Prometheus Capabilities & Projects

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1. Material Identification using Synthetic Aperture Radar (MISAR). In current use in a US Military radar (hence TRL 9), MISAR achieves detection and discrimination of radar targets by exploiting dielectric material responses.
2. Material Identification Reflectivity Kernel (MIRK). NAVSEA IWS 5, ONR, SSP and PMS 404 all supported the initial porting of MISAR to the sonar environment for improved discrimination using elastic material responses. A major US prime contractor and two other international companies have funded us from their internal money to tune MIRK to their specific sonars. That major prime is now drafting an agreement for Prometheus to give them an exclusive worldwide license for applying MIRK to towed array MCM.
3. Feature Based Pattern Recognition (FBPR). Based upon the non–Abelian group harmonic analysis described in the monograph *Group Filters and Image Processing* (Psypher Press 2003) by Prometheus Principal Scientists Myoung An and Richard Tolimieri, a family of unitary image transforms associated to noncommutative groups is generated and applied to sensor images. Completed applications include:
   (a) Line Finder (LF), developed under JIEDDO sponsorship for the automatic detection of IED triggers in single-pass images;
   (b) automatic mine detection, developed in coordination with Raytheon and NSWC–Panama City with ONR support;
   (c) video processing algorithm, code and GUI for the automatic detection of cannisters dumped off Pearl Harbor during and after World War II – see http://www.prometheus-us.com/oz/anomaly-detect.mp4.
4. Prometheus Orthonormal Set (PONS; US patent #5913186, 15 June 1999, Byrnes *et al*). Radar waveforms based upon PONS are in use in a current military radar system (TRL 9). Also Prometheus built and successfully tested a prototype 2–way radio based upon PONS software. Publications describing the mathematics underlying PONS are at http://www.prometheus-us.com/PONS-papers/.
5. Chaotic Sweeping Waveforms (CSW). Based upon *Ideal Sequence Design in Time–Frequency Space: Applications to Radar, Sonar, and Communication Systems*, Myoung An, A. Brodzik and Richard Tolimieri, Birkhäuser, 2009, these unique waveforms allow multiple platforms to transmit in the same time–frequency window. They do not interfere. In addition, the fact that the system can operate in the same time–frequency window allows the unique tracking of multiple targets. Finally, in time–frequency space the CSW waveforms are non–deterministic and therefore look like noise, enhancing counter interceptibility.
6. Real–time broadband reverberation modeling. Employing Navy SBIR Phases I, II and III contracts Prometheus developed ProVerb, now being used (TRL 9) in the NUWC Weapons Analysis Facility (WAF) to provide real–time, accurate and computationally efficient simulation of broadband reverberation. This is greatly increasing the accuracy of torpedo testing in the WAF, particularly in the critical shallow water environment, and dramatically reducing the cost of the development and testing of torpedoes. The WAF in Adelaide, Australia is also employing ProVerb.

The above should be considered as examples of Prometheus capabilities and expertise, not as boundaries on what we can accomplish.

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