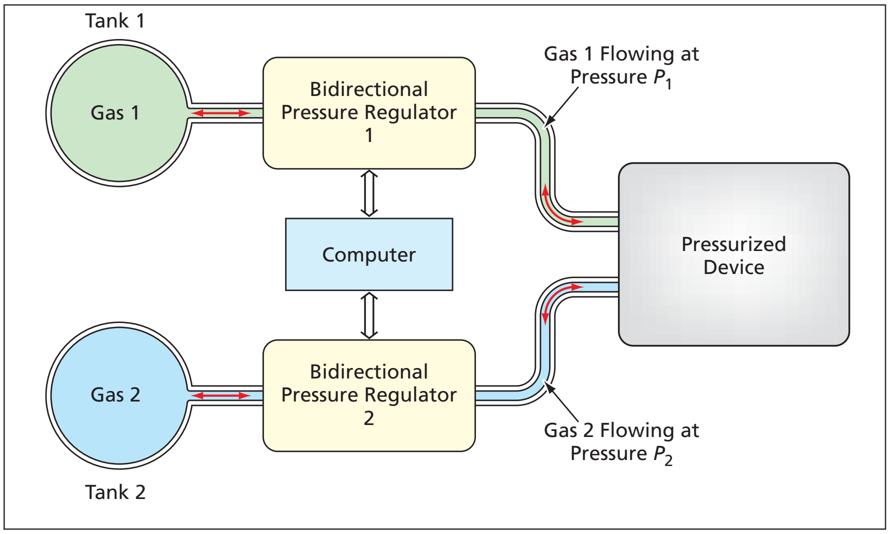

The **Bidirectional Pressure-Regulator System** regulates pressures P_1, P_2, and $P_2 - P_1$.

- A ten-turn potentiometer for providing valve-position feedback to the software; and
- Interface circuits between the computer and the stepping motor, pressure transducers, and potentiometer.

The software provides a capability for modifying set points for either upstream or downstream pressure during operation to adjust to changing flow conditions, and/or to other changing system conditions, including changing pressure-control requirements. In addition, the software can easily be modified for application to different closed gas-flow systems. The performance of the bidirectional pressure regulator can be modified by the selection of the valve, the pressure transducers, the stepping motor, and the control parameters embedded within the software control code.

In traditional pressure-regulation practice, control of a differential pressure between two gases would typically involve the use of plumbing to couple the pressures of the gases to a differential-pressure-sensing device; such a device is said to be "hardplumbed." In contrast, the bidirectionalpressure-regulator system can be said to be "soft-plumbed" because the connection between the pressures of the two gases is made only in software. In the event that the two gases are such as to pose a risk of fire, explosion, or toxicity if allowed to mix, soft plumbing offers an important safety advantage over hard plumbing by eliminating a potential source of leakage and mixing.

This work was done by Kenneth Burke and John R. Miller of Glenn Research Center and Ian Jakupca and Scott E. Sargi of Analex Corp. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17548-1.

Prism Window for Optical Alignment

Prism windows could be generally useful in manufacture of optical instruments.

NASA's Jet Propulsion Laboratory, Pasadena, California

A prism window has been devised for use, with an autocollimator, in aligning optical components that are (1) required to be oriented parallel to each other and/or at a specified angle of incidence with respect to a common optical path and (2) mounted at different positions along the common optical path. The prism window can also be used to align a single optical component at a specified angle of incidence. Prism windows could be generally useful for orienting optical components in manufacture of optical instruments.

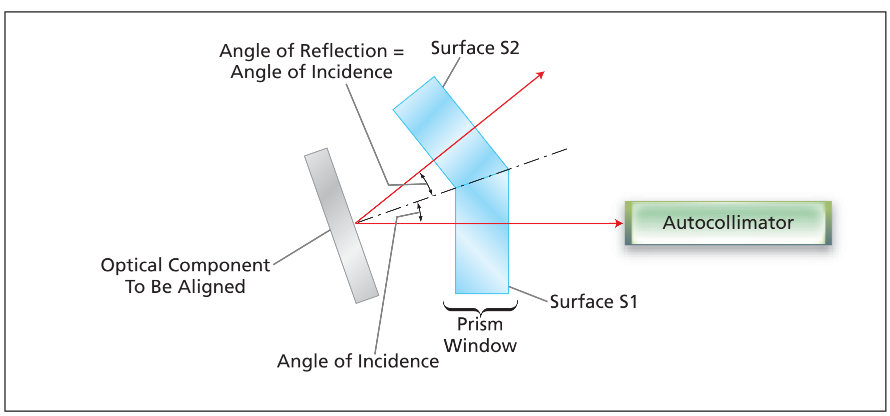

Figure 1. A **Prism Window** comprising two beam-splitter windows bonded together at a predetermined angle equal to twice a specified angle of incidence is used in conjunction with an autocollimator to align an optical component at the specified angle of incidence.

Heretofore, for aligning multiple optical components in a large optical assembly for which there is a requirement that no such component completely obstruct the alignment optical path to any other such component, it has been common practice to use a single large-aperture autocollimator or interferometer. However, the sizes of optical assemblies amenable to this alignment practice are limited by the sizes of apertures of commercially available autocollimators and interferometers. Moreover, in some cases, it may be necessary to remove some optical components to prevent obscuration of other optical components or to make room for the autocollimator or interferometer. In contrast, the prism window makes it possible to use an autocollimator or other suitable instrument of narrow aperture to align multiple optical components in a possibly large optical assembly, without

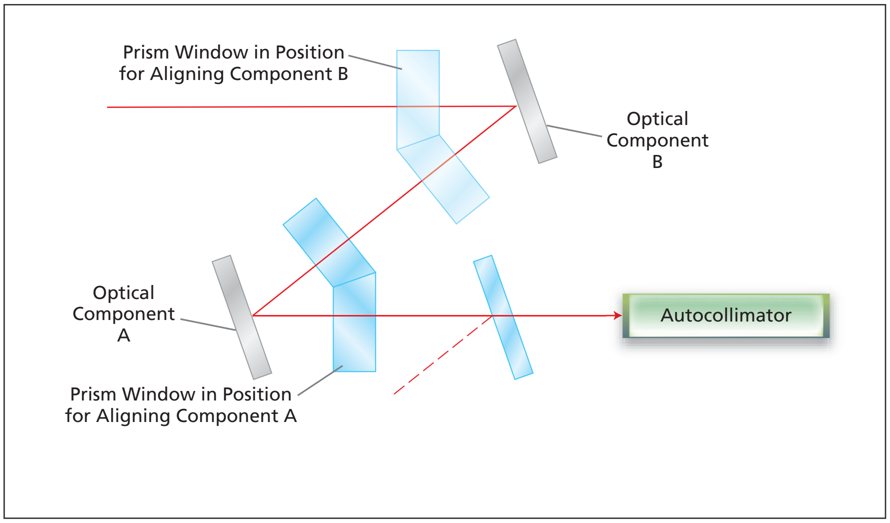

Figure 2. **Multiple Optical Components** are aligned in the manner of Figure 1 by repetition of the basic alignment procedure with the prism window suitably positioned in relation to each component to be aligned.

need to remove one or more optical components to prevent obscuration of other optical components or to make room for the alignment instrumentation.

"Prism window" as used here should not be confused with "prism window" used in U.S. Patent 4,772,094 to denote an assembly of prisms configured as a stereoscopic viewing device. Instead, as used here, "prism window" denotes an application-specific unit comprising two beam-splitter windows that are bonded together at an angle chosen to obtain the specified angle of incidence.

Figure 1 illustrates a simple example of the use of a prism window and an autocollimator to align one optical component in a horizontal plane of incidence. In this example, the autocollimator is nominally aimed horizontally and the prism window is mounted on a flat, smooth, nominally horizontal platform that can be adjusted slightly in rotation about any or all of three axes to bring the prism window into alignment with the autocollimator.

First, the surface S1 of the prism window is aligned with the autocollimator by performing such adjustments while using the autocollimator in the conventional manner to center light reflected from surface S1. Next, surface S2 is brought into alignment by rotating the platform about the axis parallel to the optical axis of the collimator until the table is as nearly level as possible, as indicated by a commercial level meter or any other suitable means. Finally, the optical component to be aligned is placed at or near the desired position and adjusted in tilt and tip. Alignment of this component is deemed to be achieved when, as observed via the autocollimator, light reflected from surfaces S1 and S2 is centered.

Figure 2 illustrates an example of the use of a prism window in conjunction with an autocollimator to align multiple optical components with respect to a multi-leg common optical path. In this case, the procedure described above for the single-component case must be repeated, with appropriate positioning of the prism window with respect to each component to be aligned.

This work was done by Hong Tang of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-45546

Single-Grid-Pair Fourier Telescope for Imaging in Hard-X Rays and γ Rays

Images would be equal to or superior to those produced by multiple-grid-pair telescopes.

Marshall Space Flight Center, Alabama

The figure is a simplified depiction of a proposed Fourier telescope for imaging in hard-x rays and γ rays. This instrument would contain only one pair of grids made of an appropriate radiation-absorpting/scattering material, in contradistinction to multiple pairs of such as grids in prior Fourier x- and γ-ray telescopes. This instrument would also include a relatively coarse gridlike image detector appropriate to the radiant flux to be imaged. Notwithstanding the smaller number of grids and the relative coarseness of the imaging detector, the images produced by the proposed instrument would be of higher quality.

A mechanism that would include a gear drive would maintain a precise alignment between the grids and the detector while stepping them through rotation and axial translation. The rotation would provide continuous two-dimensional coverage of the spatial frequencies of interest, while the slit widths of the grids and their axial translation would determine the range of magnitudes of the detected spatial frequencies. If the outer grid were translated, then there would be no need to translate the inner grid and the detector. To simplify the mechanism and the problem of maintaining alignment, the detector, its readout circuitry, and the associated image-data processor could be attached to the back of the inner grid.

Both grids would have the same overall width. If n were the number of slits or slats in one of the grids, then the other grid must contain $n + 1$ slits, respectively. Because both grids would have the same overall width, the width of an individual slit or slat would be slightly greater in the n grid than in the $n + 1$ grid. It would not matter which grid was characterized by the greater number; for the initial design, n and $n + 1$ would be chosen for the outer and inner grid, respectively. The image detector could be composed of as few as two elements; however, prior research has shown that seven elements would represent a better compromise between the quality of image data and the complexity of the hardware.

Although practically any alignment could be used as long as it were known *a*