N89-16647

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
RESEARCH AND TECHNOLOGY RESUME

TITLE

CCD Scanning for Comets and Asteroids

PERFORMING ORGANIZATION
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INVESTIGATOR'S NAME

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a. **Strategy:** Some populations of objects in the solar system are still poorly known, and the long-range goal of this program is to improve that situation. For instance, the statistics of Trojan asteroids are uncertain, while our previous surveying indicates there is an appreciable systematic difference between the L-4 and L-5 regions, which is hard to explain. We are developing for this goal a new technique of sky surveillance, namely scanning with CCD. With its quantum efficiency and wavelength range greater than that of photographic plates, the CCD should be especially valuable for fast-moving objects such as near-Earth asteroids.

b. **Accomplishments**: A 320 x 512 pixel CCD has been in operation since 1983 on a telescope that is dedicated during the dark half of each month to sky surveillance, that is the Spacewatch Telescope which is the 91-cm Newtonian reflector of the Steward Observatory on Kitt Peak. The preparations included extensive computer programming for automatic detection of moving objects and for processing in real time. With exposure time of 1 minute, the visual limiting magnitude is 19.6 at the 6-sigma detection level.

New asteroids are readily found, but we have chosen to follow with astrometry only a few of them that are of special interest: a Trojan, a Hilda-type, a 2:3 resonance asteroid, and a few Hungarias.

The system was found to be of special value for astrometry. The telescope drive is turned off at a selected distance west of the object and the scan is continued such that the number of astrometric standards is optimized. Because the drive is off, the effects of refraction practically vanish. It is in principle a transit technique, but that can be applied anywhere in the sky and not merely in the meridian. The precision turns out to be better, by nearly a factor of 2, than what is usually done for asteroids and comets. Astrometry has been done for a large number of objects, particularly also for new discoveries of other astronomers and in order to faciliate radar observations. The results have been regularly published in the Minor Planet Circulars and comet recoveries in the I.A.U. Circulars.

c. **Anticipated Accomplishments**: We are presently installing a 2048 x 2048 CCD with pixel size of 27 microns at the f/5 focus of the Spacewatch Telescope. It will gradually come online in 1989 for automatic data processing, but while this is taking place we shall use the system in tests of CCD scanning techniques on a variety of populations in the solar system.

d. Publications:

Gehrels, T., Drummond, J. D., and Levenson, N. A.: The Absence of Satellites of Asteroids. Icarus **70**, 257-263, 1987.

Gehrels, T., Landau, R., and Coyne, G. V.: Mercury: Wavelength and Longitude Dependence of Polarization, Icarus **71**, 386-396, 1987.

The Minor Planet Circulars give the monthly reports on comet and asteroid observations made by the Spacewatch Telescope; several I.A.U. Circulars have reported comet recoveries.