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P. 3

ABSTRACT

AUTOMATED RENDEZVOUS AND CAPTURE SYSTEM

BY

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Discussion:

AUTOMATED RENDEZVOUS AND CAPTURE - ARC Category 1: Hardware Systems

Statement:

This paper describes an ARC system that is an attempt to simplify operation, reduce energy requirements, reduce weight, and provide longterm use and reliability.

The ARC system is a laser/optical/holographic (LOH) control system for guidance, rendezvous, and docking (RVD).

The LOH/RVD utilizes a hologram, residing at the target platform. Excited by a laser diode, the hologram projects an image at a given distance from the platform. A vision system in the automated chase vehicle sees the projected image and, by optical comparisons, guides the chase vehicle to that image, reaching a proximity conducive to soft docking. The vision system then shifts to a second hologram image holding at close proximity (2mm) to the target platform and guides to it for controlled, precise docking at the rendezvous point.

The holographic image projections from the target platform, are composed of color hues and may be circular, triangular or of any other shape and texture that may enhance the ability of the chase vehicle's vision system to analyze information pertinent to velocity, attitude, and roll of the target platform. Any movement of the image, whether planned or errant, will be translated by the vision system into synchronous adjustments throughout the vehicle approach path.

Maturity:

The LOH/RVD system began conceptual research in 1985 by J.B. Kader. In 1990 the project came under the auspices of United Technologies' USBI and the Center for Applied Optics at the University of Alabama, Huntsville. The optics necessary and the first model of a relevant hologram were developed. The prototype test stand of the LOH/RVD system was assembled, and several successful experiments were conducted.

Test Experience:

Using an image of a cross inside a ring, the test experiment recorded several holograms projected at different distances. These holograms were used to reconstruct images for the chase vehicle as well as the target platform. An HeNe laser (wavelength 632.8 nm) was used for the recording as well as reconstruction at this concept demonstration stage. When observed through a CCD camera (see Figure), the hologram projects two images. When they superimpose, the system becomes perfectly aligned at a pre-determined location. Preliminary observations indicate that holography can be a powerful tool for the recapture and related sensing applications.

DEMONSTRATION (REDUCTION TO PRACTICE)

