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LARGE APERTURE SCANNING AIRBORNE LIDAR

by

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A large aperture scanning airborne lidar facility is being developed to provide important new capabilities for airborne lidar sensor systems. This complete stand-alone lidar facility is ear-marked to become a semi-permanent system aboard the NASA DC-8 aircraft, contingent upon completion of the proposed airframe modifications (forward nadir viewing port-54" x 63"). Due to the schedule uncertainty for this viewing port installation, the maiden flights will be performed on the NASA P-3 at the Wallops Flight Facility. The already installed bombay hatch on the P-3 will provide a more than adequate nadir viewing portal (80" x 154"). Modest internal aircraft modifications will be required to accommodate the laser optical bench, data and control systems.

The proposed scanning mechanism allows for a large aperture telescope (25" diameter) in front of an elliptical flat (25" x 36") turning mirror positioned at a 45 degree angle with respect to the telescope optical axis. There will be two coincident axes of rotation for the turning mirror; +/- 45 degrees side to side (cross-track) and 0 to 30 degrees fore and aft (along-track) which will allow viewing from the aircraft platform from nadir through 60 degrees forward. Position encoders monitoring both

excursions will provide location information and feedback data for establishing scanning operational parameters. This arrangement will allow aircraft lidar systems to be transformed into a full three-dimensional data-collection facility.

The lidar scanning capability will provide opportunities for acquiring new data sets for atmospheric, earth resources, and oceans communities. This completed facility will also make available the opportunity to acquire simulated Eos lidar data on a near global basis. The +/- 45 degree cross-track scanning feature when used aboard aircraft and at sufficient laser firing rates (50Hz) will provide the experimenter with a full 3-D view (mesoscale) of the atmosphere profile. The cross-track scanning capability can also be used to provide surface laser interaction data sets and surface altimetry mapping information. The nadir to 60 degree forward scanning will obtain a tomographic view of the atmosphere, i.e., aerosol profile; a virtual CAT scan of the atmosphere.

The design and construction of this unique scanning mechanism presents exciting technological challenges of maintaining the turning mirror optical flatness during scanning while exposed to extreme temperatures, ambient pressures, aircraft vibrations, etc. The proposed drive system will allow the experimenter to select any cross-track scanning sector within the range of +/- 45 degrees from nadir and/or along-track sector from nadir to 60 degrees forward. These scanning sectors need not be symmetric

with nadir or any fixed axis. The drive system will also provide combined 2-axes scanning capabilities. That is, while scanning cross-track the mirror may also be simultaneously tilted. This arrangement will, of course, also provide fixed off-axis viewing at any point within the range of both axes.

We are currently completing the design of the scanning mechanism and are also in the process of procuring major system components. We have received $50K funding to date from the Director's Discretionary Fund in FY88 ($200K to follow) and anticipating project completion to be around March/April 1989.

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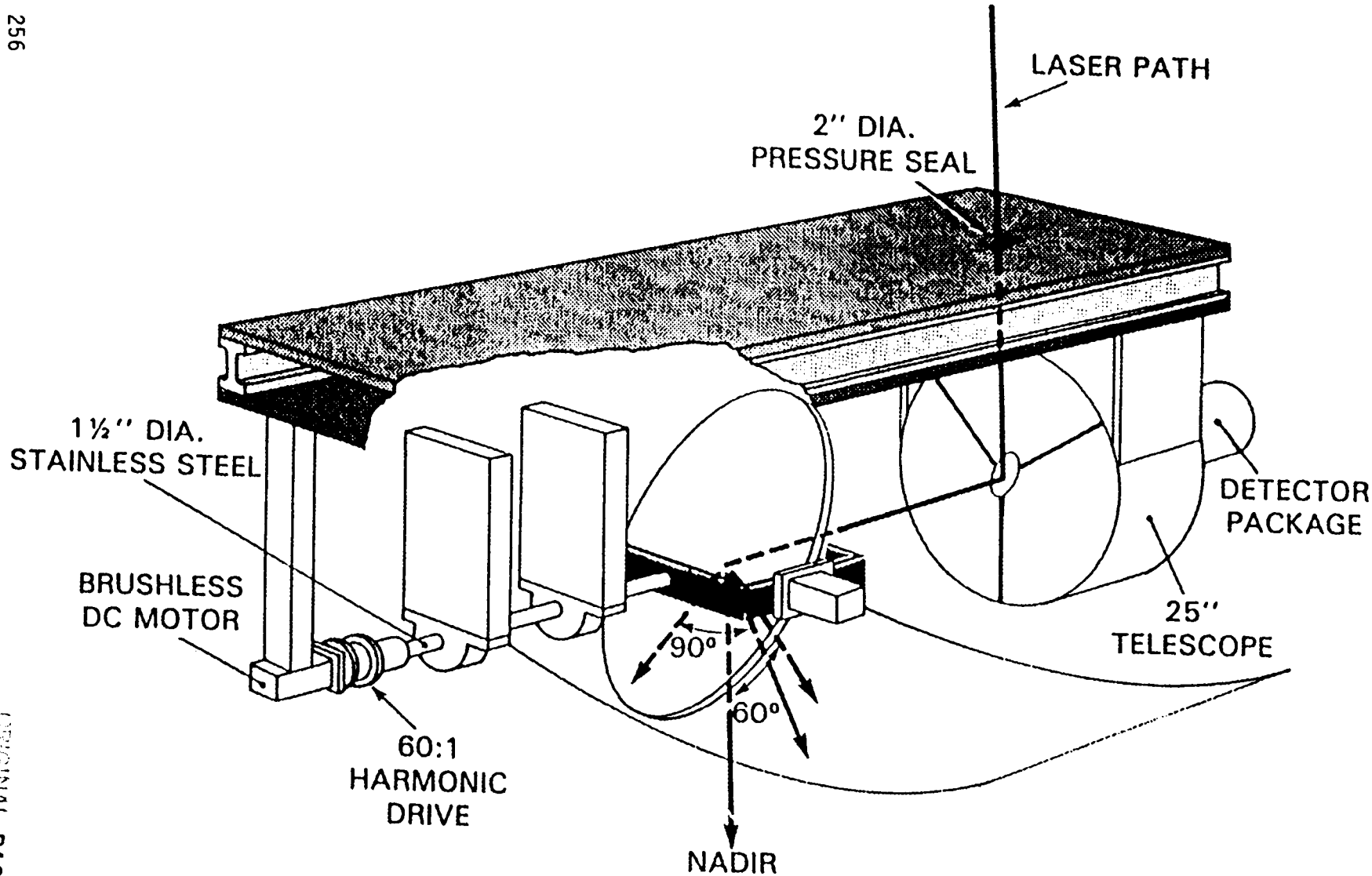

Figure 1. Scanning Lidar Mechanism

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