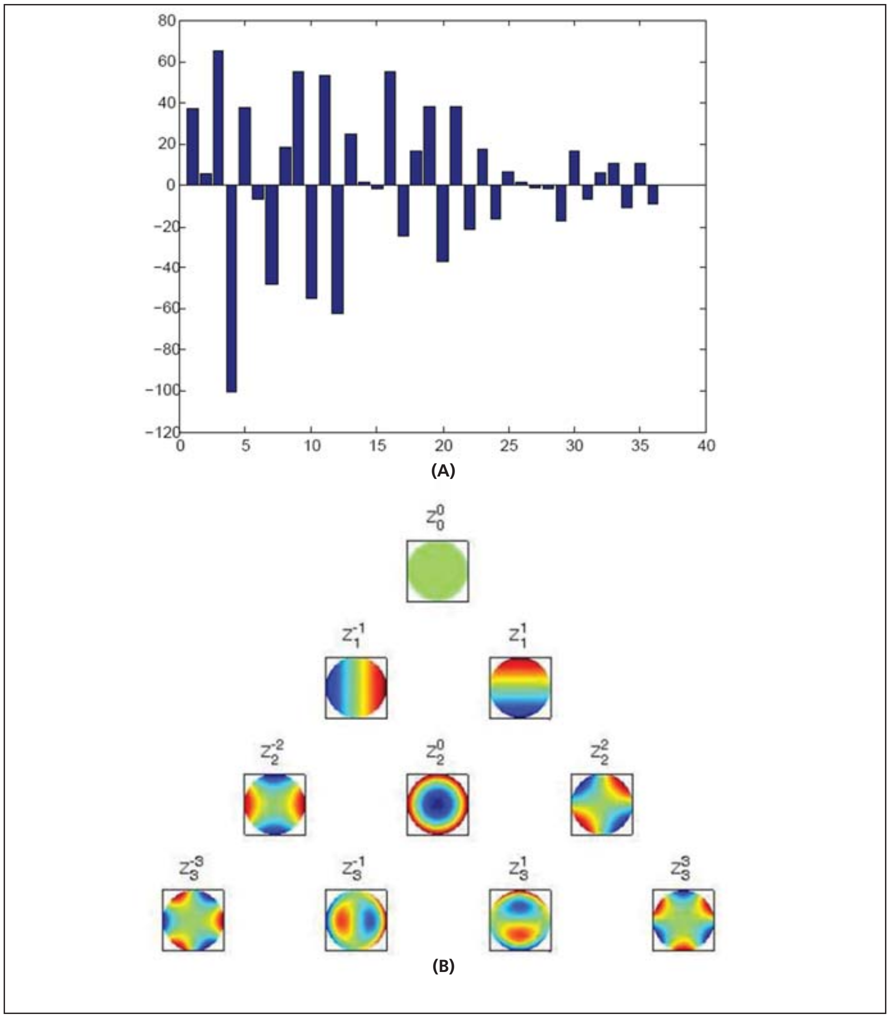

Figure 2. (a) **Quantification of Optical Aberration** as intorduced by an arbitrary lens is manifested by amplitude of its Zernicke coefficients specified in the order of (*n*= 0, 1, 2, 3, etc.: *m*=–*n*, . . . ,0, . . . , *n* if *n* even ; –*n*, . . . , *n* if *n* odd). (b) First 10 individual Zernicke functions are plotted.

These reflectors focus the energy of the THz source, and the detectors are placed at a convergent focal point to capture the radiated THz power.

One cannot place the detectors just by approximating by eye. THz waves are submillimeter, and require precise placement. The method proposed here is to use a visible low-power red laser (630 nm) with a 1-mm beam diameter (see Figure 1). The laser is beamed through a 3× beam expander to obtain a circular beam, then through a lens in order to focus the beam onto a TI DLP micro-mirror at an angle. This mirror bounces the laser light onto an ellipsoidal mirror that will focus it into a point. That is the point where the THz source is to be placed.

The initial focal point (laser source) is marked in 3D space as if the TI micromirror wasn't there. This virtual focal point is where the detector is to be placed. Since a circular beam is used, it is easier to locate the focal points by watching for the bright red spot that signals beam convergence.

Once the two focal points are found, and the energy source and energy detectors are in place, it is necessary to check calibration. Array of circular patterns can be beamed from the DLP chip to evaluate Zernike's refraction aberrations in real time (see Figure 2). In addition, various diagnostic patterns can be beamed from the DLP chip in order to measure aberrations associated with field variation. For example, a spot diagram can be beamed off of the DLP in order to analyze point spread.

This method is useful for the semiconductor industry to evaluate surface metrology of thin transparent optics, clinical optometry to measure lens aberration, telescopes and astronomical receivers to align mirrors covering optics and radiation sources, and head-mount displays to evaluate beam splitters.

This work was done by Hamid H. Javadi of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

Autoignition Chamber for Remote Testing of Pyrotechnic Devices

This rugged, reusable chamber is portable and can remotely heat pyrotechnics for autoignition tests.

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The autoignition chamber (AIC) performs by remotely heating pyrotechnic devices that can fit the inner diameter of the tube furnace. Two methods, a cold start or a hot start, can be used with this device in autoignition testing of pyrotechnics. A cold start means extending a pyrotechnic device into the cold autoignition chamber and then heating the device until autoignition occurs. A hot start means heating the autoignition chamber to a specified temperature, and then extending the device into a hot autoignition chamber until autoignition occurs. Personnel are remote from the chamber during the extension into the hot chamber.

The autoignition chamber, a commercially produced tubular furnace, has a 230-V, single-phase, 60-Hz electrical supply, with a total power output of 2,400 W. It has a 6-in. (15.2-cm) inner diameter, a 12-in. (30.4-cm) outer diameter and a 12-in.-long (30.4-cm), single-zone, solid tubular furnace (element) capable of heating to temperatures up to 2,012 °F (1,100 °C) in air. The furnace temperature is controlled by a commercial single-zone, setpoint temperature controller and solid-state relay.

The furnace features a stainless steel shell with 1/4-in.-thick (6-mm) steel end plates, and a rugged insulation package. A thermocouple port is supplied in the center of the control zone.

The furnace has a 2.5-in.-long (6.4-cm) vestibule at the top and bottom. The approximate overall length of the furnace is 17.5 in. (44.5 cm). Thermocouples on the pyrotechnic device monitor its temperature during the heating process on a strip chart recorder, or an equivalent data acquisition system. A remotely actuated ceramic protective cover is installed on top of the auto ignition chamber when test personnel are working around it.

A cage is mounted to a 115-VAC 500-lb (2,224-N) force electromechanical actuator that has an 18-in. (46-cm) stroke. The pyrotechnic device is installed in an appropriate mounting fixture, which is then installed in the cage. The actuator can be remotely operated to extend or retract the pyrotechnic device into the tube furnace. When the actuator is completely extended into the autoignition chamber, a ceramic insulating lid sits on top of the chamber to keep heat from escaping.

An accelerometer is installed on the stainless steal fixture of the electromechanical actuator to record the autoignition event. A strip chart recorder, or equivalent data acquisition system, monitors the accelerometer output. The chamber is capable of withstanding stress while still being able to function. In one instance of STS-107 Pyrotechnic Hardware, the autoignition chamber was reused a total of 18 times and did not require rebuilding.

This work was done by Maureen L. Harrington and Gerald R. Steward of Johnson Space Center, and Toby W. Dartez of Jacobs Sverdrup Corp. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809. MSC-24433-1