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C2 in the D-DIL:
Augmenting Conventional System Shortfalls at the Edge via On-Station Software Solutions

Background: As battlefield weaponry and tactics advance, so must the ways in which combat units conduct its tactical operations in areas where various important signal sources and other contextual data may be less than optimal, missing all together or even tampered with. The fluid state in these battle space environments is further impacted by wildly fluctuating bandwidth, intermittent connectivity, and, at times, complete data blockage.[1] In Disrupted, Disconnected, Intermittent and Limited bandwidth (D-DIL) environments, GPS may be denied due to environmental and/or adversary-initiated interference resulting in degraded signal integrity. In such scenarios, best case would have other viable data/signal sources (Imagery, RFI, music, AM/FM radio, TV talk shows, compass readings, triangulation sources, etc.) available for use in geolocation and navigation measurements and processes. Worst case, only imagery is available.

Problem Statement: D-DIL environments present unique challenges that can relegate an agile, connected fighting unit into a "disadvantaged user" vulnerable to a lesser enemy who is used to operating in these lacking conditions[2]. Measures must be taken to mitigate this operational degradation for the safety, security and lethality of our Warfighters. This level of disruption can dramatically hinder command and control elements and platforms which can severely disrupt critical mission activities. Thus, Command may be forced to use whatever other signals and data they can pick up/intercept in combination with terrain imagery, which may fall anywhere on the NIIRS[2] scale, to guide platforms accurately to their targets and destinations. However,

- Analysts still need a greater than 90% confidence level (CL) that the object of interest (OI) is being accurately identified and can be adequately mapped. (See **BakerSCI NIIRS WP102sci** for more detailed information.);
- Conventional on-station processing has not kept up with off-station post processing leading to data and decision latency.

Mission Critical Need: At the Edge, sensor and signal loss and jamming pose difficult problems for conventional kinetic operations, thus an alternative solution must be used to generate reliable and precise information and intelligence through available IMINT and SIGINT simultaneously across the data types in their pre and post processed states by a single cross-type analysis system. Already at a latency disadvantage, delays can be further compounded when one must wait until post-processing to garner intelligence from fused data being analyzed by multiple, different systems, which is highly undesirable. At times, there may be only one data type (imagery, radar, triangulation, etc.) available, so extracting the DEEP context within that single data type becomes critical to the precision of the platform's location and navigation systems.

BakerSCI Science & Technologies (S&T) Capabilities: BakerSCI's S&T address and mitigate/circumvent various hindrances of conventional algorithmic, statistical, and data analytic methods and systems through proprietary methods generally titled, Integrated Multi-Paradigm Processing™ (IMPP™). IMPP substantially augments conventional systems' capabilities by enabling them to discover substantially deeper data context about the micro and macro data environments. IMPP enables significant amplification of existing capabilities through Data Environment Association and Interaction™ as well as enables the implementation of new capabilities which can auto-optimize processing components and self-improve its own metacriteria and metaconnections. The use of IMPP results in higher CL decision making, guidance, navigation and targeting.

Generally, BakerSCI's applicable capabilities to this problem can:

- test and determine data, algorithm and signature fitness in both conventional system and BakerSCI system implementations;
- employ *n*--point feature analysis™, where *n is a very large range of variables for the number of data points and their organization that can be analyzed by BakerSCI's S&T;*
- operate linear-based processing methods which can be run at high speeds in a wide variety of environments, including low-bandwidth environments;
- increase CL by allowing SMEs to "tune" BakerSCI's unbiased algorithms with viable and modeling bias;
- create unique signature that are based on the associatedness and behavior of processing results rather than conventional signature creation models;
- employ proprietary methods to create neuronal ensembles from ordered and unordered signature firings and using those ensembles to independently or in amalgamated supersignatures unique to a feature and/or sensor, etc;
- run with proprietary algorithms and data evaluating processes (herein collectively defined as "algorithms") which are: 1) foundational, small and nimble; 2) atypical to conventional statistical and geometric algorithms 3) data / orientation agnostic; 4) unbiased; 5) associatedness and emergence-based/driven;
- run in new and novel software engine processes and designs,

BakerSCI Applicable Use Case Examples (Upon Request)
IMINT; SIGINT; MASINT; HUMINT; Healthcare Imaging and Genomic Research, Diagnostics and Compliance; Financial Intelligence, Transactions and Compliance; Energy Management & Distribution; Ideological Impact & Modeling; Human Performance; Logistics & Transportation.

[1] Beachy, A.J. (June 2015). C2 at the Edge: Operating in a Disconnected Low-Bandwidth Environment (master's **thesis**). Retrieved from www.dtic.mil
[2] Office of Naval Research C4ISR Department (Code 31). S&T Strategic Plan 2012. Retrieved from https://www.onr.navy.mil/
[3] Pike, S. and Aftergood, S. (1998). Federation of American Scientists. Retrieved on 20 May 2018 from https://fas.org/irp/imint/niirs.htm.