SENSOR DATA LINK – FLEXIBLE AND STANDARD DIGITAL COMMUNICATIONS FOR CURRENT AND FUTURE FORCE SENSORS

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ABSTRACT

To fulfill evolving sensor system interface and communications requirements, a team of government organizations have collaborated to develop the Sensor Data Link (SDL); providing a flexible framework of joint standard data representations, messages, and common processes for current and Future Force sensors.

1. INTRODUCTION

The roles of sensor systems in the current and Future Force have necessarily effected an evolution of sensor communications requirements. No longer do the closed, stove pipe solutions of the past come close to meeting the interoperating needs. New sensor technologies and deployment concepts have pushed sensors into the net centric world and have simultaneously presented a requirement for joint standard digital communications capable of dynamic discovery of nodes on the network, runtime configurability of sensing devices, multi-connection support, and sensor to sensor direct communications.

1.1 Sensor Data Link (SDL)

The Sensor Data Link (SDL) is the culmination of the Army sensor communications standardization initiative, Sensor Link Protocol (SLP), begun in 1997 by the Project Manager, Night Vision/Reconnaissance, Surveillance, and Target Acquisition (PM NV/RSTA) and their parent organization Program Executive Office, Intelligence, Electronic Warfare, and Sensors (POE IEW&S). The SLP is an enabling technology developed for the PM NV/RSTA family of sensor systems which provides a common digital communications protocol for command, control, and data exchange (PM/NVRSTA: ICD-SLP-200 Rev A and SLP-MSG-210 Rev (-), 2001). As SLP was used to integrate sensors with host systems and platforms it became apparent that the interoperability benefits it provided appealed to a broader audience of users. The PM NV/RSTA and PEO IEW&S initiated the process of migrating the SLP into a military standard that would be applicable and appropriate for joint use in a net centric environment. The result of these efforts is the SDL; enabling sensor interoperability via standardization of data representations and the implementation of a highly efficient and flexible message set applicable to all sensor types.

Joining this initiative is the RDECOM CERDEC Night Vision Electronic Sensor Directorate (NVESD). Collectively, these government organizations are developing the SDL. Members of the Joint Sensor Community and the Army's Future Combat System (FCS) facilitate these efforts through participation in the process of generating and vetting sensor information exchange requirements.

2. DEVELOPMENT STRATEGY

To ensure a Joint standard data representation the existing Joint standards environment and development community was analyzed. Assessed against the interface requirements of sensor systems, in particular bandwidth considerations, the military standard family of Tactical Data Links (TDLs) was determined to be the most appropriate vehicle for the transmission of sensor data in the battlefield.

To support the full range of sensor systems' data and capabilities a highly flexible messaging format was required. It was determined that the optimal path to meet the interface exchange requirements and ensure standard data representations for sensors was to develop the SDL as a subset of the Variable Message Format (VMF) standard (MIL-STD-6017) (Department of Defense Interface Standard: MIL-STD-6017, 2003). This vehicle

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established a framework of not only formatting and processing rules but also of review and acceptance across the Joint Services and NATO countries. VMF provides the message body standard. To support the exchange of sensor data across existing Link interfaces, it was necessary to also support a standard message header format common to not only systems which directly integrate and employ sensors but also common to systems providing analysis and command and control (C2) functions on the battlefield. The MIL-STD-2045-47001C header is the standard of choice for the services to carry VMF message body payloads; providing application layer message management and processing functionality (Department of Defense Interface Standard: MIL-STD-2045-47001C, 2002).

3. Sensor Information Exchange Requirements (IER) & Implementation Flexibility

Satisfying the dynamic and open-ended implications of the current, Future Force, and FCS-specific sensor information exchange requirements demanded that SDL be at its heart a protocol that enabled choice: choice at any point, as determined by the sensor system's individual requirements, from design choices through runtime choices. Further, how and when to implement these choices remain in the purview of the system developers and are based up on the requirements and doctrine applicable to the system. Core to providing this flexibility of choice were the development of SDL's Component-Wise Architecture and the exploitation of the message formatting and processing power within VMF.

3.1 Interface Abstraction via the Component-Wise Architecture

SDL's Component-Wise Architecture utilizes a dynamic schema for the definition of a sensing device. The device's capabilities, operations, and the sensing components can all be specified via a Configuration. Fundamentally, a device (sensor or otherwise) comprises its constituent components plus a set of common SDL processes (e.g., the discovery process). Sensing components are defined along functional lines rather than by the underlying technology or hardware; providing a generic method for defining, organizing, and manipulating the actual hardware components of a device – acting in essence as a generic pointing to the hardware and providing a common API for sensor developers and integrators that is independent of the hardware implementation. The SDL message set supports the dynamic discovery of other nodes (sensing and non-sensing) on the network. Support includes: dynamically obtaining an unique Device Identifier, notifying the network of the presence and operational status of a node, establishing one or more information exchange relationships to other nodes (of any type), and specifying the parameters of information exchanges to be performed during a mission thread. These capabilities are critical to support operation in the net centric and potentially ad hoc networking environment of the Future Force. Additionally, the VMF format is highly bit efficient; supporting the most restricted bandwidths used by sensors.

CONCLUSION

The PM NV/RSTA, PEO IEW&S, and NVESD have created the SDL in response to the need for a joint standard digital communications protocol for current and Future Force sensor systems. The SDL provides the message exchanges and common processes which enables sensor operations in a net centric environment. The Component-Wise Architecture and use of VMF together with the joint collection and development process used to define the sensor information exchange requirements that are the foundation of SDL ensures maximum interoperability benefits together with the discipline of a Joint standard for current and Future Force sensors.

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PM NV/RSTA, 26 March 2001: Sensor Link Protocol Message Set, SLP-MSG-210 Rev (-) (DoD and DoD contractor only).

Department of Defense Interface Standard, 29 August 2003: Variable Message Format (VMF), MIL-STD-6017 (DoD and DoD contractor only).