by the user. The output includes summaries of rocket-engine operation, ignition overpressure time histories, and one-third octave sound pressure spectra of the predicted launch acoustics. Also, documentation is available to the user to help him or her understand the various aspects of the graphical user interface and the required input parameters.

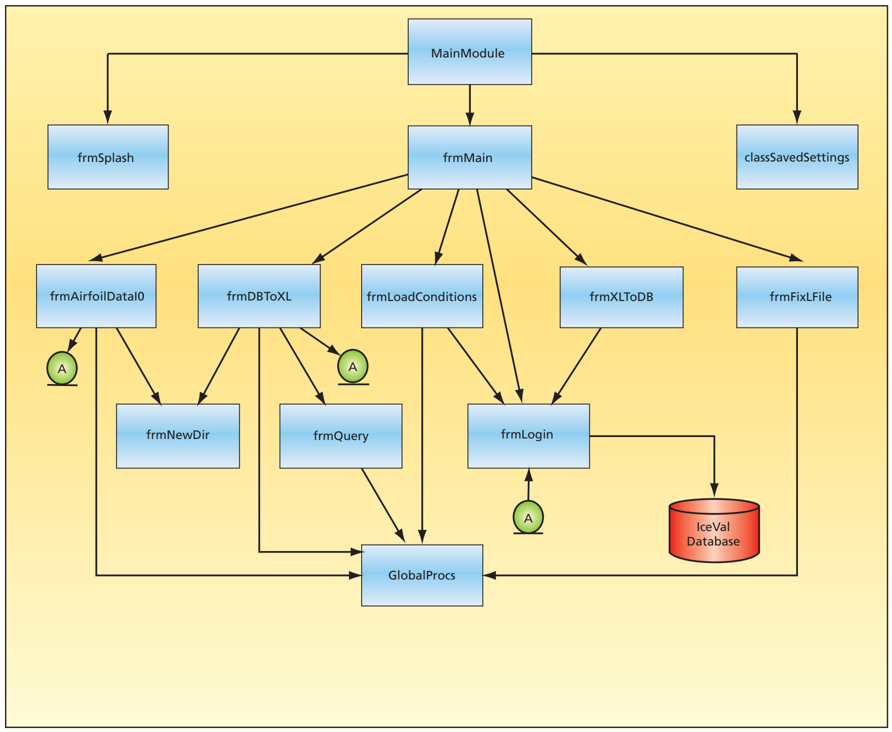
This work was done by Matthew Casiano of Marshall Space Flight Center. For more information, contact Sammy Nabors, MSFC Commercialization Assistance Lead at sammy.a.nabors@nasa.gov. Refer to MFS-32579-1.

Interactive, Automated Management of Icing Data

John H. Glenn Research Center, Cleveland, Ohio

IceVal DatAssistant is software (see figure) that provides an automated, interactive solution for the management of data from research on aircraft icing. This software consists primarily of (1) a relational database component used to store ice shape and airfoil coordinates and associated data on operational and environmental test conditions and (2) a graphically oriented database access utility, used to upload, download, process, and/or display data selected by the user.

The relational database component consists of a Microsoft Access 2003 database file with nine tables containing data of different types. Included in the database are the data for all publicly releasable ice tracings with complete and verifiable test conditions from experiments conducted to date in the Glenn Research Center Icing Research Tunnel. Ice shapes from computational simulations with the corresponding conditions performed utilizing the latest version of the LEWICE ice shape prediction code are likewise included, and are linked to the equivalent experimental runs.



IceVal DatAssistant Software system structure.

The database access component includes ten Microsoft Visual Basic 6.0 (VB) form modules and three VB support modules. Together, these modules enable uploading, downloading, processing, and display of all data contained in the database. This component also affords the capability to perform various database maintenance functions — for example, compacting the database or creating a new, fully initialized but empty database file.

This program was written by Laurie H. Levinson of Glenn Research Center. 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-18343-1.

LDPC-PPM Coding Scheme for Optical Communication

This scheme offers competitive performance and is suitable for parallel processing.

NASA's Jet Propulsion Laboratory, Pasadena, California

In a proposed coding-and-modulation/demodulation-and-decoding scheme for a free-space optical communication system, an error-correcting code of the low-density parity-check (LDPC) type would be concatenated with a modulation code that consists of a mapping of bits to pulse-position-modulation (PPM) symbols. Hence, the scheme is denoted LDPC-PPM. This scheme could be considered a competitor of a related prior scheme in which an outer convolutional error-correcting code is concatenated with an interleaving operation, a bit-accumulation operation, and a PPM inner code. Both the prior and present schemes can be characterized as serially concatenated pulse-position modulation (SCPPM) coding schemes.

Figure 1 represents a free-space optical communication system based on ei-

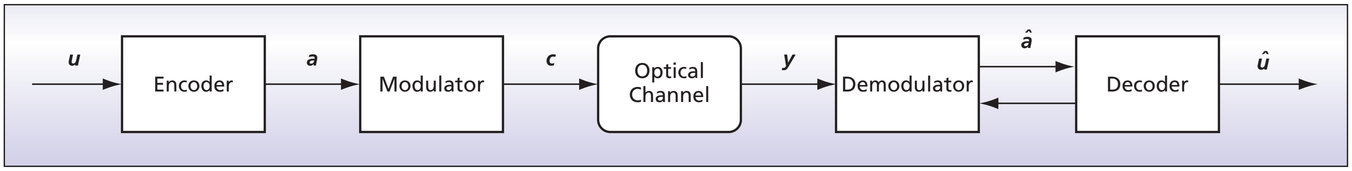


Figure 1. **Data Are Encoded**, then transmitted as a PPM optical signal. At the receiving end, the optical signal is demodulated and decoded in an iterative process.

ther the present LDPC-PPM scheme or the prior SCPPM scheme. At the transmitting terminal, the original data (u) are processed by an encoder into blocks of bits (a), and the encoded data are mapped to PPM of an optical signal (c). For the purpose of design and analysis, the optical channel in which the PPM signal propagates is modeled as a Poisson point process. At the receiving terminal, the arriving optical signal (y) is demodulated to obtain an estimate ($\hat{a}$) of the coded data, which is then processed by a decoder to obtain an estimate ($\hat{u}$) of the original data.

The demodulation and decoding subprocesses are iterated to improve the final estimates in an attempt to reconstruct the original data stream (u) exactly. The decoder implements a soft-input/soft-output (SISO) algorithm. This or any SISO decoder receives, as soft inputs, noisy versions (estimates and log-likelihoods of the estimates) of the input and output of the encoder and produces updated log-likelihoods of the estimates of the input, the output, or both. These estimates and their log-likelihoods may then be transmitted to other SISO modules in the receiver, where they are treated as noisy inputs.

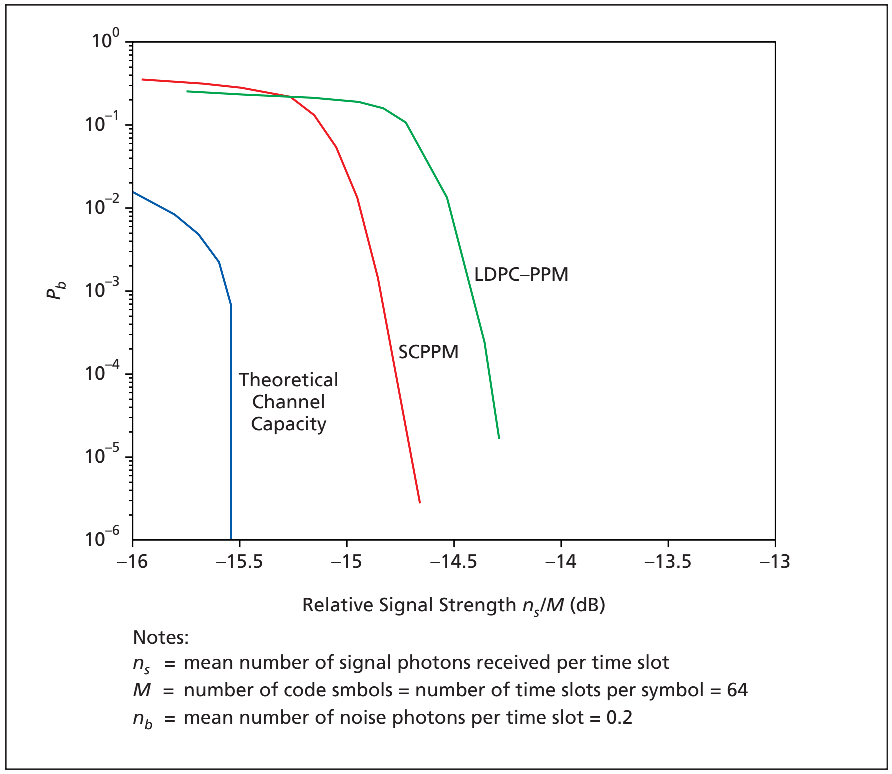


Figure 2. The **Bit-Error Rate (P_b)** was computed as a function of relative signal strength for two coding schemes and for the theoretical channel capacity for the special case of code blocks of ≈8Kb length, n_b = 0.2, and M = 64.

In comparison with non-iterative alternatives, both the present LDPC-PPM scheme and the prior SCPPM scheme offer better performance. In comparison with iterative alternatives, both schemes afford better performance with less complexity. In comparison of these schemes with each other, each is partly advantageous and partly disadvantageous: For example, computational simulations have shown that for a block length of about 8Kb, the performance of the prior SCPPM scheme is about 0.8 dB away from the theoretical channel capacity, while the performance of the LDPC-PPM scheme is expected to be about 1.2 dB away from the theoretical channel capacity at a bit-error rate of about 2×10^{-5} (see Figure 2); in other words, the performance of the LDPC-PPM scheme is expected to be about 0.4 dB below that of the prior SCPPM scheme. On the other hand, unlike the prior SCPPM scheme, the LDPC-PPM scheme is lends itself very well to low-latency parallel processing. Either scheme could serve as the basis of design of an optical communication system, depending on requirements pertaining to the PPM order, latency, and architecture of the system.

This work was done by Maged Barsoum, Bruce Moision, Dariush Divsalar, and Jon Hamkins of Caltech and Michael Fitz of UCLA for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-44408

Complex Event Recognition Architecture

Lyndon B. Johnson Space Center, Houston, Texas

"Complex Event Recognition Architecture" ("CERA") is the name of a computational architecture, and software that implements the architecture, for recognizing complex event patterns that may be spread across multiple streams of input data. One of the main components of CERA is an intuitive event pattern language that simplifies what would otherwise be the complex, difficult tasks of creating logical descriptions of combinations of temporal events and defining rules for combining information from different sources over time. In this language, recognition