RAL

DESIGN & DISCOVERY

Open Days July 1990

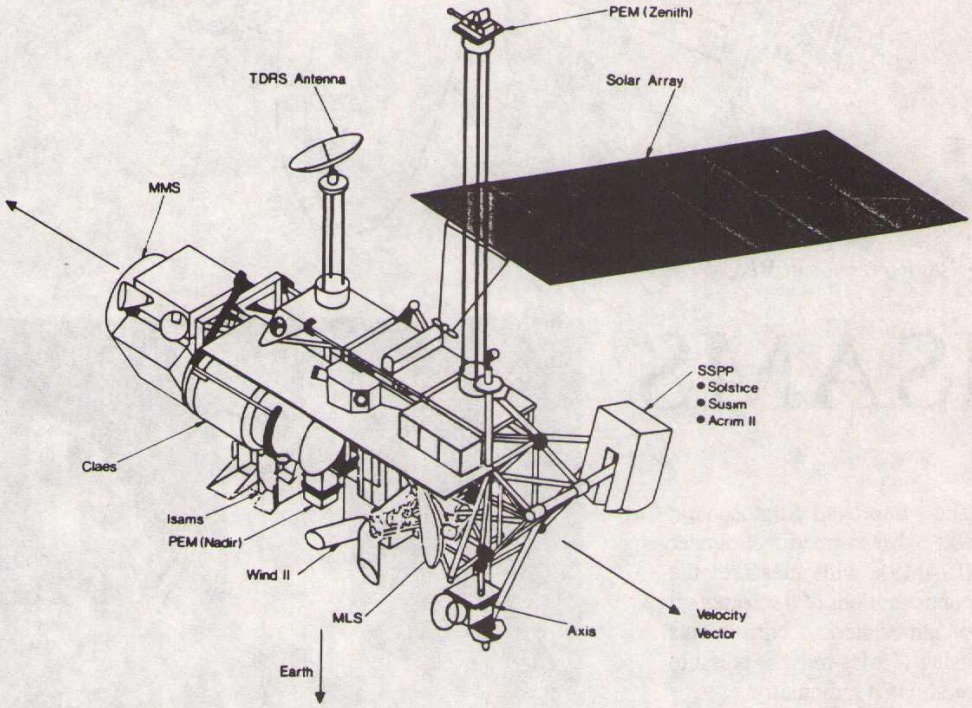
RUTHERFORD APPLETON LABORATORY

SCIENCE AND ENGINEERING RESEARCH COUNCIL

UARS (Upper Atmosphere Research Satellite)

The structure of the Earth's atmosphere is governed by the complex interplay between chemistry, physical dynamics and radiative processes in the stratosphere and upper troposphere.

The atmosphere is sensitive to external influences associated with natural phenomena and to changes arising from by - products of human activity. An example of this is the observed deletion of the ozone layer which is now known to be occuring faster than models predict and which has been dramatically highlighted by the unexpected and worsening deep depletions of ozone in antarctic spring seasons - the ozone "hole".



An artist's impression of UARS

Another area of growing concern is the increase in the "greenhouse effect" which is liable to give rise to climate changes due to the blanketing effect of increased carbon dioxide and other gases. Such changes, occuring both in the troposphere and stratosphere, may have far - reaching global consequences.

It is necessary to:

(a) understand the mechanisms that control upper atmosphere structure and variability,

(b) understand the response of the upper atmosphere to natural and anthropogenic perturbations,

(c) define the role of the upper atmosphere in climate and climate variability.

These are the goals of UARS, NASA's Upper Atmosphere Research Satellite.

Data from the ten UARS payload instruments will address the problems of global photochemistry, energy transfer and dynamics in the atmosphere above an altitude of ten kilometers.

Rutherford Appleton Laboratory (RAL) and collaborating university groups are involved with two of the instruments on UARS, they are:

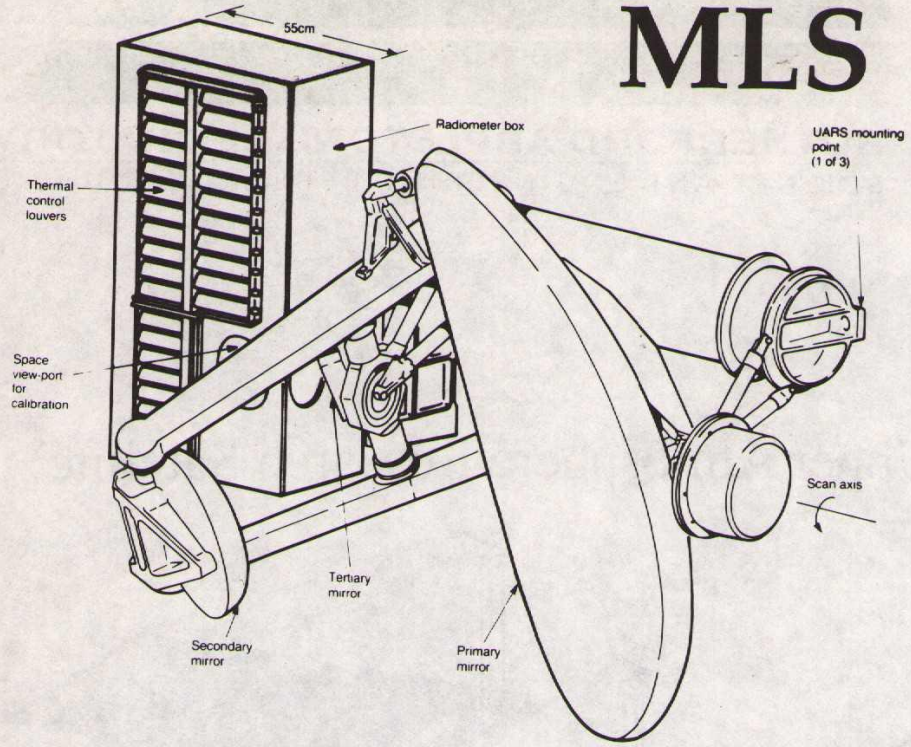
(1) ISAMS - The Improved Stratospheric and Mesospheric Sounder (collaboration with Oxford University), and

(2) MLS - The Microwave Limb Sounder (collaboration with Heriot - Watt University).

Instrument Parameters

Size	9m long, 4.3m diameter
Mass	6800kg
Launch date	1991
Orbit	600km circular, 57 deg inclination
Lifetime	18 months

MLS



Artist's impression of MLS

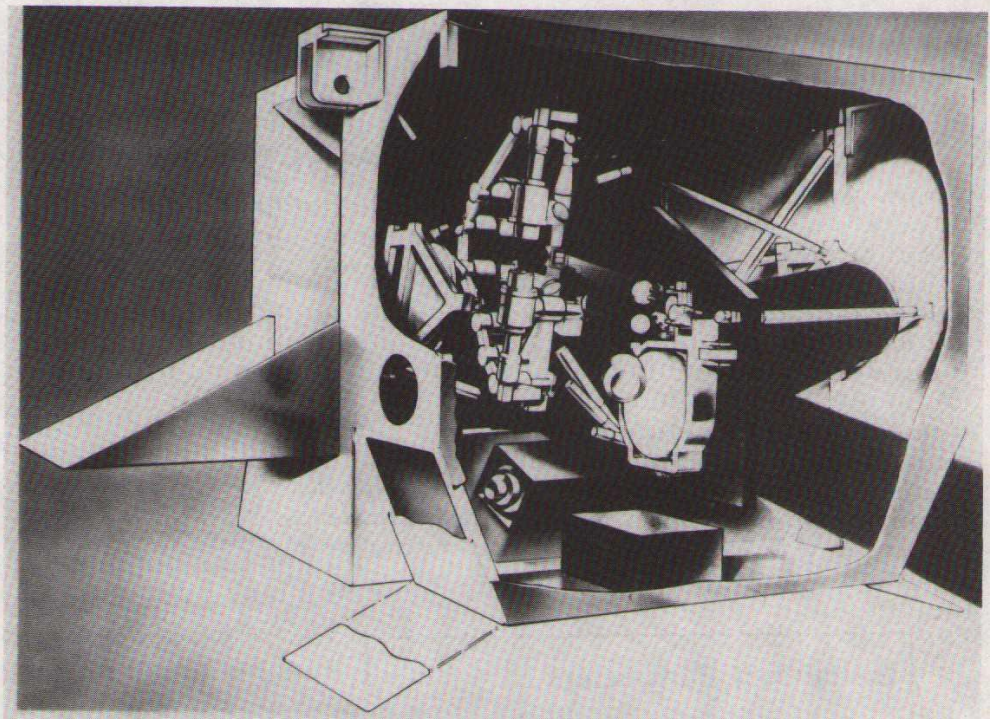
The Microwave Limb Sounder (MLS) will measure ozone, chlorine monoxide and water vapour in the stratosphere and mesosphere by detecting thermal emission from the atmospheric limb. These will be the first space measurements of chlorine monoxide, a molecule of central importance to stratospheric ozone depletion. The MLS project is an international collaboration between NASA's Jet Propulsion Laboratory (JPL) and UK groups at Heriot-Watt University, Rutherford Appleton Laboratory and Edinburgh University.

The UK contribution is a 183 GHz radiometer to measure ozone and water vapour distributions on a daily basis from the tropopause (roughly 10 km) to the mesopause (roughly 80 km).

ISAMS

The Improved Stratospheric and Mesospheric Sounder (ISAMS) will measure the concentrations of a selected set of atmospheric constituents using infra-red pressure modulated radiometry.

This is a sensitive, high spectral resolution technique for measuring radiation from atmospheric species of interest. A sample of the gas under investigation acts as a species specific filter. The gas pressure is modulated mechanically, and hence the spectral response of the system is modulated and the radiometer is sensitive only to the spectral emissions of the target species. A reservoir of gas is maintained on a molecular sieve, whose temperature controls the mean gas pressure in the pressure modulator, thereby optimising the sensitivity of the instrument to the pressure and altitude of the stratospheric gas.



Artist's impression of Improved Stratospheric and Mesospheric Sounder

The goals of ISAMS are:

(a) The determination of the thermal structure of the atmosphere and its fluctuations in space and time.

(b) The study of the photochemistry of nitrogen -containing species in the stratosphere.

(c) The study of the water vapour budget of the upper atmosphere.

These goals are central to achieving a proper understanding of the stability of the stratospheric ozone layer.

For further information

Please contact:

Professor J E Harries
Rutherford Appleton Laboratory
Chilton, Didcot,
Oxon, OX11 0QX