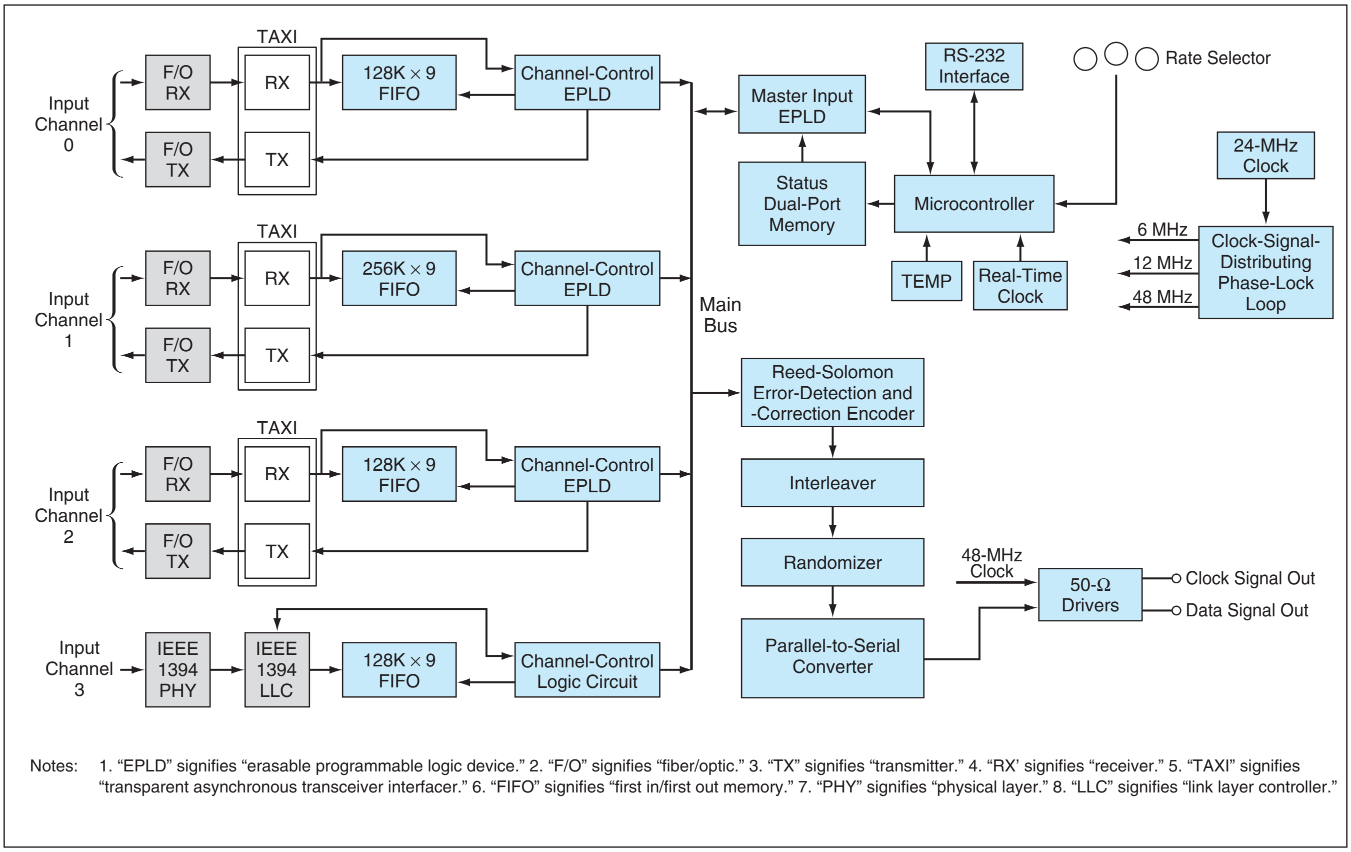

This **Data Multiplexer** combines four input streams (three fiber-optic TAXI interface channels and one IEEE 1394 channel) into a single output stream.

and/or bit-stream signals that conform to the standards of the Consultative Committee for Space Data Systems (CCSDS). The IEEE 1394 interface accepts an isochronous signal like that from a digital camcorder or a video tape recorder.

The processing of the four input data streams to combine them into one output stream is governed by a statistical multiplexing algorithm that features a flow-control capability and makes it possible to utilize the transmission channel with nearly 100-percent efficiency. This algorithm allocates the available bandwidth of the transmission channel to the data streams according to a combination of data rates and preassigned priorities. Incoming data streams that demand too much bandwidth are blocked. Bandwidth not needed for a transmission of a given data stream is allocated to other streams as available. Priority is given to the IEEE 1394 stream.

In addition to the four incoming data streams, the multiplexer transmits data on the status of the system. An operator can monitor and control the multiplexer via displays and controls on the multiplexer housing. The output of the multiplexer is connected via a coaxial cable with an impedance of 50 Ω to an interface circuit compatible with the space-shuttle high-speed digital downlink, which operates at a rate of 48 Mb/s.

This work was done by S. Douglas Holland, Glen F. Steele, Denise M. Romero, and Robert David Koudelka of **Johnson Space Center**. *Further information is contained in a TSP (see page 1).*

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, Johnson Space Center, (281) 483-0837. Refer to MSC-23303.

Viewing ISS Data in Real Time via the Internet

Marshall Space Flight Center, Alabama

EZStream is a computer program that enables authorized users at diverse terrestrial locations to view, in real time, data generated by scientific payloads aboard the International Space Station (ISS). The only computation/communication resource needed for use of EZStream is a computer equipped with standard Web-browser software and a connection to the Internet. EZStream runs in conjunction with the TReK software, described in a prior *NASA Tech Briefs* article, that coordinates multiple streams of data for the ground communication system of the ISS. EZStream includes server components that interact with TReK within the ISS ground communication system and client components that reside in the users' remote computers. Once an authorized client has logged in, a server component of EZStream pulls the requested data from a TReK application-program interface and sends the data to the client. Future

EZStream enhancements will include (1) extensions that enable the server to receive and process arbitrary data streams on its own and (2) a Web-based graphical-user-interface-building subprogram that enables a client who lacks programming expertise to create customized display Web pages.

This program was written by Gerry Myers and Jim Chamberlain of AZ Technology, Inc., for **Marshall Space Flight Center**. *For further information, contact the company's New Technology Representative, David O'Neil, at (256) 837-9877.*
MFS-31836

Autonomous Environment-Monitoring Networks

These neural networks recognize novel features in streams of input data.

NASA's Jet Propulsion Laboratory, Pasadena, California

Autonomous environment-monitoring networks (AEMNs) are artificial neural networks that are specialized for recognizing familiarity and, conversely, novelty. Like a biological neural network, an AEMN receives a constant stream of inputs. For purposes of computational implementation, the inputs are vector representations of the information of interest. As long as the most recent input vector is similar to the previous input vectors, no action is taken. Action is taken only when a novel vector is encountered. Whether a given input vector is regarded as novel depends on the previous vectors; hence, the same input vector could be regarded as familiar or novel, depending on the context of previous input vectors. AEMNs have been proposed as means to enable exploratory robots on remote planets to recognize novel features that could merit closer scientific attention. AEMNs could also be useful for processing data from medical instrumentation for automated monitoring or diagnosis.

The primary substructure of an AEMN is called a spindle. In its simplest form, a spindle consists of a central vector (**C**), a scalar (r), and algorithms for changing **C** and r. The vector **C** is constructed from all the vectors in a given continuous stream of inputs, such that it is minimally distant from those vectors. The scalar r is the distance between **C** and the most remote vector in the same set.

The construction of a spindle involves four vital parameters: setup size, spindle-population size, and the radii of two novelty boundaries. The setup size is the number of vectors that are taken into account before computing **C**. The spindle-population size is the total number of input vectors used in constructing the spindle — counting both those that arrive before and those that arrive after the computation of **C**. The novelty-boundary radii are distances from **C** that partition the neighborhood around **C** into three concentric regions (see Figure 1). During construction of the spindle, the changing spindle radius is denoted by h. It is the final value of h, reached before beginning construction on the next spindle, that is denoted by r.

During construction of a spindle, if a new vector falls between **C** and the inner boundary, the vector is regarded as completely familiar and no action is taken. If the new vector falls into the region between the inner and outer boundaries, it is considered unusual enough to warrant the adjustment of **C** and r by use of the aforementioned algorithms, but not unusual enough to be considered novel. If a vector falls outside the outer boundary, it is considered novel, in which case one of several appropriate responses could be initiation of construction of a new spindle.

An AEMN comprises a collection of spindles that represent a typical history or range of behaviors of a system that one seeks to monitor. An AEMN can be represented as a familiarity map, on which successive spindles are represented by adjacent circles that are added as construction proceeds. A familiarity map could be simple or complex, depending on the monitored system. For example, the range of behaviors of a complex system might be represented by a networklike familiarity map that could even include dead-end branches that lead to the demise of the system. An automated monitoring system based on the AEMN corresponding to the familiarity map could recognize that the system was

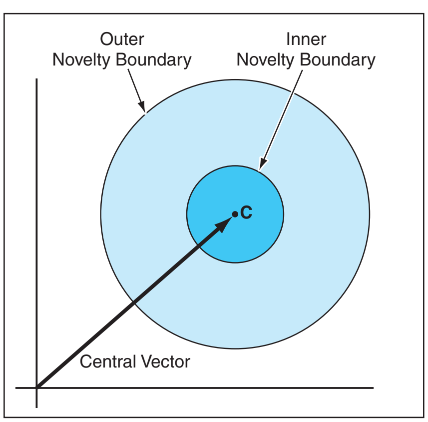

Figure 1. The **Central Vector and The Novelty Boundaries** play major roles in the construction of a spindle.

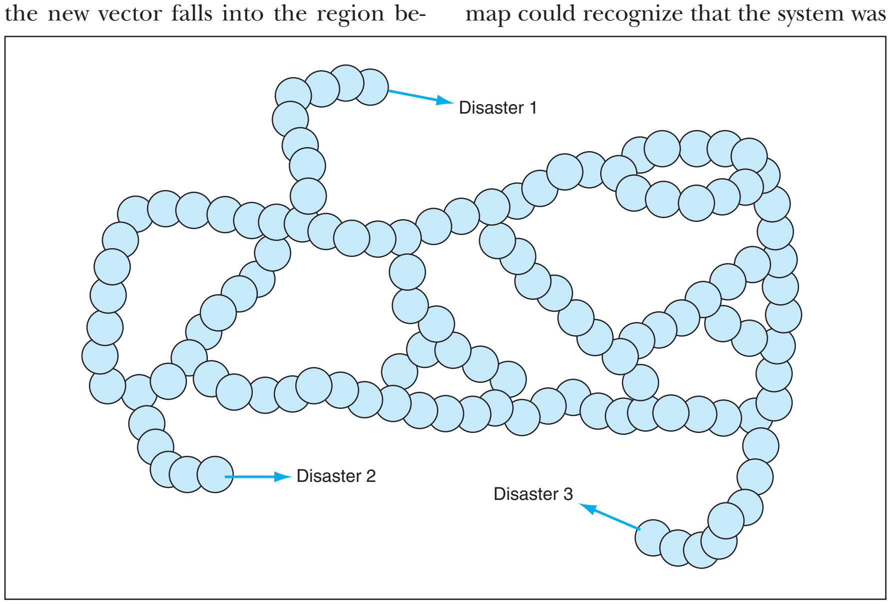

Figure 2. A **Familiarity Map** comprises a sequence of overlapping circles that represent spindles constructed from data acquired in observation or simulation of a system to be monitored.