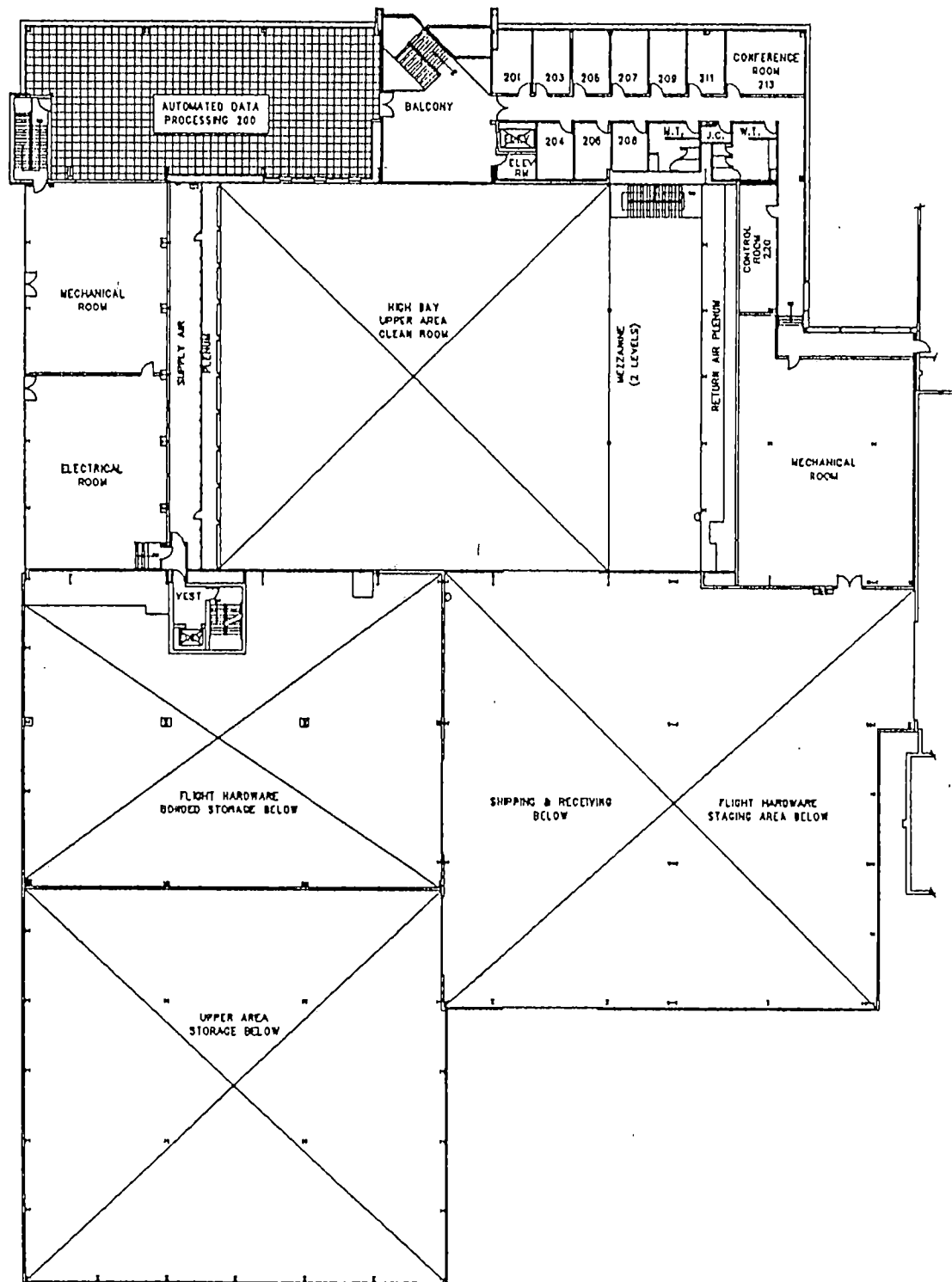


NORTH



BUILDING 29
FIRST FLOOR PLAN





NORTH

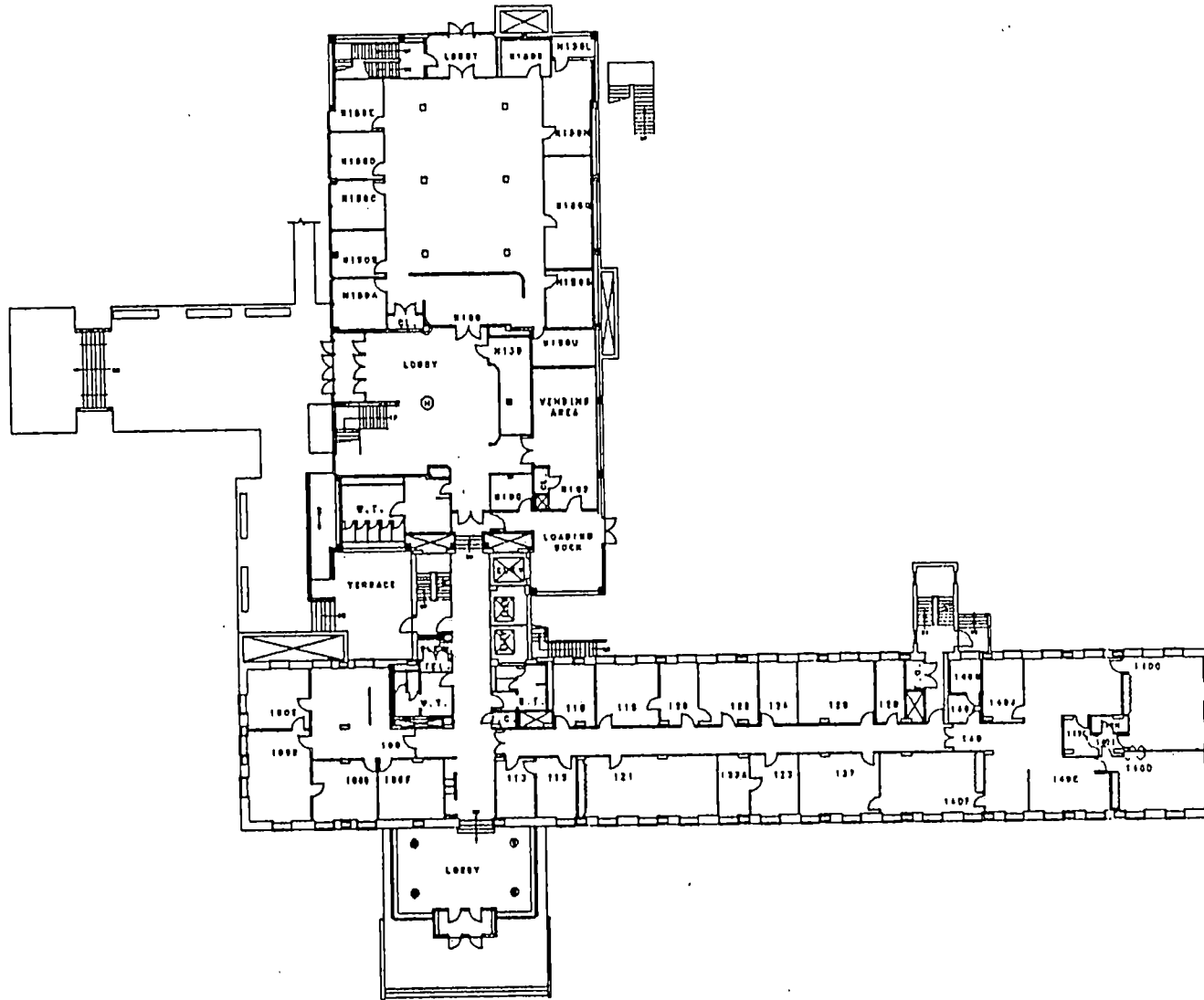


BUILDING 29
SECOND FLOOR PLAN

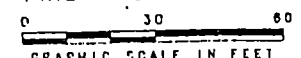
0 30 60

GRAPHIC SCALE IN FEET

NOVEMBER 1990

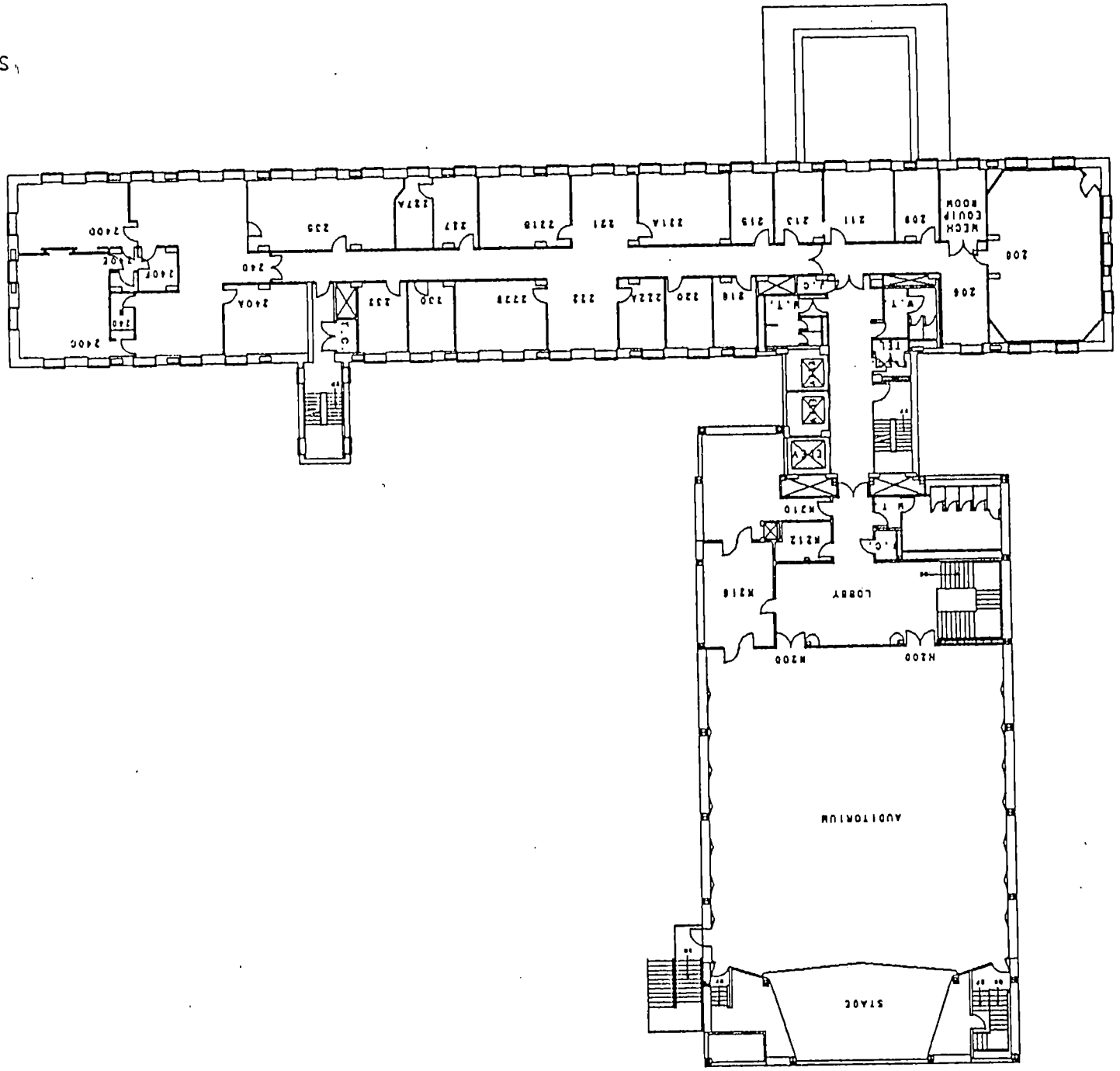
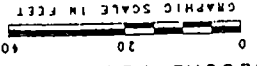


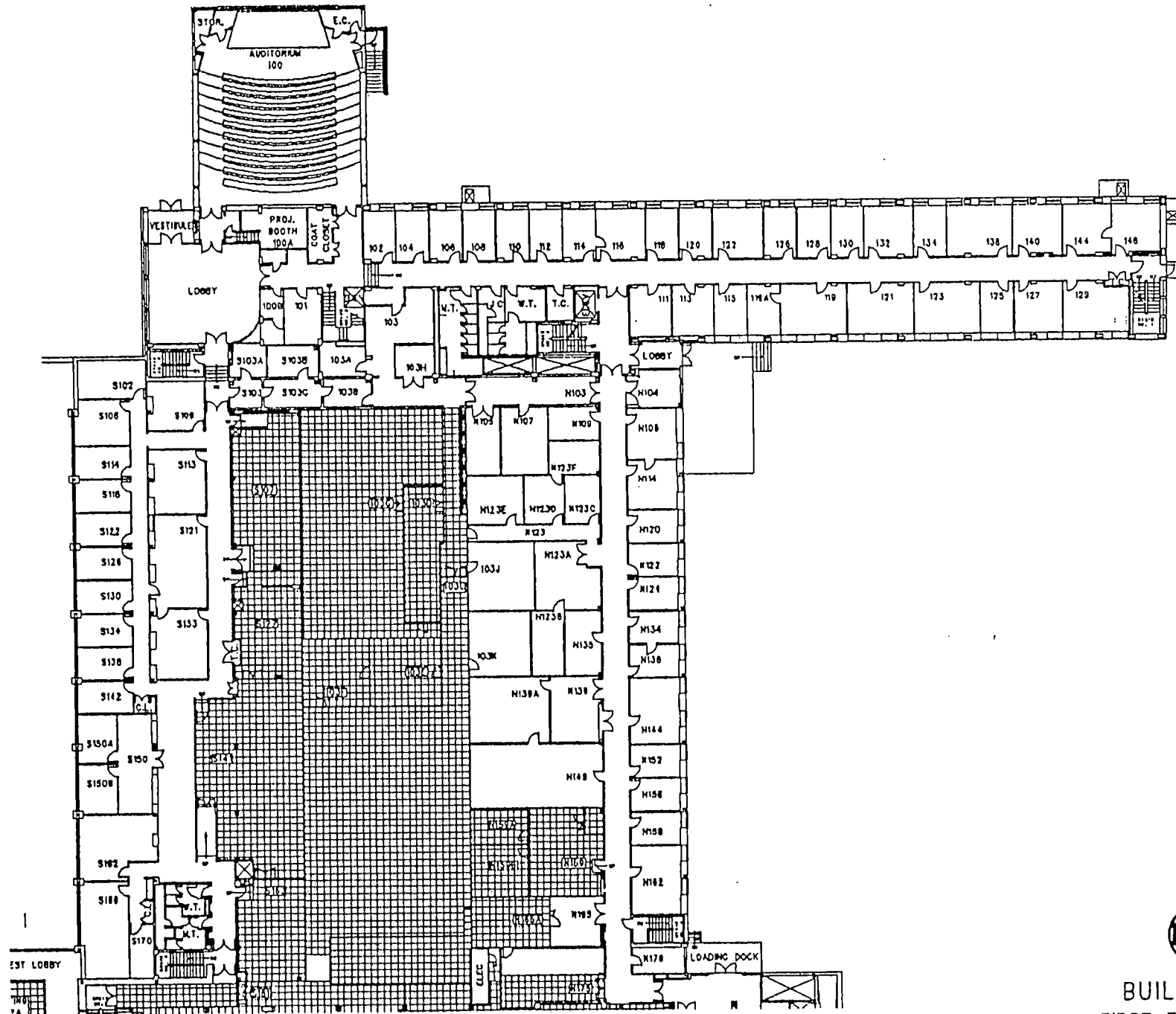
BUILDING 8
FIRST FLOOR PLAN



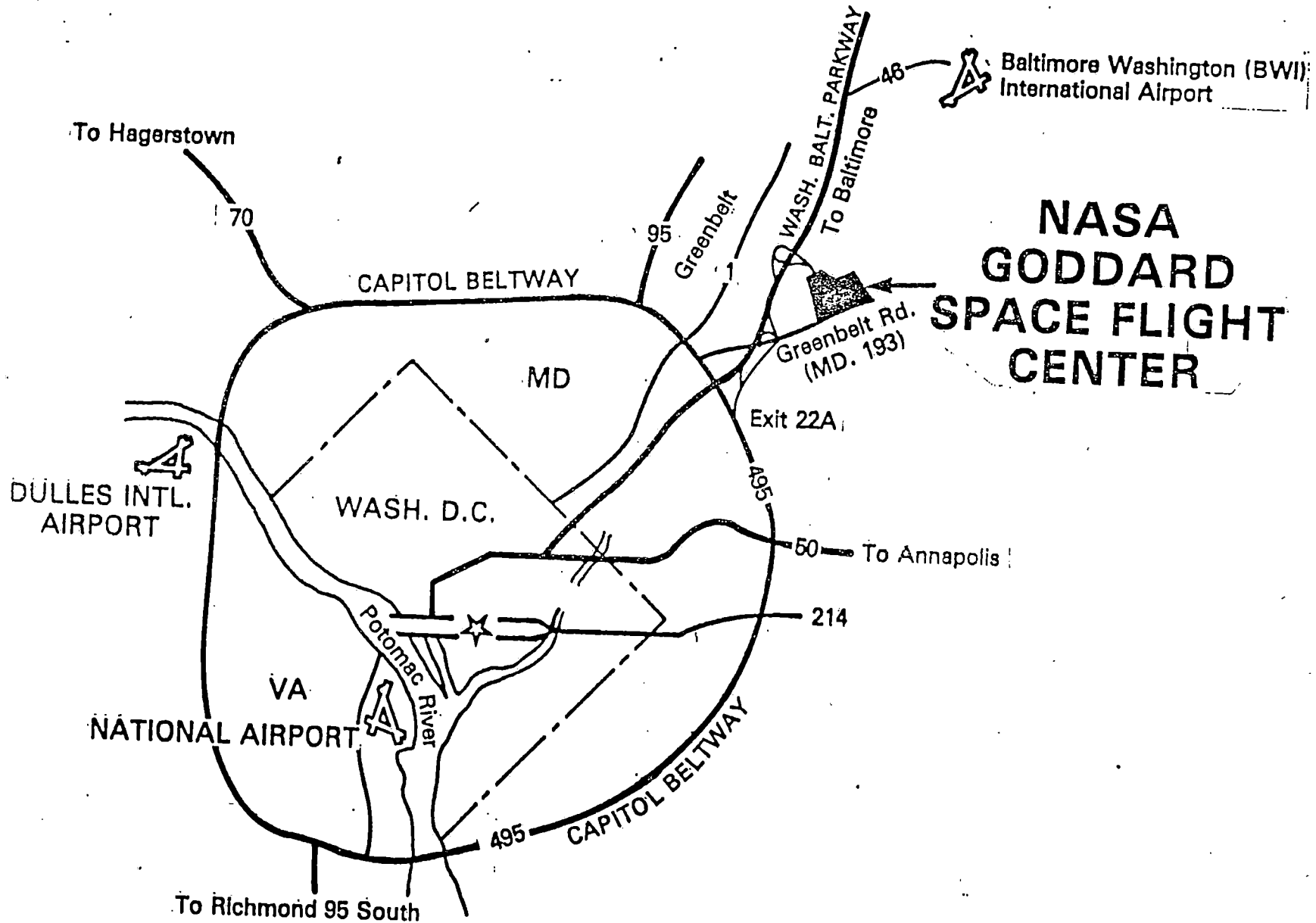
GRAPHIC SCALE IN FEET
NOVEMBER 1990

BUILDING 8
SECOND FLOOR PLAN
NOVEMBER 1990





BUILDING 3
 FIRST FLOOR PLAN
 0 30 60
 GRAPHIC SCALE IN FEET
 NOVEMBER 1990



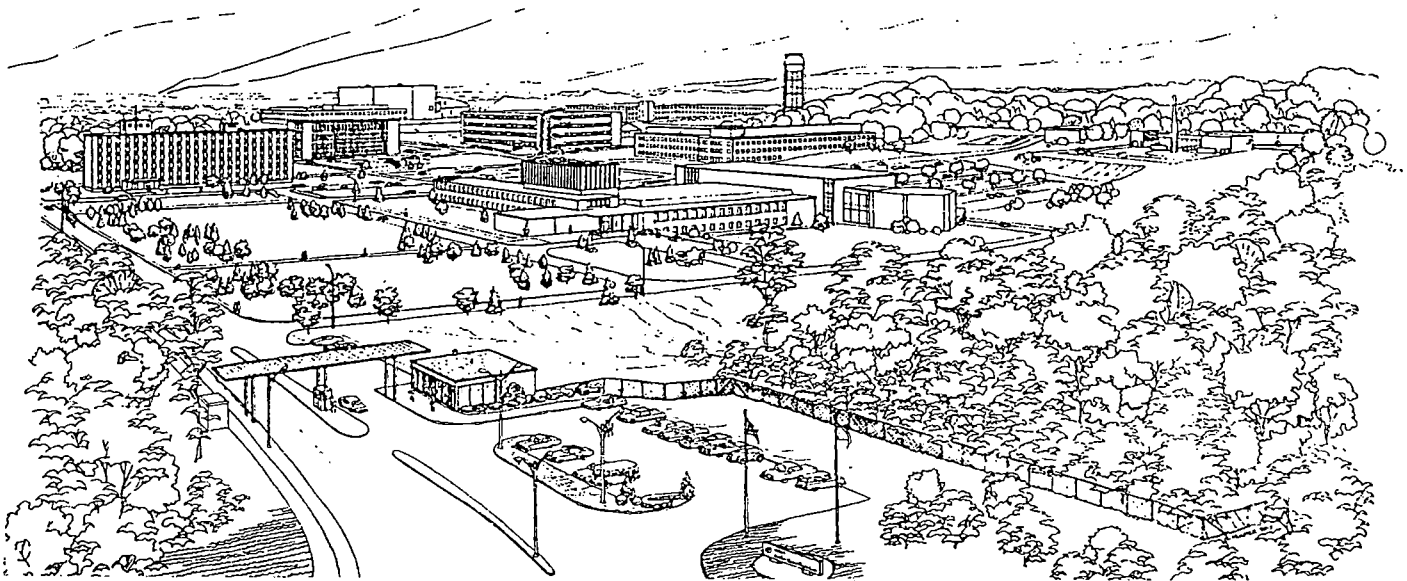
The Goddard Space Flight Center (GSFC) is located on MD. 193 (Greenbelt Road) in Greenbelt, Maryland. To reach GSFC from Maryland or the Tysons Corner area, take the Beltway (Interstate 495) to exit 22A the Baltimore-Washington (B-W) Parkway, North, and MD. 193 Greenbelt Road east to NASA. If you are coming from Washington, DC or other parts of Virginia, take Interstate 395 to New York Avenue to the B-W Parkway. The first exit after the Beltway is Greenbelt Road (MD. 193). Take MD. 193 Greenbelt Road east and follow the signs to NASA/GSFC.

NASA Facts

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771
AC 301 286-8955

Goddard Space Flight Center



Goddard Space Flight Center, Greenbelt, Maryland

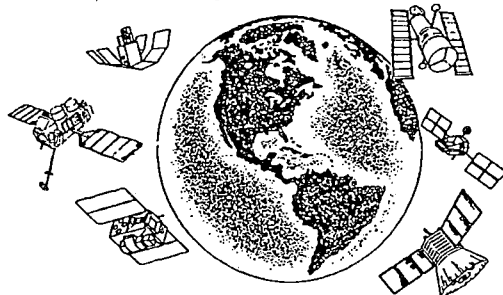
History

On January 15, 1959, by action of the National Aeronautics and Space Administration (NASA) Administrator, four divisions (Construction Division, Space Science Division, Theoretical Division and the Vanguard Division) of NASA were designated as the new Beltsville Space Center on land which was originally part of the Beltsville Agricultural Research Center, Beltsville, Maryland. Later that year, the Center was formally renamed the Goddard Space Flight Center (GSFC) "in commemoration of Dr. Robert H. Goddard, American pioneer in rocket research."

GSFC has played a major role in space progress almost from its opening. Its first employees were the 157 people of the Vanguard project who were transferred to Goddard from the Naval Research Laboratory. The first satellite under the project control of Goddard was Explorer VI, launched in August 1959, and it provided the world its first image of Earth from space. This was only the beginning of Goddard's long history in the Nation's space program.

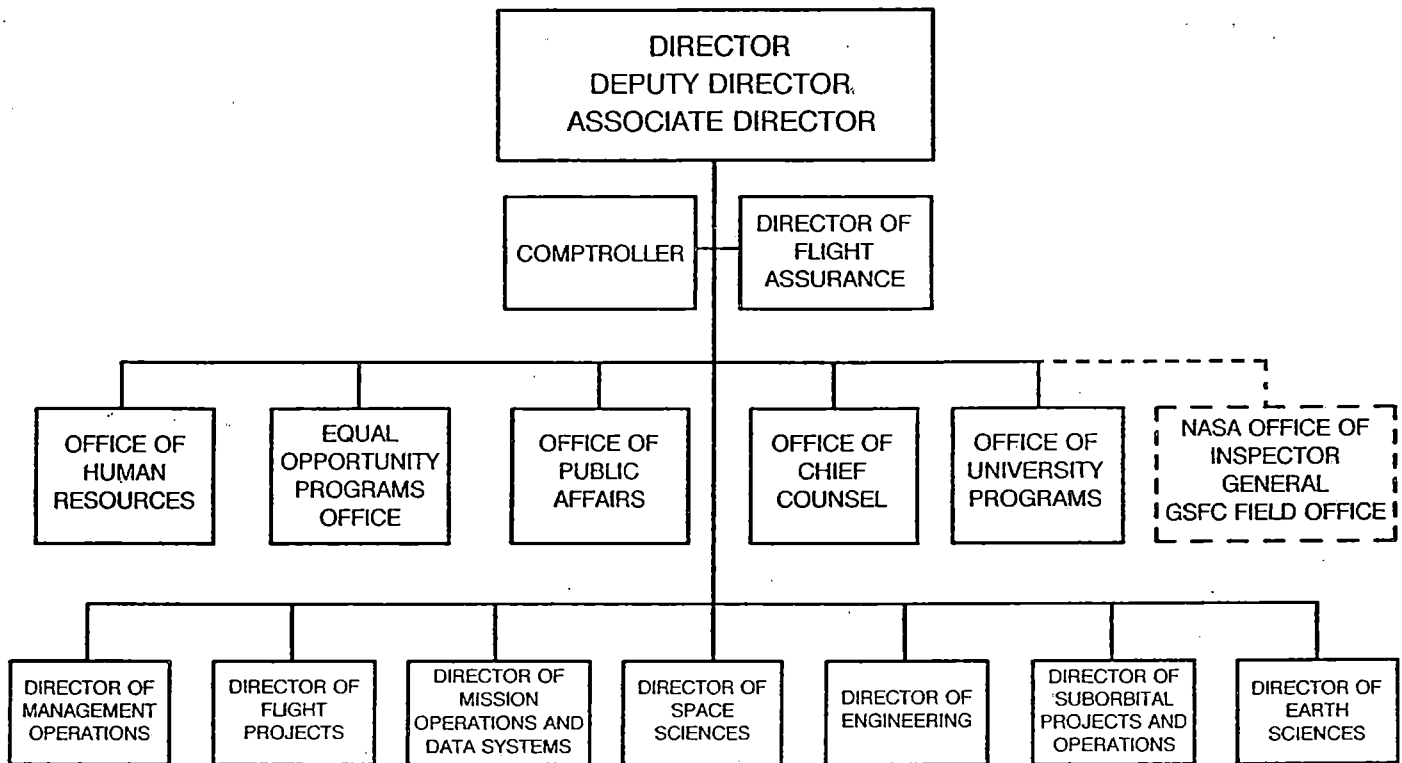
Our Mission

The mission of Goddard Space Flight Center is to expand knowledge of the Earth and its environment, the solar system and the universe through observations from space. To assure that the Nation maintains leadership in this endeavor, the Center is committed to excellence in scientific investigation, in the development and operation of space systems and in the advancement of essential technologies.



GSFC is responsible for the majority of NASA's near Earth-orbiting spacecraft.

Organization



Under the leadership of its Director, Dr. John M. Klineberg, the Center is managed by a system of directorates. The directorates and their functions are:

- Office of the Director (Code 100) - Provides overall management and coordinates control over the diversified activities of the Center.
- Management Operations (Code 200) - Provides business and institutional support and services necessary for the successful accomplishment of the Center's scientific and technical missions. Sharon C. Foster is the Director.
- Office of Flight Assurance (Code 300) - Responsible for safety, reliability and quality assurance programs to ensure flight mission success. This includes the control of electronic parts, materials and processes. The office also is responsible for independent design reviews of technical and flight safety aspects of spacecraft and instruments. Robert C. Baumann is the Director.
- Flight Projects (Code 400) - Plans, organizes and directs the management of the Center's major flight projects, new start studies, international projects, and the small and medium class expendable launch vehicles. Vernon J. Weyers is the Director.
- Mission Operations and Data Systems (Code 500) - Plans, designs, develops and operates spaceflight tracking and communications networks and provides data

systems support for near-Earth spaceflight missions. Dale L. Fahnestock is the Director.

- Space Sciences (Code 600) - Carries out research in space sciences and provides scientific counsel to other directorates that are working on space science projects. Dr. Stephen S. Holt is the Director.
- Engineering (Code 700) - Provides engineering expertise and support for the design, development, and testing of components, subsystems, systems and spacecraft for a variety of projects. In addition, Goddard's engineers consult with other NASA centers, other agencies, industry, and other countries in the area of automated space systems and related technology. Thomas E. Huber is the Director.
- Suborbital Projects and Operations (Code 800) - Responsible for the overall management, operation and support of NASA's sounding rocket and balloon programs and the conduct of aeronautical research. This function is located at the Wallops Flight Facility, Wallops Island, Virginia. Joseph T. McGoogan is the Director.
- Earth Sciences (Code 900) - Conducts scientific studies in the Earth sciences leading to a better understanding of processes affecting global change and the distribution of natural resources through research, development, and application of space technologies. Dr. Vincent V. Salomonson is the Director.

Workforce

Almost 13,500 persons work at the Goddard Space Flight Center at all of its sites. This number includes more than 4,000 civil servants and approximately 9,500 contract personnel (Greenbelt, Maryland - 3,722 civil servants and 8,654 contract personnel; Wallops Island, Virginia - 372 civil servants and 822 contract personnel; Goddard Institute for Space Studies in New York, New York - 23 civil servants and 43 contract personnel). Of this number, more than 3,600 civil servants and 7,500 contract personnel live in the State of Maryland (1,695 civil servants and 3,061 contract personnel in Prince George's County).

	Total GSFC Workforce	
	Civil Servants	Contract Personnel
Clerical/typist	494	376
Professional/administrative	825	1,949
Scientist/engineer	2,264	4,519
Technician	489	1,836
Wage Grade	74	829

Facilities

There are 30 major buildings, providing approximately 2,500,000 square feet of space, located at the Greenbelt, Maryland, site of the Goddard Space Flight Center, situated on approximately 1,200 acres.

Goddard's acreage includes four additional nearby facilities. Of these four facilities, Goddard owns the Propulsion Research Facility and the Magnetic Test Facility. The Optical Research Facility and the Antenna Range are held under revocable permit from the Beltsville Agricultural Research Center (BARC). Soil Conservation Service Road, which divides the space center's East Campus and West Campus, is owned by Goddard Space Flight Center and BARC.

In the near future, Goddard plans the addition of three major facilities to the Greenbelt campus. These include the Quality Assurance and Detector Development Laboratory (QUADDL) which will house approximately 40 civil servants and contract personnel in 58,800 square feet of space. This building is scheduled for completion in 1993 and will provide office and laboratory space for the Materials Branch and a state-of-the-art Class 100 clean room laboratory for the Electron Device Development Section.

Another facility is the Earth Observing System Data Information System (EOSDIS), which will house up to 900 civil servants and contract personnel working on a

Major Contractors at Goddard, Greenbelt, Maryland

The following is a listing of those contractors performing work at the Goddard Space Flight Center, Greenbelt, Maryland, which employ more than 50 employees.

Advanced Computer Systems Inc.
 Associate University for Research and Astronomy
 Bendix Field Engineering Corp.
 Centennial Contractors Inc.
 Computer Sciences Corp.
 City Wide Security Services
 Eagle Maintenance Service Inc.
 E.L. Hamm and Associates Inc.
 Engineering and Economic Research Systems
 Fairchild Space and Defense
 Jackson and Tull Inc.
 Kenrob and Associate.
 Lockheed Missiles and Space Corp.
 McDonnell Douglas Space Systems
 NSI Technology Services Corp.
 NYMA Inc.
 Ogden Logistics Services
 Raytheon Service Co.
 Science Systems Applications Inc.
 Swales and Associates Inc.
 ST Systems Corp.
 Unisys
 Universities Space Research Associates

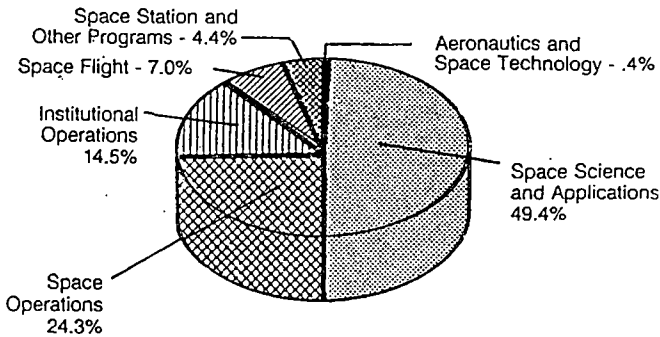
five-shift, 24-hours-a-day, 365-days-a-year basis. EOSDIS will provide approximately 200,000 square feet of office and data processing and archiving space. Occupancy is scheduled for 1994, with a full complement on board by 1997. This facility will serve as a key node in the Earth Observing System (EOS) communications system as well as a distribution center for Earth data from numerous sources such as the Total Ozone Mapping Spectrometer (TOMS) and Tropical Rainfall Measuring Mission (TRMM). The facility will house systems necessary for overall management of the EOS ground system and the largest of seven nationwide Distributed Active Archive Centers necessary for archiving a significant portion of the EOS observational data. It also will house the Mission Operations and instrument control center functions needed to monitor and control the EOS space platforms and their suite of instruments while in Earth orbit.

The third facility is the proposed Earth Systems Science Building (ESSB) which will house approximately 1,000 day shift civil servant and contractor personnel. The building will include 385,000 square feet of space and will house the present complement of Goddard Earth Science Directorate Laboratories, including the Laboratory for Atmospheres, the Laboratory for Terrestrial Physics, the Laboratory for Hydrospheric Processes, and

the Crustal Dynamics Project, all of which are at present scattered across the Center in seven different buildings. In addition, the ESSB will provide accommodations for guest investigators associated with the EOS program.

Budget

As illustrated in the pie chart below, the Goddard budget was approximately \$2.5 billion for fiscal year 1991.



Direct Funds	
Total Research & Development/Space Flight, Control & Data Communications	\$1893.4M
Total Research & Program Management/Construction of Facilities	\$339.6M
Total Reimbursable Funds (Est.)	\$250.0M
Total	\$2483.0M

Godard Launches 1991 - 1993

Gamma Ray Observatory

The second of NASA's "Great Observatories" the Gamma Ray Observatory (GRO) collects a broader range and higher quality gamma-ray data than ever before possible, providing information about the distribution and nature of gamma radiation throughout the Universe.

Tracking and Data Relay Satellite

The Tracking and Data Relay Satellite System (TDRSS) permits movement of large volumes of data from near-Earth satellites with great speed. Consisting of four satellites in geostationary orbit (22,300 miles altitude) and ground facilities at White Sands, New Mexico, the TDRS spacecraft acquire data from other orbiting user-satellites and relay that data to the ground station.

TOMS

The Total Ozone Mapping Spectrometer (TOMS), identical to the instruments flown on the Nimbus-7 spacecraft launched in 1978, was launched aboard the Soviet spacecraft Meteor-3 in an international effort to gain more data on the depleting ozone layer.

Upper Atmospheric Research Satellite

Ten scientific instruments aboard the Upper Atmosphere Research Satellite (UARS) will collect data to help scientists better understand the mechanism controlling the upper atmospheric structure and its response to natural and man-made variations.

Extreme Ultraviolet Explorer

A group of four telescopes comprising the Extreme Ultraviolet Explorer (EUVE) are designed to produce a highly-sensitive survey of the sky. The spacecraft will look at bright extreme ultraviolet sources and be used to study stellar evolution and the local stellar population.

NOAA

Goddard Space Flight Center designs and builds weather satellites for the National Oceanic and Atmospheric Administration. NOAA weather satellites track storms, pinpoint temperature differences in the oceans, and warn of early freezes and melting snow and ice from low-Earth orbit.

Diffuse X-Ray Spectrometer

Measuring the spectral distribution of near-by stars, the Diffuse X-Ray Spectrometer (DXS) will help confirm or disprove theories on how the present state of our galaxy came to be and how galaxies evolve.

Geotail

Geotail will use lunar-swingby orbit adjustment to place it in the region of Earth magnetotail, an extended region of the Earth magnetic field on the side of Earth opposite the Sun. Here the spacecraft will study charged particles and plasma characteristic resulting from Solar activity.

LAGEOS-II

The Laser Geodynamic Satellite II (LAGEOS-II) will promote research in Earth Sciences by providing very precise satellite geodetic measurements.

GOES

Acting as NOAA's agent under 1973 agreement, Goddard procures spacecraft and instruments for the National Oceanic and Atmospheric Agency (NOAA). The Geostationary Operational Environmental Satellite (GOES) series provide observations of cloud cover, atmospheric temperature and moisture profiles, as well as severe storm warnings and Search and Rescue Operations.

GGs Wind

The Wind Mission of the Global Geospace Science (GGs) Program is designed to determine solar wind input properties including plasma waves, energetic particles, and electric and magnetic fields for magnetospheric and ionospheric studies.

Advanced TDRS

Using state-of-the-art space technology, the Advanced Tracking and Data Relay Satellites will provide additional satellites to the Space Network for tracking and communication relay for near-Earth orbiting satellites.

ASTRO-D

In this cooperative mission with Japan, Goddard will provide four mirrors for a shuttle-carried payload designed to perform astronomical X-ray spectroscopy.

GGs Polar

The Polar Mission of the Global Geospace Science (GGs) Program will study the polar ionospheric region looking at energy input with a full range of plasma physics fields and particles "in situ" and remote sensing instruments.

Hubble Space Telescope Servicing

The instruments on the Hubble telescope are modular, designed for quick and simple replacement, much like changing tapes in a video cassette recorder. Because replacing Hubble's mirror in space or bringing the telescope back to Earth are not practical, scientists plan to compensate for the mirror's imperfection with the "second generation" scientific instruments, replaced on orbit.

In 1959, the Goddard Space Flight Center was established and, while its charter has changed and grown, its preeminence in space and Earth sciences, communications and tracking, data management, development of spacecraft and spacecraft-borne instruments, operations, and management has been demonstrated throughout its history.

During its first three decades, the Center developed more than 40 satellites in-house; managed the development of more than 160 satellites for NASA; launched over 175 payload-carrying Delta rockets; flew scientific payloads on over 2,500 sounding rockets and 550 balloons; and provided tracking, communications, and data handling for the Agency.

Goddard's scientific and engineering activities literally extend from the depths of the oceans to the edge of the universe. Goddard scientists have pioneered the development of many of the current space and Earth sciences disciplines. Goddard space scientists are involved in astrophysical research, in space physics, and in Solar System exploration. Studies in these disciplines reveal the nature of the terrestrial environment and the nature and evolution of planets, stars, galaxies, and the universe. Goddard Earth scientists are exploring the causes of global change by examining the dynamics, energetics, and chemistry of the atmosphere along with the interaction of land and oceans and the geodynamics and geophysics of the solid earth.

Observations from space are made possible by spacecraft and their instruments developed and operated at the Center. Goddard engineers and technicians develop

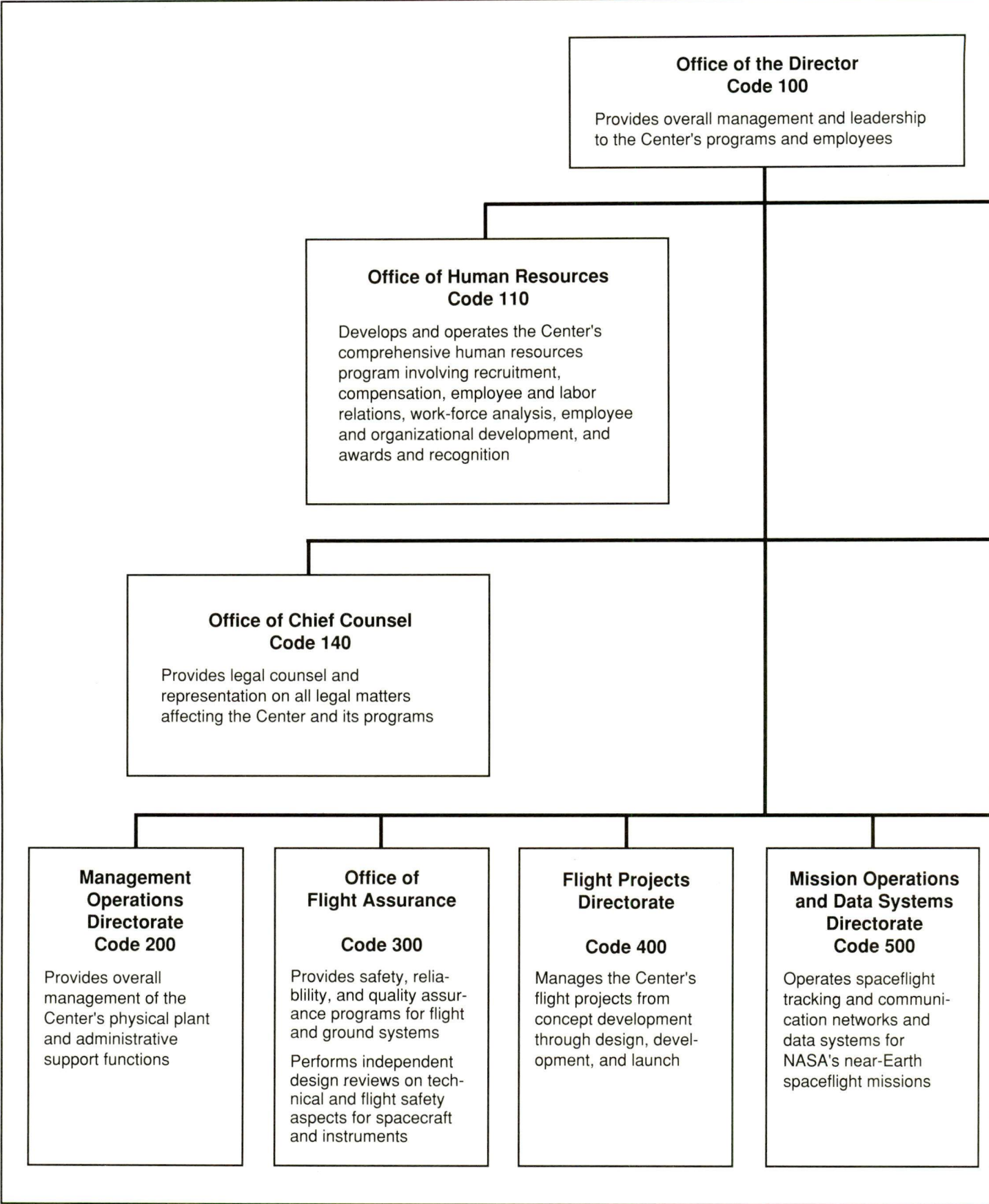


technologies and engineer solutions to complex problems in sensor development, optics, control systems, communication and data systems for operations, and science data management.

At any point in time, Goddard is involved in the management and development of 14 to 16 major projects that include smaller payloads, such as Hitchhiker, sounding rockets and research balloons, and major programs that span decades, such as the Tracking and Data Relay Satellite System and the Earth Observing System.

The Goddard Space Flight Center is a national resource. Its facilities, laboratories, and equipment provide the capability to build complex scientific satellites in-house, such as the Cosmic Background Explorer, which examines the evolution of the universe, and to manage satellite development, mission operations, data systems, and science.

The most significant resource of the Center is its 4,000 employees. These are the scientists, engineers, technicians, managers, and administrative and support personnel whose creativity and work are synonymous with the Goddard Space Flight Center.



**Equal Opportunity Programs Office
Code 120**

Coordinates and evaluates Centerwide Equal Opportunity Programs
Manages the EEO Complaint System
Fosters Center involvement with community and educational institutions

**Office of Public Affairs
Code 130**

Disseminates information on Goddard activities to the public and news media
Conducts space-oriented education programs and teacher workshops

**Office of the Comptroller
Code 150**

Provides the central overview of Center budgets and resource planning activities
Analyzes and forecasts program and institutional resource requirements

**Office of University Programs
Code 160**

Provides the focal point of Goddard program activities with colleges and universities

**Space Sciences
Directorate**

Code 600

Conducts scientific studies in high-energy astrophysics, astronomy, solar physics, and extraterrestrial physics

**Engineering
Directorate**

Code 700

Conducts a broad program of technical research, and design, development, and test for spaceflight programs, including in-house engineering and fabrication of instruments and satellites

**Suborbital Projects
and Operations
Directorate
Code 800**

Conducts NASA's Sounding Rocket Program and Balloon Program, operates a research airport, and provides tracking and communications for mission operations

**Earth Sciences
Directorate**

Code 900

Conducts scientific studies on Earth's atmosphere; land, ocean, and atmosphere interactions; and geodynamics and geophysics of the solid earth

Skill Needs

There are opportunities within the Office of the Director requiring general business, law, economics, or liberal arts backgrounds, such as:

Office of Human Resources

- Human Resource Specialists
 - Staffing
 - Classification
 - Labor and Employee Relations
 - Employee Development
 - Organizational Development
 - Program Analysts
 - Computer Systems Analysts
-

Equal Opportunity Programs Office

- EEO Specialists
 - Program Analysts
-

Office of Public Affairs

- Public Affairs Specialists
 - Educational Specialists
 - External Liaison Specialists
-

Office of Chief Counsel

- General Attorneys
-

Office of the Comptroller

- Resource Analysts
- Operations Research Analysts
- Program Analysts

Management Operations Directorate

The Directorate serves as City Manager to the Center, providing business and institutional support services to accomplish Goddard's mission at both the Greenbelt and Wallops Island facilities. The organization prides itself on service to its customers and on finding ways to improve these services within a complex Federal environment.

Divisions in our organization accomplish the following roles:

- The Financial Management Division oversees billings, payments, and accounting services for the Center.
- The Patent Counsel staff provide specialized legal advice.

- The Facilities Engineering Division plans, designs, and constructs institutional and research facilities and is responsible for all engineering alterations to existing facilities.

- The Plant Operations and Maintenance Division maintains the Center's buildings, roads, and grounds and provides power, heating, and other utilities support.

- The Procurement organizations acquire the supplies, services, and hardware necessary to support the Center's programmatic and institutional activities.

- The Logistics Management Division provides complete logistics support to the Center including transportation services, property management, mail services, and supply management.



The Goddard Library, employing the latest information technology, is considered a valuable resource to the Goddard community.

- The Information Management Division provides computing support for all administrative functions, as well as library services, and a full range of graphics and publication services.
- The Health, Safety and Security Office provides health, safety, security, fire protection, and emergency medical services, and manages complex environmental issues.

Patent Counsel

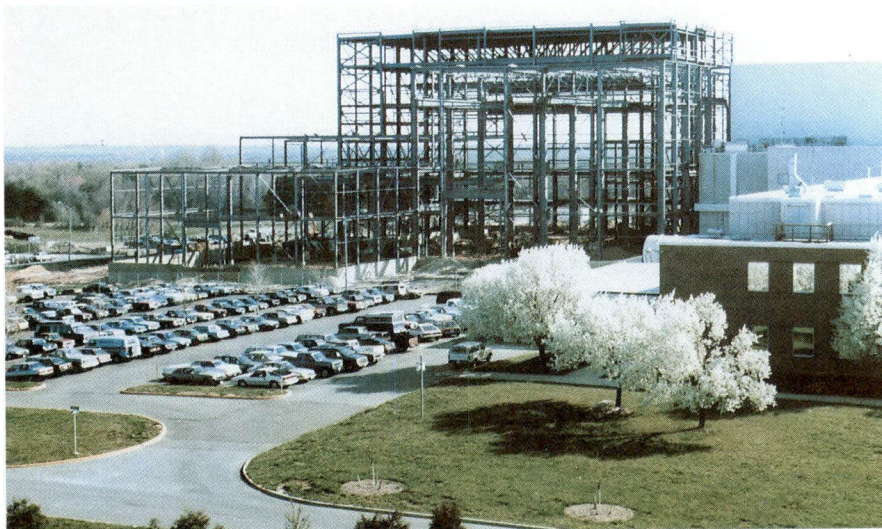
The office assists the Center's scientists and engineers in evaluating inventions for patent potential, patent preparation, and patent prosecution. We also support procurement personnel in the area of intellectual property rights and contract monitoring to ensure contractor compliance with provisions in the NASA patent rights clause and new technology clause.

Health, Safety and Security

Our programs focus on the health and safety of our employees, as well as on Center security—from the guards at the gate to national security communications. A unifying theme in all programs is the management of risks consistent with the "open campus" environment enjoyed by Goddard employees. As a major initiative, we are implementing a keycard access control system to heighten security in an unobstructive manner. Additionally, we have taken a proactive role in dealing with the complex environmental issues that we are facing at Greenbelt and Wallops.

Financial Management

The Division is responsible for financial management activities and associated budget and accounting functions for the Center. We support Goddard's programmatic goals through accurate and timely financial information and guidance. We have undertaken major efforts to enhance our accounting systems capabilities, to streamline reporting capabilities for our customers, and to actively support the development of the NASA Financial Accounting Information System (NAFIS). Improving communication and service delivery to our customers is a major organizational commitment.



Logistics Management

We provide complete logistics support at Greenbelt and Wallops. Activities include logistics support to the flight projects and technical communities for procurement and management of their technical parts stock, transportation of scientific instruments and spacecraft, and storage of space-flight hardware. The Division provides supply services, including a 12,000-line-item supply system, and has accountability for \$1 billion of property. Transportation services include traffic management, package

Spacecraft Systems Development and Integration Facility during construction (top) and after completion (bottom). It is the largest laminar flow clean room of its type.

engineering, material handling, shipment of goods, a large vehicle fleet, and personnel travel arrangements. We also manage the Greenbelt Mail Services Center, the furniture and carpet program, and office space planning and design.

Procurement

Eighty-eight percent of the Center's budget is spent through the

contracting process. The procurement function includes institutional acquisitions (facilities, construction, commercial, and small purchases), procurement policy, pricing and analysis, and acquisition for Goddard's major space projects. Our procurements approach \$2 billion annually, including approximately 4,800 large contractual actions and 17,800 small purchases (under \$25 K). Goddard has led NASA in simplifying the complex procurement process, including initiatives to reduce lead-time on Goddard's major procurements and to automate the small purchases system.

Information Management

A broad scope of services is offered to Goddard customers. We support all administrative computing, and our systems analysts create automated systems best suited to our customers' needs. The Library is a state-of-the-art resource to the technical communities at both Greenbelt and Wallops. Our photographers document each phase of spacecraft development,



Project Engineer designing a building structural system on a Computer-Aided Design and Drafting workstation.

and the computer graphics facility produces full-color slides and transparencies. We operate Information Technology Centers—unique, computerized, self-paced learning laboratories—at both sites.

Facilities Engineering

The Division plans, designs and constructs Goddard's facilities. Recent major construction includes the Second Tracking and Data Relay Satellite System (TDRSS)

Ground Terminal, which is a second ground station for the TDRSS, and the Spacecraft Systems Development and Integration Facility, the largest clean room of its kind. The Division will undertake a major challenge in constructing the Center's "Eastern Campus" to support the President's "Mission to Planet Earth." These new facilities will greatly enhance our effectiveness in processing data and in conducting complicated global scientific research. At Wallops, we are constructing an integrated control center for airfield and rocket launch operations and are restoring several miles of seawall on Wallops Island. The Division is also in the process of revitalizing our services for small construction projects.

Plant Operations and Maintenance

This Division maintains our buildings, utilities, grounds, roads and is responsible for the physical plants at Greenbelt and Wallops. We have undertaken major initiatives to improve Center maintenance and utility operations including a multimillion-dollar effort to renovate Goddard's aging facilities and utility systems, and plans to construct a "Cogeneration Power Plant" at Greenbelt to provide electricity and steam at lower cost than at present. The Division also will be expanding its capabilities to include minor alteration and modification services to its customers at Greenbelt.

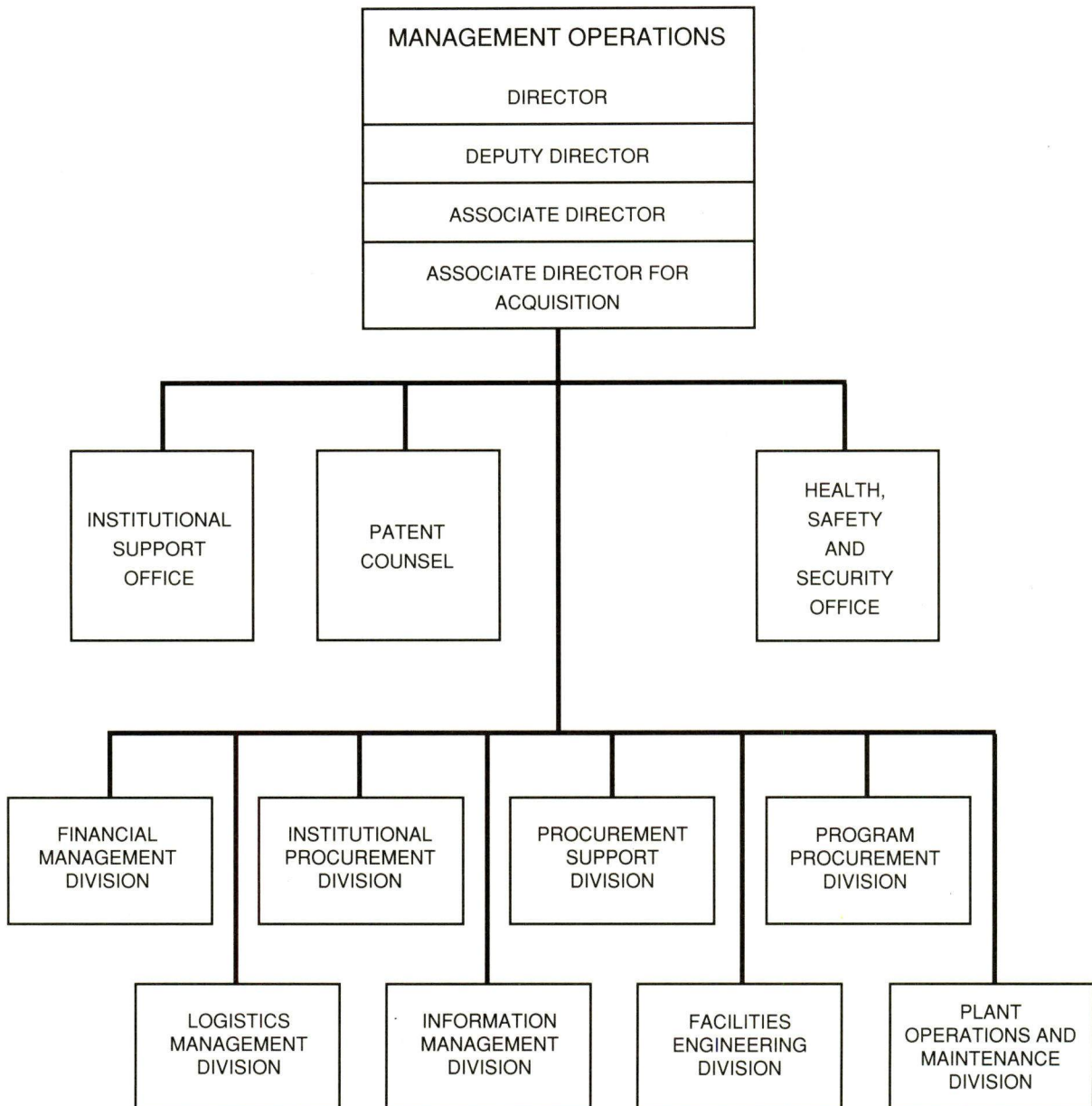


Preparing for contract negotiation.

Skill Needs

There are opportunities within the Management Operations Directorate requiring general business, economics, liberal arts or backgrounds such as:

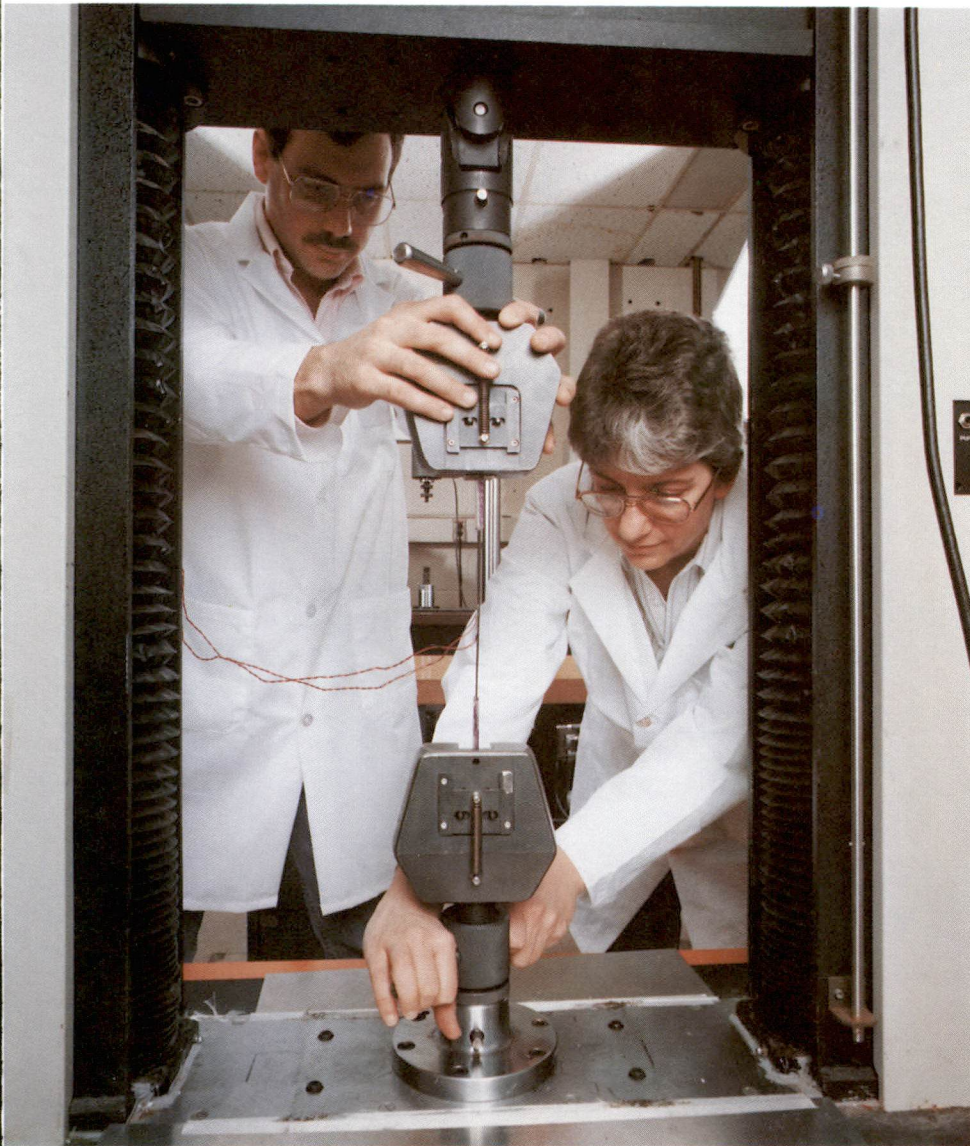
- | | | |
|---------------|------------------------------|---------------------------|
| Engineers: | Accountants | Cost/Price Analysts |
| Environmental | Budget Analysts | Patent Attorneys |
| Civil | Financial Analysts | Legal Technicians |
| Mechanical | Systems Analysis and | Boiler Plant Operators |
| Electrical | Development Specialists | High-Voltage Electricians |
| Architects | Computer Science Specialists | Logistics Specialists |



The technical flight safety aspects of all Goddard's flight projects, including spacecraft, launch vehicle operational ground systems, and scientific instruments, must be reviewed before, during, and after launches. This ensures that they meet Center goals for mission success and reliability. The Office of Flight Assurance conducts those reviews and provides technical support and guidance to all flight programs. We develop general policy requirements for quality assurance, parts and material control, environmental testing, verification, reliability, flight-system safety, and software assurance.

Office activities include:

- Ensure flight readiness through identification and correction of anomalies.
- Work closely with flight project teams to establish and implement policy and requirements for test verification, system safety, reliability, product and software assurance, and reliable parts and materials.
- Provide lab testing and analysis for parts and materials.
- Ascertain that the functional requirements of NASA and Goddard are met in purchasing materials and supplies, and prepare documentation for the technical specifications and, if necessary, the contract provisions.
- Evaluate plans, proposals, and procedures for all flight projects to ensure they meet requirements.



Conducting a tensile test in the Materials Laboratory.

Systems Review Office

Using a small cadre of the Center's more experienced technical experts, this Office reviews all flight projects beginning at the conceptual design stage and progressing to the final flight readiness review. Potential problems are identified and resolved before we recommend mission launch to the Center

Director. All Center-managed projects, as well as many other Government and international programs, are provided Flight Assurance support as required.

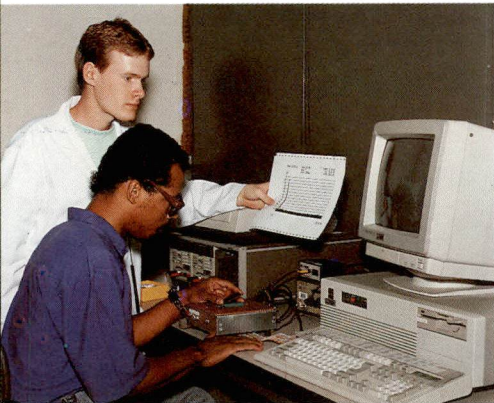
The Parts Branch

Reliability engineers in the Parts Branch develop and maintain plans and procedures for assuring the procurement, testing, and use of

maintains expertise for EEE parts and microelectronic devices while the Parts Technology Section studies radiation effects and electronic packaging process technology, and provides expertise in EEE parts areas, such as microcircuits and certain electromechanical parts.

The Materials Branch

This Branch provides technical support in materials science, technology, and applications. These experts are the Center's focal point for consultation, control, and review of all materials, materials systems, and designs for flight missions. As such, our staff investigate all spacecraft materials problems and their resolution and assist management in arriving at materials policy goals and guidelines for qualified flight hardware. We also support cooperative ventures with other Government agencies, educational



ABOVE: Automated Test Equipment (ATE) semi-automatic setup for performing test plots.

RIGHT: Working in the Parts Testing Laboratory, ATE room, on a digital microcircuit tester.



flight-quality parts. We provide parts expertise to determine suitability, reliability, and quality of parts.

This Branch determines and designates NASA standard electrical, electronic, and electromechanical (EEE) parts and documents. We prepare the Parts Application Handbook and participate in the parts standardization program. The Parts Engineering Section

institutions, and private industry to develop improved, more reliable materials.

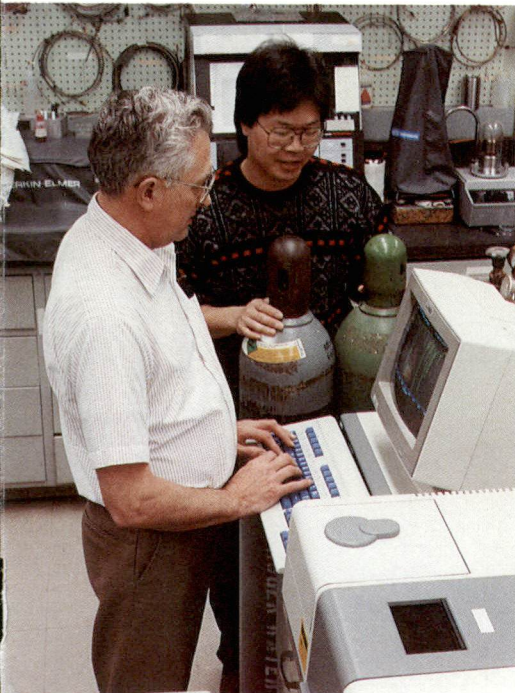
The Metals Section provides engineering expertise in metallurgy, mechanical engineering, fracture mechanics, tribology, and inorganic chemical analysis. The Polymers

Section specializes in organic chemical analysis, polymer research, inorganic chemical analysis, polymer degradation, modeling polymer processing, gas kinetics, materials outgassing kinetics, and gaseous and particulate contamination in space. The Ceramics Section focuses on optical materials and coatings, electronic materials, measurements and instrumentation systems, and

safety, test levels, and durations at appropriate levels of assembly and related analytical requirements. Staff within the System Safety Branch develop system safety policies and requirements for special missions.

The Assurance Management Office

Our Flight Assurance Managers and Product Assurance Engineers



environmental testing while the Composites Section works with composite and brittle materials.

The Assurance Requirements Office

Our senior safety and reliability experts develop and implement policies and requirements for environmental testing, verification, reliability system safety, and software assurance for safe, reliable space systems. We establish test and design factors of

are assigned to Goddard projects; they manage all aspects of performance assurance, from negotiating resources to garnering support from other offices. They constantly assess hardware and software quality and status and provide feedback both for the project and the Office. As part of the ever-evolving Office of Flight Assurance, they provide feedback to the Director on the effectiveness of assurance programs.

ABOVE LEFT: Polymer Section employees conducting a Fourier Transform Infrared analysis on organic material.

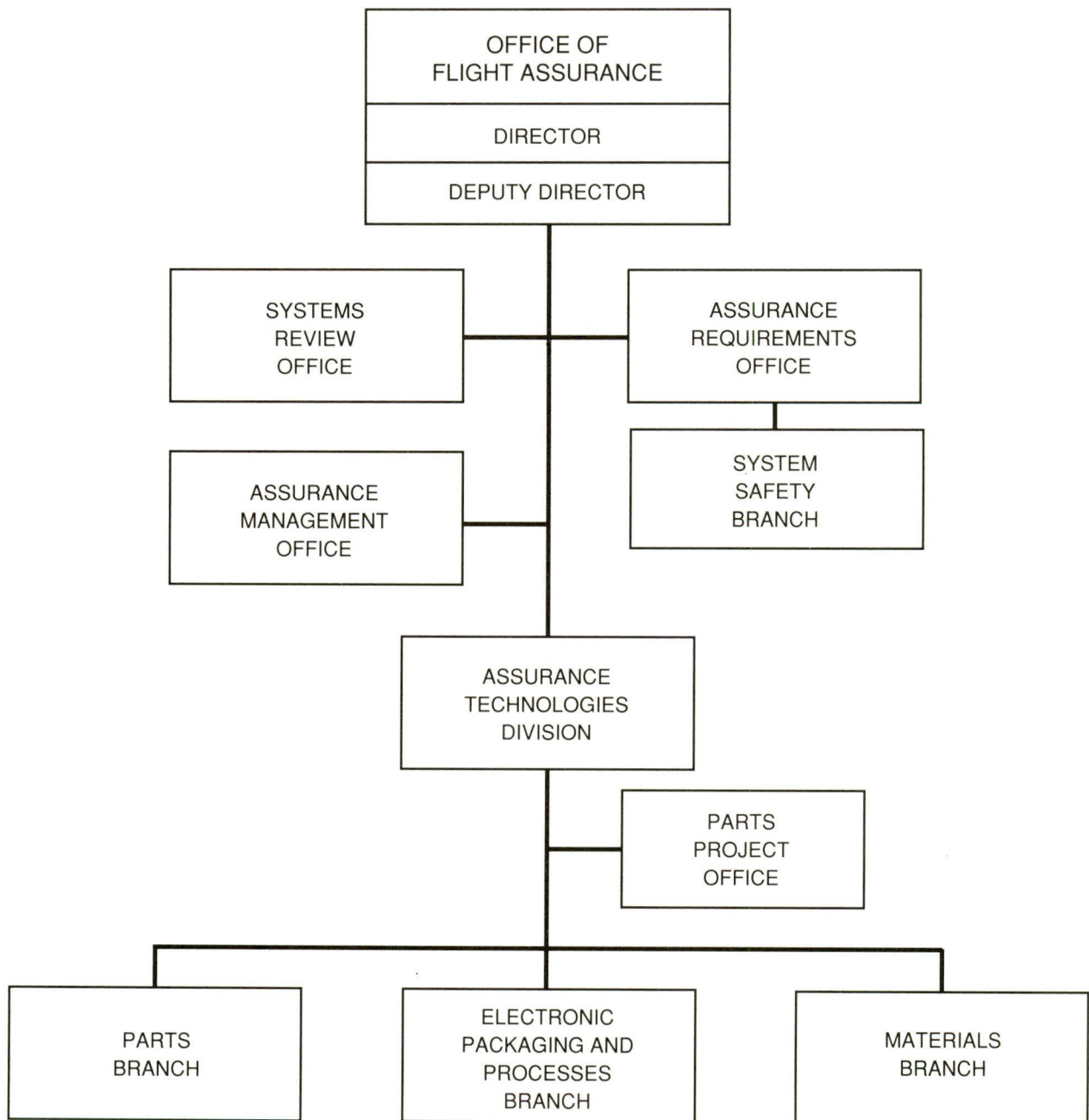
ABOVE: Training center for soldering of electrical connections.

Skill Needs

There are opportunities within the Flight Assurance Office in the following disciplines:

Flight Assurance
Product Assurance
Systems Review
Project Safety
Parts Engineering
Materials Engineering

Metallurgy
Ceramics
Polymer Chemistry
Chemistry
Physics

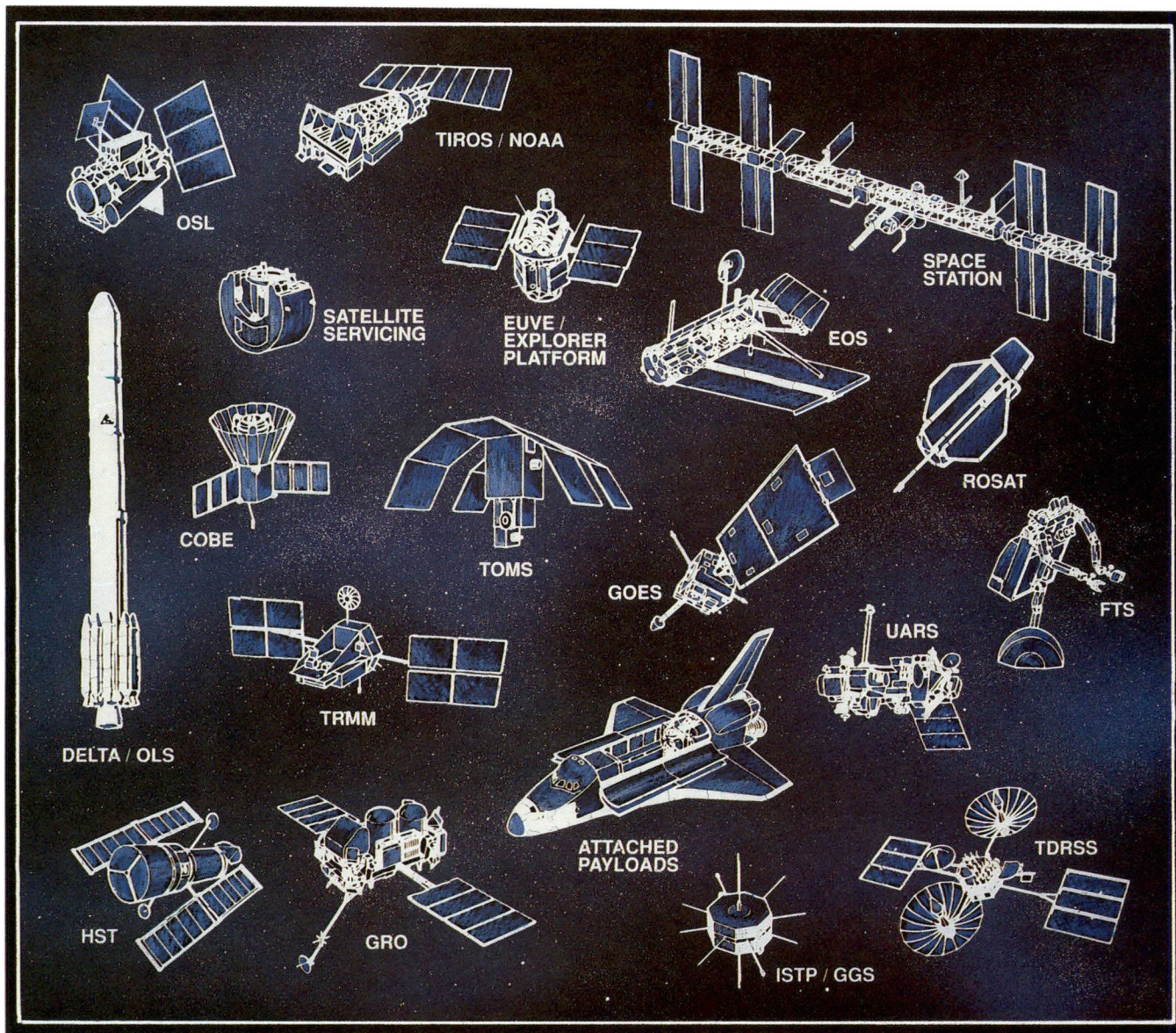


Flight Projects Directorate

Many dynamic and interesting projects are managed by this Directorate. Goddard flight projects range in complexity from small explorer-class satellites and attached Shuttle payloads to large Earth-orbiting observatories; the Earth Observing System, which is the centerpiece of NASA's Mission to Planet Earth; international

cooperative programs; and expendable launch vehicle development and services. The lifetime of the projects and the missions is up to 15 years. Because of this Directorate's expertise in on-orbit satellite refurbishment and servicing, the Hubble Space Telescope is expected to transmit valuable astronomical data for 15

years. We are responsible for the overall management, development, testing, and pre- and post-launch activities, including on-orbit checkout, of these important flight systems. Launches are scheduled aboard the Shuttle as well as on expendable launch vehicles. The Flight Projects Directorate manages an annual budget in excess of \$1 billion.



Current and future activities

Satellite Servicing Project

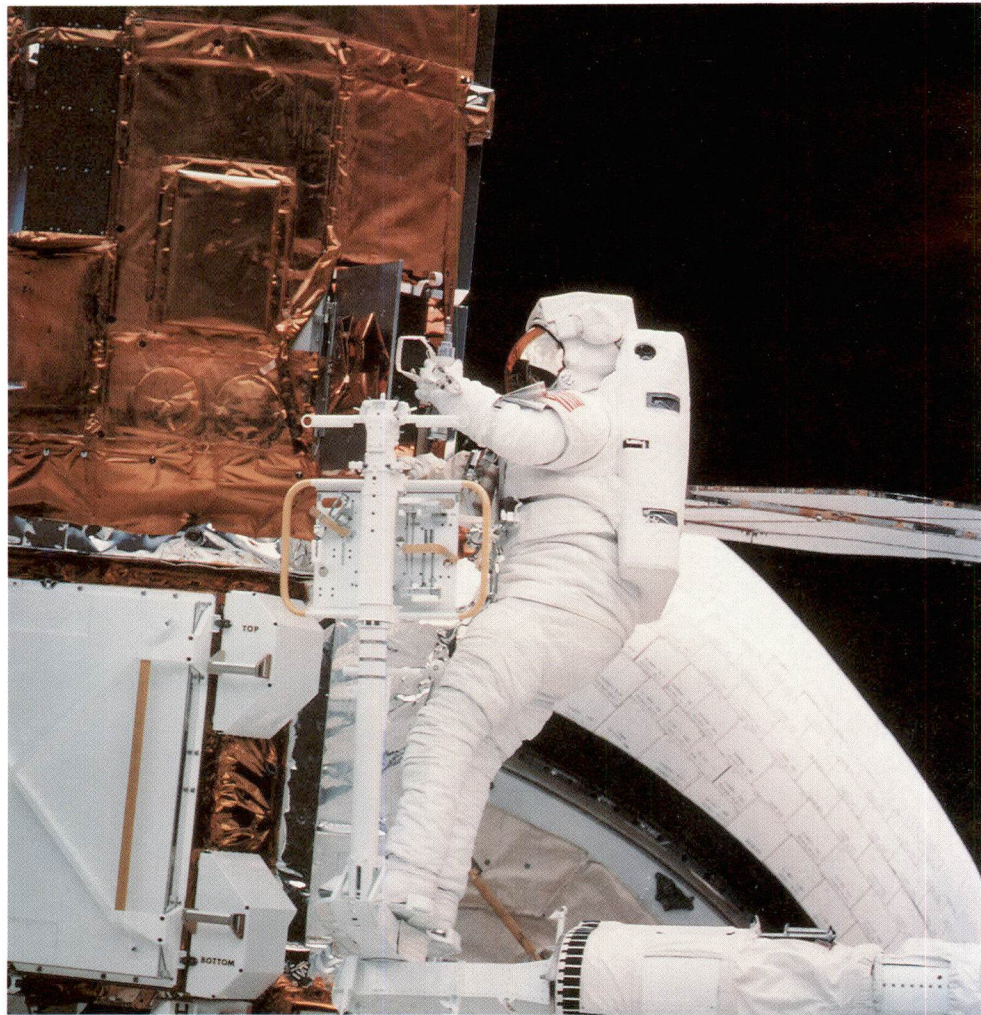
This project develops and produces the NASA multimission modular spacecraft and the explorer platform. It also conducts on-orbit servicing of Goddard spacecraft and develops serviceable spacecraft, airborne support equipment, and new extravehicular activity (EVA) support equipment.

The project team plans, prepares, and conducts Shuttle-based satellite repair missions, such as the Solar Max Repair Mission and Hubble Space Telescope repair missions. The project team also is developing EVA-unique equipment and lightweight airborne support equipment to support combination deploy/retrieval missions.

Satellite servicing works on the principle that repair and refurbishment of satellites can benefit the entire space program by reducing spacecraft costs, allowing the recovery of scientific instruments, and using well-proven space engineering technology in the ever-changing and always demanding space field. We are always looking for fresh ideas and innovative engineers eager to work on the cutting edge of technology and looking to get more science for the dollar!

The Earth Observing System (EOS)

The goal of the EOS mission is to advance the understanding of the entire Earth system on a global scale by developing a deeper



understanding of the components of that system, their interactions, and how the Earth system is changing. The EOS mission will create an integrated scientific observing system that will enable a multidisciplinary study of the Earth, including the atmosphere, oceans, land surfaces, polar regions, and solid earth. The Directorate manages and directs the mission; investigations will include developing and operating remote-sensing instruments. EOS is an international, coordinated effort that combines observational

instruments with the scientific power to produce significant parts of the database needed for Mission to Planet Earth.

Within the EOS organization, there are three major projects: the EOS Platforms Project, which manages and develops the large orbiting "platforms" needed to carry instruments; the EOS Instruments Project, which manages the design and development of the flight facility and principal investigator instruments for flight; and the EOS Ground Systems and Operations



LEFT: Astronaut repairing Solar Maximum Satellite aboard Shuttle (STS-41C).

Project, which designs and develops a comprehensive data system that includes observatory and instrument control, processing, storage, and efficient retrieval of EOS instrument data.

The EOS project is the largest ever undertaken by Goddard and will provide data for more than 20 years. EOS will be the most significant unifying effort of its time to understand the Earth as a planet.

The Hubble Space Telescope Project

The Hubble Space Telescope, launched in April of 1990, is a unique spaceborne observatory designed to conduct long-range astronomical research. This orbiting facility — a 2.4-meter-aperture telescope system with an

ABOVE: Artist's concept of the Earth Observing System (EOS) Polar Platform. The EOS, as a whole project, will be largest endeavor ever undertaken by Goddard.

initial complement of five scientific instruments — is supported by a combination of dedicated flight and ground systems.

The project team here at Goddard is dedicated to maintaining and operating the Hubble Telescope for approximately 15 years. This involves ground-systems operation and data analysis; the development, fabrication, and launch readiness of orbital replacement units and instruments; flight-systems performance analysis; maintenance mission planning and execution; and management of flight and support hardware.

Resources Management staff organize, plan, and direct the business and financial operations of the Project. Flight Systems employees develop new, state-of-the-art spacecraft hardware and the scientific instruments to be used in upgrading the Telescope during servicing missions. Flight Operations personnel provide day-to-day operations capability to command, monitor spacecraft status, and provide science program planning, real-time target acquisition, acquisition of data, and standard processing of data. Mission Systems Engineering/Analysis staff provide observatory-level systems engineering and analysis in support of Flight Operations.

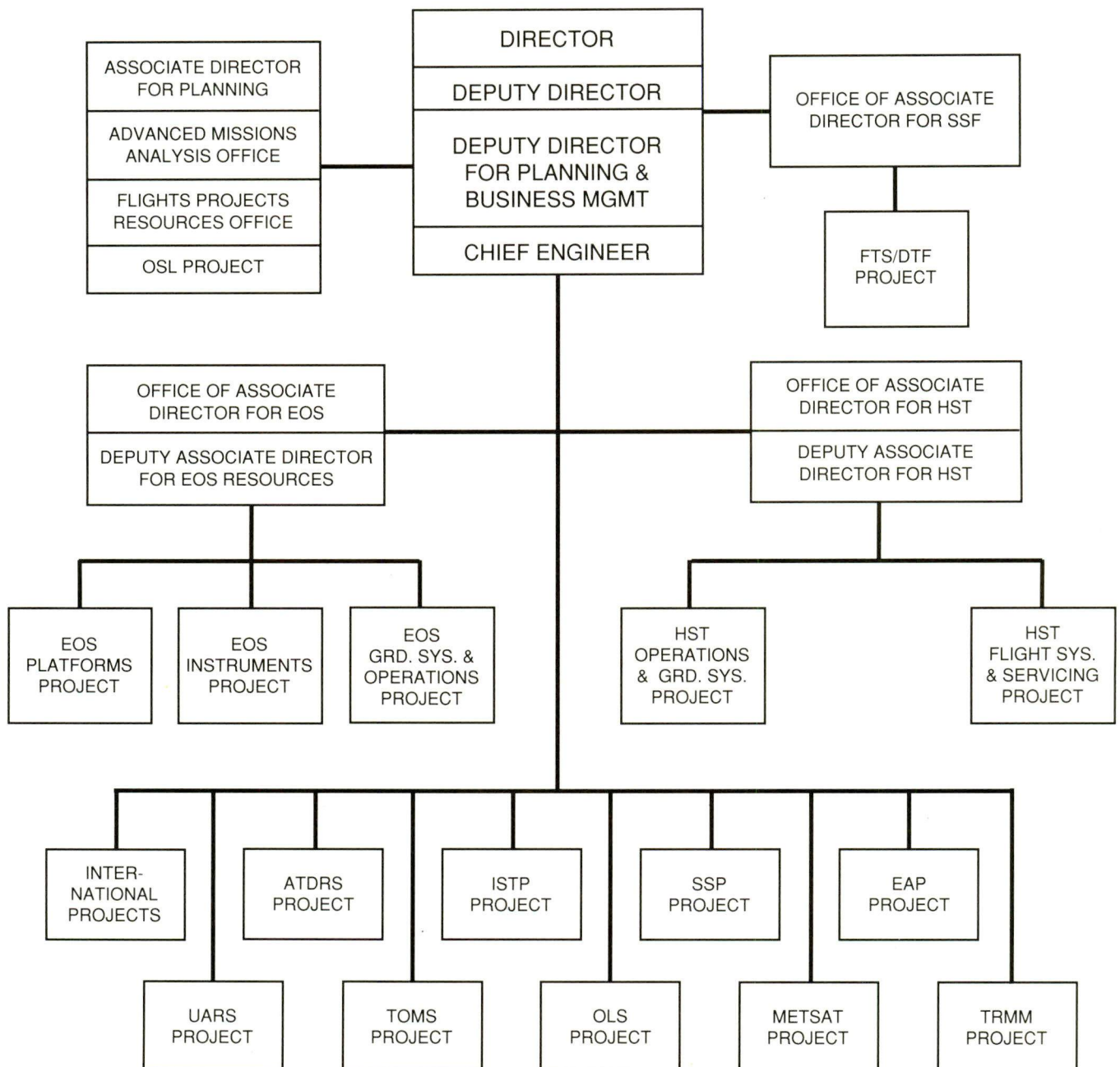


Hubble Space Telescope launched April 24, 1990, is scheduled for on-orbit servicing in approximately 3 years.

Skill Needs

There are opportunities within the Flight Projects Directorate in the following disciplines:

Project Management	Resource Management
Systems Management	Engineering
Instrument Management	Mathematics
Ground Systems and Data- Processing Management	Accounting
Software Management	Finance
Resource Analysis	



The goal of NASA's telecommunications and data processing systems is to make the link between scientists and their experiments appear as direct and transparent as possible. At the heart of these systems is the organization within the Goddard Space Flight Center chartered to provide advanced telecommunications and information systems technology: the Mission Operations and Data Systems Directorate (MO&DSD).

The great strength of the MO&DSD systems is that they provide a total end-to-end tracking, data, and communications service, an interactive network that transports commands to a satellite and returns the scientific data to the user. The major components of this two-way service, to be discussed on the following pages, are:

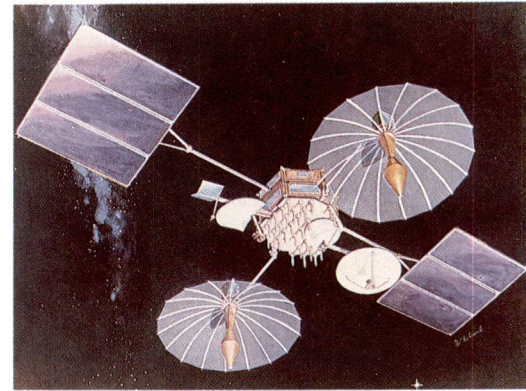
- Flight Dynamics
- Operations Control Centers
- Space and Ground Networks
- NASA Communications Network
- Data Processing
- Technology Applications



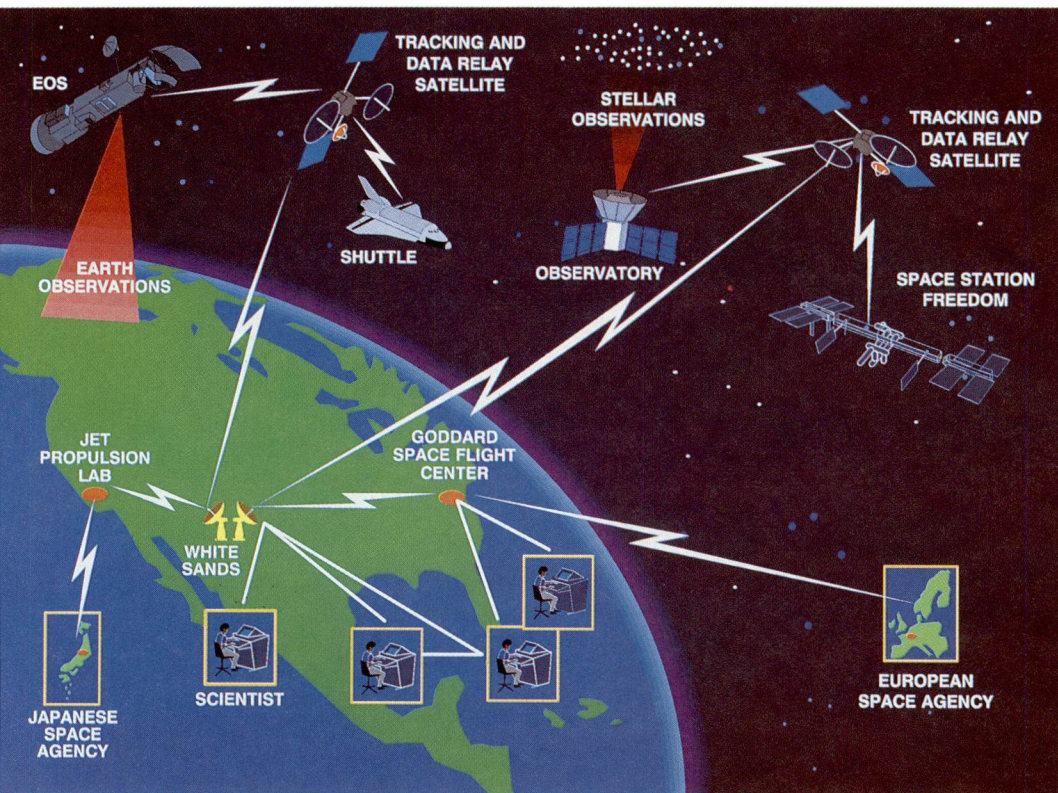
Flight Dynamics

The engineers responsible for the orbital and attitude dynamics of Goddard Space Flight Center missions begin their work years before a satellite is launched. Analyzing the science objectives of the mission, they determine the optimum orbit for fulfilling those objectives. They must decide on launch window, number and type of orbital maneuvers, how much fuel will be required, and when the satellite will reenter the Earth's atmosphere.

In addition to mission design, the flight dynamics function within MO&DSD provides ongoing orbit and attitude determination and control. The Flight Dynamics Facility, located at Goddard, analyzes real-time tracking and telemetry data to generate definitive and predictive orbits. Definitive orbits are used by experimenters in processing and interpreting scientific data. Predictive orbits are used to plan spacecraft operations and to produce acquisition data which indicate precisely where and when



tracking stations and tracking satellites must point their antennas to acquire a particular satellite. Spacecraft attitude is also determined and evaluated by flight engineers to control the pointing direction of the scientific satellite.



The MO&DSD provides end-to-end tracking and data system services to a broad range of customers, as shown in the picture above. Data rates of up to 300 megabits per second will allow tremendous volumes of data to be relayed between space-based scientific instruments— such as those aboard NASA's polar orbiting platforms of the Earth Observing System — and analysts at widely distributed locations on the ground. In the 1990s, MO&DSD will also support ongoing Shuttle operations, Space Station Freedom and numerous scientific missions, including the three "Great Observatories": Hubble Space Telescope, Gamma Ray Observatory and the Advanced X-Ray Astrophysics Facility. A major challenge in this decade will be the development of the data distribution and processing systems for programs such as Space Station Freedom and the Earth Observing System.

Operations Control Centers

The commands that keep a satellite on track and point or adjust its onboard instruments emanate from an operations control center. Control center personnel contribute significantly to mission planning and are responsible for on-line execution of the spacecraft operations plan. Depending on the category of spacecraft (for example, small explorer, Shuttle, large platforms), different types of control centers will be used. One of the largest and most sophisticated control centers ever developed is located at Goddard and supports the Hubble Space Telescope.

Space and Ground Networks

Transmissions to and from spacecraft in low-Earth orbit are controlled by NASA's Space and Ground Networks, both of which are managed by the MO&DSD's Network Control Center at Goddard. NASA's early tracking and data acquisition network, a worldwide system of ground stations, provided satellite contact limited by the Earth's horizon. Today's Tracking and Data Relay Satellite System (TDRSS) has —

LEFT: The Tracking and Data Relay Satellites (TDRSs) provide nearly full-orbit coverage to spacecraft in low-Earth orbit, relaying commands on the forward link and scientific data on the return link. The TDRSs are the centerpiece of NASA's Space Network and will be enhanced in the 1990s to meet the increased data requirements of the Space Station Freedom era.

figuratively speaking — deployed those ground stations in space at geosynchronous altitude, thereby achieving approximately 85-percent orbit coverage for spacecraft in low-Earth orbit.

Space Network

The TDRSS is the key element in NASA's Space Network. The TDRSS is composed of a space segment (the orbiting relay satellites) and a ground segment (principally, the ground terminals located at White Sands, New Mexico). The baseline space configuration consists of two operational relay satellites and a spare in geosynchronous orbit. The satellites provide a relay for signals between user spacecraft and the ground terminals. The Phase-B definition studies are underway for the Advanced TDRSS that will be developed for a first launch in late 1996.

Ground Network

The implementation of the TDRSS has allowed many ground tracking stations to be phased out. There remains a critical Shuttle support responsibility, however, at four Ground Network facilities. The stations at Merritt Island and Ponce de Leon, Florida and Cooper's Island, Bermuda, support Space Shuttle launches from the Kennedy Space Center. The facility at Dakar, Senegal functions as

emergency backup for Shuttle orbital insertion communications. Free-flyer pre-launch and launch activities are also supported at these ground stations.

NASA Communications Network

After the Space and Ground Networks have acquired and returned the spacecraft data to Earth, the NASA Communications

and provides data transport switching and control facilities which link approximately 140 domestic and foreign terminals. The primary switching center, which operates 24 hours a day, 7 days a week, is located at Goddard.

Data Processing

The last step for the telemetry information in the MO&DSD data system is data processing. This function captures the raw data from the spacecraft and processes them into usable products. These products can be near-real-time data sets for scientific investigators, long-term archived data stored for later research, or other products such as images and digital computer tapes distributed throughout the world. The MO&DSD develops and operates a number of central data handling facilities dedicated to



MO&DSD's Microelectronics Laboratory is equipped to develop systems in-house, from chip design to integration and test.

(Nascom) Network reenters the data system picture — Nascom was also responsible for transport services on the forward link. Once Nascom has assumed responsibility for data transport at the point of ground reception, the data is routed via satellite, through terrestrial or ocean cable links to the required destinations, which include project control centers, central data handling facilities, the Flight Dynamics Facility, and regional data handling/switching centers for further distribution.

The Nascom Network is a worldwide complex of communications services that include data, voice, teletype, and video systems. The network consists of approximately 850 satellite and terrestrial circuits,

specific missions as well as facilities that provide multi-mission support.

Technology Applications

Providing the essential control and data links between scientists and their instruments for increasingly complex missions requires a continuing effort to develop and apply information systems and communications technology throughout the space operations systems described above. Research in automation techniques, microelectronics, and system design and development are an integral part of the Directorate's contribution in preparing for future missions as mankind's quest for greater knowledge about the Universe grows.

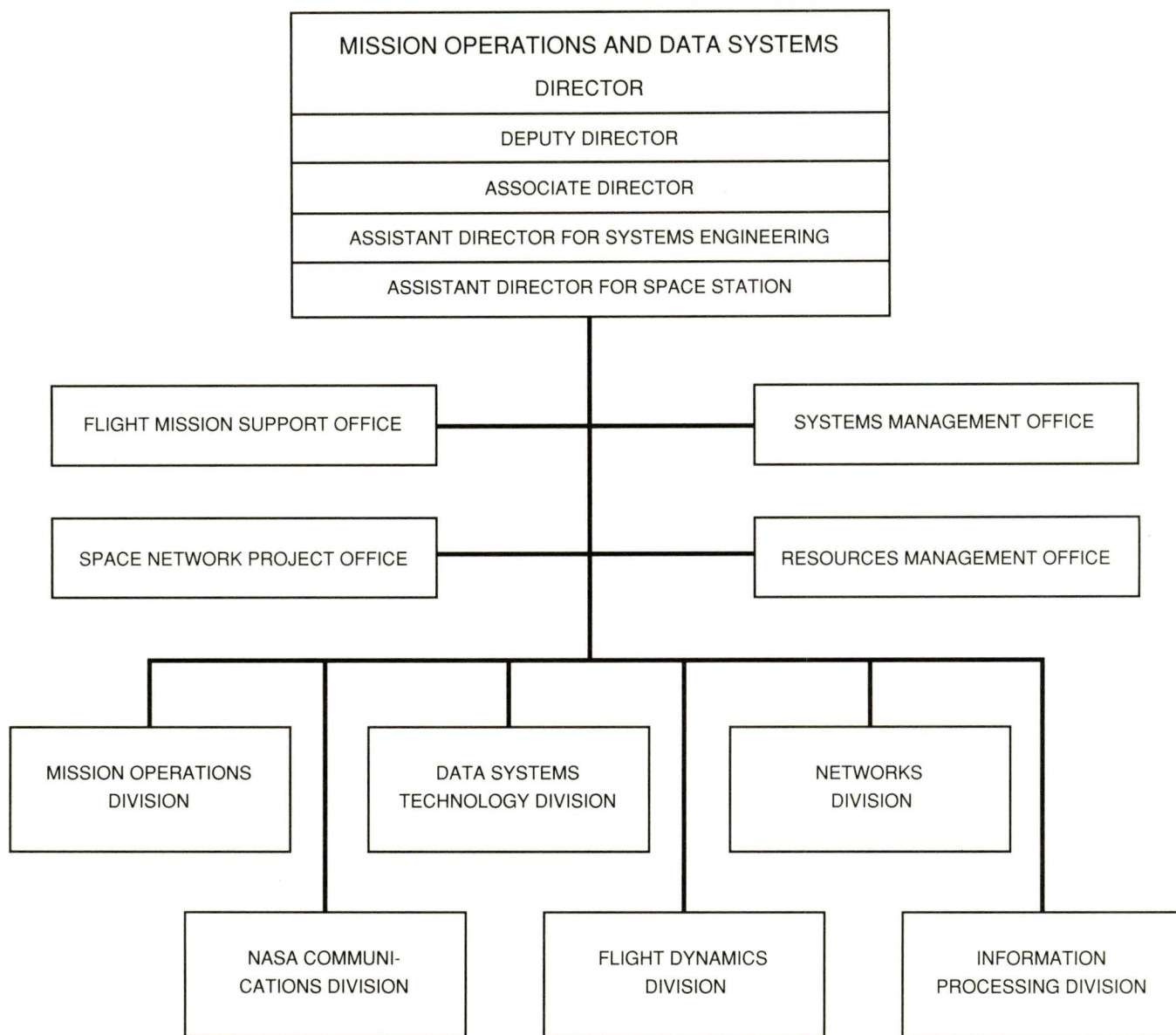
Skill Needs

There are opportunities within the Mission Operations and Data Systems Directorate in the following disciplines:

Application Software
 Data Base Management
 Data Systems Management
 Digital Data Communications
 Digital Data Processing

Digital Data Systems
 Expert Systems
 Flight Mechanics
 Logic Design
 Mission Design

Mission Operations Management
 RF Communications
 Software Engineering
 Spacecraft Command and Control
 Systems Engineering



Space Sciences Directorate

The Space Sciences Directorate plays a leading role in conceiving and developing instruments and spacecraft for the scientific exploration of space through its three research organizations:

Laboratory for Astronomy and Solar Physics

Laboratory for Extraterrestrial Physics

Laboratory for High Energy Astrophysics

Also, through its Orbiting Satellites Project, the Directorate manages scientific spacecraft developed by Goddard.

The major strength of the Space Sciences Directorate is its people. The majority of the professional staff of the three laboratories are research scientists with doctoral degrees. Administrative, clerical, computer, engineering, and technical employees have the opportunity to participate in basic research while using cutting-edge technology and working directly with world-recognized scientists.



Our Milky Way galaxy, seen in infrared light from above the Earth's atmosphere. The image is based on data from an instrument built under the supervision of the Laboratory for Astronomy and Solar Physics and launched in November 1989, aboard NASA's Cosmic Background Explorer satellite.

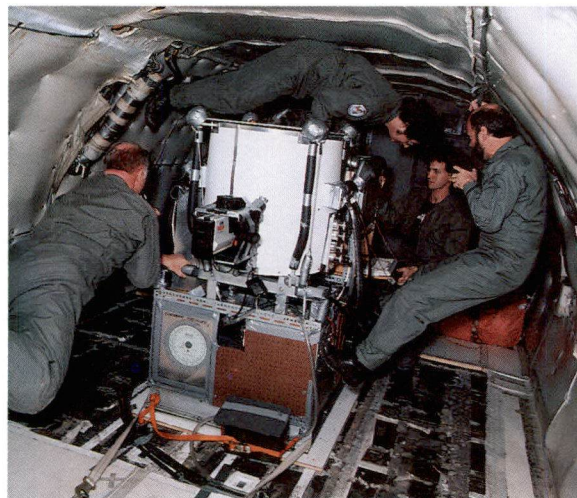
Laboratory for Astronomy and Solar Physics (LASP)

LASP researches a wide range of subjects in astronomy, cosmology, and solar studies. Astronomical and cosmological studies are done primarily through observation of ultraviolet and infrared light. Solar research includes measurements of x rays, gamma rays, and radio waves, as well.

LASP members help design and operate apparatus launched on satellites, sounding rockets, aircraft, and balloons. They study data obtained from this equipment to gain new knowledge of the universe. They also develop computer systems and programs to aid in developing new instruments and to process and analyze data. Computer work is performed on a wide variety of systems ranging from personal workstations to supercomputers.

Laboratory for Extraterrestrial Physics (LEP)

LEP performs experimental and theoretical research on physical properties and dynamical processes of solar, planetary, and stellar objects, as well as the interstellar and interplanetary media. LEP scientists study the chemistry and physics of comets, planetary atmospheres, and solid objects in the Solar System, including meteorites, asteroids, and planets. They also pursue a vigorous program in astronomy, especially at infrared wavelengths.



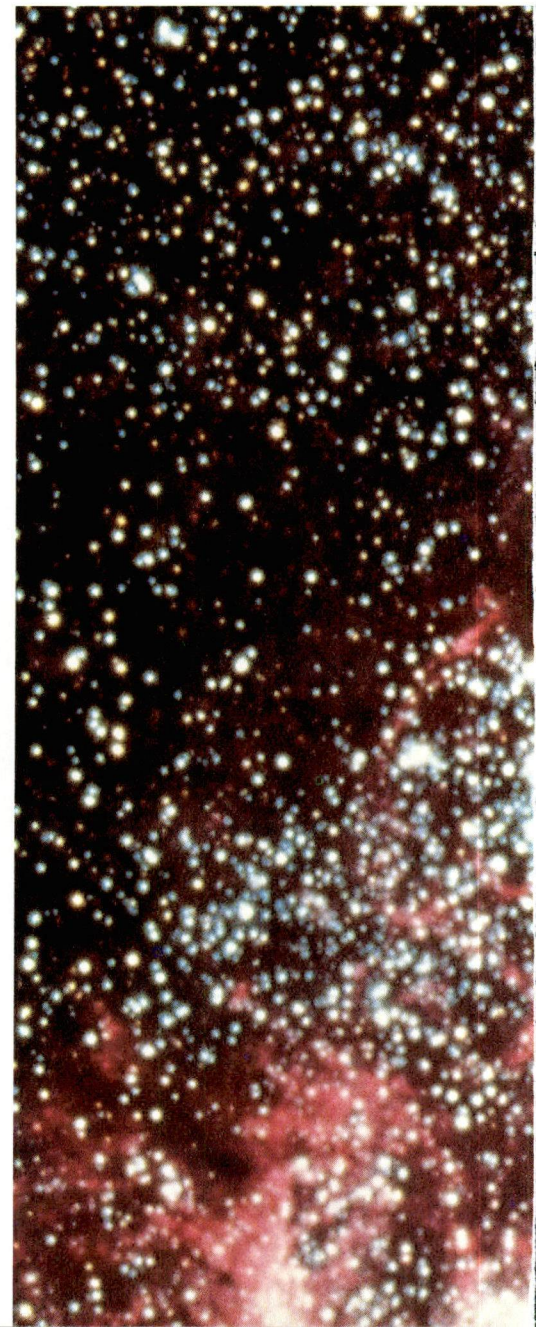
LEP conceives, develops, and builds experiments and integrates them into Earth-orbiting, planetary and interplanetary spacecraft, to measure magnetic and electric fields and space plasmas. The staff also develops spectrometers for observations of spectral lines and continua in the infrared and submillimeter spectral regions; these devices are flown on aircraft, balloons, and spacecraft, and are mounted on ground-based telescopes.

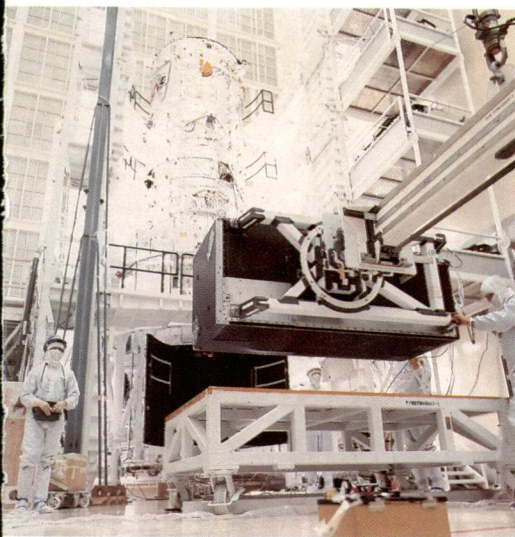
Laboratory for High Energy Astrophysics (LHEA)

LHEA explores the fundamental questions of astrophysics by gathering and interpreting the information carried by photons and subatomic particles with typical energies that are much higher than those found in the atmospheres of ordinary stars like the Sun. This field of research is called high energy astrophysics and the information collected constitutes the "signatures" of the most energetic processes in the universe.

With few exceptions, the radiation and particles studied by LHEA can only be collected above the Earth's atmosphere. The LHEA seeks, through space experiments and physical interpretation, to understand the origin and evolution of high-energy phenomena in the Sun and other ordinary stars; in collapsed stars, supernova remnants, and the interstellar and intergalactic media; in galaxies and their central cores; and in huge clusters of galaxies at great distances from the Milky Way.

Chemistry in zero gravity. A high-temperature refractory nucleation experiment on board NASA's KC-135 Reduced Gravity Research Aircraft.

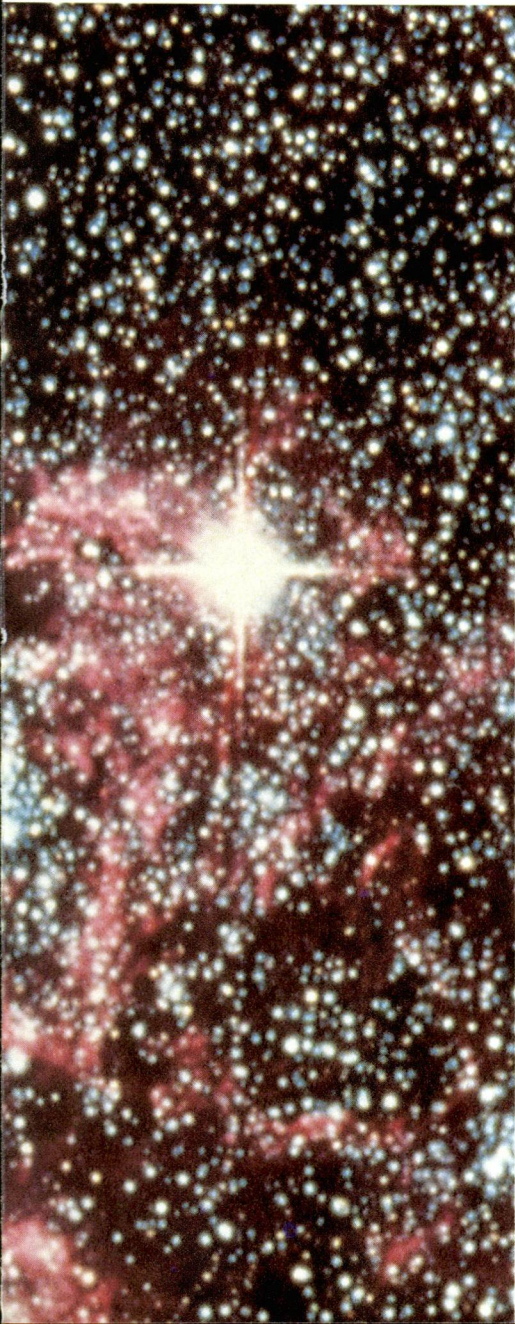




LEFT: Goddard High Resolution Spectrograph (GHRS). Mounted on the Hubble Space Telescope, the GHRS was developed by the staff of LASP. It is the most accurate and powerful ultraviolet instrument ever flown in space.



RIGHT: Pegasus satellite chemical release experiment over Canada, April 1990. The whitish hemisphere is expanding, electrically neutral barium, while the magenta "tail" is barium ionized by sunlight and trapped in the Earth's magnetic field.



Current Activities in Space Sciences Directorate Laboratories

Laboratory for Astronomy and Solar Physics

Cosmic Background Explorer – *satellite operations and research on cosmology and the origin of galaxies*

Goddard High Resolution Spectrograph – *initial calibration and scientific operations on the Hubble Space Telescope (HST)*

Space Telescope Imaging Spectrograph – *advanced equipment to enormously increase the spectroscopic capabilities of the HST*

Laboratory for Extraterrestrial Physics

Voyager 1 and 2 – *research on the outer planets and the interplanetary medium with data from instruments developed in the Laboratory*

Mars Observer – *LEP hardware on this Mars-orbiting spacecraft will make the first comprehensive study of Mars' magnetic field*

International Solar Terrestrial Physics Project – *LEP has a leading role in this joint U.S. - Japan - European Space Agency program*

Laboratory for High Energy Astrophysics

Broad Band X-Ray Telescope – *research on supernovae, binary stars, and galaxies on the Astro-1 mission of Space Shuttle Columbia*

Energetic Gamma Ray Experiment Telescope – *a major component of NASA's Gamma Ray Observatory satellite, launched in 1991*

Energetic Particle Acceleration, Composition, and Transport – *cosmic ray studies on the WIND satellite in interplanetary space*

Supernova 1987A. Gamma rays from nucleosynthesis in this cosmic explosion were observed by LHEA's Gamma Ray Imaging Spectrometer, on a balloon above Australia. LHEA instruments on the Astro mission, Gamma Ray Observatory, and Astromag will investigate x rays, gamma rays, and cosmic rays from supernovae (photo: European Southern Observatory).

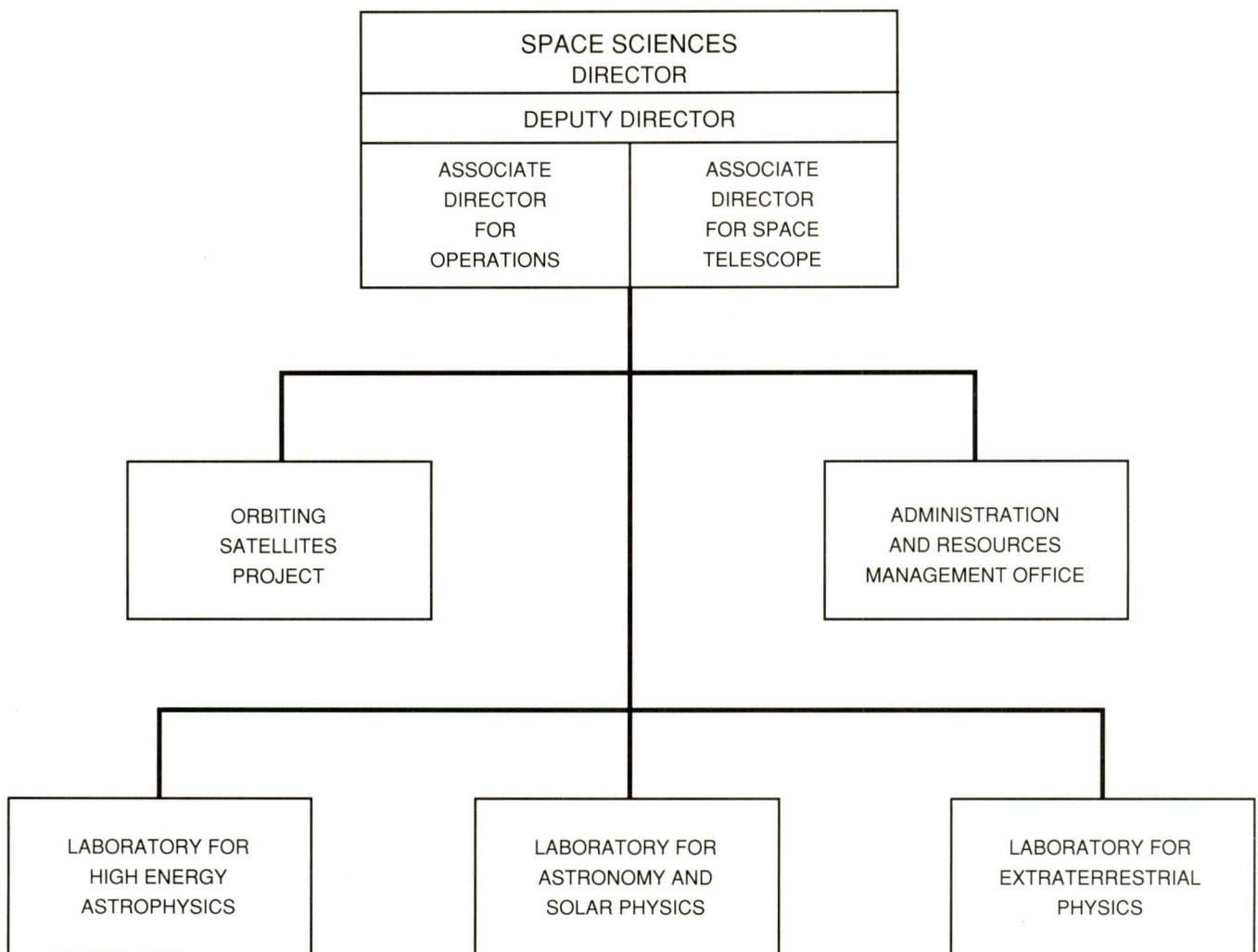
Skill Needs

There are opportunities within the Space Sciences Directorate in the following disciplines:

Astronomy
Astrophysics
Chemistry
Computer Science (design,
operation, programming,
systems analysis)

Aerospace Engineering
Electrical Engineering
Mechanical Engineering
Magnetohydrodynamics
Mathematics (applied and
theoretical)
Physics (atomic, engineering,
high energy, nuclear plasma)

Finance
Business
Public Administration
Procurement
Accounting

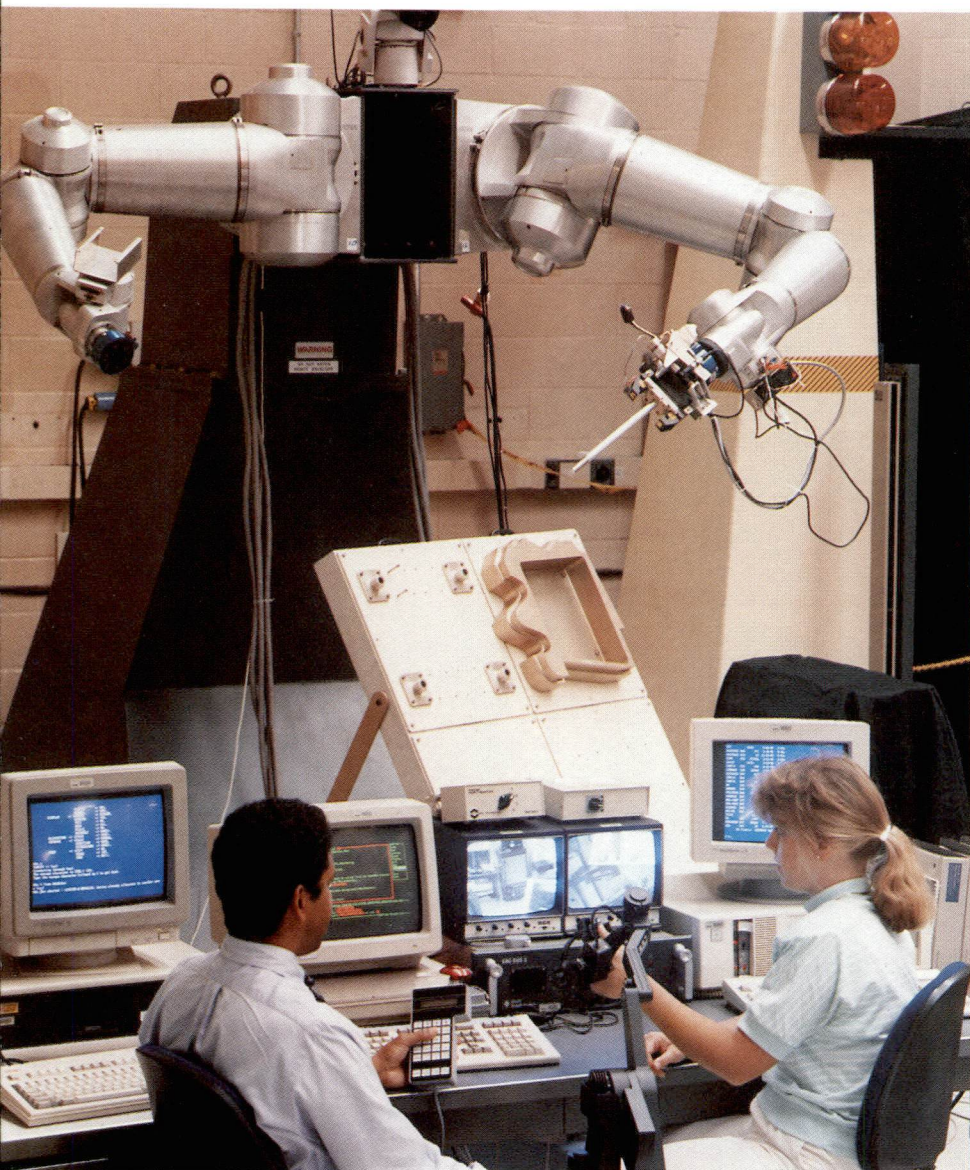


Engineering Directorate

The Engineering Directorate supports NASA space and Earth sciences and applications programs through technical research and development. Our enabling technology program increases knowledge and capabilities in areas necessary for the success of assigned NASA

missions. We design, develop, and test components, subsystems, instruments, and spacecraft for multiple programs and projects. We oversee in-house development of flight hardware and software including instruments, Attached Shuttle Payloads and Small Explorer Spacecraft, and system

and discipline engineering support for space- and Earth-science missions hardware such as the Hubble Space Telescope.



These seven-degree-of-freedom robotic arms are part of the engineering test bed supporting the development of robotic systems for space sciences and exploration.

Directorate Activities Include:

- Technology research in laser communications and sensing, cryogenics, sensors, spaceborne data systems, and robotics.
- Small Explorer Satellite Program for frequent astrophysics missions.
- Instrument development for the Earth Observing System (EOS), the Advanced X-ray Astronomy Facility, the Space Infrared Telescope Facility, and the Mars Observer, among others.
- Development of payload modules and spacecraft for the Tropical Rainfall Measuring Mission and the X-ray Timing Explorer.
- On-Orbit Cryogen Transfer Flight Experiments.
- Development of the Payload Module flight hardware for the Extreme Ultraviolet Explorer.
- Development of advanced high-capacity spaceborne data systems.
- Application of new materials and manufacturing techniques.

The Space Technology Division

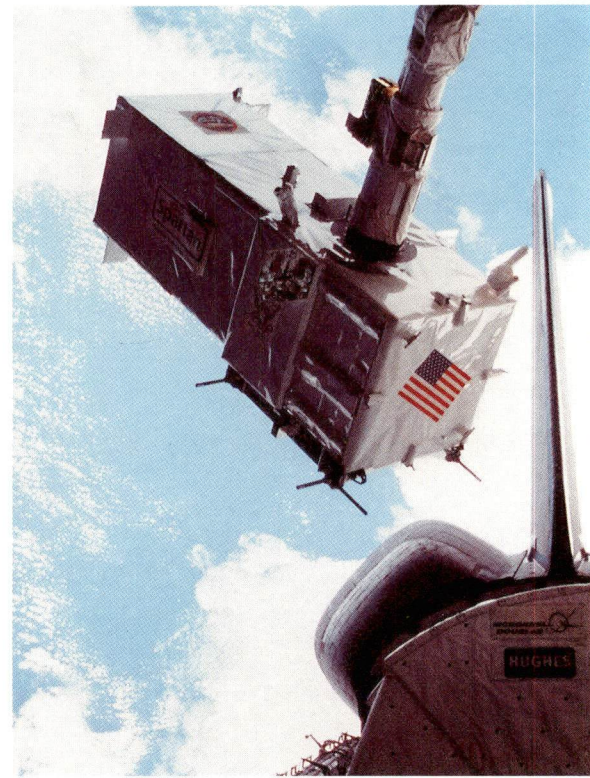
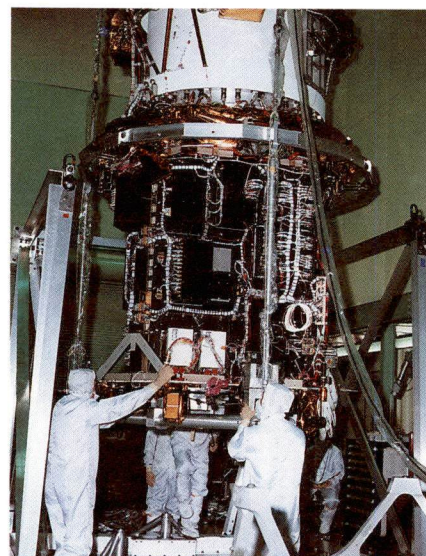
This group develops spacecraft and instrument subsystem hardware and software in the areas of power, guidance and control, cryogenics propulsion and fluid systems, electromechanisms and electronics, optics, and robotics. Our work cuts across all flight programs and is typically multidisciplinary, at or advancing the state of the art. We research and maintain unique laboratories and development facilities, including a systems-level robotics laboratory and test bed. We were instrumental in developing the successful Cosmic Background Explorer.

The Instrument Division

Space and Earth science instruments that fly aboard NASA spacecraft are developed in-house by our Division. We provide instrument development expertise for all flight programs. Research is conducted in wideband optical communications, electro-optical systems, microwave instrument design, communications systems, and sensor systems. Design and manufacturing capability exists for instrument electronic systems including micro-electronic devices, solid-state detectors, integrated and hybrid circuits, and on chip-data processing devices. Our facilities include high-bay clean rooms, laser research and data- and signal-processing laboratories, and areas specializing in electro-optics, electronics, micro-electronics, and RF engineering.

The Applied Engineering Division

Our organization manages the development of spacecraft systems in the areas of mechanical, structural, thermal, contamination, electrical, and data-systems engineering; our efforts are at spacecraft or observatory level in scope. We perform system-level studies for new and ongoing missions. Our Division integrates and tests all major in-house flight programs; branches in this Division typically perform "cradle-to-grave" engineering for those disciplines encompassed in the organization. An active research and development program is maintained to enhance capabilities in all technical areas, such as composite structures, two-phase thermal systems, test beds, and development and qualification efforts in flight computers and optical disk storage devices. An active flight experiment program is an ongoing effort to qualify these articles under development and to verify the conclusions reached in the Division test beds and laboratories.



The Special Payloads Division

This Division manages the Small Explorer Program, supports Attached Shuttle Payload missions using the Hitchhiker and Get Away Special systems, and other low-cost, rapid-response payload systems intended to fly on small expendable launch vehicles. We developed the first payload flown on the Pegasus launch vehicle in six months! Our organization provides missions management, design, development, assembly, and operation of diverse mechanical, structural, electrical, attitude control, power, and data-handling systems. Coordination with science investigators and integration of investigator instrumentation into the various payloads are required.

LEFT: The final integration of the Cosmic Background Explorer is shown in the laminar flow clean room at Goddard.



FAR LEFT: The Shuttle Pointed Autonomous Research Tool for Astronomy (SPARTAN) was developed at Goddard. It is shown here being retrieved by the Shuttle remote manipulator arm after 45 hours of independent flight.

LEFT: Shown is the Extreme Ultraviolet Explorer Payload Module attached to the Explorer Platform. The Space Shuttle will visit the Explorer Platform every 2-3 years and exchange payload modules, which will redirect the scientific mission of the spacecraft.

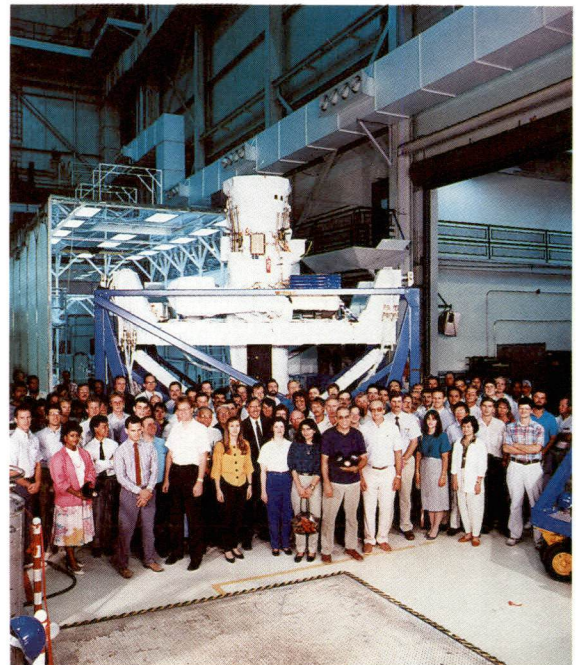
We maintain development laboratories and an assembly operations area. Field operations of the payloads use ground equipment developed by our Division. Research into the development of new, low-cost and standard reusable systems is ongoing. The Small Explorer Program, for example, will make the first use of a new generation of flight data systems developed at the Center.

The Engineering Services Division

This working group analyzes, designs and develops, fabricates, integrates, tests, and evaluates spacecraft and instruments. An array of unique facilities and

equipment allows the organization to provide end-to-end development capability for flight hardware including full Shuttle-bay payloads. Included among these are a world-unique, large magnetic-properties measurement facility and the largest high-bay laminar flow clean room in the United States. Specialized expertise is provided in advanced materials, such as composites and plastics, and in manufacturing engineering. Tests simulating launch loads, vibration, acoustics, shock, thermal/vacuum, and other space environments are conducted using our in-house facilities. Launch and missions performance are predicted by a combination of these environmental tests and theoretical analyses.

Goddard in-house projects include the Broad Band X-ray Telescope.



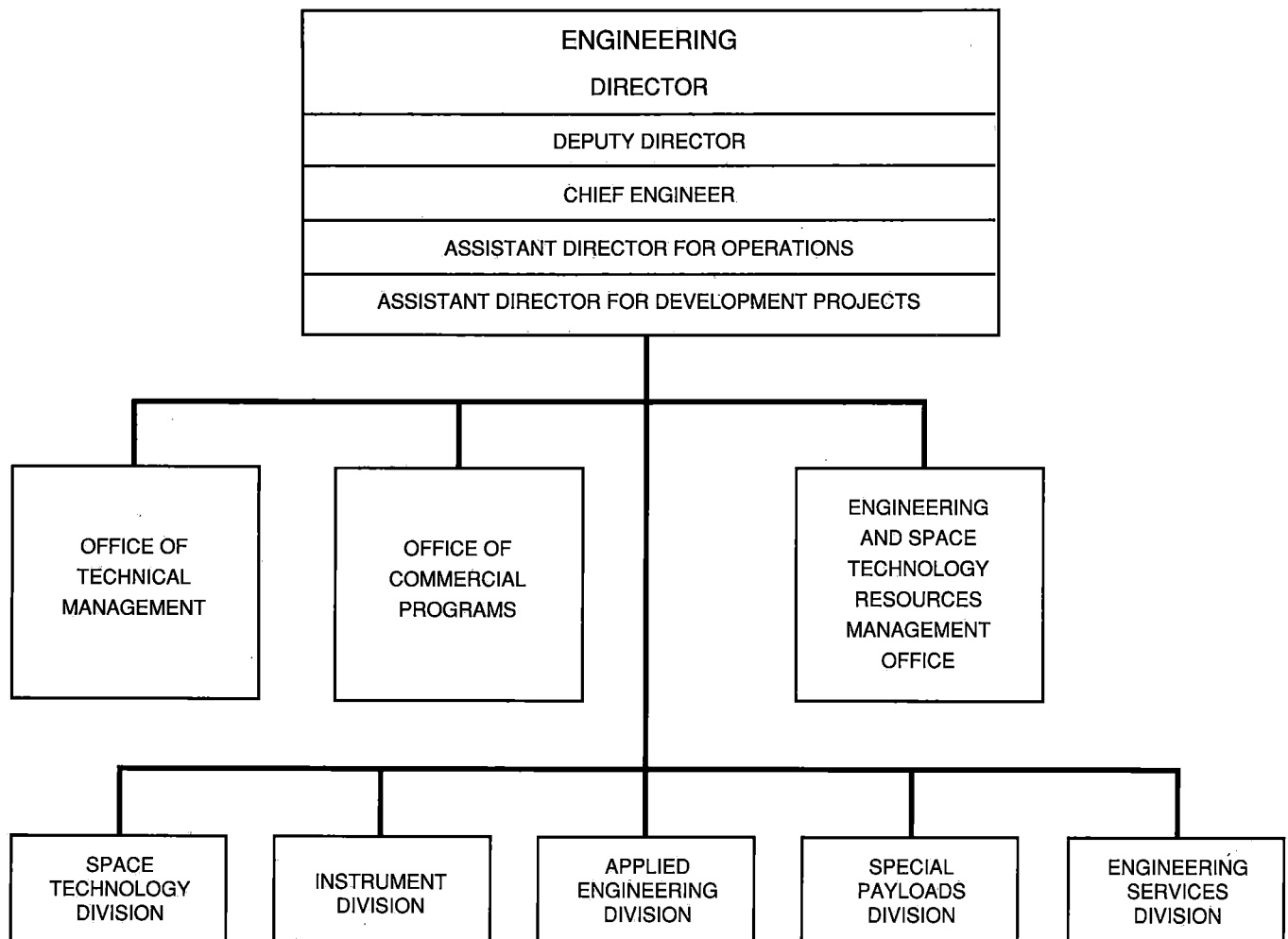
Skill Needs

There are opportunities within the Engineering Directorate in the following disciplines:

Space Power Systems
Guidance and Control
Cryogenics and Propulsion
Mechanisms
Optics
Photonics
Microelectronics and Detectors

Microwave Instruments
RF Communications
Signal Processing
Structures
Thermal Engineering
Contamination Control
Electrical and Electronic Systems

Flight Data Systems
Spacecraft and Instrument Systems
Spacecraft and Instrument
Integration and Testing
Experimental Fabrication
Verification and Environmental Test
Engineering



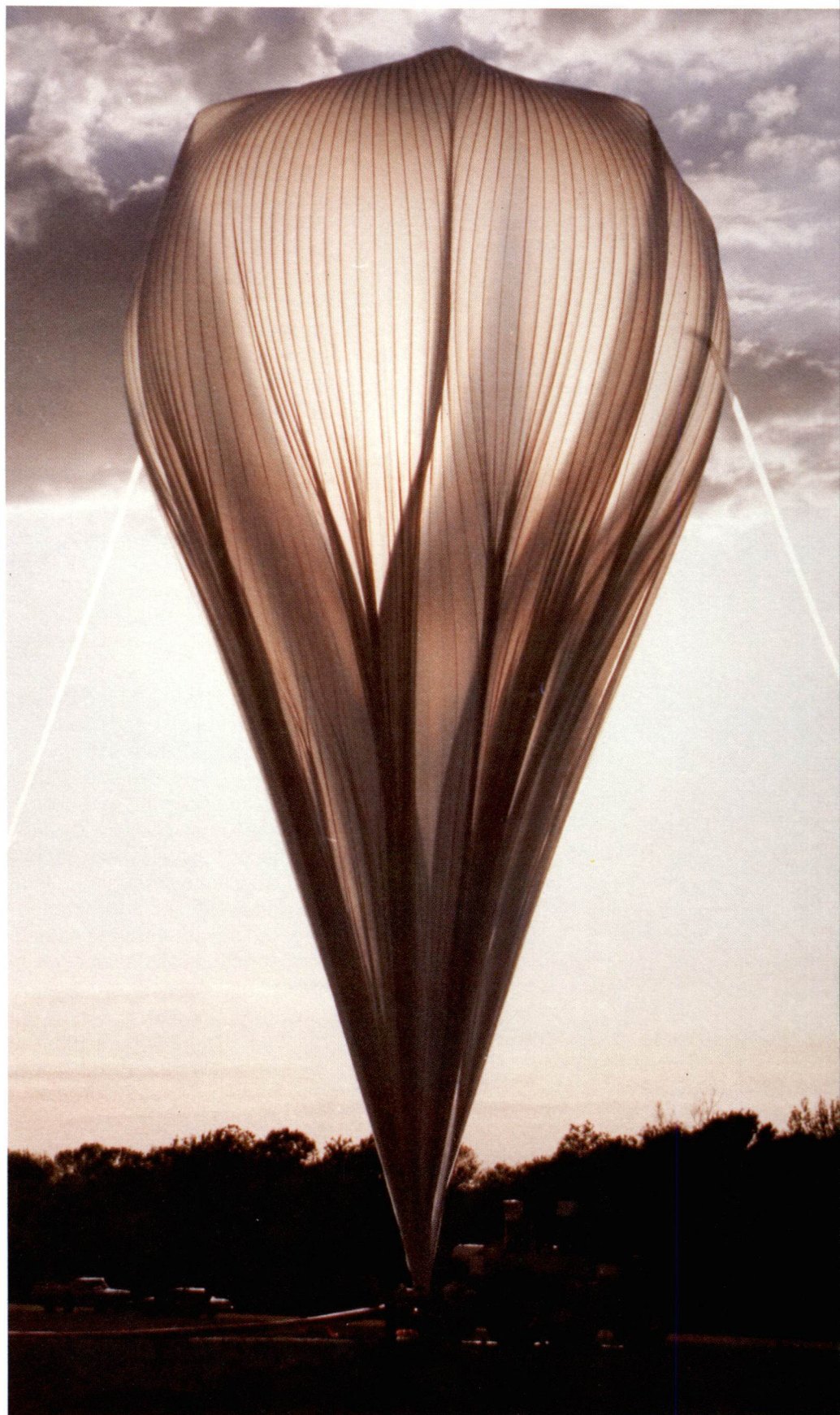
Since 1945, work conducted at the Wallops Flight Facility, located in the coastal areas of Virginia, has undergone many changes. In the early years, the research focused on obtaining aerodynamic data at very high speeds as part of the effort to penetrate the sound barrier and to operate at supersonic speeds. The hallmark of the Wallops Flight Facility has been its suborbital research projects. This Directorate, the only one solely located at Wallops, manages NASA's suborbital programs, and supports the aeronautical programs. The sounding rockets, scientific balloons, and aircraft provide scientists with unique avenues for conducting science and research worldwide.

The sounding rocket program conducts an average of 35 missions each year. The sounding rocket fleet consists of 15 different vehicles, ranging from 10 to 64 feet in length. These 1- to 4-stage vehicles fly vertical trajectories carrying their payloads from 30 to 600 miles in altitude.

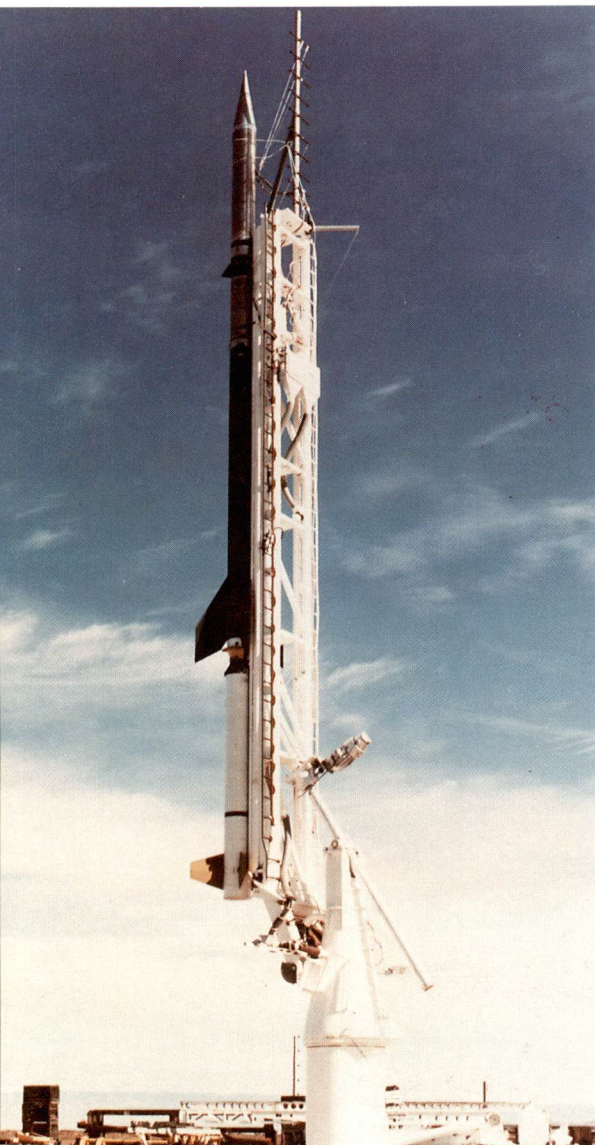
Throughout its history, the Suborbital Projects and Operations Directorate has adapted to the changing focus of the country's aerospace research endeavors and has maintained a dedication to applying inexpensive and innovative methods to scientific research.

Current activities include:

- Sounding Rocket Program
- Aeronautical Research Programs
- NASA-Owned Airport
- Aircraft Operations and Maintenance
- Project Management
- Engineering Support
- Flight and Ground Safety
- Computer Operations and Software Support
- Balloon Program
- Launch Range Operations
- Wallops Orbital Tracking Station
- Tracking and Data Acquisition
- National Scientific Balloon Facility
- Poker Flat Research Range
- Off-Range Expeditions



Scientific balloon is prepared for flight at the National Scientific Balloon Facility, Palestine, Texas.



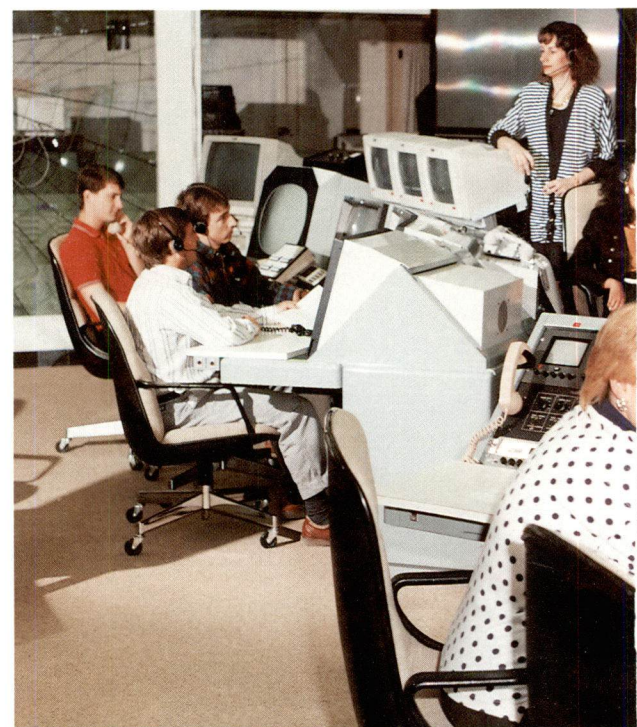
Black Brant IX two-stage sounding rocket awaits launch from the pad at White Sands Missile Range, New Mexico.

Suborbital Resources Management Office

This Office develops budgetary plans and operating plan requirements; we monitor the actual progress of the plan throughout the year. Resources personnel assist technical managers with developing and executing plans using financial and personnel resources for institutional needs and Research & Development (R&D) programs under the cognizance of the Directorate.

Engineering Division

The Division plans, develops, fabricates, integrates, and tests both airborne and ground-based mechanical and instrument systems. This Division provides management and engineering support to the Office of Space Operations Tracking and Data Acquisition Program at Wallops, engineering and fabrication support for the Sounding Rocket Program, and software support for real-time operations and post-flight data processing, ground flight safety, and aeronautical research programs. We have four branches: Technical Support, Instrumentation Engineering, Electro-Mechanical Systems, and Safety and Quality Assurance. Our staff operate the mechanical and electronic fabrication shops; design, engineer, integrate, and test sounding rocket payloads; design and procure ground tracking, telemetry, and support systems; provide flight and ground safety analysis and support for rocket and balloon flights; and provide off-site launch range development.



Operations Division

The Operations Division plans, manages, and conducts aerospace and other project operations for Wallops personnel on-site, as well as at other locations. Radar and optical tracking, communications, acquisition of telemetry data, and computing support for range operations and data processing are as much a part of our work as are the preparation and launch of rockets and airplanes. The Division plans and directs Wallops' efforts in aeronautical research operations and airborne science support, as well as range operations and off-range expeditions. The most recent addition to operations is the Wallops Orbital Tracking Station that operates around the clock, every day of the week. Our staff operate and maintain the many facilities, instrument systems, and aircraft required to support the programs. Staff members travel



Wallops personnel monitor mission operations from the Range Control Center.

including management of the National Scientific Balloon Facility at Palestine, Texas. The Division is composed of the Sounding Rocket Projects Branch and the Balloon Projects Branch. Sounding rockets fly near-vertical paths carrying scientific instruments to altitudes from 30 to approximately 600 miles (three to four times higher than the Space Shuttle). The experiment time above the Earth's atmosphere ranges up to 15 minutes.

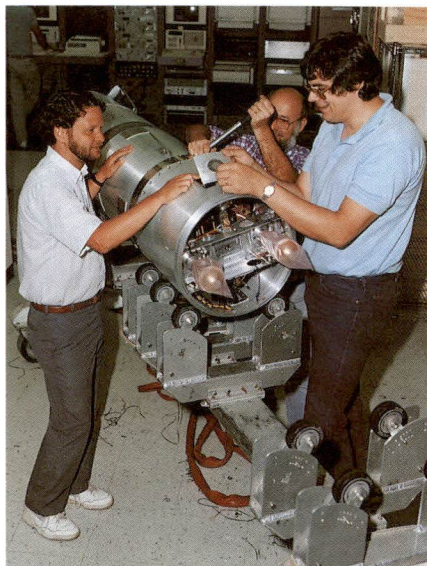
Parachutes are used to recover the instruments for reuse, and special high-altitude parachutes sometimes are used for science purposes.

frequently on mission support and expeditions. They provide assistance and train foreign nationals. We have four branches: Aircraft Programs, Range Management, Data Acquisition, and Launch Vehicles.

Projects Division

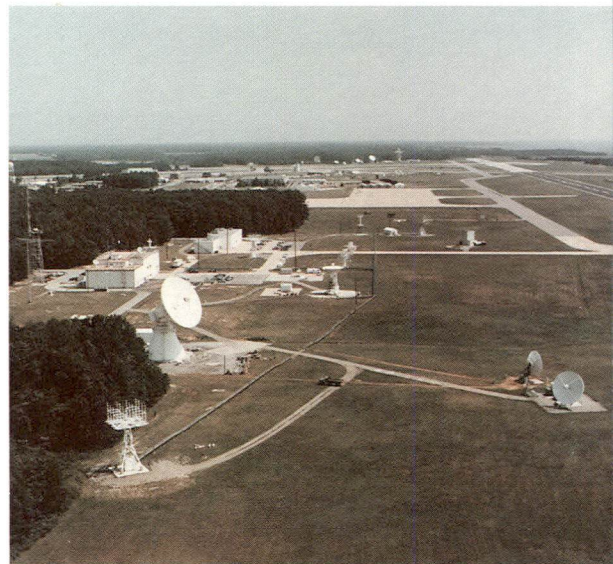
Since 1959, the NASA Sounding Rocket Program has conducted more than 2,400 launches with a vehicle success rate of 95 percent and a mission success rate of 86 percent. Balloons can travel up to 30 miles in altitude, and their flight lifetime ranges from several hours to several days. Since 1976, more than 400 balloons have been launched with an overall success rate of 85 percent.

The Division plans, manages, and conducts the NASA Sounding Rocket Program, other Lighter-Than-Air Program activities, and the NASA Balloon Program,



Final preparations for a spin balance test are conducted on a Black Brant IX sounding rocket payload section.

The Sounding Rocket and Balloon Programs provide low-cost, fast-response flight platforms and support basic scientific research. The combined programs support scientific organizations from domestic and foreign universities, international and commercial research institutions, and other government agencies, as well as various NASA field centers. The experiments provide a variety of information, such as density and temperature of particles in the upper atmosphere, properties and changes in the ionosphere, the natural radiation surrounding the Earth, and many other phenomena. Approximately 40 sounding rockets and 45 balloons are launched each year from various locations around the world. Financial support for university investigators is provided by the Sounding Rocket and Balloon Programs, and many graduate students have earned degrees based on participation.



Wallops Orbital Tracking Station supports such satellite programs as COBE, IUE, and Nimbus-7.

Skill Needs

There are opportunities within the Suborbital Projects and Operations Directorate in the following disciplines:

Aerospace Engineering
Electrical Engineering
Electronics Engineering
Mechanical Engineering
Mathematics
Physical Sciences

Computer Programming
Aircraft Piloting
Scientific and Technical Photography
Resources Analysis and Management



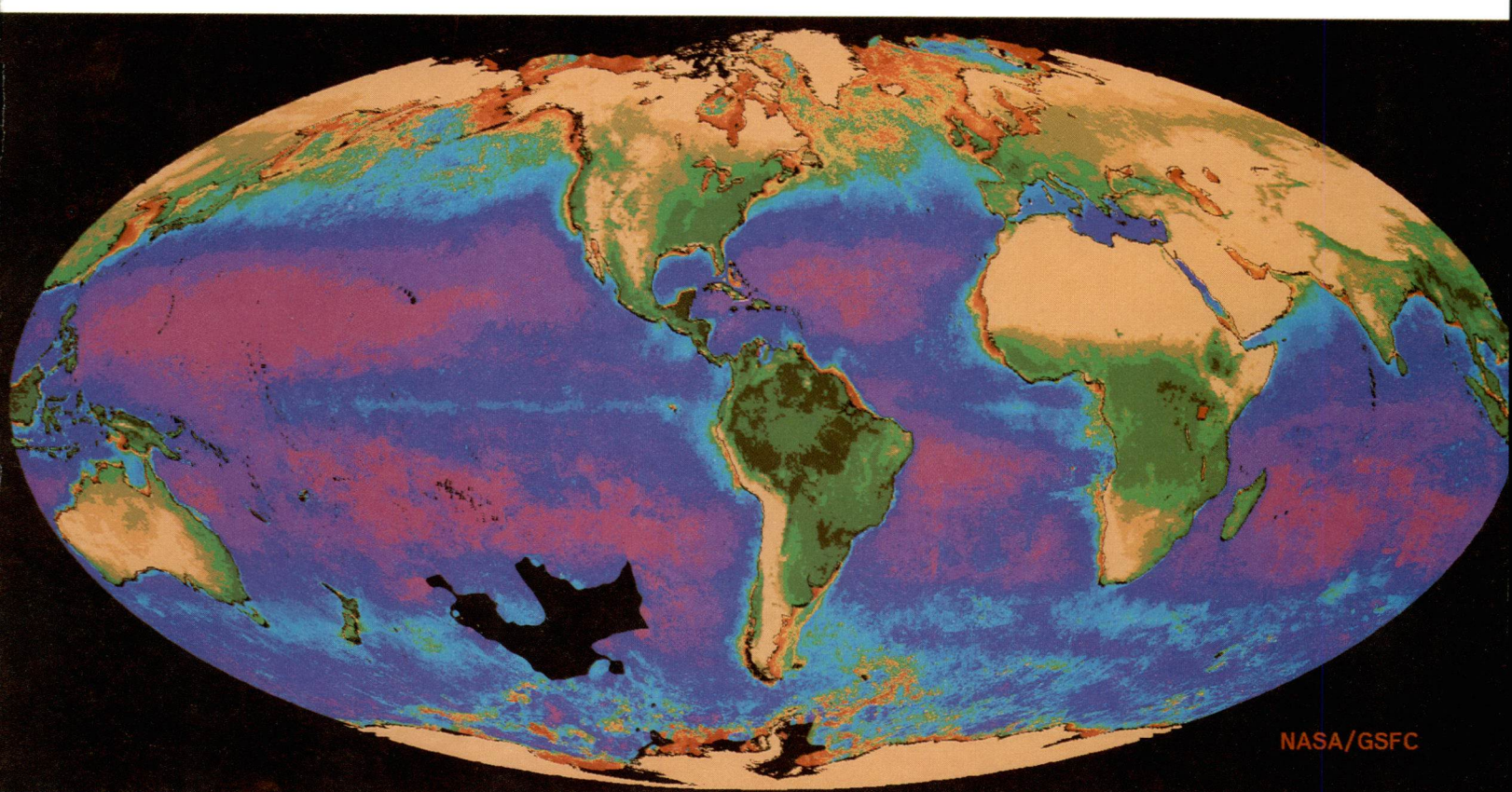
Earth Sciences Directorate

Our goal is to develop a better understanding of processes affecting global change and the distribution of natural resources through research, development, and application of advanced space technologies. The program ranges from basic research, including modeling and data analysis, to the development of sensor systems for

ground-based, airborne, and spaceflight observing activities. The Directorate is evidence that Goddard is a center-of-excellence in research and a major location and resource for Earth observation activities.

Related aspects of oceanography, hydrology, and climate research in

areas such as global physical system modeling, interactive process studies, and solar-terrestrial relationships are research topics.



Directorate activities, ongoing and future, include:

- Develop an understanding of solar, anthropogenic, and natural influences on the atmosphere and related systems that affect the habitability of the Earth.
- Study long-term global climate change.

- Conduct oceans research, including development of remote-sensing algorithms and analysis and interpretation of data.
- Acquire and analyze data on plate tectonics, continental and regional crustal deformation, and local earthquake hazards.
- Develop, test, apply, and evaluate algorithms for processing satellite image and non-image data.

Representation of global biomass in the oceans and on land as retrieved from the Coastal Zone Color Scanner (CZCS) and the Advanced Very High Resolution Radiometer (AVHRR).

The Laboratory for Atmospheres

Our staff plan, manage, and execute a comprehensive theoretical and experimental research program dedicated to advancing our knowledge and understanding of the atmospheres of the Earth and other planets. A large portion of the research program is aimed specifically at advancing our ability to predict the weather and climate of Earth. The Laboratory also identifies requirements for observations of atmospheric processes by satellite or other techniques; conceives, designs, develops, and analyzes electronic, electromagnetic and mechanical sensors operating in the ultraviolet, infrared, optical, and radio portions of the EM spectrum for remote and in-situ exploration and examination of terrestrial and planetary atmospheres; and provides for analysis and interpretation of data to further our knowledge of atmospheric phenomena.

The Laboratory for Terrestrial Physics

This Laboratory researches applications of remote sensing and other space technology to advance the state of knowledge in the Earth sciences and to aid in the improved management of the resources of the Earth. Most of the effort is focused in specific research areas, such as investigation of the Earth's geoid, gravity, and magnetic fields for application to crustal and ocean dynamics, Earth structure, and earthquake mechanisms; understanding motions and mechanics associated with plate tectonics; studies of the spatial and temporal dynamics of land features;

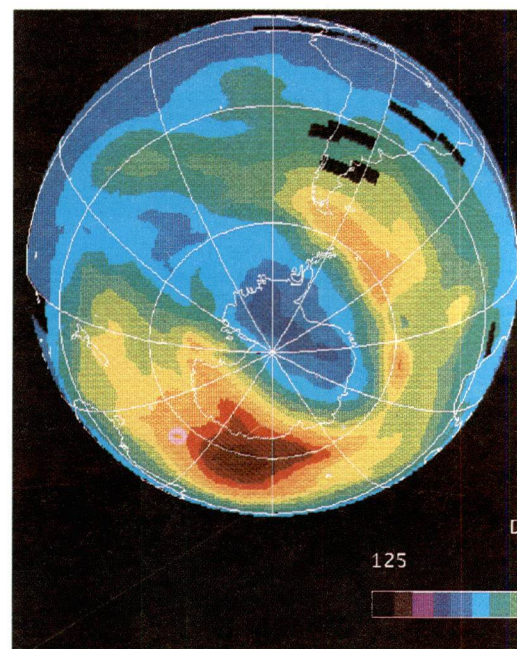


and soils and soil moisture. Instruments and data systems are developed; new, one-of-a-kind ocean, atmosphere, and terrestrial remote-sensing instruments, covering the visible and infrared spectra, are designed, fabricated, calibrated, and tested by our staff.

The Goddard Institute for Space Studies (GISS)

Located on the campus of Columbia University in New York City, GISS conducts a broad program of research in space and Earth sciences for current and future Goddard programs. Current research emphasizes a broad study of global change, an interdisciplinary research initiative addressing natural and man-made changes in our environment that occur on time scales of decades and affect the habitability of our planet. A key objective is prediction of atmospheric and climate changes. The research

combines analysis of comprehensive global data sets, derived mainly from spacecraft observations, with global models of atmospheric, land surface, and oceanic processes. The research approach includes study of past changes on Earth such as paleoclimate changes and study of other planets as an aid to prediction of future evolution of the Earth on a planetary scale.



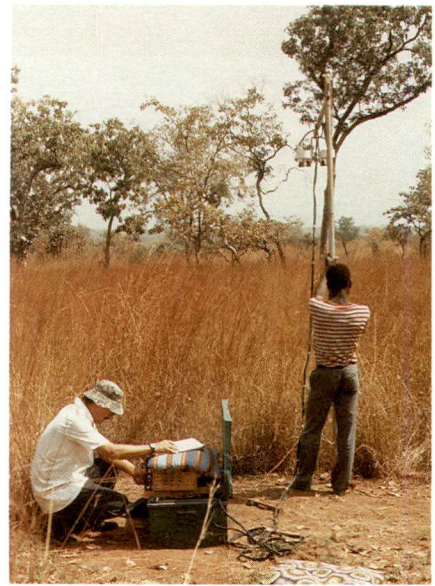


FAR LEFT: Researcher setting up instrumentation on the Black Rapids Glacier in Alaska.

LEFT: The CRAY YMP is a supercomputer used to support NASA-funded researchers in space and Earth sciences.

RIGHT: Scientists on an African field trip measure plant spectral reflectance for later comparison with satellite data.

systems and techniques associated with remote and in-situ sensing. The uses of remote sensing in research on the Earth environment, global habitability, global biogeochemical cycles, and global change are demonstrated through flight programs and analyses.



The Laboratory for Hydrospheric Processes

Our staff perform theoretical and experimental research on various components of the hydrological cycle and its role in the Earth system. The program observes, understands, and models the global oceans and ice, surface hydrology, and mesoscale atmospheric processes. The Laboratory researches Earth observational

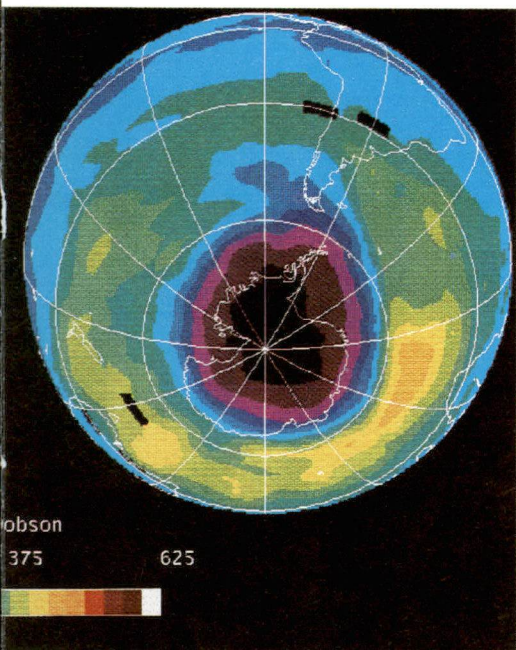
The Crustal Dynamics Project

Project staff develop and apply space geodetic techniques to study the dynamic motions of the Earth. An extensive measurement program is using both Very Long Baseline Interferometry (VLBI) and Satellite Laser Ranging (SLR). The Crustal Dynamics Project's developments of SLR and VLBI technology result in very accurate

geodetic measurements of plate motion, plate deformation, regional deformation, and polar motion.

The Space Data and Computing Division

This Division makes data from satellites and other sources accessible and useful to an international, multidisciplinary research community. The Division operates three computational facilities for analyzing data, simulating complex processes, and storing and distributing data. The NASA Center for Computational Sciences enables research in a full range of space and Earth science disciplines. The National Space Science Data Center staff develop state-of-the-art data management systems, data visualization techniques, distributed data bases, and new technologies for mass storage. The Science Information Systems Center researches advanced data-systems architectures and satellite information-processing techniques.



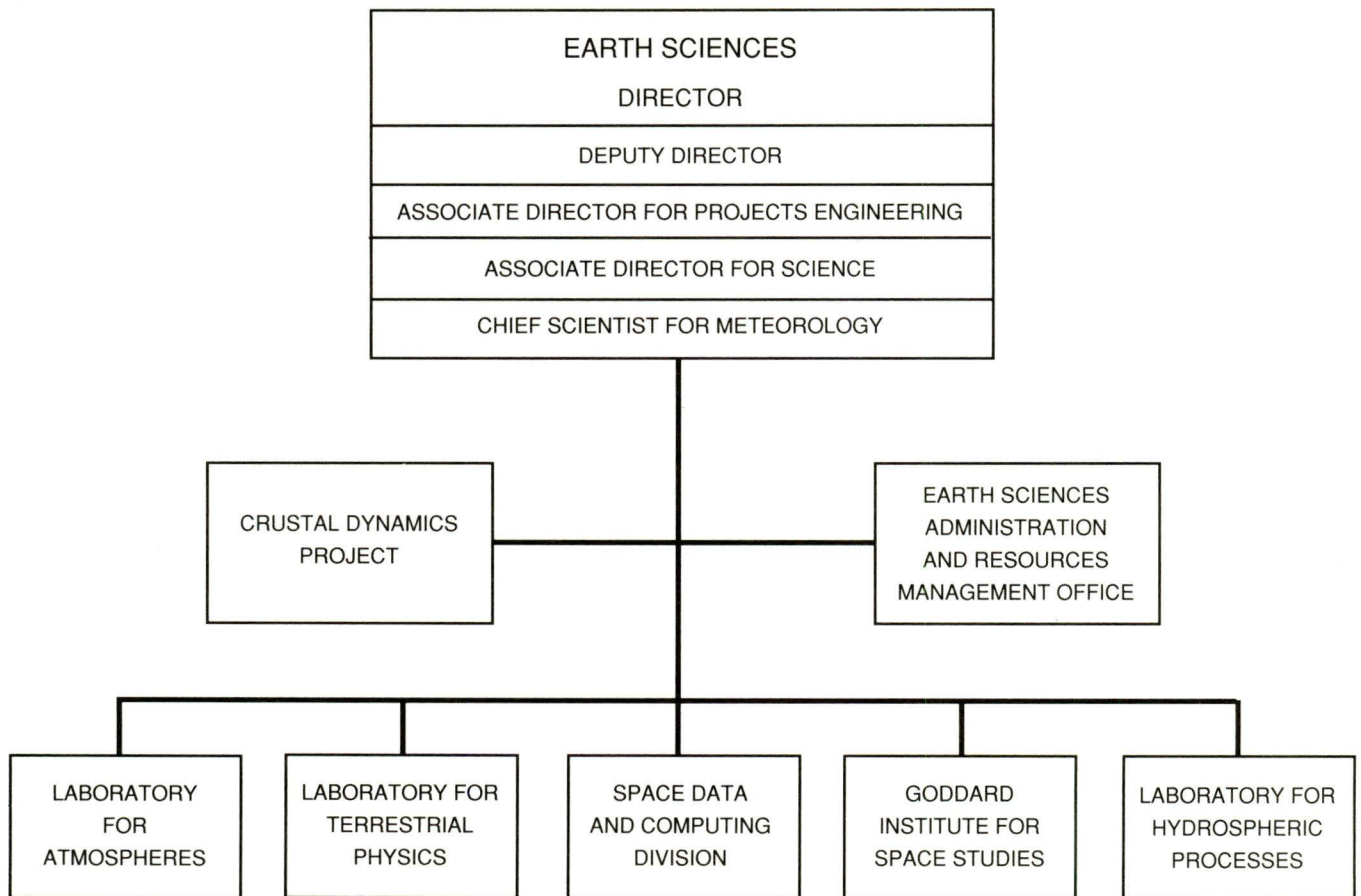
The appearance of the ozone hole as shown by the Nimbus-7 Total Ozone Mapping Spectrometer (TOMS). TOMS measures the total column of ozone using back-scattered sunlight. Dobson units represent the number of ozone molecules in the atmospheric column. One thousand Dobson units is equivalent to a 1-cm-thick layer of pure ozone at standard pressures and temperatures. Nimbus 7 was launched in November 1978, and TOMS has been taking data for 12 years. The data from TOMS are analyzed at Goddard.

Skill Needs

There are opportunities within the Earth Sciences Directorate in the following disciplines:

Sensor/Instrument Engineering
Mathematics
Meteorology/Climatology
Atmospheric Physics
Computer Sciences
Data System Analysis/Data System Engineering
Geography

Oceanography
Geophysics/Geodynamics/Geology
Hydrology
Botany/Biology/Forestry/Agronomy
Glaciology
Resource Analysis
Administrative Operation Analysis



Benefits

The Goddard Space Flight Center recognizes that its employees are its greatest asset and is committed to fostering an environment that provides career development, training, attractive benefits, services, and facilities.



Developmental Opportunities

The Center considers employee training and development to be essential to its mission.

Center goals are to:

- keep employees abreast of knowledge and new developments in their respective fields of specialization;
- provide employees with the necessary skills and knowledge to deal effectively with current and changing programs, procedures, technology, and mission requirements;
- meet future leadership requirements through the systematic identification, selection, and development of supervisors and managers.

Each year, the Center sponsors on-site, 150-200 courses in science, engineering, administration, management, and computing. A Learning Center with over 160 different courses, provides further opportunity for independent learning through video and computer-based training.

Goddard's training programs include:

Professional Intern Program (PIP)

The PIP Program is a developmental program for entry-level scientists, engineers and professional administrative employees. This program is designed to acquaint employees with NASA and Center missions and operations, integrate employees into the workforce, and

prepare employees for complex duties and increased responsibility.

Program activities include:

- preparation of an Individual Development Plan (IDP) by each intern with the assistance of the supervisor;
- the establishment of a mentoring relationship with a senior staff member;
- participation in various orientation activities;
- formal on-the-job training; and
- the completion of a PIP project and presentation of results to a panel along with a final written report.

Part-Time Graduate Study Program (PTGSP)

The PTGSP allows employees to pursue graduate studies at local colleges and universities in areas relevant to their work and the mission of the Center. Participants may use a specific amount of work hours for academic studies while the remaining work week is spent on regularly assigned duties. The Center funds tuition, books, and related laboratory and equipment fees.

Masters of Science Program

The Masters of Science program is a cooperative endeavor between George Washington University's School of Engineering and Applied Science and the Goddard Space

Flight Center. The program gives qualified employees a chance to increase their technical knowledge and skills in areas relevant to the work being performed at the Center. Courses are held on-site at Goddard after normal working hours.

Masters of Engineering Management (MEM)

The MEM is conducted on-site at the Goddard Space Flight Center by George Washington University. The program provides an opportunity for qualified employees to further develop their skills to meet Center skill needs in technical administration and management of Goddard's programs and projects. Tuition costs for the program are Center-funded. Courses are held on-site at Goddard after normal working hours.

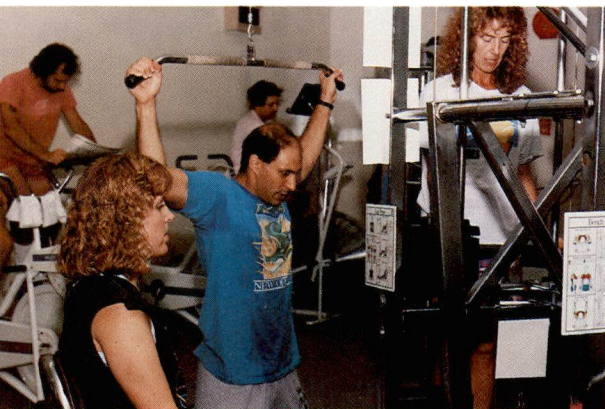
Federal Employment Benefits

Paid Moving Expenses

Concerned about the cost of relocation? You may be eligible for reimbursement of certain travel expenses and the shipment of household goods.

Flexible Work Schedule

Employees work a basic 40-hour work week, 8 1/2-hour workday, with 1/2 hour for lunch.



The Fitness Lab offers an array of exercise equipment.



The Learning Center provides employees the opportunity for independent study.

Flexitour provides employees the opportunity to establish start time between 6:30 and 9:00 a.m. Your work schedule will be determined by yourself and your immediate supervisor, based on your preferences and your work unit needs.

Leave

Beginning your first day on the job, you earn 13 days of annual leave each year. This is personal time off that you schedule with the approval of your immediate supervisor. You earn 20 days of leave after three years of employment; and a maximum of 26 days of leave after 15 years of service. You also earn 13 days of sick leave each year. This leave may be used for illness, doctor appointments, or for maternity. Unused sick leave is accumulated indefinitely and thus provides continuation of pay should an employee have a long illness. Other types of leave are available for specific situations (e.g., jury duty or military service).

Paid Holidays

Federal holidays are observed with pay:

- New Years' Day
- Martin Luther King's Birthday
- Inauguration Day

- Washington's Birthday
- Memorial Day
- Independence Day
- Labor Day
- Columbus Day
- Veteran's Day
- Thanksgiving
- Christmas

Health Care

You can enroll in one of several comprehensive health insurance plans, with approximately 75 percent of the cost paid by the Center. There are two major types of plans:

- **Fee-for-Service Plans**
You may choose your own physician, hospital, and other health care providers. These plans reimburse you or the health care provider for covered services.
- **Prepaid Plans**
These are the Comprehensive Medical Plans/Health Maintenance Organizations that provide or arrange for health care by designated plan physicians, hospitals, and other providers in particular locations.

Life Insurance

In addition, you may elect low-cost life insurance. You are eligible to enroll in two group life insurance plans:

- Federal Employee Group Life Insurance (FEGLI) available to all Federal employees.

- NASA Employees Benefit Association (NEBA) available to NASA employees.

The amount of coverage you elect depends on your basic annual salary. Additional life insurance is also available.

Awards and Recognition

Goddard's success is due to the creativity, innovation, and performance of its employees. The Center's awards program acknowledges and rewards employee contributions.

Employees are eligible to receive cash and honorary awards for superior work that contributes to the productivity, economy, or effectiveness of NASA or Goddard programs. Awards can be for either individual or group performance. An Employee Suggestion Program also acknowledges and rewards employees for their ideas.

Retirement

As a new employee to the Federal government, you are automatically covered by the Federal Employees Retirement System (FERS). FERS is a three-tiered Retirement Plan consisting of:

- Social Security
- Basic Benefits
- Thrift Savings Plan

Once you retire, after meeting basic eligibility requirements, you will receive a retirement pension in the form of a paid monthly annuity for the rest of your life.

Advancement

Salary Increases

All employees receive annual cost-of-living increases, designed to keep salaries in pace with private-industry salaries. In addition, you

are eligible to receive periodic salary increases.

Accelerated Promotion

Entry-level (GS-7) Engineers and Scientists are eligible for promotion to the GS-9 level in six months.

Career Promotion Eligibility

The career ladder is as follows:

To GS-9	6 months*
To GS-11	1 year*
To GS-12	1 year*
To GS-13	1 year*

*Basic eligibility. Actual promotion may vary at each grade level depending on performance.

You and your supervisor will jointly develop performance standards that define your job requirements. Your performance will be evaluated against these standards at least twice each year.

Informal performance discussions with your supervisor are encouraged at any time. This formal and informal feedback gives you a sense of your achievements and career development.

Services and Facilities

GEWA

The Goddard Employees Welfare Association (GEWA) offers activities that foster and promote social, athletic, educational, cultural, and welfare interests for the entire Center workforce.

Specific facilities and activities maintained and sponsored by GEWA include:

A Recreation Center available to all GEWA members for on-site organization functions such as picnics, dinners, award ceremonies, and parties.

An Exchange Store which offers all employees and their families discounted tickets to theaters, sporting events, and local area attractions. Items and mementos are also available at reduced costs.

A Souvenir/Gift Shop located at the Visitor Center offers reduced prices on merchandise through GEWA special discount privileges.

Club Activities

A few of the over 50 clubs on Center sponsored by GEWA include: Aerobics, Music and Drama, Photo, Softball, Toastmasters, and Travel.

Other Facilities

The Center also houses two cafeterias, a credit union, a child



The Center's child care facility offers creative play and development to children ages 2 through kindergarten.

care center, a full-service library, and a travel office for both official and personal travel.

The Goddard Health Unit provides a wide range of physical programs and counseling services.

The Goddard Fitness Lab offers individual exercise programs, monitoring of employees' blood pressure, body-fat evaluations, and special programs. The Lab features a variety of physical fitness equipment.

An Employee Assistance Program is also available to you to help you deal with stress, financial, marital, and other personal problems.

Employees are also offered free annual physical examinations.

Employee Services Area
The Center's Office of Human Resources' Employee Services Area houses brochures, pamphlets, publications, and videos about a wide range of personnel information. Such information includes job opportunities, health and life insurance, retirement, career development and training, housing and relocation services, and other items of interest to employees and the public.

Goddard's Communication
The Center emphasizes communication to its workforce. The communication network consists of daily bulletins, newsletters and frequent announcements that keep you informed of current and future activities.

The Surrounding Area
Goddard is ideally located between Washington, D.C. and Baltimore, Maryland. We are surrounded by outstanding cultural, recreational, and historical points of interest. The Washington, D.C. metropolitan area offers a lifestyle for everyone.

Getting around the area is easier than one expects. There are five Metrorail stations that link the county with the Nation's Capital and several others are under construction. We have the historic Union Station located near The U.S. Capitol, the Amtrak Metroliner, the Maryland Rail Commuter Line, and Ride Sharers Matching services. In addition, we are serviced by three major airports: Baltimore-Washington International Airport, Dulles Airport and the



The Washington Mall

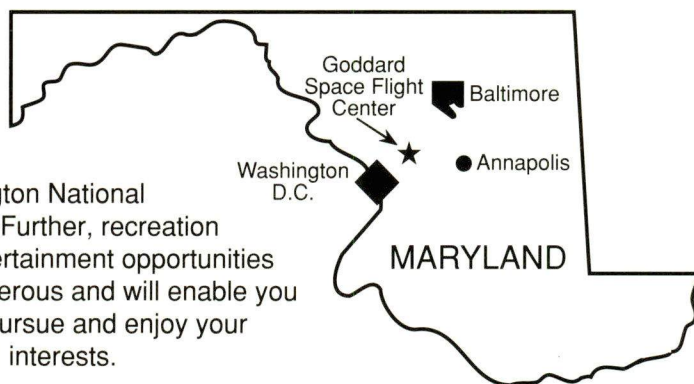


The Air and Space Museum

The Washington D.C. metropolitan area offers diverse cultural and recreational activities to suit any lifestyle.



The Baltimore Inner Harbor



Washington National Airport. Further, recreation and entertainment opportunities are numerous and will enable you to fully pursue and enjoy your personal interests.

As for education, colleges and universities in the commuting area offer undergraduate and graduate courses of study.

They include:
American University
The Catholic University of America

George Washington University
Howard University
The Johns Hopkins University
Mary Washington College
University of Maryland

WHITE HOUSE STAFFING MEMORANDUM

DATE: 5/29/92 ACTION/CONCURRENCE/COMMENT DUE BY: TODAY, 5/29 5:00pm!!

SUBJECT: PRESIDENTIAL REMARKS: ENVIRONMENTAL ADDRESS
GODDARD SPACE CENTER - MONDAY, JUNE 1 - 2:00 p.m.

	ACTION	FYI		ACTION	FYI
VICE PRESIDENT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	HORNER	<input type="checkbox"/>	<input type="checkbox"/>
SKINNER	<input type="checkbox"/>	<input checked="" type="checkbox"/>	MCBRIDE	<input checked="" type="checkbox"/>	<input type="checkbox"/>
SCOWCROFT	<input checked="" type="checkbox"/>	<input type="checkbox"/>	MOORE	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DARMAN	<input checked="" type="checkbox"/>	<input type="checkbox"/>	PETERSMEYER	<input checked="" type="checkbox"/>	<input type="checkbox"/>
BRADY	<input type="checkbox"/>	<input checked="" type="checkbox"/>	PORTER	<input checked="" type="checkbox"/>	<input type="checkbox"/>
BROMLEY	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ROLLINS	<input checked="" type="checkbox"/>	<input type="checkbox"/>
CALIO	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SMITH	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DEMAREST	<input checked="" type="checkbox"/>	<input type="checkbox"/>	YEUTTER	<input type="checkbox"/>	<input checked="" type="checkbox"/>
FITZWATER	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>FINDLAY</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
GRAY	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>KAUFMAN</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
HOLIDAY	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>MCGROARTY</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
DELAND	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>ALBRECHT</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

REMARKS:

Please forward your comments directly to Dan McGroarty, RM. 122, x2930, no later than 5:00 p.m., TODAY, FRI. MAY 29, with a copy to this office. Thank you.

RESPONSE:

PHILLIP D. BRADY
Assistant to the President
and Staff Secretary
Ext. 2702

((Grady))
5/27/92

PRESIDENTIAL REMARKS:

ENVIRONMENTAL ADDRESS
GODDARD SPACE CENTER
GREENBELT, MARYLAND
MONDAY, JUNE 1, 1992
2:00 p.m.

22 MAY 29 P12:39

Thank you, Administrator Dan Goldin, for that introduction.
((Senator Mikulski)), ((Administrator Reilly)):

You know, in just over a month on the job, Dan Goldin has supervised the recovery of a satellite on Endeavor's maiden voyage, won a vote to save the space station on the floor of the House, and launched his own "cultural revolution" at NASA. I'd say the "new NASA" is off to a flying start.//

Twenty years ago this month, the leaders of the world gathered in Sweden to talk about the human environment.

The Stockholm Declaration they adopted had a simple conclusion, that: "...through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes."

That meeting occurred when the environmental movement was in its infancy. Later that year, the first Clean Water Act passed the United States Congress. Our EPA at the time was one year old. America, like so many nations around the world, was just beginning to face up to the consequences of unmitigated pollution.

Back then, DDT levels showing up in wildlife around the Great Lakes were eight times what they are today. PCBs were six times as prevalent. Thousands of miles of rivers and streams

were not fit for swimming or fishing. Sulfur dioxide and lead clogged the lungs of city dwellers. The Cayohoga River in Cleveland actually caught fire spontaneously -- prompting the songwriter Randy Newman to pen the song "Burn on, big river, burn on."

Much has occurred since those early days of environmentalism. And much of what has occurred happened first in the United States of America. In just two decades, we've passed a comprehensive superstructure of statutes to protect our air, our water, and our wildlife -- to expand our natural areas and to clean up the lingering legacy of hazardous wastes. Today, America is a safer, cleaner nation -- and our laws have served as a model for environmental laws the world over.

We were the first nation to recognize the danger of CFC emissions by eliminating aerosol propellants, which we did in 1978. Other nations are now following suit as they meet their obligations under an international agreement to phase out CFCs.

We were the first nation, back in 1975, to adopt catalytic converters to reduce emissions from our cars and trucks -- European nations are now in the process of adopting them.

In 1982, we began phasing out lead from American gasoline. Today, ambient levels of lead in our air have been cut by 95 percent. Now, several other nations are looking at the possibility of cutting back on leaded gasoline as a means of meeting their clean air objectives.

Since 1977, carbon monoxide levels in our air have been cut 30 percent; ozone 20 percent; particulate 25 percent; and sulfur dioxide 18 percent. The discharge of suspended solids into our waterways was cut by over 80 percent. And as of 1988, 96 percent of our lakes and reservoirs were found to be fishable and swimmable.

Throughout these two decades since Stockholm, then, America has been the leader in protecting the environment.

In the last four years, we have worked to extend that record -- on every front. The 1990 Clean Air Act will cut emissions of sulfur dioxide in half, emissions of toxic chemicals by ninety percent, and the number of U.S. cities not meeting smog and carbon monoxide standards from over a hundred to a handful by the end of the decade.

We've signed new laws to prevent oil spills by requiring double hulls on oil tankers, to protect the flyways of migratory birds, and to help protect our largest rainforest -- the Tongass. We have fined and jailed polluters in record numbers; placed a moratorium on oil and gas drilling in precious areas of our coasts; added over a billion dollars to our system of parks, wildlife refuges, forests, and public lands; launched a reforestation plan to plant a billion trees a year; and signed international agreements on everything from the transboundary movement of hazardous wastes to the protection of the African elephant.

Next week, dozens of heads of state will again gather -- in Rio de Janeiro. I will join them, because the United States has a stake -- indeed, every nation has a stake -- in a safer, cleaner world.

And I suppose it is only fitting to come to this center, on the eve of the Rio summit, to talk about my vision for building such a world. To talk about what we have accomplished -- and what we hope to accomplish. To talk about the lessons learned since Stockholm, and about the road ahead.

Goddard, through its invaluable contributions to the understanding and observation of our earth, has in a very real sense made progress at the UNCED meeting possible.

Your work has revealed some fundamental truths about the environmental challenges we face.

A spacecraft created at Goddard provided the world with its first image of Earth from space. In one breathtaking photo, you underlined what volumes of words could not have described better -- that the earth and its atmosphere are our common inheritance. That any solution to the problems facing the earth must involve every nation -- because those problems are global in scope.

It was Goddard scientists who developed the Upper Atmospheric Research Satellite -- UARS --- launched last year, which is providing us new insight about the ozone layer. The buildup of chlorine in the upper atmosphere, and the depletion of

ozone, are long-term problems, built up over many years. They will require sustained commitment to solve.

And the lion's share of the science that the world is using to understand our climate comes from a program with its heart and soul right here -- the U.S. Global Change Research Program, built around the Earth Observing System that Goddard is developing. We are still learning about the enormously complex challenges this planet faces -- from global warming to El Nino, from biodiversity to desertification. To make the right decisions, we will need to learn as we go. So we need a sustained investment in the knowledge base that makes sound policymaking possible.

At the end of the day, that's what the Rio summit is all about. Policy. Making decisions. And taking action.

Frankly, the United States of America has brought a very non-nonsense approach to the preparations for Rio. We have made it clear that what matters to us, what matters from the perspective of the global environment, and what should matter to those who care about its health, is action.

From the beginning of the climate change negotiations which formed the centerpiece of this conference, we made clear this bias for action.

We offered to host the first round of negotiations at Chantilly, Virginia in 1991. And at that time, we laid on the table an action agenda on climate change -- with specific policy proposals we were implementing or prepared to implement, and with our specific calculations concerning how much we expected to

reduce greenhouse gas emissions as a result of those policies. The result was encouraging. We found that our expected year 2000 greenhouse gas emission levels were expected to be below our current levels.

When the science changed, indicating that cutting CFCs would not reduce warming as much as we had thought, we supplemented that plan. Earlier this year, we added a whole range of additional measures -- from EPA's Green Lights program to the range of energy efficiency measures contained in my National Energy Strategy. We again laid our plan on the table -- in specific detail -- showing that our policies would reduce U.S. net greenhouse gas emissions by 125 to 200 million tons a year by the year 2000.

No other nation has laid out such a specific plan of action. And that explains our strategy during the negotiations. That every nation should have a plan of action, with a focus on results -- not rhetoric.

It may not have been widely reported in the press, but in area after area, the U.S. laid down specific proposals, and worked for their adoption. Forests. Oceans. Living Marine Resources. Public participation. Financing.

Make no mistake: America has not retreated, and will not retreat from its leadership role in protecting the global environment.

Today, the United States spends about two percent its Gross National Product -- over 100 billion dollars per year --

protecting the environment from pollution. That investment is scheduled to rise.

That continuing commitment of resources and national energy reflects one central tenet of our policy -- that what counts is performance over the long haul. We may not go to Rio with the best words, but we will go with the best policies.

More importantly, the commitment to act must not end at UNCED. If Rio is a one-shot deal, it will have been a failure.

So when I travel to Brazil next week, I will bring with me several proposals to extend the commitment of the world community into the future. We need not just the will to meet, but the will to act.

To make sure that the process and the institutional capacity for follow-up exists, we will endorse a continuing entity under the auspices of the United Nations -- a Council on Sustainable Development -- to help foster the international cooperation we will need to tackle these global problems.

To strengthen the will to act, I will offer a four point plan of cooperation.

First with respect to climate. The signing of a convention that calls for action plans is just a first step. Now countries must move quickly to develop them. So I will join in proposing a "prompt start" to implementation of climate action plans.

The United States is already well along the road to not only developing but implementing its action plan. But we stand ready

to assist others -- particularly the developing countries -- in preparing theirs.

The participation of these developing countries is vital. Over the next three decades, carbon dioxide emissions from the developing countries are projected to triple. While today these nations account for about one quarter of the world's emissions, by the year 2025, they will contribute almost half. So any agreement which ignores the need to include them is destined to fail.

To begin this process, the United States has already committed to help fund country studies that can help these nations identify the sources of emissions and the best means of curbing them.

We have insisted throughout the negotiations that any solution to the climate change problem must be comprehensive -- that is, it should allow for the inclusion of all sources and sinks of greenhouse gases. The agreement we have reached does just this.

One of the most cost effective means of reducing net emissions for many countries will be to enhance greenhouse sinks -- in particular, forests.

So the second point which I will propose in Rio is a major new initiative to protect and enhance the world's forests.

The benefits of forests are many -- they filter the air and water; they provide products from timber and fuelwood to

ingredients for Ben and Jerry's Ice Cream; they sequester carbon; and they provide habitat for all manner of living things.

Tropical forests cover just seven percent of the world's surface -- yet they are home to more than half the world's species. And forest loss today contributes about 20 percent of net man made carbon dioxide emissions.

We can jump start progress on addressing global warming and protecting the biological diversity of the earth with a single forceful step on behalf of forests -- and we can do it today.

At the Houston Economic Summit two years ago, I proposed to the leaders of the G-7 countries that we work for a global forest convention. And it remains my hope that the principles leading to such a convention will be agreed at Rio.

But I propose today to move ahead in advance of that formal convention. At Rio, I will ask the other industrialized countries of the world to join me in doubling worldwide forests assistance. The goal of this initiative would be to stabilize world forest cover by the end of this decade.

About \$1.35 billion dollars a year are now provided worldwide in forest assistance. I propose to double this amount to \$2.7 billion. As a downpayment, the U.S. will increase its bilateral forest assistance by 150 million dollars next year.

Forests today are under stress. In the last decade, tropical forests have disappeared at a rate of over 40 million acres a year.

This initiative would reverse that trend. The assistance can be provided through existing bilateral or multilateral mechanisms. And recipient countries could propose new projects.

The plan is to encourage investor countries to in effect bid on the most effective projects. This down payment on forests will use a market mechanism to achieve the greatest environmental return -- because investments will flow to the projects with the greatest marginal benefit in terms of decreased net emissions or critical habitat preserved.

((We will also act to get our own house in order. We will push Congress to fund our program -- the world's largest reforestation effort -- to plant a billion trees a year. And this week, the Forest Service will adopt new rules to end the clearcutting of our national forests as an acceptable forest practice.))

Saving the forests may be the most effective immediate step the world can take -- but it is not the only one.

The history of the world has been to benefit from technology. Technology has made us more productive, and raised our standard of living. In the U.S., technology has helped us cut pollution, and become more energy efficient as well.

That's one reason that my budget includes an investment of almost a billion dollars in developing the new energy and efficiency related technologies of tomorrow.

It is time for a new generation of clean growth -- the world over. We need a quantum leap in the world's develop,

fueled by new, more energy efficient technology -- and yes, I hope much of it will be American technology.

In preparation for the UNCED summit, I met with the Business Council for Sustainable Development -- businessmen from around the world who sense the opportunity presented by a partnership between businesses and governments oriented toward cleaner, more efficient development.

I am pleased to note that hundreds of American businessmen will be travelling to Rio for this conference. I want the opportunities facing them -- and the benefits their goods and services can provide to the rest of the world -- to be long lasting.

So the third part of our plan is to support a broad program of technology cooperation at Rio -- and afterwards. Specifically, I propose to create a Technology Cooperation Corps. This Corps would be teams of U.S. businessmen and women who, with institutional support from the government, would investigate the needs of countries around the world for environmentally sound technology, and knock down the barriers to making it available.

The need for an ongoing program of technology cooperation underscores the point that our ability to address global environmental challenges is evolving -- as indeed is our understanding of the challenges themselves.

So the fourth point of any program for a cleaner future must involve a continued program of research and understanding. This year, we are requesting over \$1.4 billion for the U.S. Global

Change Research Program -- that's more than half the money spent on climate research in the entire world.

We want to make sure that this work is useful. That was the point behind our restructuring of the EOS program last year -- to get results faster, cheaper, and better. That's what Dan Goldin is driving for throughout NASA. Today, I am signing a National Space Policy Directive, developed by Vice President Quayle's Space Council, that will place us firmly on this path. By using new technology and smaller satellites, we can move up the timetable for obtaining critical data on global change.

The directive does something else -- it formalizes our policy of making this data available and affordable for scientists and researchers from the public and private sector from all around the world.

We believe in sharing the benefits of our earth observation system -- and I will take that message to Rio. To make that message concrete, we will distribute at UNCED, at no cost, thousands of copies of computer disks -- each with over a billion bytes of data -- with our best information on greenhouse effects.

And upon our return, the U.S. will open this year a Global Change Research Information Office to disseminate this information to governments, businesses, and scientists.

UNCED not only holds out the promise of ushering in an era of sustainable development; it gives us the chance to help launch a new generation of clean growth.

These four steps -- the preparation of solid action plans; a dramatic first step to protect and enhance forests; cooperation in deploying cleaner, more efficient technology; and an ongoing program to develop and share sound science -- can help us seize that opportunity long after the speeches in Rio have been given and the conference is over.

Our predecessors who met at Stockholm had the gift of foresight. They explicitly called for the discussion at Rio to be about both environment and development. They knew, back then, that the two were inextricably linked.

Only a growing economy which provides hope for the future can generate the resources and the will to manage natural assets for the longer term and the common good. But only assets which are so managed can support the growth on which so much human hope is hinged. By definition, for development to be successful in the long-term, it must be sustainable.

They couldn't have known how clear the lessons of history would be in the intervening two decades. How it would be revealed for all to see, when the pollution spawned by totalitarianism in Eastern Europe and for former Soviet Union was exposed to the world, that only free markets and democratic systems provide the accountability necessary for a clean environment.

They couldn't have known that, as the leaders of the world prepared to gather for this next earth summit, the specter of

nuclear war -- with its unthinkable destruction -- would be calmed as never before in our postwar history.

They couldn't have envisioned that, with a world at peace, a more knowledgeable public, and a commitment from the public and private sectors of virtually every country, those who would be coming to Rio would be poised to launch a new generation of clean growth.

The signers of the Stockholm declaration called the protection and improvement of the environment "the urgent desire of all peoples." They could never have known how far we'd come in these two decades -- and how much further we'd have the potential to go.

Thank you, God bless you, and God bless the United States of America.

#

WHITE HOUSE STAFFING MEMORANDUM

DATE: 5/29/92 ACTION/CONCURRENCE/COMMENT DUE BY: TODAY, 5/29 5:00pm!!

SUBJECT: PRESIDENTIAL REMARKS: ENVIRONMENTAL ADDRESS
GODDARD SPACE CENTER - MONDAY, JUNE 1 - 2:00 p.m.

	ACTION	FYI		ACTION	FYI
VICE PRESIDENT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	HORNER	<input type="checkbox"/>	<input type="checkbox"/>
SKINNER	<input type="checkbox"/>	<input checked="" type="checkbox"/>	MCBRIDE	<input checked="" type="checkbox"/>	<input type="checkbox"/>
SCOWCROFT	<input checked="" type="checkbox"/>	<input type="checkbox"/>	MOORE	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DARMAN	<input checked="" type="checkbox"/>	<input type="checkbox"/>	PETERSMEYER	<input checked="" type="checkbox"/>	<input type="checkbox"/>
BRADY	<input type="checkbox"/>	<input checked="" type="checkbox"/>	PORTER	<input checked="" type="checkbox"/>	<input type="checkbox"/>
BROMLEY	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ROLLINS	<input checked="" type="checkbox"/>	<input type="checkbox"/>
CALIO	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SMITH	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DEMAREST	<input checked="" type="checkbox"/>	<input type="checkbox"/>	YEUTTER	<input type="checkbox"/>	<input checked="" type="checkbox"/>
FITZWATER	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>FINDLAY</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
GRAY	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>KAUFMAN</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
HOLIDAY	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>MCGROARTY</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
DELAND	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ALBRECHT	<input checked="" type="checkbox"/>	<input type="checkbox"/>

REMARKS:

Please forward your comments directly to Dan McGroarty, RM. 122, x2930, no later than 5:00 p.m., TODAY, FRI. MAY 29, with a copy to this office. Thank you.

RESPONSE:

PHILLIP D. BRADY
 Assistant to the President
 and Staff Secretary
 Ext. 2702

((Grady))
5/27/92

PRESIDENTIAL REMARKS:

ENVIRONMENTAL ADDRESS
GODDARD SPACE CENTER
GREENBELT, MARYLAND
MONDAY, JUNE 1, 1992
2:00 p.m.

22 MAY 29 P12:39

Thank you, Administrator Dan Goldin, for that introduction.
((Senator Mikulski)), ((Administrator Reilly)):

You know, in just over a month on the job, Dan Goldin has supervised the recovery of a satellite on Endeavor's maiden voyage, won a vote to save the space station on the floor of the House, and launched his own "cultural revolution" at NASA. I'd say the "new NASA" is off to a flying start.//

Twenty years ago this month, the leaders of the world gathered in Sweden to talk about the human environment.

The Stockholm Declaration they adopted had a simple conclusion, that: "...through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes."

That meeting occurred when the environmental movement was in its infancy. Later that year, the first Clean Water Act passed the United States Congress. Our EPA at the time was one year old. America, like so many nations around the world, was just beginning to face up to the consequences of unmitigated pollution.

Back then, DDT levels showing up in wildlife around the Great Lakes were eight times what they are today. PCBs were six times as prevalent. Thousands of miles of rivers and streams

were not fit for swimming or fishing. Sulfur dioxide and lead clogged the lungs of city dwellers. The Cuyahoga River in Cleveland actually caught fire spontaneously -- prompting the songwriter Randy Newman to pen the song "Burn on, big river, burn on."

Much has occurred since those early days of environmentalism. And much of what has occurred happened first in the United States of America. In just two decades, we've passed a comprehensive superstructure of statutes to protect our air, our water, and our wildlife -- to expand our natural areas and to clean up the lingering legacy of hazardous wastes. Today, America is a safer, cleaner nation -- and our laws have served as a model for environmental laws the world over.

We were the first nation to recognize the danger of CFC emissions by eliminating aerosol propellants, which we did in 1978. Other nations are now following suit as they meet their obligations under an international agreement to phase out CFCs.

We were the first nation, back in 1975, to adopt catalytic converters to reduce emissions from our cars and trucks -- European nations are now in the process of adopting them.

In 1982, we began phasing out lead from American gasoline. Today, ambient levels of lead in our air have been cut by 95 percent. Now, several other nations are looking at the possibility of cutting back on leaded gasoline as a means of meeting their clean air objectives.

Since 1977, carbon monoxide levels in our air have been cut 30 percent; ozone 20 percent; particulate 25 percent; and sulfur dioxide 18 percent. The discharge of suspended solids into our waterways was cut by over 80 percent. And as of 1988, 96 percent of our lakes and reservoirs were found to be fishable and swimmable.

Throughout these two decades since Stockholm, then, America has been the leader in protecting the environment.

In the last four years, we have worked to extend that record -- on every front. The 1990 Clean Air Act will cut emissions of sulfur dioxide in half, emissions of toxic chemicals by ninety percent, and the number of U.S. cities not meeting smog and carbon monoxide standards from over a hundred to a handful by the end of the decade.

We've signed new laws to prevent oil spills by requiring double hulls on oil tankers, to protect the flyways of migratory birds, and to help protect our largest rainforest -- the Tongass. We have fined and jailed polluters in record numbers; placed a moratorium on oil and gas drilling in precious areas of our coasts; added over a billion dollars to our system of parks, wildlife refuges, forests, and public lands; launched a reforestation plan to plant a billion trees a year; and signed international agreements on everything from the transboundary movement of hazardous wastes to the protection of the African elephant.

Next week, dozens of heads of state will again gather -- in Rio de Janeiro. I will join them, because the United States has a stake -- indeed, every nation has a stake -- in a safer, cleaner world.

And I suppose it is only fitting to come to this center, on the eve of the Rio summit, to talk about my vision for building such a world. To talk about what we have accomplished -- and what we hope to accomplish. To talk about the lessons learned since Stockholm, and about the road ahead.

Goddard, through its invaluable contributions to the understanding and observation of our earth, has in a very real sense made progress at the UNCED meeting possible.

Your work has revealed some fundamental truths about the environmental challenges we face.

A spacecraft created at Goddard provided the world with its first image of Earth from space. In one breathtaking photo, you underlined what volumes of words could not have described better -- that the earth and its atmosphere are our common inheritance. That any solution to the problems facing the earth must involve every nation -- because those problems are global in scope.

It was Goddard scientists who developed the Upper Atmospheric Research Satellite -- UARS --- launched last year, which is providing us new insight about the ozone layer. The buildup of chlorine in the upper atmosphere, and the depletion of

ozone, are long-term problems, built up over many years. They will require sustained commitment to solve.

And the lion's share of the science that the world is using to understand our climate comes from a program with its heart and soul right here -- the U.S. Global Change Research Program, built around the Earth Observing System that Goddard is developing. We are still learning about the enormously complex challenges this planet faces -- from global warming to El Nino, from biodiversity to desertification. To make the right decisions, we will need to learn as we go. So we need a sustained investment in the knowledge base that makes sound policymaking possible.

At the end of the day, that's what the Rio summit is all about. Policy. Making decisions. And taking action.

Frankly, the United States of America has brought a very non-nonsense approach to the preparations for Rio. We have made it clear that what matters to us, what matters from the perspective of the global environment, and what should matter to those who care about its health, is action.

From the beginning of the climate change negotiations which formed the centerpiece of this conference, we made clear this bias for action.

We offered to host the first round of negotiations at Chantilly, Virginia in 1991. And at that time, we laid on the table an action agenda on climate change -- with specific policy proposals we were implementing or prepared to implement, and with our specific calculations concerning how much we expected to

reduce greenhouse gas emissions as a result of those policies. The result was encouraging. We found that our expected year 2000 greenhouse gas emission levels were expected to be below our current levels.

When the science changed, indicating that cutting CFCs would not reduce warming as much as we had thought, we supplemented that plan. Earlier this year, we added a whole range of additional measures -- from EPA's Green Lights program to the range of energy efficiency measures contained in my National Energy Strategy. We again laid our plan on the table -- in specific detail -- showing that our policies would reduce U.S. net greenhouse gas emissions by 125 to 200 million tons a year by the year 2000.

No other nation has laid out such a specific plan of action. And that explains our strategy during the negotiations. That every nation should have a plan of action, with a focus on results -- not rhetoric.

It may not have been widely reported in the press, but in area after area, the U.S. laid down specific proposals, and worked for their adoption. Forests. Oceans. Living Marine Resources. Public participation. Financing.

Make no mistake: America has not retreated, and will not retreat from its leadership role in protecting the global environment.

Today, the United States spends about two percent its Gross National Product -- over 100 billion dollars per year --

protecting the environment from pollution. That investment is scheduled to rise.

That continuing commitment of resources and national energy reflects one central tenet of our policy -- that what counts is performance over the long haul. We may not go to Rio with the best words, but we will go with the best policies.

More importantly, the commitment to act must not end at UNCED. If Rio is a one-shot deal, it will have been a failure.

So when I travel to Brazil next week, I will bring with me several proposals to extend the commitment of the world community into the future. We need not just the will to meet, but the will to act.

To make sure that the process and the institutional capacity for follow-up exists, we will endorse a continuing entity under the auspices of the United Nations -- a Council on Sustainable Development -- to help foster the international cooperation we will need to tackle these global problems.

To strengthen the will to act, I will offer a four point plan of cooperation.

First with respect to climate. The signing of a convention that calls for action plans is just a first step. Now countries must move quickly to develop them. So I will join in proposing a "prompt start" to implementation of climate action plans.

The United States is already well along the road to not only developing but implementing its action plan. But we stand ready

to assist others -- particularly the developing countries -- in preparing theirs.

The participation of these developing countries is vital. Over the next three decades, carbon dioxide emissions from the developing countries are projected to triple. While today these nations account for about one quarter of the world's emissions, by the year 2025, they will contribute almost half. So any agreement which ignores the need to include them is destined to fail.

To begin this process, the United States has already committed to help fund country studies that can help these nations identify the sources of emissions and the best means of curbing them.

We have insisted throughout the negotiations that any solution to the climate change problem must be comprehensive -- that is, it should allow for the inclusion of all sources and sinks of greenhouse gases. The agreement we have reached does just this.

One of the most cost effective means of reducing net emissions for many countries will be to enhance greenhouse sinks -- in particular, forests.

So the second point which I will propose in Rio is a major new initiative to protect and enhance the world's forests.

The benefits of forests are many -- they filter the air and water; they provide products from timber and fuelwood to

ingredients for Ben and Jerry's Ice Cream; they sequester carbon; and they provide habitat for all manner of living things.

Tropical forests cover just seven percent of the world's surface -- yet they are home to more than half the world's species. And forest loss today contributes about 20 percent of net man made carbon dioxide emissions.

We can jump start progress on addressing global warming and protecting the biological diversity of the earth with a single forceful step on behalf of forests -- and we can do it today.

At the Houston Economic Summit two years ago, I proposed to the leaders of the G-7 countries that we work for a global forest convention. And it remains my hope that the principles leading to such a convention will be agreed at Rio.

But I propose today to move ahead in advance of that formal convention. At Rio, I will ask the other industrialized countries of the world to join me in doubling worldwide forests assistance. The goal of this initiative would be to stabilize world forest cover by the end of this decade.

About \$1.35 billion dollars a year are now provided worldwide in forest assistance. I propose to double this amount to \$2.7 billion. As a downpayment, the U.S. will increase its bilateral forest assistance by 150 million dollars next year.

Forests today are under stress. In the last decade, tropical forests have disappeared at a rate of over 40 million acres a year.

This initiative would reverse that trend. The assistance can be provided through existing bilateral or multilateral mechanisms. And recipient countries could propose new projects.

The plan is to encourage investor countries to in effect bid on the most effective projects. This down payment on forests will use a market mechanism to achieve the greatest environmental return -- because investments will flow to the projects with the greatest marginal benefit in terms of decreased net emissions or critical habitat preserved.

((We will also act to get our own house in order. We will push Congress to fund our program -- the world's largest reforestation effort -- to plant a billion trees a year. And this week, the Forest Service will adopt new rules to end the clearcutting of our national forests as an acceptable forest practice.))

Saving the forests may be the most effective immediate step the world can take -- but it is not the only one.

The history of the world has been to benefit from technology. Technology has made us more productive, and raised our standard of living. In the U.S., technology has helped us cut pollution, and become more energy efficient as well.

That's one reason that my budget includes an investment of almost a billion dollars in developing the new energy and efficiency related technologies of tomorrow.

It is time for a new generation of clean growth -- the world over. We need a quantum leap in the world's develop,

fueled by new, more energy efficient technology -- and yes, I hope much of it will be American technology.

In preparation for the UNCED summit, I met with the Business Council for Sustainable Development -- businessmen from around the world who sense the opportunity presented by a partnership between businesses and governments oriented toward cleaner, more efficient development.

I am pleased to note that hundreds of American businessmen will be travelling to Rio for this conference. I want the opportunities facing them -- and the benefits their goods and services can provide to the rest of the world -- to be long lasting.

So the third part of our plan is to support a broad program of technology cooperation at Rio -- and afterwards. Specifically, I propose to create a Technology Cooperation Corps. This Corps would be teams of U.S. businessmen and women who, with institutional support from the government, would investigate the needs of countries around the world for environmentally sound technology, and knock down the barriers to making it available.

The need for an ongoing program of technology cooperation underscores the point that our ability to address global environmental challenges is evolving -- as indeed is our understanding of the challenges themselves.

So the fourth point of any program for a cleaner future must involve a continued program of research and understanding. This year, we are requesting over \$1.4 billion for the U.S. Global

Change Research Program -- that's more than half the money spent on climate research in the entire world.

We want to make sure that this work is useful. That was the point behind our restructuring of the EOS program last year -- to get results faster, cheaper, and better. That's what Dan Goldin is driving for throughout NASA. Today, I am signing a National Space Policy Directive, developed by Vice President Quayle's Space Council, that will place us firmly on this path. By using new technology and smaller satellites, we can move up the timetable for obtaining critical data on global change.

The directive does something else -- it formalizes our policy of making this data available and affordable for scientists and researchers from the public and private sector from all around the world.

We believe in sharing the benefits of our earth observation system -- and I will take that message to Rio. To make that message concrete, we will distribute at UNCED, at no cost, thousands of copies of computer disks -- each with over a billion bytes of data -- with our best information on greenhouse effects.

And upon our return, the U.S. will open this year a Global Change Research Information Office to disseminate this information to governments, businesses, and scientists.

UNCED not only holds out the promise of ushering in an era of sustainable development; it gives us the chance to help launch a new generation of clean growth.

These four steps -- the preparation of solid action plans; a dramatic first step to protect and enhance forests; cooperation in deploying cleaner, more efficient technology; and an ongoing program to develop and share sound science -- can help us seize that opportunity long after the speeches in Rio have been given and the conference is over.

Our predecessors who met at Stockholm had the gift of foresight. They explicitly called for the discussion at Rio to be about both environment and development. They knew, back then, that the two were inextricably linked.

Only a growing economy which provides hope for the future can generate the resources and the will to manage natural assets for the longer term and the common good. But only assets which are so managed can support the growth on which so much human hope is hinged. By definition, for development to be successful in the long-term, it must be sustainable.

They couldn't have known how clear the lessons of history would be in the intervening two decades. How it would be revealed for all to see, when the pollution spawned by totalitarianism in Eastern Europe and for former Soviet Union was exposed to the world, that only free markets and democratic systems provide the accountability necessary for a clean environment.

They couldn't have known that, as the leaders of the world prepared to gather for this next earth summit, the specter of

nuclear war -- with its unthinkable destruction -- would be calmed as never before in our postwar history.

They couldn't have envisioned that, with a world at peace, a more knowledgeable public, and a commitment from the public and private sectors of virtually every country, those who would be coming to Rio would be poised to launch a new generation of clean growth.

The signers of the Stockholm declaration called the protection and improvement of the environment "the urgent desire of all peoples." They could never have known how far we'd come in these two decades -- and how much further we'd have the potential to go.

Thank you, God bless you, and God bless the United States of America.

#

WHITE HOUSE STAFFING MEMORANDUM

DATE: 5/29/92 ACTION/CONCURRENCE/COMMENT DUE BY: TODAY, 5/29 5:00pm!!PRESIDENTIAL REMARKS: ENVIRONMENTAL ADDRESS
SUBJECT: GODDARD SPACE CENTER - MONDAY, JUNE 1 - 2:00 p.m.

	ACTION	FYI		ACTION	FYI
VICE PRESIDENT	<input type="checkbox"/>	<input checked="" type="checkbox"/>	HORNER	<input type="checkbox"/>	<input type="checkbox"/>
SKINNER	<input type="checkbox"/>	<input checked="" type="checkbox"/>	MCBRIDE	<input checked="" type="checkbox"/>	<input type="checkbox"/>
SCOWCROFT	<input checked="" type="checkbox"/>	<input type="checkbox"/>	MOORE	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DARMAN	<input checked="" type="checkbox"/>	<input type="checkbox"/>	PETERSMEYER	<input checked="" type="checkbox"/>	<input type="checkbox"/>
BRADY	<input type="checkbox"/>	<input checked="" type="checkbox"/>	PORTER	<input checked="" type="checkbox"/>	<input type="checkbox"/>
BROMLEY	<input checked="" type="checkbox"/>	<input type="checkbox"/>	ROLLINS	<input checked="" type="checkbox"/>	<input type="checkbox"/>
CALIO	<input checked="" type="checkbox"/>	<input type="checkbox"/>	SMITH	<input checked="" type="checkbox"/>	<input type="checkbox"/>
DEMAREST	<input checked="" type="checkbox"/>	<input type="checkbox"/>	YEUTTER	<input type="checkbox"/>	<input checked="" type="checkbox"/>
FITZWATER	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>FINDLAY</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
GRAY	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>KAUFMAN</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
HOLIDAY	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>MCGROARTY</u>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
DELAND	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>ALBRECHT</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

REMARKS:

Please forward your comments directly to Dan McGroarty, RM. 122, x2930, no later than 5:00 p.m., TODAY, FRI. MAY 29, with a copy to this office. Thank you.

RESPONSE:

PHILLIP D. BRADY
Assistant to the President
and Staff Secretary
Ext. 2702

((Grady))
5/27/92

PRESIDENTIAL REMARKS:

ENVIRONMENTAL ADDRESS
GODDARD SPACE CENTER
GREENBELT, MARYLAND
MONDAY, JUNE 1, 1992
2:00 p.m.

2 MAY 29 P12:39

Thank you, Administrator Dan Goldin, for that introduction.
((Senator Mikulski)), ((Administrator Reilly)):

You know, in just over a month on the job, Dan Goldin has supervised the recovery of a satellite on Endeavor's maiden voyage, won a vote to save the space station on the floor of the House, and launched his own "cultural revolution" at NASA. I'd say the "new NASA" is off to a flying start.//

Twenty years ago this month, the leaders of the world gathered in Sweden to talk about the human environment.

The Stockholm Declaration they adopted had a simple conclusion, that: "...through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes."

That meeting occurred when the environmental movement was in its infancy. Later that year, the first Clean Water Act passed the United States Congress. Our EPA at the time was one year old. America, like so many nations around the world, was just beginning to face up to the consequences of unmitigated pollution.

Back then, DDT levels showing up in wildlife around the Great Lakes were eight times what they are today. PCBs were six times as prevalent. Thousands of miles of rivers and streams

were not fit for swimming or fishing. Sulfur dioxide and lead clogged the lungs of city dwellers. The Cayohoga River in Cleveland actually caught fire spontaneously -- prompting the songwriter Randy Newman to pen the song "Burn on, big river, burn on."

Much has occurred since those early days of environmentalism. And much of what has occurred happened first in the United States of America. In just two decades, we've passed a comprehensive superstructure of statutes to protect our air, our water, and our wildlife -- to expand our natural areas and to clean up the lingering legacy of hazardous wastes. Today, America is a safer, cleaner nation -- and our laws have served as a model for environmental laws the world over.

We were the first nation to recognize the danger of CFC emissions by eliminating aerosol propellants, which we did in 1978. Other nations are now following suit as they meet their obligations under an international agreement to phase out CFCs.

We were the first nation, back in 1975, to adopt catalytic converters to reduce emissions from our cars and trucks -- European nations are now in the process of adopting them.

In 1982, we began phasing out lead from American gasoline. Today, ambient levels of lead in our air have been cut by 95 percent. Now, several other nations are looking at the possibility of cutting back on leaded gasoline as a means of meeting their clean air objectives.

Since 1977, carbon monoxide levels in our air have been cut 30 percent; ozone 20 percent; particulate 25 percent; and sulfur dioxide 18 percent. The discharge of suspended solids into our waterways was cut by over 80 percent. And as of 1988, 96 percent of our lakes and reservoirs were found to be fishable and swimmable.

Throughout these two decades since Stockholm, then, America has been the leader in protecting the environment.

In the last four years, we have worked to extend that record -- on every front. The 1990 Clean Air Act will cut emissions of sulfur dioxide in half, emissions of toxic chemicals by ninety percent, and the number of U.S. cities not meeting smog and carbon monoxide standards from over a hundred to a handful by the end of the decade.

We've signed new laws to prevent oil spills by requiring double hulls on oil tankers, to protect the flyways of migratory birds, and to help protect our largest rainforest -- the Tongass. We have fined and jailed polluters in record numbers; placed a moratorium on oil and gas drilling in precious areas of our coasts; added over a billion dollars to our system of parks, wildlife refuges, forests, and public lands; launched a reforestation plan to plant a billion trees a year; and signed international agreements on everything from the transboundary movement of hazardous wastes to the protection of the African elephant.

Next week, dozens of heads of state will again gather -- in Rio de Janeiro. I will join them, because the United States has a stake -- indeed, every nation has a stake -- in a safer, cleaner world.

And I suppose it is only fitting to come to this center, on the eve of the Rio summit, to talk about my vision for building such a world. To talk about what we have accomplished -- and what we hope to accomplish. To talk about the lessons learned since Stockholm, and about the road ahead.

Goddard, through its invaluable contributions to the understanding and observation of our earth, has in a very real sense made progress at the UNCED meeting possible.

Your work has revealed some fundamental truths about the environmental challenges we face.

A spacecraft created at Goddard provided the world with its first image of Earth from space. In one breathtaking photo, you underlined what volumes of words could not have described better -- that the earth and its atmosphere are our common inheritance. That any solution to the problems facing the earth must involve every nation -- because those problems are global in scope.

It was Goddard scientists who developed the Upper Atmospheric Research Satellite -- UARS --- launched last year, which is providing us new insight about the ozone layer. The buildup of chlorine in the upper atmosphere, and the depletion of

ozone, are long-term problems, built up over many years. They will require sustained commitment to solve.

And the lion's share of the science that the world is using to understand our climate comes from a program with its heart and soul right here -- the U.S. Global Change Research Program, built around the Earth Observing System that Goddard is developing. We are still learning about the enormously complex challenges this planet faces -- from global warming to El Nino, from biodiversity to desertification. To make the right decisions, we will need to learn as we go. So we need a sustained investment in the knowledge base that makes sound policymaking possible.

At the end of the day, that's what the Rio summit is all about. Policy. Making decisions. And taking action.

Frankly, the United States of America has brought a very nonsense approach to the preparations for Rio. We have made it clear that what matters to us, what matters from the perspective of the global environment, and what should matter to those who care about its health, is action.

From the beginning of the climate change negotiations which formed the centerpiece of this conference, we made clear this bias for action.

We offered to host the first round of negotiations at Chantilly, Virginia in 1991. And at that time, we laid on the table an action agenda on climate change -- with specific policy proposals we were implementing or prepared to implement, and with our specific calculations concerning how much we expected to

reduce greenhouse gas emissions as a result of those policies. The result was encouraging. We found that our expected year 2000 greenhouse gas emission levels were expected to be below our current levels.

When the science changed, indicating that cutting CFCs would not reduce warming as much as we had thought, we supplemented that plan. Earlier this year, we added a whole range of additional measures -- from EPA's Green Lights program to the range of energy efficiency measures contained in my National Energy Strategy. We again laid our plan on the table -- in specific detail -- showing that our policies would reduce U.S. net greenhouse gas emissions by 125 to 200 million tons a year by the year 2000.

No other nation has laid out such a specific plan of action. And that explains our strategy during the negotiations. That every nation should have a plan of action, with a focus on results -- not rhetoric.

It may not have been widely reported in the press, but in area after area, the U.S. laid down specific proposals, and worked for their adoption. Forests. Oceans. Living Marine Resources. Public participation. Financing.

Make no mistake: America has not retreated, and will not retreat from its leadership role in protecting the global environment.

Today, the United States spends about two percent its Gross National Product -- over 100 billion dollars per year --

protecting the environment from pollution. That investment is scheduled to rise.

That continuing commitment of resources and national energy reflects one central tenet of our policy -- that what counts is performance over the long haul. We may not go to Rio with the best words, but we will go with the best policies.

More importantly, the commitment to act must not end at UNCED. If Rio is a one-shot deal, it will have been a failure.

So when I travel to Brazil next week, I will bring with me several proposals to extend the commitment of the world community into the future. We need not just the will to meet, but the will to act.

To make sure that the process and the institutional capacity for follow-up exists, we will endorse a continuing entity under the auspices of the United Nations -- a Council on Sustainable Development -- to help foster the international cooperation we will need to tackle these global problems.

To strengthen the will to act, I will offer a four point plan of cooperation.

First with respect to climate. The signing of a convention that calls for action plans is just a first step. Now countries must move quickly to develop them. So I will join in proposing a "prompt start" to implementation of climate action plans.

The United States is already well along the road to not only developing but implementing its action plan. But we stand ready

to assist others -- particularly the developing countries -- in preparing theirs.

The participation of these developing countries is vital. Over the next three decades, carbon dioxide emissions from the developing countries are projected to triple. While today these nations account for about one quarter of the world's emissions, by the year 2025, they will contribute almost half. So any agreement which ignores the need to include them is destined to fail.

To begin this process, the United States has already committed to help fund country studies that can help these nations identify the sources of emissions and the best means of curbing them.

We have insisted throughout the negotiations that any solution to the climate change problem must be comprehensive -- that is, it should allow for the inclusion of all sources and sinks of greenhouse gases. The agreement we have reached does just this.

One of the most cost effective means of reducing net emissions for many countries will be to enhance greenhouse sinks -- in particular, forests.

So the second point which I will propose in Rio is a major new initiative to protect and enhance the world's forests.

The benefits of forests are many -- they filter the air and water; they provide products from timber and fuelwood to

ingredients for Ben and Jerry's Ice Cream; they sequester carbon; and they provide habitat for all manner of living things.

Tropical forests cover just seven percent of the world's surface -- yet they are home to more than half the world's species. And forest loss today contributes about 20 percent of net man made carbon dioxide emissions.

We can jump start progress on addressing global warming and protecting the biological diversity of the earth with a single forceful step on behalf of forests -- and we can do it today.

At the Houston Economic Summit two years ago, I proposed to the leaders of the G-7 countries that we work for a global forest convention. And it remains my hope that the principles leading to such a convention will be agreed at Rio.

But I propose today to move ahead in advance of that formal convention. At Rio, I will ask the other industrialized countries of the world to join me in doubling worldwide forests assistance. The goal of this initiative would be to stabilize world forest cover by the end of this decade.

About \$1.35 billion dollars a year are now provided worldwide in forest assistance. I propose to double this amount to \$2.7 billion. As a downpayment, the U.S. will increase its bilateral forest assistance by 150 million dollars next year.

Forests today are under stress. In the last decade, tropical forests have disappeared at a rate of over 40 million acres a year.

This initiative would reverse that trend. The assistance can be provided through existing bilateral or multilateral mechanisms. And recipient countries could propose new projects.

The plan is to encourage investor countries to in effect bid on the most effective projects. This down payment on forests will use a market mechanism to achieve the greatest environmental return -- because investments will flow to the projects with the greatest marginal benefit in terms of decreased net emissions or critical habitat preserved.

((We will also act to get our own house in order. We will push Congress to fund our program -- the world's largest reforestation effort -- to plant a billion trees a year. And this week, the Forest Service will adopt new rules to end the clearcutting of our national forests as an acceptable forest practice.))

Saving the forests may be the most effective immediate step the world can take -- but it is not the only one.

The history of the world has been to benefit from technology. Technology has made us more productive, and raised our standard of living. In the U.S., technology has helped us cut pollution, and become more energy efficient as well.

That's one reason that my budget includes an investment of almost a billion dollars in developing the new energy and efficiency related technologies of tomorrow.

It is time for a new generation of clean growth -- the world over. We need a quantum leap in the world's develop,

fueled by new, more energy efficient technology -- and yes, I hope much of it will be American technology.

In preparation for the UNCED summit, I met with the Business Council for Sustainable Development -- businessmen from around the world who sense the opportunity presented by a partnership between businesses and governments oriented toward cleaner, more efficient development.

I am pleased to note that hundreds of American businessmen will be travelling to Rio for this conference. I want the opportunities facing them -- and the benefits their goods and services can provide to the rest of the world -- to be long lasting.

So the third part of our plan is to support a broad program of technology cooperation at Rio -- and afterwards. Specifically, I propose to create a Technology Cooperation Corps. This Corps would be teams of U.S. businessmen and women who, with institutional support from the government, would investigate the needs of countries around the world for environmentally sound technology, and knock down the barriers to making it available.

The need for an ongoing program of technology cooperation underscores the point that our ability to address global environmental challenges is evolving -- as indeed is our understanding of the challenges themselves.

So the fourth point of any program for a cleaner future must involve a continued program of research and understanding. This year, we are requesting over \$1.4 billion for the U.S. Global

Change Research Program -- that's more than half the money spent on climate research in the entire world.

We want to make sure that this work is useful. That was the point behind our restructuring of the EOS program last year -- to get results faster, cheaper, and better. That's what Dan Goldin is driving for throughout NASA. Today, I am signing a National Space Policy Directive, developed by Vice President Quayle's Space Council, that will place us firmly on this path. By using new technology and smaller satellites, we can move up the timetable for obtaining critical data on global change.

The directive does something else -- it formalizes our policy of making this data available and affordable for scientists and researchers from the public and private sector from all around the world.

We believe in sharing the benefits of our earth observation system -- and I will take that message to Rio. To make that message concrete, we will distribute at UNCED, at no cost, thousands of copies of computer disks -- each with over a billion bytes of data -- with our best information on greenhouse effects.

And upon our return, the U.S. will open this year a Global Change Research Information Office to disseminate this information to governments, businesses, and scientists.

UNCED not only holds out the promise of ushering in an era of sustainable development; it gives us the chance to help launch a new generation of clean growth.

These four steps -- the preparation of solid action plans; a dramatic first step to protect and enhance forests; cooperation in deploying cleaner, more efficient technology; and an ongoing program to develop and share sound science -- can help us seize that opportunity long after the speeches in Rio have been given and the conference is over.

Our predecessors who met at Stockholm had the gift of foresight. They explicitly called for the discussion at Rio to be about both environment and development. They knew, back then, that the two were inextricably linked.

Only a growing economy which provides hope for the future can generate the resources and the will to manage natural assets for the longer term and the common good. But only assets which are so managed can support the growth on which so much human hope is hinged. By definition, for development to be successful in the long-term, it must be sustainable.

They couldn't have known how clear the lessons of history would be in the intervening two decades. How it would be revealed for all to see, when the pollution spawned by totalitarianism in Eastern Europe and for former Soviet Union was exposed to the world, that only free markets and democratic systems provide the accountability necessary for a clean environment.

They couldn't have known that, as the leaders of the world prepared to gather for this next earth summit, the specter of

nuclear war -- with its unthinkable destruction -- would be calmed as never before in our postwar history.

They couldn't have envisioned that, with a world at peace, a more knowledgeable public, and a commitment from the public and private sectors of virtually every country, those who would be coming to Rio would be poised to launch a new generation of clean growth.

The signers of the Stockholm declaration called the protection and improvement of the environment "the urgent desire of all peoples." They could never have known how far we'd come in these two decades -- and how much further we'd have the potential to go.

Thank you, God bless you, and God bless the United States of America.

#



Fax Message

from the EPA Office of Water

Number of Pages To Follow ~~11/11~~ (1)

Transmit to Fax Number 456-6218

Please deliver Immediately to:

Name Jean Burton Jennifer Grosman
Organization _____
Room _____
Telephone _____

Sent by

Ben Luser

Comments

"as requested"

To Confirm Receipt or Report Transmission Problems, Please Contact

Name

Arlin A. Wright

Voice Phone

260-5700

Sent via Fujitsu Dex 140 (202) 260-5711

Note to: Jennifer Grossman, by fax no. 202-456-6218

From: Ben Lesser 260-5692



Date: May 29, 1992

RE: Water accomplishments

As we discussed, the waste water statement has to have some specific caveats:

Since 1977 we have achieved an 80 per cent reduction in solid pollutants (or "suspended solids") from industries and sewage treatment plants (or "point sources" of pollution.)

This figure is not carved in stone anywhere, but we believe we can support it if challenged.

I'm sure I butchered your name, but can't read the note given me. Sorry!



Fax Message from the EPA Office of Water

Number of Pages To Follow ~~1~~ (2)
Transmit to Fax Number 456-6218

Please deliver Immediately to:

Name Jean Burton Jennifer Grosman

Organization _____

Room _____

Telephone _____

Sent by Ben Lewis

Comments "as requested"

To Confirm Receipt or Report Transmission Problems, Please Contact

Name Austin A. Wright

Voice Phone 260-5700

Sent via Fujitsu Dex 140 (202) 260-5711

United States
Environmental Protection
Agency

Communications, Education,
And Public Affairs
(A-107)

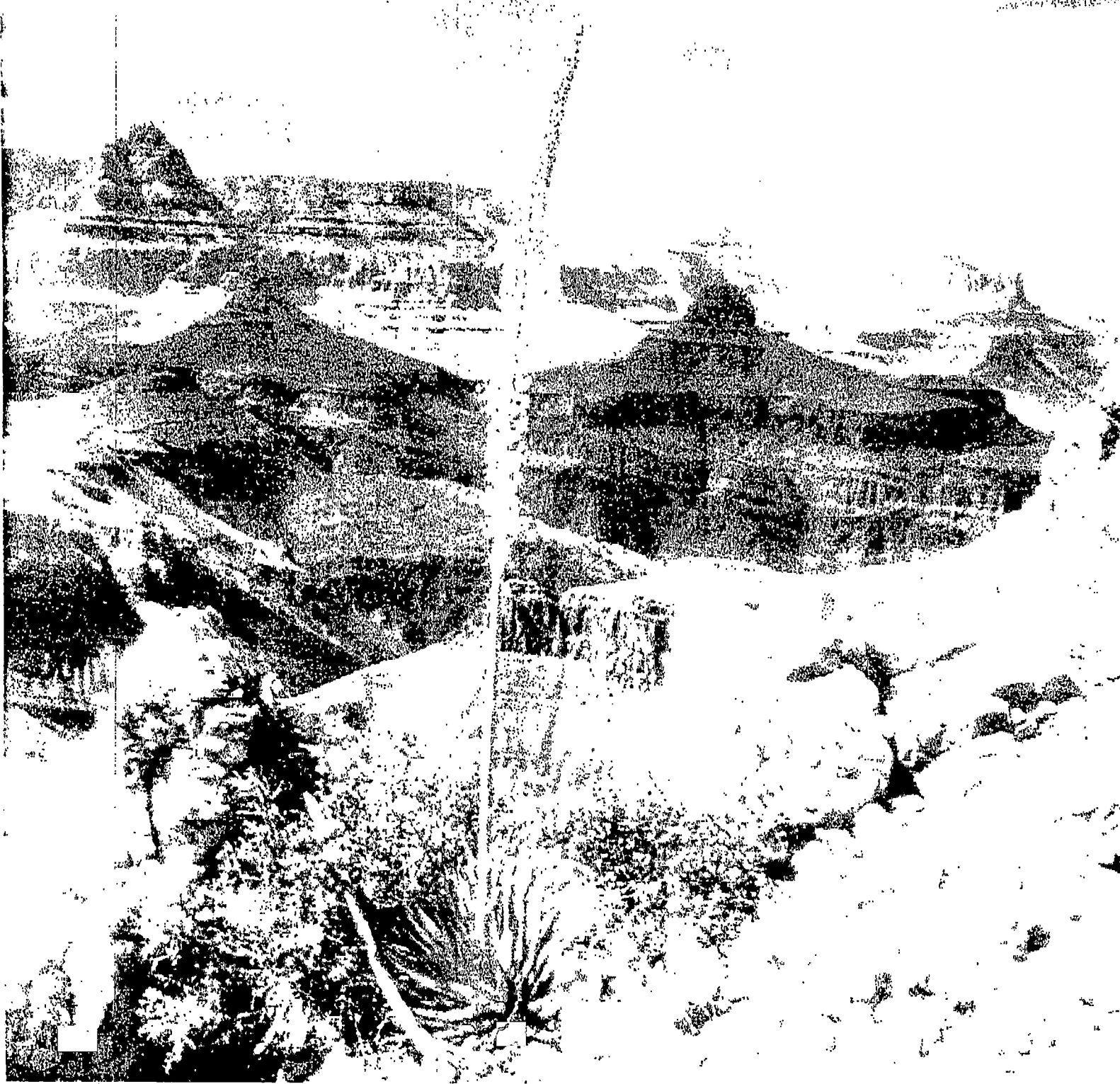
175 R-92-001
April 1992

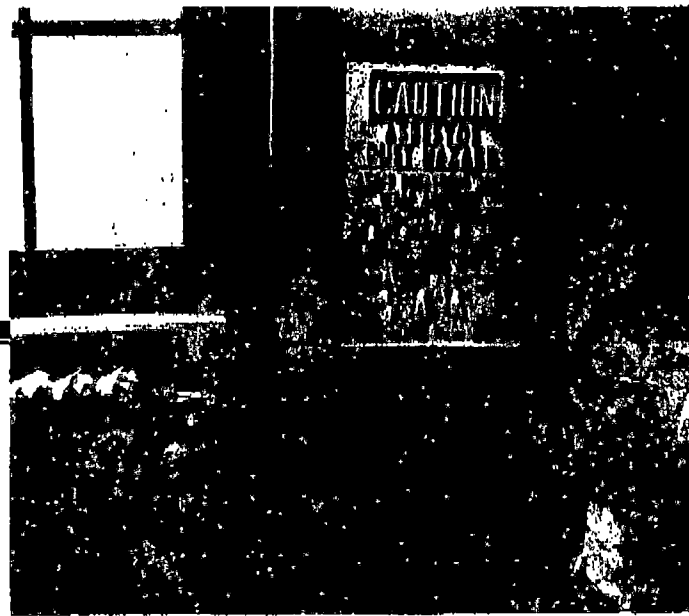


Securing Our Legacy

An EPA Progress Report 1989-1991

LESSER





low; but it identified a need for improved inspections and abatement actions in some schools. Two 1992 guidance documents—one on reinspections, and the other on the responsibilities of a school district's designated AHERA official—should help schools further improve their asbestos control efforts.

and cleaning up ground-water contamination, and site maintenance after a landfill is closed. Special provisions were made to ease the regulatory burden for some small communities (see page 47).

♦ **Hazardous wastes.** EPA issued final regulations in 1990,

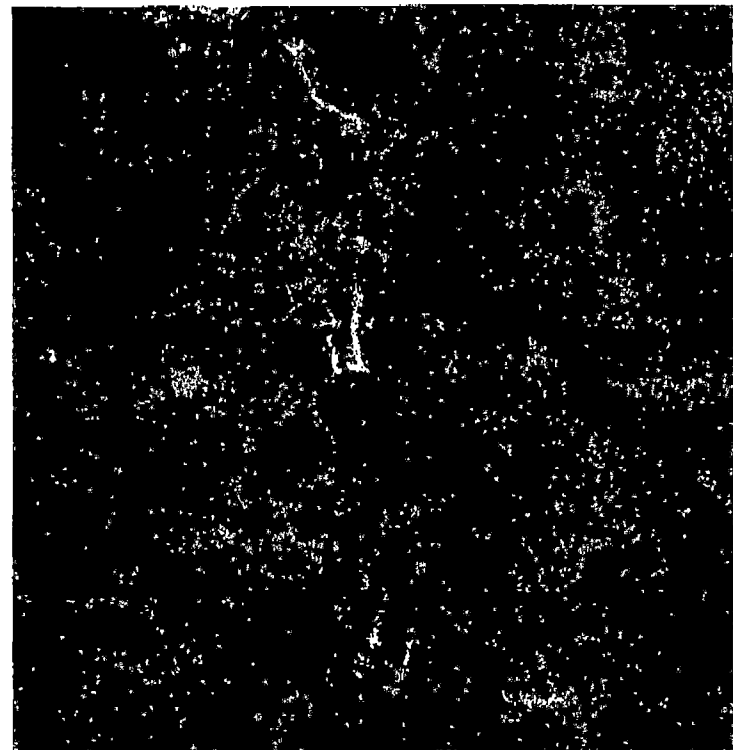
effective in May 1992, that restrict land disposal of hundreds of untreated wastes. New treatment standards are designed to reduce toxicity of wastes, prevent future ground-water contamination, and ensure safer management of hazardous wastes.

- ♦ **Underground storage tanks.** EPA worked with states and private parties to clean up contamination from leaking underground storage tanks. More than 1.7 million regulated underground tanks across the nation store petroleum and other hazardous chemicals that can cause fires and explosions, contaminate drinking water, and damage lakes and streams. From 1987 through 1991, cleanups began at more than 86,000 sites and were completed at more than 29,000. Six state programs had been approved by early 1992.

Water Quality

One of the nation's most persistent and troublesome environmental problems is the discharge of toxic substances into water from a wide variety of sources. EPA has taken many steps to protect the nation's water supply:

- ♦ **Storm water.** Pollution from stormwater runoff from farms, city streets and other sources is responsible for as much as 30 percent of the national water quality problem. EPA issued a storm water rule in 1990 under the Clean Water Act describing how 100,000 industrial facilities, 173 cities and 47 counties can obtain permits for discharging storm water into municipal sewage systems. Stormwater management permits developed under this program will specify the use of best management practices to prevent pollution.
- ♦ **Water quality standards.** EPA proposed water quality standards in 1991 for as many as 105 toxic pollutants in 22 states that have failed to adopt adequate standards on their own. This was the largest, most comprehensive standard-setting action ever taken under the Clean Water Act.
- ♦ **Toxic waste.** EPA's effluent guideline regulations annually prevent the direct release of more than 500 million pounds of toxic chemicals to water from 51 types of industries, including iron and steel, organic chemical, and metal finishing plants.
- ♦ **Drinking water.** EPA issued standards in 1991 for 38 inorganic and synthetic organic chemicals commonly found in drinking water, and re-proposed standards for six others. Final standards for lead and copper in drinking water were also published in 1991. Since 1989, the number of drinking water contaminants regulated by EPA rose from 35 to 62, and will reach 85 by the end of 1992.
- ♦ **Municipal landfills.** EPA issued new requirements for more than 6,000 municipal solid-waste landfills in 1991 to protect ground water and the health and safety of communities. The rules cover design and operating requirements, procedures for preventing, detecting,





Fax Message

from the EPA Office of Water

Number of Pages To Follow 7
Transmit to Fax Number 456-6218

Please deliver immediately to:

Name Jean Burton Jennifer Grosman
Organization _____
Room _____
Telephone _____

Sent by Ben Lewis

Comments "as requested"

To Confirm Receipt or Report Transmission Problems, Please Contact

Name Arlin A. Wright

Voice Phone 260-5700

Sent via Fujitsu Dex 140 (202)260-5711

William R. Rilly
testimony
4/91

- 2 -

by untreated sewage and industrial discharges. Despite our accomplishments, we have many important challenges ahead. I am here today to provide some perspective on the scope of our programs under the Clean Water Act, what we have accomplished over the past 20 years, and where we need to head in the future.

STATE OF THE NATION'S WATERS: TWO DECADES OF ACCOMPLISHMENTS

For a moment, let me "paint a picture" to illustrate what our waters were like two decades ago. In the late 1960's, President Lyndon Johnson declared the Potomac River a national disgrace. The river was clogged with blue-green algae blooms which killed fish and destroyed underwater habitat. The extensive pollution in the river was both a nuisance and a genuine threat to public health. It has been said that the sad condition of the Potomac was among the more powerful catalysts driving the early environmental movement. Another memorable symbol of those times was the Cuyahoga River which was so loaded with industrial waste--oil, grease, heavy metals, and other toxics--that it periodically caught fire. Massive algae blooms choked the Great Lakes, particularly Lake Erie and Ontario, killing millions of fish and tainting the water supplies of millions.

At the time, many States had water pollution control programs. However, they were limited in scope and effectiveness, and there was a great deal of variation among States and virtually no federal authority.

The Federal Water Pollution Control Amendments (Clean Water Act) of 1972 provided that the federal government (through EPA) would assume the lead role in coordinating and defining water pollution control programs across the country. The law set forth national goals and objectives, established an enormous public works program to build and improve municipal waste water treatment facilities, expanded water quality standards to intrastate waters, and established the National Pollutant Discharge Elimination System (NPDES) permit and enforcement program. Moreover, it established a national policy that municipal and industrial dischargers meet uniform technology-based limitations. Over the last 20 years, the Clean Water Act has provided a remarkably successful framework for EPA and the States to address the gross pollution problems caused by domestic sewage and industrial discharges.

Since 1972, the Nation has invested over \$75 billion in federal, State and local funds to construct municipal sewage treatment facilities across this country. We have almost doubled the number of people served by the statutory goal of "secondary treatment" or better from 85 million in 1972 to 144 million in 1988. We now have a total of 15,591 municipal wastewater treatment facilities in operation, approximately 82% of which have been constructed to provide secondary treatment levels or better.

To control the overwhelming amount of industrial waste that was being poured into our Nation's waterways, EPA and the States have issued permits covering approximately 70,000 industrial facilities. We have implemented discharge standards for over 50

industrial categories, typically reducing pollutant loadings by 90%. These technology-based requirements cover the majority of the direct dischargers and thousands of industrial facilities that discharge to sewage treatment plants. For example, these discharge standards reduced two conventional pollutants--total suspended solids and biochemical oxygen demand--by a combined total of about 1,000,000 tons between 1973 and 1984 in the pulp and paper industry alone.

The U.S. Geological Survey (USGS) reported that in the decade 1972-1982 alone, municipal loads of biochemical oxygen demanding substances decreased by an estimated 46% and industrial loads decreased by at least 71%. Continued progress has been made since then, with the emphasis since 1987 on removing toxic chemicals from discharges.

In the early 1970s, many of the Great Lakes States adopted phosphorus detergent bans to protect the Great Lakes and other waters in the region which were affected by excess nutrients, which create fish and habitat-killing algal blooms. USGS data reflect the results of these bans, documenting declines in total phosphorus concentrations in the Great Lakes and Upper Mississippi regions. In particular, between 1967 and 1985, phosphorous loadings to Lake Erie decreased by roughly 60%.

Ocean dumping of industrial and municipal sewage sludge was also a problem in the early 1970's. Today it has nearly come to an end. In 1973, we dumped approximately 5.9 million wet tons of industrial waste into the coastal waters of the United States.

This dumping has stopped. The dumping of sewage sludge is also being terminated, and is now limited to a few municipal sewage systems in the New York/New Jersey area. New York City will be the last of these systems to halt ocean dumping of sewage sludge, and is scheduled to do so by June, 1992.

As we move toward reconciling our environmental goals with our economic goals, we are beginning to glimpse the true benefits of environmental protection and its interrelationship with continued economic prosperity. We have not attempted to quantify the costs of not pursuing environmental protection, but many of the benefits are obvious, including: improved health and increased life spans; the value of our waters as sources of food supply, recreation and commerce; improved efficiency of our industries and farms; and, the unmeasurable value of wildlife and the natural environment.

Over the last decade we have continued to invest in water quality. Our level of investment has increased substantially from roughly \$24 billion in 1981 to nearly \$41 billion in 1991. I think it is obvious that these have been sound investments; it is also heartening to know that the American people are willing to increase their investment in clean water and in a sound environment.

We have a great deal for which to be proud. The Potomac now supports recreational fishing. In fact, progress has been so great in the Potomac that President Bush caught a three-pound bass last April. From what we can tell, the last President to fish the River was Teddy Roosevelt. Lake Erie is also recovering, and the massive

algae blooms so common in the late 1960's and 1970's are a phenomenon of the past.

Today, nearly 75% of the Nation's assessed surface waters are meeting their statutory goals. When we think back one or two generations and remember the water-borne diseases of our grandparents' generation, we can be proud and thankful for our achievements. When we read accounts of the dangerous exposure levels of Eastern European children to lead, nitrate, and arsenic, we can be thankful for the vision embodied in the Clean Water Act. When we read in the newspaper of the current cholera epidemic in Peru, with over 55,000 sick and over 258 dead from contaminated water and contaminate fish, it is a sobering reminder of how important it was that the Congress, 20 years ago, acted when it did.

HOW HAVE WE ACCOMPLISHED THIS PROGRESS?

In 1972, Congress gave EPA and the States broad authority to address water pollution. The goal of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of our Nation's waters." Under this mandate, we have developed sound programs to reduce point source discharges of pollutants entering all surface waters, including lakes, rivers, estuaries, oceans, and wetlands. In particular, the Clean Water Act creates a framework for controlling point source discharges which, I believe, has been quite successful and has resulted in enormous progress in improving water quality.

William Reilly -

Office of Water All-Hands -- April 7, 1992

Contact: Ben Lesser 260-5692

I am pleased to be here today. Away from contracts, air permits, Superfund cleanups and all the other Agency controversies. Today's celebration is for the water program -- where all is peaceful, no controversies, no irate constituent letters, no interagency bickering, just a mature program everyone is pleased with....

Actually, I know all too well the tough issues you face. Storm water permitting, contaminated sediment criteria, the toxics rule, sulfates, dioxin, the wetlands delineation manual, and so much more. I fully expect that during Office of Water Month you will settle all these issues once and for all.

LaJuana tells me that this month is a celebration of all that the office of water has accomplished -- and a celebration of the people who have made it all happen. Many of you have been making it all happen for the last 20 years. You have pushed us through the birth, childhood and adolescence of the Agency. You have made the water program develop, mature and succeed beyond expectation.

In 20 years you've accomplished a great deal -- you know the litany: \$65 billion spent on wastewater treatment. 144 million people now served by secondary or better. phosphorus detergent bans in the Great Lakes. BOD and suspended solid reductions across the nation. Industrial and municipal permits covering almost 65,000 facilities. 17 National Estuary Programs launched -- soon to be 21. An end to the ocean dumping of sewage sludge. Regulations developed for 62 drinking water contaminants with another 23 set for promulgation next month. And the list of accomplishments goes on.

This office is a vibrant, exciting and cutting-edge program. The fact that it is mature is no detraction -- something I find myself explaining ever more frequently to my own daughters these days.

As we have accomplished a great deal, we have learned a great deal. We have promulgated the first rules for wet weather runoff, including the nation's first storm water regulations in November of 1990, and our first non-point source control proposal just last June. We issued a landmark ground water strategy last May which sets a new policy direction for the Agency.

We know there is much more to be done. In the broadest sense, our efforts at epa can be grouped around three overriding missions.

First, we have an obligation to strive to restore and protect the natural, ecological systems of the United States. Ours is a mission that goes beyond human health. We must protect the wetlands and groundwater, the estuaries and lakes, the soil and fish, the whole biotic platform of the United States. In fact, we must strive to restore and protect the life support systems of our planet, working with countries such as Mexico and the fledgling democracies of Eastern Europe which now face ecological disaster after

decades of uncontrolled industrial growth.

Second, we have the great challenge of ushering in a new era of integration between the nation's economic goals and its environmental aspirations. All activity -- including economic activity -- depends on healthy systems. We must strive to bring home the point that environmental protection is essential to the long term vigor of the economy. We must strive to find low cost and flexible alternatives for environmental protection efforts - to bring down the cost of compliance. That is as great an incentive for people to protect the environment as any regulations we could write.

And third, we must set priorities for these efforts based on risk. We will set our risk-based priorities properly through the application of sound science. Science is the lifeblood of our efforts and crucial to maintaining the public's confidence. I applaud your efforts in the Office of Water to strengthen basic science by building a science and technology office. Your work through that office to develop a national toxics rule, to establish contaminated sediment criteria, and to build our knowledge base on the human health concerns of fish contamination, are examples of the considerable scientific talent here.

Our risk-based targeting in the agency is leading us to increase our focus on protecting the ecology as well as human health. One of the key points raised in the SAB's recommendations on reducing risk was the idea that "EPA should attach as much importance to reducing ecological risk as it does to reducing human health risk."

Your efforts in the office of water are critical to the agency accomplishing these missions. I know we can do it. One year ago this month you went through the tough job of reorganizing this office. It is a job well done. Through that effort you have streamlined programs and reduced program overlaps. You have positioned your Office to use well the tools we have refined over the last several years: risk based priority setting, geographic targeting and pollution prevention.

YOU ARE ALSO CREATING A STRONGER ENFORCEMENT PRESENCE, WHICH IS CRITICAL TO OUR SUCCESS. Not only must we ensure that violators of the nation's laws are punished, but strong enforcement also provides an added impetus to pollution prevention activities. In order to walk softly, it helps to carry a big stick.

OFFICE OF WATER LEADERSHIP LED EPA TO COLLECT RECORD SUMS FROM WATER POLLUTERS IN 1991. In one year, the Office of Water assessed more than 25 per cent of the total civil penalties assessed under the Clean Water Act since 1975. Clean Water Act penalties amounted to 37 per cent of the penalties collected by the entire Agency in FY91. Your enforcement efforts have been tireless. LaJuana and Rosanna Ciupek (kyoo'-pek) even had the dubious distinction of coming by my house one midnight to go over the Exxon Valdez settlement with me while I sat in my pajamas. I don't know if the "pajama factor" helped, but we now have an

Pat Quinn

260
5200

Association of State &
Interstate Water
Pol. Control
Administrators

level

758,000 river + stream
miles assessed

36% met state's water
supply

bad 94%

Since 1977, carbon monoxide levels in our air have been cut
30 percent; ozone 20 percent; particulates 25 percent; and sulfur
dioxide 17 percent. The discharge of suspended solids into our
waterways was cut by over 80 percent. [And as of 1988, 96 percent
of our lakes and reservoirs were found to be fishable and
swimmable.]

usage
in 72
in 82
64%
met standards

Rivers + streams 70%
Lakes + Reser 60%
Estuaries 67%
As of now

EPA figures

Throughout these two decades since Stockholm, then, America
has been the leader in protecting the environment.

In the last four years, we have worked to extend that record
-- on every front. The 1990 Clean Air Act will cut emissions of
sulfur dioxide in half, emissions of toxic chemicals by ninety
percent, and the number of U.S. cities not meeting smog and
carbon monoxide standards from over a hundred to a handful by the
end of the decade.

We've signed new laws to prevent oil spills by requiring
double hulls on oil tankers, [to protect the flyways of migratory
birds,] and to help protect our largest rainforest -- the Tongass.
We have fined and jailed polluters in record numbers; placed a
moratorium on oil and gas drilling in precious areas of our
coasts; [added over a billion dollars to our system of parks,
wildlife refuges, forests, and public lands;] launched a
reforestation plan to plant a billion trees a year; and signed
international agreements on everything from the transboundary
movement of hazardous wastes to the protection of the African
elephant.

Don Dudge

Interior
Nat Park
Service

Next week, dozens of heads of state will again gather -- in Rio de Janeiro. I will join them, because the United States has a stake -- indeed, every nation has a stake -- in a safer, cleaner world.

And I suppose it is only fitting to come to this center, on the eve of the Rio summit, to talk about my vision for building such a world. To talk about what we have accomplished -- and what we hope to accomplish. To talk about the lessons learned since Stockholm, and about the road ahead.

Goddard, through its invaluable contributions to the understanding and observation of our earth, has in a very real sense made progress at the UNCED meeting possible.

Your work has revealed some fundamental truths about the environmental challenges we face.

A spacecraft created at Goddard provided the world with its first image of Earth from space. In one breathtaking photo, you underlined what volumes of words could not have described better -- that the earth and its atmosphere are our common inheritance. That any solution to the problems facing the earth must involve every nation -- because those problems are global in scope.

It was Goddard scientists who developed the Upper Atmospheric Research Satellite -- UARS --- launched last year, which is providing us new insight about the ozone layer. The buildup of chlorine in the upper atmosphere, and the depletion of

ozone, are long-term problems, built up over many years. They will require sustained commitment to solve.

And the lion's share of the science that the world is using to understand our climate comes from a program with its heart and soul right here -- the U.S. Global Change Research Program, built around the Earth Observing System that Goddard is developing. We are still learning about the enormously complex challenges this planet faces -- from global warming to El Nino, from biodiversity to desertification. To make the right decisions, we will need to learn as we go. So we need a sustained investment in the knowledge base that makes sound policymaking possible.

At the end of the day, that's what the Rio summit is all about. Policy. Making decisions. And taking action.

Frankly, the United States of America has brought a very non-nonsense approach to the preparations for Rio. We have made it clear that what matters to us, what matters from the perspective of the global environment, and what should matter to those who care about its health, is action.

From the beginning of the climate change negotiations which formed the centerpiece of this conference, we made clear this bias for action.

[We offered to host the first round of negotiations at Chantilly, Virginia in 1991.] And at that time, we laid on the table an action agenda on climate change -- with specific policy proposals we were implementing or prepared to implement, and with our specific calculations concerning how much we expected to

6
reduce greenhouse gas emissions as a result of those policies.

The result was encouraging. We found that our expected year 2000 greenhouse gas emission levels were expected to be below our current levels.

When the science changed, indicating that cutting CFCs would not reduce warming as much as we had thought, we supplemented that plan. Earlier this year, we added a whole range of additional measures -- from EPA's Green Lights program to the range of energy efficiency measures contained in my National Energy Strategy. We again laid our plan on the table -- in specific detail -- showing that our policies would reduce U.S. net greenhouse gas emissions by 125 to 200 million tons a year by the year 2000.

No other nation has laid out such a specific plan of action. And that explains our strategy during the negotiations. That every nation should have a plan of action, with a focus on results -- not rhetoric.

It may not have been widely reported in the press, but in area after area, the U.S. laid down specific proposals, and worked for their adoption. Forests. Oceans. Living Marine Resources. Public participation. Financing.

Make no mistake: America has not retreated, and will not retreat from its leadership role in protecting the global environment.

Today, the United States spends about two percent its Gross National Product -- over 100 billion dollars per year --

*Don Dullage
Air Policy Analyst
+ office of
+ Air + Radiation
+ Asst
+ Admins
9/5/74
260-
5663*

*Grady
dwyer*

*Don
Dullage*

*EPA
chart*

protecting the environment from pollution. That investment is scheduled to rise.

That continuing commitment of resources and national energy reflects one central tenet of our policy -- that what counts is performance over the long haul. We may not go to Rio with the best words, but we will go with the best policies.

More importantly, the commitment to act must not end at UNCED. If Rio is a one-shot deal, it will have been a failure.

So when I travel to Brazil next week, I will bring with me several proposals to extend the commitment of the world community into the future. We need not just the will to meet, but the will to act.

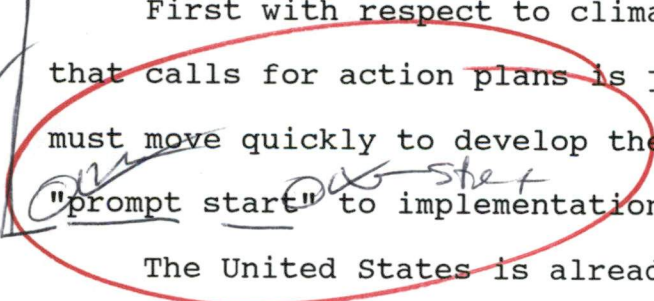
To make sure that the process and the institutional capacity for follow-up exists, we will endorse a continuing entity under the auspices of the United Nations -- a Council on Sustainable Development -- to help foster the international cooperation we will need to tackle these global problems.

To strengthen the will to act, I will offer a four point plan of cooperation.

First with respect to climate. The signing of a convention that calls for action plans is just a first step. Now countries must move quickly to develop them. So I will join in proposing a "prompt start" to implementation of climate action plans.

The United States is already well along the road to not only developing but implementing its action plan. But we stand ready

Bill Pistorz
260-
5200



to assist others -- particularly the developing countries -- in preparing theirs.

The participation of these developing countries is vital.

Pist Over the next three decades, carbon dioxide emissions from the developing countries are projected to triple. While today these nations account for about one quarter of the world's emissions, by the year 2025, they will contribute almost half. So any agreement which ignores the need to include them is destined to fail.

Pist To begin this process, the United States has already committed to help fund country studies that can help these nations identify the sources of emissions and the best means of curbing them.

Pist We have insisted throughout the negotiations that any solution to the climate change problem must be comprehensive -- that is, it should allow for the inclusion of all sources and sinks of greenhouse gases. The agreement we have reached does just this.

Pist One of the most cost effective means of reducing net emissions for many countries will be to enhance greenhouse sinks -- in particular, forests.

Pist So the second point which I will propose in Rio is a major new initiative to protect and enhance the world's forests.

Pist The benefits of forests are many -- they filter the air and water; they provide products from timber and fuelwood to

ingredients for Ben and Jerry's Ice Cream; they sequester carbon; and they provide habitat for all manner of living things.

Tropical forests cover just seven percent of the world's surface -- yet they are home to more than half the world's species. ^{Deforestation} And forest loss today contributes about 20 percent of net man made carbon dioxide emissions.

check's
???

We can jump start progress on addressing global warming and protecting the biological diversity of the earth with a single forceful step on behalf of forests -- and we can do it today.

Piston

At the Houston Economic Summit two years ago, I proposed to the leaders of the G-7 countries that we work for a global forest convention. And it remains my hope that the principles leading to such a convention will be agreed at Rio.

But I propose today to move ahead in advance of that formal convention. At Rio, I will ask the other industrialized countries of the world to join me in doubling worldwide forests assistance. The goal of this initiative would be to stabilize world forest cover by the ^{early next decade} end of this decade.

doubly check's

About \$1.35 billion dollars a year are now provided worldwide in forest assistance. I propose to double this amount to \$2.7 billion. As a downpayment, the U.S. will increase its bilateral forest assistance by 150 million dollars next year.

Piston

Forests today are under stress. In the last decade, tropical forests have disappeared at a rate of over 40 million acres a year.

double check

fish
 This initiative would reverse that trend. The assistance can be provided through existing bilateral or multilateral mechanisms. And recipient countries could propose new projects.

Crazy
 The plan is to encourage investor countries to in effect bid on the most effective projects. This down payment on forests will use a market mechanism to achieve the greatest environmental return -- because investments will flow to the projects with the greatest marginal benefit in terms of decreased net emissions or critical habitat preserved.

fish
 ((We will also act to get our own house in order. We will push Congress to fund our program -- the world's largest reforestation effort -- to plant a billion trees a year. And this week, the Forest Service will adopt new rules to end the clearcutting of our national forests as an acceptable forest practice.))

Saving the forests may be the most effective immediate step the world can take -- but it is not the only one.

The history of the world has been to benefit from technology. Technology has made us more productive, and raised our standard of living. In the U.S., technology has helped us cut pollution, and become more energy efficient as well.

Doc
 That's one reason that my budget includes an investment of almost a billion dollars in developing the new energy and efficiency related technologies of tomorrow.

It is time for a new generation of clean growth -- the world over. We need a quantum leap in the world's develop,

fueled by new, more energy efficient technology -- and yes, I hope much of it will be American technology.

fish

In preparation for the UNCED summit, I met with the Business Council for Sustainable Development -- businessmen from around the world who sense the opportunity presented by a partnership between businesses and governments oriented toward cleaner, more efficient development.

✓

I am pleased to note that hundreds of American businessmen will be travelling to Rio for this conference. I want the opportunities facing them -- and the benefits their goods and services can provide to the rest of the world -- to be long lasting.

fish
time

So the third part of our plan is to support a broad program of technology cooperation at Rio -- and afterwards. Specifically, I propose to create a Technology Cooperation Corps. This Corps would be teams of U.S. businessmen and women who, with institutional support from the government, would investigate the needs of countries around the world for environmentally sound technology, and knock down the barriers to making it available.

The need for an ongoing program of technology cooperation underscores the point that our ability to address global environmental challenges is evolving -- as indeed is our understanding of the challenges themselves.

Study

So the fourth point of any program for a cleaner future must involve a continued program of research and understanding. This year, we are requesting over \$1.4 billion for the U.S. Global

1/24 93
budget

Change Research Program -- that's more than half the money spent on climate research in the entire world.

We want to make sure that this work is useful. That was the point behind our restructuring of the EOS program last year -- to get results faster, cheaper, and better. That's what Dan Goldin is driving for throughout NASA. Today, I am signing a National Space Policy Directive, developed by Vice President Quayle's Space Council, that will place us firmly on this path. By using new technology and smaller satellites, we can move up the timetable for obtaining critical data on global change.

The directive does something else -- it formalizes our policy of making this data available and affordable for scientists and researchers from the public and private sector from all around the world.

We believe in sharing the benefits of our earth observation system -- and I will take that message to Rio. To make that message concrete, we will distribute at UNCED, at no cost, thousands of copies of computer disks -- each with over a billion bytes of data -- with our best information on greenhouse effects.

And upon our return, the U.S. will open this year a Global Change Research Information Office to disseminate this information to governments, businesses, and scientists.

UNCED not only holds out the promise of ushering in an era of sustainable development; it gives us the chance to help launch a new generation of clean growth.

These four steps -- the preparation of solid action plans; a dramatic first step to protect and enhance forests; cooperation in deploying cleaner, more efficient technology; and an ongoing program to develop and share sound science -- can help us seize that opportunity long after the speeches in Rio have been given and the conference is over.

Our predecessors who met at Stockholm had the gift of foresight. They explicitly called for the discussion at Rio to be about both environment and development. They knew, back then, that the two were inextricably linked.

Only a growing economy which provides hope for the future can generate the resources and the will to manage natural assets for the longer term and the common good. But only assets which are so managed can support the growth on which so much human hope is hinged. By definition, for development to be successful in the long-term, it must be sustainable.

They couldn't have known how clear the lessons of history would be in the intervening two decades. How it would be revealed for all to see, when the pollution spawned by totalitarianism in Eastern Europe and for former Soviet Union was exposed to the world, that only free markets and democratic systems provide the accountability necessary for a clean environment.

They couldn't have known that, as the leaders of the world prepared to gather for this next earth summit, the specter of

nuclear war -- with its unthinkable destruction -- would be calmed as never before in our postwar history.

They couldn't have envisioned that, with a world at peace, a more knowledgeable public, and a commitment from the public and private sectors of virtually every country, those who would be coming to Rio would be poised to launch a new generation of clean growth.

The signers of the Stockholm declaration called the protection and improvement of the environment "the urgent desire of ^{of the} ~~all~~ ^{whole world} peoples." They could never have known how far we'd come in these two decades -- and how much further we'd have the potential to go.

Thank you, God bless you, and God bless the United States of America.

#

Pat Quinn
260-2090

((Grady))
5/27/92

PRESIDENTIAL REMARKS: ENVIRONMENTAL ADDRESS
GODDARD SPACE CENTER
GREENBELT, MARYLAND
MONDAY, JUNE 1, 1992
2:00 p.m.

Thank you, Administrator Dan Goldin, for that introduction.
((Senator Mikulski)), ((Administrator Reilly)):

You know, in just over a month on the job, Dan Goldin has supervised the recovery of a satellite on Endeavor's maiden voyage, won a vote to save the space station on the floor of the House, and launched his own "cultural revolution" at NASA. I'd say the "new NASA" is off to a flying start.//

✓ Twenty years ago this month, the leaders of the world gathered in Sweden to talk about the human environment.

The Stockholm Declaration they adopted had a simple conclusion, that: "...through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes."

copy of P.M. Dec.

That meeting occurred when the environmental movement was in its infancy. Later that year, the first Clean Water Act passed the United States Congress. [Our EPA at the time was one year old.] America, like so many nations around the world, was just beginning to face up to the consequences of unmitigated pollution.

double check

Back then, DDT levels showing up in wildlife around the Great Lakes were eight times what they are today. PCBs were six times as prevalent. Thousands of miles of rivers and streams

CEQ annual report table

P. 262
263
"12"

were not fit for swimming or fishing. Sulfur dioxide and lead clogged the lungs of city dwellers. The Cayohoga River in Cleveland actually caught fire spontaneously -- prompting the songwriter Randy Newman to pen the song "Burn on, big river, burn on."

Much has occurred since those early days of environmentalism. And much of what has occurred happened first in the United States of America. In just two decades, we've passed a comprehensive superstructure of statutes to protect our air, our water, and our wildlife -- to expand our natural areas and to clean up the lingering legacy of hazardous wastes. Today, America is a safer, cleaner nation -- and our laws have served as a model for environmental laws the world over.

We were the first nation to recognize the danger of CFC emissions by eliminating aerosol propellants, which we did in 1978. Other nations are now following suit as they meet their obligations under an international agreement to phase out CFCs.

We were the first nation, back in 1975, to adopt catalytic converters to reduce emissions from our cars and trucks -- European nations are now in the process of adopting them.

In 1982, we began phasing out lead from American gasoline.

Today, ambient levels of lead in our air have been cut by 95 percent. Now, several other nations are looking at the possibility of cutting back on leaded gasoline as a means of meeting their clean air objectives.

pg. 9

pg. 2

Epa
Riley
Made

not speed

not speed

not in
not speed

Air



National Air Pollutant Emission Estimates 1940 - 1990

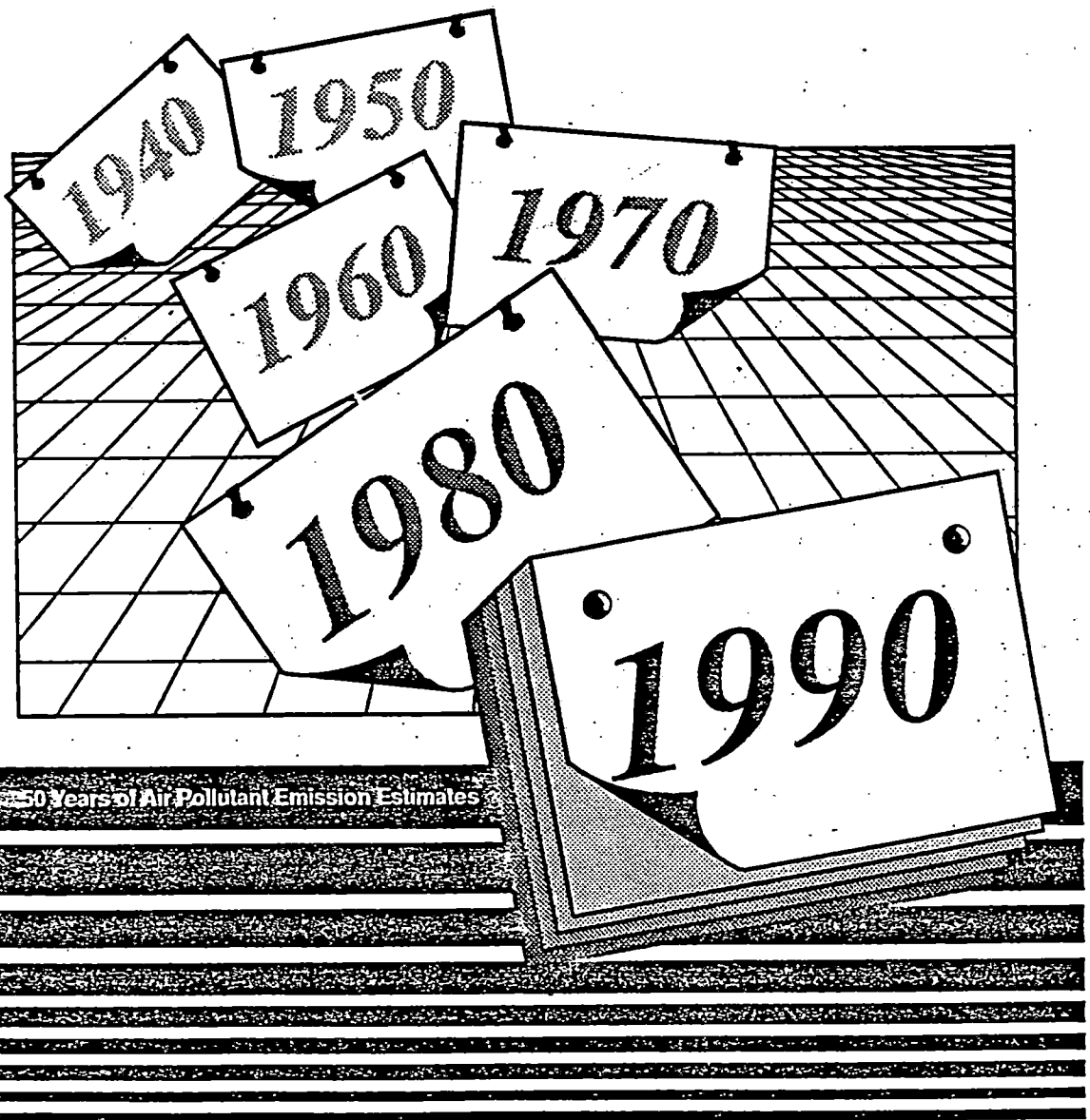
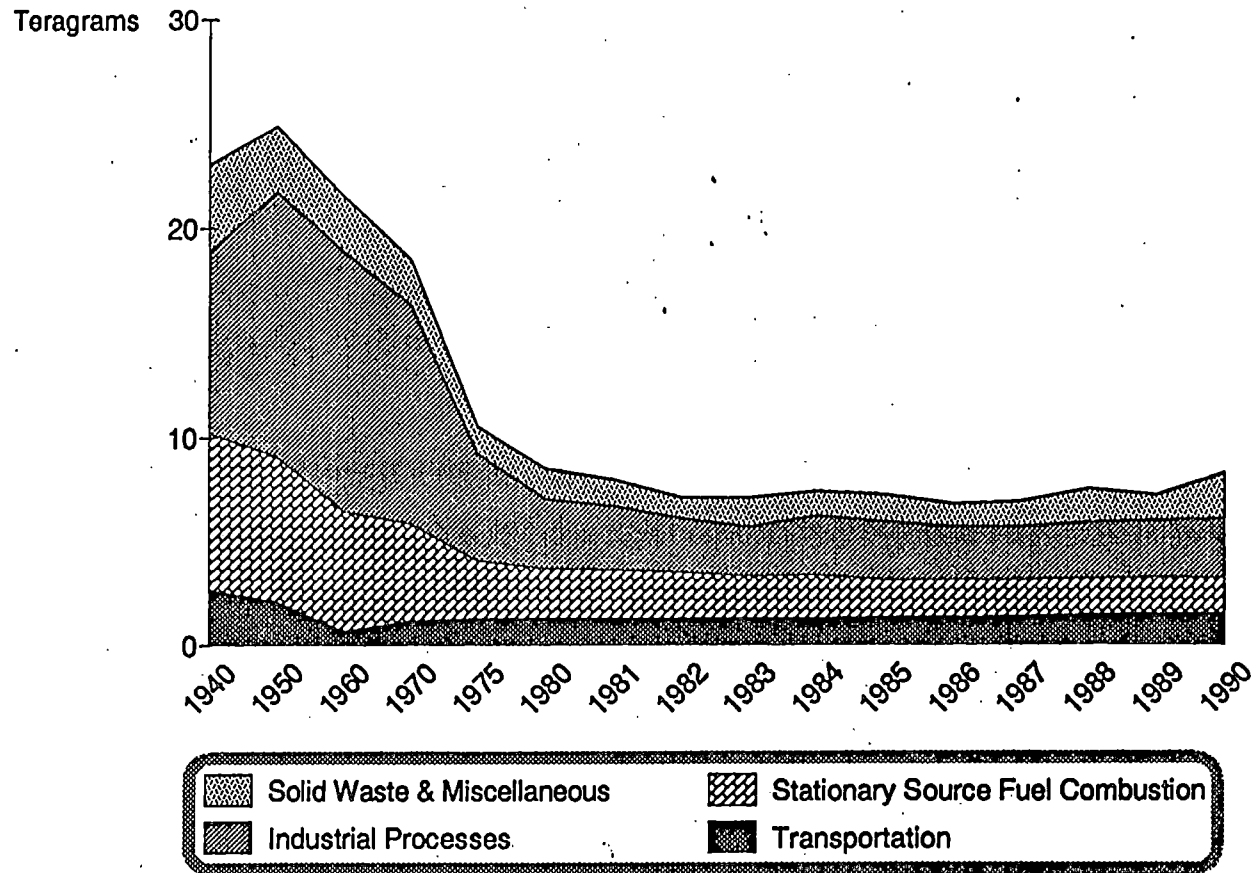
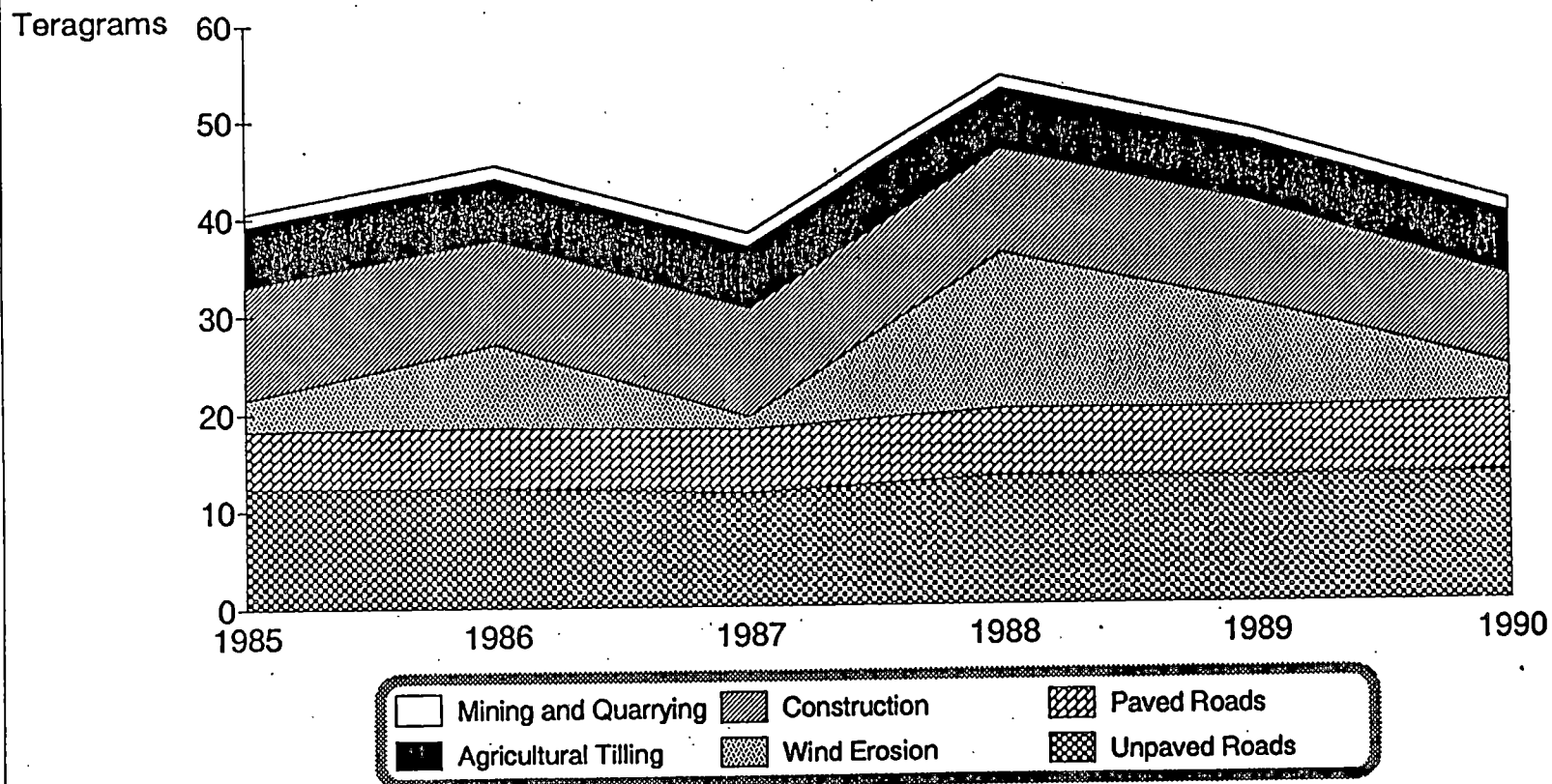


Figure 1. Trend in TOTAL PARTICULATE MATTER Emissions from 1940 to 1990 for the United States and by Source Category.



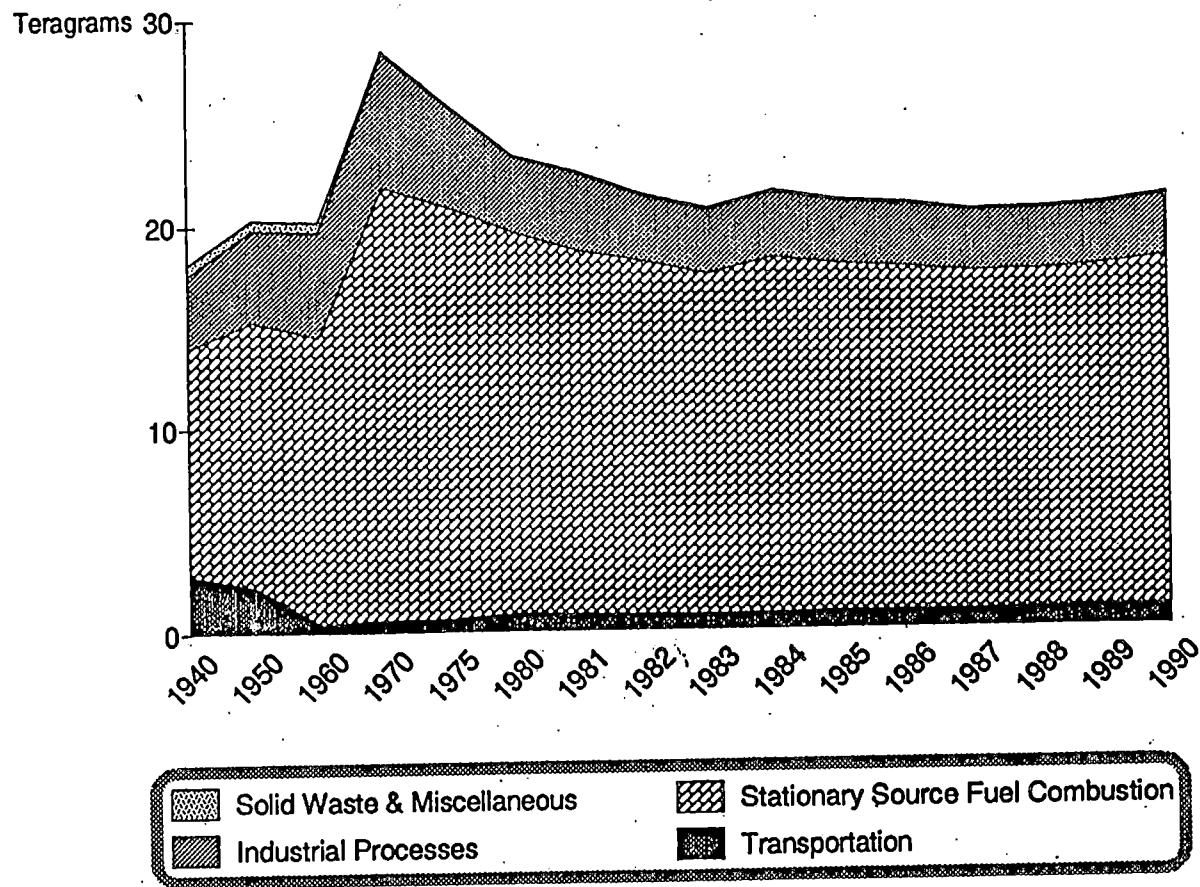
Note: One teragram equals one million metric tons, or approximately 1.1 million short tons (2000 lbs.).

Figure 2. Trend in FUGITIVE DUST PM-10 Emissions from 1985 to 1990 for the United States and by Source Category.



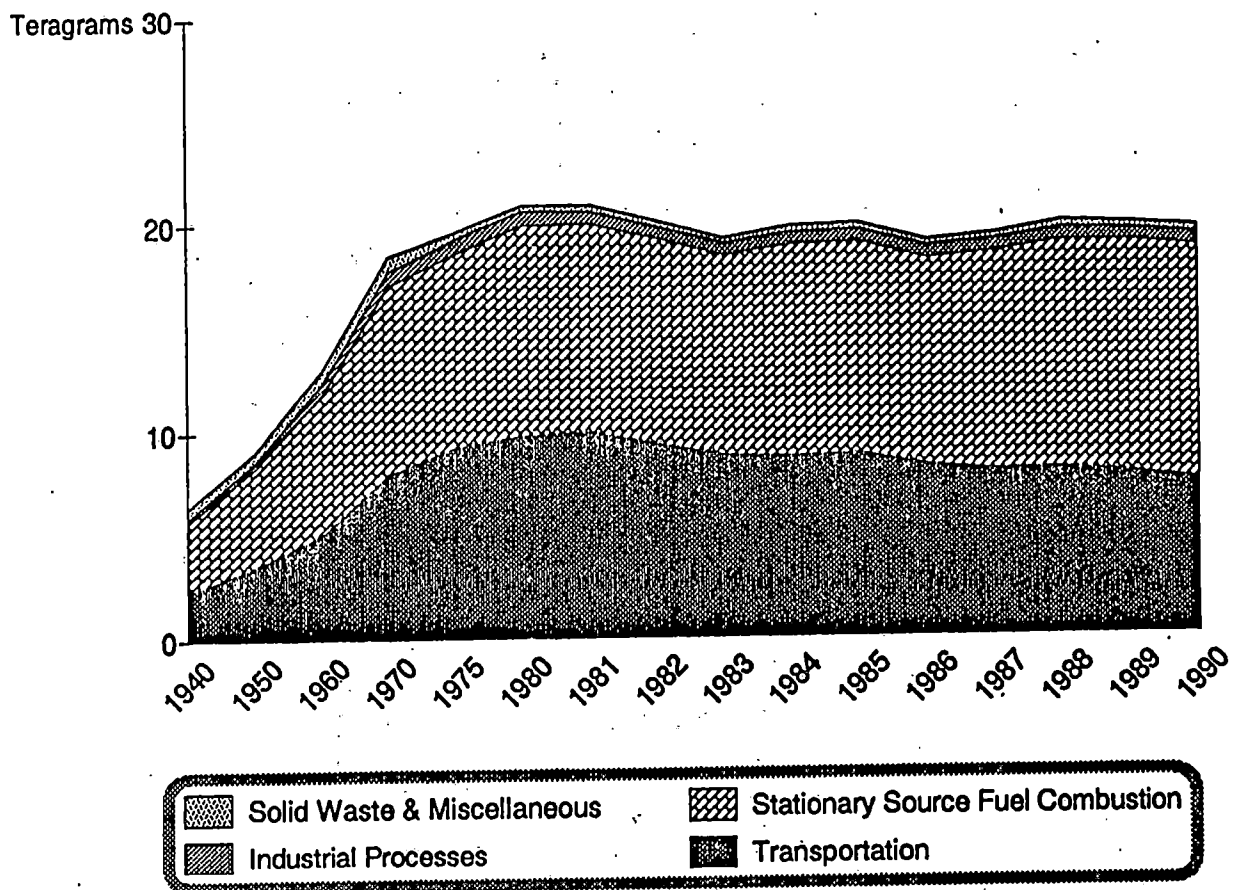
Note: One teragram equals one million metric tons, or approximately 1.1 million short tons (2000 lbs.).

Figure 3. Trend in SULFUR OXIDE Emissions from 1940 to 1990 for the United States and by Source Category.



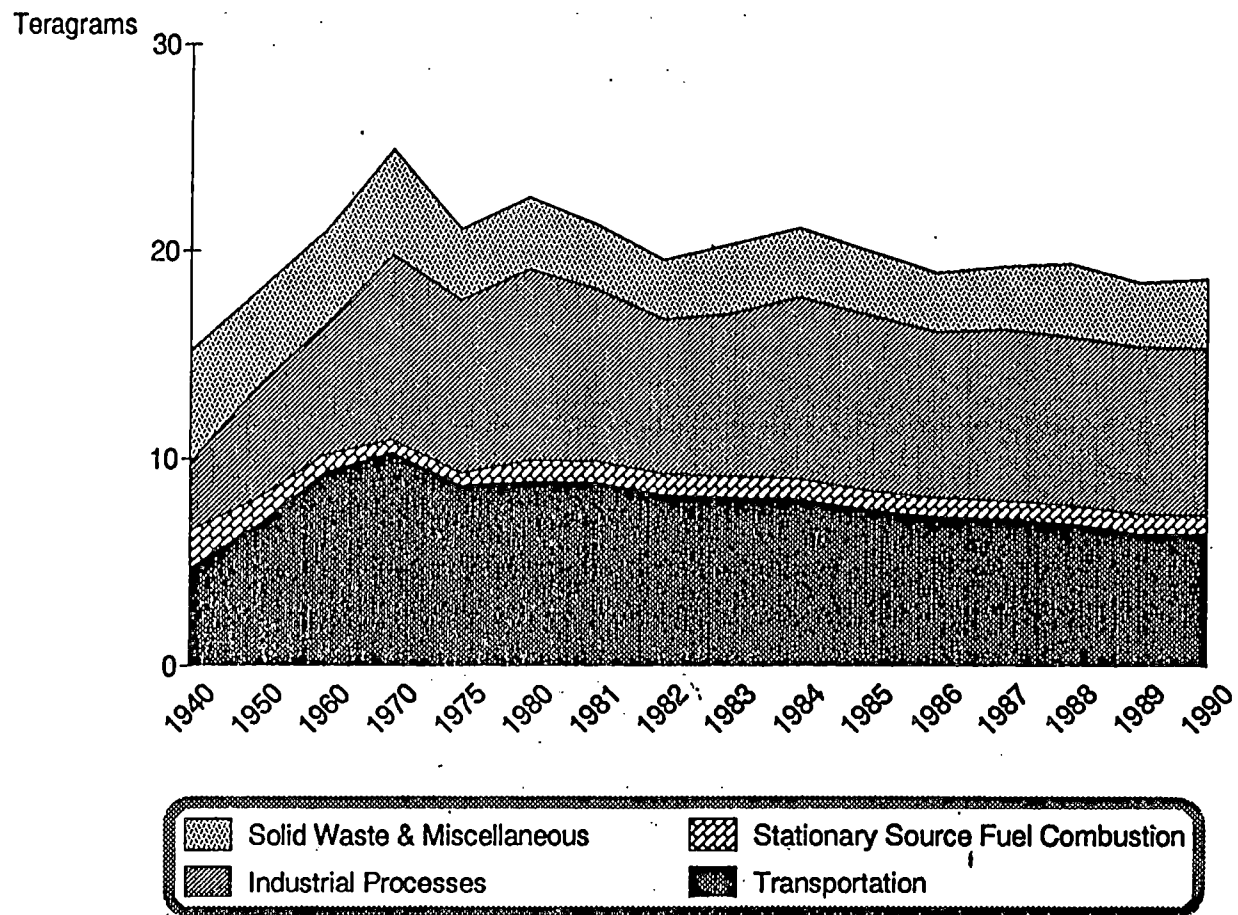
Note: One teragram equals one million metric tons, or approximately 1.1 million short tons (2000 lbs.).

Figure 4. Trend in NITROGEN OXIDE Emissions from 1940 to 1990 for the United States and by Source Category.



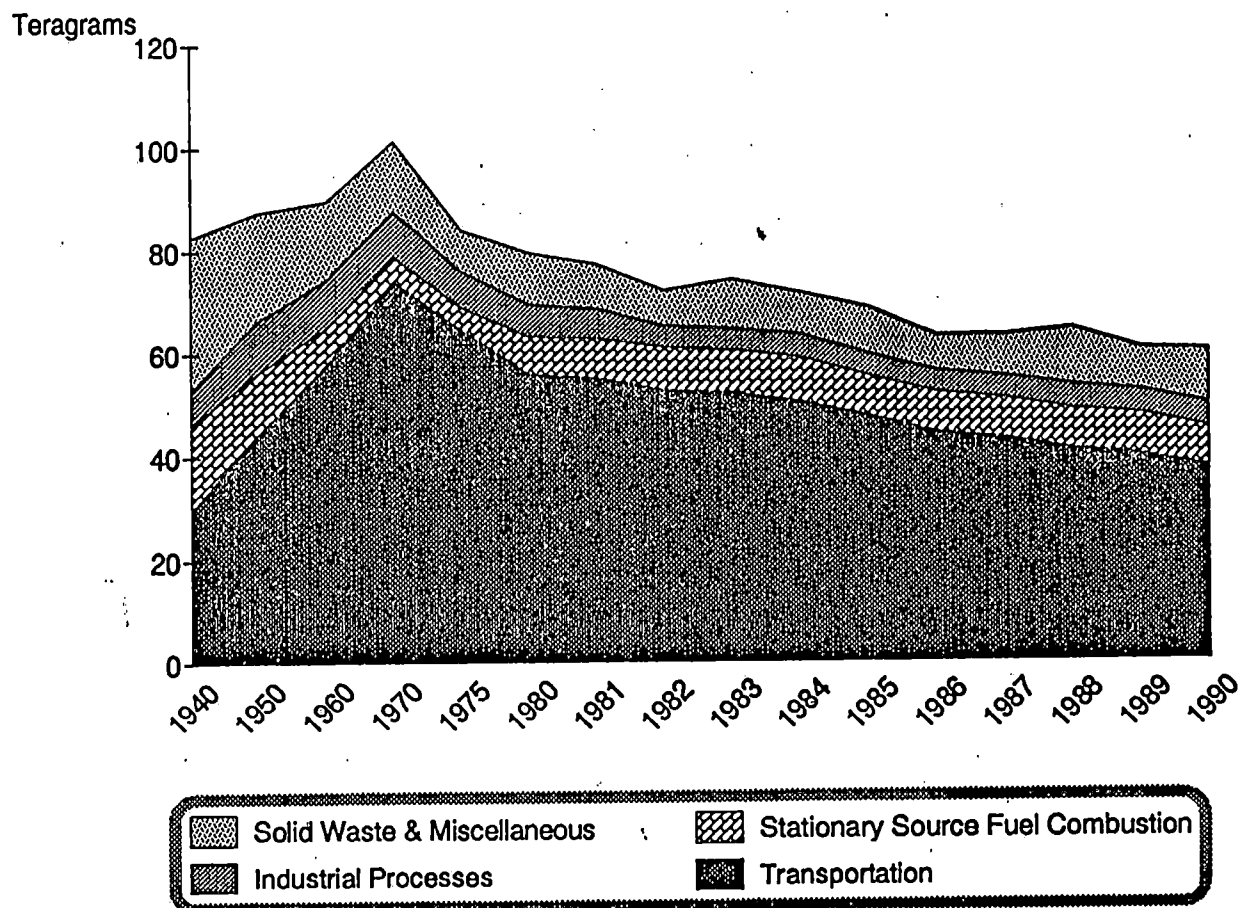
Note: One teragram equals one million metric tons, or approximately 1.1 million short tons (2000 lbs.).

Figure 5. Trend in NON-METHANE VOLATILE ORGANIC COMPOUND Emissions from 1940 to 1990 for the United States and by Source Category.



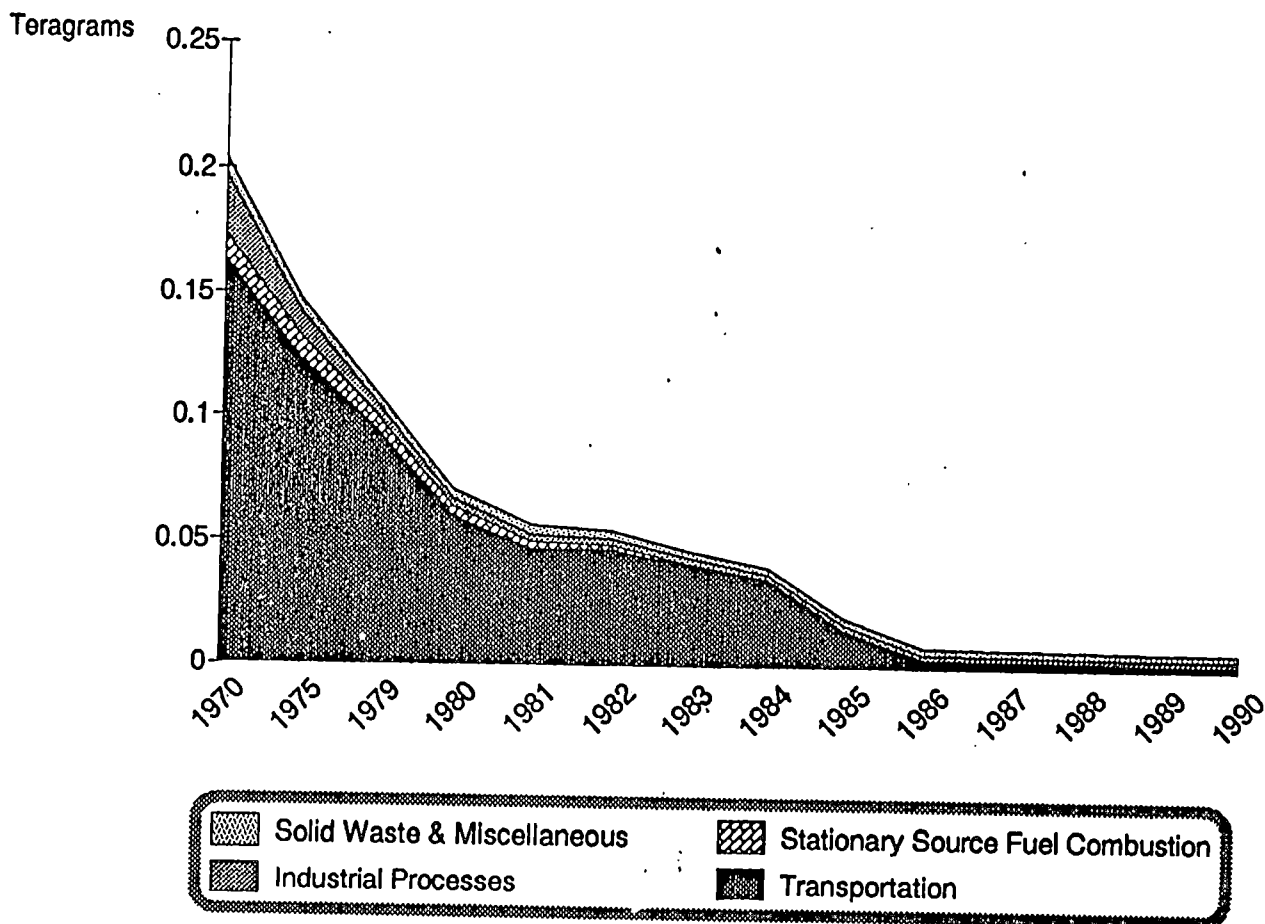
Note: One teragram equals one million metric tons, or approximately 1.1 million short tons (2000 lbs.).

Figure 6. Trend in CARBON MONOXIDE Emissions from 1940 to 1990 for the United States and by Source Category.



Note: One teragram equals one million metric tons, or approximately 1.1 million short tons (2000 lbs.).

Figure 7. Trend in LEAD Emissions from 1970 to 1990 for the United States and by Source Category.



Note: One teragram equals one million metric tons, or approximately 1.1 million short tons (2000 lbs.).

**TABLE 3. TOTAL NATIONAL EMISSIONS OF
TOTAL PARTICULATE MATTER, 1940-1990
(Teragrams/Year)**

Source Category	1940	1950	1960	1970	1980	1990
Transportation						
Highway Vehicles	0.2	0.3	0.6	0.9	1.1	1.3
Aircraft	0.0	0.0	0.0	0.1	0.1	0.1
Railroads	2.4	1.7	0.1	0.1	0.1	0.0
Vessels	0.1	0.1	0.0	0.0	0.0	0.0
Other Off Highway	0.0	0.0	0.0	0.1	0.1	0.1
Transportation	2.7	2.1	0.7	1.2	1.3	1.5
Stationary Source Fuel Combustion						
Electric Utilities	1.3	2.0	2.8	2.3	0.8	0.4
Industrial	3.3	2.8	1.8	1.6	0.5	0.3
Commercial-Institutional	0.4	0.5	0.1	0.1	0.1	0.0
Residential	2.5	1.7	1.0	0.6	1.0	1.0
Stationary Source Fuel Combustion	7.5	7.0	5.7	4.6	2.4	1.7
Industrial Processes						
Iron and Steel Mills	3.0	3.5	1.7	1.2	0.3	0.2
Primary Metal Smelting	0.6	0.6	0.5	0.6	0.1	0.1
Secondary Metals	0.2	0.3	0.2	0.2	0.1	0.1
Mineral Products	2.0	2.9	3.8	2.9	0.7	0.5
Chemicals	0.3	0.4	0.3	0.2	0.1	0.1
Petroleum Refining	0.0	0.0	0.1	0.1	0.1	0.0
Wood Products	0.5	0.8	0.9	0.7	0.2	0.2
Food and Agriculture	0.8	0.8	0.9	0.8	0.6	0.5
Mining Operations	1.3	3.4	4.1	3.9	1.1	1.2
Industrial Processes	8.7	12.7	12.5	10.5	3.3	2.8
Solid Waste Disposal						
Incineration	0.3	0.3	0.4	0.4	0.2	0.1
Open Burning	0.2	0.3	0.5	0.7	0.2	0.2
Solid Waste Total	0.5	0.6	0.9	1.1	0.4	0.3
Miscellaneous						
Forest Fires	2.9	1.7	1.0	0.7	1.0	1.1
Other Burning	0.8	0.8	0.8	0.4	0.1	0.1
Miscellaneous Total	3.7	2.5	1.8	1.1	1.1	1.2
Total of All Sources	23.1	24.9	21.6	18.5	8.5	7.5

Note: 1990 emission estimates are preliminary. The sums of subcategories may not equal total due to rounding.

**TABLE 4. TOTAL NATIONAL EMISSIONS
OF SULFUR OXIDES, 1940-1990
(Teragrams/Year)**

Source Category	1940	1950	1960	1970	1980	1990
Transportation						
Highway Vehicles	0.0	0.1	0.3	0.4	0.4	0.6
Aircraft	0.0	0.0	0.0	0.0	0.0	0.0
Railroads	2.7	2.0	0.2	0.1	0.1	0.1
Vessels	0.2	0.2	0.1	0.2	0.3	0.2
Other Off Highway	0.0	0.0	0.0	0.1	0.1	0.1
Transportation Total	2.9	2.3	0.4	0.6	0.9	0.9
Stationary Source Fuel Combustion						
Electric Utilities	2.2	4.1	8.4	15.8	15.5	14.2
Industrial	5.5	5.2	3.5	4.1	2.4	2.3
Commercial-Institutional	1.0	1.7	1.0	0.9	0.7	0.4
Residential	2.3	1.9	1.1	0.5	0.2	0.3
Fuel Combustion Total	11.0	12.9	14.0	21.3	18.7	17.1
Industrial Processes						
Primary Metal Smelting	2.5	2.8	3.0	3.7	1.2	0.5
Pulp Mills	0.0	0.0	0.1	0.2	0.2	0.3
Chemicals	0.2	0.4	0.4	0.5	0.3	0.2
Petroleum Refining	0.2	0.3	0.6	0.7	0.8	1.0
Iron and Steel	0.5	0.6	0.6	0.7	0.5	0.4
Secondary Metals	0.0	0.0	0.0	0.0	0.0	0.0
Mineral Products	0.3	0.5	0.5	0.6	0.6	0.6
Natural Gas Processing	0.0	0.0	0.1	0.1	0.1	0.2
Industrial Processes Total	3.7	4.6	5.3	6.4	3.8	3.1
Solid Waste Disposal						
Incineration	0.0	0.0	0.0	0.0	0.0	0.0
Open Burning	0.0	0.0	0.0	0.0	0.0	0.0
Solid Waste Total	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous						
Miscellaneous	0.0	0.0	0.0	0.0	0.0	0.0
Forest Fires	0.0	0.0	0.0	0.0	0.0	0.0
Other Burning	0.5	0.5	0.5	0.1	0.0	0.0
Miscellaneous Total	0.5	0.5	0.5	0.1	0.0	0.0
Total of All Sources	17.6	19.8	19.7	28.3	23.4	21.2

Note: 1990 emission estimates are preliminary. The sums of subcategories may not equal total due to rounding.

**TABLE 5. TOTAL NATIONAL EMISSIONS
OF NITROGEN OXIDES, 1940-1990
(Teragrams/Year)**

Source Category	1940	1950	1960	1970	1980	1990
Transportation						
Highway Vehicles	1.4	2.2	3.8	6.3	7.9	5.6
Aircraft	0.0	0.0	0.0	0.1	0.1	0.1
Railroads	0.6	0.9	0.7	0.6	0.8	0.5
Vessels	0.1	0.1	0.1	0.1	0.2	0.2
Other Off Highway	0.2	0.4	0.5	0.8	1.0	1.1
Transportation Total	2.3	3.6	5.1	8.0	9.8	7.5
Stationary Source Fuel Combustion						
Electric Utilities	0.6	1.2	2.3	4.4	6.4	7.3
Industrial	2.3	2.9	3.7	3.9	3.1	3.3
Commercial-Institutional	0.2	0.3	0.3	0.3	0.3	0.2
Residential	0.3	0.3	0.4	0.4	0.4	0.4
Fuel Combustion Total	3.4	4.7	6.7	9.1	10.1	11.2
Industrial Processes						
Petroleum Refining	0.1	0.1	0.2	0.2	0.2	0.2
Chemicals	0.0	0.0	0.1	0.2	0.2	0.1
Iron and Steel Mills	0.0	0.1	0.1	0.1	0.1	0.0
Pulp Mills	0.0	0.0	0.0	0.0	0.0	0.0
Mineral Products	0.1	0.1	0.1	0.2	0.2	0.2
Industrial Processes Total	0.2	0.3	0.5	0.7	0.7	0.6
Solid Waste Disposal						
Incineration	0.0	0.1	0.1	0.1	0.0	0.0
Open Burning	0.1	0.1	0.2	0.3	0.1	0.1
Solid Waste Total	0.1	0.2	0.3	0.4	0.1	0.1
Miscellaneous						
Forest Fires	0.7	0.4	0.2	0.2	0.2	0.2
Other Burning	0.2	0.2	0.2	0.1	0.0	0.0
Miscellaneous Total	0.9	0.6	0.4	0.3	0.2	0.3
Total of All Sources	6.9	9.4	13.0	18.5	20.9	19.6

Note: 1990 emission estimates are preliminary. The sums of subcategories may not equal total due to rounding.

**TABLE 6. TOTAL NATIONAL EMISSIONS OF
NON-METHANE VOLATILE ORGANIC
COMPOUNDS, 1940-1990
(Teragrams/Year)**

Source Category	1940	1950	1960	1970	1980	1990
Transportation						
Highway Vehicles	4.0	5.7	8.3	9.1	7.7	5.1
Aircraft	0.0	0.1	0.2	0.3	0.2	0.2
Railroads	0.5	0.5	0.2	0.2	0.2	0.1
Vessels	0.0	0.1	0.2	0.3	0.4	0.5
Other Off Highway	0.2	0.4	0.5	0.5	0.5	0.5
Transportation Total	4.7	6.8	9.4	10.3	9.0	6.4
Stationary Source Fuel Combustion						
Electric Utilities	0.0	0.0	0.0	0.0	0.0	0.0
Industrial	0.1	0.1	0.1	0.1	0.1	0.1
Commercial-Institutional	0.0	0.0	0.0	0.0	0.0	0.0
Residential	1.7	1.2	0.7	0.4	0.8	0.7
Fuel Combustion Total	1.8	1.3	0.8	0.6	0.9	0.9
Industrial Processes						
Chemicals	0.8	1.2	1.1	1.6	1.8	1.9
Petroleum Refining	0.4	0.5	0.7	0.7	1.0	0.7
Iron and Steel Mills	0.3	0.4	0.3	0.4	0.3	0.2
Mineral Products	0.0	0.0	0.0	0.0	0.0	0.0
Food and Agriculture	0.1	0.1	0.2	0.2	0.2	0.2
Industrial Organic Solvent Use	1.0	2.1	2.4	4.0	3.9	3.1
Petroleum Product Production and Marketing	0.7	1.1	1.6	2.1	2.1	2.1
Industrial Processes Total	3.3	5.4	6.3	8.9	9.2	8.1
Solid Waste Disposal						
Incineration	0.4	0.4	0.5	0.5	0.3	0.3
Open Burning	0.5	0.6	0.9	1.3	0.3	0.3
Solid Waste Total	0.9	1.0	1.4	1.8	0.6	0.6
Miscellaneous						
Forest Fires	3.1	1.7	0.9	0.7	0.9	1.1
Other Burning	0.6	0.6	0.5	0.3	0.1	0.1
Miscellaneous Organic Solvent Use	0.8	1.3	1.7	2.3	1.9	1.5
Miscellaneous Total	4.5	3.6	3.1	3.3	2.9	2.7
Total of All Sources	15.2	18.1	21.0	25.0	22.6	18.7

Note: 1990 emission estimates are preliminary. The sums of subcategories may not equal total due to rounding.

**TABLE 7. TOTAL NATIONAL EMISSIONS
OF CARBON MONOXIDE, 1940-1990
(Teragrams/Year)**

Source Category	1940	1950	1960	1970	1980	1990
Transportation	22.6	34.2	47.7	65.3	48.7	30.3
Highway Vehicles	0.0	0.8	1.6	0.9	1.0	1.1
Aircraft	3.7	2.8	0.3	0.3	0.3	0.2
Railroads	0.2	0.2	0.6	1.2	1.4	1.7
Vessels	3.4	6.7	8.0	6.8	4.7	4.4
Other Off Highway	29.9	44.7	58.2	74.4	56.1	37.6
Stationary Source Fuel Combustion	0.0	0.1	0.1	0.2	0.3	0.3
Electric Utilities	0.4	0.5	0.6	0.7	0.7	0.7
Industrial	0.1	0.1	0.0	0.1	0.1	0.1
Commercial-Institutional	15.8	10.9	6.4	3.5	6.4	6.4
Residential	16.3	11.6	7.1	4.5	7.4	7.5
Fuel Combustion Total	3.8	5.3	3.6	3.1	2.0	1.7
Industrial Processes	0.2	2.4	2.8	2.0	1.6	0.4
Petroleum Refining	1.5	1.1	1.3	1.6	1.0	0.7
Iron and Steel Mills	0.0	0.1	0.3	0.6	0.8	0.7
Primary Metal Smelting	1.0	1.4	1.0	1.1	0.3	0.2
Secondary Metals	0.1	0.2	0.3	0.6	0.7	0.9
Pulp Mills	6.6	10.5	9.3	8.9	6.3	4.7
Industrial Processes Total	2.0	2.5	2.5	2.7	1.2	0.9
Solid Waste Disposal	1.3	1.8	2.6	3.7	1.0	0.8
Incineration	3.3	4.3	5.1	6.4	2.2	1.7
Solid Waste Total	22.8	12.8	6.7	5.1	6.9	8.1
Miscellaneous	3.7	3.7	3.3	2.1	0.7	0.6
Other Burning	26.5	16.5	10.0	7.2	7.6	8.6
Miscellaneous Total	82.6	87.6	89.7	101.4	79.6	60.1
Total of All Sources						

Note: 1990 emission estimates are preliminary. The sums of subcategories may not equal total due to rounding.

offset increases due to assumed economic growth. Implementation by States of discretionary measures needed to meet ambient standards or progress requirements for VOC are accounted for.

In order to project emission trends it is necessary to predict economic growth, industrial activity, fuel consumption and other factors. Therefore future trends are speculative and there may be a significant level of uncertainty associated with them. Projected emission estimates will be updated periodically using the most recent information on actual activity by each source category. As new information becomes available emission trends will be updated and emission projections will be recalculated.

6.1 Future Trends in Sulfur Oxide Emissions

Table 9 presents the current estimates of future total national SO_x emissions, and SO_x emissions from electric utilities and other sources. The expected emission trends are shown in Figure 17. The estimated electric utility emissions are based on a model (AIRCOST-PC) which simulates emissions according to current and future emission standards and controls, electric utility generation capacity and future demand for electricity.³⁴ Electricity generation forecasts were obtained from the U.S. Department of Energy.³⁵ Nonutility SO_x emissions are based on the 1985 NAPAP emission inventory and earnings projections by source category as reported by the Bureau of Economic Analysis³⁶ and the estimated rate of retirement of existing sources.

Future SO_x emissions will be significantly affected by the CAAA of 1990 with a projected reduction of 10 million short tons (approximately 9.1 teragrams) from the 1980 emission level to be achieved by 2010. SO_x emissions from electric utilities will be subject to mandated reductions as part of a two phase program beginning in 1995. While the second phase of mandated reductions begins in 2000, the effect of various special phase-in provisions will result in higher emissions in the early 2000s, until by 2010 total allowable sulfur dioxide will be 8.9 million tons (approximately 8.1 teragrams). The acid rain title limits the total allowable tons of sulfur dioxide from the utility sector but leaves plant by plant compliance decisions to the industry. That is, acid rain control amendments will be implemented using a market-based emissions allowance trading system which allows utility managers to decide which combination of pollution control equipment, low sulfur fuel, energy conservation, emissions dispatching and emissions allowances they feel is suitable to ensure compliance with the primary prohibition against emitting sulfur dioxide in excess of the number of allowances held.

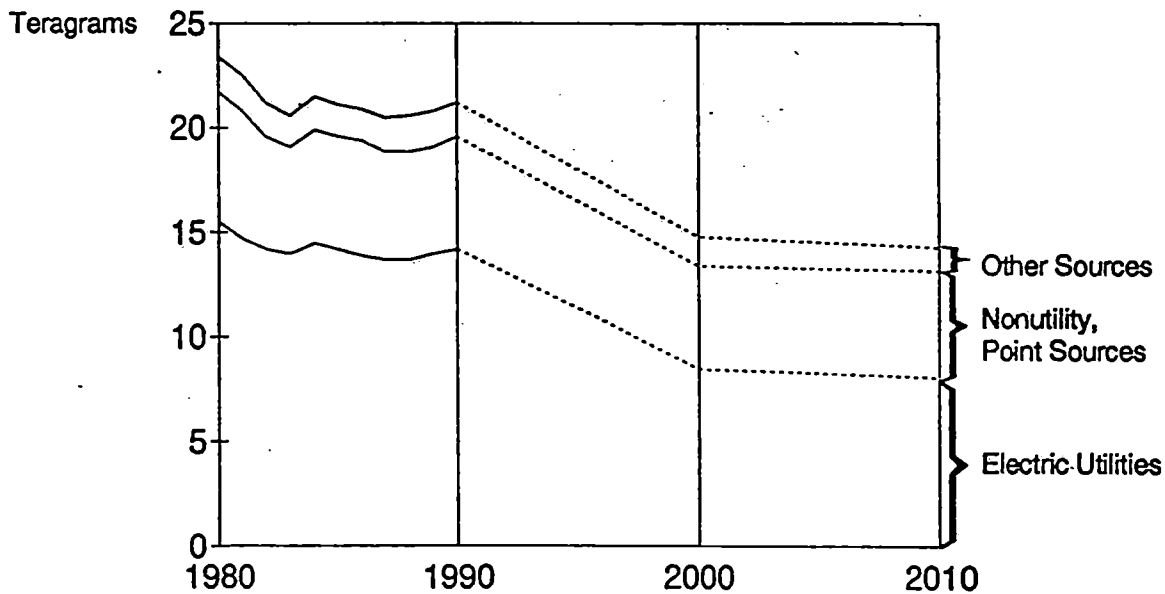
SO_x emissions from nonutility point sources have declined from 1980 levels due to reduced activity in steel production, nonferrous smelting and other heavy industrial processes which historically were major sources. Emission reductions in the CAAA were based on the assumption that net emission reductions, which occurred between 1980 and 1985, would not be offset by growth in future years. The projections presented here are based on that assumption. Because of the uncertainty associated with the emissions from these and other sources, the EPA will conduct a study of future industrial SO_x emissions.

Further reductions in SO_x emissions are expected after 1990 as a result of motor vehicle diesel fuel being limited to 0.05 percent sulfur (by weight). This limit is expected to produce about an 80 percent reduction in emissions per diesel-powered vehicle. Some of this reduction may be offset by the expected increase in diesel fuel consumption over the next 10 to 20 years.

TABLE 9. TOTAL NATIONAL SULFUR OXIDE EMISSIONS, 1980 TO 2010 .
(Teragrams/Year)

	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2010</u>
Electric Utilities	15.5	14.2	8.5	8.1
Nonutility, Point Sources	6.2	5.4	4.9	5.1
Other Sources	<u>1.7</u>	<u>1.6</u>	<u>1.4</u>	<u>1.1</u>
Total	23.4	21.2	14.8	14.3

Figure 17. Projected Trend in SULFUR OXIDE Emissions, 1990 to 2010



6.2 Future Trends in Nitrogen Oxide Emissions

Table 10 presents the current estimates of future total NO_x emissions and NO_x emissions from highway vehicles, industrial sources, electric utilities and all other sources. These expected emission trends are shown in Figure 18. The projections account for the expected net effect of all provisions of the CAAA concerning NO_x. These include the NO_x emission limits prescribed for utility boilers under the acid rain provisions, the Tier I automobile tailpipe standards, and application of technology based requirements to nonutility boilers (generally greater than 100 tons/year) in ozone nonattainment areas and the Northeast Ozone Transport Region. The estimates do not fully incorporate new source review requirements such as offsets and lowest achievable emission rates in nonattainment areas, nor additional controls required based on attainment demonstration modeling. They also do not attempt to estimate the extent to which any areas might be exempted from NO_x stationary source controls under Section 182(f).

Projections of NO_x emissions from highway vehicles are based on projected vehicle miles travelled and MOBILE4.1 emission factors. These emission factors reflect current emission control standards and Tier I motor vehicle emission standards of the CAAA. (Tier II standards are not reflected because these are discretionary.) As a result of these standards, NO_x emissions from highway vehicles are expected to decrease by almost 50 percent from 1990 to 2000.

By 2000, all electric utility units with capacities greater than 25 megawatts are expected to meet new emission limits imposed by the CAAA. Also, new or modified electric power units will be subject to revised performance standards. As a result, NO_x emissions from electric utilities are expected to decrease by 16 percent in the next ten years. The analysis for utilities was performed under the assumption that low NO_x combustion technology would be employed to meet the NO_x provisions of Title IV. The 6.1 teragram estimate for electric utilities in 2000 is approximately 1.8 teragrams (2 million short tons) less than what would have been emitted by utilities without controls implemented as a result of the CAAA of 1990.

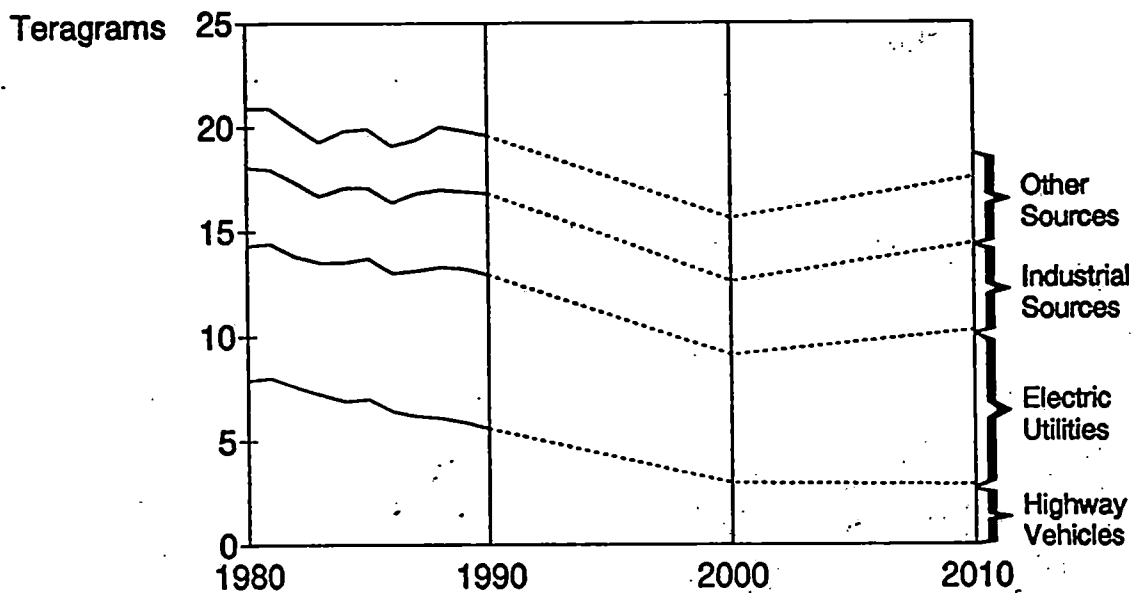
Estimates of future NO_x emissions from industrial sources are based on state-level growth factors and the expected application of reasonable available control technology where required. As a result, a 10 percent reduction is expected in NO_x emissions from industrial sources from 1990 to 2000. This reduction may be more than offset by increases in emissions between 2000 and 2010. The future trend of stationary source NO_x emissions is presently uncertain because it is not known whether ozone nonattainment areas will be exempt from the proposed new source review policy that requires lowest achievable emission reductions and offsets for new major sources.

TABLE 10. TOTAL NATIONAL NITROGEN OXIDE EMISSIONS, 1980 TO 2010
(Teragrams/Year)

	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2010</u>
Electric Utilities	6.4	7.3	6.1	7.4
Industrial Sources *	3.8	3.9	3.5	4.1
Highway Vehicles	7.9	5.6	3.0	2.9
Other	<u>2.8</u>	<u>2.8</u>	<u>3.0</u>	<u>3.2</u>
Total	20.9	19.6	15.6	17.6

* Includes industrial fuel combustion and processes.

Figure 18. Projected Trend in NITROGEN OXIDE Emissions, 1990 to 2010



6.3 Future Trends In Non-methane Volatile Organic Compound Emissions

Table 11 presents the current estimates of future total national VOC emissions and VOC emissions from highway vehicles. The expected emission trends are shown in Figure 19. These estimates are also based on the Emission Reduction and Cost Analysis Model (ERCAM)³⁷ which has been used to analyze costs and benefits of the nonattainment and motor vehicle provisions in the CAAA of 1990 in addition to projecting NO_x emissions. The estimates are based on presumed growth rates in population, industrial activity, and vehicle miles travelled. It is assumed that mandatory emission control measures specified in the CAAA, such as tailpipe emission standards and prescribed emission controls for point sources, will be implemented. It is also assumed that states will meet the minimum emission control requirements and reductions as specified by the CAAA in order to meet the National Ambient Air Quality Standards for ozone. In reality, states may exceed the minimum requirements, and therefore, future emissions may be overestimated.

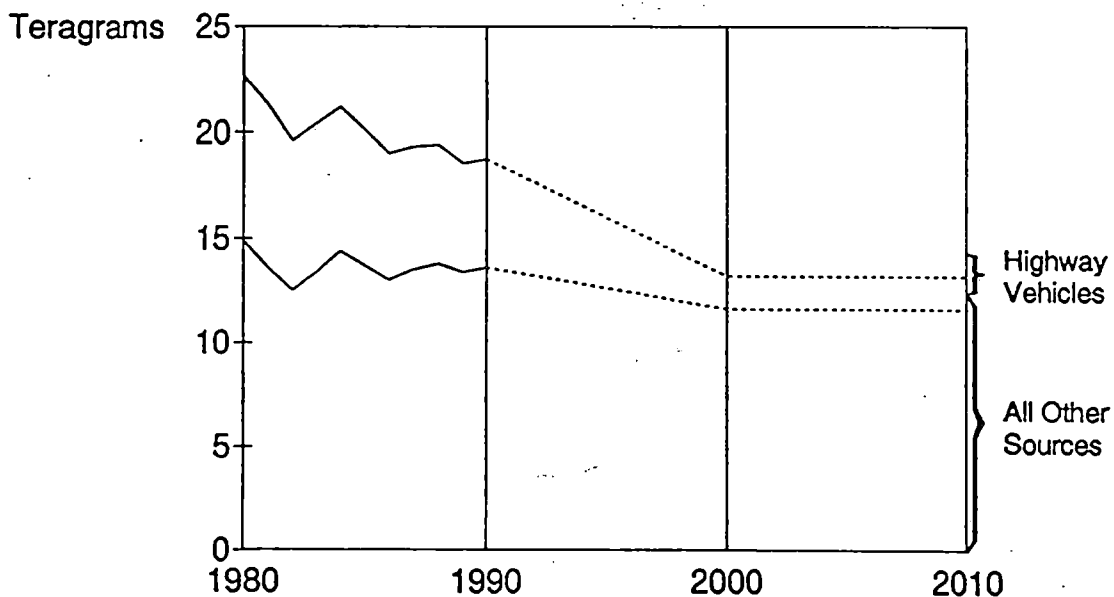
Table 11 shows a 27 percent decrease in total national VOC emissions from 1990 to 2000. This decrease is largely due to an expected 65 percent reduction in emissions from highway vehicles as a result of continued fleet turnover and additional emission controls despite an expected 25 percent increase in total vehicle miles travelled over this time period.

From 2000 to 2010, the estimates are substantially more uncertain, but currently indicate that total emissions will remain stable. Growth and development in attainment areas (areas meeting the National Ambient Air Quality Standards for ozone), is expected to result in increased emissions. This increase is expected to offset continued declines in nonattainment area emissions, especially those where additional reductions will be needed after 2000.

TABLE 11. TOTAL NATIONAL NON-METHANE VOLATILE ORGANIC COMPOUND EMISSIONS, 1980 TO 2010 (Teragrams/Year)

	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2010</u>
Highway Vehicles	7.7	5.1	1.6	1.6
All Other Sources	<u>14.9</u>	<u>13.6</u>	<u>11.6</u>	<u>11.6</u>
Total	22.6	18.7	13.2	13.2

Figure 19. Projected Trend in NON-METHANE VOLATILE ORGANIC COMPOUND Emissions, 1990 to 2010



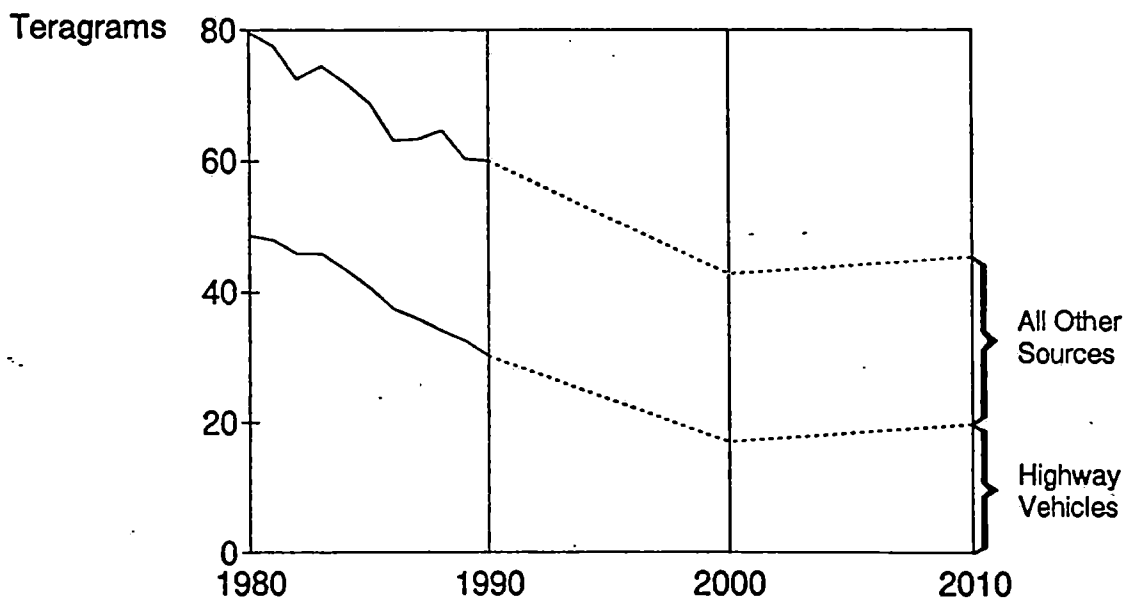
6.4 Future Trends in Carbon Monoxide Emissions

Table 12 presents the current estimates of future total national CO emissions and CO emissions from highway vehicles. The expected emission trends are shown in Figure 20. These estimates are also based on ERCAM. The projections show a 43 percent decrease by the year 2000 in total CO emissions from highway vehicles as a result of continued fleet turnover and new measures such as enhanced automobile inspection and maintenance programs, and the expected use of oxygenated fuels in CO nonattainment areas.

TABLE 12. TOTAL NATIONAL CARBON MONOXIDE EMISSIONS, 1980 TO 2010
(Teragrams/Year)

	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2010</u>
Highway Vehicles	48.7	30.3	17.1	19.8
All Other Sources	<u>30.9</u>	<u>29.8</u>	<u>25.8</u>	<u>25.6</u>
Total	79.6	60.1	42.9	45.4

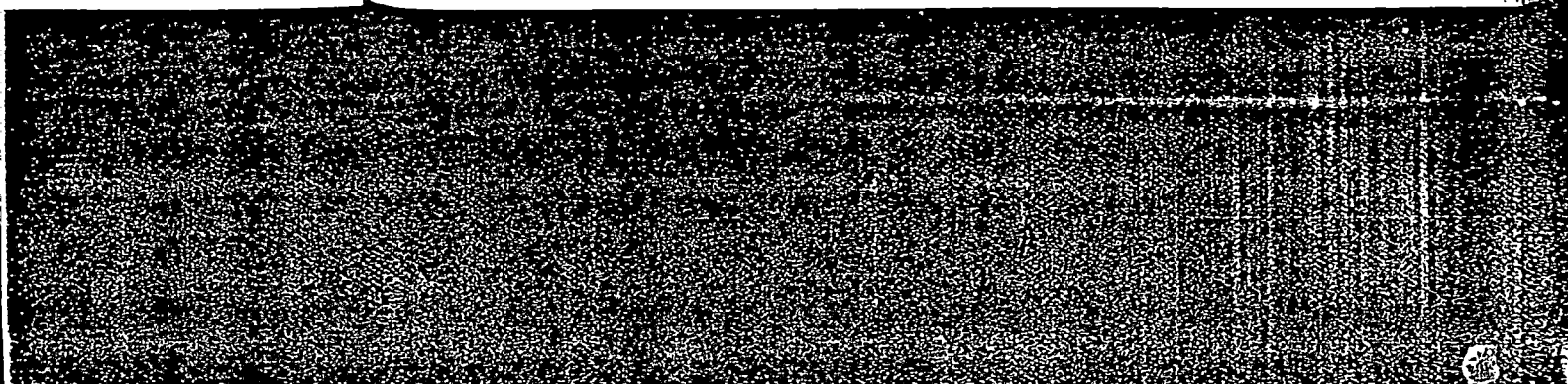
Figure 20. Projected Trend in CARBON MONOXIDE Emissions, 1990 to 2010



GLOBAL ENERGY

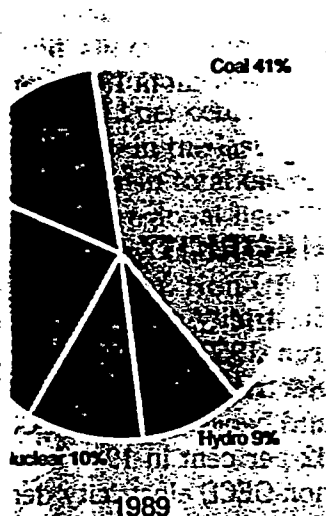
THE CHANGING OUTLOOK

1992



cept Latin America, the
rely to the USSR, eastern

ENERATION

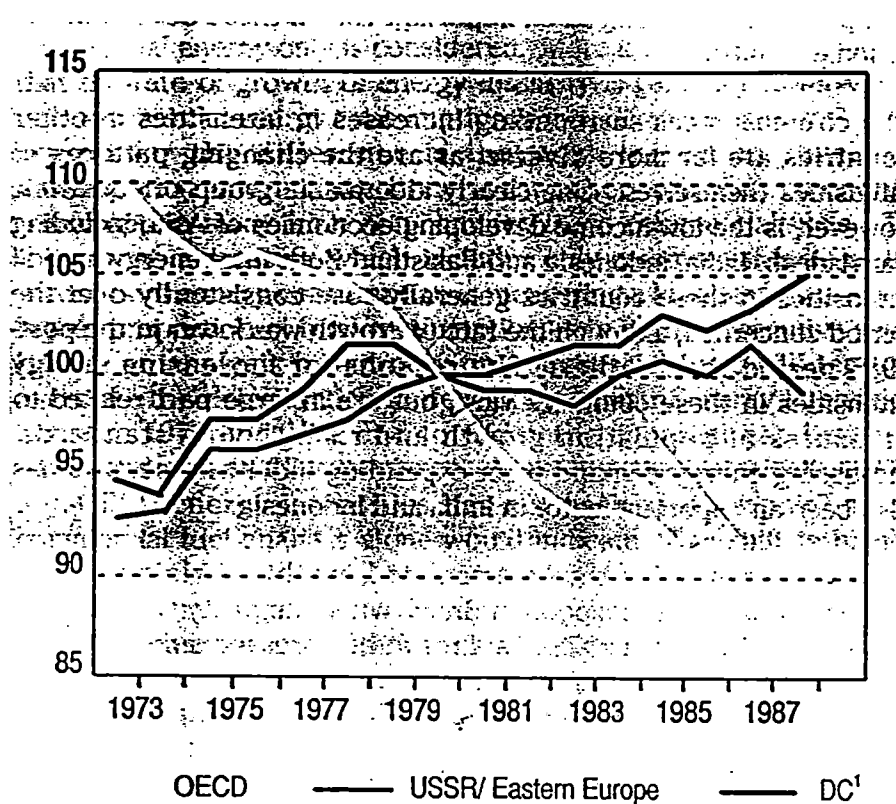


l across the non-OECD
ent in 1980, but declined
natural endowments, the
y generation has never
ut 13 per cent in 1989 in
region and 22 per cent in
e of 10 per cent for the

gy conservation and
use were taken in some
review. But in terms of

energy intensity — measured as the ratio of TPES (in toe) to GDP (in \$US1000 at 1985 prices and exchange rates) — the situation in general did not improve; i.e. in many countries, more energy was required to produce a given unit of GDP in 1989 than in 1973. This contrasts with the experience in OECD countries over the same period where energy intensities fell by an average of 1.7 per cent per year. The trends in the non-OECD region reflect a variety of factors associated with rising income levels, including the processes of industrialisation and urbanisation and increased demand for transport fuels. They often reflect, in addition, changes in the structure of an economy's output towards more energy-intensive activities. In a range of countries, the trend has been compounded

Figure 16: ENERGY INTENSITY (TPES/GDP)
1980 = 100



1. Developing countries
Source: IEA Secretariat

energy intensities are still remarkably low in many non-OECD countries, particularly those of Africa and developing Asia. In 1989, the average per capita energy intensity of OECD countries was 4.8 toe per person and, since 1973, had grown at an average annual rate of only 0.2 per cent. In the lowest-income developing countries, per capita intensities ranged from 0.06 toe per person in Bangladesh

Table 2: Energy Intensity — Selected Countries, 1973 and 1989

	1973		1989		Average Annual Growth %	
	TPES/GDP ¹	TPES/POP ²	TPES/GDP ¹	TPES/POP ²	TPES/GDP ¹	TPES/POP ²
Africa						
Algeria	0.16	0.30	0.45	1.08	6.7	8.3
Egypt	0.44	0.21	0.58	0.55	1.7	6.2
Nigeria	0.04	0.05	0.16	0.14	9.1	6.6
South Africa	1.20	1.94	1.75	2.81	2.4	2.3
Asia-Pacific						
Bangladesh	0.18	0.02	0.36	0.06	4.4	7.1
Hong Kong	0.28	0.88	0.25	1.90	-0.7	4.9
India	0.58	0.12	0.71	0.21	1.3	3.6
Indonesia	0.26	0.09	0.38	0.23	2.4	6.0
Malaysia	0.36	0.43	0.50	1.01	2.1	5.5
Pakistan	0.53	0.11	0.64	0.21	1.2	4.1
Philippines	0.48	0.25	0.48	0.29	0.0	0.9
Singapore	0.56	1.86	0.43	3.50	-1.6	4.0
South Korea	0.65	0.64	0.65	1.89	0.0	7.0
Taiwan	0.51	0.84	0.50 ³	2.19	-0.1	6.2
Thailand	0.54	0.22	0.47	0.44	-0.9	4.4
Latin America						
Argentina	0.60	1.34	0.77	1.43	1.6	0.4
Brazil	0.41	0.47	0.40	0.66	-0.2	2.1
Colombia	0.52	0.49	0.52	0.61	0.0	1.4
Mexico	0.43	0.79	0.67	1.36	2.8	3.5
Venezuela	0.44	2.10	0.62	2.07	2.2	-0.1
Middle East						
Iran	0.17	0.78	0.40 ³	1.15	5.5	2.5
Kuwait	0.18	6.16	0.55	6.10	7.2	-0.1
Saudi Arabia	0.10	1.01	0.67	4.69	12.6	10.1
UAE	0.13	3.53	0.70	14.40	11.1	9.2
OECD	0.52	4.62	0.40	4.79	-1.7	0.2

1 Metric tons of oil equivalent per \$1000 of GDP at 1985 prices and exchange rates

2 Metric tons of oil equivalent per inhabitant

3 Latest available data are 1988

Source: IEA Secretariat

Table A1: World Total Primary Energy Supply, 1973-1989
Mtoe

	1973	1975	1980	1985	1989
Africa	89	101	138	183	220
Asia-Pacific	195	215	300	386	509
Latin America	207	226	303	330	376
Middle East	62	73	124	190	230
China	264	314	412	516	650
Eastern Europe	349	378	458	482	480
USSR	839	929	1111	1252	1362
Non-OECD	2005	2235	2846	3340	3828
OECD	3411	3262	3622	3640	3987
World	5416	5497	6468	6980	7815

Share of World Total (%)

	1973	1975	1980	1985	1989
Africa	1.6	1.8	2.1	2.6	2.8
Asia-Pacific	3.6	3.9	4.6	5.5	6.5
Latin America	3.8	4.1	4.7	4.7	4.8
Middle East	1.1	1.3	1.9	2.7	2.9
China	4.9	5.7	6.4	7.4	8.3
Eastern Europe	6.4	6.9	7.1	6.9	6.1
USSR	15.5	16.9	17.2	17.9	17.4
Non-OECD	37.0	40.7	44.0	47.9	49.0
OECD	63.0	59.3	56.0	52.1	51.0
World	100	100	100	100	100

Note: Because of rounding, totals and sub-totals may not exactly equal the sums of their individual components

Source: IEA Secretariat

Table 3: Non-OECD* — Primary Energy Balance^a
Mtoe

	1989	1995	2000	2005
Coal				
Production	1385	1561	1780	2093
Net Imports	-1	32	26	17
Consumption	1385	1593	1806	2110
Oil				
Production	2429	2930	3247	3560
Net Imports	-1064	-1207	-1265	-1387
Consumption	1365	1723	1982	2173
Gas				
Production	992	1333	1651	2110
Net Imports	-114	-164	-198	-229
Consumption	878	1169	1453	1881
Nuclear	100	126	165	196
Hydro	98	123	151	185
Total				
Production	5005	6073	6994	8144
Net Imports	1179	-1340	-1437	-1600
Consumption	3827	4733	5557	6544

a Includes eastern Germany
b Excludes non-commercial fuels

Note: Because of rounding, totals and sub-totals may not exactly equal the sums of their individual components

Source: IEA Secretariat

AF

Fro
cor
cor
is u
thr

(a)

(b)

(c)

Not
the
GN
cor
imp

Tot

TPI
slig
354
Afr
acc
exp

GLO

Table 10: USSR — Primary Energy Balance^a
Mtoe

	1989	2005
Coal		
Production	314	357
Net Imports	-12	-23
Consumption	301	334
Oil		
Production	610	571
Net Imports	-177	-50
Consumption	433	521
Gas		
Production	644	1246
Net Imports	-89	-227
Consumption	555	1019
Nuclear	55	120
Hydro	21	29
Total		
Production	1644	2323
Net Imports	-278	-300
Consumption	1366	2023

a Excludes non-commercial fuels

Note: Because of rounding, totals and sub-totals may not exactly equal the sums of their individual components

Source: IEA Secretariat

increasingly towards natural gas, which will account for about 75 per cent of inputs in 2005, compared with 40 per cent in 1989. Oil's share is expected to decline from 46 per cent to 20 per cent over the same period, reflecting policies to shift demand for oil away from domestic markets towards exports.

Table 9: Middle East — Primary Energy Balance^a
Mtoe

	1989	1995	2000	2005
Coal				
Production	0	1	1	1
Net Imports	3	2	3	3
Consumption	3	3	3	4
Oil				
Production	841	1232	1395	1596
Net Imports	-692	-1013	-1086	-1223
Consumption	149	218	309	372
Gas				
Production	80	146	195	300
Net Imports	-3	-5	-4	-11
Consumption	77	141	191	289
Nuclear	0	0	0	0
Hydro	1	1	1	1
Total				
Production	923	1380	1591	1897
Net Imports	-693	-1016	-1087	-1231
Consumption	230	364	504	666

a Excludes non-commercial fuels

Note: Because of rounding, totals and sub-totals may not exactly equal the sums of their individual components

Source: IEA Secretariat

Electricity

Electricity production is expected to grow 5.2 per cent per year in this region, from 612 TWh to 1370 TWh during the projection period. As noted above, electricity production in the region has been characterised by the dominance of hydropower which provided about two-thirds of total electricity output in 1989. This dominance is likely to persist in the years to come, but, with the increasing use of natural gas, hydro's share is expected to fall to about 57 per cent.

Table 8: Latin America — Primary Energy Balance^a
Mtoe

	1989	1995	2000	2005
Coal				
Production	22	32	46	64
Net Imports	0	-7	-11	-17
Consumption	22	26	34	47
Oil				
Production	365	418	480	510
Net Imports	-126	-123	-161	-177
Consumption	239	295	319	333
Gas				
Production	75	90	117	166
Net Imports	1	-2	-3	0
Consumption	75	88	114	165
Nuclear	2	5	8	8
Hydro	38	48	60	76
Total				
Production	500	593	711	824
Net Imports	-125	-131	-175	-194
Consumption	376	462	535	630

a Excludes non-commercial fuels

Note: Because of rounding, totals and sub-totals may not exactly equal the sums of their individual components

Source: IEA Secretariat

s energy supplies. The power production will projection period, its 1 per cent by 2005. The region are located on the river. However, the environmental grounds and potential for small hydro and as well as perhaps in

n in eastern Europe has 1. This trend is expected t of electricity output is plants, the share of which 2005. A major proportion erated from natural gas.

per cent of total fixed the electricity sector in e same level as in OECD ined future generating nuclear plants have yet to nal capacity. Although nificant than investment night be expected if the reases significantly or if are reduced. Over the een a net exporter of per cent of electricity in

Table 7: Eastern Europe^a — Primary Energy Balance^b
Mtoe

	1989	2005
Coal		
Production	273	312
Net Imports	-3	-5
Consumption	270	308
Oil		
Production	18	15
Net Imports	86	174
Consumption	104	189
Gas		
Production	40	43
Net Imports	40	106
Consumption	80	149
Nuclear	18	32
Hydro	5	5
Total		
Production	354	408
Net Imports	123	275
Consumption	477	683

a Includes eastern Germany
b Excludes non-commercial fuels

Note: Because of rounding, totals and sub-totals may not exactly equal the sums of their individual components

Source: IEA Secretariat

Table 6: China — Primary Energy Balance^a
Mtoe

	1989	1995	2000	2005
Coal				
Production	517	622	730	850
Net Imports	-3	-4	-5	-6
Consumption	513	618	725	844
Oil				
Production	140	156	175	205
Net Imports	-26	-12	-3	-4
Consumption	114	144	172	201
Gas				
Production	12	16	22	33
Net Imports	0	0	0	0
Consumption	12	16	22	33
Nuclear	0	0	0	0
Hydro	10	14	19	24
Total				
Production	679	808	946	1112
Net Imports	-30	-16	-8	-10
Consumption	649	792	937	1102

a Excludes non-commercial fuels

Note: Because of rounding, totals and sub-totals may not exactly equal the sums of their individual components

Source: IEA Secretariat

n is coupled with cost
te preparation for its

ring the period 1980 to
th will average about
terms, this implies an
n 2005. The share of
ergy supply will remain

ve some hydroelectric
ly. Estimates of such
Malaysia and most of
ected to occur in these
and Malaysia, however,
example, about 90 per
nds outside Java where
5 per cent is located in
emand is weak.

a relatively inexpensive
potential environmental
n the region, especially
ents of hydro plants are
potential is the largest in
en realised to date. As
in the country, the
d to continue but the
diment.

as well as increased
mand for electricity in
e Secretariat's analysis

indicates annual increases of the order of 5.6 per cent per year. In absolute terms this implies an increase from 710 TWh in 1989 to 1694 TWh in 2005. Inputs to conventional thermal electricity generation are expected to shift increasingly away from oil towards coal and natural gas. Coal is expected to account for about 51 per cent of inputs in 2005, compared with 41 per cent in 1989. The share of natural gas is also expected to increase to 12 per cent by the end of the forecast period, compared with 8 per cent in 1989.

Table 5: Asia-Pacific — Primary Energy Balance^a
Mtoe

	1989	1995	2000	2005
Coal				
Production	155	190	242	317
Net Imports	34	60	85	127
Consumption	189	250	327	444
Oil				
Production	152	176	188	182
Net Imports	81	168	206	237
Consumption	233	344	393	419
Gas				
Production	85	116	160	212
Net Imports	-38	-45	-56	-61
Consumption	47	71	103	151
Nuclear	22	28	33	33
Hydro	19	24	31	39
Total				
Production	432	534	654	783
Net Imports	77	183	234	303
Consumption	509	717	887	1086

a Excludes non-commercial fuels

Note: Because of rounding, totals and sub-totals may not exactly equal the sums of their individual components

Source: IEA Secretariat

coal-fired and about 49 per cent of regional output was from South Africa. South Africa's dominance is unlikely to diminish in the years ahead and the majority share of coal in regional electricity production is also unlikely to change. There is a possibility elsewhere in the region, however, that natural gas will be substituted increasingly for oil in power generation in order to free oil for export markets. The share of gas is expected to rise to 20 per cent in 2005 compared with 11 per cent in 1989, while that of oil is expected to fall to only 5 per cent, compared with 16 per cent in 1989.

Table 4: Africa — Primary Energy Balance^a
Mtoe

	1989	1995	2000	2005
Coal				
Production	106	88	128	192
Net Imports	-19	6	-19	-63
Consumption	87	94	109	129
Oil				
Production	303	390	438	481
Net Imports	-210	-285	-313	-344
Consumption	94	105	125	137
Gas				
Production	57	77	90	111
Net Imports	-25	-41	-36	-37
Consumption	32	35	54	75
Nuclear	3	3	3	3
Hydro	5	7	8	11
Total				
Production	473	564	667	797
Net Imports	-254	-320	-368	-443
Consumption	220	244	299	354

a Excludes non-commercial fuels

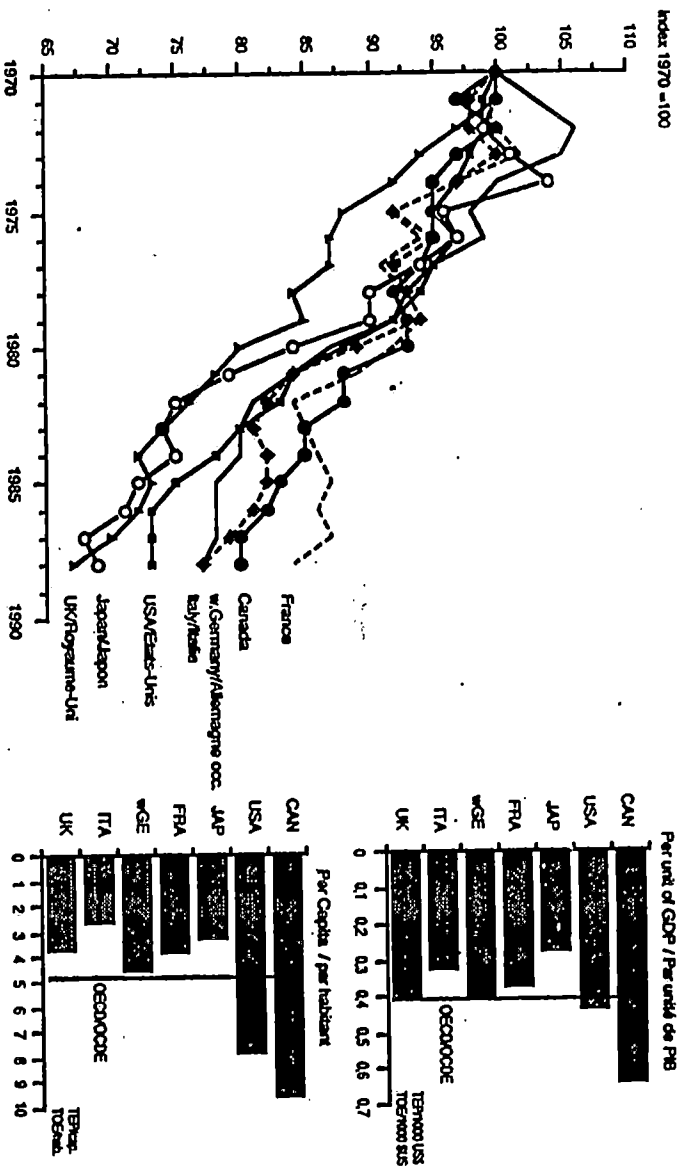
Note: Because of rounding, totals and sub-totals may not exactly equal the sums of their individual components

Source: IEA Secretariat

STRUCTURAL CHANGES: ENERGY INTENSITY

TRENDS / TENDANCES *

STATE / ETAT (1988)



Energy Intensity / Intensité énergétique

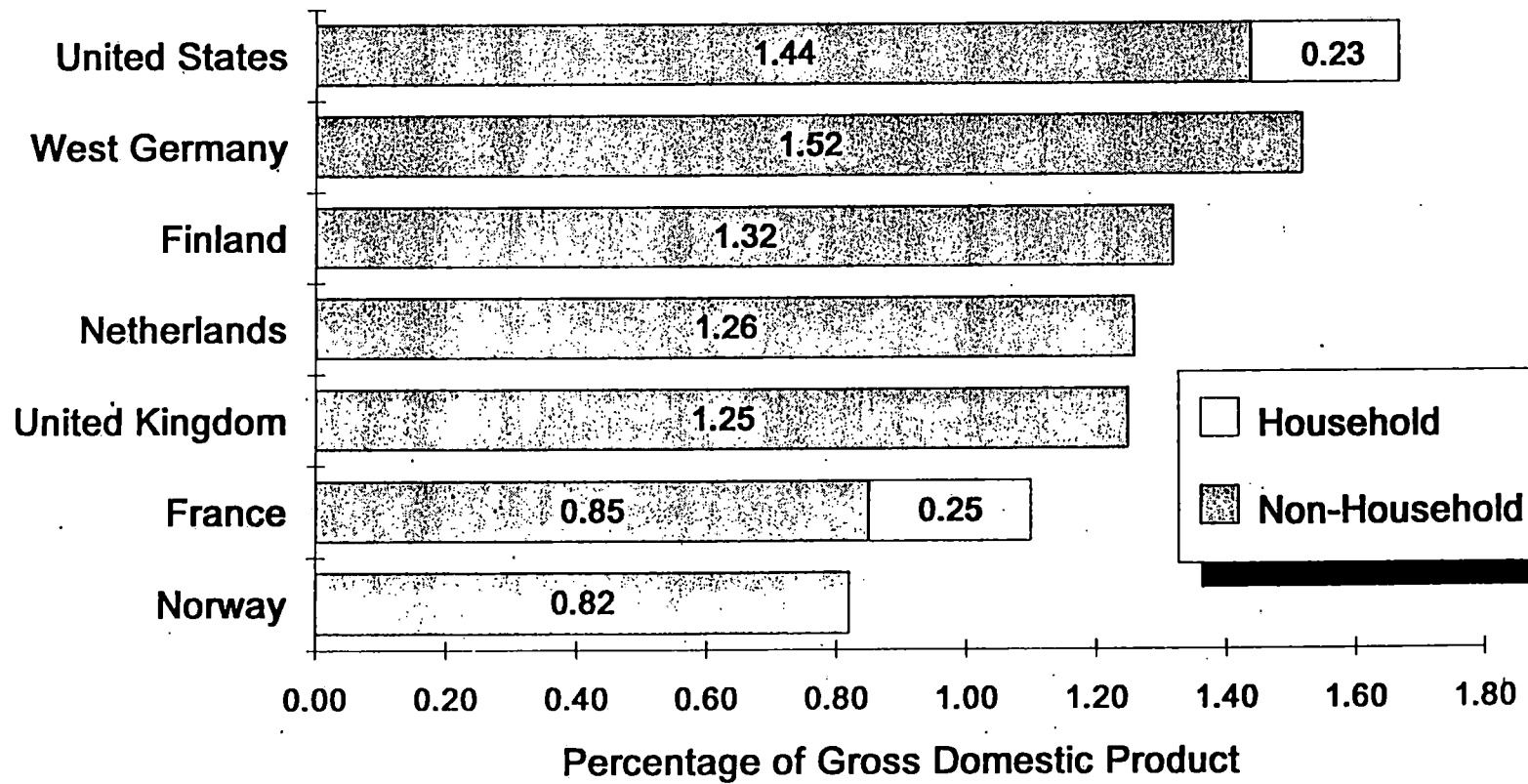
Energy requirements / Besoins en énergie

	1970					1975					1980					1985					1988					Change from 1970 Evolution depuis 1970 (%)	1970-1988	Total per capita / par habitant (TOEcap/TEI/hab.) (MTCAL/TEI)	1988	1988	
	1970	1975	1980	1985	1988	1970	1975	1980	1985	1988	1970	1975	1980	1985	1988	1970	1975	1980	1985	1988											
Canada	0.80	0.76	0.74	0.66	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	20.5	9.6	249.5	Canada	Canada	9.6	249.5				Canada	249.5	Canada			
USA	0.60	0.57	0.53	0.45	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	-27.4	7.8	1928.1	USA	USA	7.8	1928.1				USA	1928.1	USA			
Japan	0.38	0.37	0.32	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	-30.9	3.3	398.8	Japan	Japan	3.3	398.8				Japan	398.8	Japan			
Australia	0.54	0.53	0.53	0.48	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	-12.6	5.0	82.7	Australia	Australia	5.0	82.7				Australia	82.7	Australia			
New Zealand	0.48	0.46	0.50	0.56	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	32.4	4.3	14.3	New Zealand	New Zealand	4.3	14.3				New Zealand	14.3	New Zealand			
Austria	0.49	0.45	0.44	0.42	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	-16.4	3.8	28.8	Austria	Austria	3.8	28.8				Austria	28.8	Austria			
Belgium	0.72	0.64	0.60	0.54	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	-26.3	4.6	45.9	Belgium	Belgium	4.6	45.9				Belgium	45.9	Belgium			
Denmark	0.49	0.40	0.38	0.34	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	-35.5	3.7	19.0	Denmark	Denmark	3.7	19.0				Denmark	19.0	Denmark			
Finland	0.58	0.54	0.56	0.50	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	-16.3	6.0	29.6	Finland	Finland	6.0	29.6				Finland	29.6	Finland			
France	0.44	0.41	0.41	0.38	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	-22.5	3.7	208.9	France	France	3.7	208.9				France	208.9	France			
w. Germany	0.53	0.48	0.47	0.43	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	-22.5	4.5	274.1	w. Germany	w. Germany	4.5	274.1				w. Germany	274.1	w. Germany			
Greece	0.43	0.49	0.53	0.57	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	36.6	2.0	20.5	Greece	Greece	2.0	20.5				Greece	20.5	Greece			
Ireland	0.61	0.53	0.52	0.49	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	-21.4	2.7	9.7	Ireland	Ireland	2.7	9.7				Ireland	9.7	Ireland			
Italy	0.42	0.41	0.41	0.37	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	-23.1	2.6	151.7	Italy	Italy	2.6	151.7				Italy	151.7	Italy			
Netherlands	0.55	0.57	0.55	0.49	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	-12.7	4.4	64.5	Netherlands	Netherlands	4.4	64.5				Netherlands	64.5	Netherlands			
Norway	0.57	0.52	0.49	0.46	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	-21.9	6.7	28.0	Norway	Norway	6.7	28.0				Norway	28.0	Norway			
Portugal	0.55	0.57	0.58	0.62	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	22.1	1.5	15.7	Portugal	Portugal	1.5	15.7				Portugal	15.7	Portugal			
Spain	0.39	0.55	0.57	0.48	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	16.5	2.2	2.2	Spain	Spain	2.2	2.2				Spain	2.2	Spain			
Sweden	0.58	0.55	0.44	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	-10.5	6.7	56.2	Sweden	Sweden	6.7	56.2				Sweden	56.2	Sweden			
Switzerland	0.27	0.28	0.29	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	3.3	4.2	28.2	Switzerland	Switzerland	4.2	28.2				Switzerland	28.2	Switzerland			
Turkey	0.49	0.76	0.80	0.78	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	61.0	0.9	50.3	Turkey	Turkey	0.9	50.3				Turkey	50.3	Turkey			
UK	0.61	0.53	0.49	0.44	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	-33.1	3.7	208.5	UK	UK	3.7	208.5				UK	208.5	UK			
OECD	0.54	0.52	0.48	0.43	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	-24.6	4.8	4002.9	OECD	OECD	4.8	4002.9				OECD	4002.9	OECD			
World				0.38	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41		1.6	7956.5	World	World	1.6	7956.5				World	7956.5	World			

Note: a) Primary energy requirements per unit of GDP (at 1985 prices and exchange rates).
 b) Besoins en énergie primaire par unité de PIB (aux prix et taux de change de 1985).
 Technical notes are in the technical annex.
 Les notes techniques sont dans l'annexe technique.

Source: OECD-EMOCDE/AIE

1985 POLLUTION CONTROL EXPENDITURES BY COUNTRY



Source: EPA, 1990a

Air

The Greenhouse Effect

Of all the greenhouse gases, carbon dioxide is responsible for over half of the warming and is released primarily by burning fossil fuels. Chlorofluorocarbons account for nearly 25 percent, and methane and nitrous oxide are responsible for the remaining quarter. The contribution of ground-level ozone is still unaccountable.

In reference to the related table and graphs, trends in man-made carbon dioxide emissions provides a snapshot view of emissions for the years 1971, 1975, 1980 and 1988 for selected countries and areas. Note that the greatest percentage increase during this span occurred in the non-OECD countries, like the former Soviet Union and China. The percentage increase in OECD countries was relatively smaller, and France, West Germany and the United Kingdom actually experience a negative percentage change. Figures for the United States, OECD Europe and Japan have been highlighted in the subsequent graph. Note that data represents only man-made emissions from energy use, and methods of measurement may vary between countries.

The graphs portraying the top ten countries for greenhouse gas emissions (expressed in percentage of total carbon heating equivalents) and per capita gas emissions by country (in tons of carbon per capita) give two perspectives on prominent emitters of greenhouse gases in 1988. Significantly, the United States leads all other countries in both comparisons. Greenhouse gas emissions are also shown in respect to gross domestic product. Here, the United States is second to Australia, and Canada remains third. Furthermore, estimates are based on World Resources Institute methodology.

Trends in man-made carbon dioxide emissions

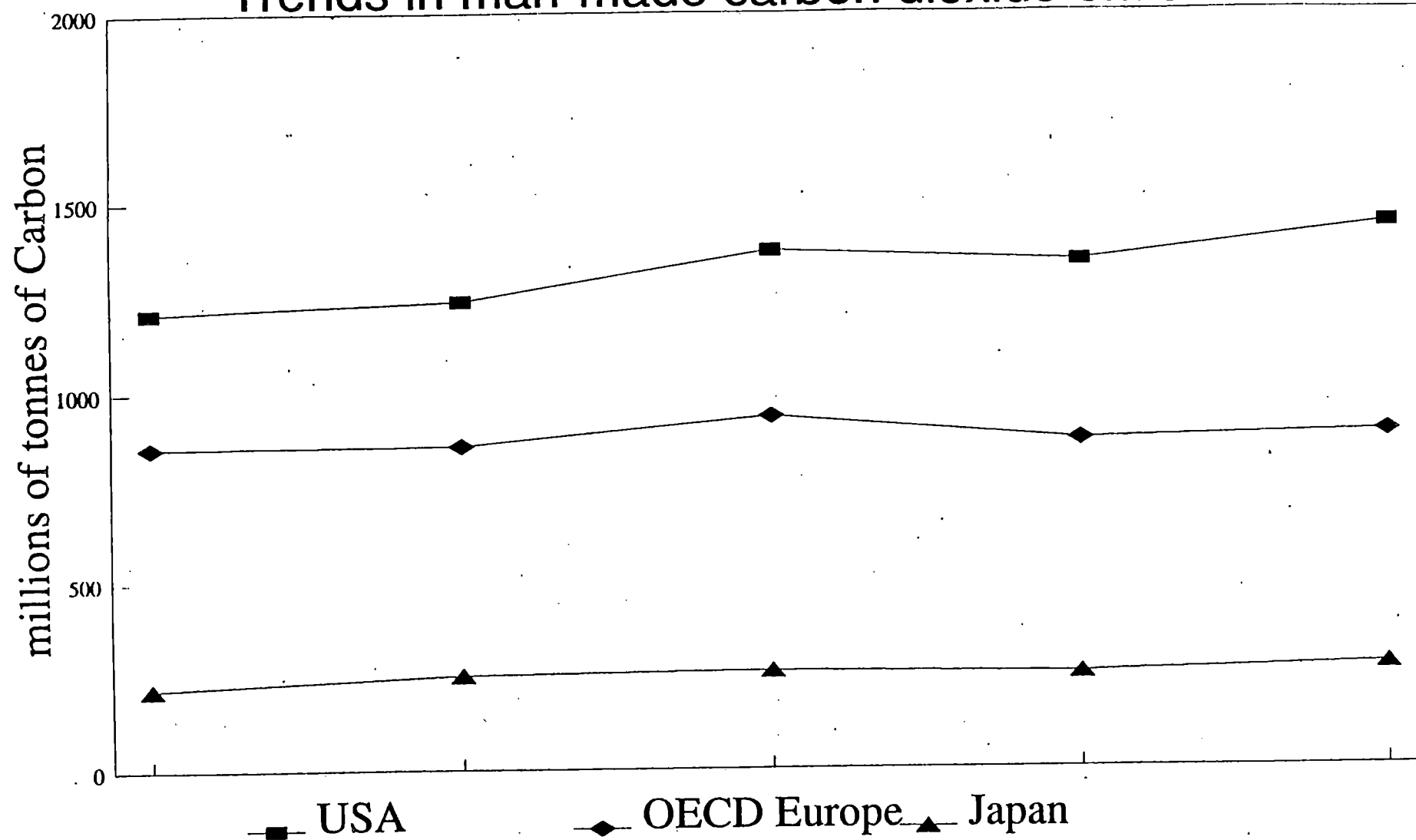
1971-1988

	Millions of tonnes of Carbon				
	1971	1975	1980	1985	1988
Canada	94	109	124	115	124
USA	1209	1240	1369	1339	1433
Japan	217	252	261	253	272
France	126	126	139	109	103
W.Germany	208	198	219	200	198
Italy	92	97	106	101	108
UK	187	170	167	159	163
North America	1302	1349	1493	1453	1557
OECD Pacific	270	312	330	325	350
OECD Europe	855	860	934	870	886
Non-OECD					
Africa	141	162	202	256	273
America	195	233	289	305	334
Asia	266	308	386	458	538
Eastern Europe	322	360	424	444	452
Middle East	60	70	102	144	169
USSR	691	800	907	960	1025
Peoples Republic of China	276	356	460	584	670
OECD	2427	2522	2756	2648	2793
World	4750	4811	5528	5802	6256

Note: Data refer to man-made emissions from energy use only.

Source: OECD-IEA, OECD Environmental Data 1991.

Trends in man-made carbon dioxide emissions

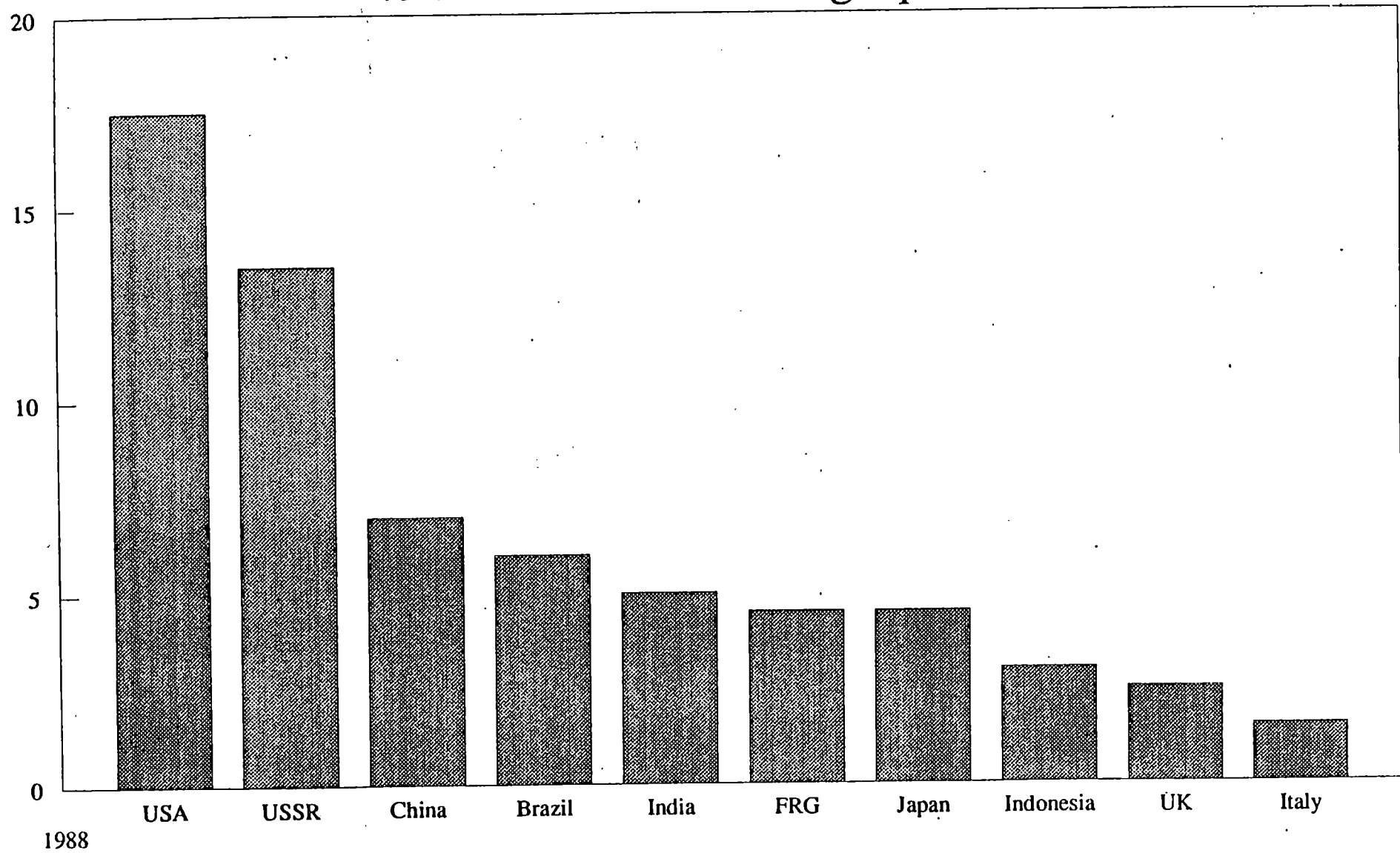


Note: Data refer to man-made emissions from energy use only.

Source: OECD-IEA, OECD Environmental Data 1991.

Top 10 countries for greenhouse gas emissions

% of total carbon heating equivalents

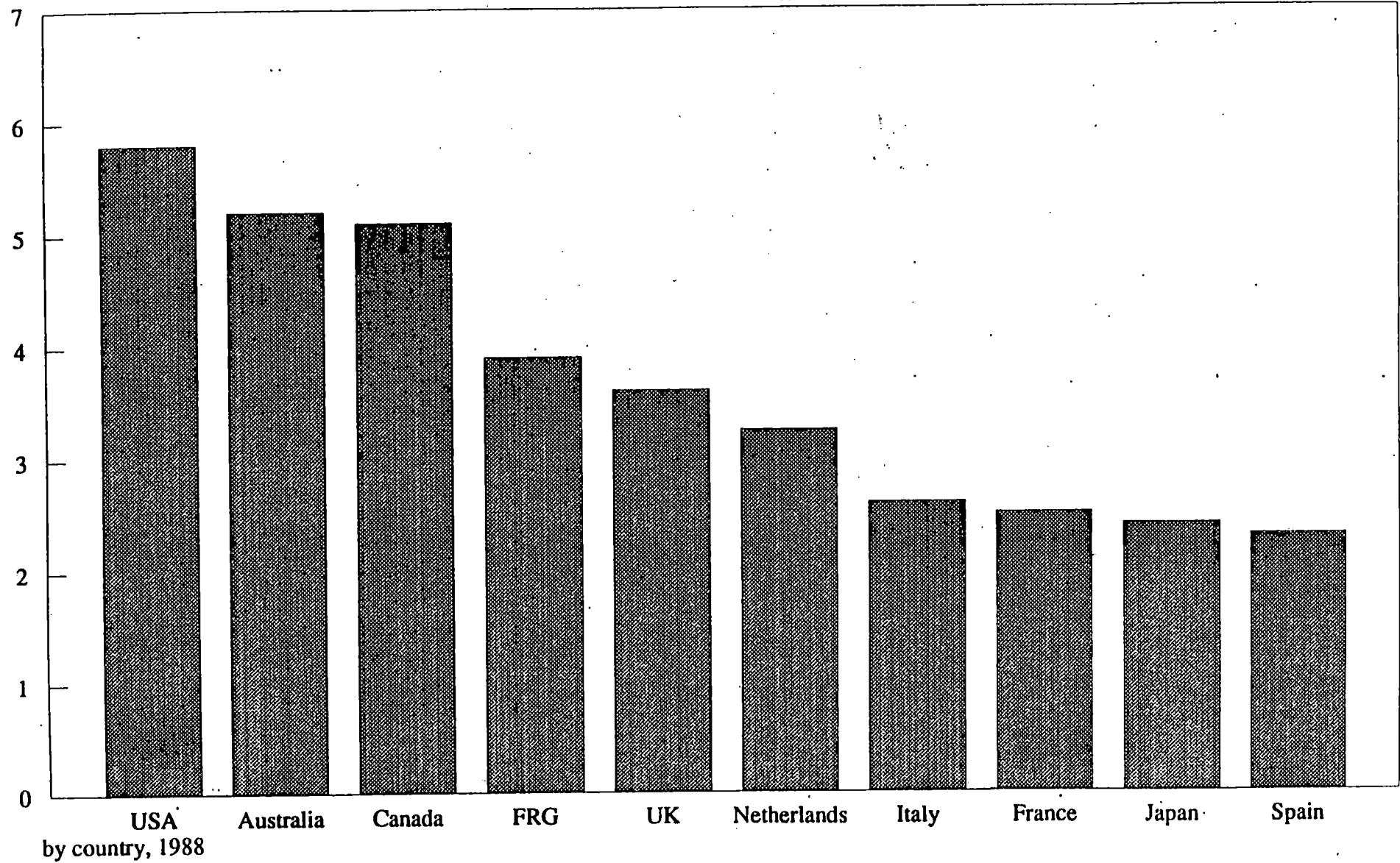


1988

Source: World Resource Institute, 1991.

Per capita greenhouse gas emissions, by country

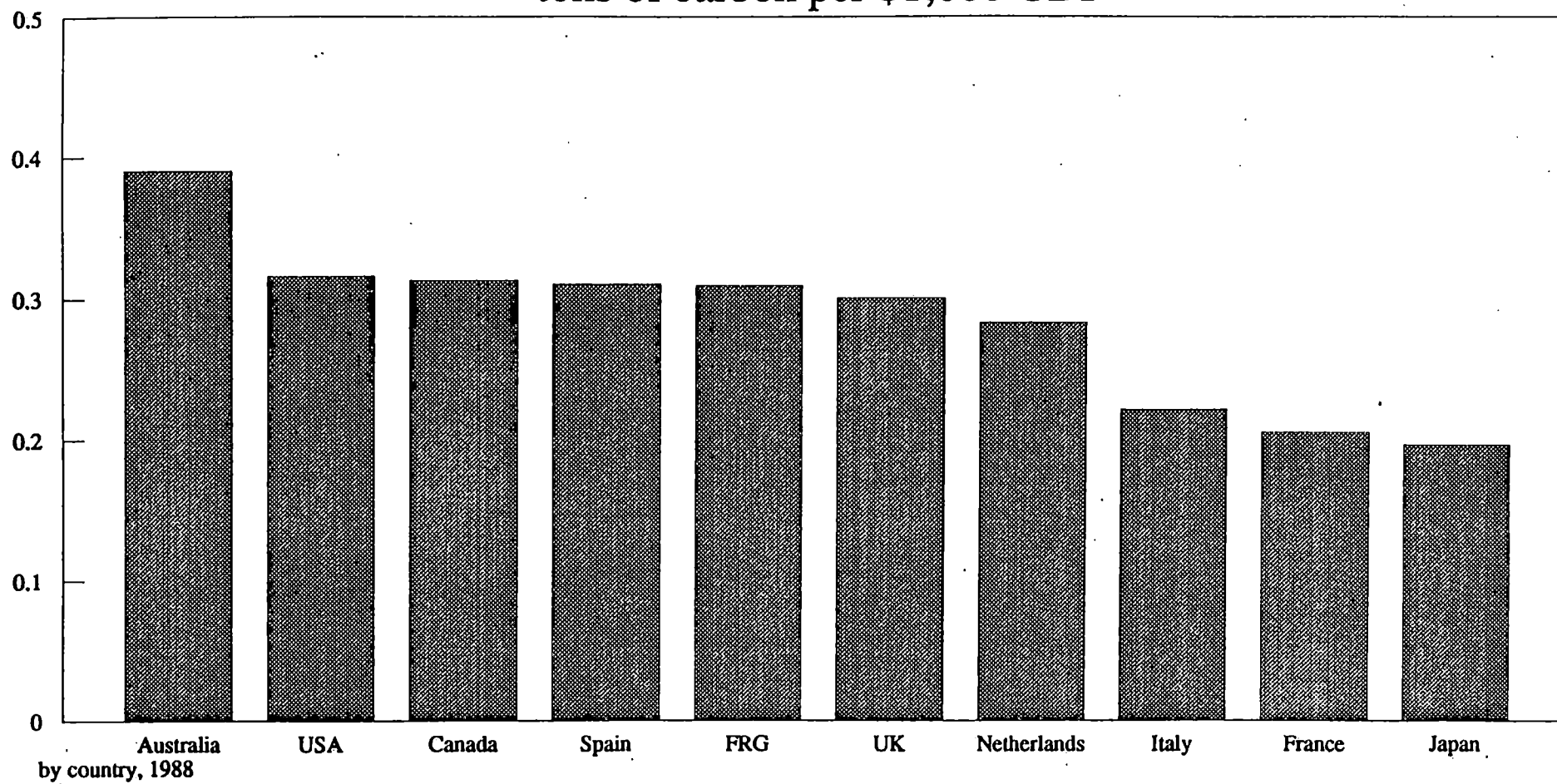
Tons of carbon per capita



Source: World Resource Institute, 1991.

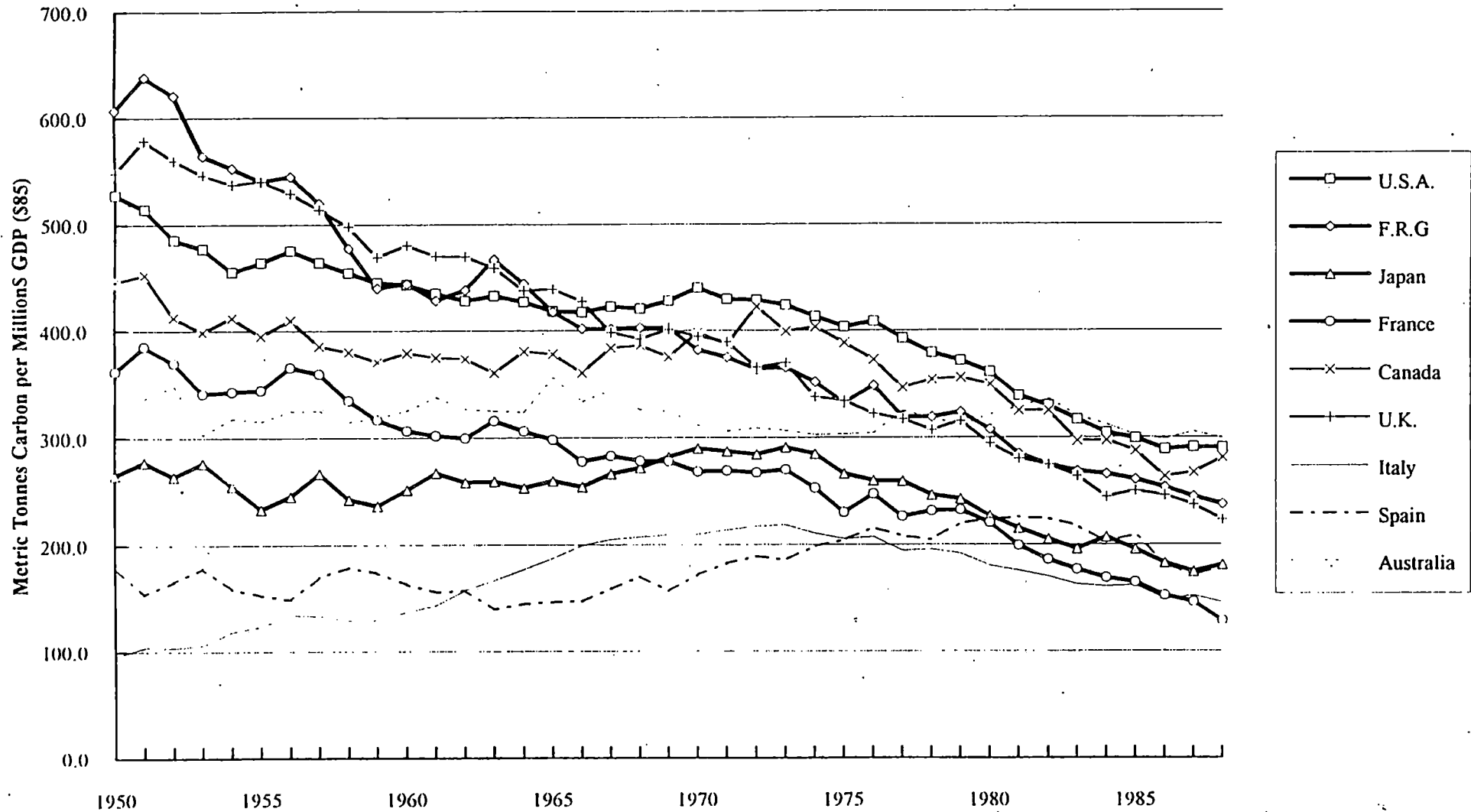
Greenhouse Gas Emissions per GDP

tons of carbon per \$1,000 GDP



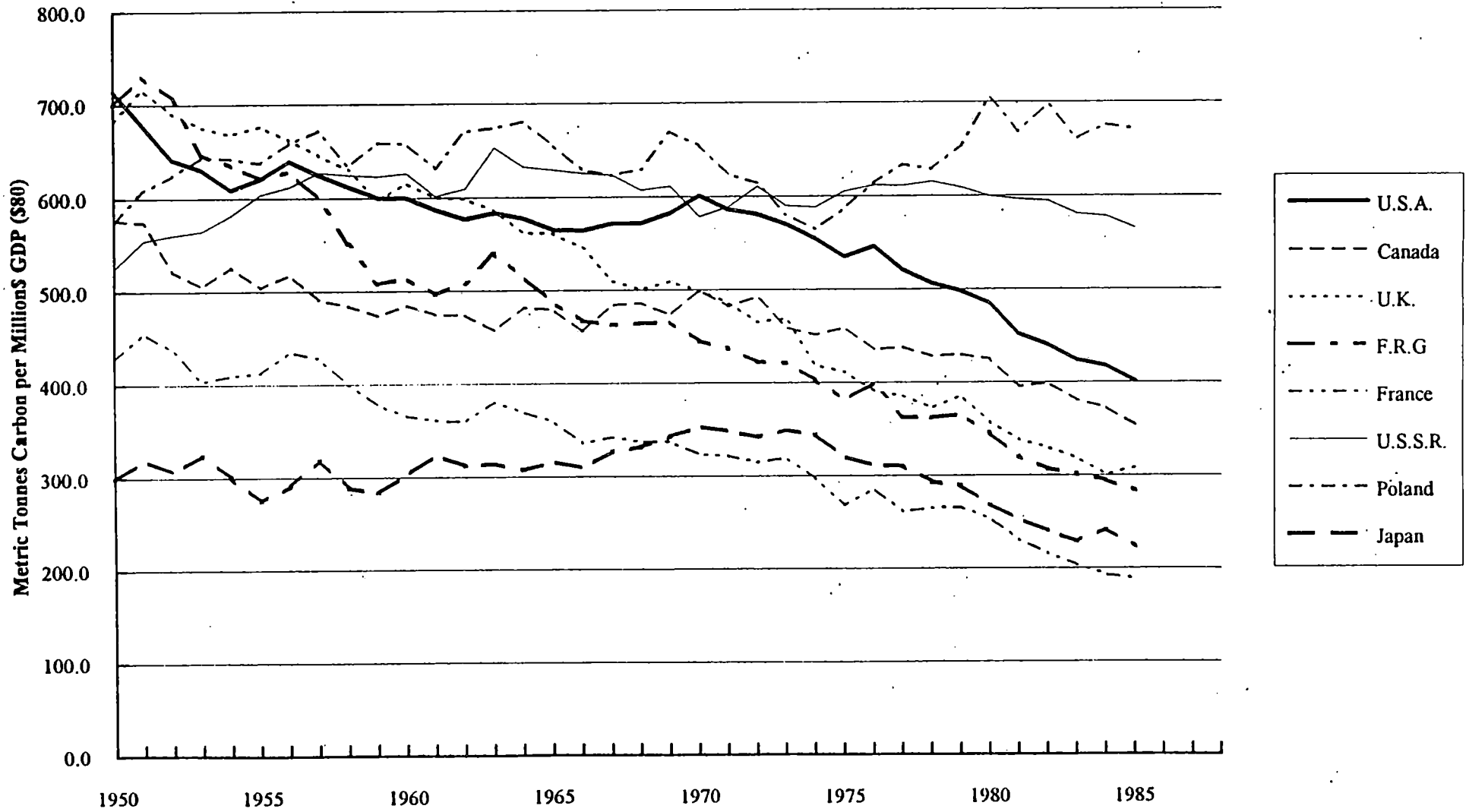
Sources: World Resource Institute, 1991.
Penn World Tables (Mark 5).

Carbon Intensity, Selected Countries



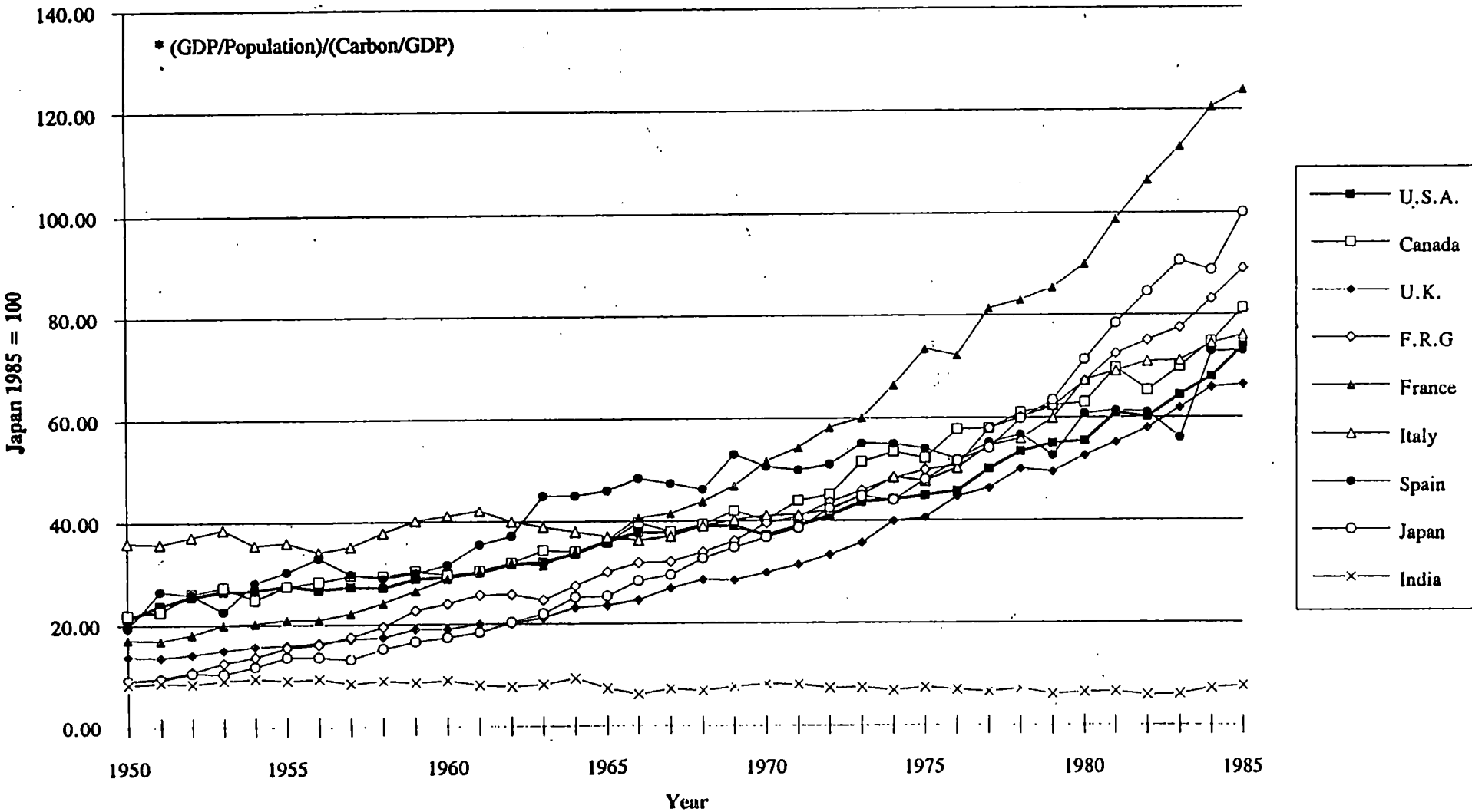
Sources: Penn World Tables (Summers & Heston); Carbon Dioxide Information Analysis Center.

Carbon Intensity, Selected Countries



Sources: Penn World Tables (Summers & Heston); Carbon Dioxide Information Analysis Center.

Per Capita GDP/Carbon Intensity Ratios*, Selected Countries



Source: Penn World Tables (Summers & Heston); Carbon Dioxide Information Analysis Center

Urban Air Pollution

Urban air pollution, particularly from industries and vehicles, has become a chronic, costly and critical threat to architecture, flora and fauna and human health. Residents of Southern California inhaled polluted air on 232 days in 1988, and on two-thirds of those days the pollution was deemed so excessive that adults with respiratory problems and children were warned to remain inside. And in China, urbanites have a six times greater chance of contracting lung cancer than people residing in the countryside. Breathing the air in Mexico City is said to be equivalent to smoking two packs of cigarettes a day. Primary pollutants emitted from urban areas, like carbon monoxide, sulphur and nitrogen oxides, and heavy metals, may combine to form other pollutants resulting acid rain and ozone production.

The following group of tables and graphs examines trends in total emissions of carbon monoxide, non-methane hydrocarbons, nitrous oxides, sulphur oxides and particulates, respectively. Units are given in 1,000 tonnes for selected years, spanning 1970-1990. Selected countries are highlighted for each pollutant in a graph below. Trends in total emission of each pollutant view also viewed in respect to gross domestic product for selected countries (1,000 tonnes per \$1,000 of gross domestic product) also in the form of a graph. Note that methods of measuring emissions may vary between countries, and be altered to the *notes* corresponding to the tables and graphs.

Carbon monoxide poses a health threat in that it limits red blood cell ability to absorb oxygen. The United States has the greatest carbon monoxide emissions in terms of total emission and total emissions per gross domestic product. However, the United States is also responsible for the greatest success in reduction of these emissions, especially in relation to gross domestic product. Note the slight overall decline or stabilization for most of the compared countries in the table.

Non-methane hydrocarbons are volatile organic compounds associated with photochemical air pollution, which includes ozone production. The United States, as in the case of carbon monoxide, has the most significant total hydrocarbon emissions; however, in terms of total emission per gross domestic product, the United States' improvements over time have now placed them below Canada and in a similar range with countries of comparable economic status.

In the case of nitrous oxides, all OECD countries increased total emissions slightly, with the United States distinctly highest. But compared in relation to gross domestic product, Canada again rises above the United States. In fact all six of the countries highlighted in the graph depicting trends per unit of gross domestic product show a reduction in nitrous oxide emissions over time. Emissions of nitrous oxides result primarily from the burning of fossil fuels, and are connected with ozone production, acid precipitation and smog.

All OECD countries show a promising, although slight, decreasing trend in both total emissions of sulphur oxides and total emissions per unit of gross domestic product. Once again,

the United States is forefront in total emissions, but falls below Canada and is comparable to the United Kingdom for total emissions relative to gross domestic product. Particularly apparent in relation to gross domestic product, all of the highlighted countries show declining emissions of sulphur oxides. Sulphur oxides add to acid deposition, which affect human health, agriculture, forests and architecture.

Particulate matter is the substance responsible for reduced visibility in fog and may also be comprised of heavy metals and other toxic substances. Notable reductions in total emissions of particulate matter are present in the United States(although it remains the highest emitter), France, West Germany and the United Kingdom. Reductions to a lesser extent are noted in Canada, the Netherlands, Austria, Norway, Portugal and Switzerland. Slight increases occurred in Ireland and Italy. Particulate emissions in relation to gross domestic product also show a downward trend, with the United States falling below Canada into a range relative to comparable economies.

The final set of comparisons relative to urban air pollution focuses first on relative concentrations(percentage) of nitrogen dioxide, sulphur dioxide and particulate matter for cities or regions in 1988 and second shows those same comparisons per billion dollars of gross domestic product. In respect to concentrations no single country ranked highly in all three pollutants, although Copenhagen showed first and second in particulates and sulphur oxide, respectively. However Netherlands and Brussels traded between the highest rankings for nitrogen dioxide, sulphur dioxide and particulate matter in terms of relative concentration percentage per billion dollars of gross domestic product. New York and Tokyo had the lowest relative concentrations in relation to gross domestic product. When interpreting these tables and graphs, account for differing methods of measurement.

Trends in total emissions of CO, 1970-1990

1000 tonnes

		1970	1975	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Canada	(a)	10057	10594	10273	.	.	.	.	10781	.	.	.	.	.
USA		101400	84100	79600	77400	72400	74500	71800	69600	64000	64200	65000	60900	.
Austria		.	.	1268	.	.	.	.	1205	.	1221	1161	.	.
Denmark		.	.	.	.	.	.	.	.	.	.	.	.	.
France		0	6522	6616	6527	6388	6286	6312	6295	6431	6198	.	.	.
W.Germany		14540	13987	12006	10769	9975	9294	9223	8894	9015	8777	8671	8872	.
Ireland	(b)	.	388	497	500	493	472	464	456	457	.	.	.	.
Italy	(a, f)	4306	4798	5487	.	.	.	5426	5417	5571	5585	5923	.	.
Luxembourg		.	.	.	.	.	.	.	240	.	.	.	.	.
Netherlands	(c)	1928	1917	1413	1299	1250	1217	1205	1162	1133	1118	1125	1152	1054
Norway	(d)	.	560	606	585	590	591	598	588	628	653	635	582	557
Portugal	(g, h)	290	461	533	.	.	267	.	.	.	.	.	.	.
Spain	(e, i)	.	3032	3780	.	.	1822	.	.	.	.	.	.	.
Sweden		.	1390	1250	.	1754	.	.	.	.	.	494	462	431
Switzerland		.	736	711	.	.	.	621	.	.	.	.	.	.
UK		4844	4665	4829	4831	4993	5015	5085	5318	5535	5892	6140	6522	.

Notes:

(a) 1975 data refer to 1974.

(b) New estimation method in 1987.

(c) 1990 data are provisional. 1987 data and data of later years include provisional figures for emissions from the industrial process.

(d) 1989 and 1990 data are provisional.

(e) New estimation method since 1983.

(f) Emissions from industrial process excluded.

(g) Secretariat estimate.

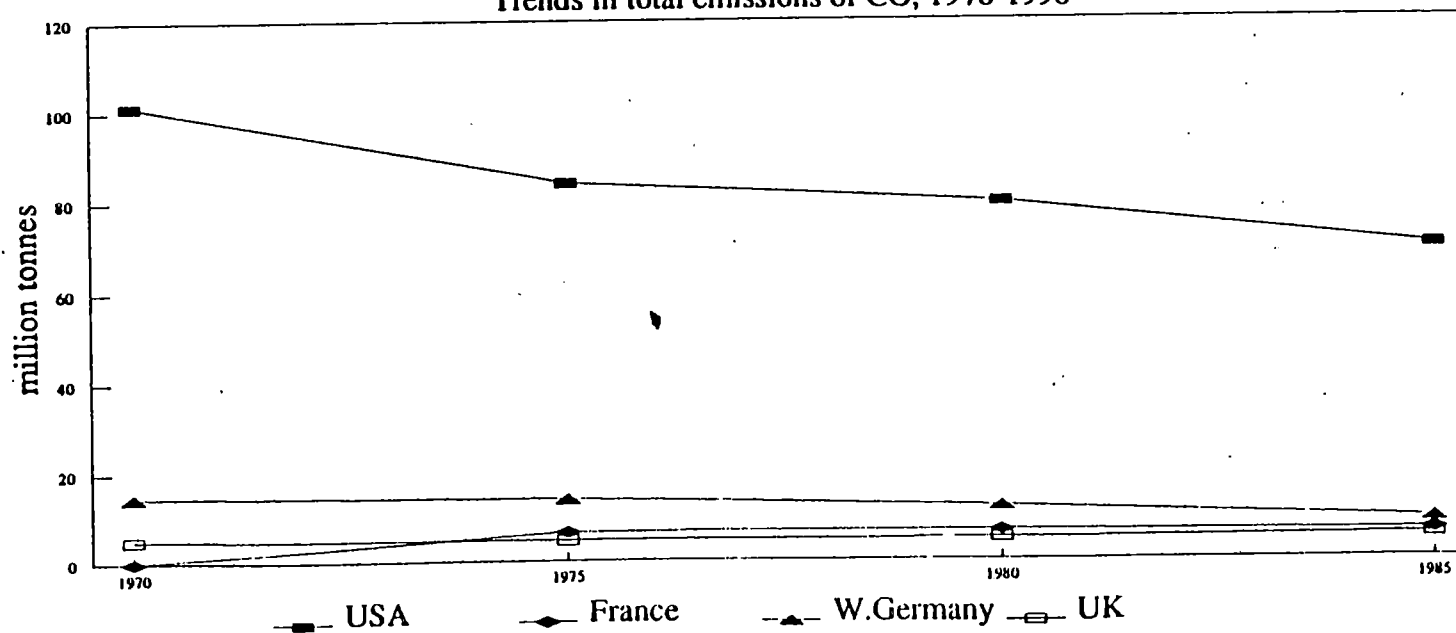
(h) Emissions from fuel combustion not listed.

(i) 1975 and 1980 data exclude emissions from power stations and fuel combustion.

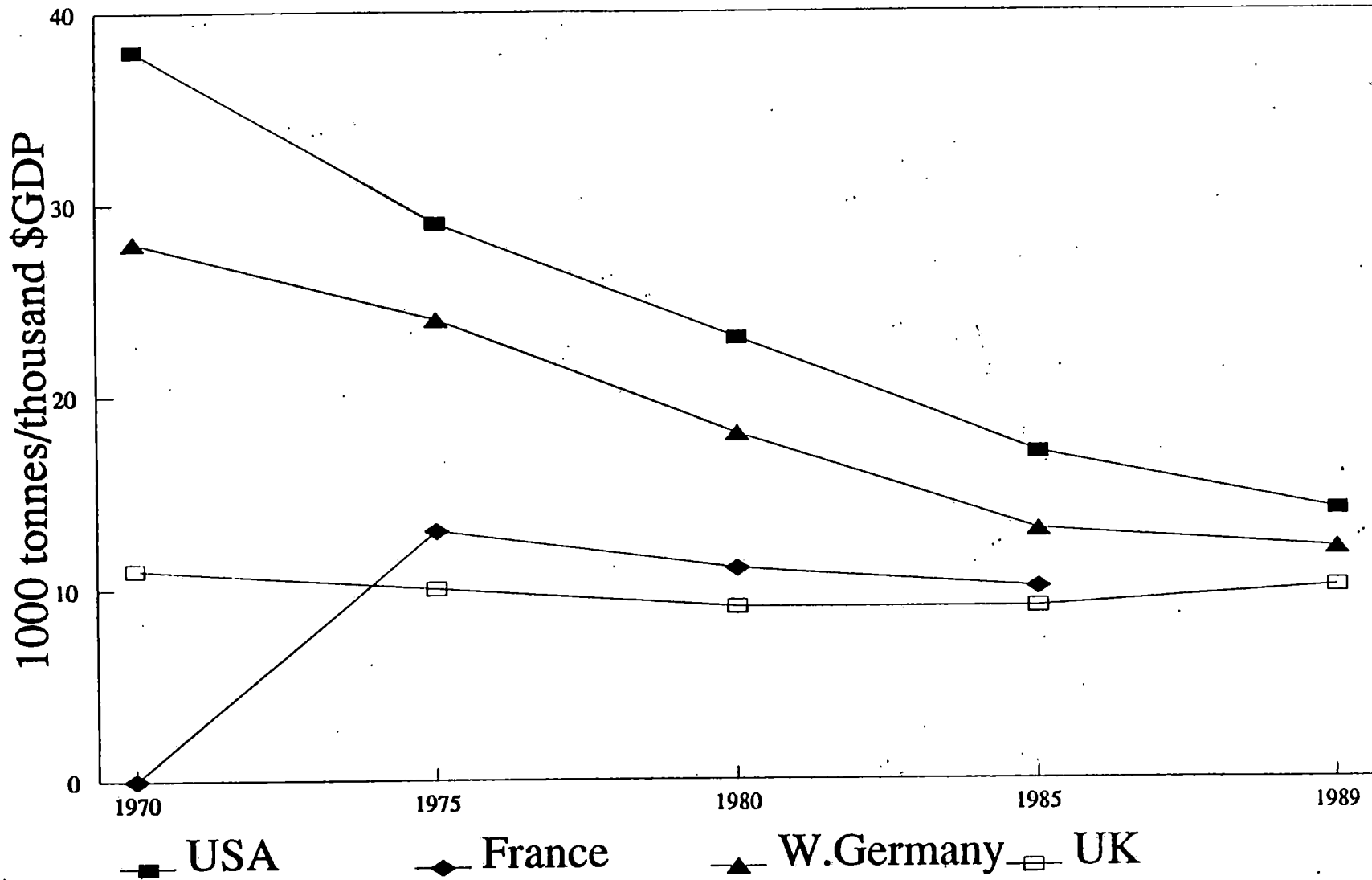
* represents an unknown figure.

Source: OECD Environmental Data 1991.

Trends in total emissions of CO, 1970-1990



Trends in total emissions of CO/GDP, 1970-1989



Source: OECD Environmental Data 1991 and Penn World Tables(Mark 5); Summers and Heston: 1991.

Trends in total emissions of HC(a), 1970-1990

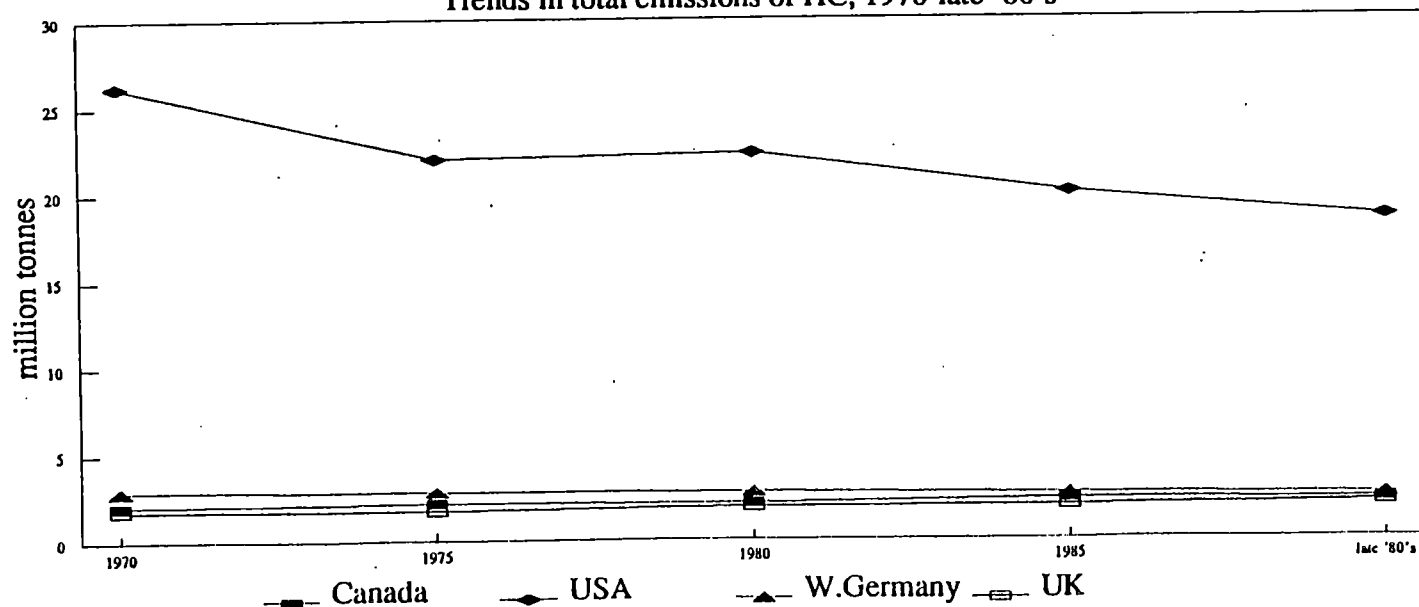
		1000 tonnes												
		1970	1975	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Canada	(b,c)	2017	2168	2099	.	.	.	.	2315	.	.	.	.	2256
USA		26200	22000	22300	20900	19600	20500	21500	20000	19400	19600	18500	.	.
Austria		.	.	382	.	.	.	.	441	.	.	466	.	.
Denmark	(e)	.	.	197	.	.	.	.	146	.	.	.	.	.
Finland		.	.	163	.	.	.	.	181	.	.	.	.	.
France	(e)	.	.	1972	.	.	.	.	1877	.	.	.	.	.
W.Germany		2881	2808	2754	2661	2637	2632	2651	2624	2661	2633	2603	2536	.
Ireland	(d)	.	48	62	63	63	62	64	64	.	108	.	.	.
Italy	(b,i)	504	583	696	.	.	.	724	737	767	786	827	.	.
Luxembourg	(k)	.	.	.	.	.	.	.	20	.	.	.	.	.
Netherlands	(f,i)	540	555	502	474	463	448	428	416	404	398	396	399	381
Norway	(g)	.	149	158	172	182	198	209	224	247	267	248	245	226
Portugal	(j)	.	.	55	.	.	63	.	134	145	149	156	.	.
Spain		.	.	843	.	.	843	.	.	.	.	.	.	.
Sweden	(k)	.	432	410	.	413	.	.	446	.	.	440	.	.
Switzerland		289	261	311	.	.	.	339	.	.	.	311	304	297
UK		1750	1733	1887	1893	1912	1903	1907	1926	1957	1984	2013	2066	.

Notes:

- (a) Non methane hydrocarbons. Man made emissions.
- (b) 1975 data refers to 1976.
- (c) Total hydrocarbons. 1990 data are Secretariat estimates.
- (d) New estimation method in 1987.
- (e) 1985 data refer to EMGP figures.
- (f) 1990 data provisional, 1987 data and data of later years include provisional figures for emissions from industrial processes.
- (g) 1989 and 1990 data are provisional.
- (h) Since 1984, data include emissions from charge conversion.
- (i) Use of paint/solvents (household) included.
- (j) Emissions from industrial process excluded.
- (k) Total hydrocarbons.

Source: OECD Environmental Data 1991.

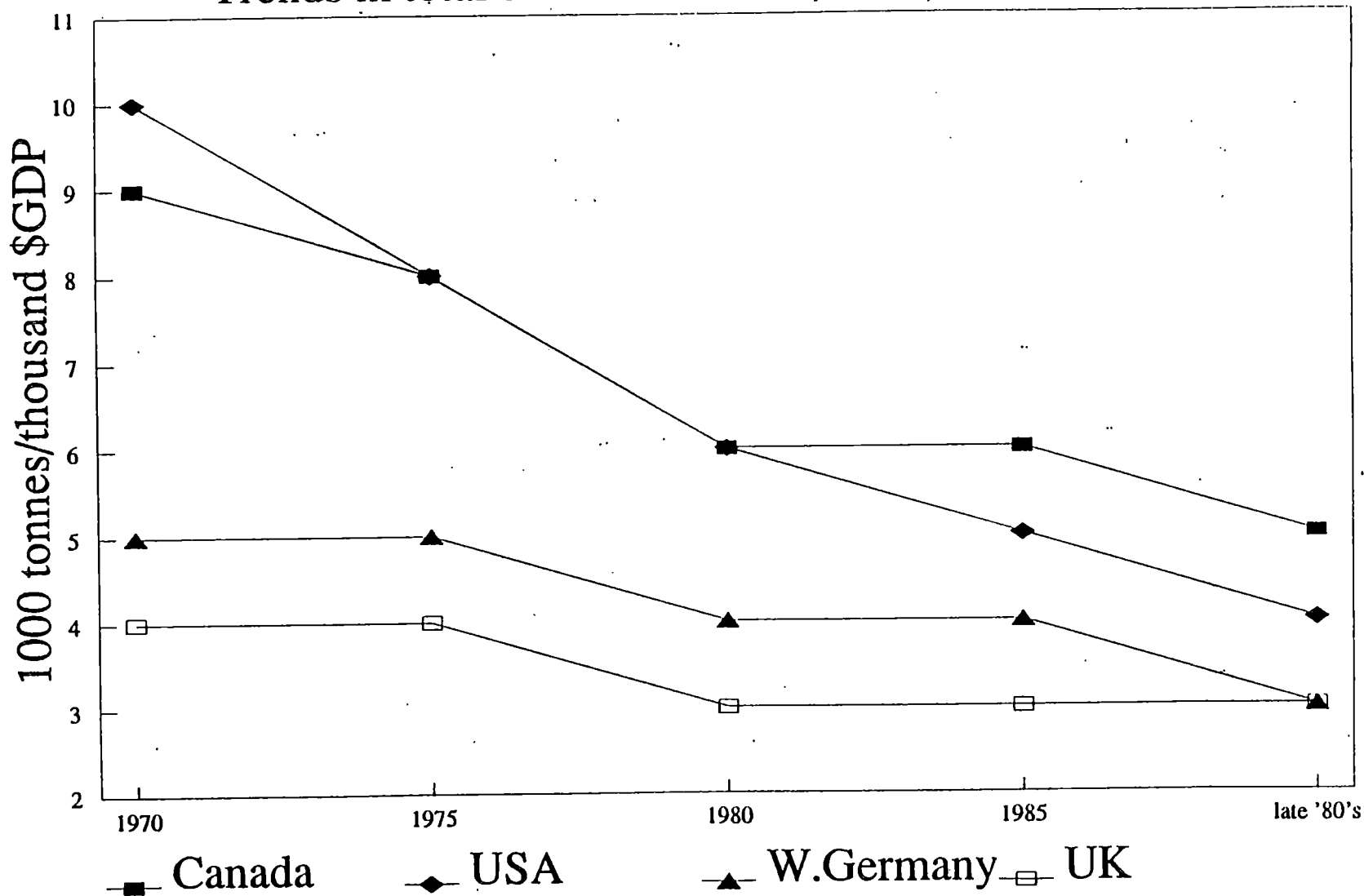
Trends in total emissions of HC, 1970-late '80's



Notes

- late '80's data refer to 1987 Canada, 1988 USA, 1986 Japan, 1990 France, 1990 Germany and 1989-UK
- 1983 data for Japan refers to 1983

Trends in total emissions of HC/GDP, 1970-late '80's



Notes:

late '80's data refer to 1987-Canada, 1988-USA, 1986-Japan, 1990-France, 1990-Germany and 1989-UK.

1985 Data for Japan refers to 1983.

Source: OECD Environmental Data 1991 and Penn World Tables(Mark 5); Summers and Heston: 1991.

Trends in total emissions of NOx, 1970-1990

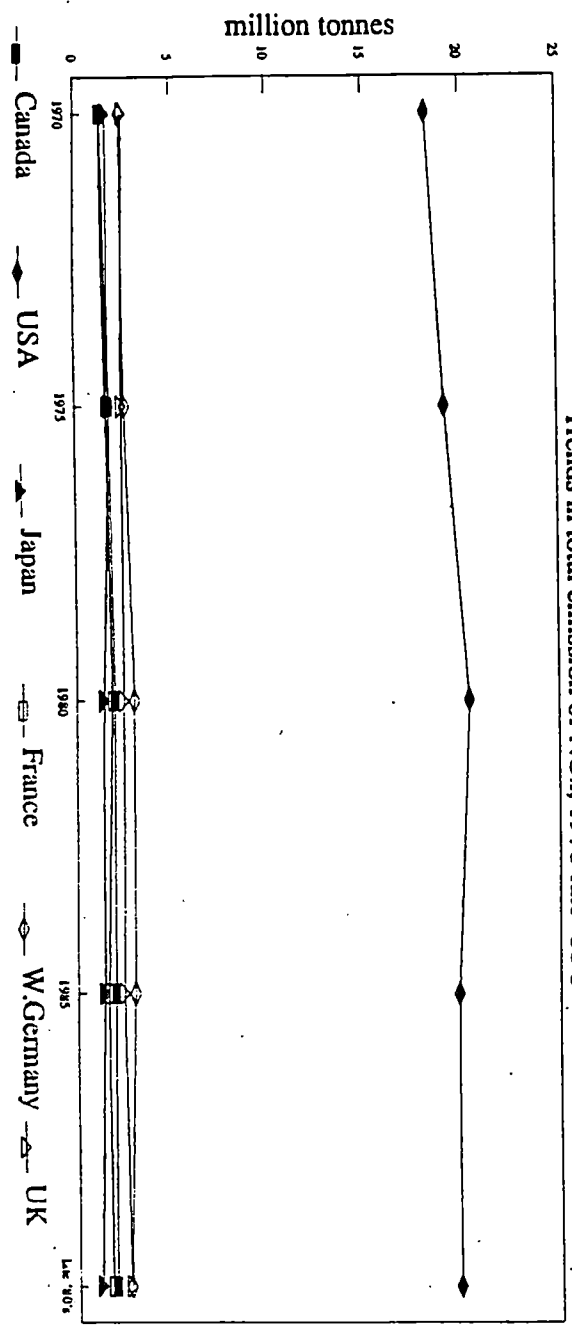
	1970	1975	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Canada	1364	1756	1939	1907	1897,000	1884	1871	1939	19300	19500	18800	•	•
USA	18300	18200	20400	20400	19600	19000	19700	19800	19300	19500	18800	•	•
Japan	1651	1781	1400	•	•	1367	•	230	1176	205	213	•	•
Austria	•	•	232	•	•	•	•	281	292	297	•	•	179
Belgium	•	•	317	•	297	271	•	281	287	282	249	•	•
Denmark	(i)	178	241	207	224	218	225	259	287	282	249	•	•
Finland	(c)	160	264	248	245	236	233	251	296	270	276	•	•
France	(d)	1332	1608	1834	1703	1696	1645	1579	1584	1605	1658	1760	1742
W.Germany	(b)	2381	2571	2890	2897	2864	2965	2959	3008	2827	2859	2707	•
Ireland	(e)	60	71	71	68	68	68	88	•	115	•	•	•
Italy	(e,j)	1410	1507	1585	•	•	1529	1555	1570	1650	1705	•	•
Luxembourg	(i,h)	•	•	23	•	•	22	22	•	•	•	•	•
Netherlands	(i,h)	456	484	558	552	545	540	547	585	578	585	549	530
Norway	(g)	159	176	192	179	179	206	203	222	233	225	220	212
Portugal	(g)	72	104	166	•	•	182	86	110	118	122	•	•
Spain	(h)	•	•	951	•	937	937	826	•	•	•	•	•
Sweden	(h)	302	308	394	385	385	384	398	405	404	396	384	371
Switzerland	(h)	149	182	186	•	•	214	•	•	•	194	189	184
UK	(h)	2510	2427	2442	2322	2322	2293	2402	2475	2578	2642	2680	2680
Yugoslavia	•	•	350	370	370	370	380	400	420	440	480	430	•

Notes:

- (a) 1970 data via Secretariat submission.
- (b) Data submission received in 1975.
- (c) 1975 data refer to 1976.
- (d) Data refer to 1976.
- (e) Data refer to 1976.
- (f) Data refer to 1976.
- (g) Data refer to 1976.
- (h) Data refer to 1976.
- (i) Data refer to 1976.
- (j) Data refer to 1976.

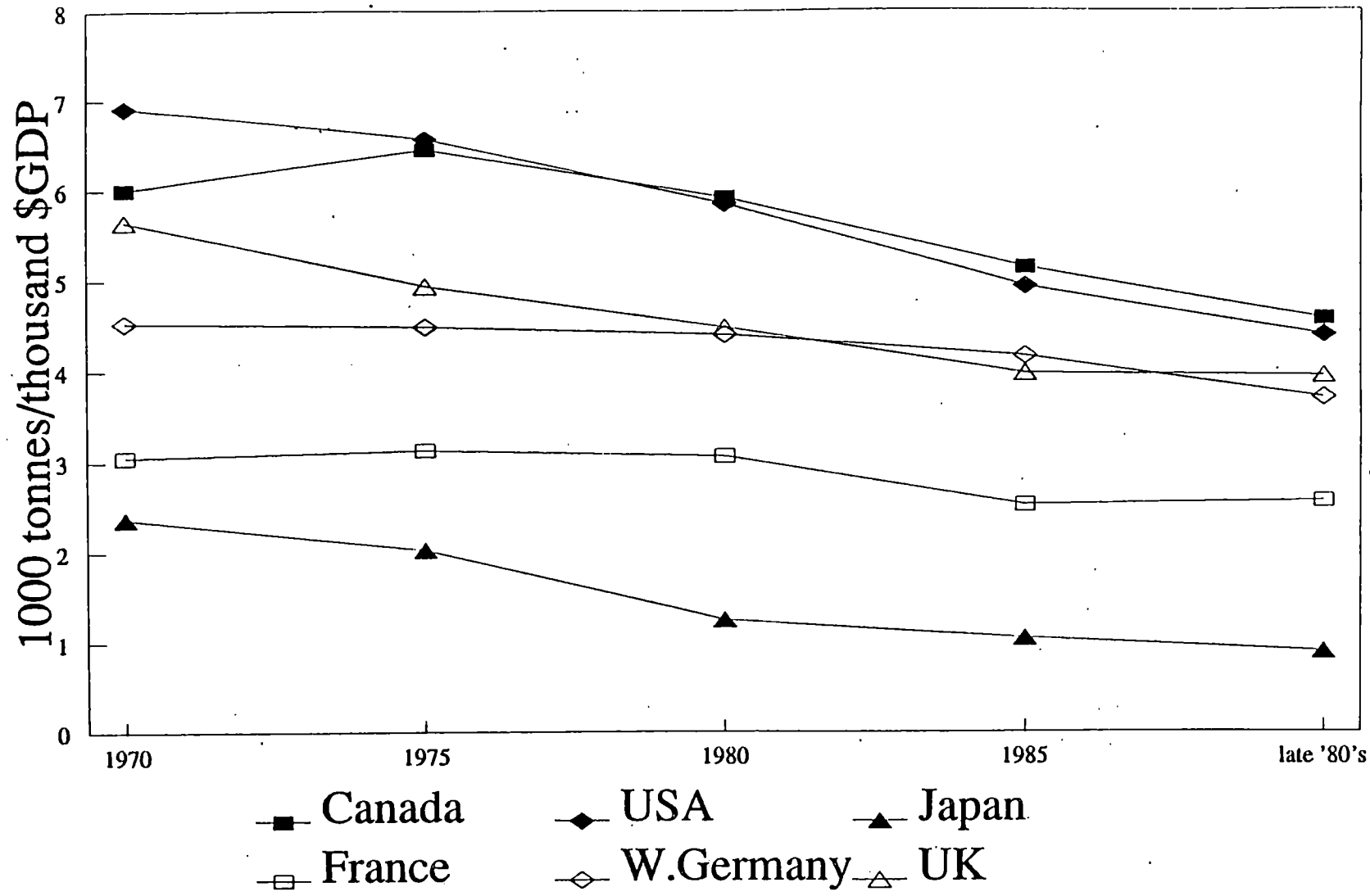
(i) 1970 data via Secretariat submission.
 (ii) 1975 and 1990 data via government.
 (iii) 1977 data and data of later years include government figures for emissions from industrial processes.
 (iv) 1978-1990 data refer to ECOTR figures.
 (v) Data from industrial processes are in italics.
 (vi) 1979 data via government; 1970 data for total emissions via formula.

Trends in total emission of NOx, 1970-late '80's



Notes:
 See '80's data refer to 1987 Canada, 1988 USA, 1985 Japan, 1970 France, 1970 Germany and 1989 UK.
 1983 data for Japan refers to 1981.
 Based on: UNCTAD International Data Year 1991

Trends in total emissions of NO_x/GDP, 1970-late '80's



Notes:
 late '80's data refer to 1987-Canada, 1988-USA, 1986-Japan, 1990-France, 1990-Germany and 1989-UK.
 1985 Data for Japan refers to 1983.

Source: OECD Environmental Data 1991 and Penn World Tables(Mark 5): Summers and Heston: 1991.

Trends in total emissions of SOx, 1970-1990

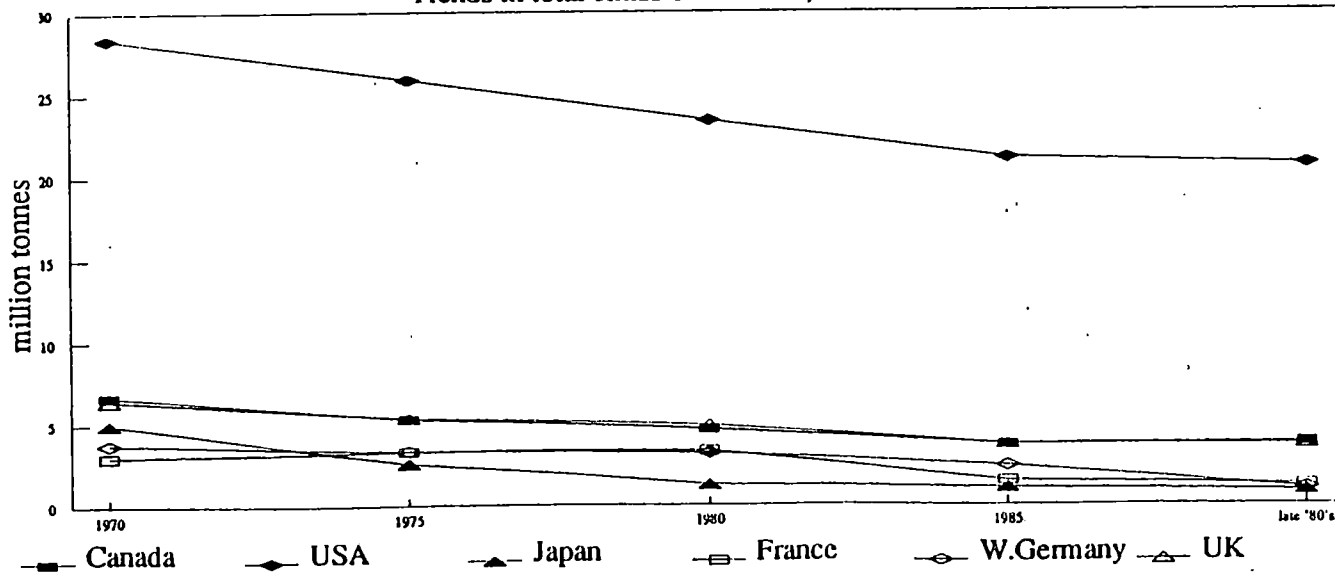
		1970	1975	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
		1000 tonnes													
Canada	(a,e)	6677	5319	4643	4291	3612	3625	3955	3704	.	3800	.	.	.	
USA	(l)	28400	25900	23400	22600	21400	20800	21500	21100	20700	20400	20700	.	.	
Japan		4973	2586	1263	.	.	1049	.	.	835	.	.	.	.
Austria		.	.	389	.	.	.	.	190	.	119	121	.	.
Belgium		.	.	828	712	691	560	500	452	474	414	.	.	420	
Denmark	(m)	574	418	447	364	368	312	296	340	278	249	242	193	.	
Finland		515	535	584	534	484	372	368	382	331	328	302	242	.	
France	(d)	2966	3328	3339	2588	2490	2095	1867	1475	1348	1288	1223	1272	1207	
W.Germany		3743	3334	3194	3039	2868	2690	2603	2396	2263	1933	1237	1001	.	
Ireland	(b)	.	186	217	189	155	140	129	138	.	174	.	.	.	
Italy	(e,j)	2830	3331	3211	.	.	2233	2240	2086	2074	2010	2006	.	.	
Luxembourg		.	.	24	20	16	14	14	16	14	14	12	12	10	
Netherlands	(f,k)	807	429	492	468	394	319	302	269	273	267	259	218	217	
Norway	(g)	171	137	142	129	111	104	95	97	91	75	67	59	59	
Portugal		116	178	267	.	.	305	.	198	234	218	205	.	.	
Spain	(h)	.	3003	3404	.	.	2543	.	2156	.	.	.	.	.
Sweden	(c,i)	930	690	611	422	362	303	287	284	263	241	213	174	168	
Switzerland		125	109	126	.	.	.	95	.	.	.	74	68	63	
UK		6424	5370	4894	4431	4208	3861	3719	3718	3895	3898	3813	3699	.	
Yugoslavia		.	.	1300	1300	1300	1400	1450	1500	1500	1500	1600	1550	.	

Notes

- (a) 1987 data are Secretariat estimates.
- (b) New estimation method in 1987.
- (c) 1989 data are provisional; 1990 data are forecasts.
- (d) 1980-89 data have been revised; 1990 data are provisional.
- (e) 1975 data refer to 1976.
- (f) 1990 data are provisional.
- (g) 1989 and 1990 data are provisional.
- (h) New estimation method since 1983.
- (i) H2S excluded.
- (j) Emissions from industrial processes on chabot.
- (k) 1987 data and data of later years include provisional figures for emissions from industrial processes.
- (l) 1988 data include Secretariat estimates for emissions from power plants.
- (m) 1984-90 data refer to EMEP figures.

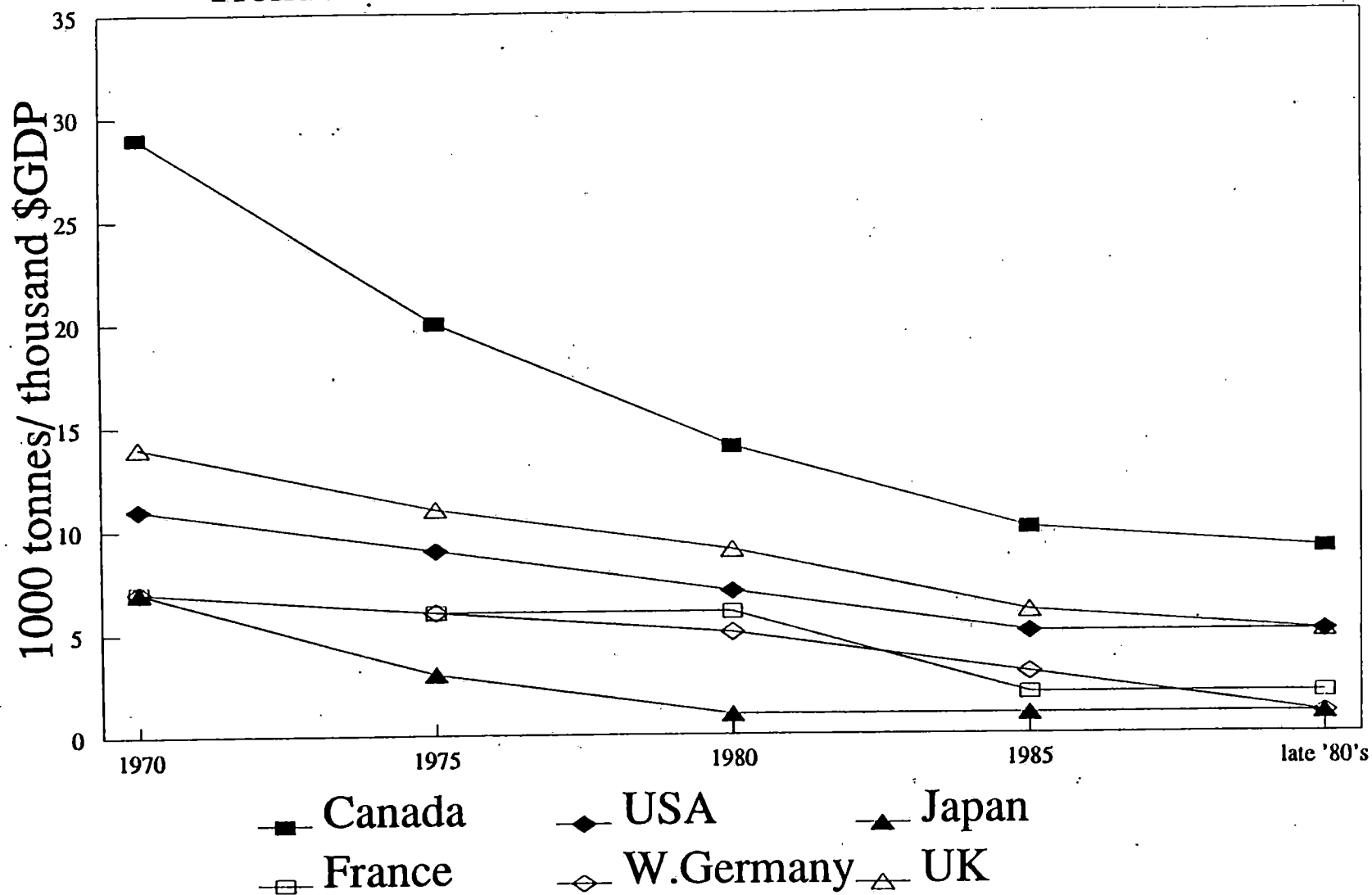
Source: OECD Environmental Data 1991

Trends in total emissions of SOx, 1970-late '80's



Notes
late '80's data refer to 1987-Canada, 1988 USA, 1980 Japan, 1990 France, 1990 Germany and 1989 UK
1983 Data for Japan refer to 1981

Trends in total emissions of SO_x/GDP, 1970-late '80's



Notes:

late '80's data refer to 1987-Canada, 1988-USA, 1986-Japan, 1990-France, 1990-Germany and 1989-UK.

1985 Data for Japan refers to 1983.

Trends in total emissions of Particulates, 1970-1990

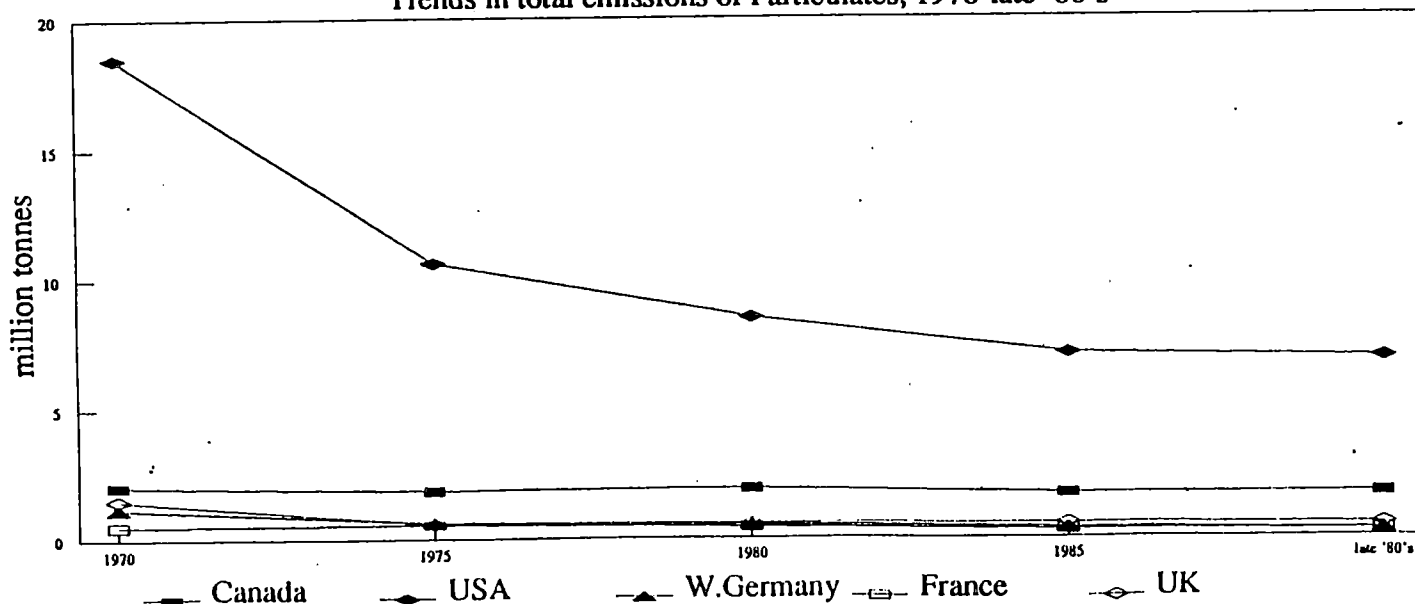
		1970	1975	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	
		1000 tonnes													
Canada	(a)	2027	1867	1907	.	.	.	.	1709	.	.	.	.	.
USA		18500	10600	8500	8100	7100	7100	7400	7100	6800	7000	6900	.	.	
Japan		.	.	.	.	.	.	.	.	.	.	.	.	.
Austria		.	.	75	.	.	.	.	55	.	30	39	.	.
Denmark		.	.	.	.	.	.	.	.	.	.	.	.	.
France		.	558	427	380	365	335	323	304	288	282	284	298	278	
W.Germany	(e)	1168	642	517	477	431	409	412	397	382	344	320	268	.	
Ireland	(b)	.	75	94	97	98	100	112	117	.	107	.	.	.	
Italy	(a, l)	330	337	386	.	.	.	.	384	390	413	427	452	.
Luxembourg		.	.	.	.	.	.	.	3	.	.	.	.	.
Netherlands	(g)	183	149	163	156	146	125	110	101	99	98	98	76	73	
Norway	(c)	.	25	27	24	22	22	23	23	26	25	21	20	20	
Portugal	(h)	121	74	119	.	.	93	.	.	.	.	.	.	.
Spain	(d)	.	.	.	.	.	.	.	.	.	.	.	.	.
Sweden	(j)	.	170	170	.	.	.	.	.	.	.	.	.	.
Switzerland		41	28	28	.	.	.	22	.	.	.	21	21	20	
UK	(f)	1049	570	570	540	538	520	481	555	585	538	533	512	.	

Notes:

- (a) 1975 data refer to 1976.
- (b) New estimation method in 1987.
- (c) 1989 and 1990 data are provisional.
- (d) Stationary sources include power stations only.
- (e) Data exclude transport, treatment and disposition of heavy materials.
- (f) Data refer to black smoke.
- (g) 1990 data are provisional; 1987 data and data of later years include provisional figures for emissions from industrial processes.
- (h) Secondary estimates.
- (i) Emissions from industrial processes excluded.
- (j) 1980 data refer to 1978.

Source: OECD Environmental Data 1991.

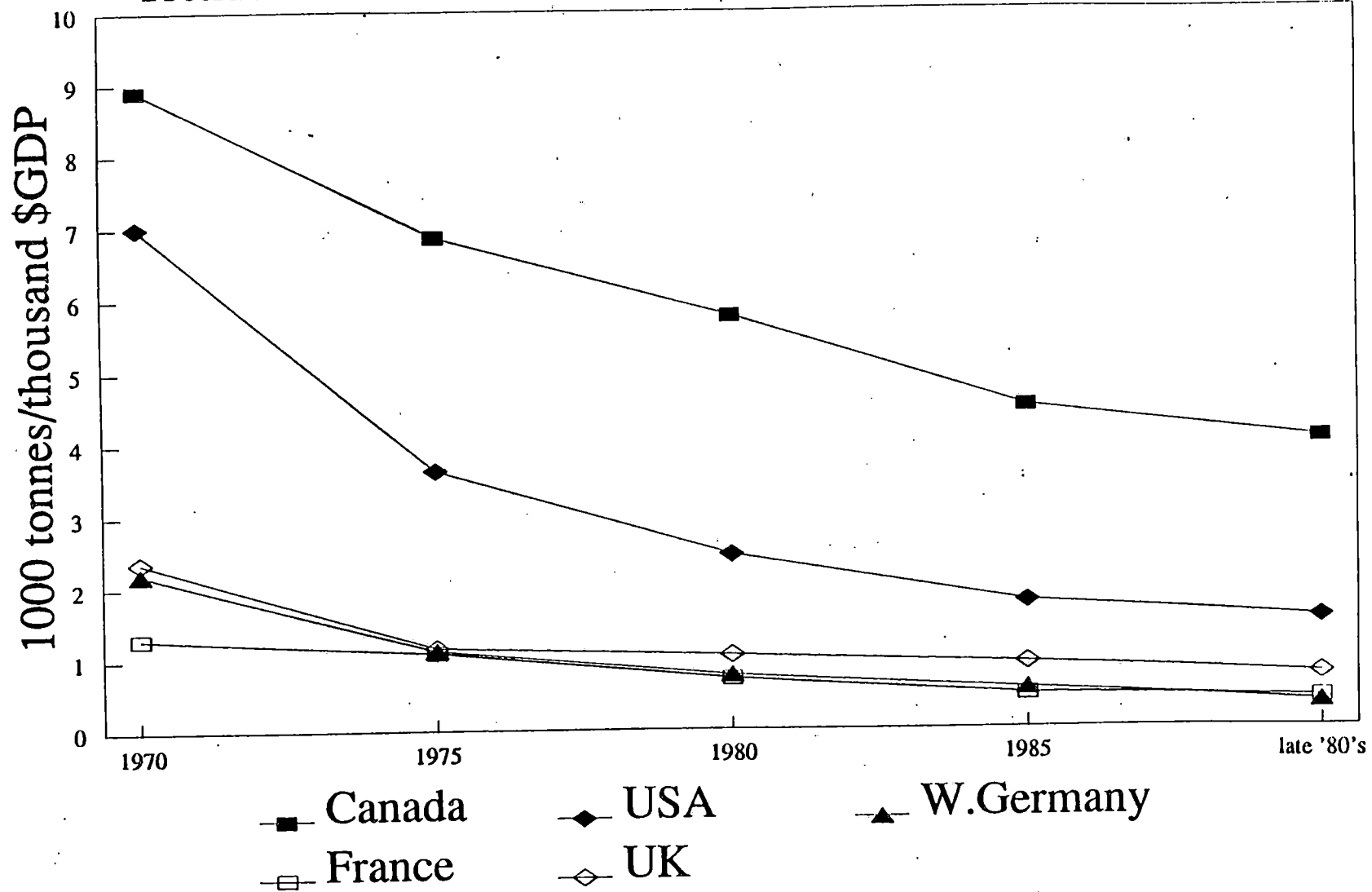
Trends in total emissions of Particulates, 1970-late '80's



Notes:

late '80's data refer to 1985 Canada, 1988 USA, 1990 France, 1990 Germany and 1989 UK.
1970 data for France refers to 1973

Trends in total emissions of Particulates/GDP, 1970-late '80's



Notes:

late '80's data refer to 1987-Canada, 1988-USA, 1986-Japan, 1990-France, 1990-Germany and 1989-UK.

1985 Data for Japan refers to 1983.

Source: OECD Environmental Data 1991 and Penn World Tables(Mark 5): Summers and Heston: 1991.

Concentration of NO2, SO2 and Particulates

relative concentration(%), 1988 figures

	city or region	NO2	SO2	Particulates
USA	New York	101	87	88
Japan	Tokyo	97	40	110
Belgium	Brussels	78	63	56
Denmark	Copenhagen	73	68	139
France	Dunkerque	98	40	57
W.Germany	Berlin	129	57	92
Ireland	Dublin	-	67	119
Luxembourg	National	-	42	82
Netherlands	National	142	53	66
Portugal	Lisbone	93	55	87
UK	London	105	56	90

Source: OECD

Concentration of NO2, SO2 and Particulates

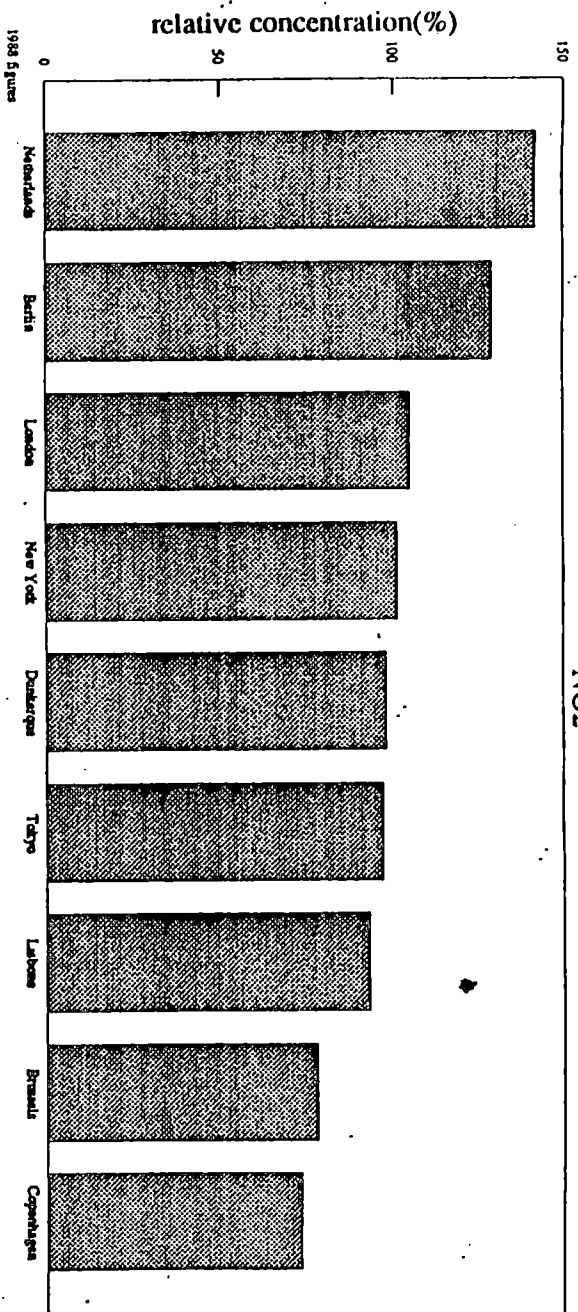
relative concentration(%)/billion \$ of GDP, 1988 figures

	city or region	NO2	SO2	Particulates
USA	New York	0.02	0.02	0.02
Japan	Tokyo	0.06	0.02	0.07
Belgium	Brussels	0.52	0.42	0.38
Denmark	Copenhagen	0.10	0.10	0.20
France	Dunkerque	0.13	0.05	0.08
W.Germany	Berlin	0.14	0.06	0.10
Ireland	Dublin	-	2.68	4.76
Luxembourg	National	-	8.40	16.40
Netherlands	National	0.76	0.28	0.35
Portugal	Lisbone	0.15	0.09	0.14
UK	London	0.14	0.08	0.12

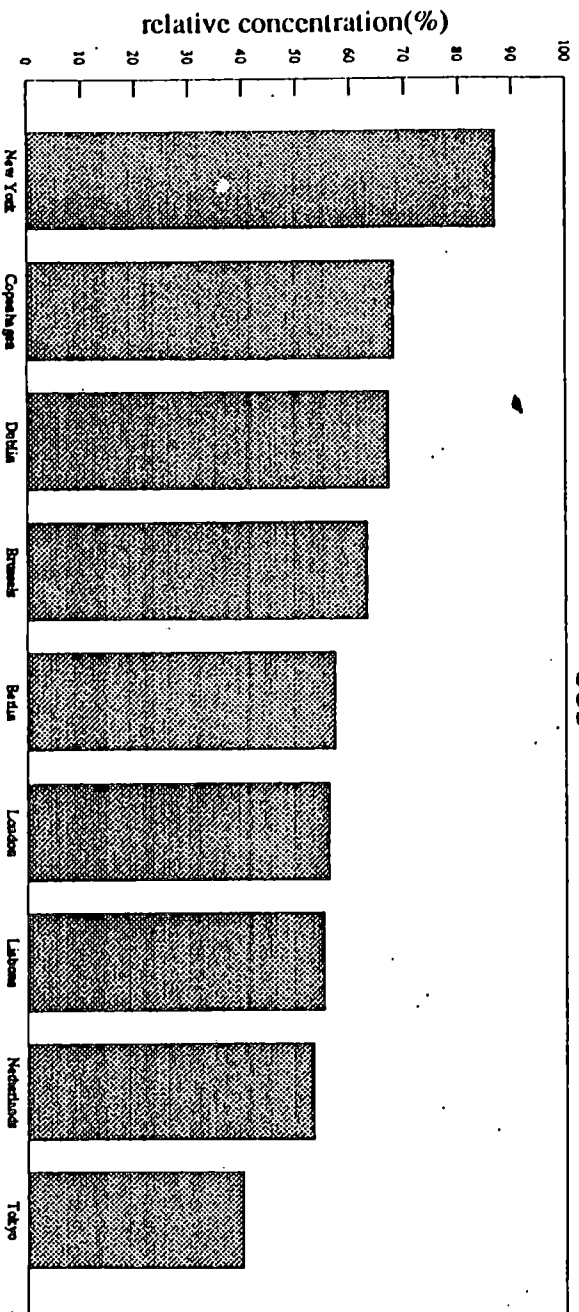
Sources: OECD and Penn World Tables(Mark 5): Summers and Heston(1991).

Concentration of NO2, SO2 and Particulates

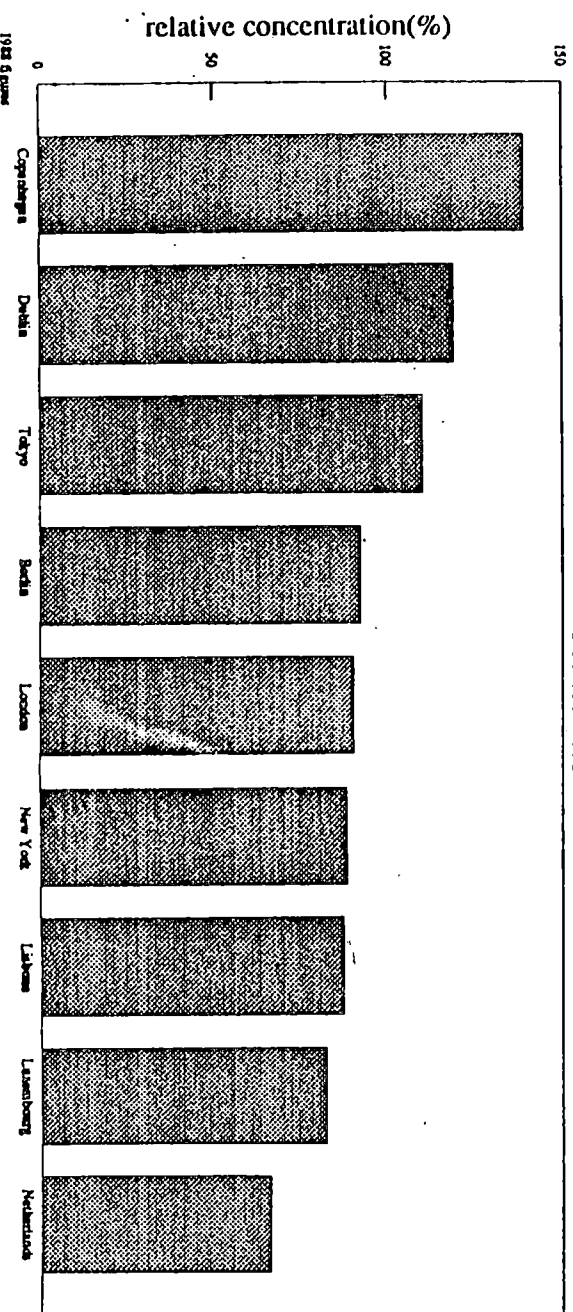
NO2



SO2



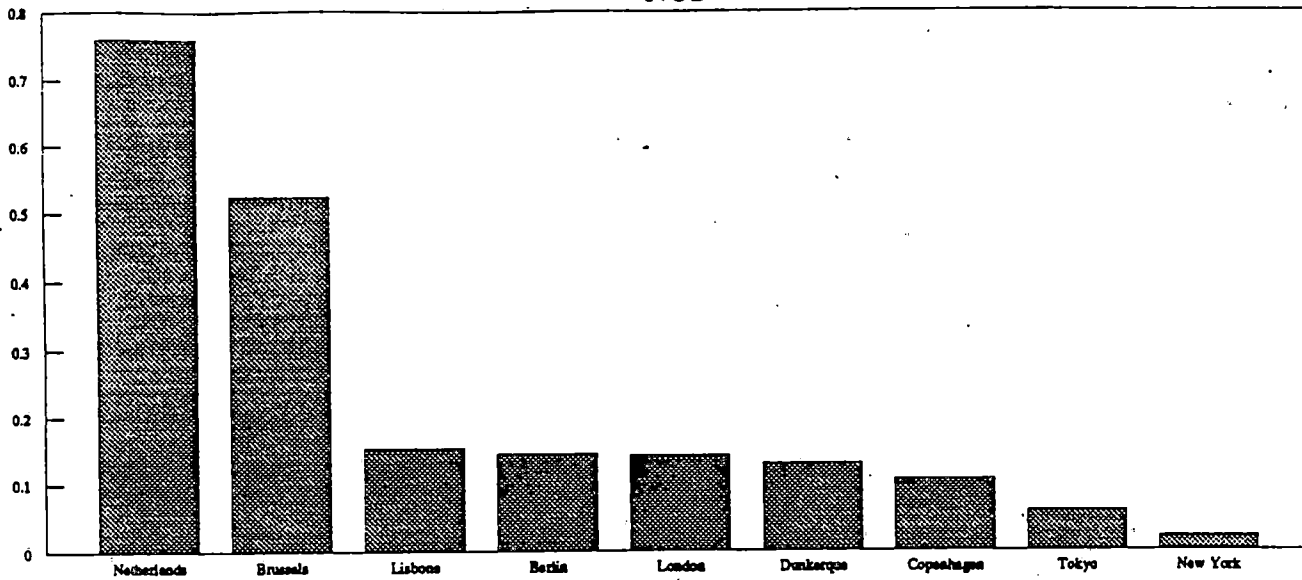
Particulates



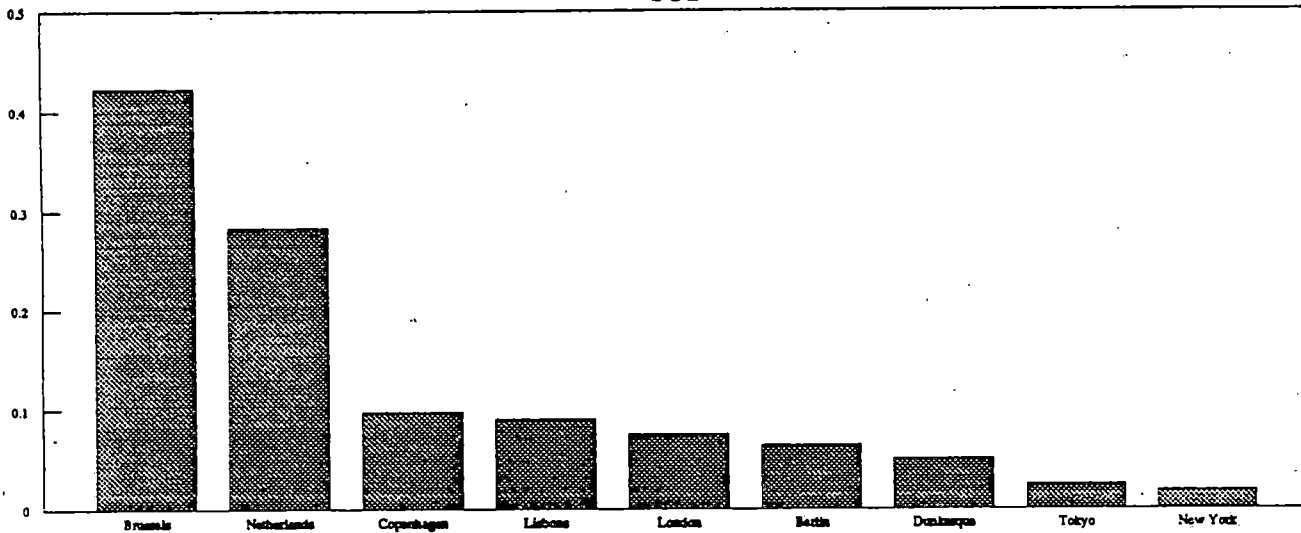
Concentration of NO2, SO2 and Particulates

Relative concentration(%) / billion \$ of GDP, 1988

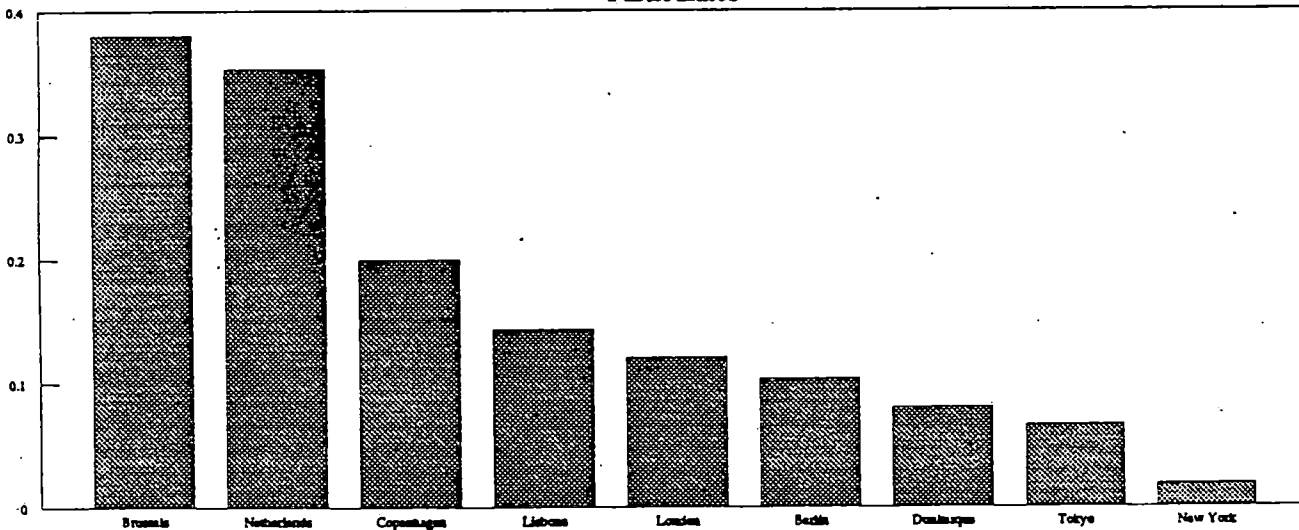
NO2



SO2



Particulates



Sources: OECD Environmental Data, 1991.

Penn World Tables(Mark %): Summers and Heston (1991).

Acid Rain

Sulphur and nitrogen emissions together with sunlight, atmospheric oxygen and moisture create acid precipitation, commonly called "acid rain". Rain is naturally slightly acidic with a pH level of about 5.6, and fish die at a level below 5 (the lower the pH level the more acidic the water). 4,000 of Sweden's lakes are thought to be too acidic for fish, and the same is believed for 10 percent of northeastern United States' lakes. Over 40 percent of central Switzerland's conifers are believed to be dead or dying because of the acid rain.

The related table and graph, concentrations in acid precipitation, examine pH levels, and mean concentrations of sulphur and nitrogen oxides (milligrams per liter); the former as an indicator of acidity of water, and the latter as necessary components. Note that the data relates to specific areas and the varying methods of measurement and mean concentration calculations exist between countries. Pay special attention to the *notes* below the table. The figures for pH do not show any notable trends but notice that in 1989 only Germany and Portugal have levels above 5. In several countries there is a slight decline in concentrations of sulphur oxides for all countries. Data for nitrous oxides appears fairly level over time.

Concentrations in Acid Precitation

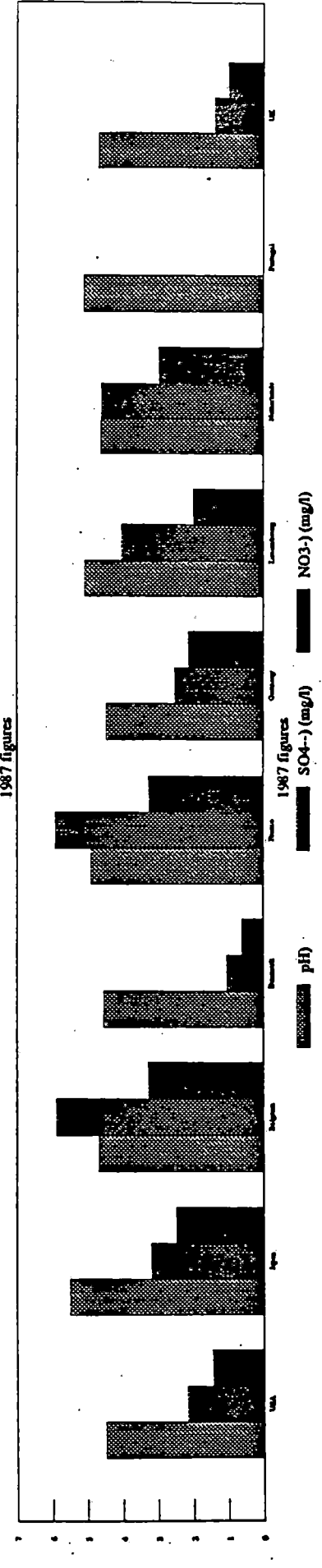
selected areas, 1975-1990

Area	No. Stations	pH							SO ₄ ⁻² (mg/liter)							NO ₃ ⁻ (mg/liter)						
		1970	1980	1985	1988	1989	1990	1991	1975	1980	1985	1988	1989	1990	1991	1975	1980	1985	1988	1989	1990	1991
USA	23		4.42	4.53	4.32	4.50	4.50		2.85	2.06	2.25	2.18			1.63	1.35	1.42	1.48				
Japan	1			5.00	5.00	5.30				2.30	3.50	3.20				1.20	2.20	2.50				
Belgium	1			5.28	5.15	4.68	4.84	4.81		0.51	0.12	0.88	0.13	5.73		3.10	3.10	3.28	2.87	3.76		
Denmark	1		4.43	4.48	4.88	4.58	4.46		2.98	1.18	0.74	1.94	0.70		1.41	0.68	0.51	0.62	0.53			
France	1	5.40	5.30	5.70	5.50	4.90	5.45	6.10	0.00	5.58	3.18	3.23	3.35	3.75	1.68	2.47	1.81	1.83	3.28	2.81	1.81	
Germany	1			4.58	4.42	5.07	5.23	4.48		3.33	2.80	4.05	3.90			2.48	1.86	2.15	2.16	2.34		
Luxembourg	5			4.46	4.71	4.88	4.82	4.88		0.18	0.43	0.81	0.81			3.08	2.81	3.27	2.91	2.41	2.47	
Netherlands	6			4.22	5.30	4.88	4.88	4.83		1.80	1.00	1.41	0.88	0.73		0.21	0.30	0.24	0.44	0.64	0.64	
Portugal	1		4.33	4.24	4.72	4.68	4.83	4.78		2.50	1.48	1.41	1.88	1.34		1.24	0.83	0.86	1.00	1.08	1.08	
UK	1																					

Notes:
 (a) Measurements were made on the NADP wet deposition network and not on other stations in these countries.
 (b) 1988 data only for USA.
 (c) 1976 to 1989 data for USA are reported as mg per dry g.
 (d) 1987 and 1989 data are reported as mg per liter.

Source: ORNL/CI/CRS, NADP.

1987 figures



Quality of Freshwater

The pollution from point and non-point sources tax our ability to improve and maintain the quality of our inland water resources. Improvements in water quality have been made primarily through control of point-source pollution, as in sewer treatment controls on effluents. However, the problem remains. The Rhine, Po and Themes are major drains to some of the world's most highly industrialized areas. Their damage is suffered mainly from industrial effluents and chemical spills, which pose a serious threat to human well-being as well as water quality. Run-off from agricultural nutrients in fertilizer and animal waste also seep into freshwater sources. Almost 60 percent of polluted lakes in the United States highlighted agricultural nutrients as their major spoil. The Black sea, filled by rivers travelling through the large well-farmed areas of eastern Europe, is also plagued by excessive agricultural run-off. The widespread death of fish, increase in algae blooms and an overall decline in water quality are the result. Agriculture, like all non-point sources, poses problems in measuring source effluents to rivers and lakes.

Assessment of water quality of selected *rivers* examines biological oxygen demand(oxygen regime), which allows aquatic life to exist, and annual mean nitrogen concentration, which promotes algae growth. Data measures biological oxygen demand in milligrams per liter for 1970, late '80's and average of the last three years(the latter of which is portrayed in the graph) for major rivers in OECD countries. An improvement or sustained level can be noted in nearly all the rivers, which reflects improved wastewater treatment. The Netherlands have realized the greatest improvement as well as the Rhine and Donau to a lesser extent. The remaining high levels in Spain, Italy and France in the average of their last three years may reflect the smaller percentage of wastewater treatment facilities, relative to their neighbors. Data also measures annual mean nitrate concentration in milligrams of nitrogen per liter for 1970, late '80's and average of the last three years available. Little if any improvements can be noted in the rivers, and data suggests that the problem is a chronic one with steady increases over time. This trends reflects agricultural nitrate leaching from fertilizers and animal wastes. UK, Denmark and Netherlands hold the highest averages of the last three available years respectively. Measurement methods vary between countries and the reader is advised to look to trends over time rather than absolute values.

Assessment of water quality of *lakes* examine annual mean concentration of phosphorous and nitrogen(in milligrams of phosphorous or nitrogen per liter) for the years 1970, 1975, 1980, 1985 and the late 1980's. These nutrients relate to eutrophication of lakes, and the reader should note the variety of sampling techniques use by different countries. For phosphorous, a slight improvement or sustained level can be noted in nearly all the lakes. Spain and the Netherlands posses the highest levels of the average of the last three years available. For nitrogen, levels generally appear to be increasing slightly. Of the average of the last three years available, the Netherlands and Denmark carry the highest levels of nitrogen.

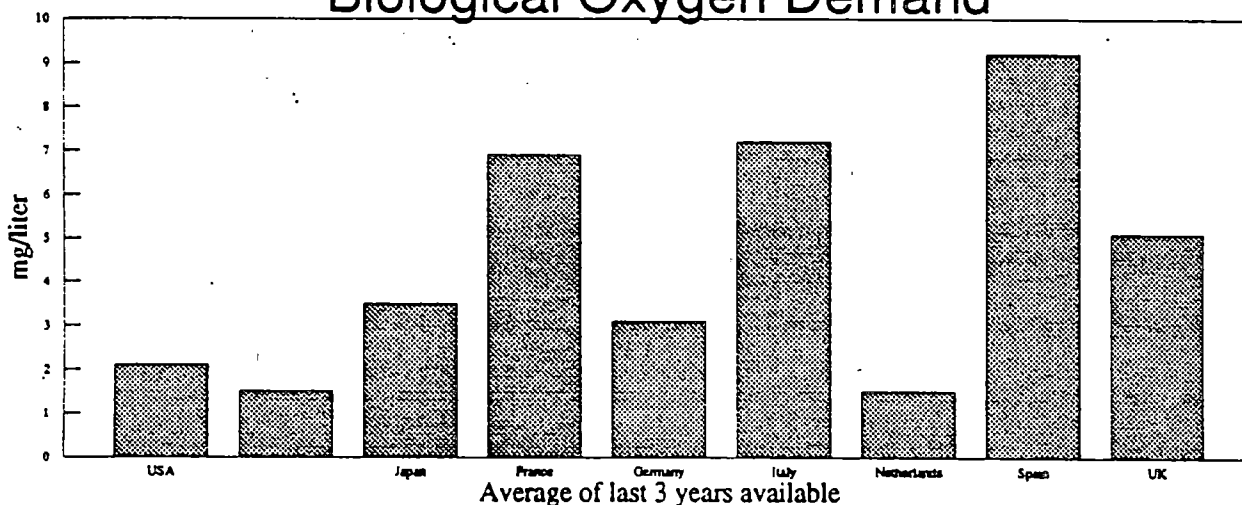
Water Quality of Selected Rivers

		Biological Oxygen Demand (mg/liter)			Nitrate Concentration (mg N/liter)		
		1970	late 1980's	Average last 3 yrs available	1970	late 1980's	Average last 3 yrs available
USA	Delaware	2.1	2.0	2.1	n/a	1.20	1.12
	Mississippi	3.0	1.4	1.5	n/a	0.90	1.10
Japan	Ishikari	1.9	1.5	1.3	0.36	n/a	n/a
	Yodo	5.2	3.3	3.5	n/a	n/a	n/a
Denmark	Escaut-Doel	4.0	2.3	2.7	3.00	5.06	4.98
France	Gudena	n/a	3.5	3.0	n/a	0.47	1.39
	Loire	6.7	6.4	6.9	1.58	2.53	2.56
Germany	Rhone	2.9	2.4	4.4	0.88	1.38	1.82
	Donau	6.1	2.9	3.1	1.82	3.70	3.77
Italy	Po	4.8	2.5	2.5	0.20	0.50	1.53
	Meusse	n/a	8.3	7.2	0.95	1.68	2.34
Netherlands	Ijssel-Kampen	6.2	1.3	1.5	3.07	3.86	4.08
	Tejo	5.7	n/a	n/a	2.76	4.33	n/a
Portugal	Guadalquivir	1.6	1.5	1.7	0.52	0.67	0.97
Spain	Thames	n/a	8.3	9.2	n/a	3.47	3.34
UK	Mersey	n/a	2.4	2.5	n/a	7.67	7.07
		n/a	5.9	5.1	n/a	2.86	2.82

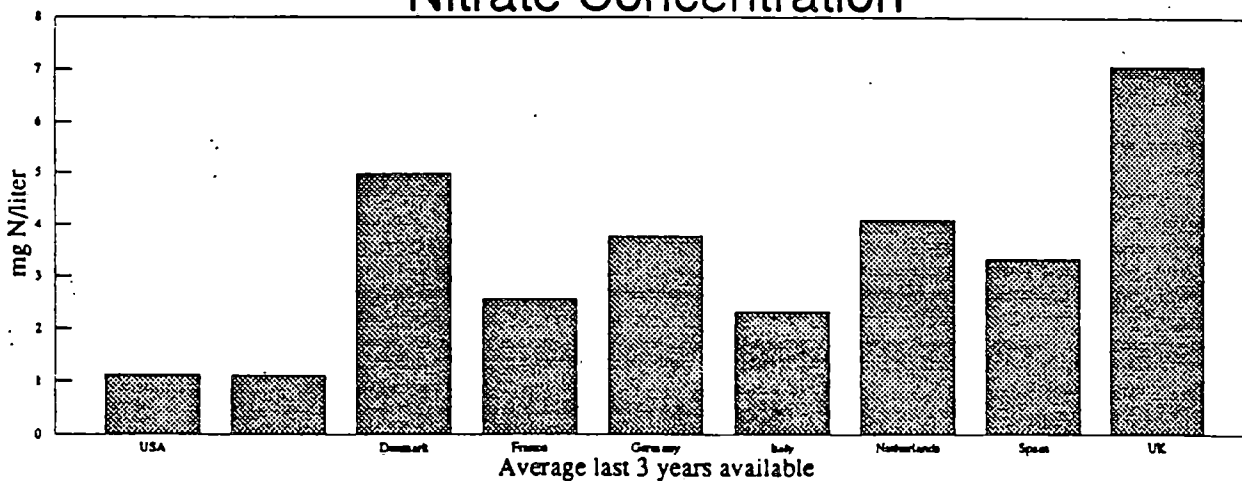
Note: Measured at mouth or downstream frontier of rivers

Source: OECD, 1991

Biological Oxygen Demand



Nitrate Concentration



Water quality of lakes

Annual mean concentrations of phosphorous and nitrogen, 1970 - late 1980's

	Total phosphorous (mgP/liter)					Total nitrogen (mgN/liter)					
	1970	1975	1980	1985	late '80's	1970	1975	1980	1985	late '80's	
Canada	Ontario	0.022	0.022	0.017	0.013	0.010	0.226	0.283	0.308	0.572	0.218
	Erie	0.017	0.023	0.011	0.012	0.010	0.370	0.278	0.163	0.218	0.218
	Cayuga(NY)	0.020	0.020	0.011	0.012	0.010	0.370	0.510	0.163	0.218	0.218
USA	W.Twin(OH)	0.150	0.100	0.009	0.007	0.008	1.930	0.290	0.270	0.260	0.290
	Biwa (North)	0.009	0.005	0.009	0.007	0.008	0.200	0.400	0.330	0.360	0.390
	Biwa (South)	0.013	0.015	0.017	0.020	0.017	0.270	0.400	0.330	0.360	0.390
Japan	Kasumigaura	0.013	0.040	0.080	0.060	0.074	0.270	1.200	1.000	1.200	1.200
	Mondsee	0.013	0.029	0.025	0.014	0.010	0.270	0.470	0.340	0.200	0.200
Austria	Ossiachersee	0.015	0.015	0.010	0.016	0.034	0.270	0.470	0.340	0.200	0.200
	Knud Soe	0.060	0.060	0.050	0.042	0.025	0.900	1.150	1.350	2.900	3.000
Denmark	Paelsejorne	0.013	0.014	0.010	0.014	0.013	0.500	0.460	0.460	1.100	1.400
	Paelsejorne	0.010	0.011	0.008	0.008	0.007	0.500	0.180	0.170	0.510	0.520
Finland	Yli-Ikka	0.005	0.005	0.006	0.007	0.006	0.755	0.763	0.856	0.260	0.220
Germany	Bodensee	0.099	0.089	0.099	0.071	0.069	0.270	0.270	0.470	0.875	1.566
	Ennel	0.029	0.025	0.020	0.032	0.010	0.640	0.710	0.800	0.770	0.800
Ireland	Derg	0.026	0.026	0.036	0.019	0.052	0.310	0.300	0.390	0.350	0.350
	Magjore	0.068	0.068	0.078	0.011	0.011	13.000	9.620	9.500	7.110	7.110
Italy	Como	0.020	0.020	0.011	0.006	0.006	0.400	4.025	4.385	4.140	3.950
	Garda	0.009	0.009	0.011	0.006	0.006	0.400	0.400	0.500	0.432	0.430
	Ota	0.350	0.350	0.350	0.290	0.240	0.400	0.400	0.514	0.432	0.460
Netherlands	IJssel	0.010	0.010	0.009	0.007	0.010	0.400	0.400	0.514	0.432	0.460
Norway	Mjosea	0.015	0.015	0.004	0.026	0.006	1.341	2.864	0.859	0.688	0.688
	Randsfjorden	0.387	0.428	5.790	4.805	3.158	0.918	0.735	0.708	0.681	0.730
Portugal	Ria de Aveiro	0.029	0.024	0.034	0.031	0.024	0.594	0.562	0.660	0.730	0.709
Spain	Castrojon	0.008	0.009	0.009	0.006	0.005	0.961	0.960	0.900	0.930	0.970
	Alcantara	0.104	0.082	0.090	0.073	0.058	0.430	0.942	0.360	0.617	0.280
Sweden	Vaettlem	0.055	0.078	0.110	0.200	0.060	1.550	1.550	1.580	1.810	1.303
	Lemnan	0.030	0.030	0.030	0.030	0.030	0.300	0.300	0.300	0.300	0.300
Switzerland	Kunbogaazi	0.107	0.107	0.114	0.106	0.106	0.300	0.300	0.300	0.300	0.300
Turkey	Saparca	0.095	0.095	0.009	0.009	0.009	0.300	0.300	0.300	0.300	0.300
	Alinapa	0.009	0.009	0.009	0.009	0.009	0.300	0.300	0.300	0.300	0.300
UK	Neagh	0.009	0.009	0.009	0.009	0.009	0.300	0.300	0.300	0.300	0.300
	Lomond	0.009	0.009	0.009	0.009	0.009	0.300	0.300	0.300	0.300	0.300

Notes:

(a) Mean 1973 and 1980 data refer to 1978 and 1979.

(b) 1973 data refer to 1978.

(c) 1975 and 1980 data refer to 1974 and 1977.

(d) Total inorganic nitrogen (NH4+NO3+NO2 as N).

(e) 1970 and 1973 data refer to 1972 and 1973.

(f) Sampling conducted at 3-5 sampling stations, in surface, biologically enriched during mid-April-May and September-October, and in nearby streams the rest of the year, down the long axis of the lake.

(g) 1970 and 1973 data refer to 1971 and 1974.

(h) Samples obtained from the deepest part of each lake, generally monthly from late spring-early fall, and less frequently the rest of the year at 1, 2, 4, 7 and 10 meters.

(i) Mean '80's data refer to 1986.

(j) 1970 data refer to 1972.

(k) 1985 data refer to 1986.

(l) Only surface and near surface in N.

(m) Mean nitrogen: average of monthly samples taken in the deepest part of the lake, 1981 data.

(n) Mean '80's data refer to 1986.

(o) Rio de Aveiro at 0.1 mg/m.

(p) Pongoloma, low '80's refer to 1988.

(q) Pongoloma: 1989 figure represents upper limit.

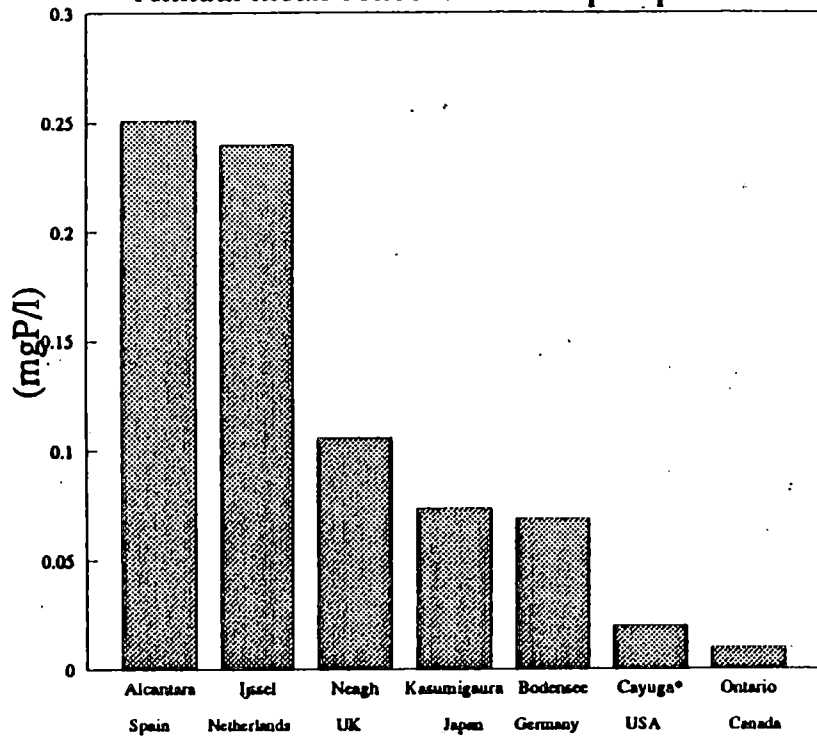
(r) 1986 figure refers to Avonlea in the only lake '80's data refer to 1990.

(s) Pongoloma: low '80's data refer to 1980.

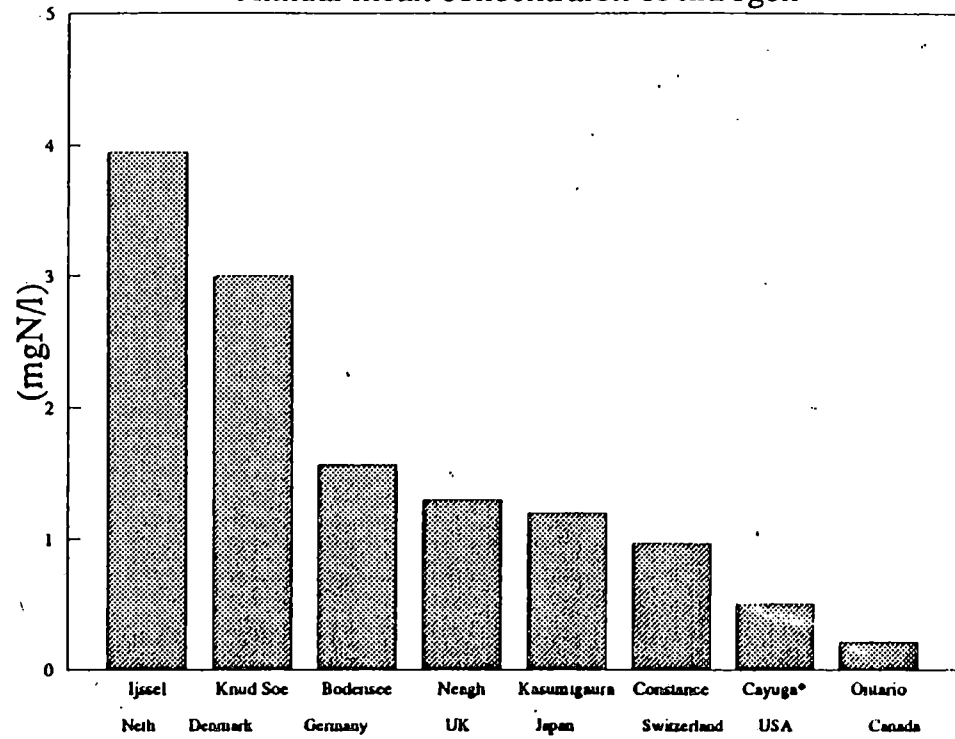
(a) Mean 1973 and 1980 data refer to 1978 and 1979.
 (b) 1973 data refer to 1978.
 (c) 1975 and 1980 data refer to 1974 and 1977.
 (d) Total inorganic nitrogen (NH4+NO3+NO2 as N).
 (e) 1970 and 1973 data refer to 1972 and 1973.
 (f) Sampling conducted at 3-5 sampling stations, in surface, biologically enriched during mid-April-May and September-October, and in nearby streams the rest of the year, down the long axis of the lake.
 (g) 1970 and 1973 data refer to 1971 and 1974.
 (h) Samples obtained from the deepest part of each lake, generally monthly from late spring-early fall, and less frequently the rest of the year at 1, 2, 4, 7 and 10 meters.
 (i) Mean '80's data refer to 1986.
 (j) 1970 data refer to 1972.
 (k) 1985 data refer to 1986.
 (l) Only surface and near surface in N.
 (m) Mean nitrogen: average of monthly samples taken in the deepest part of the lake, 1981 data.
 (n) Mean '80's data refer to 1986.
 (o) Rio de Aveiro at 0.1 mg/m.
 (p) Pongoloma, low '80's refer to 1988.
 (q) Pongoloma: 1989 figure represents upper limit.
 (r) 1986 figure refers to Avonlea in the only lake '80's data refer to 1990.
 (s) Pongoloma: low '80's data refer to 1980.

Water Quality of Lakes

Annual mean concentration of phosphorous



Annual mean concentration of nitrogen



Notes:
 late 1980's data
 *data refers to 1973.

Freshwater Use

Only a fraction of a percentage of the earth's freshwater is easily accessible, and the distribution is unequal between countries. Already approximately two billion people suffer from persistent water shortages, and several areas of the world face near crisis situations, including East Africa, the southern Mediterranean coast and parts of the arid United States. The quality of this scarce resource is also deteriorating as a result of surface and groundwater pollution.

People use three times more water than in 1950, and Americans use the most, at almost 2,000 cubic meters per capita. Patterns of use diversify between developed nations, and the graph depicts descending amounts of usage for selected countries. Note in the table that very little freshwater is used domestically in most countries (excepting the United Kingdom). Most of the water is used for irrigation, industry and electrical cooling. Note also the varying percentages used in each category between countries. For example, Turkey uses nearly 80 percent of its water supply for irrigation, whereas West Germany uses less than one percent. When interpreting the graph and table, please regard the notes at the bottom of each. Water withdrawal totals are considered in terms of million cubic meters and million cubic meters per capita (graph) and categories of uses as a percentage of the total withdrawal. The United States uses more water in terms of total withdrawal as well as total withdrawal per capita.

Water withdrawal

late 1980's

By major uses

	Total water withdrawal (million m3)	public water supply %	Irrigation %	Industry no cooling %	Electrical cooling %
Canada	43888	11.3	7.1	9.1	55.6
USA (c)	467000	10.8	40.5	7.4	38.8
Japan (b)	84831	16.1	66.8	15.7	1.0
Finland	4000	10.6	0.5	37.5	3.5
France (c)	43273	13.7	9.7	10.4	51.9
W.Germany	44390	11.1	0.5	5.0	67.6
Italy (b)	56200	14.2	57.3	14.2	12.5
Spain	45845	11.6	65.5	22.9	*
Sweden	2996	32.4	3.1	40.2	0.3
Turkey	29600	12.8	79.1	9.8	*
UK (c,d)	13221	48.6	0.3	10.8	18.8

Notes:

* indicates an unknown figure.

(a) The four sectors do not necessarily add up to 100%, since "other agricultural uses than irrigation", "industrial cooling" and "other uses" are not covered in this table.

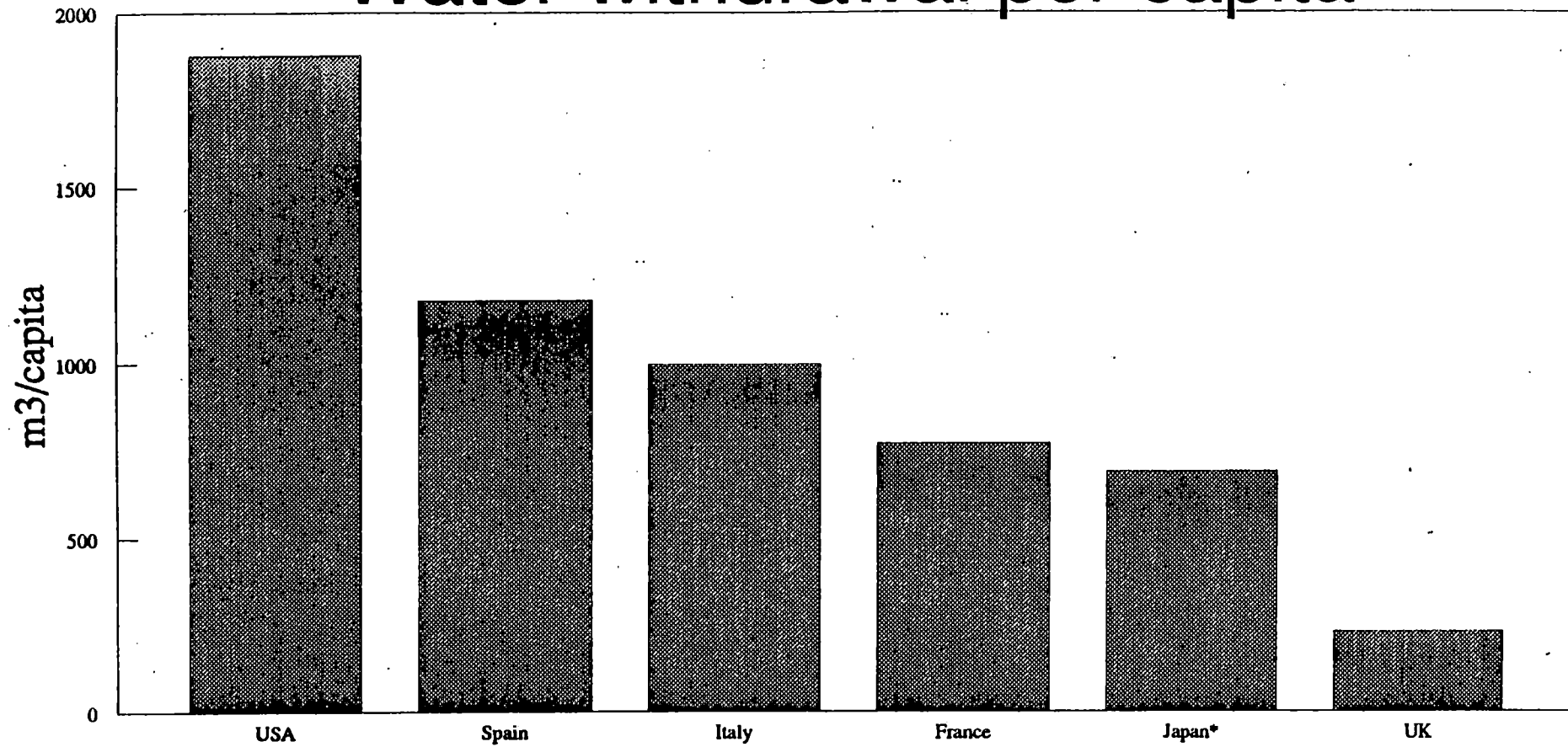
(b) 1980.

(c) Industry includes industrial cooling.

(d) Irrigation: total agricultural weather withdrawal.

Source: OECD, 1991.

Water withdrawal per capita



late 1980's

Note: * 1980 data.

Source: OECD, 1991.

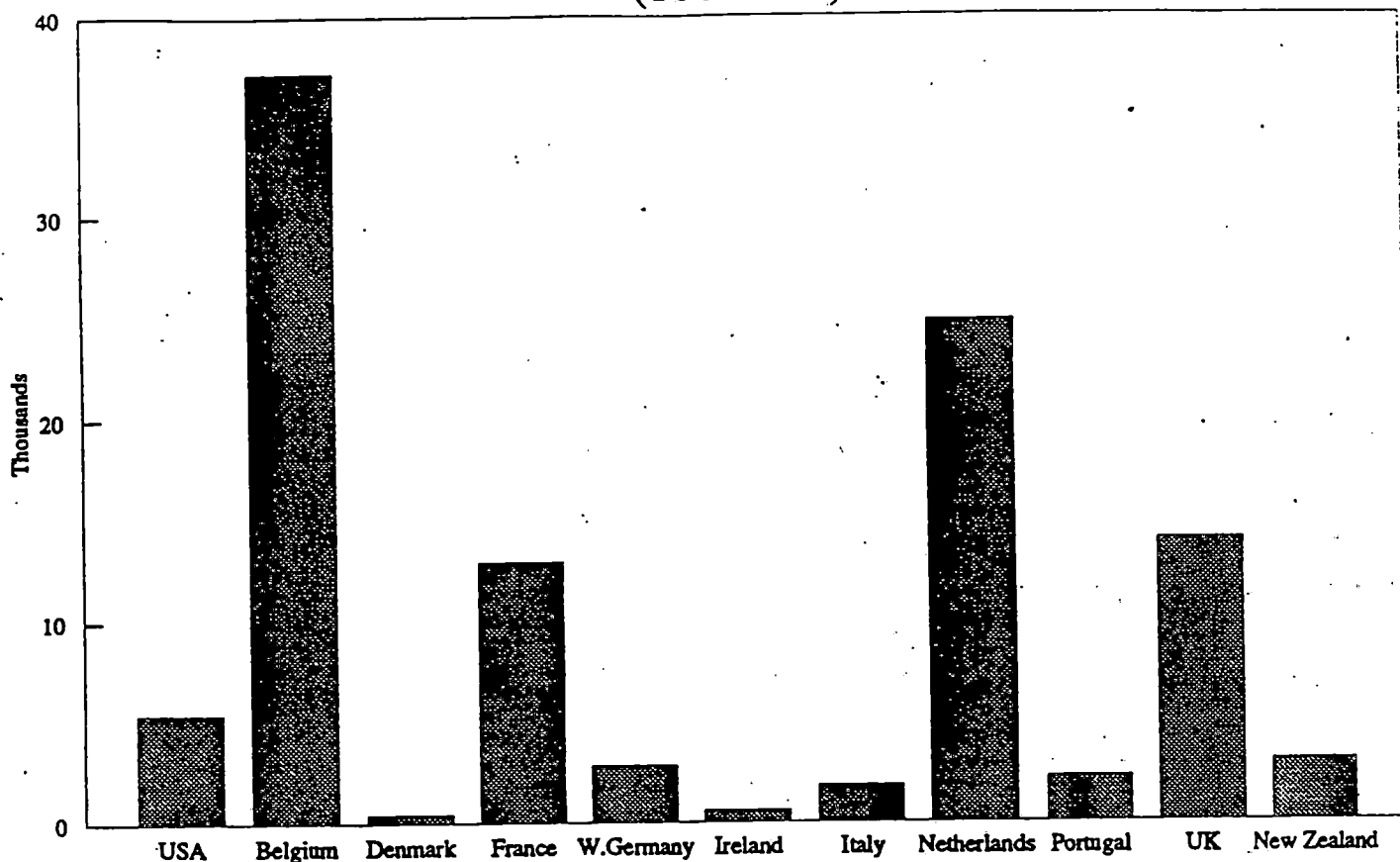
Pollution of Oceans and Seas

Our seas have historically been a dumping ground, and until recently, marine pollution prompted only local concern. Now, traces of toxic chemicals can be found in all marine environments from Antarctic penguins to fish indigenous to depths of 3,000 meters. Agricultural and industrial wastes nourish algae to vast and toxic proportions, killing millions of fish literally hundreds of times each year. An estimated 25 percent of the United Kingdom's bathing areas consistently do not comply to safety standards, resulting in serious health risks especially to young children. Although the number of large oil spills is declining, more than one million tonnes of oils are discharged annually from oil tankers, *deliberately*, as holding tanks are rinsed cleaned. Valuable recreational beaches in the Caribbean and Red Sea areas have been destroyed by tar balls, and the effect on plankton and larvae is immeasurable.

On a positive note, ocean dumping is decreasing. The burning of hazardous and industrial and sewage dumping at sea are all currently being phased out, and radioactive waste dumping has been prohibited since 1983. Still, dredge spoils comprise most of the dumping, and 10 percent is contaminated with toxic chemicals, heavy metals and other spoils. Furthermore, the dumping of plastic fishing nets and other plastic materials is on the rise, particularly in Japan. Millions of animals are tangled and die in these nets, including fish, birds, seals, dolphins and whales.

The subsequent graphs depict the average amounts of wastes (industrial, sewage sludge and dredge spoils, in order) dumped annually from 1976-1986. Interpreters need consider the notes for each graph. Regarding industrial wastes dumped at sea, the United Kingdom, France and the United States have, on average, been most responsible. The United Kingdom, the United States and West Germany have, on average, dumped the most prominent percentages of sewage sludge annually; this graph does not reveal the specific volume dumped by each country, only an average overall percentage. Dredged spoils dumping, which comprises 90 percent of all ocean dumping, is lead by Belgium, the Netherlands and the United Kingdom.

Dredged spoils dumped at sea, average 1976-1986* (1000 ta-1)



*USA data includes 1976-81,83; France data includes 1978-86; W.Germany includes 1980-5; Ireland includes 1976-8, 1980-6; Italy includes only 1981; New Zealand includes 1976-81,83.

Sources:

DOE 1987 Digest of Environmental Protection and Water Statistics, Dept. of the Environment, Her Majesty's Stationary Office, London.

IMCO 1979 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972: Report of Permits Issued for Dumping in 1976, Inter-governmental Maritime Consultative Organization, London.

IMCO 1979 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972: Report of Permits Issued for Dumping in 1977, Inter-governmental Maritime Consultative Organization, London.

IMCO 1980 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972: Report of Permits Issued for Dumping in 1978, Inter-governmental Maritime Consultative Organization, London.

IMCO 1981 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972: Report of Permits Issued for Dumping in 1979, Inter-governmental Maritime Consultative Organization, London.

IMO 1983 Seventh Consultative Meeting of Contracting Parties to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter: Summary Report of Permits Issued in 1980, International Maritime Organization, London.

OECD 1987 OECD Environmental Data Compendium 1987, Organization for Economic Co-operation and Development, Paris.

Oslo Commission 1984, Eighth Annual Report, Oslo Commission, London.

Oslo Commission 1984, Ninth Annual Report, Oslo Commission, London.

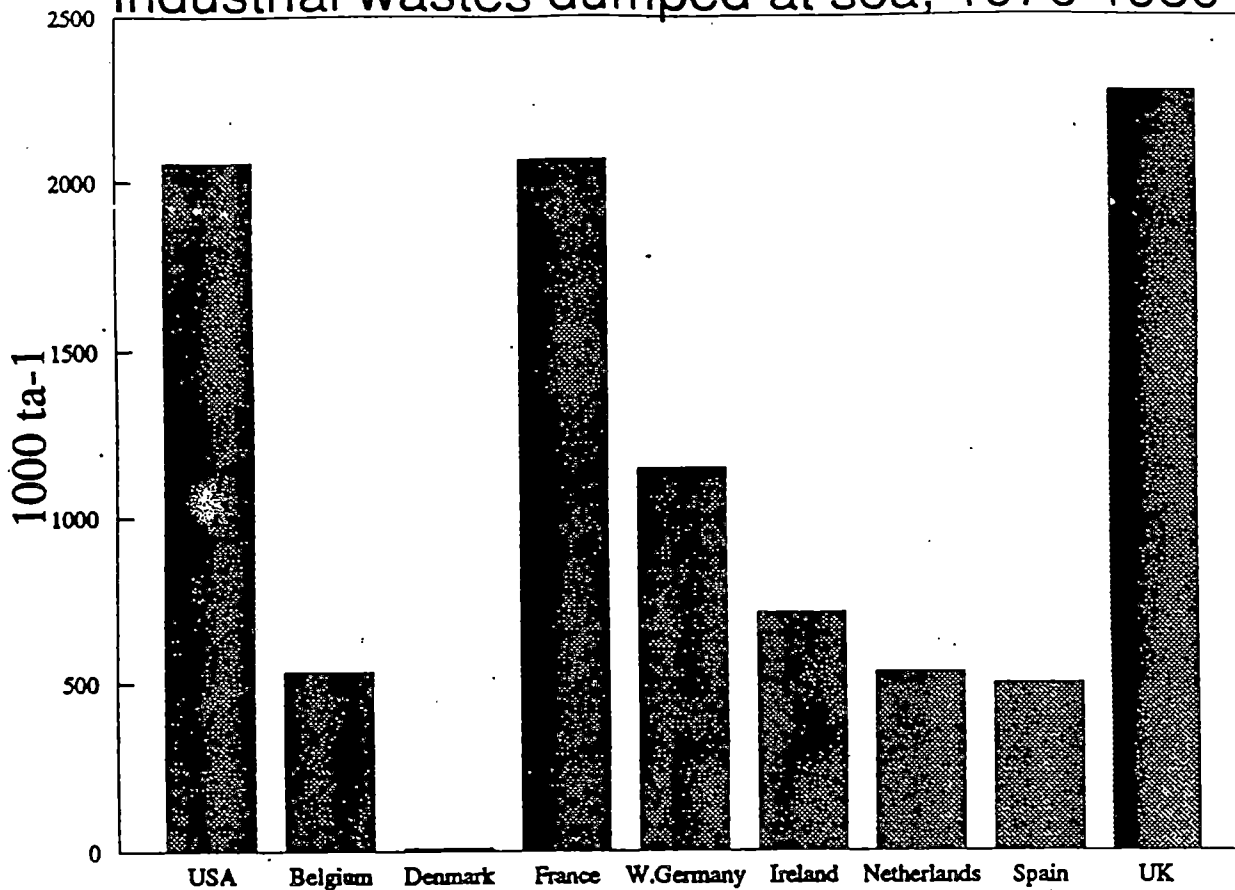
Oslo Commission 1985, Tenth Annual Report, Oslo Commission, London.

Oslo Commission 1986, Eleventh Annual Report, Oslo Commission, London.

Oslo Commission 1987, Twelfth Annual Report, Oslo Commission, London.

Oslo Commission 1988, Thirteenth Annual Report, Oslo Commission, London.

Industrial wastes dumped at sea, 1976-1986*



*USA data includes averages for 1976-1981 only, and Denmark data includes averages for 1976-1983 only.

Sources:

IMCO 1979 Convention on the Prevention of Marine Pollution by dumping of wastes and other Matter 1972: Report of Permits Issued for Dumping in 1976, Inter-governmental Maritime Consultative Organization, London.

IMCO 1979 Convention on the Prevention of Marine Pollution by dumping of wastes and other Matter 1972: Report of Permits Issued for Dumping in 1977, Inter-governmental Maritime Consultative Organization, London.

IMCO 1980 Convention on the Prevention of Marine Pollution by dumping of wastes and other Matter 1972: Report of Permits Issued for Dumping in 1978, Inter-governmental Maritime Consultative Organization, London.

IMCO 1981 Convention on the Prevention of Marine Pollution by dumping of wastes and other Matter 1972: Report of Permits Issued for Dumping in 1979, Inter-governmental Maritime Consultative Organization, London.

IMO 1983 Seventh Consultative Meeting of Contracting Parties to the Convention on the Prevention of Marine Pollution by dumping of wastes and other Matter: Summary Report of Permits Issued in 1980, International Maritime Organization, London.

OECD 1985 OECD Environmental Data Compendium 1985, Organization for Economic Cooperation and Development, Paris.

Oslo Commission 1984 Eighth Annual Report, Oslo Commission, London.

Oslo Commission 1984 Ninth Annual Report, Oslo Commission, London.

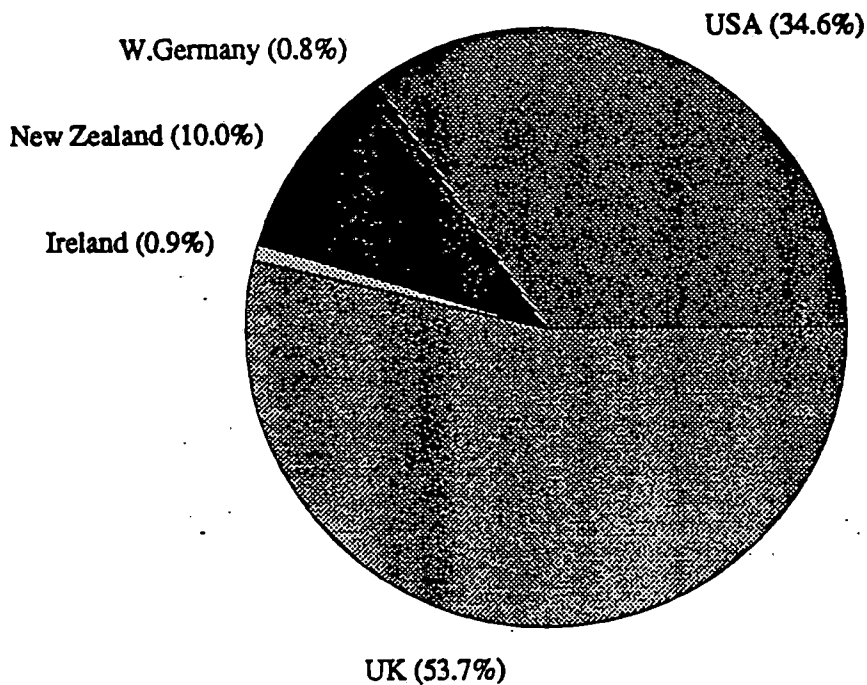
Oslo Commission 1985 Tenth Annual Report, Oslo Commission, London.

Oslo Commission 1986 Eleventh Annual Report, Oslo Commission, London.

Oslo Commission 1987 Twelfth Annual Report, Oslo Commission, London.

Oslo Commission 1989 Thirteenth Annual Report, Oslo Commission, London.

Sewage sludge dumped at sea* average 1976-1986 (1000ta-1)+



*No sewage sludge is dumped at sea by Belgium, Denmark, Finland, France, Netherlands, Norway, Portugal and Sweden. No data is available for countries not included.

+W.Germany stopped dumping sewage sludge at sea in 1982. Data for New Zealand includes 1976 only.

Sources:

CEQ 1980 Environmental Quality - 1980, Council on Environmental Quality, Washington, D.C.

IMCO 1979 Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter 1972: Report of Permits Issued in 1977, inter-governmental Maritime Consultative Organization, London.

IMO 1983 Seventh Consultative Meeting of Contracting Parties to the Convention on the Prevention of Marine Pollution by the Dumping of Wastes and Other Matter: Summary Reports of the Permits Issued in 1980, International Maritime Organization, London.

OECD 1985 OECD Environmental Data Compendium 1985, Organization for Economic Cooperation and Development, Paris.

Oslo Commission 1984 Eighth Annual Report, Oslo Commission, London.

Oslo Commission 1984 Ninth Annual Report, Oslo Commission, London.

Oslo Commission 1985 Tenth Annual Report, Oslo Commission, London.

Oslo Commission 1986 Eleventh Annual Report, Oslo Commission, London.

Oslo Commission 1987 Twelfth Annual Report, Oslo Commission, London.

Oslo Commission 1989 Thirteenth Annual Report, Oslo Commission, London.

Generation of Solid Waste

Nearly all human activities produce some form of waste, and the quantity of wastes generated from OECD countries is rising steadily--nine billion metric tons of waste in 1990 alone. Waste may be categorized by source: municipal(or household)waste, industrial waste and hazardous and special waste, for example. Waste minimization is the elemental goal for environmental policy and can be achieved through recycling, recovery and waste prevention.

Amount of municipal waste generated (in tons per person) is displayed in the graph and is comprised of mainly household and small business wastes. The amounts range from over 800 tons per capita in the United States to approximately 300 tons per capital in Italy. This range of waste production masks trends in waste composition. The proportion of plastics and general packaging materials is growing in developing countries, as well as a higher moisture and ash content. All OECD countries, and thus essentially all urban centers have access to municipal waste disposal services.

Industrial waste is expressed in the graph in pounds per dollar of gross domestic product and consists of a breadth of substances, ranging from factor rubbish to acids. Notable portions of industrial wastes are classified as hazardous and, therefore, require unique treatment and disposal. In volume alone the United States produces the most industrial waste, but in terms of pounds per dollars of gross domestic product, Belgium, Japan and Austria, respectively, lead the United States.

Agricultural waste was considered in 1000 tonnes and is made up chiefly of manure and silage effluents but may also include pesticide and fertilizer residues. Animal manure is nutrient-rich organic slurry, but like sewage sludge, may contain heavy metals, organic chemicals and oils. France, United Kingdom and the United States are the largest producers of agricultural wastes, as portrayed in the graph.

Considering production of nuclear waste, each country's generation was viewed as a factor of the total in tonnes per total primary energy requirements. As the world seek alternatives to fossil fuel production, nuclear energy offers a mixed blessing. Science has yet to find a safe means of disposal for nuclear waste; it is a problem that may haunt us for millions of years if natural forces are left to break the waste down to safe levels. Japan has the fastest growing nuclear program, but public opinion has steadily declined in the last decade. As of the late 1980's, Canada, France and the United Kingdom lead the OECD countries in tonnes of nuclear waste produced per total energy requirements. In sheer amount alone, the United States, Canada and France are the major producers.

The interpreter is advised to note that definitions and classifications of waste differ between countries. Furthermore the extent of agriculture varies between countries as well as the importance of nuclear energy to the total energy supply.

Amount of waste generated

by source, late 1980's
in 1000 tonnes

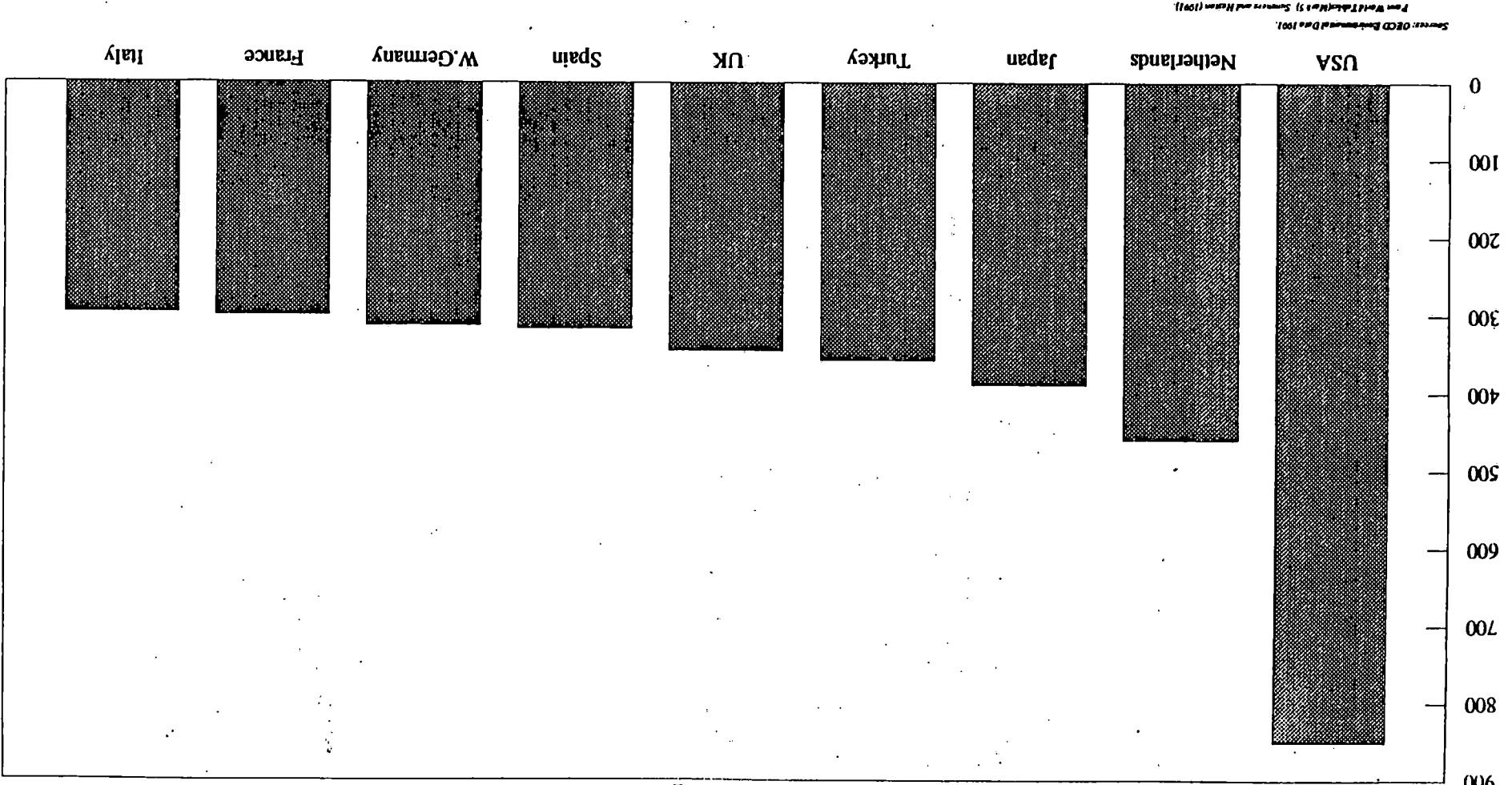
Year	Municipal (a)	Industrial	Energy production	Agriculture	Mining	Demolition wastes	Dredge spoils	Sewage sludge	Others
Canada	1989 16400	61000 (h)	12400 (k)	48000 (h)	10529	1540 (h)	7540	500	38500 (k)
USA	1986 208760	760000 (c)	99247	150566	14000	31500	10400	10400	•
Japan	1988 48283	312271 (h)	19828 (k)	62690 (k)	26017 (h)	57686 (k)	2001 (h)	2001 (h)	•
Austria	1983 2700 (d)	13258 (h)	707	•	466	390	2100	1350	•
Belgium	1988 3470 (f)	26700 (s)	1069 (i)	53000 (h)	7069 (h)	680 (i)	4805 (i)	687 (i)	2830 (k)
Denmark	1985 2400	2400	1532	•	•	1500	•	1263	300
Finland	1987 2500 (i)	10500	950	23000 (d)	21600	2000	420	153	•
France	1989 17000	50000	11702	400000	10000 (o)	•	•	620	2800
W. Germany	1987 19483	61424	7880	•	9488	11826	•	1750 (i)	•
Greece	1989 3147	4304	130	90	3900	240	•	570	1200
Ireland	1984 1100	1580	130	22000	1930	34374	•	3500	860
Italy	1989 17300	39978	•	29830 (i)	57000 (h)	•	•	15	1985
Luxembourg	1990 170	1300	•	•	•	4000	•	252	•
Netherlands	1988 6900	6687	1482 (h)	86000 (e,p)	121 (g)	7700 (d)	16000 (p)	100	664
Norway	1989 2000	2186 (h,i)	•	18000	9000	2000	•	•	•
Portugal	1987 2350 (h)	662	260	202	3900 (h)	•	•	•	•
Spain	1988 12546	5108	•	45000	18000 (k)	•	•	10000 (h)	•
Sweden	1985 2650	4000 (h)	550	21000 (m)	28000	3000 (q)	600 (h)	372	3995
Switzerland	1989 2850	•	•	•	•	3000	•	260	•
Turkey	1989 19500	•	•	•	•	•	•	•	•
UK	1989 20000 (j)	50000	14000	250000	23000	25000	37000 (d)	30000 (b)	21000
Yugoslavia	1989 7164	•	•	20597	•	•	•	•	•

(a) Includes residential, commercial, institutional, and other waste not otherwise classified by order of origin.
 (b) Not available.
 (c) Includes construction waste from 175 to 200 tonnes of solid waste.
 (d) Data refer to 1991.
 (e) Production of waste from research in domestic industry.
 (f) Includes waste from chemical, electrical, and other.
 (g) Data refer to 1986.
 (h) Data refer to 1990.
 (i) Chemical industrial waste only.
 (j) Household waste only.

(k) Data refer to 1984.
 (l) Data refer to 1990.
 (m) Data refer to 1982.
 (n) Data refer to 1984.
 (o) Data refer to 1984.
 (p) Data refer to 1984.
 (q) Data refer to 1984.
 (r) Data refer to 1984.
 (s) Data refer to 1984.
 (t) Data refer to 1984.
 (u) Data refer to 1984.
 (v) Data refer to 1984.
 (w) Data refer to 1984.
 (x) Data refer to 1984.
 (y) Data refer to 1984.
 (z) Data refer to 1984.

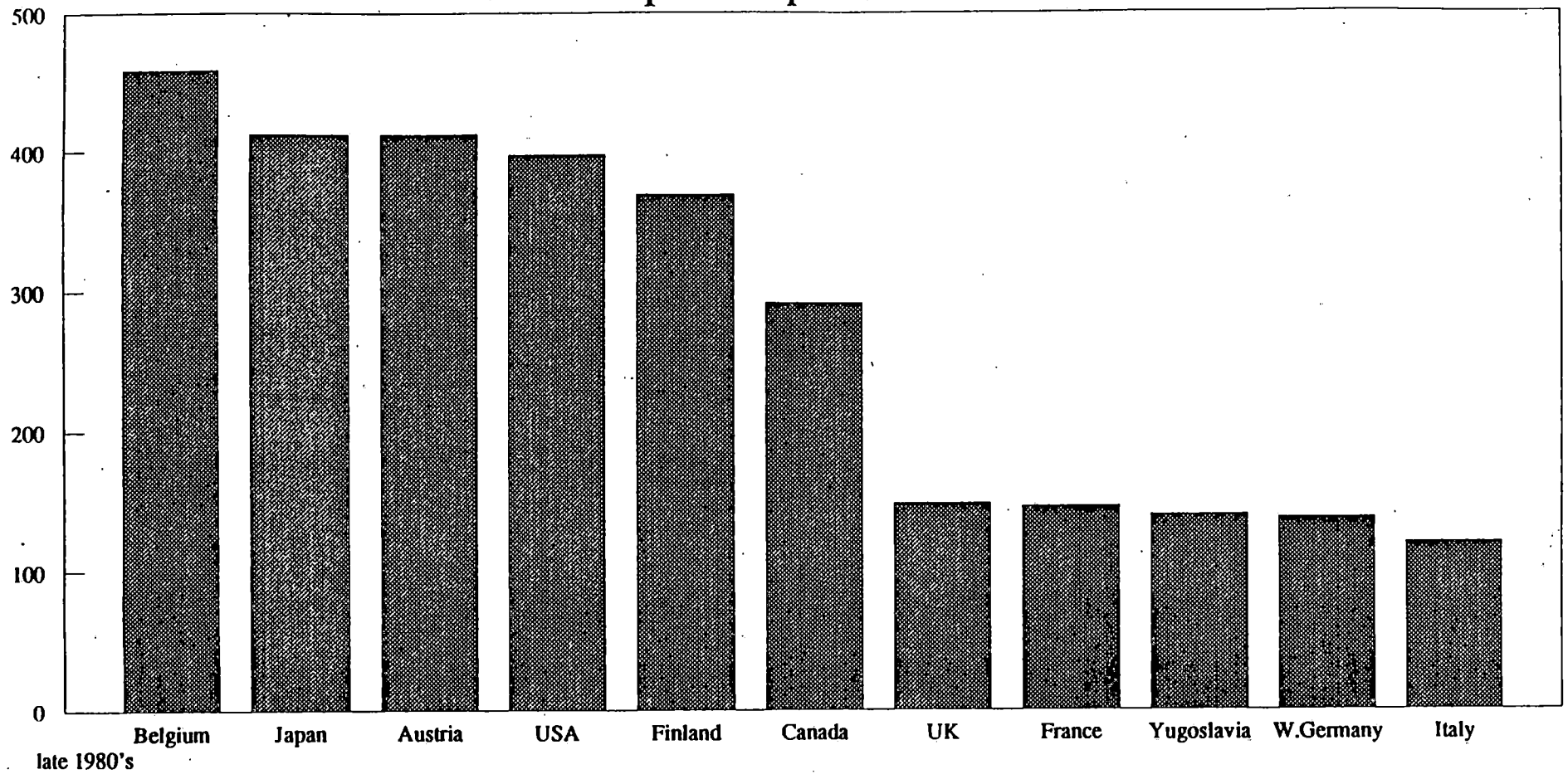
(aa) Data refer to 1984.
 (ab) Data refer to 1984.
 (ac) Data refer to 1984.
 (ad) Data refer to 1984.
 (ae) Data refer to 1984.
 (af) Data refer to 1984.
 (ag) Data refer to 1984.
 (ah) Data refer to 1984.
 (ai) Data refer to 1984.
 (aj) Data refer to 1984.
 (ak) Data refer to 1984.
 (al) Data refer to 1984.
 (am) Data refer to 1984.
 (an) Data refer to 1984.
 (ao) Data refer to 1984.
 (ap) Data refer to 1984.
 (aq) Data refer to 1984.
 (ar) Data refer to 1984.
 (as) Data refer to 1984.
 (at) Data refer to 1984.
 (au) Data refer to 1984.
 (av) Data refer to 1984.
 (aw) Data refer to 1984.
 (ax) Data refer to 1984.
 (ay) Data refer to 1984.
 (az) Data refer to 1984.

Municipal waste generated in tons per person



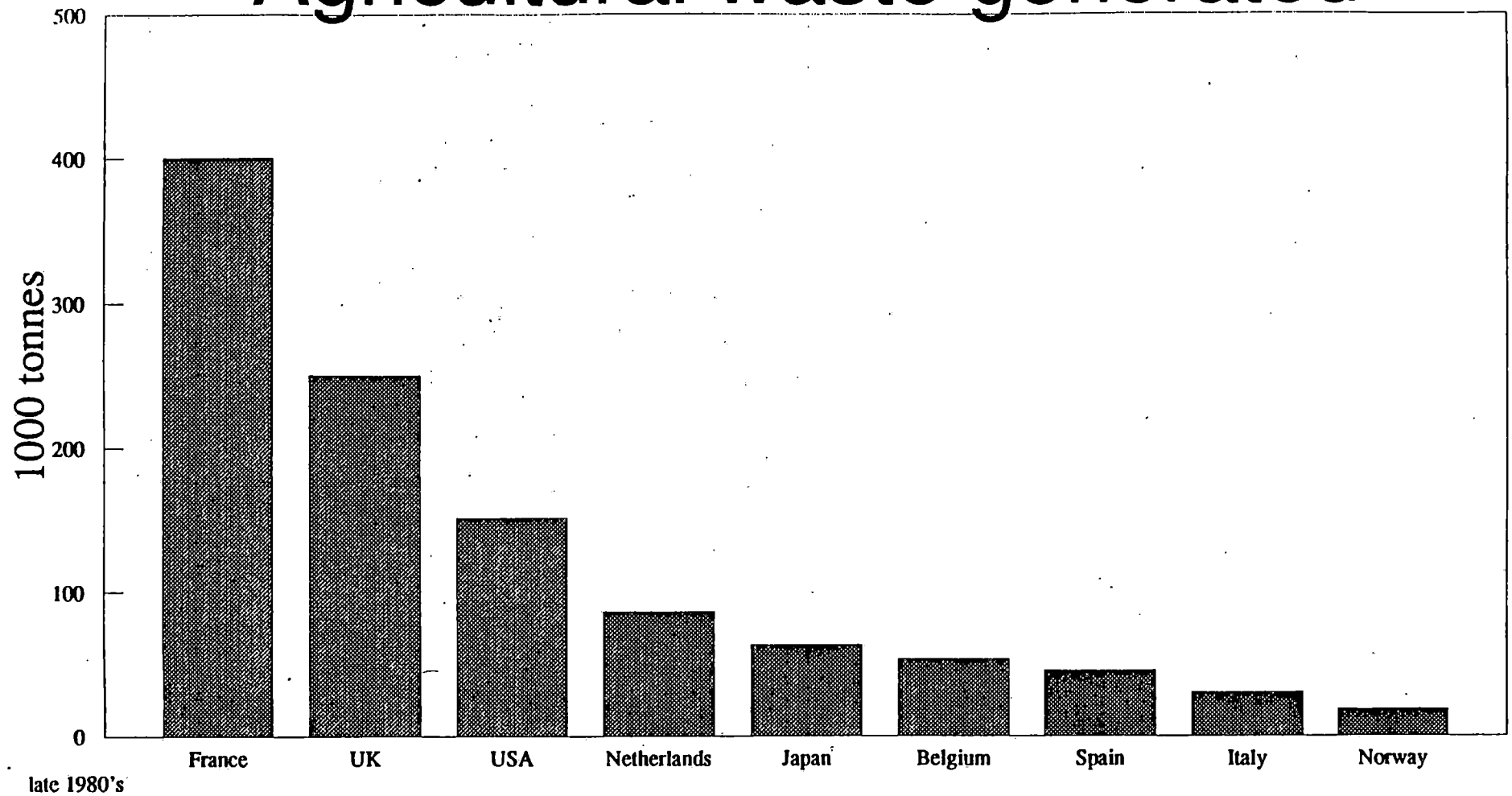
Industrial waste generated

in pounds per \$ of GDP



Source: OECD Environmental Data (1991)
From World Tables (Mark 3), Summers and Heston (1991).

Agricultural waste generated



Source: OECD Environmental Data 1991.

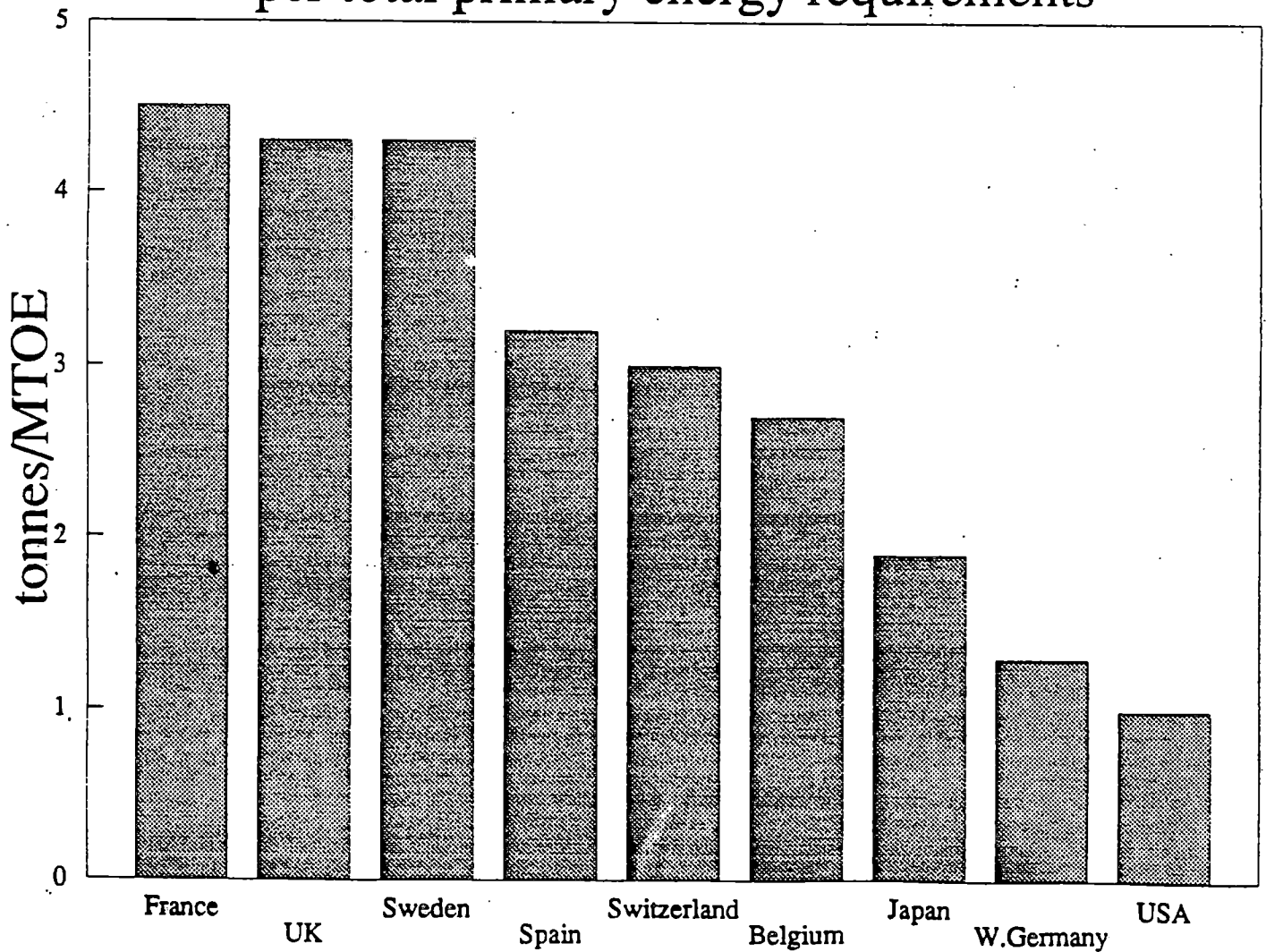
Nuclear waste late 1980's		
	Per unit of energy (tonnes/MTOE)*	Total (tonnes)*
Canada	5.2	1300
USA	1.0	1900
Japan	1.9	770
Belgium	2.7	122
Finland	2.6	77
France	4.5	950
W.Germany	1.3	360
Netherlands	0.2	15
Spain	3.2	270
Sweden	4.3	240
Switzerland	3.0	85
UK	4.3	900

* Expressed in tonnes of heavy metal and tonnes of heavy metal per unit of total primary energy requirements, respectively

Source: OECD, 1991.

Nuclear waste

per total primary energy requirements



Renewable Energy

As a result of fossil fuel dependence, we are polluting our air, acidifying our water and changing the climate of our world. As the severity of these effects increases and the supply dwindles, the possibilities of renewable energy becomes more fascinating.

Hydro-electric power already contributes more than 20 percent of the world's electricity, protecting our air from more than two billion tonnes of carbon dioxide annually. Furthermore, the World Energy Conference predicts a sixfold increase in the next fifty years. North America has already harness over half of its potential for large dams and generates approximately a third of total world production. And apparently, an even greater potential for hydro-electric power exists in developing nations. There may be, however, adverse environmental effects from the utilization of large dams for hydro-electric power production. Large dams have been known to flood valuable land, such as parts of the Brazilian rainforest, aid in the spread of diseases like malaria, trap nutrient-rich silt and prevent downstream fertilization (which in turn makes farming more difficult or impossible and could cause farmers or even whole villages to relocate), and tremendous water pressure may result in earthquakes. But small dams seem to skirt the disadvantages of the larger ones.

Production of hydro-electric power by country is depicted in terms of amount generated in gigawatt hours and amount generated as a factor of gross domestic product(kilowatt hours per dollars of gross domestic product). Concerning amount of hydro-power produced, the United States leads the world by a wide margin. In relation to gross domestic product, France and Spain produce the greatest amounts, followed by the United Kingdom, Italy and the United States.

Harnessing the earth's heat for energy is the privilege of select and diversified areas fortunate enough to have this hot water trapped in rock. Iceland uses geothermal energy to heat the majority of its homes. Japan is planning an increase of ten times its current use in this decade. More than 15 percent of Central America's energy is geothermal. And in the last ten years alone world capacity has increased three-fold.

Geothermal energy production is represented in gigawatt hours and kilowatt hours per unit of gross domestic product. In respect to the former, the United States produces a great deal more than the world's other leading producers: Italy, New Zealand and Japan. But the picture changes in respect to the latter. Here, in kilowatts per dollars of gross domestic product, New Zealand is very much the leading producer, followed respectively by Italy, the United States and Japan.

To produce electricity from a wind turbine, wind of steady speeds atleast 25 kilometers per hour is needed. In terms of total wind power generation(in gigawatt hour), the United States is the largest producer, with California alone producing 90 percent of the world total. The state's Energy Commission is predicting that 8 percent of California's energy will be obtained by wind by the year 2000. Giant windmills are also being built in Europe and Australia, and developing nations, like India and China, are planning to use wind generated energy as a significant portion of their total future energy supply. In terms of total wind power generated per dollars of gross domestic product, Australia leads the world with the United States as second and Netherlands and Sweden as growing producers.

To harness solar energy, heat from the sun is concentrated in water, oil or solar cells. In the United States, solar rivals nuclear power. By-products from plants and trees, which use the sun's energy to grow, are also used to produce electricity; ethanol and other alcohol fuels are examples. The United States, in terms of total amounts in gigawatt hours, also leads world production of solar energy. West Germany, Spain and France have also successfully harnessed solar power. Concerning kilowatt hours of solar energy produced per dollars of gross domestic product, however, the United States falls third behind Spain and West Germany, respectively.

1987 gross domestic product numbers were taken from the Penn World Tables and figures are determined by current international prices in 1985 dollars.

Electricity generated from renewable sources

Gigawatt hours, 1987

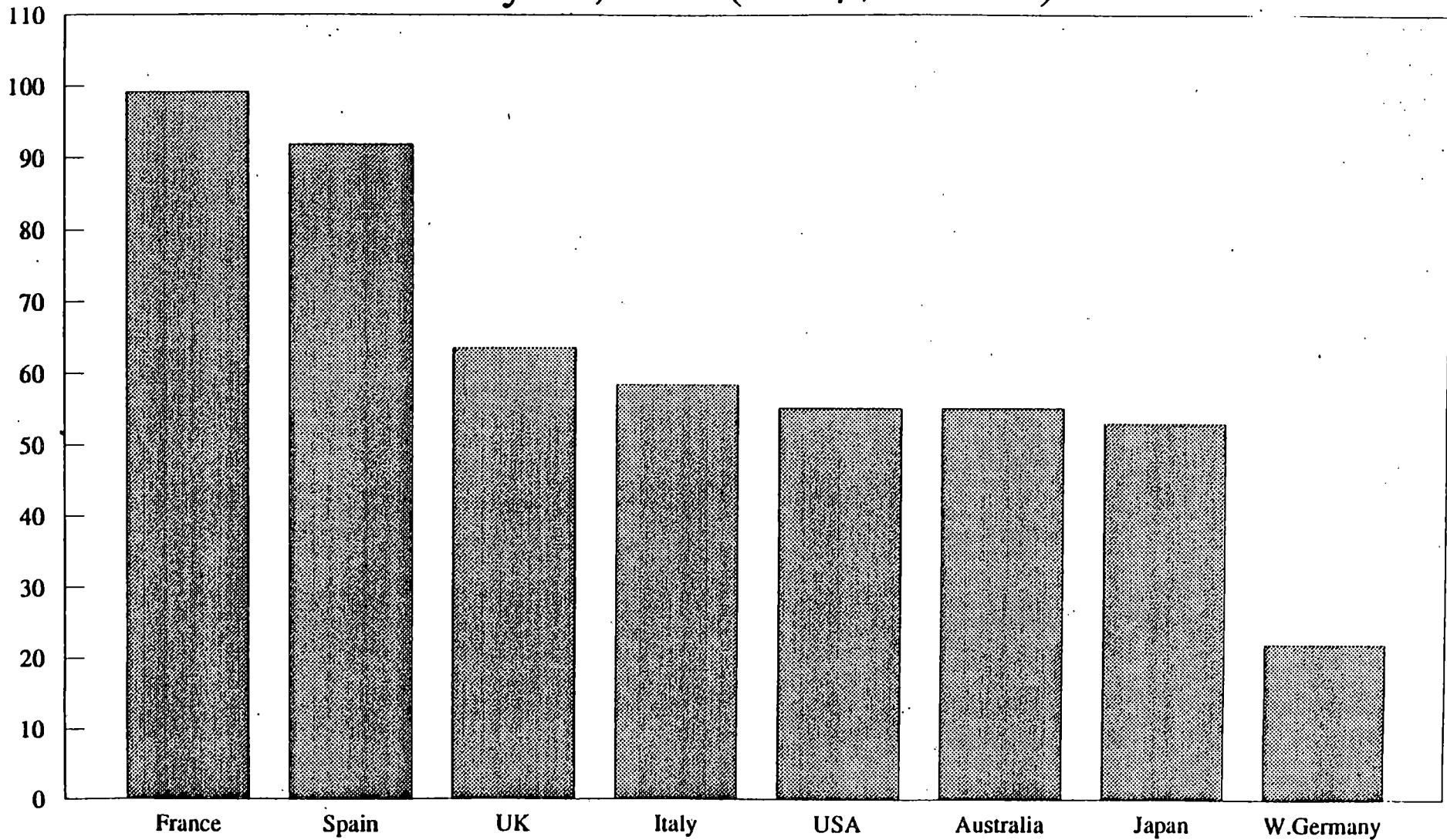
	<i>Hydro</i>	<i>Geothermal</i>	<i>Wind</i>	<i>Solar</i>
Australia	13939	*	125	*
Belgium	425		*	*
Denmark	29		*	
France	70264		0.4	1.0
W.Germany	18283		2.4	3.0
Greece	2779	*		
Italy	40495	2986		
Japan	80800	1100		
Luxembourg	110			
Netherlands	1		10	*
New Zealand	27392	1224	*	*
Portugal	9060		*	*
Spain	27210		1.6	2.0
Sweden	70990		6	*
Switzerland	35412			
United Kingdom	4035		1.5	<0.1
United States	249695	10775	1700	15

Source: World Wildlife Fund Atlas of the Environment, Geoffrey Lean, Don Hinrichsen & Adam

Markham, Prentice Hall Press: New York, 1990.

Renewable energy resources

Hydro, 1987 (kWh/\$ of GDP)

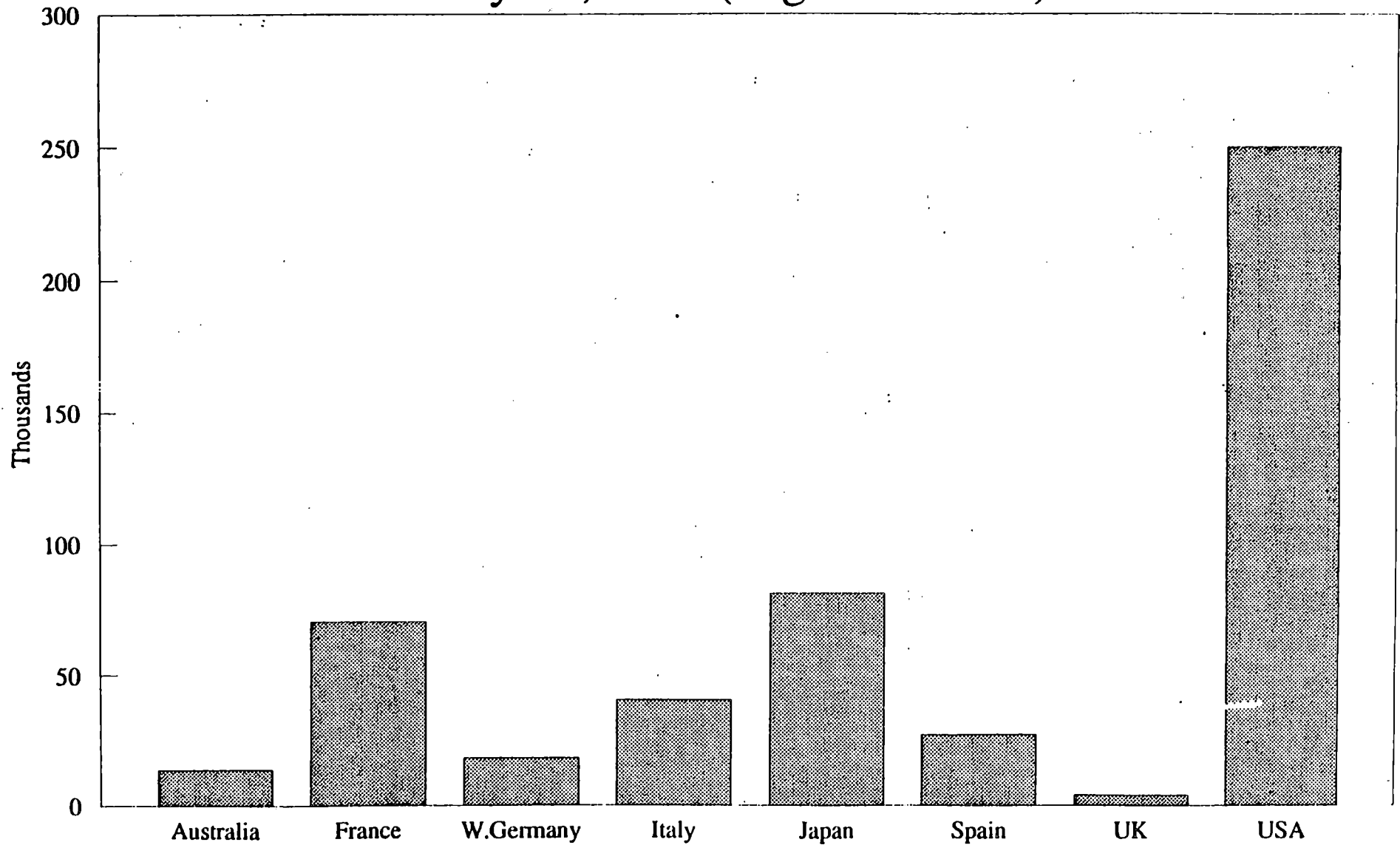


ources: World Wildlife Fund Atlas of the Environment, Geoffrey Lean, Don Hinrichsen & Adam Markham, Prentice Hall Press: New York, 1990.

Penn World Table (Mark 5): Summers & Heston (1991).

Renewable energy resources

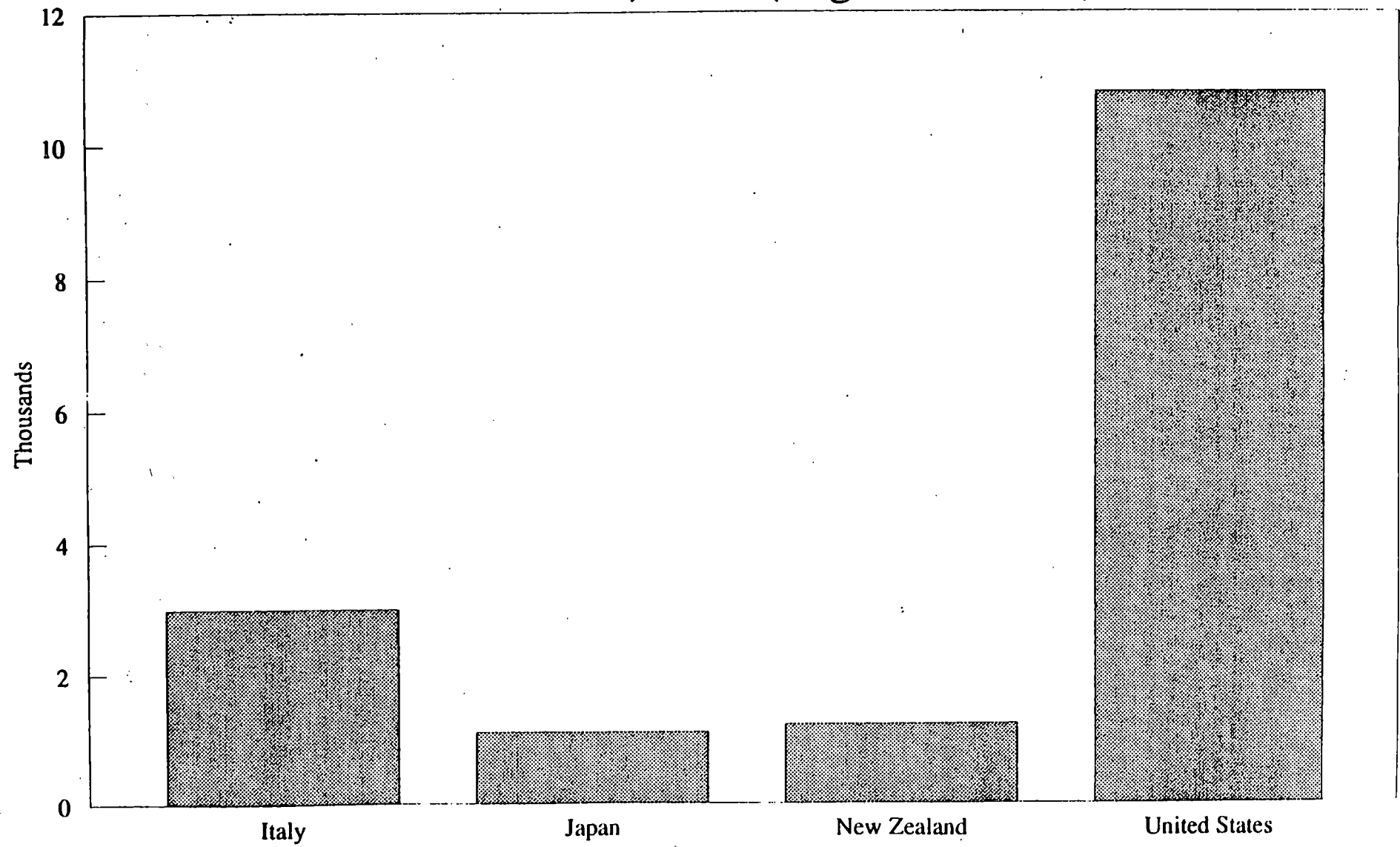
Hydro, 1987 (Gigawatt hours)



Source: World Wildlife Fund Atlas of the Environment, Geoffrey Lean, Don Hürchsen & Adam Markham, Prentice Hall Press: New York, 1990.

Renewable energy resources

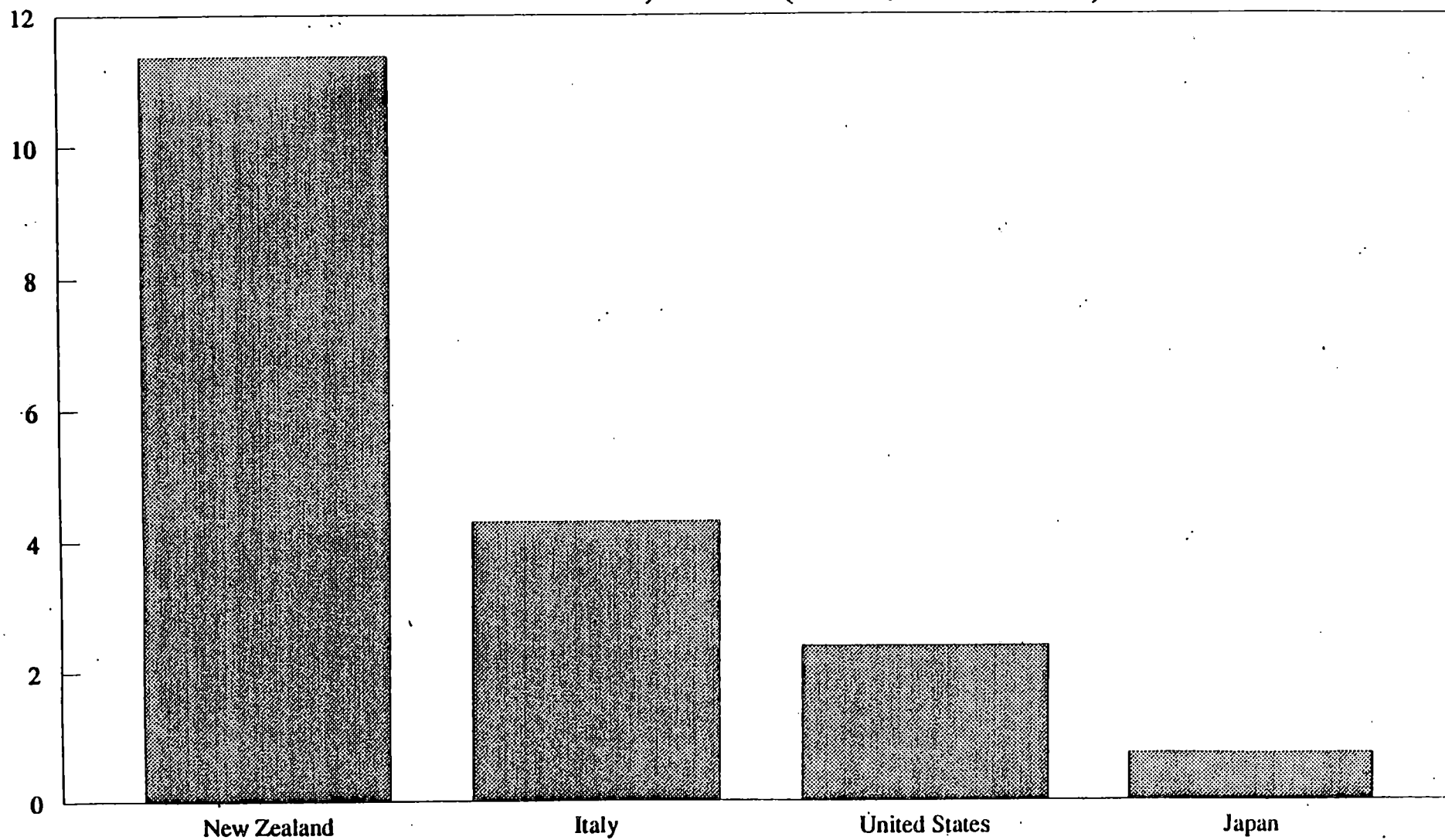
Geothermal, 1987 (Gigawatt hours)



Source: World Wildlife Fund Atlas of the Environment, Geoffrey Lean, Don Hinrichsen & Adam Markham, Prentice Hall Press: New York, 1990.

Renewable energy resources

Geothermal, 1987 (kWh/\$ of GDP)

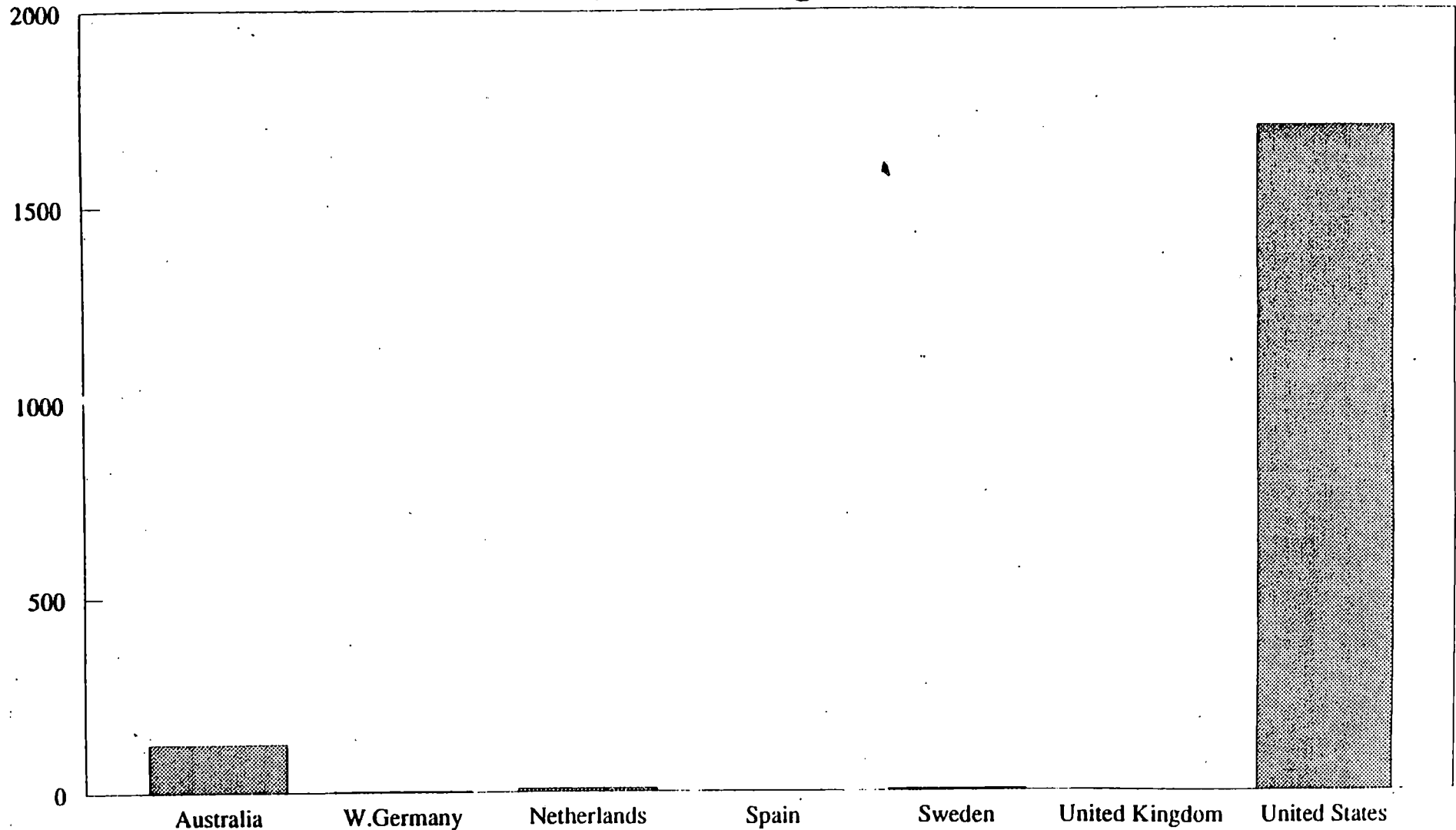


Sources: World Wildlife Fund Atlas of the Environment, Geoffrey Lean, Don Hinrichsen & Adam Markham, Prentice Hall Press: New York, 1990.

Penn World Table (Mark 5): Summers & Heston (1991).

Renewable energy resources

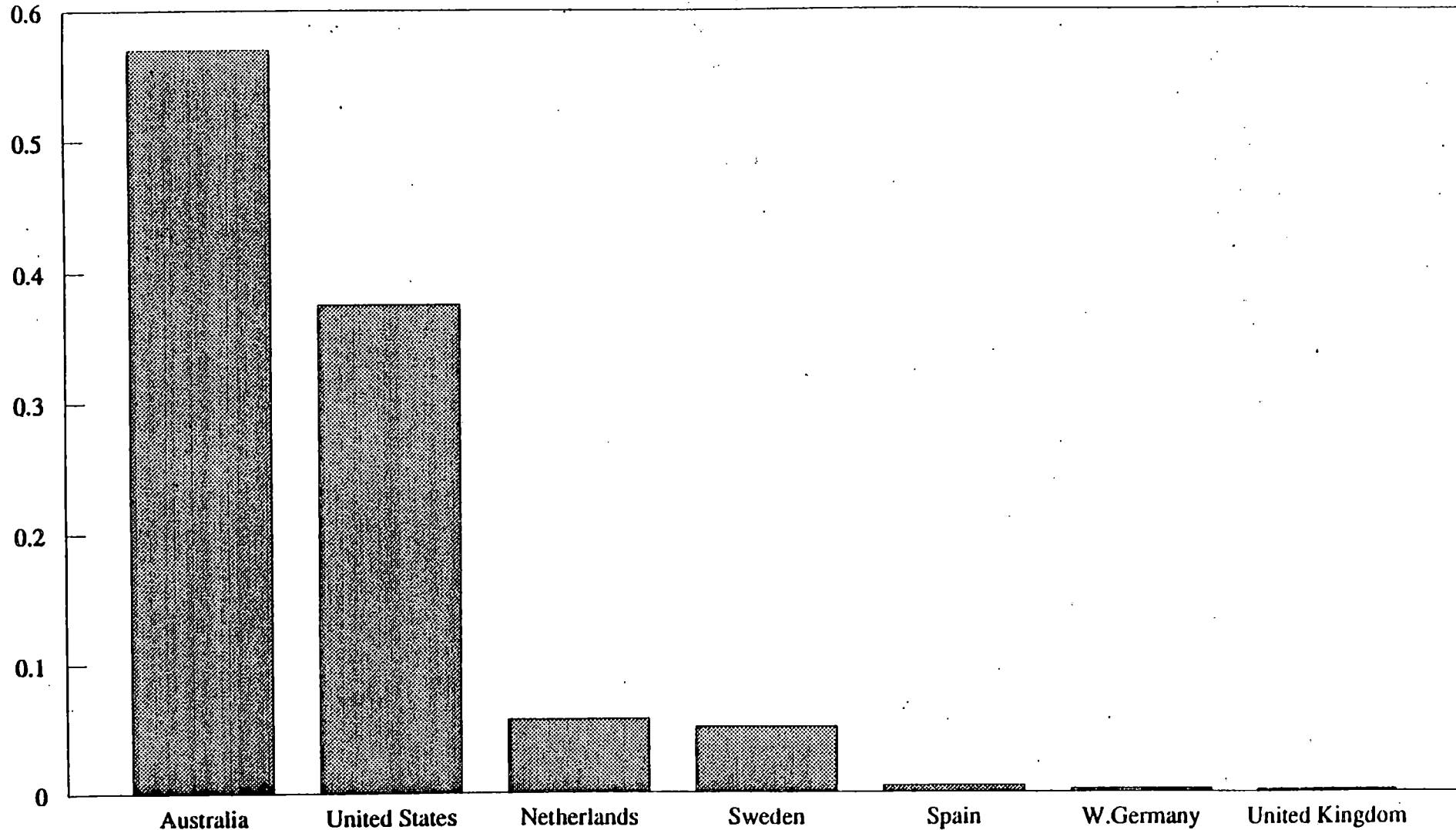
Wind, 1987 (Gigawatt hours)



Source: World Wildlife Fund Atlas of the Environment, Geoffrey Lean, Don Hinrichsen & Adam Markham, Prentice Hall Press: New York, 1990.

Renewable energy resources

Wind, 1987 (kWh/\$ of GDP)

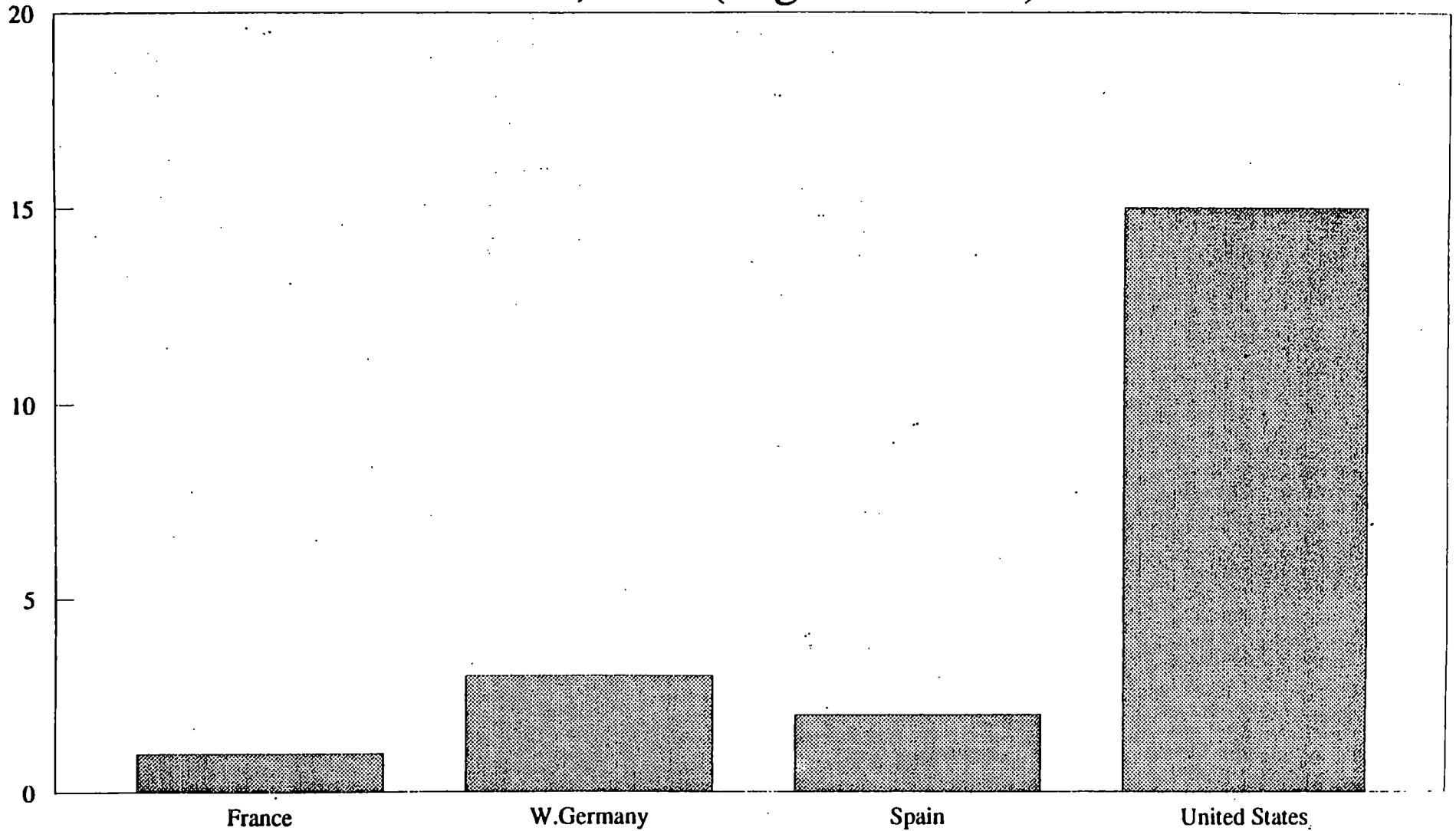


Sources: World Wildlife Fund Atlas of the Environment, Geoffrey Lean, Don Huurschen & Adam Markham, Prentice Hall Press: New York, 1990.

Paau World Table (Mark 5): Summers & Heston (1991).

Renewable energy resources

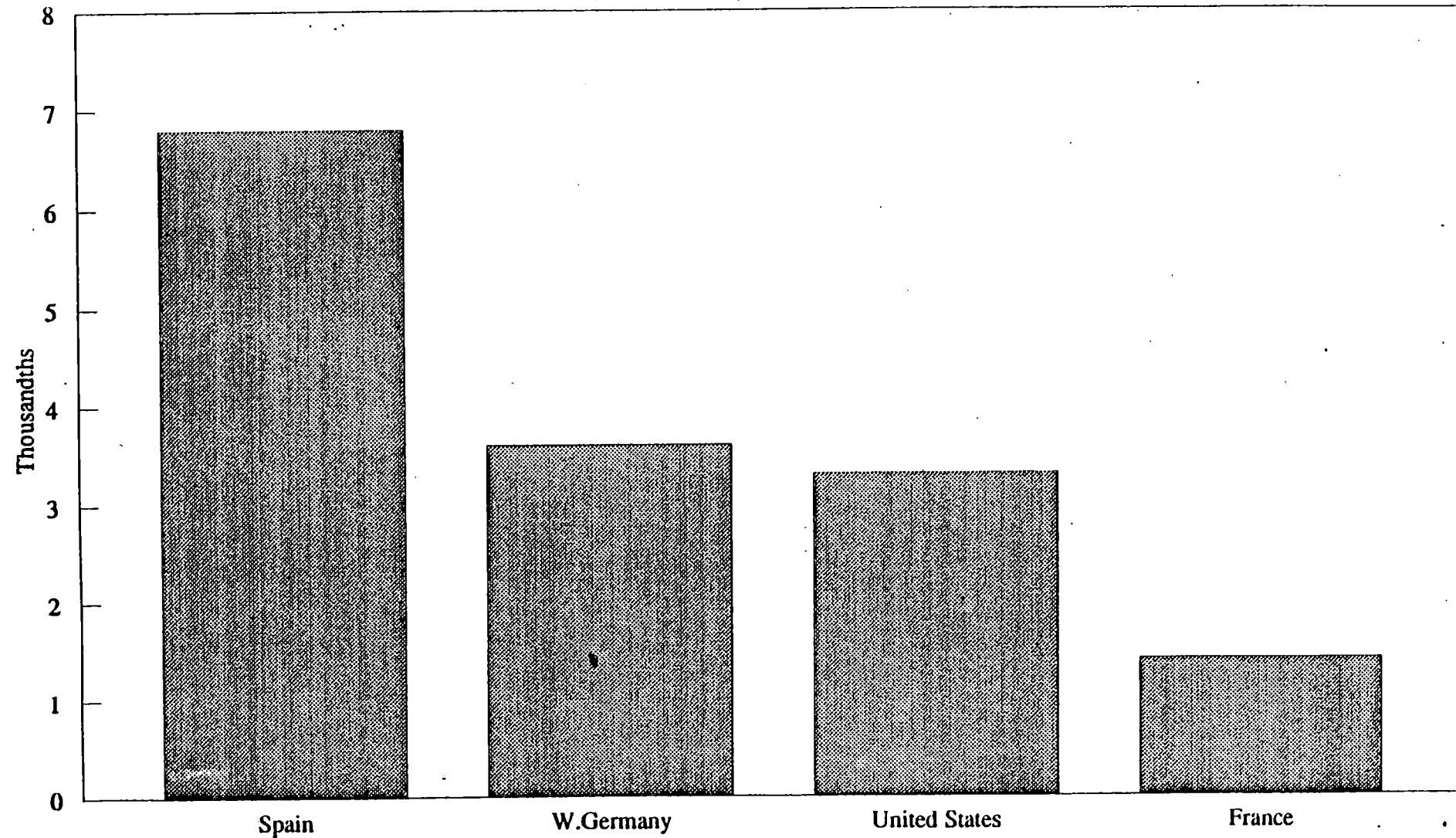
Solar, 1987 (Gigawatt hours)



Source: World Wildlife Fund Atlas of the Environment, Geoffrey Lean, Don Hinrichsen & Adam Markham, Prentice Hall Press: New York, 1990.

Renewable energy resources

Solar, 1987 (kWh/\$ of GDP)



ources: World Wildlife Fund Atlas of the Environment, Geoffrey Lean, Don Hinrichsen & Adam Markham, Prentice Hall Press: New York, 1990.

Penn World Table (Mark 5): Summers & Heston (1991).

Major Protected Areas

Major protected areas in OECD countries are increasing in both number of sites and total area. Since 1950 the number of sites has risen from 306 to 2,523 and the total area has increased from 329,751 to 2,511,239 kilometers squared. The environmental pressures on these areas are pollution from nearby industries and human activities and the effects of acid rain. The economic pressures result from an increasing intensity of use, specifically a rise in the numbers of visitors to these areas, and pressure from the timber industry to harvest more area.

The United States, Australia and Canada have the greatest number of protected sites overall and also own the greatest total area. Sweden, UK, Norway and West Germany rank the highest in relation to protected area as a percentage of territory. The United States, owning the most territory of all the countries compared here, still ranks sixth in protected areas as a percent of territory. In respect to protected area per 1000 inhabitants, less populated countries like Iceland and Australia fared highest.

The OECD includes scientific reserves, national parks, natural monuments, nature reserves and protected landscapes in its definition of major protected areas and warns that definitions may vary between countries.

Major Protected Areas(a) OECD Countries, 1990				
	No. of sites	Total area km ²	% of territory	Protected area/ 1000 inhabitants
Canada	523	701255	7.0	2671.7
USA	961	982974	10.5	395.1
Japan	65	24024	6.4	19.5
Australia	728	456544	5.9	2716.4
New Zealand	152	28391	10.6	849.3
Austria	129	15939	19.0	209.1
Belgium	2	718	2.4	7.2
Denmark (b)	65	4225	9.8	82.3
Finland	35	8073	2.4	162.6
France (c)	80	47787	2.3	85.1
W.Germany	54	29559	11.9	47.7
Greece	20	1037	0.8	10.3
Iceland	22	9159	8.9	3620.2
Ireland	6	268	0.4	7.6
Italy	108	13006	4.3	22.6
Luxembourg	.	.	.	.
Netherlands (d)	68	3550	8.7	23.9
Norway (e)	67	47624	14.7	1126.7
Portugal	21	4536	4.9	43.9
Spain	161	3511	7.0	90.3
Sweden	99	17584	3.9	207.0
Switzerland	15	1112	2.7	16.5
Turkey	18	2692	0.3	4.9
UK	138	46392	18.9	81.1
Yugoslavia	68	7913	3.1	33.2

Notes: (a) IUNC management categories I-V. Each area, excepting islands, is >10km². Nat'l classifications may vary.

(b) Excluding Greenland.

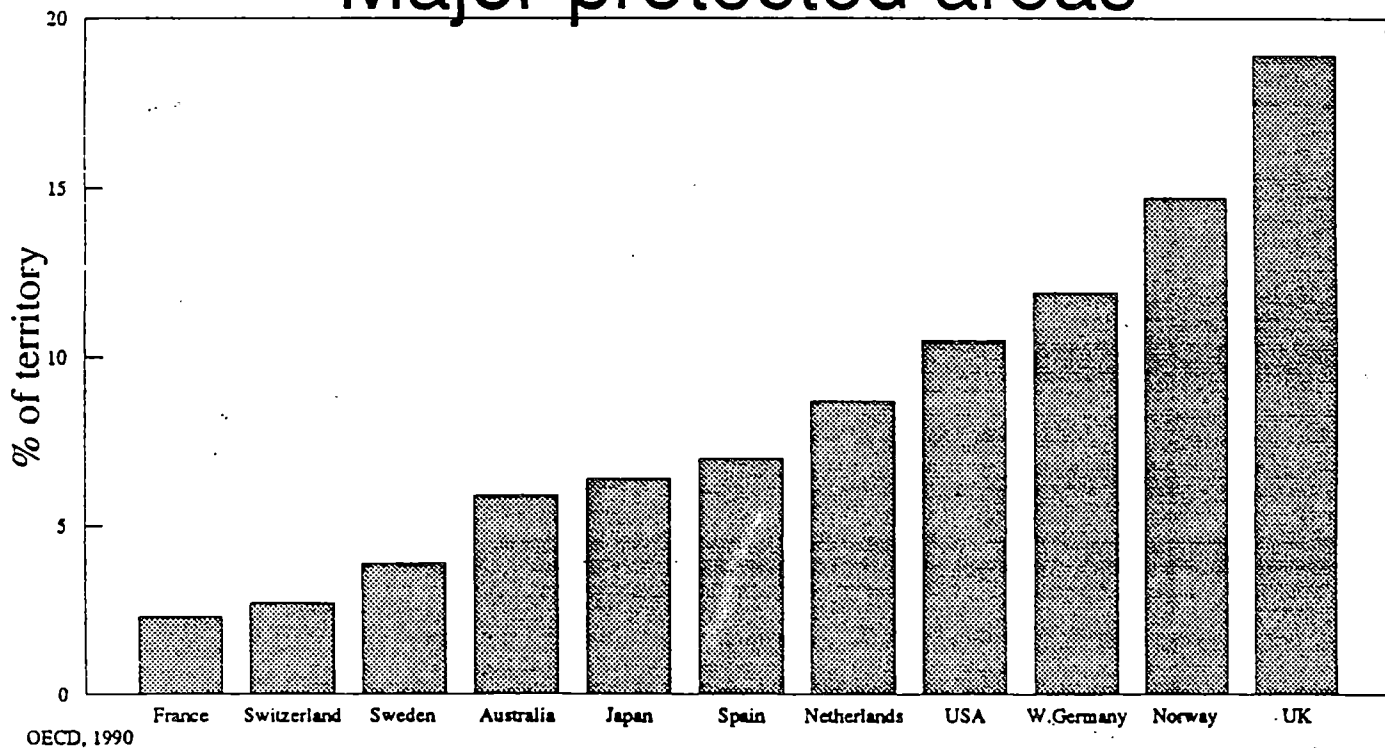
(c) Excluding non metropolitan areas.

(d) Excluding Arilles.

(e) Including Svalbard, Jan Mayan and Bouvet islands.

Sources: IUNC, OECD, Environmental Data, 1991.

Major protected areas



Threatened Species

The extinction rate has snowballed to 25,000 times the natural rate. The loss of every species affects other plants and animals dependant upon it, including humans. Beyond its aesthetic value, wildlife's economic contributions totals \$40 billion annually in timber products and \$12 billion in fishery products. World medicines from wildlife products are approximated at \$40 billion annually. The United States alone reaped \$142 million in industrial trade from wild species between 1976 and 1980. The benefit of wildlife genetic resources are essential for agricultures, crops and livestock by improving their resistance to disease and pests, aiding in pollination and cross-breeding new species to satisfy the growing demand for new foods. With the loss of each irreplaceable species, we also lose its unique qualities, and hence our ability to appreciate and benefit from them.

To indicate the extent of wildlife loss figures are expressed as threatened species as a percentage of total species inhabiting country by the following classes: Mammals, Birds, Fish, Reptiles, Amphibians and Vascular plants.

In respect to the data on mammals, note that the United States and Japan have the greatest number of species. France, West Germany, Netherlands and Portugal have the greatest percentage of threatened species, all above 40 percent. The decline of whale and large carnivores species have been historically over-hunted and show steadily decreasing numbers despite recent conservation efforts.

Pertaining to birds, there appears to be a direct relation between population density and percentage threatened species. France, West Germany, Netherlands and Portugal show 30 percent of their species threatened. Japan is an exception to this relationship with only 8.1 percent threatened. The North American Breeding Bird Survey showed decreases in the United State's bird populations of migratory birds and ducks, most likely due to loss of tropical forests and wetlands.

Concerning fish populations most countries compared here show approximately 15 percent threatened; however, the West Germany data marks 70 percent of their fish populations threatened. Inland water pollution and acidification are concerns for freshwater species, and loss of coastal wetlands and over-fishing rank highest concerning marine species.

Regarding reptiles and amphibians, the percentage of threatened species is highest in most of the European countries, which have very few species overall. The leading cause of this decline is attributed to pollution of breeding pools.

Belgium and West Germany report the greatest loss of plant species, approximately one quarter. The remaining compared countries fall under the 15 percent mark.

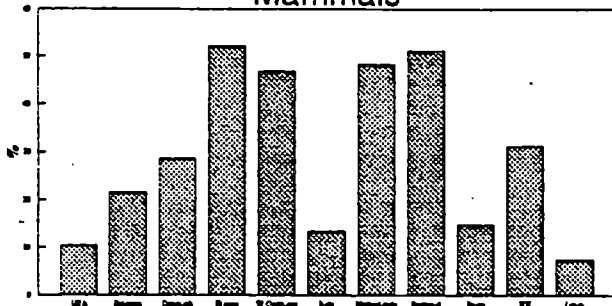
The reader need note several elements of the data when interpreting the data. First, direct measure of wildlife species is difficult, and number of species known does not always portray the number of actual species. Also, the definition of "threatened" is not always consistent between countries. Furthermore, these data do not state the influence of human behavior on wildlife population levels.

Threatened Species as a % of Total Species Inhabiting Country, Late 1980's

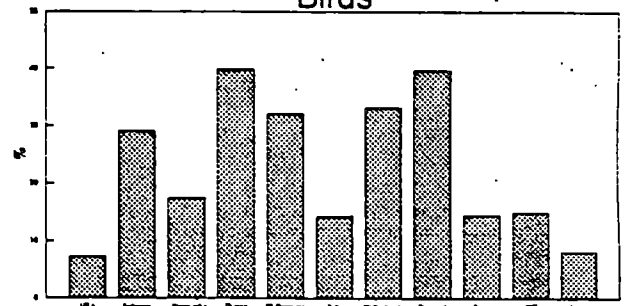
	Mammals	Birds	Fish	Reptiles	Amphibians	Vascular Plants
USA	10.5	7.2	2.4	7.1	3.6	0.5
Belgium	21.5	29.0	n/a	75.0	100.0	24.0
Denmark	28.6	17.4	7.8	0.0	21.4	13.7
France	52.2	39.8	18.6	38.9	62.1	8.4
W.Germany	46.8	32.1	70.0	75.0	57.9	28.2
Italy	13.4	14.3	13.9	52.2	46.4	10.0
Netherlands	48.3	33.1	22.4	85.7	66.7	n/a
Portugal	51.2	39.6	28.2	37.1	23.5	n/a
Spain	14.8	14.5	18.2	14.1	4.2	2.5
UK	31.2	15.0	3.4	45.5	33.3	9.6
Japan	7.4	8.1	10.6	3.5	6.3	10.2

Source: OECD, 1991.

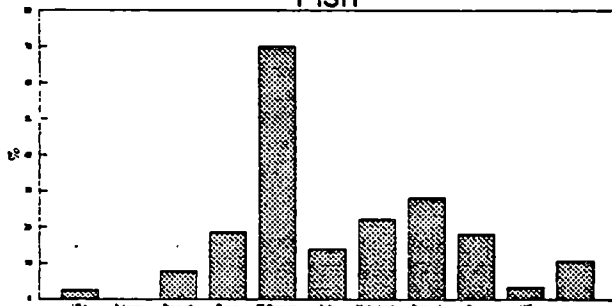
Mammals



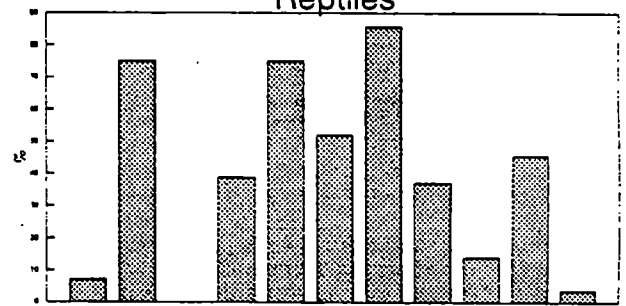
Birds



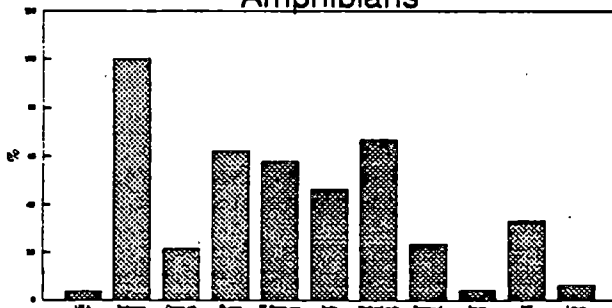
Fish



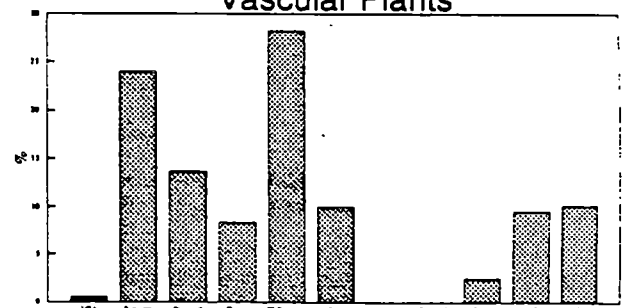
Reptiles



Amphibians



Vascular Plants



Cork and Wood Imports From Tropical Countries

The problem of tropical deforestation has stretched beyond local to international concern, affecting the build-up of CO₂, the overall warming of our climate and the depletion of our genetic resources. Tropical forests are cleared for agricultural grazing, harvesting of wood fuel and export to developed nations, among other reasons.

The data is expressed as a percentage of total cork and wood imports from tropical countries. Japan is the main importer, followed by Europe and to a lesser extent by the United States. Japan imports the greatest proportion from the Far East, while Europe and the United States import mainly from Africa and Latin America, respectively.

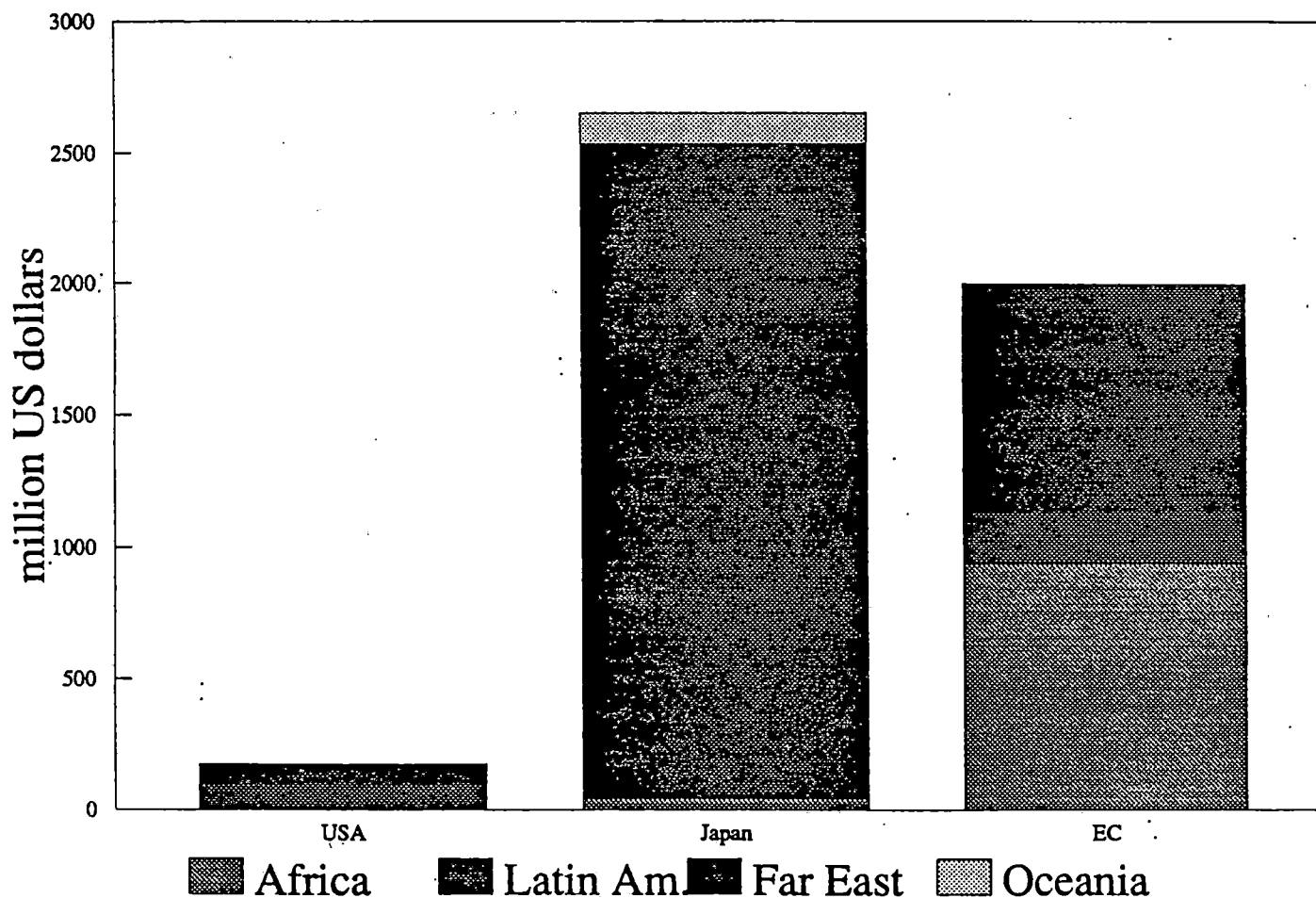
The reader is cautioned that definitions and classifications may vary between countries. Import values are determined by region of origin and are expressed at current prices and exchange rates for the latest available year.

Cork and Wood Imports from Tropical Countries, 1988

in 1,000 US\$

	Africa	Latin Am.	Far East	Oceania	TOTAL
USA	6800	96500	71200	100	174600
Japan	42900	12700	2475700	120400	2651700
EC	941800	198700	857800	300	2037300
<hr/>					
Belg.-Lux.	16400	1600	63500	100	81800
Denmark	3000	1800	9400	0	14100
France	221800	9000	116000	0	346800
W.Germany	124300	10100	157900	0	292300
Greece	33000	100	200	0	333000
Ireland	20400	8000	2400	0	30800
Italy	202100	19900	136100	0	358000
Netherlands	42100	8500	173000	0	223700
Portugal	105900	8400	600	0	114800
Spain	168500	32400	2500	0	225900
UK	4300	98900	173700	200	315800

Source: OECD, 1991.



Dependence on Agrichemicals

World fertilizer use has increased more than 10 times since 1950 and pesticide use more 32 times. Distorting agricultural subsidies and declining availability of land promote intensive agricultural practices. Farmers are meeting the demand for higher cropping frequencies and larger production increases by substituting agrichemicals for land. Developed nations dominate fertilizer and pesticide use, but less-developed countries also raised agricultural output 55% from 1965-1976 by boosting chemical use. As world dependence grows, diminishing returns appear. Today each tonne of fertilizer applied increases yields by only half as much.

Excessive use of agrichemicals causes fertilizer nutrient run-off and harmful residues collect in soils, foods, groundwater and our lakes and river. It will take decades before the fertilizers we apply today will seep through the earth and into our water, but we already see evidence of pollution. A 1984 EPA study found 8000 wells above acceptable limits. Toxic algae blooms in the North Sea in 1988 killed literally millions of fish and hampered tourism in the Adriatic in 1989. Crude estimates predict between 400,000 and 2 million cases of acute pesticide poisoning every year, ending in 10,000 to 40,000 deaths. The US Research Council estimates as many as 20,000 Americans may die of cancer annually as a result of low levels of pesticides from domestically grown products.

To indicate intensity of fertilizer and pesticide use figures are expressed in amount of commercial fertilizer or pesticide per kilometer squared of arable land and the percentage change relative to 1970. For nitrogenous fertilizer trend analysis shows an increase in all OECD countries. The greatest percentage increase is in Europe(average), which is also the most intensive user. Japan's use increased by a relatively small 9% but remains the second most intensive user. The US, although the least intensive of the three, has increased its percentage usage by almost a third. EC(average) refers to the averages obtained from the countries listed in the bottom portion of the table.

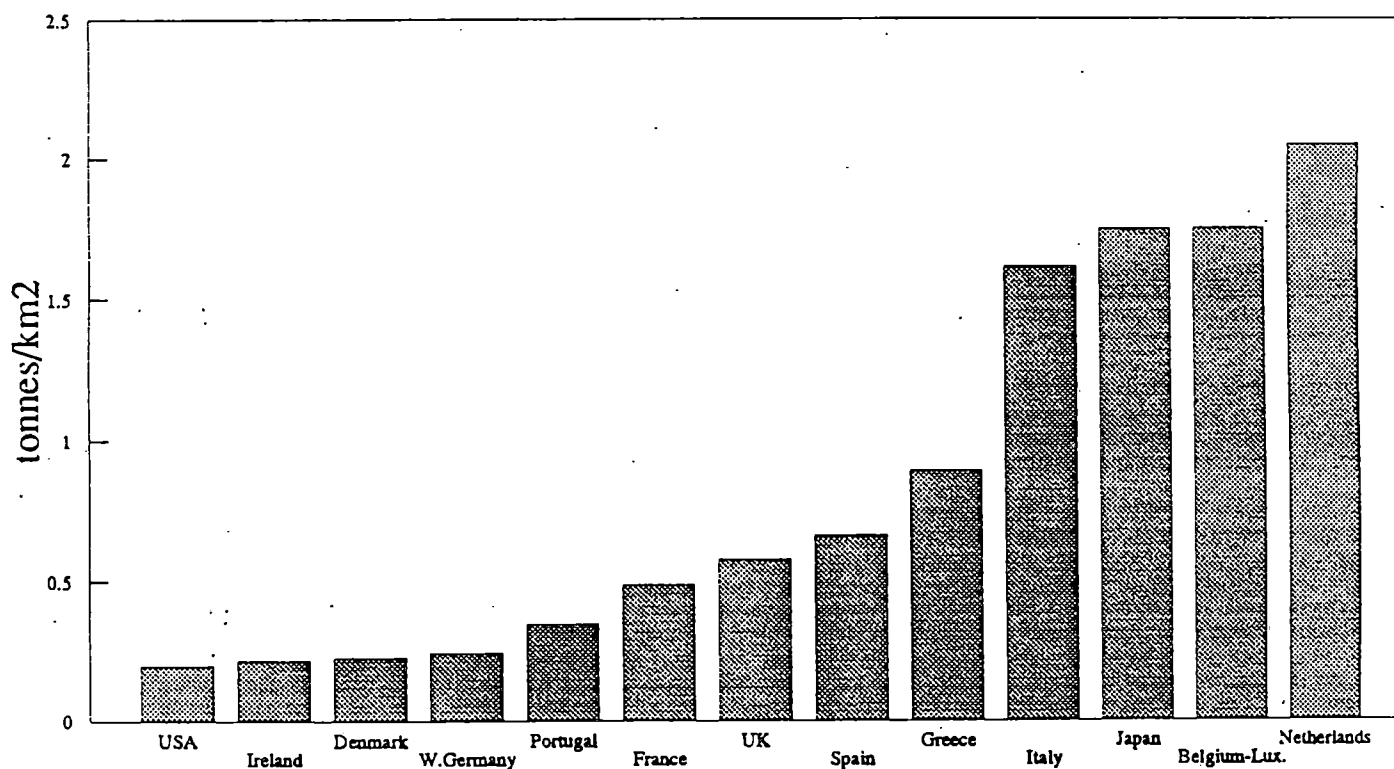
Sources:

- OECD Environmental Data 1991.
- OECD The State of the Environment, 1991.
- WWF Atlas of the Environment, 1990.

Consumption of Pesticides per km² of Agricultural Area in tonnes/km²

	Year	Total Pesticides (tonnes)	Arable and Permanent Cropland (km ²)	Consumption per area of Cropland (tonnes/km ²)
USA	1984	373333	1899150	0.20
Japan	1985	83096	47580	1.75
Belgium-Lux.	1984	13263	7580	1.75
Denmark	1988	5774	25700	0.22
France	1988	92500	190510	0.49
W.Germany	1987	29857	124090	0.24
Greece	1984	35124	39520	0.89
Ireland	1984	2250	10440	0.22
Italy	1988	196097	121490	1.61
Netherlands	1989	19146	9360	2.05
Portugal	1988	12907	37710	0.34
Spain	1989	134150	203450	0.66
UK	1982	40300	70020	0.58

Source: OECD, 1991.

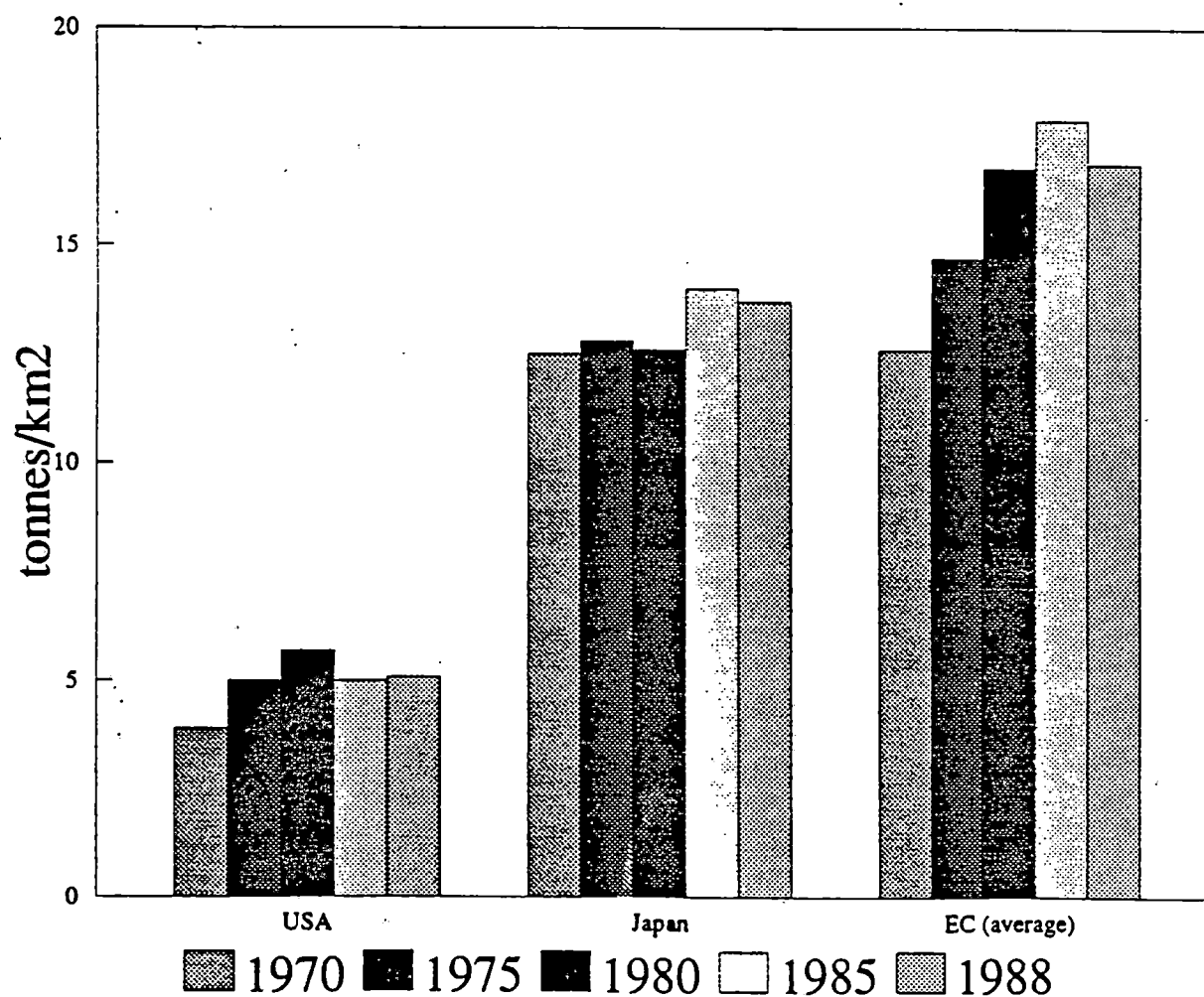


Note: See table for corresponding year.

Nitrogenous Fertilizers Applied on Arable Land (tonnes/km²)

	1970	1975	1980	1985	1988	%Change from 1970 1970-1988
USA	3.9	5.0	5.7	5.0	5.1	32
Japan	12.5	12.8	12.6	14.0	13.7	9
EC (average)	12.6	14.7	16.8	17.9	16.9	34
<hr/>						
Belgium	19.3	20.7	23.2	24.5	24.5	27
Denmark	10.8	12.7	14.1	14.6	14.7	35
France	7.9	9.2	11.4	12.5	13.3	69
W.Germany	14.9	16.2	20.7	20.3	20.6	38
Greece	5.1	6.7	8.5	11.6	10.6	106
Italy	4.9	6.1	8.3	8.7	7.6	57
Netherlands	46.1	53.3	56.2	55.6	46.7	1
Portugal	2.0	3.8	3.8	3.9	4.4	116
Spain	2.7	3.7	4.4	4.7	5.5	101
UK	12.4	15.0	17.7	22.2	20.9	69

Source : OECD, 1991.



Human Exposure

The quality of human health is another measure of the state of our environment. A declining environmental quality holds potential negative side-effects to human health. Over-exposure to lead, for example, may have cardiovascular, neurological, osteopathic, reproductive and potential carcinogenic effect, especially in children. Science has not had time to assess all potential health risks in our rapidly developing world. This section examines human exposures to known risks to human health: lead, cadmium and mercury.

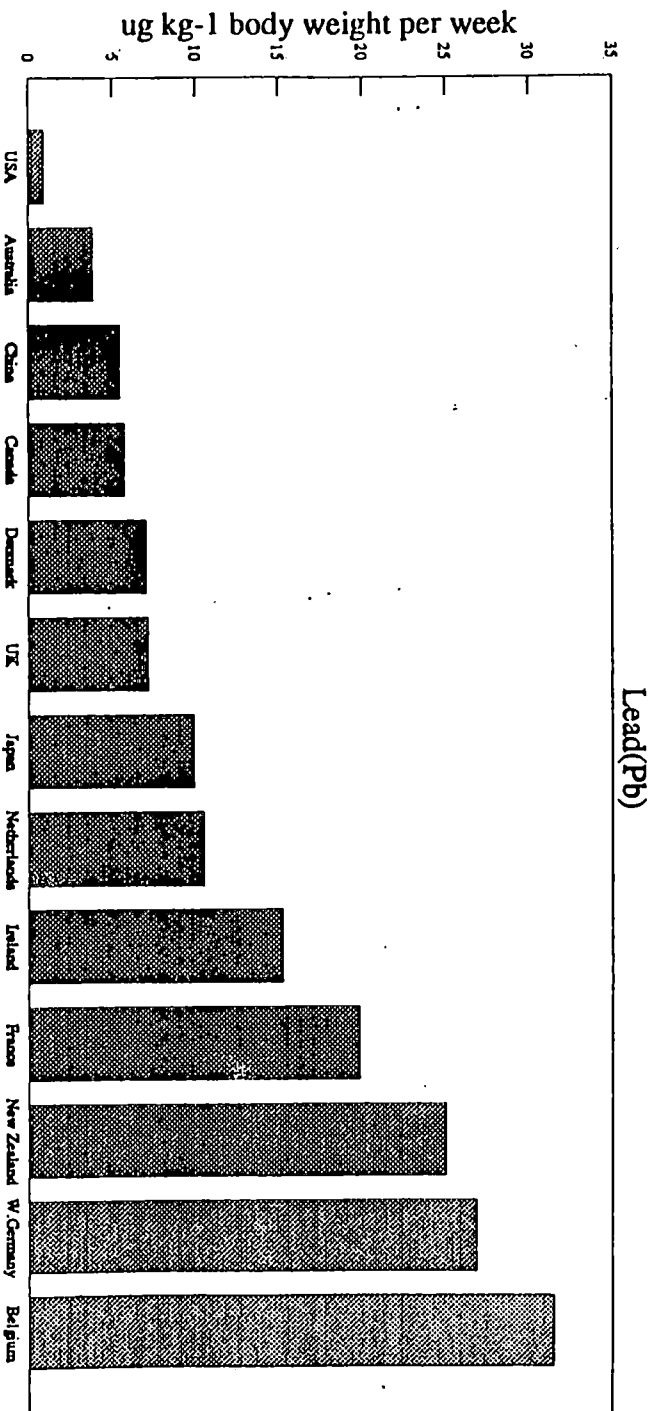
Source-oriented indicators of contaminants involve monitoring human exposure to such media as air, food and water. The table and subsequent graph measuring adult dietary intake of selected heavy metals examines dietary exposure averages from 1980-1988 by country in ug kg-1 body weight per week. Note that sampling methods may vary between countries. Belgium, West Germany and New Zealand had the highest concentrations of lead; Belgium, New Zealand and France ranked highest in concentrations of Cadmium, and for Mercury, West Germany, Belgium and Denmark had the most pronounced concentrations.

Unlike source-oriented indicators which express the presence of the contaminant in human surroundings, measures of concentrations of contaminants in human tissue assist in assessing human individual exposure. Blood, breast milk and human excrement all provide a register of human exposure. The table and subsequent graph, titled lead in blood of adults, measures mean concentrations of lead in blood samples (micrograms per 100 milliliters of blood) for selected locales in each country. Consider the notes below the table when interpreting, as methods of sampling may vary between countries. Brussels, Italy(national average) and Baltimore had the highest concentrations overall.

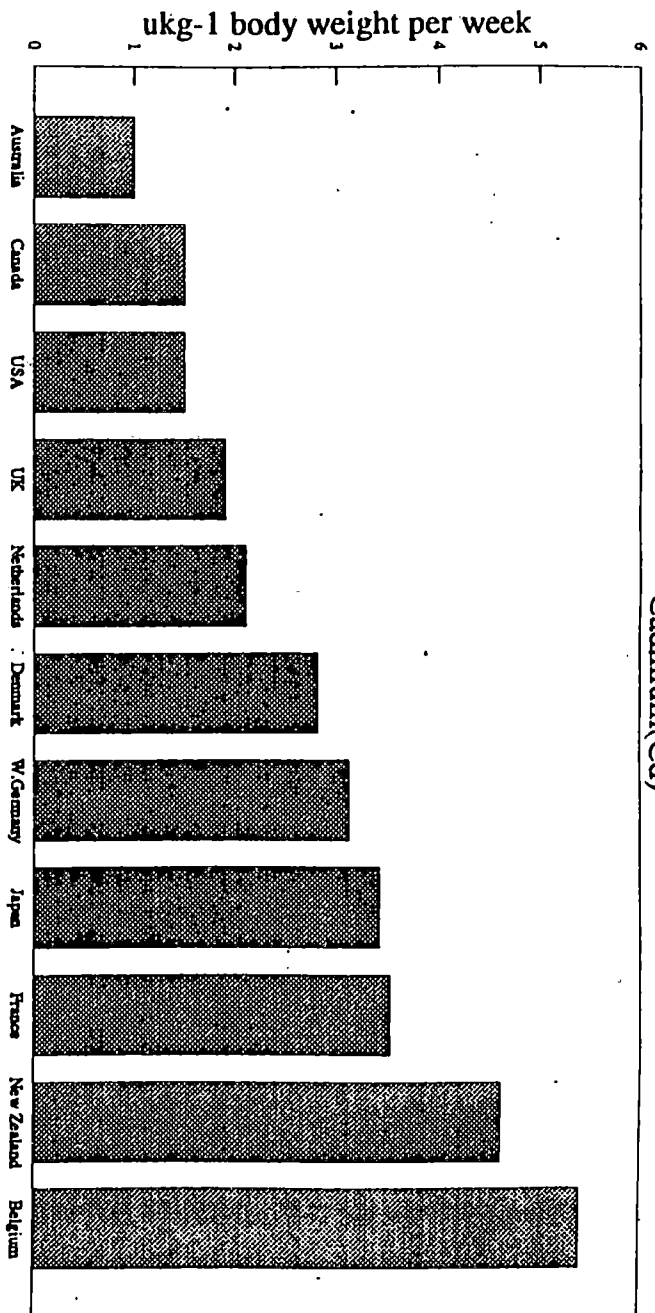
Adult dietary intake of Lead(Pb), Cadmium(Cd) and Mercury(Hg), 1980-1988 (ug kg-1 body weight per week)

Country	Pb	Cd	Hg	Country	Pb	Cd	Hg
AMERICAS				WESTERN PACIFIC			
Canada	5.7	1.5	1.0	W.Germany	26.8	3.1	2.6
Cuba	63.3			Hungary	11.1	0.6	
Guatemala	32.3	2.0	1.4	Italy	59.5	3.4	1.1
USA	0.9	1.5	0.3	Ireland	15.2		
SOUTH EAST ASIA				Netherlands	10.5	2.1	0.6
India	60.0			Poland	18.2	4.3	
Thailand	48.1		0.8	Sweden	2.6	1.0	
EUROPE				Switzerland	3.5		
Belgium	31.5	5.4	1.5	Turkey	6.4	1.9	0.4
Denmark	7.0	2.8	1.3	UK	7.1		
France	19.8	3.5	1.2	Yugoslavia	1.8		
Finland	1.7	1.2	0.2	WESTERN PACIFIC			
				Australia			
				China	3.8	1.0	0.3
				Japan	5.4		
				New Zealand	9.9	3.4	
					25.0	4.6	0.6

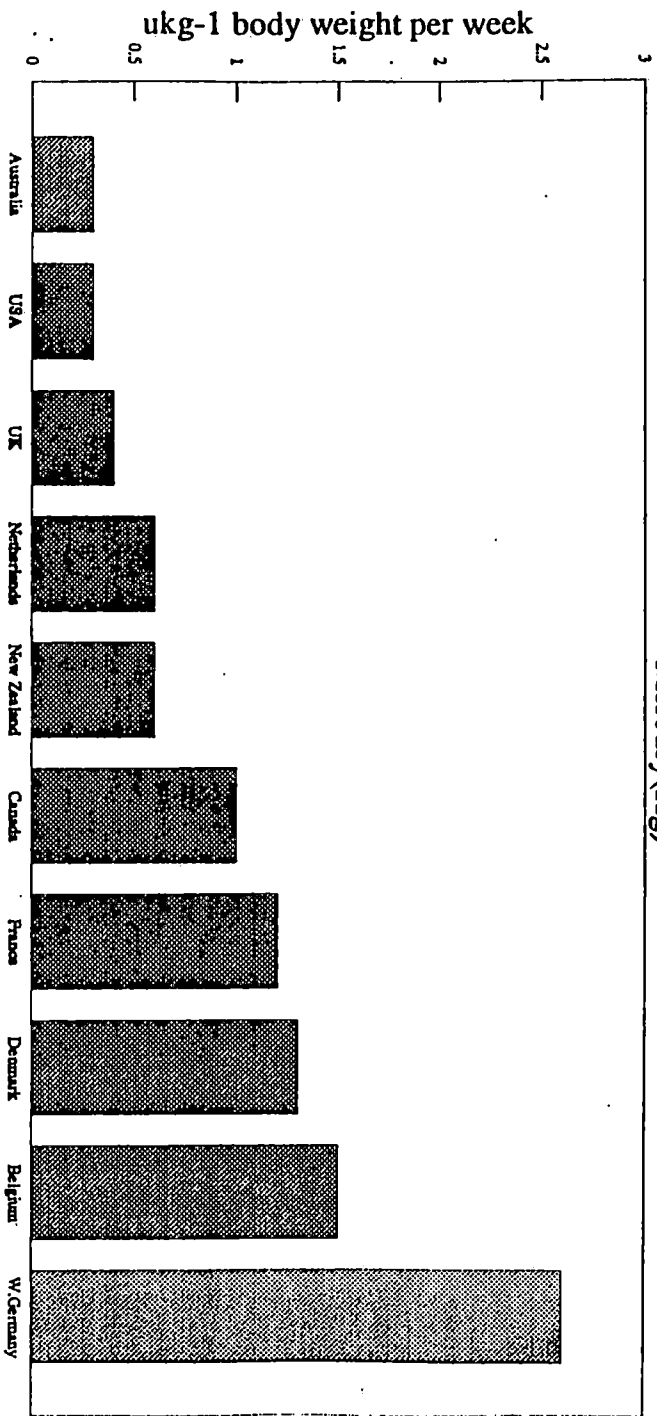
Source:
United Nations Environmental Programme,
Environmental Data Report, 1991, 3rd edition
Basil Blackwell, Oxford.



Cadmium(Cd)



Mercury(Hg)



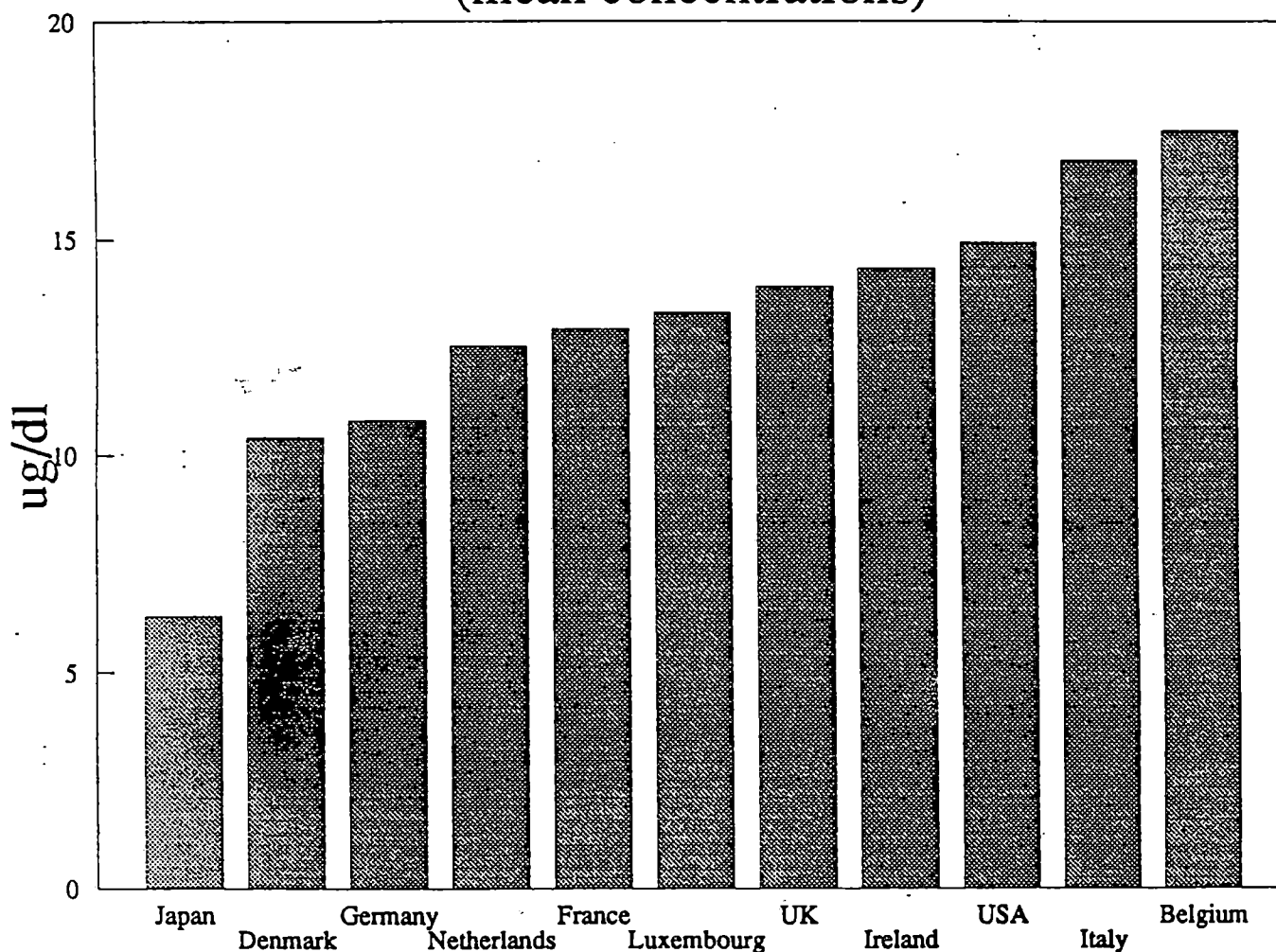
Source:
United Nations Environmental Programme,
Environmental Data Report, 1991, 2nd edition
Basil Blackwell, Oxford.

Lead in blood of adults
(mean concentrations in ug/100ml blood)

	area	men	women	total
USA	Baltimore	16.8	13.0	14.9
Belgium	Brussels	19.0	16.0	17.5
Denmark	Copenhagen	11.8	8.9	10.4
Germany	National*	11.6	9.9	10.8
France	National*	15.0	10.7	12.9
Ireland	Dublin	16.0	12.5	14.3
Italy	National*	20.0	13.5	16.8
Japan	Tokyo	6.7	5.8	6.3
Luxembourg	Luxembourg	15.0	11.5	13.3
Netherlands	Amsterdam	15.0	10.0	12.5
UK	National*	16.0	11.8	13.9

*Note: "National" refers to the averages of more than one area in each country: Germany - Hanover and Hamburg, France - Lyon, Marseille, Nice, Paris and Toulouse, Italy - Bologna, Milan, Naples and Rome, UK - Birmingham, Liverpool, London Islington, London Lambeth and Manchester.

Lead concentration in blood of adults
(mean concentrations)



Sources:

*Von Moltke, J.C. (1987). Possibilities for the Development of a Community Strategy for the control of lead. October
 UNEP/WHO 1982: Assessment of Human Exposure to Lead and Cadmium Through Biological Monitoring, ed. M. Vaher,
 National Swedish Institute of Environmental Medicine and Dept. of Environmental Hygiene, Karolinska
 Institute, Stockholm, Sweden.

Selected Bibliography

Brown, Lester, *et al.*(1992). *State of the World*. World Watch Report on Progress Toward a Sustainable Society. W.W.Norton & Company for World Watch Institute, New York.

OECD(1989).*OECD Environmental Data*. Organization for Economic Cooperation and Development, Paris.

OECD(1991).*Environmental Indicators*. Organization for Economic Cooperation and Development, Paris.

OECD(1991).*OECD Environmental Data*. Organization for Economic Cooperation and Development, Paris.

OECD(1991).*The State of the Environment*. Organization for Economic Cooperation and Development, Paris.

Oslo Commission(1989).*Thirteenth Annual Report of the Oslo Commission*. The Oslo Commission, London.

UNEP(1987).*The State of the Environment*. Butterworths, London.

UNEP(1990).*The State of the Marine Environment: UNEP Regional Seas Programme*, Reports and Studies 115. United Nations Environmental Programme, Nairobi.

UNEP(1991).*Environmental Data Report*. Basil Blackwell, Oxford.

WHO/UNEP(1987).*Global Pollution and Health*. Yale University Press for World Health Organization and United Nations Environmental Programme, London.

WHO(1989).*World Health Statistics Annual*. World Health Organization, Geneva.

WRI/UNEP/UNDP(1992). *World Resources Guide to Global Environment Toward Sustainable Development*. Oxford University Press for World Resources Institute, United Nations Environmental Programme and United Nations Development Programme, Oxford.

WWF(1990).*Atlas of the Environment*. Prentice Hall, New York.