



U.S. Army Vetronics Institute
Team Charter

sponsored by the

U.S. Army Vetronics Technology Area

Preface

This document establishes the Vetronics Institute as an arm of the U.S. Army Vetronics Technology Area. The primary objective of the VI is to enhance core mission capabilities by expanding and enriching organizational and individual research capabilities. The charter of the Vetronics Institute describes the scope, principal activities, and motivation for initiating and continuing the activities of the Vetronics Institute.

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1. Introduction

This charter established the Vetronics Institute (VI) as an arm of the U.S. Army Vetronics Technology Area (VTA). The objective of the VI is to provide a mechanism between local universities and the VTA that will facilitate overall research activities. More specifically, the goals of this team are to:

- (i) enable VTA personnel to acquire knowledge of relevant research in Vetronics technology,
- (ii) create the forum and necessary dialogue to identify Vetronics research objectives,
- (iii) contribute to fostering good relationships and cooperation among the local scientific and technological community.

The primary means for accomplishing the stated objective will be to establish liaisons at interested universities with a strong base in relevant research activities. These relationships will be formulated into a unified virtual team that will generate coordinated perspectives and conduct cooperative efforts to insure maximum benefit and efficiency. In particular, a number of universities located in Southeastern Michigan have established rich and diverse research programs that support the large automotive and industrial manufacturing base located in the region. An important facet of the VI will be to leverage these local resources. This team will focus on the following recurring and periodic tasks:

(1) Team Planning and Information Exchange: The Vetronics VI will share ideas, define specific activities needed to accomplish team objectives, determine technological focus areas, and generate and maintain an annual Vetronics Research Plan (VRP). Periodic meetings with VTA personnel will be required for the VI to acquire and maintain an understanding of Vetronics technology and business objectives. The Vetronics technology objectives must be translated into recognized and detailed academic research domains. This mapping should be hierarchical and documented in the VRP. The top level Vetronics technology focus areas are as follows:

- Machine Intelligence/Vehicle Robotics
- Embedded Simulation
- Vehicle System Control and Information Architectures
- User Interface/Crew Stations

As an example, *User Interface Technology* may map into the academic research domains of *telematics* and *human factors* at the top level.

(2) Presentation of Research Overviews: Once the relevant and detailed academic research topics are identified, overviews of these topics will be presented to VTA personnel. These overviews will be presented in a short course format via customized presentations and supporting papers that will include: the *fundamental principles, issues, and motivation* of the research topic; an overview of the state of the art/practice based on literature searches and other knowledge gained by VI assigned experts; and the status of selected and specific research, to include any VTA funded research as well as other relevant research conducted by, or familiar to, the VI expert.

(3) Recommendation of Research Objectives: The VI will identify Vetronics research objectives and document them in the VRP. These research objectives will form a comprehensive set that will best advance the broad spectrum of Vetronics technology. It will consist of important on-going research as well as proposed new research. These research objectives will be considered by the VTA for further funding.

(4) Collaborative Research Activities: VTA research associates and team leaders will specify and undertake collaborative research activities with participating universities that directly contribute to the VTA mission. It is anticipated that the scope and goals of the research activities will be separate and varied.

(5) Team Administration: The VI will perform the necessary administrative tasks to keep the team functioning in an efficient manner. It is anticipated that the contracting mechanisms to accomplish the above tasks with each University will be separate and varied.

2. Team Structure and Process

Team Structure: The VTA will appoint a team leader for the Vetronics VI from a local university. Each participating university will identify a point of contact (POC) for planning and coordination. Each university POC will be responsible for basic planning as well as coordinating within their respective university to acquire the expertise as needed to accomplish the above objectives.

Team Process: General duties of the team leader will be to organize the initial and follow on team activities, provide any needed administrative support not provided by the VTA, facilitate VI team meetings, and to ensure that an effective working relationship between team activities and VTA objectives is maintained. The VI team leader, in coordination with TARDEC University, will identify interested candidate research universities within the Southeastern Michigan. Research teams from interested universities will be invited to a ground-breaking session where the draft charter containing objective, motivation, scope, and means will be presented for review. The VI will include its' final (subject to VTA approval) objective, motivation, scope, and means in the initial version of the VRP.

3. Motivation - Vetronics Technology Scope

3.1 The Impact of Electronics and Complexity on Combat Vehicles: Combat vehicles have evolved from simple mechanical weapon carrying platforms that appeared during World War I to today's sophisticated electronics intense weapon systems. Changes in the battlefield environment in terms of lethality and operational tempo (OPTEMPO) have resulted in the need for continuous improvements in basic combat vehicle capabilities of lethality, mobility, command & control & communications, survivability and maintainability. The rate of change for performance, precision, and operational capability is rapidly increasing the complexity of the total system (depicted in Figure 1). Future Air-land Battle Operations will require a synchronized, highly mobile maneuver force capable of continuous, fluid operations. This battlefield will be three-dimensional and contain a highly sophisticated information dominant electronic dimension. A major influx of digital electronics will be required in military ground vehicles to achieve the capabilities needed for the future. The traditional development approach cannot achieve the

resultant performance and operational capability requirements due to limitations on crew workload, vehicle size, weight and cost. In order to counter these trends, a change must take place to evolve military ground systems from the traditional industrial era approach to the integrated computer information era that is the basis for future Air-land battle operations. **A concept called Vetronics is necessary** to overcome these limitations.

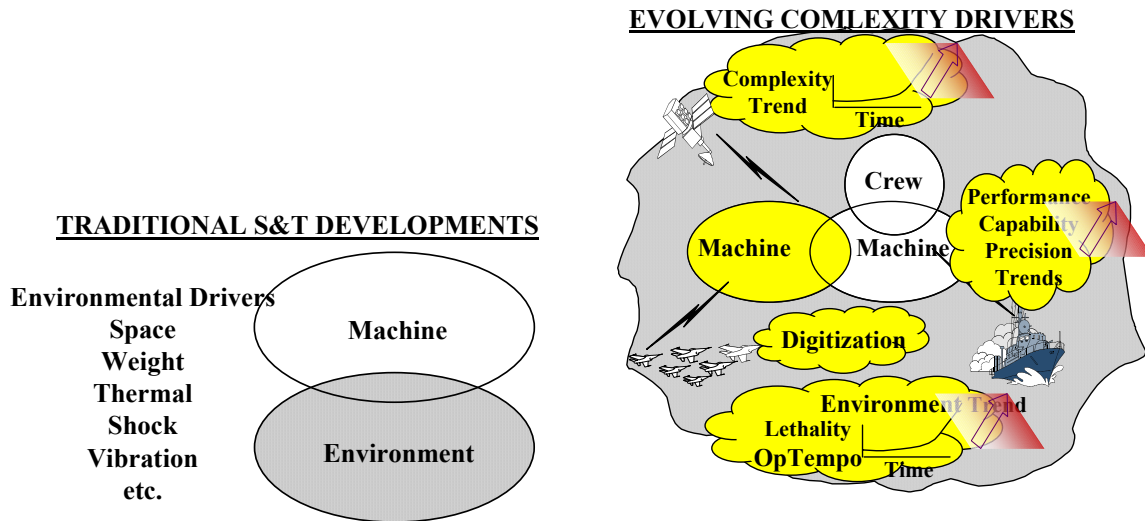


Figure 1 - Evolving Complexity

The traditional approach in combat vehicle development was to focus on technologies applicable to a subsystem for a given operational capability. This resulted in standalone subsystems; that is, they were self contained and generally only required electrical power to operate. They had their own controls and displays, power conditioning, logic, feedback loops etc. This resulted in stovepipe technology development focus that only considered technology drivers for a specific subsystem. This approach fails to take advantage of all of the technology drivers for the total system and thereby loses the synergism potential of the total machine to machine and crew to machine interactions.

3.2 The Vetronics Concept: Vetronics is the **discipline** for **total** electrical/electronics **system** integration. This discipline has both a state-of-the-art (technology) and practice of electronics integration (science/methods) which must be addressed within the Army Science & Technology program if we are to improve on what we have experienced in today's highly integrated vehicles. The most basic Vetronics concept, from an engineering model standpoint (as opposed to a marketing standpoint), is defined as a crew centric and system or global technological resources focused on machine to machine and crew to machine interactions for military ground vehicles (Figure 2).

The fundamental purpose is to provide the necessary crew and machine capability fusion to enable and enhance the following objectives: system performance (or decreasing task execution timelines), cross-functional synergies (i.e. fire on the move), intelligence and automation, and implementation efficiencies. Vetronics is not a specific piece of hardware or software or technology.

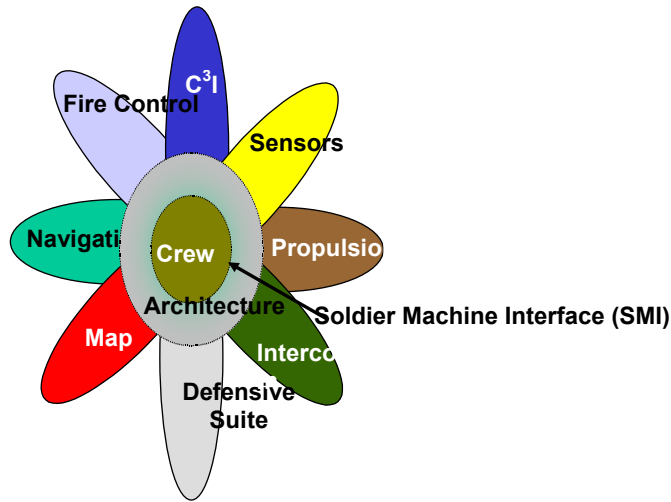


Figure 2 - Capability Fusion

Vetronics goes beyond the most basic concept described above and beyond the notion of "Avionics" in a ground system or the electronics integration of a ground system. It is the state-of-the-art (Technology) and Practice of Electronics Integration (Science and Methods) of the Total System, which includes more than just the vehicle itself (Figure 3).

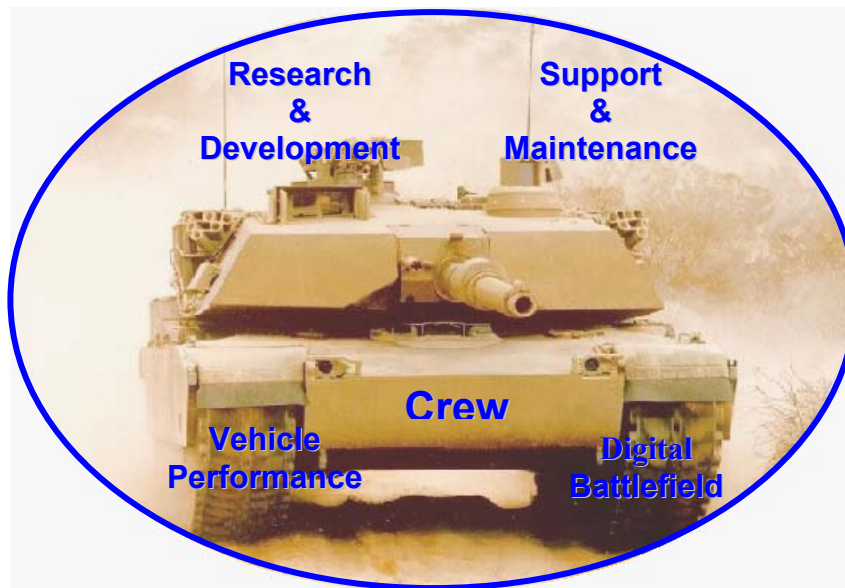


Figure 3 - Total System View

When applied, it takes the form of an architecture (both hardware & software) that provides the infrastructure or "glue" to enable optimizing the integration of all elements of the total system. These elements include the vehicle itself (via intra-data distribution), the vehicle as part of a battlefield force (via inter-data distribution), the vehicle as part of the support infrastructure ("pitstop" analogy, Built-in-Test, embedded training), the vehicle as part of the development process (via embedded test support and reuse of simulation) and most importantly, the soldier via an intelligent crew interface. Vetronics is the new paradigm that will enable the evolution of the ground vehicles into the integrated computer information era to meet the Army's needs on the future battlefield.

Historically, the Vetronics technological focus has been on the hardware and software architecture and integrated multifunction crew stations. However, any technology where a crew centric and/or global perspective would enable the above objectives could result in new areas of focus. Robotics and embedded simulation are examples of emerging focus areas.

3.3 Top Level Technology Development Model.

Science and Technology (S&T) applied development constitutes the core mission in Vetronics. However, to insure effective results, gain efficiencies, and maximize application of the technology and expertise, a broader view of technology development is required over and above S&T project management. This broader view is provided in Figure 4. In turn, the broader level activities must be centered around and provide value to the core mission.

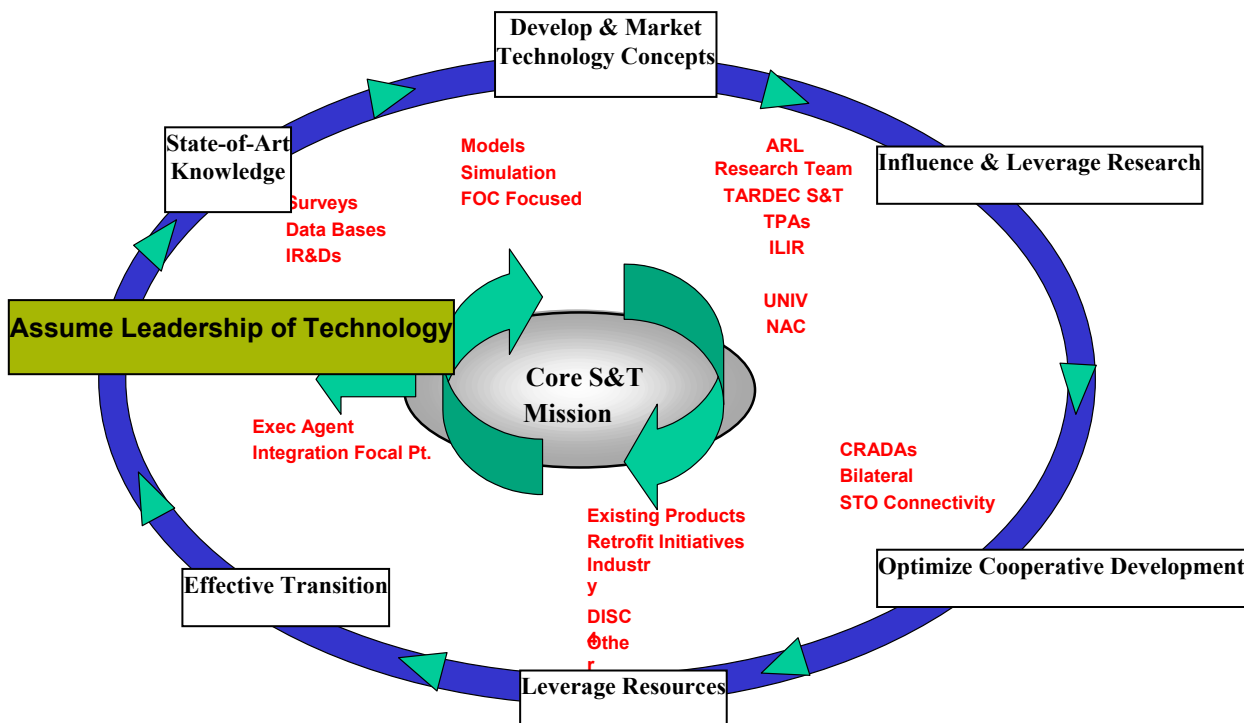


Figure 4 - Technology Development Model

For Vetronics teams to properly plan for applied technology development programs, a thorough understanding of the current and anticipated state-of-the-art/practice is needed. This knowledge coupled with the Army desired future operational capabilities is used to generate technology concepts for future ground vehicles. These technology concepts attempt to leverage the most promising research where possible.

The Vetronics teams must continually seek ways to efficiently acquaint themselves with the technology state-of-the-art and identify the most promising research for application. There is also an increasing trend toward the application of commercial technology toward Army ground vehicles, particularly in the areas of factory automation, automotive electronics and information systems and networking. The Vetronics Institute, as a team devoted to this task and composed of appropriate representation from universities, should contribute greatly to Vetronics technology development efforts.

4. Acronyms and Abbreviations:

CGV:	combat ground vehicle
OPTEMPO:	operational tempo
R&D:	research and development
S&T:	science and technology
Vetronics:	vehicle electronics
VI:	University Virtual Team
VTA:	U.S. Army Vetronics Technology Area
VRP:	Vetronics Research Plan