UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL ENVIRONMENTAL SATELLITE, DATA,
AND INFORMATION SERVICE
Washington, D.C. 20233

FEB 1 2000

MEMORANDUM FOR: SAF/PAS
1690 Air Force Pentagon - 5D227
Washington DC 20330-1690

FROM: Francis G. Hinnant, Col, USAF
Associate Director of Acquisition
NPOESS Integrated Program Office
8455 Colesville Rd, Suite 1450
Silver Spring, MD 20910

SUBJECT: Ozone Mapping and Profiler Suite (OMPS) Presentation

Enclosed are the required ten (10) copies of the subject presentation. This briefing is requested for public disclosure and discussion during the Global Change Observation Mission (GCOM) – A1 satellite workshop. This workshop is hosted by the National Space Development Agency of Japan, NASDA and will be held 16-17 Feb 2000 in Tokyo, Japan. The presenter will be Mr. Dave Furlong, Deputy Associate Director for Acquisition, NPOESS Integrated Program Office.

The program office has reviewed the information and found it appropriate for public disclosure without change.

Point of contact on this matter is Capt Elisa Kang, NPOESS IPO/ADA at 301-427-2084 (Ext. 142).

cc: ADA (E. Kang)

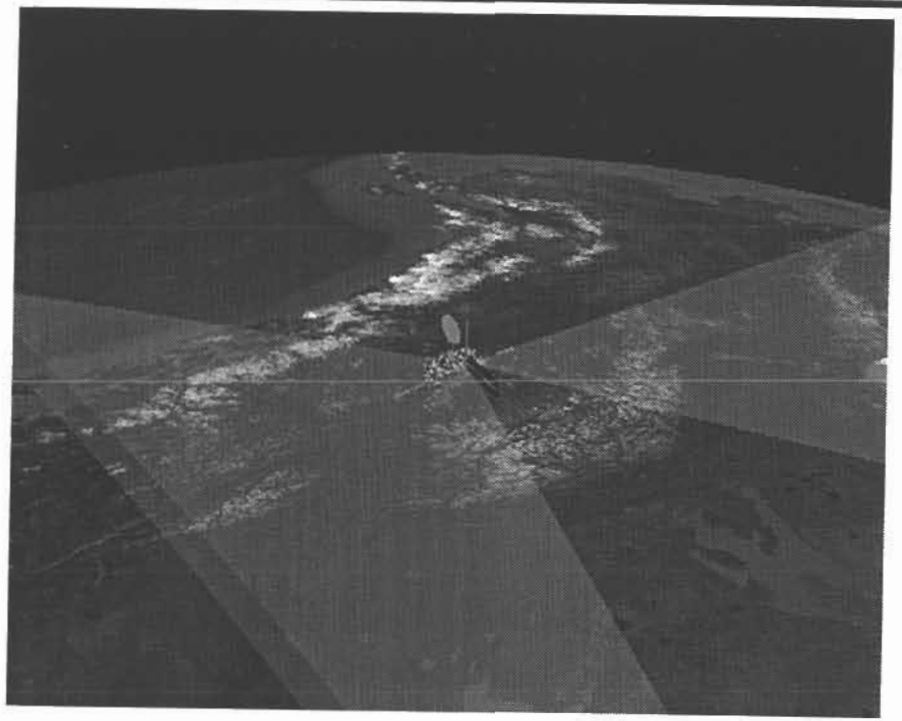
Attachment: Presentation—10 copies

# Ozone Mapping and Profiler Suite (OMPS)

National Polar-orbiting Operational
Environmental Satellite System (NPOESS)

Integrated Program Office

# Ozone and Mapping Profiler Suite (OMPS)



## Three Unique Fields of View

- Nadir Mapper
- Nadir SBUV Heritage for Data Continuity
- Limb Profiler

Heritage

Total Ozone Mapping Spectrometer (TOMS)
Solar Backscatter UltraViolet (SBUV)
Global Ozone Monitoring Experiment (GOME)

Sensor Contractor

Ball Aerospace & Technologies

# OMPS Description

[redacted]

- The OMPS flight hardware is:
  - Nadir sensor
  - Limb sensor
  - Interface and Control electronics (ICE) box
- The nadir sensor has two spectrometers fed by one telescope
- The limb sensor has 3 FOVs - each centered along-track
  - Each FOV has 3 images on the focal plane for high dynamic range
- The OMPS algorithms created four data products
  - High-performance total column mapper
  - Heritage TOMS V7 total column data records
  - High-performance ozone profile
  - Heritage SBUV/2 nadir profile data records

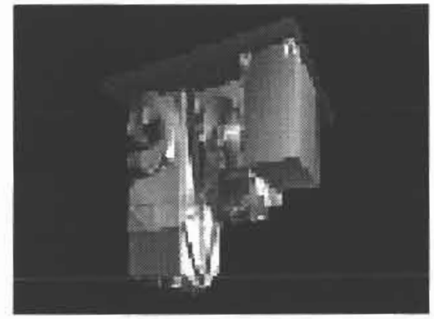
[redacted]

# Sensor Concept

[redacted]

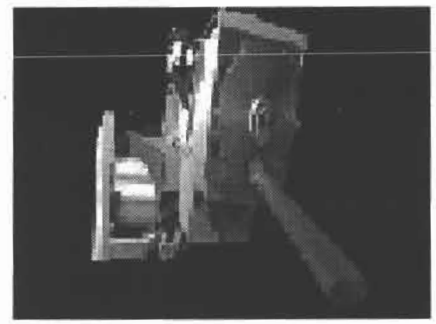
[redacted]

[redacted]



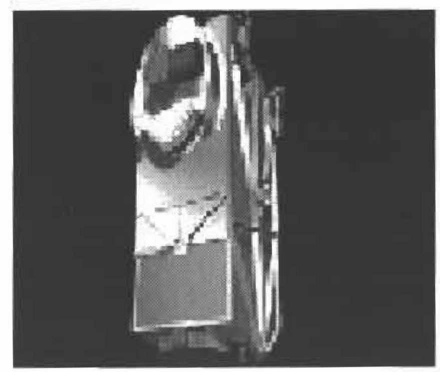
[redacted]

Hyperstrctral UV, visible, and near IR sensor

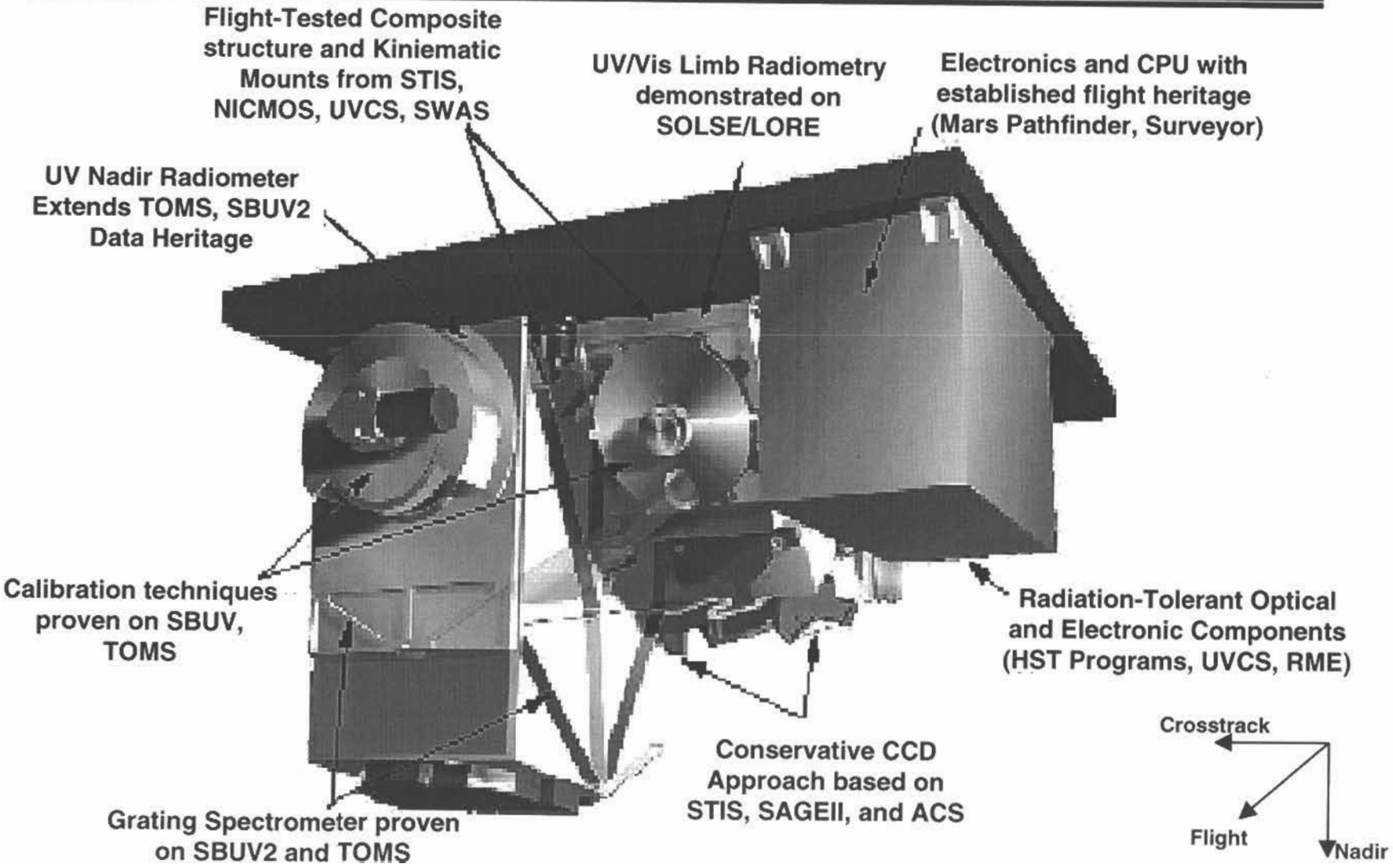


[redacted]

Hyperstrctral UV sensor using single 110 deg. Wide field telescope



# Sensor Concept



# OMPS
# Spacecraft Accommodations

[redacted]

- Mass
  - Allocation 45 Kg
  - Expected Suite mass 40.6 Kg (including 25% margin)
- Orbit average power
  - Allocation 45W
  - Expected 43.7 (w/25% margin)
- Volume and Data rates are within allocations
  - Peak data rate allocation 40kbits/sec-expected 38.2 kbps
  - Volume allocation and used 54x56x35cm

# OMPS
# Environmental Data Records
(Limb Profile Performance)

- **Horizontal cell size: 250 km**
- **Sensor swath width: 12 degrees 750 km**

**Vertical cell size: 3km**

**Horizontal coverage: SZAa less than or equal to 80 deg**

**Vertical coverage: Tropopause - 60 km**

**Measurement range: 0.1-15ppmv**

**Measurement accuracy**
  - **Tropopause-15km: greater of 20% and 0.1 ppmv**
  - **15-60 km: greater of 10% and 0.1 ppmv**

- **Measurement precision**
  - **Tropopause - 15 km: 10%**
  - **15-50 km: 3%**
  - **50-60 km:10%**
- **Long-term stability: 2% over 7-year single sensor lifetime**

OMPS performance meets or exceeds threshold requirements and image product quality

# OMPS
# Environmental Data Record
(Total Column)

- Horizontal cell size: 50 km at nadir
- Sensor swath width: 110 degrees 2700 km

Vertical cell size: 60 km

Horizontal coverage: SZAs less than or equal to 80 deg

Measurement range: 50-650 Dobson Units (DU)

Measurement accuracy
  - 450 DU < column: 15 DU
  - 250 DU < column <= 450 DU: 12 DU
  - Column <= 250 DU: 9 DU
- Measurement precision
  - 450 DU < column: 3 DU + 0.5%
  - 250 DU < column <= 450 DU: 2.75 DU + 0.5%
  - column <= 250 DU: 2.5 DU + 0.5%
- Long-term stability: 1% over 7-year single sensor lifetime

Total Column
performance
s or exceeds
threshold
ements and
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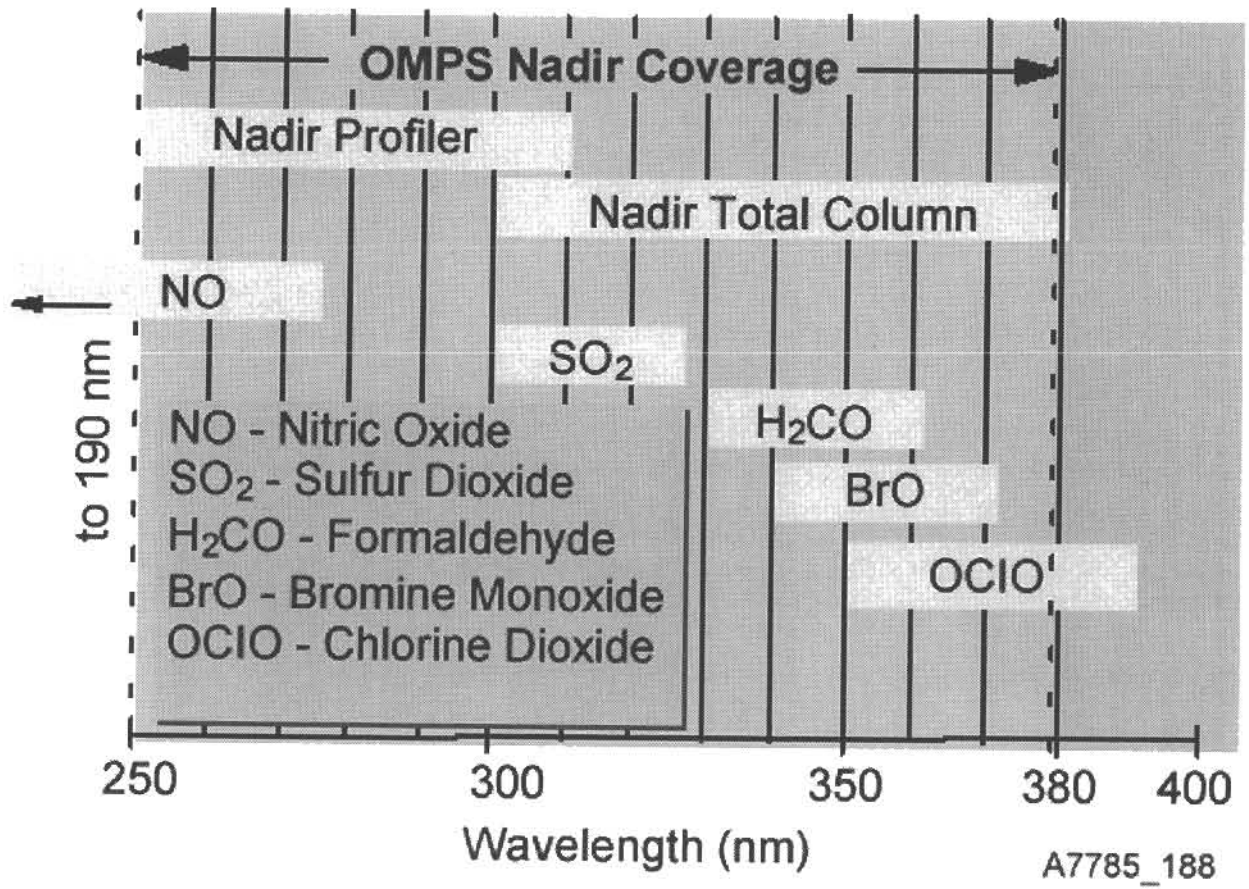
quality

# Non $O_3$ Data Products

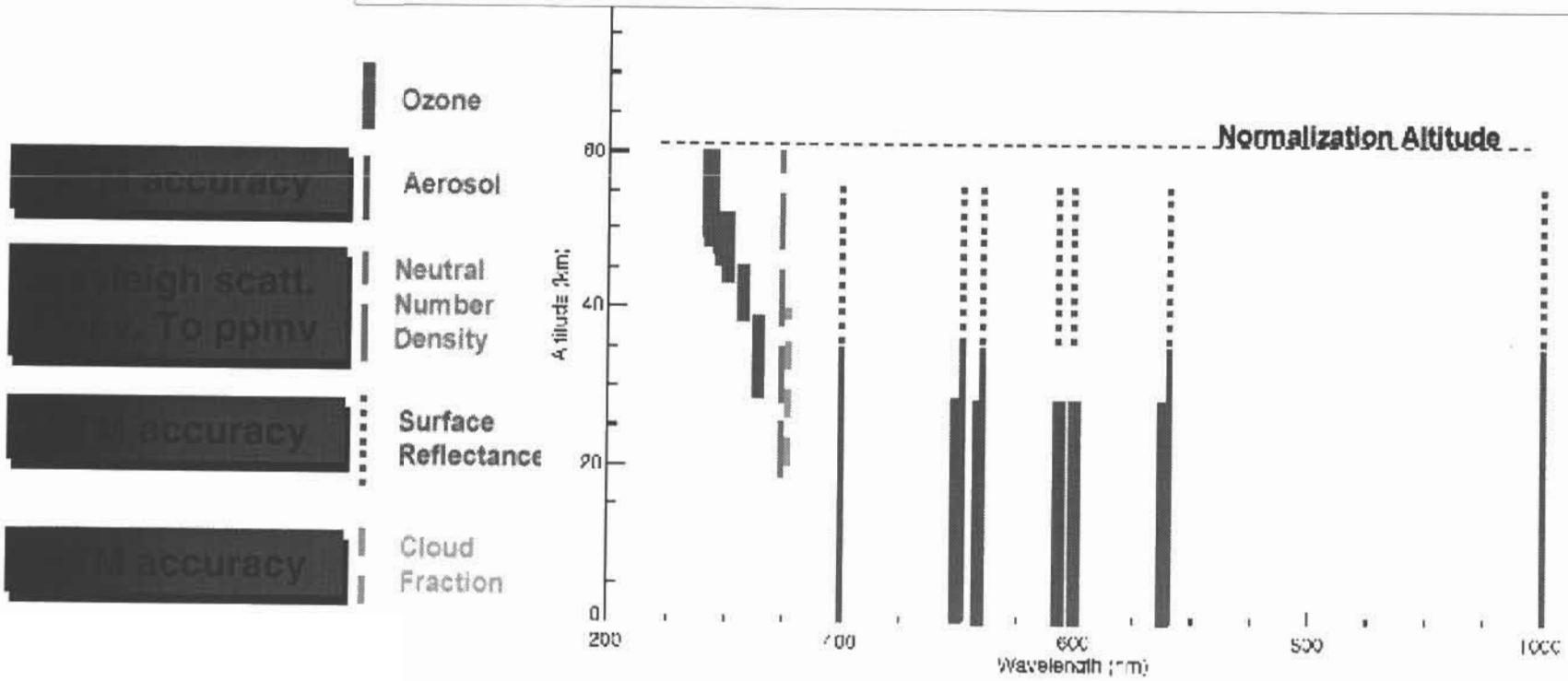
[redacted]

[redacted]



# Limb Profile Algorithm

- OMPS Utilizes the UV and visible spectrum to measure ozone
  - Combines ozone-sensitive and ozone-insensitive channels
  - Selects channels to provide vertical coverage from 0 to 60 km



# OMPS Master Schedule

| ID | Task Name | 1999 '99 | 2000 '00 | 2001 '01 | 2002 '02 | 2003 '03 | 2004 '04 | 2005 '05 | 2006 '06 | 2007 '07 | 2008 '08 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kickoff | 5/14 | | | | | | | | | |
| 2 | System/Subsys Spec Rev | | 10/12 | | | | | | | | |
| 3 | Risk Reduction Rev #1 | | 2/14 | | | | | | | | |
| 4 | RRR #2 | | | 10/18 | | | | | | | |
| 5 | RRR #3 | | | 7/4 | | | | | | | |
| 6 | RRR #4 | | | | 3/6 | | | | | | |
| 7 | RRR #5 | | | | | 1/30 | | | | | |
| 8 | Critical Design Review | | | | | 5/29 | | | | | |
| 9 | FCA/PCA F-1 | | | | | | | 6/22 | | | |
| 10 | Delivery F-1 | | | | | | | 7/1 | | | |
| 11 | Delivery F-2 | | | | | | | | | 4/17 | |
| 12 | Delivery F-3 | | | | | | | | | | |

**OMPS schedule can be adjusted to support GCOM A-1 delivery in 2004**

# OMPS Master Schedule

| ID | Task Name | 1999 '99 | 2000 '00 | 2001 '01 | 2002 '02 | 2003 '03 | 2004 '04 | 2005 '05 | 2006 '06 | 2007 '07 | 2008 '08 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Kickoff | 5/14 | | | | | | | | | |
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**OMPS schedule can be adjusted to support GCOM A-1 delivery in 2004**

03/08/00 14:30 FAX 703 697 0678 SAF/PAS 001

# Ozone Mapping and Profiler Suite (OMPS)

National Polar-orbiting Operational Environmental Satellite System (NPOESS)
Integrated Program Office

CLEARED
FOR OPEN PUBLICATION

FEB 24 2000 3

DIRECTORATE FOR FREEDOM OF INFORMATION
AND SECURITY REVIEW
DEPARTMENT OF DEFENSE

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SAF/PAS document

00--0068

Call 697-3222/697-8932
for pickup or return to 5D227

00-S-1047

# Ozone Mapping and Profiler Suite (OMPS)

National Polar-orbiting Operational
Environmental Satellite System (NPOESS)
Integrated Program Office

This is a
SAF/PAS document

00--0068

Call 697-3222/697-8932
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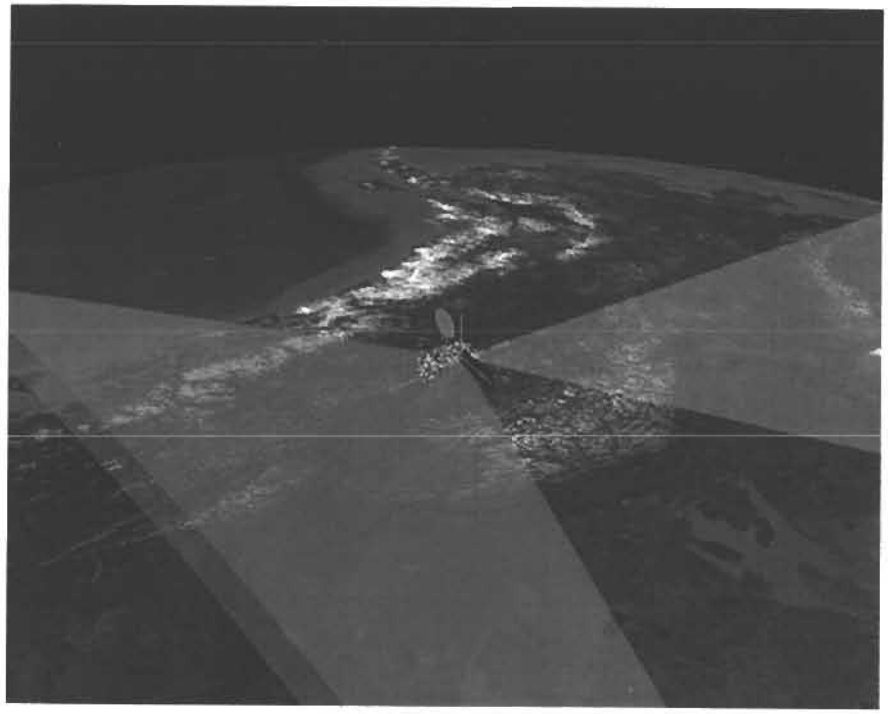
# Ozone and Mapping Profiler Suite (OMPS)



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Heritage

Total Ozone Mapping Spectrometer (TOMS)
Solar Backscatter UltraViolet (SBUV)
Global Ozone Monitoring Experiment (GOME)

Sensor Contractor

Ball Aerospace & Technologies

# OMPS Description

Hardware design supports parallel development and separate S/C mounting

- **The OMPS flight hardware is:**
  - Nadir sensor
  - Limb sensor
  - Interface and Control electronics (ICE) box
- **The nadir sensor has two spectrometers fed by one telescope**
- **The limb sensor has 3 FOVs - each centered along-track**
  - Each FOV has 3 images on the focal plane for high dynamic range
- **The OMPS algorithms created four data products**
  - High-performance total column mapper
  - Heritage TOMS V7 total column data records
  - High-performance ozone profile
  - Heritage SBUV/2 nadir profile data records

Design led to production of heritage data products at low marginal cost

# Sensor Concept

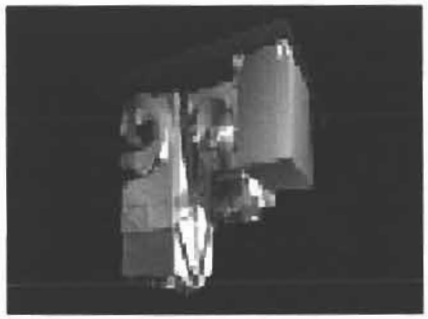
## Key Sensor Attributes

FUNCTIONAL
- Modular 2-sensor design provides data continuity, growth, and flexibility
- Fully redundant for high reliability
- Working and reference diffuser for proven calibration method

PHYSICAL
- Mass and Power: 45 KG and 45 Watts with 25% margin
- Modular design provides maximum flexibility for spacecraft accommodation

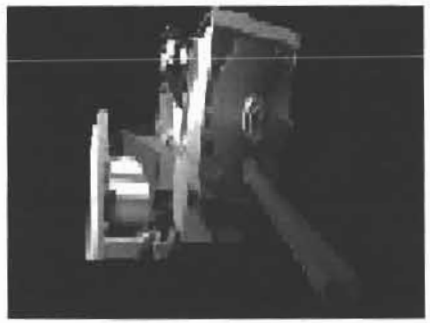
TECHICAL IMPLEMENTATION
- Common focal planes across all sensors reduces cost
- No scan mechanisms reduces cost and complexity and increases reliability
- Rad 6000 flight computer provides growth margin

**OMPS**



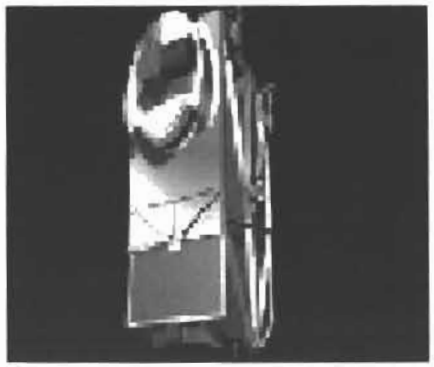
**Limb Sensor**

Hyperstrctral UV, visible, and near IR sensor

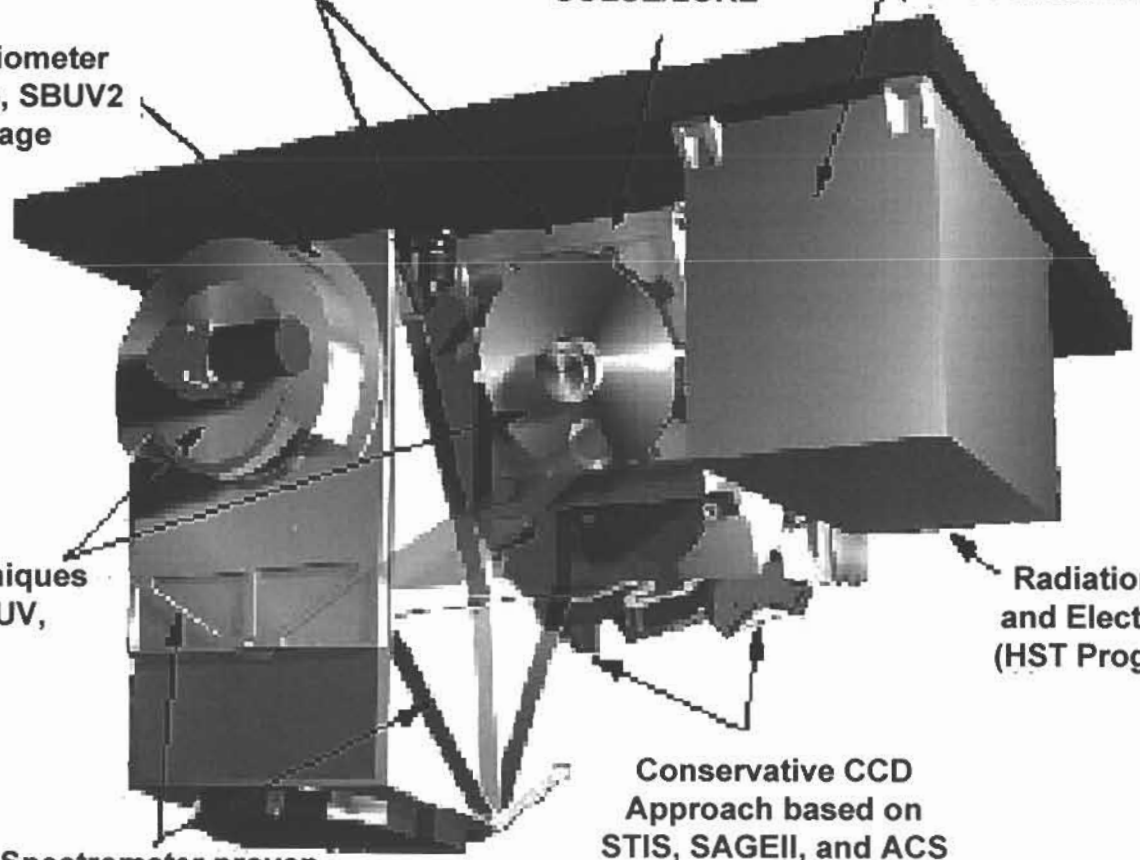


**Nadir Sensor**

Hyperstrctral UV sensor using single 110 deg. Wide field telescope



# Sensor Concept



# OMPS
# Spacecraft Accommodations

**OMPS has significant mass and power margins**

- Mass
  - Allocation 45 Kg
  - Expected Suite mass 40.6 Kg (including 25% margin)
- Orbit average power
  - Allocation 45W
  - Expected 43.7 (w/25% margin)
- Volume and Data rates are within allocations
  - Peak data rate allocation 40kbits/sec-expected 38.2 kbps
  - Volume allocation and used 54x56x35cm

# OMPS
# Environmental Data Records
## (Limb Profile Performance)

**OMPS performance meets or exceeds threshold requirements and heritage product quality**

- **Horizontal cell size: 250 km**
- **Sensor swath width:**

  **Vertical cell size: 3km**

  **Horizontal coverage: SZAa less than or equal to 80 deg**

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  **Measurement range: 0.1-15ppmv**

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# OMPS
# Environmental Data Record
(Total Column)

Total Column performance meets or exceeds threshold requirements and heritage product quality

- **Horizontal cell size: 50 km at nadir**
- **Sensor swath width:**

  **Vertical cell size: 60 km**

  **Horizontal coverage: SZAs less than or equal to 80 deg**

  **Measurement range: 50-650 Dobson Units (DU)**

  **Measurement accuracy**
  - **450 DU < column: 15 DU**
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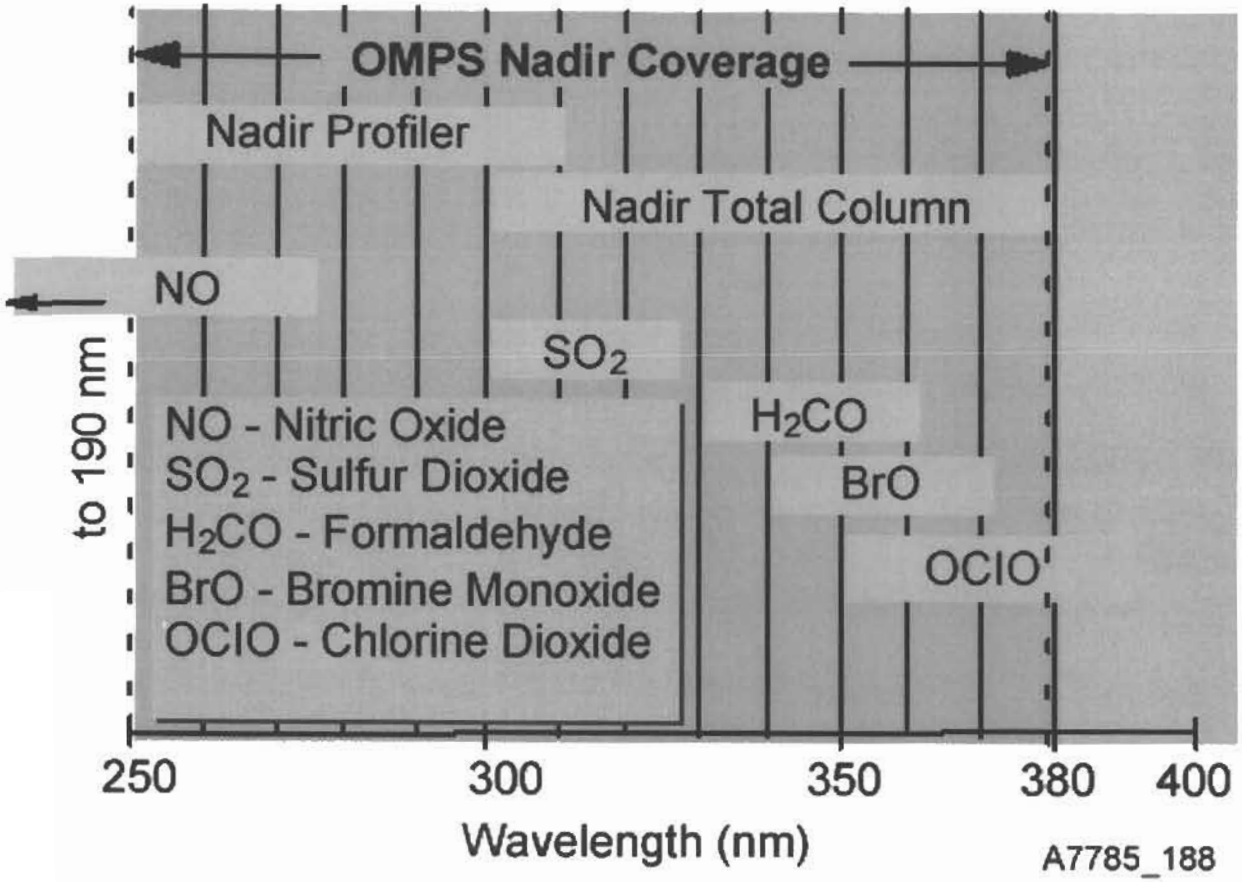
  - **450 DU < column: 3 DU + 0.5%**
  - **250 DU < column <= 450 DU: 2.75 DU + 0.5%**
  - **column <= 250 DU: 2.5 DU + 0.5%**
- **Long-term stability: 1% over 7-year single sensor lifetime**

# Non $O_3$ Data Products

**Sulfur dioxide index is a by product of total column algorithm**

**Hyperspectral data permits trace gas retrievals as with GOME**



# Limb Profile Algorithm

**Channel selection strategy**

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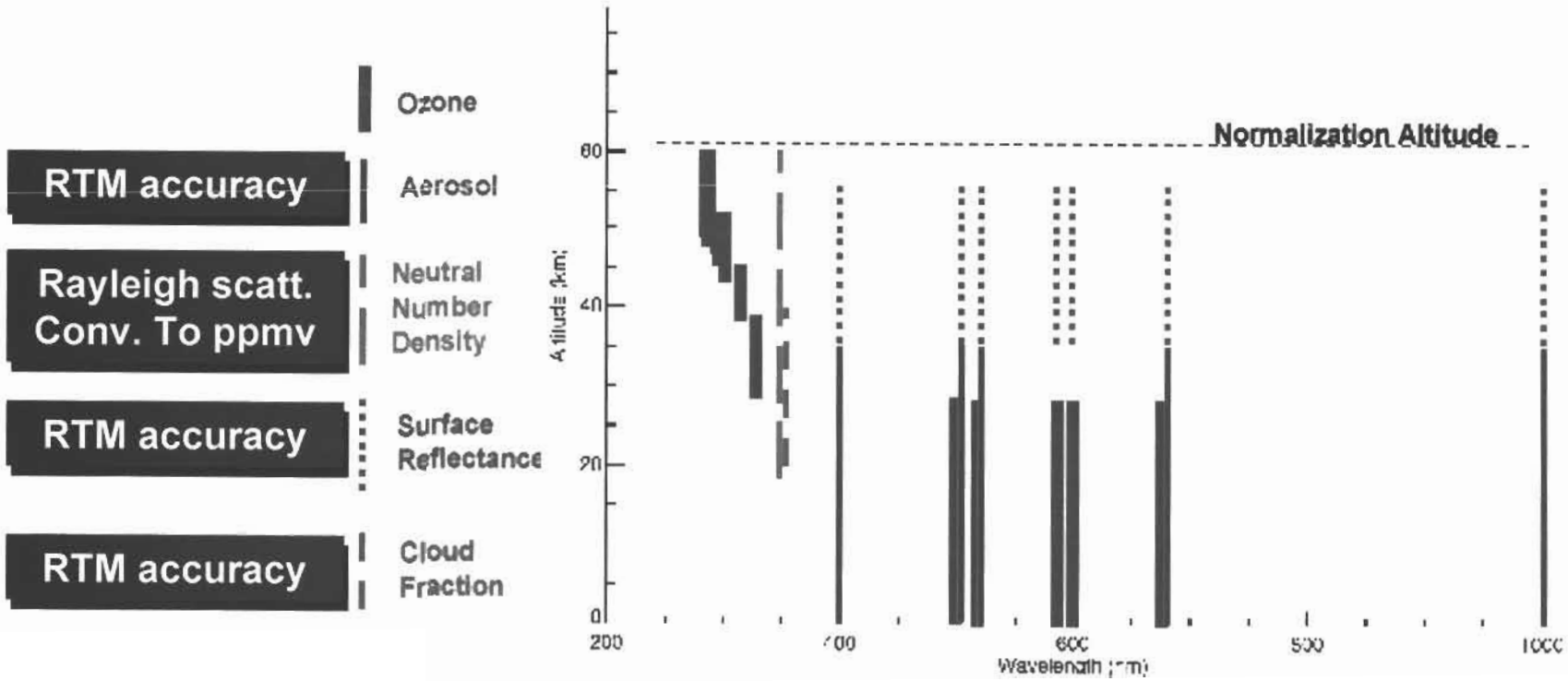
  - **Combines ozone-sensitive and ozone-insensitive channels**
  - **Selects channels to provide vertical coverage from 0 to 60 km**



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**OMPS schedule can be adjusted to support GCOM A-1 delivery in 2004**

# NOAA/NESDIS

## Office of Research and Applications
## Fax Transmittal Sheet

DATE: April 20th 2000
TO: F. Sanner or E. Kang
PHONE: 301-427-2084
FAX:

FROM: L. Flynn
PHONE: 301-763-8136
FAX: (301) 763-8~~108~~034

MESSAGE:
AGU
OMPS Presentation

**American Geophysical Union**
2000 Florida Avenue, NW
Washington, DC 20009
Tel: +1-202-462-6900
Fax: +1-202-328-0566

April 13, 2000

Lawrence E Flynn
NOAA/NESDIS Office of Research and Applications
World Weather Building #810
5200 Auth Rd
Camp Springs, MD 20746-4304
United States

Dear Lawrence E Flynn:

This letter will serve as an invitation for you to participate in the 2000 Spring Meeting, May 30 - June 3, 2000, at the Washington Convention Center, 900 9th Street, NW in Washington, DC.

The Program Committee has accepted the abstract listed below for presentation at the 2000 Spring Meeting. It is your responsibility as the corresponding author to notify all authors. This correspondence is the last you will receive regarding this abstract.

Title: OMPS (Ozone Mapping and Profiling Suite): Continuing the United States Operational Ozone-Monitoring Program

Paper Number: **A42C-04** Presentation Type: Poster

Day: Thursday Starting Time: 1445h

Location: Washington Convention Center Room Name/No.: Hall D

Your posters should be placed on the posterboards on the day of your presentation between 0730h and 0830h and remain on the board for the remainder of the day. You are requested to be present at your board for at least one hour during your scheduled presentation time. You may remove your posters between 1700h and 1800h. See enclosed guidelines for more information.

The meeting summary will be published in the April 25, 2000, issue of Eos. The abstracts for this meeting will be published in the May 9 supplemental issue of Eos. Both the summary and program are currently available on the AGU Web site: http://www.agu.org.

All meeting participants must pay a registration fee to attend the meeting. The preregistration deadline is April 28, 2000. AGU will accept late registrations for the meeting until May 10, 2000. After this date, registration must be done on site. See the enclosed "Important Information" for details.

We look forward to seeing you in Washington.

Sincerely,
Robert Lussier
Meetings Coordinator

Enclosures

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***** ABSTRACT RECEIPT *****

**This is to verify that AGU received payment from Lawrence E Flynn in the amount of $50 for the non-refundable abstract submittal fee for the above referenced abstract, reference number 1585. Payment was made by Master Card. Thank you.**

**Ellyn Terry**
**Meetings Manager**
**(202) 777-7330**

The American Geophysical Union encompasses the Earth and space sciences:
Geodesy, Seismology, Atmospheric Sciences, Geomagnetism and Paleomagnetism
Ocean Sciences, Hydrology, Volcanology, Geochemistry and Petrology
Tectonophysics, Planetary Sciences, Space Physics and Aeronomy

# GUIDELINES FOR POSTER PRESENTATIONS

**POSTERBOARD SIZE: 4 ft. High X 6 ft. Wide, less 1" frame**

1. **GENERAL INFORMATION**

- With submission of your abstract to the 2000 Spring Meeting, you agreed to present your paper on the day, time, and in the mode of presentation assigned by the Program Committee. You have been assigned to a POSTER session at the time listed on your acceptance letter; this cannot be changed.

- Schedule times given in the abstract volume are subject to change without prior notice. Check the At-Meeting Program and the Addendum for any program changes.

2. **POSTER PREPARATION**

- Place the title of your paper prominently at the top of the poster board to allow viewers to identify your paper easily. Indicate 1) the presentation number of the abstract, 2) title, and 3) author(s) names. Highlight the authors' names and address information, in case the viewer is interested in contacting them for more information.

- Prepare all diagrams or charts neatly and legibly beforehand, in a size **sufficient to be read at a distance of 5 feet. Type should be at least 1 inch (2.5 cm) high.** Use creativity by using different font sizes and styles, perhaps even color. Double-space all text. Use different colors or textures for each line or bar contained in your graph or chart.

- Organize the paper on the posterboard so that it is clear, orderly, and self explanatory. You have complete freedom in displaying your information in figures, tables, text, photographs, etc. The presentation must cover the same material as the abstract. Label different elements as 1, 2, 3, or A, B, C. This will make it easier for a viewer to easily follow your display.

- Include the background of your research, followed by results and conclusions. A successful poster presentation depends on how well you convey information to an interested audience.

3. **YOUR PRESENTATION**

- Poster sessions will be held in Exhibit Hall D of the Washington Convention Center.

- To locate your assigned posterboard, look for the board with your paper number on it. A diagram will be posted at the AGU Facilities Desk, and staff will be available to direct you to your posterboard.

- All posters should be placed on the posterboards **between 0730h-0830h** on the day of your presentation. **Posters must remain up the entire day.** Posters must be removed between 1700h-1800h. Posters remaining after 1800h will be removed by AGU and placed on the floor directly beneath the board. ***AGU will not be responsible for posters and materials left on poster boards after the stated hours.***

- Place your poster on the side of the posterboard that is marked with your paper number. Dimensions of the useable work area are: **4 feet high by 6 feet , *less the 1-inch frame***. The background color of the board is cork.

OVER

- You are **required** to be present at your board for at least one hour during your scheduled presentation time. Presenters of **A.M. sessions** should be present between **0900h-1100h**; presenters of **P.M. sessions** should be present between **1400h-1600h**. Leave a message on your board detailing the hours you plan to be at your presentation. After the session, leave a note on your posterboard as to where you can be reached, in case someone wishes to discuss your research further.

3. **AUDIO VISUAL EQUIPMENT AND INTERNET ACCESS**

- Audio-visual (AV) equipment is available to enhance your poster presentation. You may request either a VHS video cassette player or a personal computer (IBM-compatible or Macintosh). AGU will provide this equipment to you for a fee of $60 when your order is received by may 5, 2000. **Equipment may be used only during your active session time (A.M. or P.M.) and not for the entire day.**

- To place your order, complete the enclosed AV order form, and send to AGU with payment by May 5, 2000. **Even if you already indicated your desire for such equipment on your abstract, you must complete the order form and send payment for this equipment.**

- If you plan to bring your own computer, you still must complete the AV order form to request an electrical outlet. There is no charge for this if ordered by May 5, 2000. Orders placed on-site, however, are subject to availability and may incur a fee.

- A limited number of **internet connections** will be available. Indicate your request for internet access on the enclosed AV order form. There is no charge for an internet connection, with the rental of a PC. The fee for internet access is $60 if you bring your own computer. Orders must be placed by May 5, 2000. **On-site orders for internet may not available.**

5. **FACILITIES DESK**

- The AGU Facilities Desk will be located in Exhibit Hall D in the Washington Convention Center. AGU staff will be available to assist you.

- Thumbtacks, pushpins, tape, and scissors will be available. Additional supplies may be available, however, if you have special needs for your poster presentation, we suggest you bring those supplies with you to the meeting.

- Questions about AV equipment should be directed to the AGU Facilities Desk.

FORM CD-15 LF
(REV. 10-93)
DAO 214-2

U.S. DEPARTMENT OF COMMERCE

# TRANSMIT/ROUTE SLIP

DATE 9 May 00

| NAME | BUILDING, ROOM OR REFERENCE NO. | TAKE ACTION BELOW | INITIALS AND DATE |
|---|---|---|---|
| Bob Weagant (for Fred) | | 1 | via e-mail |
| Barb Polston | | 1 | CW 5/9/00 |
| | | | |
| Col Hinnant | | 1 | FH 5/9/00 |
| | | | |
| | | | |
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## ACTION ITEMS

1. APPROVAL/SIGNATURE
2. CLEARANCE/INITIALS
3. RECOMMENDATION OR COMMENT
4. RETURN WITH MORE DETAILS
5. INVESTIGATE AND REPORT
6. NOTE AND SEE ME
7. NOTE AND RETURN
8. NOTE AND FILE
9. YOUR INFORMATION
10. PER OUR CONVERSATION
11. AS REQUESTED
12. NECESSARY ACTION
13. CIRCULATE AMONG STAFF
14. ANSWER DIRECTLY
15. PREPARE REPLY FOR SIGNATURE OF: _____

COMMENTS

Col Hinnant – just a few addt'l parameters added to this final abstract. Need your approval to release into public domain. No technical data that is sensitive here. ☐ Continued on reverse

| FROM (Name) | BUILDING, ROOM OR REFERENCE NO. | CODE AND EXTENSION |
|---|---|---|
| Elisa | | |

# The Preliminary Design of the Ozone Mapping and Profiler Suite (OMPS)

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## Introduction

The Ozone Mapping and Profiler Suite (OMPS) is a new US program to monitor ozone from space. It was the first sensor suite selected to fly on the National Polar-orbiting Operational Environmental Satellite System (NPOESS) spacecraft - the successor to both the National Oceanic and Atmospheric Administration (NOAA) Polar-Orbiting Operational Environmental Satellite (POES) and Department of Defense (DOD) Defense Meteorological Satellite Program (DMSP) systems. OMPS will provide more than 20 years of total column and vertical profile ozone data. These operational data products will continue the global, daily data products similar to, but of higher fidelity than, those from the Solar Backscatter Ultraviolet radiometer (SBUV/2) and the Total Ozone Mapping Spectrometer (TOMS), and provide new, high vertical resolution limb profile data.

This entirely new program provided the Integrated Program Office (IPO, the US tri-agency - NOAA, Air Force, and National Aeronautics and Space Administration - procurement office) the opportunity to ensure optimum system performance. Their sensor system procurement process provides threshold and objective requirements for data products, allocates spacecraft accommodations and cost targets and then has a two-step competitive selection. This process encouraged industrial teams to balance hardware and algorithm performance, risk and cost issues with end users' objectives in mind – high quality, reliable, global ozone total column and profile data. NPOESS and OMPS description documents are available at the IPO electronic library at: http://npoesslib.ipo.noaa.gov/ElectLib.htm

## OMPS Design Constraints

The OMPS design process was primarily constrained by the ozone data content and quality factors and a few significant flight system requirements. These driving system requirements include: sensor life (0.86 reliability after 8 years of storage and 7 years on-orbit); spacecraft accommodations (mass $\leq$ 45 kg, orbit average power $\leq$ 45 watts, peak data rate $\leq$ 40 kbps, and volume $\leq 0.106\ m^3$), and ozone vertical resolution $\leq$ 5 km. This vertical resolution requirement drove the design to include a limb-viewing sensor in addition to a heritage-based nadir-viewing sensor. The resulting primary spectrometer performance parameters for these sensors are listed in Table 1.

## Nadir Sensor

The nadir sensor wide-field telescope feeds two separate spectrometers, one for total column observations and one for nadir profiling observations similar to SBUV/2. The total column spectrometer (300-380 nm) has a 2800 km cross-track swath divided into 35 IFOVs of nearly equal angular extent. The nadir cell is 49 km cross-track (the NPOESS C1 orbit altitude is 833 km with a 13:30 ascending node).

The nadir profile spectrometer (250-310 nm) has a 250 km cross-track swath corresponding to a single cell. Co-registration with the total column spectrometer provides the total ozone, surface and cloud cover information needed for nadir profile retrievals. The TOMS V7 algorithm has been adapted for total column retrievals. The SBUV V6 algorithm has been adopted for nadir profile retrievals.

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Table 1. OMPS spectrometer performance parameters

| Parameter | Nadir Total Column | Nadir Profile | Limb |
|---|---|---|---|
| **Wavelength Range** | 300 – 380 nm | 250 – 310 nm | 290 – 1000 nm |
| **Scene Radiance Range (photons/sec-cm$^2$-sr-nm)** | 9e13 (380 nm)<br>8e11 (308 nm) | 2e13 (310 nm)<br>1.5e8 (252 nm) | 9e13 (600 nm)<br>5e10 (300 nm) |
| **Minimum SNR (Expected)** | 1000 | 35 (252 nm)<br>400 (310 nm) | 320 (290 nm at 60 km)<br>1200 (600 nm at 15 km) |
| **Integration Time** | 7.6 seconds | 38 seconds | 38 seconds |
| **Spectral resolution** | 1 nm fwhm<br>2.4 samples / fwhm | 1 nm fwhm<br>2.4 samples / fwhm | 1.5-40 nm fwhm<br>1 sample / fwhm |
| **FOV** | 110 x 0.3 deg | 16.7 x 0.3 deg | 8.5 x 2.7 deg |
| **Cell Size** | 49 x 50 km at nadir | 250 x 250 km | 1 km vertical |
| **Swath** | 2800 km | 250 km | 3 vertical slits along track and $\pm$ 250 km |

## Limb Sensor

The limb sensor uses a single prism to disperse three vertical slits directed along-track, each separated by 250 km at the limb tangent point. These slits are 150 km high in object space and are sampled at 1 km intervals. To accommodate the very high scene dynamic range, these slit images pass through a beam splitter to divide the scene brightness into three brightness ranges. As a result there are nine limb images of the dispersed slits on the CCD. The measured limb radiances in the ultraviolet, visible, and near-infrared provide data on ozone, aerosols, Rayleigh scattering, surface and clouds that are used to retrieve ozone profiles from the tropopause to 60 km. The algorithm is based on that developed for the Shuttle Ozone Limb Sounding Experiment (SOLSE) and Limb Ozone Retrieval Experiment (LORE) mission.

## Calibration

Solar illuminated diffusers are used for radiometric and spectral calibrations. Due to the long orbit life requirement and the high radiometric accuracy requirements, there are two diffusers for each sensor. The working diffuser is used weekly and the reference diffuser is used twice annually to monitor the on-orbit degradation of the working diffuser. The three focal plane assemblies, including the CCDs and thermo-electric coolers, are identical, thus reducing development and production costs.

## Data Products

The science community will receive operational ozone data products daily. These will be unprocessed (raw data records, e.g., level 0), geolocated and calibrated (sensor data records, e.g., level 1), and geolocated ozone total column and profile ozone data (environmental data records or EDRs, e.g., level 2) data. There are five level 2 global ozone products: three total column products (OMPS EDR, TOMS V7 and an infrared-derived product from the NPOESS Cross-track Infrared Sounder), the high vertical resolution (3 km resolution with 1 km sampling) limb profile EDR, and the SBUV V6 nadir profile data product. The algorithms are described in another Symposium talk.

## Future Work

The OMPS preliminary design review was held January 1999 and the completion of the detailed design will be marked by the critical design review (CDR) scheduled for June 2003. The most significant managed risks for our detailed design efforts are: transient radiation effects on the focal planes, long term radiation effects on the CCD related to dark current and charge transfer efficiency, spectrometer internal stray light and limb ozone profile algorithm corrections for aerosols, surface scattering and cloud effects.

The NPOESS C1 satellite will be launched no sooner than July 2008, although earlier flights of opportunity for OMPS are being considered.

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