The Canadian Shuttle missions . . .

Astronaut Marc Garneau will be the first Canadian in space when he flies aboard Space Shuttle Challenger as a payload specialist for an eight-day mission scheduled for launch October 1, 1984.

During this mission, the first of three a Canadian will travel aboard within the next four years, Garneau will conduct experiments in three main categories: space technology, space science, and life sciences.

The space technology experiments involve two areas: important development tests for the NRC Space Vision System experiment to be flown on a later mission; and tests to determine the effect of exposure to space on different advanced composite materials., The space science studies deal with the physical characteristics of the space environment and of the earth's upper atmosphere. The life sciences component includes several experiments on human adaptation to space flight as preparation for the more detailed investigations on a future flight.

Space Technology

NRC Space Vision System Development Tests

During the space vision development test, Garneau will assist in the operation of the orbiter's closed-circuit television cameras (see illustration) and make video recordings of stationary and moving test targets under a range of lighting conditions and distances.

Special test targets will be attached to the Earth Radiation Budget Satellite (ERBS) which will be released into orbit by using Canadarm. ERBS will be tracked by the orbiter's closed-circuit television cameras and the video data will be analyzed during the mission by NRC's prototype real-time machine vision system located in Houston. The position, orientation and rate of movement of ERBS relative to the orbiter cameras will be calculated 30 times a second to permit an assessment of how smoothly it was released from the orbiter.

An important aspect of the tests will be to assess the effects of the sharp contrast in lighting which occurs in space on the closed-circuit television camera images.

The purpose of the tests is to aid development of the NRC Space Vision System to be used in space for rendez-vous, inspection and assembly tasks and to be flown in orbit for the first time in 1986.

Advanced Composite Materials Exposure

Spacecraft structures and mechanisms have begun to make use of strong light-weight composite materials of graphite fibre and epoxy compounds. There is some evidence that these materials deteriorate in the space environment through exposure to atomic oxygen at orbital velocitites (eight kilometers a second). In this experiment, a number of samples of different materials will be attached to Canadarm before launch to see what deterioration, if any, occurs during a short-duration flight. For purposes of this experiment, Canadarm will be extended so that the samples face the direction of flight for 36 hours. Although Garneau will observe and photgraph the composite material samples several times during the mission, the analysis will be conducted after the flight when the samples have been returned to Canada.

These flight tests will provide data which complements that to be obtained from similar materials installed by Canadian researchers on the Long Duration Exposure Facility Satellite launched by the shuttle earlier this year for a stay in space of several months.

The question to be answered is whether deterioration occurs rapidly during the first few days in space or slowly during many months. These tests will give some of the answers and will provide spacecraft designers with valuable data on the materials considered for space use.

Space Science

Measurements Using a Sunphotometer

The Canadian-made Sunphotometer is a hand-held instrument which is pointed at the sun to obtain readings of solar radiation at several wavelengths in the visible and near-infrared region of the spectrum. This instrrument is used by the Atmospheric Environment Service of Canada to measure local atmospheric constituents and to monitor acidic haze.

"the first test involves pointing the instrument directly at the Sun . . ."

Marc Garneau will use the Sunphotometer for two tests:

The first involves pointing the instrument directly at the sun to determine the Sunphotometer's calibration. It is known that sunlight is scattered or absorbed by dust, moisture, pollution and acidic-haze, but it is very difficult to estimate the extent with any great precision from earth. In space, there is no interference from the earth's Sunphotometer's absolute accuracy.

The second test is pointing the instrument at sunset and sunrise when the sun is viewed through the earth's atmosphere. These measurements will be of great value in determining:

- the density and distribution of the El Chichon volcanic cloud (before it has completely disappeared) Mexico's El Chichon volcano erupted March 26, 1982.
- the distribution of water vapor and other atmospheric gases which affect the chemistry of the ozone layer.

Results will have application in the area of climate research and in studies of the earth's ozone layer and the effects of volcanic clouds on climate.

Atmospheric Emission and Shuttle Glow Measurements

During space flight, some surfaces of the orbiter develop a faintly visible reddish glow which could affect optical instruments of payloads. For example it is possible that the glow could adversely affect the WAMDII (Wide Angle Michaelson Doppler Imaging Interferometer) experiment being developed by Canada for a shuttle flight in 1988