# More Shuttle

lem encountered during space flight by more than 40 per cent of all astronauts and cosmonauts. Tc date there are no reliable tests to predict who will be affected, little knowlege of how to prevent the disorder once in space and no fully-acceptable means of treating the symptoms once they appear. Increased understanding of the underlying mechanism of SMS and practical ways of dealing with it could benefit not only astronauts but also the large number of persons who suffer from common forms of motion sickness, such as sea sickness, car sickness and air sickness.

This experiment will involve careful study of the onset of symptoms and evaluation of the effectiveness of various forms of prevention and treatment.

**f) Taste in Space**

Although some astronauts have reported that substances taste sweeter and less spicy in space, to date no formal experiments have been carried out on taste sensation. To define whether taste is affected by weightless conditions, Garneau will apply different colorless dilute solutions to his tongue and record whether each sample is sweet, sour, bitter, salty or distilled water. The weak solutions of sucrose, citric acid, urea and sodium chloride used will be in numbered containers and identical in appearance.

To test whether his sense of smell is also afffected, Garneau will close his eyes while another crew member has him smell the contents of four small bottles, identical in appearance, containing gauzes wetted with spearmint, lemon, vanilla extract or distilled water.

The tests will be performed three times during the mission and should help researchers understand more about the basic science of taste and how the central nervous system adapts to various situations. Results could be of importance in refining space diets for long-term flights.

## Experiment for the Second Mission Targeted for Early 1986

### NRC Space Vision System

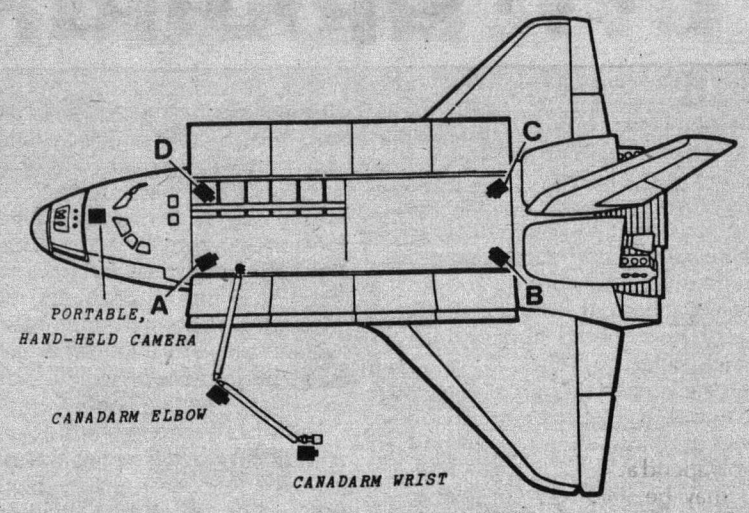
The National Research Council Space Vision System is a state-of-the art development in robotic technology designed to work with Space Shuttle and Canadarm, the remote manipulator system Canada contributed to the United States Space Shuttle Program. The same technology also has many potential applications in today's factories.

The NRC system is designed to give more precise guidance information to make it easier for astronauts to approach, capture and then berth large satellites or to assemble other structures in space.

An early prototype of the system has already been demonstrated to NASA by the National Research Council in ground simulations at the Johnson Space Center, Houston. The time it took to berth a large satellite was reduced to only one minute from about five minutes.

The NRC Space Vision System would also make it easier for the shuttle to rendez-vous with a satellite and for its Canadarm to subsequently manoeuvre it whether the orbiter or satellite is in sunlight or dark. That's important because the visual cues astronauts use to approach and grapple a satellite can change dramatically as the lighting conditions change from day to night.

For on-orbit operations, crew members currently must rely on the qualitative information they get from viewing a satellite through the shuttle orbiter's windows and from using their closed-circuit television cameras to estimate the position, orientation and motion of the satellite relative to the orbiter.




*TV Cameras Aboard Space Shuttle*

*Cameras A,B,C and D are atttached at the four corners of the payload bay; two other cameras are attached to Canadarm's wrist and elbow joint. All six cameras are controlled remotely by astronauts on the flight deck inside the crew compartment. Degrees of control include focus, iris, zoom, pan and tilt. A portable camera is also located in the cabin.*

ting the arm under considerable stress.

To deal with this problem, astronauts must ensure that massive satellites are only moving very slowly relative to the shuttle before capture. With the NRC Space Vision System, which senses and calculates the exact position of a satellite 30 times every second, the astronauts will be able to tell quickly and precisely whether the satellite is moving in the correct speed range to permit capture.

Similarly, the system would also make shuttle docking operations with satellites and Space Station reflected back to a camera on the shuttle. The video image of the target cluster is processed and analyzed by a very fast computer to provide precise data on the position and motion of the satellite. The information is displayed both numerically and graphically on television screens at the control station inside the orbiter.

Using conventional lights, the system can spot an object up to 200 metres away; using a laser, its reach could extend to several kilometres.

Moreover, with NASA building Space Station, the NRC Space Vision System would be invaluable for

***"...some astronauts have reported that substances taste sweeter and less spicy in space..."***

With the NRC Space Vision System, this information would be quantified for use in guidance and control, either by the crew member or, ultimately, by a fully-automatic control system for Canadarm.

The astronauts to date have had no trouble on orbit manipulating Canadarm — indeed they have been delighted with its performance — more critical conditions will arise when huge satellites of up to 30,000 kilograms are captured and manoeuvred near the shuttle.Although satellites are weightless in zero-gravity, the effects of inertia remain in space. If, for example, the astronaut were to try to capture a massive satellite which is moving too fast, the satellite would tend to keep on going, putsafer, quicker and more accurate, especially when huge satellites which obliterate all direct views need to be berthed.

The NRC Space Vision System — a combination of light source, TV cameras, computers and TV displays — locates and tracks a satellite by measuring its position up or down; left or right; fore or aft; and its angle in pitch, yaw and roll relative to the shuttle orbiter. It is accurate to one part in 2,000. For example, if a satellite is 200 metres away, its range would be measured to an accuracy of better than 10 centimetres.

To use space vision, the satellite may need to be fitted with special reflectors. Natural or artificial light from sources on the orbiter is such operations as manoeuvring two large elements of the station together or for assembling other large satellites in orbit.

Space experts anticipate such technology as that provided by the NRC Space Vision System to be a necessary part in the evolutionary process leading to comprehensive telepresence in space. Telepresence refers to the ability of operators in the safety of the crew compartment to control, assemble and conduct other operations in space. Such capabilities also have many applications in hazardous or hostile environments on earth, for example in some manufacturing industries, in nuclear reactors and in underwater operations.

*continued to page 26.*