NASA SBIR 2005 Phase I Solicitation

O1.01 Coding, Modulation, and Compression

Lead Center: GSFC

Participating Center(s): GRC, JPL

Power and spectrum efficient solutions are needed for both near Earth and deep space application scenarios. Coding efficiency from 50% to 87% will be combined with digital modulation from 2 bits/symbol/Hz up to yield-optimal solutions. In compression, tunable technique from over 10:1 compression ratio to lossless is desired. Proposals are sought in the following specific areas:

Compression

- Software for transcoding of compressed bit streams from CCSDS Image Data Compression recommendation to commercial JPEG2k bit stream; and

- Demonstration in either PC-based or workstation-based systems with minimal loss of quality during the transcoding process.

Coding and Coded Modulation

- A design for a set of coded modulations operating at bandwidth efficiencies from 0.5 bits/symbol/Hz to 3+ bits/symbol/Hz, in steps of approximately 0.5 bits/symbol/Hz. Each point design shall require a bit signal-to-noise ratio not higher than 1 dB above the unconstrained-input, 2-dimensional capacity of the additive white Gaussian noise (AWGN) channel. The preferred input block frame length is 4K to 16K bits.

- Special emphasis is placed on a channel coding design suitable for near Earth missions, operating at least at over 80% coding rate with an error floor lower than Bit-Error-Rate (BER) of 10e-10, and encoder/decoder complexity consistent with implementations at data rates up to 1 Gbps. The new design, when compared with current CCSDS Reed-Solomon (255,223) coder at BER of 10e-5, should have over 2dB Eb/No gain. The preferred code block frame length is from 4K to 16K bits.

- High-speed implementation of the coded modulation suite with processing throughput close to 300 Mbits/sec and demonstration in test bed. The test bed shall include functions of encoding, modulation, demodulation, and decoding. The ability for the test bed to incorporate channel impairments, an over-the-air RF component, and software re-configurability, are desirable.
RF receivers with symbol synchronizer providing soft-decision output over 8 bits/sample, as input to Maximum Likelihood Detector to provide metrics for decoding Trellis-coded-Modulation.