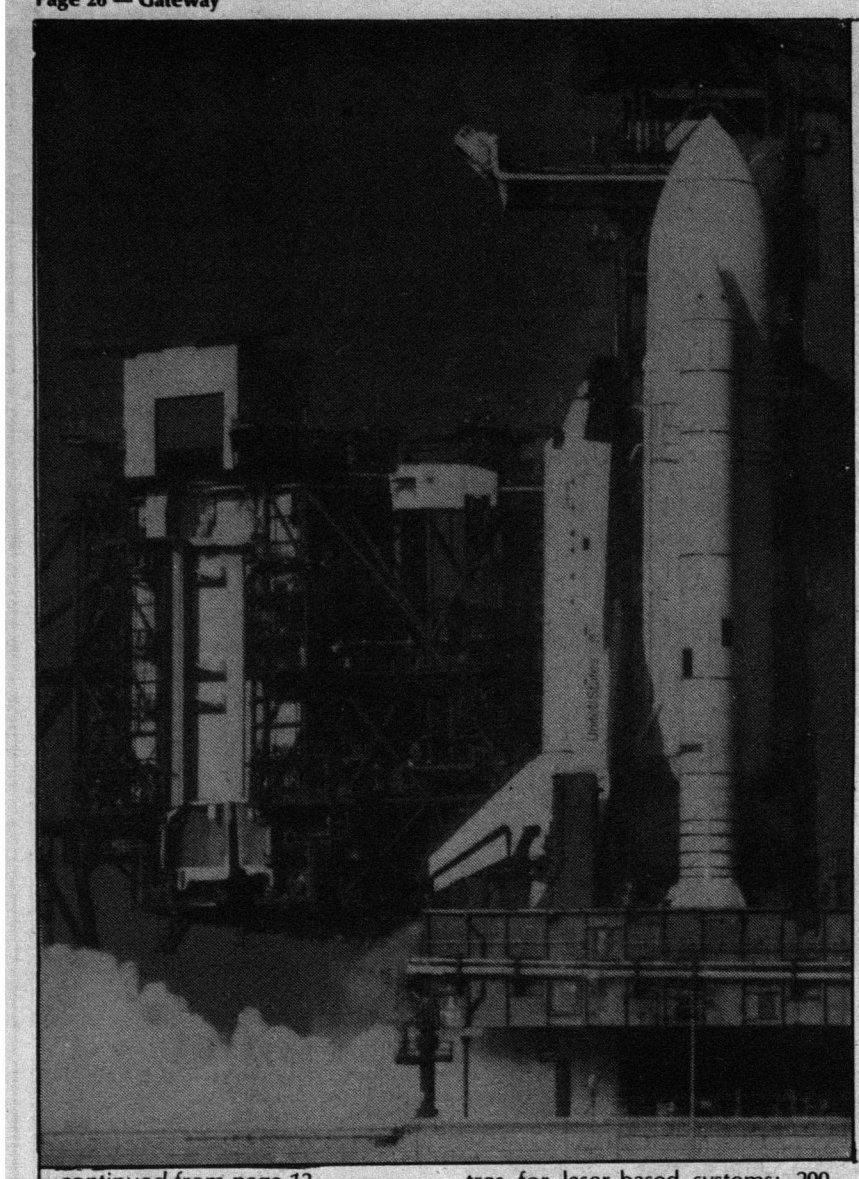

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Technical Data

Maximum Range: Several kilometres for laser-based systems; 200 metres for conventional lighting systems.

Output: Position, orientation and rate of movement of payload relative to orbiter.

Accuracy: One part in 2,000, that is, at 200 metres, accuracy is 10 centimetres.

Update rate: 30 times a second.

Experiments for the Third Mission Targeted for Mid-1986

Space Adaptation Syndrome Experiments

The Department of National-Defence and McGill University have jointly developed four experiments to be conducted in orbit. The long-term goals of such experiments are to alleviate the problem of motion sickness on land, sea, in the air and in space; to diminish the problem of disorientation in flight (aircraft flight and space flight) and to expand basic knowledge of the human vestibular system.

The problem of motion sickness on land, sea and in the air is well-known, but it is less well-known that more than 40 per cent of persons who have flown in large spacecraft have suffered motion sickness during the first two or three days in space. This condition can seriously reduce productivity.

The human vestibular system in addition to playing a major role in motion sickness, is also a frequent source of dizzy spells some people experience when walking about normally on earth. The system normally contributes to the stability of body posture, to the stability of the eyes in space and to the body's equilibrium. Unfortunately, the motions of modern transportation vehicles exceed the limitations of this system and false information is reported to the brain. Disorientation and motion sickness follow.

The four components of the experiment are described below:

a) H-Reflex Testing

The H-Reflex is much like a knee--jerk reflex. The tibial nerve of the leg is given a small electric shock and the response is recorded by special sensors that pick up the biological activity associated with the responding muscular contraction. Subjects wearing a blindfold and ear plugs will be seated on a 'mini-sled' and subjected to carefully controlled to-and-fro motions in different directions while the shocks are applied.

The aim of this experiment is to measure vestibular adaptation to weightlessness in a precise and systematic manner and to see whether crew members who become space sick can be distinguished, perhaps through screening test on earth, from those who do not.

b) Awareness of Position Component

During space flights, astronauts may often lose their sense of orientation and perception of the body's shape and position in the absence of gravity, visual cues or meaningful sensory inputs.

Subjects will be instructed to view the location of several different targets and they will then be blindfolded. After a time, they will be asked to describe the position of their limbs and then to identify and point a flashlight at the targets. An observer will score the subject by indicating the location of the beam of light on a suitable sketch of the Shuttle's mid-deck.

This procedure is designed to establish whether this apparent phenomenon can be demonstrated objectively, to determine the mechanisms behind it. Also to be investigated, are whether the phenomenon occurs immediately after closing the eyes or some time later, and how it is affected by time spent in weightlessness.

c) Visually-Induced Roll Test

This test will examine the interactions between the visual and vestibular systems, particualarly "circularvection" — a false sensation of body rotation when the subject is exposed to a rotating visual environment.

Subjects will face an umbrella-shaped, highly patterned visual field. When this field is rotated at a constant rate, the subject will develop a sensation of self-motion in the direction opposite to that of visual field rotation (circularvection). After an appropriate length of time, field rotation will cease and the sensation of rotation will gradually diminish. The sole task of the subject will be to concentrate on his feeling of body rotation and to indicate the rate of this rotation on a measuring device.

d) Motion Sickness Studies

These studies will expose a trained payload specialist to the actual space environment to observe and experience the disorder and conduct a battery of appropriate tests. The motion sickness studies will be divided into three parts.

The first will be a detailed observation and recording of any spontaneous or induced motion sickness signs and symptoms. This will be done by using a checklist and a pocket tape recorder to provide a permanent record.

The second part will consist of systematic testing of the payload specialist to quantify changes in motion sickness susceptibility as they adapt to weightlessness. This will involve head movements with eyes open until either a mild level of motion sickness or a time limit is reached. Brief stops every 30 seconds will permit the subject to report his symptoms and recovery will be tracked upon completion of the test.

The third part will examine the effectiveness of various means of treating space motion sickness, taking advantage of the payload specialist's ability to spend significant periods of time on any given approach. Methods to be evaluated include restricting head movements, closing the eyes or viewing a strongly patterned, non-moving visual scene, the use of tactile cues or taking various drugs (to be selected in cooperation with NASA Space Adaptation researchers).

In addition to those in orbit, studies will be performed on earth before flight to provide baseline data for all four components of the Space Adaptation Syndrome Experiment. Motion sickness testing, carried out at the Johnson Space Center with NASA researchers, will probably start about six months prior to launch and finish some two months before flight. Pre and post flight motion sickness testing will include test of susceptibility to sickness while flying zero-G parabolas in an aircraft.

Post-flight testing of all involved crew members is of particular importance to study the process of re-adaptation to a one-G environment. All four test will be carried out during the two weeks following landing or longer if any response fails to return to normal by that time.