PHY 499S
EARTH OBSERVATIONS FROM SPACE
Spring Term 2005
Essay and Presentation

THE ESSAY:

Due: Tuesday, March 29, 2005 (in class)
Marks: 15% of course total
Late penalty: 1 mark per day, up to 1 week, after which the essay will not be accepted.

Some selected topics are listed below, and have been chosen to represent various types of satellite instrumentation important to Earth observations. These essay topics will be assigned on a "first-come, first-served" basis. You may also suggest a topic that interests you - please discuss this with me.

The essay should be 15-20 pages of 8.5×11 inch paper at 25-30 lines/pages with 1-inch margins. Double-spaced 12-point type-written is preferred, although hand-written is acceptable if it is legible. Marks will primarily be given for content, but some marks will be given for style and presentation.

Sources should include textbooks and original published papers. The world-wide web may provide a useful starting point, as many satellites and satellite instruments have web pages. However, simply copying the material off a web site (or from anywhere else) will not constitute a valid essay. References to all sources (including web sites) must be noted in the essay where relevant, and included in a list at the end of the essay. Figures should be included to illustrate concepts or measurements.

Each essay should include (but not necessarily be limited to):

(1) some historical context for the instrument, *e.g.*, who built it? when? what was its "instrument heritage"? was it the first/second/third/... of its kind? on which satellite or space vehicle did it fly? was it part of a larger satellite project addressing a particular issue? relevant orbital parameters, *etc.*
(2) a discussion of the scientific and measurement objectives of the instrument,
(3) a description of the instrument and the technique(s) it used for remote sounding measurements, why was it chosen to meet the measurement objectives? was the technology innovative or well-proven?
(4) a discussion of the actual measurements that were made and any difficulties or advantages that arose,
(5) an assessment of these measurements and whether or why the mission was important,
(6) a brief summary of any follow-up missions conducted or planned, and why they were or are needed.

THE PRESENTATION:

Date: During the week of March 28 - April 1, 2005. Exact time to be arranged.
Marks: 15% of course total

The ability to make a good verbal presentation can be just as important as the ability to write a good report. This part of the project is intended to provide you with some experience of the former, both by giving a presentation yourself and by observing the presentations of others.

The presentations will be made in a "mini-conference" at a mutually convenient time during the week after the essays are due. Each will be allowed 20 minutes, with 5 minutes for questions and follow-up. Marks will be given for content, clarity, general presentation, and responses to questions.

These talks should highlight each of the topics addressed in your essay. The use of overhead transparencies is highly recommended - I will make these available to you, if requested. A useful guideline is no more than one overhead per minute.

POSSIBLE TOPICS:

(1) PMR – Pressure Modulator Radiometer (Nimbus 6, 1975)
- measured atmospheric temperature
- used infrared gas correlation spectroscopy

(2) SSBUV – Shuttle Solar Backscatter Ultraviolet Instrument (8 Space Shuttle flights, 1989-1996)
- measured ozone columns and solar ultraviolet (UV) irradiance
- used UV-visible nadir sounding of backscattered radiation

(3) ATMOS (Space Shuttle, 1985)
- measured atmospheric composition
- used infrared limb sounding with a Fourier transform interferometer

(4) LITE – Lidar In-space Technology Experiment (Space Shuttle, 1994)
- observes clouds, aerosols, temperature, and composition
- three wavelength lidar

(5) SAGE II – Stratospheric Aerosol and Gas Experiment II (Earth Radiation Budget Satellite (ERBS), 1984)
- measured aerosols, ozone, and nitrogen dioxide
- used visible and near-infrared solar occultation

(6) GOME (ERS-2, 1995)
- measures atmospheric composition
- nadir viewing UV-visible spectroscopy

(7) AVHRR – Advanced Very High Resolution Radiometer (3 versions on meteorological satellites)
- measures upwelling radiation from the Earth, providing surface and cloud images
- visible and infrared scanning radiometer

(8) Precipitation Radar on TRMM – Tropical Rainfall Measuring Mission (1997)
- measures rainfall and observes storm systems
- first spaceborne radar designed to provide three-dimensional maps of storm structure

(9) RADARSAT (1995)
- images the surface, including ice, through clouds and darkness
- uses synthetic aperture radar (microwave)

(10) ATSR – Along Track Scanning Radiometer (ERS-1, 1991)
- measures sea surface temperature
- uses four channels in the thermal infrared, nadir and forward scanning

(11) GPS – Global Positioning System (currently a series of 24 satellites)
- measures the Earth's shape, gravity field, and plate motions
- transmits radio signals to globally distributed tracking stations

(12) Any one of the instruments on the Upper Atmosphere Research Satellite (1991)
- CLAES – Cryogen Limb Array Etalon Spectrometer
- HALOE – Halogen Occultation Experiment
- ISAMS – Improved Stratospheric and Mesospheric Sounder
- MLS – Microwave Limb Sounder
- HRDI – High Resolution Doppler Imager
- WINDII – Wind Imaging Interferometer
- ACRIM II – Active Cavity Radiometer Irradiance Monitor
- SOLSTICE – Solar/Stellar Irradiance Comparison Experiment
- SUSIM – Solar Ultraviolet Spectral Irradiance Monitor