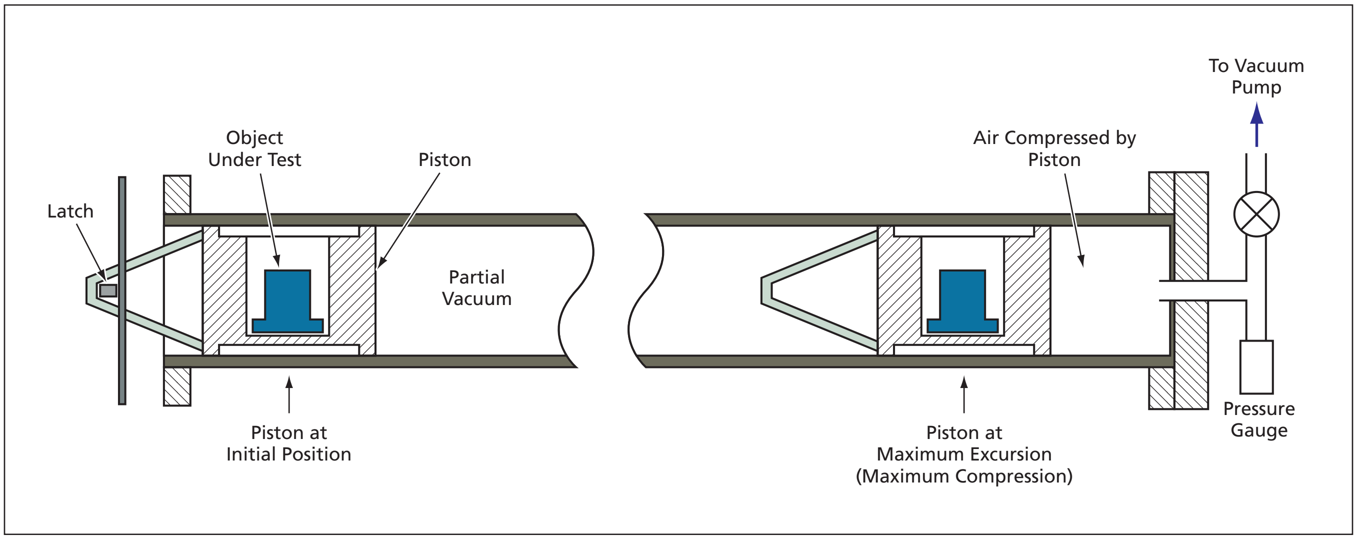

Atmospheric Pressure Drives the Piston along the partially evacuated pipe toward the closed end. The piston is then decelerated strongly when it compresses the remaining air at the closed end of the pipe.

gasket. One end of the pipe is open; the opposite end of the pipe is closed and connected to a vacuum pump.

At the beginning of a test, the piston is held at the open end of the pipe by use of a latch while the vacuum pump is activated to introduce a partial vacuum [typically, characterized by an absolute pressure of 0.2 bar (20 kPa)] between the piston and the closed end. Once the desired partial vacuum has been reached, the latch is released so that differential pressure (atmospheric minus partial vacuum) accelerates the piston along the pipe toward the closed end. The piston reaches a maximum speed typically between 20 and 40 m/s, the exact value depending on the mass of the object under test and the starting pressure in the partly evacuated volume. As the piston approaches the closed end, it compresses the air ahead of it until, at a distance between 5 and 20 cm from the closed end, the pressure becomes high enough to stop the piston (and bounce it back toward its starting position). An accelerometer on the piston measures the impact deceleration.

The impact deceleration is a strong function of the amount of gas (and, hence, of the pressure) initially in the partially evacuated volume at the closed end of the pipe. Therefore, it is easy to adjust the peak deceleration by adjusting the pressure of the partial vacuum. The maximum speed is not a strong function of the mass of the object under test or of the starting partial-vacuum pressure but can be tailored over a wide range by using pipes of different length.

This work was done by Pat R. Roach and Jeffrey Feller of Ames Research Center. Further information is contained in a TSP (see page 1).
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Multi-Antenna Radar Systems for Doppler Rain Measurements

Use of multiple antennas would enable removal of platform Doppler contributions.

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Use of multiple-antenna radar systems aboard moving high-altitude platforms has been proposed for measuring rainfall. The platforms contemplated in the proposal would be primarily spacecraft, but, in principle, the proposal could also apply to aircraft. The problem of measuring rainfall velocity from a moving platform is especially challenging because the velocity of the platform (especially in the case of a spacecraft) can be so large that it is difficult to distinguish between the rainfall and platform contributions to Doppler frequency shifts. Furthermore, nonuniform filling of radar beams can lead to biases in Doppler estimates. Although it might be possible to reduce these biases through improved data processing, a potential alternative is to use multiple antennas positioned at suitable along-track intervals.

The basic principle of the proposed systems is a variant of that of along-track interferometric synthetic-aperture radar systems used previously to measure ocean waves and currents. The simplest system according to the proposal would include two antennas that would perform cross-track scans as in a prior rainfall-measuring radar system. The antennas would be located at different along-track positions. The along-track distance between them would be chosen, in conjunction with the along-track velocity of the platform and the radar pulse-repetition frequency (PRF), such that this distance would equal the distance traveled by the platform between two successive pulses. (If necessary, the PRF could be adjusted to enforce this equality.) Thus, in effect, two sets of measurements would be performed at each platform position. Under this condition, extraction of the rainfall Doppler velocity without the platform contribution is substantially simplified and can be done with only minor modification of processing techniques traditionally used for ground-based Doppler radars.

This work was done by Stephen Durden, Simone Tanelli, and Paul Siqueira of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).
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