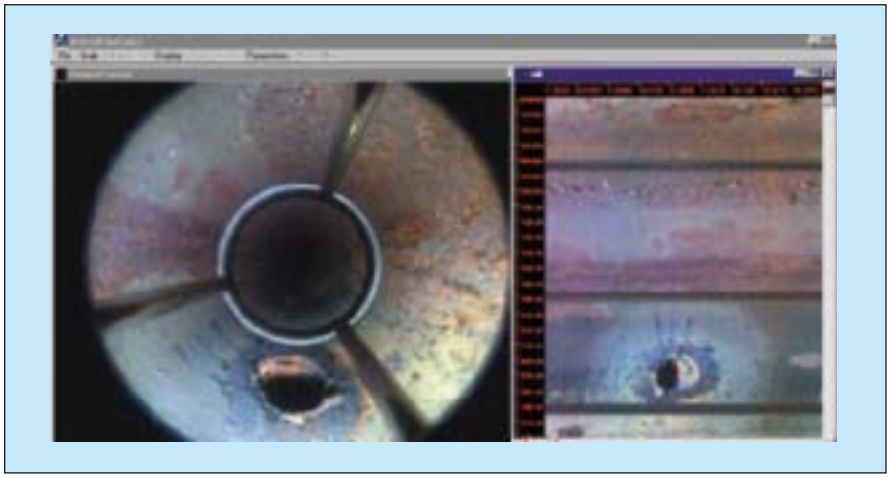


Figure 2. A **Picture Taken Looking Along a Pipe** is distorted (warped) by the combined effects of the lens and the viewing geometry (left). The image data are processed to unwarp the image (right), yielding an undistorted radial view.

pensates for the decrease in illumination with distance from the ring of LEDs.

The potential advantages to be gained from the development of this system are best understood in comparison with visual pipeline-inspection systems in current use. Almost all of those systems offer unprocessed video images for viewing by humans in real time or in post-inspection playback. The fatigue induced by long viewing of mostly featureless images makes such inspection somewhat unreliable, and cost of labor for such inspection is high. If, as planned, the present system could be enhanced by use of additional computer vision techniques, then visual inspection of pipelines could be promoted to supervised inspection, which, in turn, could be a precursor to partly or totally automated inspection. According to one scenario, a system derived from the present one would provide enhanced graphical displays, possibly with highlights on potential defects, and could even provide audible alarms to alert operators. Operators could then concentrate their attention on pipeline sections most likely to contain defects. Reliability of pipeline inspection would thus be increased and the cost of labor reduced.

This work was done by Darby Magruder of **Johnson Space Center** *and Chiun-Hong Chien of Hernandez Engineering. For further information, contact the Johnson Technology Transfer Office at (281) 483-3809.*
MSC-23075

Shuttle-Data-Tape XML Translator

Lyndon B. Johnson Space Center, Houston, Texas

JSDTImport is a computer program for translating native Shuttle Data Tape (SDT) files from American Standard Code for Information Interchange (ASCII) format into databases in other formats. JSDTImport solves the problem of organizing the SDT content, affording flexibility to enable users to choose how to store the information in a database to better support client and server applications. JSDTImport can be dynamically configured by use of a simple Extensible Markup Language (XML) file. JSDTImport uses this XML file to define how each record and field will be parsed, its layout and definition, and how the resulting database will be structured. JSDTImport also includes a client application programming interface (API) layer that provides abstraction for the data-querying process. The API enables a user to specify the search criteria to apply in gathering all the data relevant to a query. The API can be used to organize the SDT content and translate into a native XML database. The XML format is structured into efficient sections, enabling excellent query performance by use of the XPath query language. Optionally, the content can be translated into a Structured Query Language (SQL) database for fast, reliable SQL queries on standard database server computers.

This program was written by Matthew R. Barry and Richard N. Osborne of United Space Alliance for **Johnson Space Center**. *For further information, contact the Johnson Technology Transfer Office at (281) 483-3809.*
MSC-23579

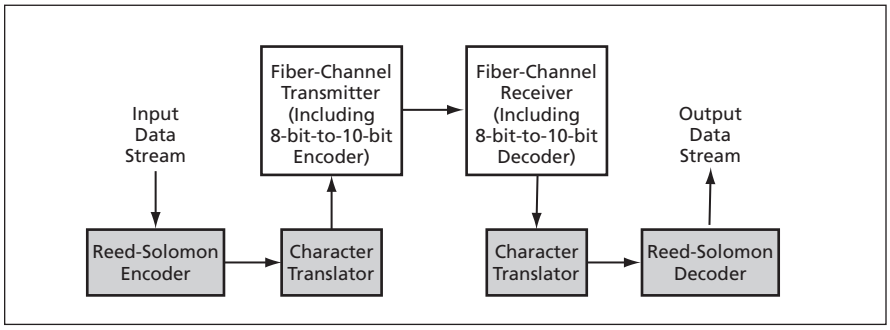
Highly Reliable, High-Speed, Unidirectional Serial Data Links

Forward error correction would afford reliability in the absence of retransmission.

Lyndon B. Johnson Space Center, Houston, Texas

Highly reliable, high-speed, unidirectional serial data-communication subsystems have been proposed to be installed in an upgrade of the computing systems aboard the space shuttles. The basic design concept of these serial data links is also adaptable to terrestrial use in applications in which there are requirements for highly reliable serial data communications.

The hardware and software aspects of the architecture of the data links are dictated largely by a requirement, in the original space-shuttle application, for one computer to monitor the memory transactions and memory contents of other computers in real time with high reliability and without reliance on requests for retransmission. To minimize weight while affording a capability to transfer data at a required rate of 2.56×10^8 bits per second, it was decided that the links would be serial ones of the fiber-channel type. ["Fiber channel" denotes a type of serial computer bus that is used to connect a computer (usually a supercomputer) with a high-speed data-storage device. Depending on the spe-



A **Unidirectional Serial Data Link** according to the proposal would be made from a commercial fiber-channel transmitter and receiver augmented externally with character translators and a Reed-Solomon encoder and decoder.

cific application, the physical connection between the transmitter and receiver could be made via an optical fiber or a twisted pair of wires.]

Heretofore, fiber-channel links have ordinarily been bidirectional and have operated under protocols that provide for receiving stations to detect errors and request retransmission when necessary. In the present case, the time taken by processing to request retransmission would conflict with the requirement for real-time transfer of data. To ensure reliability without retransmission, a link according to the proposal would utilize a modified version of the normal fiber-channel character set in conjunction with forward error correction by means of a Reed-Solomon code (see figure). The Reed-Solomon encoding and decoding and the translations between the normal and modified character sets would be effected by logic circuitry external to the fiber-channel transmitter and receiver, which would be commercial off-the-shelf units.

The receiving end of the link could detect and correct errors at a rate as high as 4 million times per second, if necessary. The receiver detects uncorrectable double-byte errors. It has been estimated that uncorrectable-error rate would amount to one failure in about 10^{19} characters.

This work was done by Robert M. Cole and Jamie Bishop of Lockheed Martin Corp. for **Johnson Space Center**.

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act {42 U.S.C. 2457(f)}, to Lockheed Martin Corp. Inquiries concerning licenses for its commercial development should be addressed to:

Lockheed Martin Systems Integration
1801 State Route 17C
Building 102
Owego, NY 13827-3998

Refer to MSC-23763, volume and number of this NASA Tech Briefs *issue, and the page number.*

Data-Analysis System for Entry, Descent, and Landing

NASA's Jet Propulsion Laboratory, Pasadena, California

A report describes the Entry Descent Landing Data Analysis (EDA), which is a system of signal-processing software and computer hardware for acquiring status data conveyed by multiple-frequency-shift-keying tone signals transmitted by a spacecraft during descent to the surface of a remote planet. The design of the EDA meets the challenge of processing weak, fluctuating signals that are Doppler-shifted by amounts that are only partly predictable. The software supports both real-time and post processing. The software performs fast-Fourier-transform integration, parallel frequency tracking with prediction, and mapping of detected tones to specific events. The use of backtrack and refinement parallel-processing threads helps to minimize data gaps. The design affords flexibility to enable division of a descent track into segments, within each of which the EDA is configured optimally for processing in the face of signal conditions and uncertainties. A dynamic-lock-state feature enables the detection of signals using minimum required computing power — less when signals are steadily detected, more when signals fluctuate. At present, the hardware comprises eight dual-processor personal-computer modules and a server. The hardware is modular, making it possible to increase computing power by adding computers.

This work was done by Timothy Pham, Christine Chang, Edgar Sartorius, Susan Finley, Leslie White, Polly Estabrook, and David Fort of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

The software used in this innovation is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (818) 393-2827. Refer to NPO-41220.