of the network data flow. The term "leveling" refers to the spreading of data across a longer time horizon without violating the corresponding latency requirement of the data type. Two versions of the leveling scheme were developed:

1. A straightforward version that simply spreads the data of each data type across the time horizon and doesn't take into account the interactions among data types within a pass, or between data types across overlapping passes at a network node, and is inherently sub-optimal.

2. Two-state Markov leveling scheme that takes into account the second order behavior of the store-and-forward mechanism, and the interactions among data types within a pass.

The novelty of this approach lies in the modeling of the store-and-forward mechanism of each network node. The term store-and-forward refers to the data traffic regulation technique in which data is sent to an intermediate network node where they are temporarily stored and sent at a later time to the destination node or to another intermediate node. Store-and-forward can be applied to both space-based networks that have intermittent connectivity, and ground-based networks with deterministic connectivity. For ground-based networks, the store-and-forward mechanism is used to regulate the network data flow and link resource utilization such that the user data types can be delivered to their destination nodes without violating their respective latency requirements.

This work was done by Kar-Ming Cheung, Esther H. Jennings, and John S. Segui of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.

The software used in this innovation is available for commercial licensing. Please contact Dan Broderick at Daniel.F.Broderick@jpl.nasa.gov. Refer to NPO-48426.

Detection of Moving Targets Using Soliton Resonance Effect

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The objective of this research was to develop a fundamentally new method for detecting hidden moving targets within noisy and cluttered data-streams using a novel "soliton resonance" effect in nonlinear dynamical systems.

The technique uses an inhomogeneous Korteweg de Vries (KdV) equation containing moving-target information. Solution of the KdV equation will describe a soliton propagating with the same kinematic characteristics as the target. The approach uses the time-dependent data stream obtained with a sensor in form of the "forcing function," which is incorporated in an inhomogeneous KdV equation. When a hidden moving target (which in many ways resembles a soliton) encounters the natural "probe" soliton solution of the KdV equation, a strong resonance phenomenon results that makes the location and motion of the target apparent.

Soliton resonance method will amplify the moving target signal, suppressing the noise. The method will be a very effective tool for locating and identifying diverse, highly dynamic targets with ill-defined characteristics in a noisy environment.

The soliton resonance method for the detection of moving targets was developed in one and two dimensions. Computer simulations proved that the method could be used for detection of singe point-like targets moving with constant velocities and accelerations in 1D and along straight lines or curved trajectories in 2D. The method also allows estimation of the kinematic characteristics of moving targets, and reconstruction of target trajectories in 2D. The method could be very effective for target detection in the presence of clutter and for the case of target obscurations.

This work was done by Igor K. Kulikov of Caltech and Michail Zak of Raytheon for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-48785