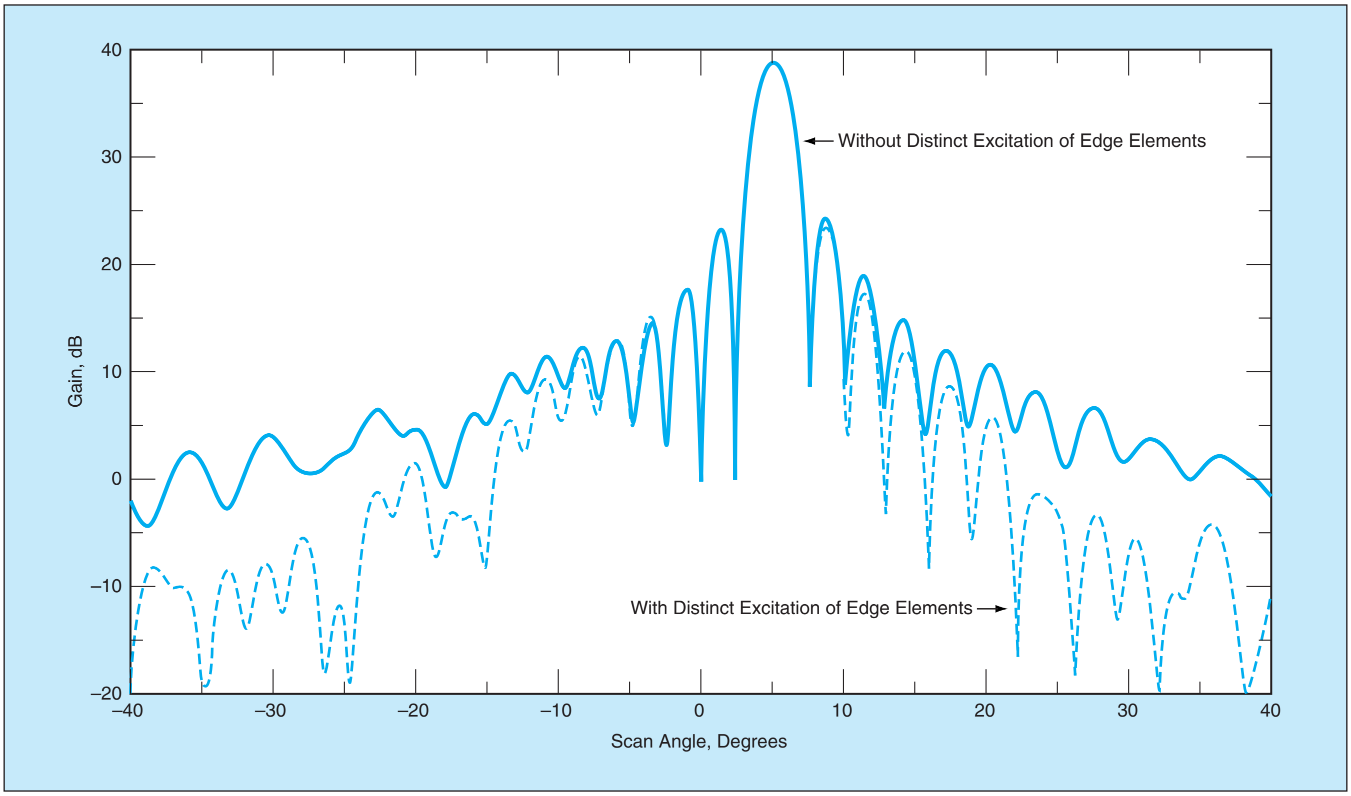


Figure 2. **Results of Numerical Simulations**, with and without distinct excitation of the edge elements, are plotted for a scan angle of 5°.

(that is, the phase difference between adjacent elements) needed to point the main lobe of the radiation beam in a given direction in the (y,z) plane. For an edge radiating element, the excitation coefficient would be of the form

$$we^{j\phi} = a_{\pm N/2}e^{\pm jN\alpha/2}(1+ce^{\pm j\delta}),$$

where w and $a_{\pm N/2}$ are magnitudes; ϕ is the phase of the excitation; c and δ are a magnitude scale factor and a phase shift, respectively, necessary for the desired degree of cancellation of a specified side lobe, and N is one less than the total number of radiating elements.

Computational simulations have been performed, following diffraction-analysis procedures based on a physical-optics formulation. Some of the parameters used in the simulations were a = 5.4 m, b = 3 m, F = 4.32 m, and N + 1 (the number of elements) = 41. The phased array had a length equal to that of the cylindrical axis of the antenna (2b = 6 m) and comprised 41 y-polarized elements spaced at intervals of 0.63 wavelength. The results of the computational simulations showed that the radiation pattern could be controlled with high versatility through control of the edge-element excitation amplitudes and phases. In particular, it was demonstrated that the side-lobe levels could be reduced (see Figure 2) and even effectively canceled and that side-lobe envelopes could be made steeper (side-lobe levels made lower) by choosing, for cancellation, a specific side lobe near the peak of the main lobe. In addition, one could choose the edge-element excitations to obtain different side-lobe envelopes simultaneously on the opposite sides of the main lobe.

This work was done by Ziad Hussein and Jeff Hilland of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-30251

Command Interface ASIC — Analog Interface ASIC Chip Set

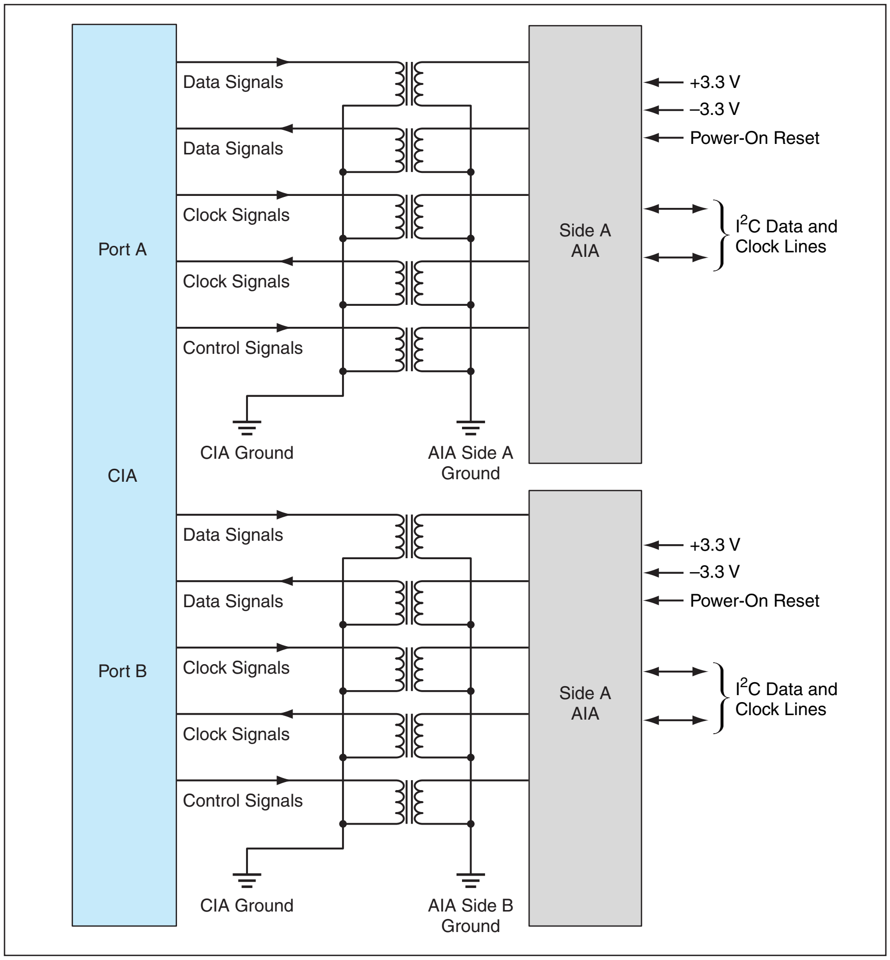
These are radiation-hard integrated circuits for power-control applications.

NASA's Jet Propulsion Laboratory, Pasadena, California

A command interface application-specific integrated circuit (ASIC) and an analog interface ASIC have been developed as a chip set for remote actuation and monitoring of a collection of switches, which can be used to control generic loads, pyrotechnic devices, and valves in a high-radiation environment. The command interface ASIC (CIA) can be used alone or in combination with the analog interface ASIC (AIA). Designed primarily for incorporation into spacecraft control systems, they are also suitable for use in high-radiation terrestrial environments (e.g., in nuclear power plants and facilities that process radioactive materials).

The primary role of the CIA within a spacecraft or other power system is to provide a reconfigurable means of regulating the power bus, actuating all valves, firing all pyrotechnic devices, and controlling the switching of power to all switchable loads. The CIA is a mixed-signal (analog and digital) ASIC that includes an embedded microcontroller with supporting fault-tolerant switch-control and monitoring circuitry that is capable of connecting to a redundant set of interintegrated circuit (I^2C) buses. Commands and telemetry requests are communicated to the CIA. Adherence to the I^2C bus standard helps to reduce development costs by facilitating the use of previously developed, commercially available components.

The AIA is a mixed-signal ASIC that includes the analog circuitry needed to connect the CIA to a custom higher-powered version of the I^2C bus. The higher-powered version is designed to enable operation with bus cables longer than those contemplated in the I^2C standard. If there are multiple higher-power I^2C-like buses, then there must an AIA between the CIA and each such bus. The AIA includes two identical interface blocks: one for the side-A I^2C clock and data buses and the other for the side B buses. All the AIAs on each side are powered from a common power converter module (PCM). Sides A and B of the I^2C buses are electrically isolated from each other (see figure). They are also isolated from the CIA by use of transformer coupling of signals between the AIA blocks and the CIA.



The **AIA and the Interface between the AIA and the CIA** provide ground isolation between the CIA and sides A and B of the I^2C bus.

This work was done by Baldes Ruiz, Burton Jaffe, Gary Burke, Gerald Lung, Gregory Pixler, Joe Plummer, Sunant Katanyoutanant, and William Whitaker of Caltech for **NASA's Jet Propulsion Laboratory**.*Further information is contained in a TSP (see page 1).*

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

Intellectual Assets Office
JPL
Mail Stop 202-233
4800 Oak Grove Drive
Pasadena, CA 91109
(818) 354-2240
E-mail: ipgroup@jpl.nasa.gov

Refer to NPO-30275, volume and number of this NASA Tech Briefs *issue, and the page number.*