PARAGON

RESEARCH CORPORATION

A MODEL OF EXCELLENCE

An ISO 9001-2015 Certified Company
2017 Mentor Protégé Nunn-Perry Award
2018 TEEX National finalist

ENGINEERING CONCEPTS

PROTOTYPING

TURN-KEY SOLUTIONS

CORPORATE OVERVIEW

Paragon Research Corporation (PRC), a WOSB, was started in 2009 to make a positive difference. We have successfully challenged the status quo among the thought process of the small business community, by government agencies, and the large contractor community. We believe in thinking differently with the delivery of products and services as a small business. We provide products that not only achieve our customers' requirements, but are engineered as simple to use and user-friendly as possible. We provide services through a staff whom believe as we do - They want to make a positive difference too – as evident by their 7-year in a row nomination as contractor of the year and winning twice! This portfolio provides the proof of our success of why we do what we do!

PARAGON PROFESSIONAL SNAPSHOT

Corporate Headquarters	4845 University Square, Ste.3, Huntsville, AL 35816
BD Contacts	Paul Christian: 256-656-3924 Kelly Falter: 256-425-1494
Web Address	www.prc-hsv.com
Classification	Woman Owned Small Business
NASIC Codes	541330, 541380, 541511, 541512, 541519, 541690, 541710, 541712, 541712, 541720, 541990 (< $7M Category)
CAGE Codes	5URK0
Accounting	DCAA Approved accounting system and rates
Contract Vehicles	AMCOM-X, Agile Cyber, MIDAESS, Warfighter, SETAC-10, Seaport-e, DESP III. IBD, OPTARS
Visit our Interactive Sensor Situational Awareness Dashboard	http://sensor.prc-hsv.com:8081/Dashboard-3.0-SNAPSHOT/

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Paragon, a **Woman Owned Small Business,** has a senior staff with over 30 years experience designing, developing, simulating, integrating, engineering, and testing sensor based C4ISR solutions. We provide turn-key flight and ground-based hardware and software TRL-6 through TRL-9 technologies for various federal, state, and local government agencies. We maintain an outstanding cybersecurity (IA/CND) capability that is currently supporting the Department of Defense by leveraging the smart agent based technologies to detect/protect networks from penetrating cyber threats. These collective capabilities are unique among the small business community – the ability to provide totally integrated Hardware & Software solutions.

Risk Adverse

Paragon is able to attract an exceptional engineering staff based on the engineering opportunities we are leading and supporting. We maintain an active database of highly qualified engineers and scientists in all the disciplines to support surge needs in the following specialized areas:

Cyber Security – Provide extensive Information Assurance and Computer Network Defense (IA/CND) experience for the Department of Defense, Tennessee Valley Authority (TVA) power grid and infrastructure, and other National critical infrastructure.

Hardware/Software Design & Integration – Provide expert EEs, MEs, SEs for TRL-6 prototype through TRL-9 deployments supporting all facets of development (Sensor integration, Flight and ground vehicle M&S, T&E, Embedded Software, Communications, IT, Systems Engineering, Robotics)

Diversifications – Paragon maintains a diverse portfolio of business areas with federal, state, and local governments spanning the highest projected growth areas to ensure Paragon's sustainment well into the future.

"Our customer satisfaction is demonstrated through our corporate success and commitments."
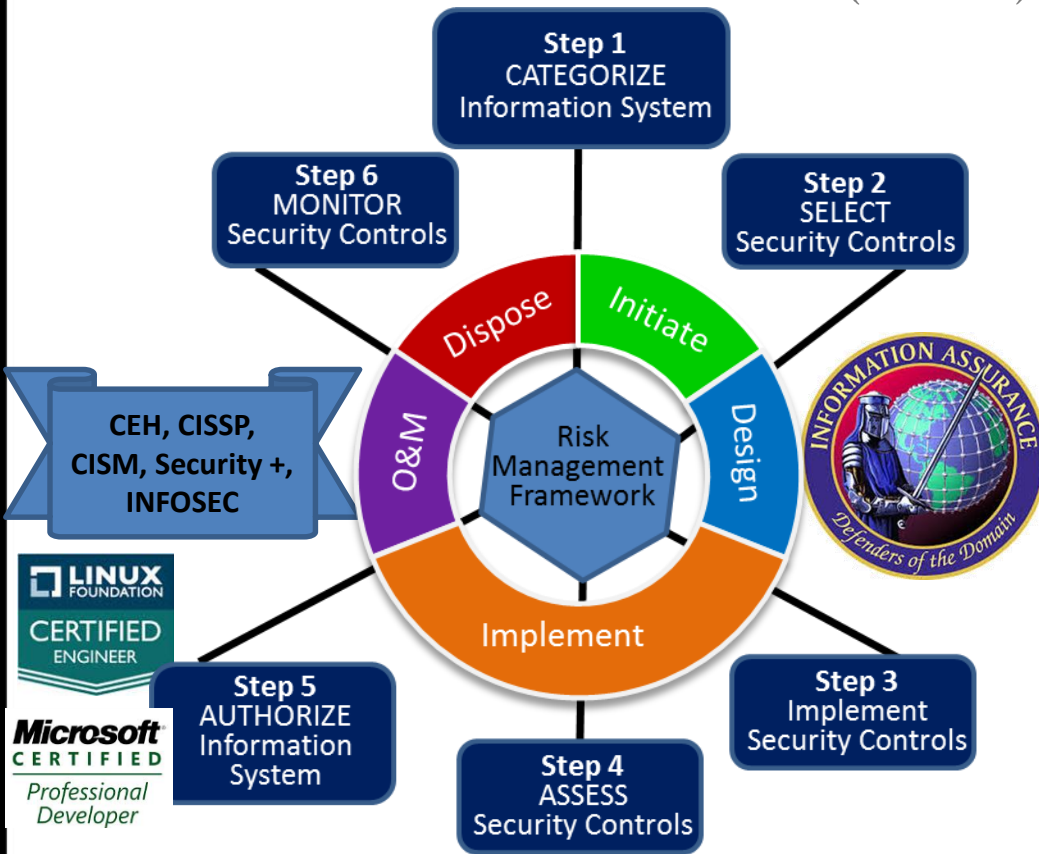
KEY FEATURES

- Turn-Key IT Hardware and Software Security Solution providers
- Prototype (TRL-4) through Deployment (TRL-9) Developments
- CBRNE Detection & Classification Systems
- Cyber Security Solutions
- Insider Threat Mitigation
- Information Assurance
- Condition Based Maintenance
- Data Analytics
- Integrated Base and Critical Infrastructure Defense
- Intrusion detection, Tracking and mitigation
- Flight and Ground system dynamic M&S (missile, UAV, robotics)
- Video Analytics Intelligent Agents
- Open source software real-time applications
- Generic and Targeted Embedded Software Developments
- Real-time Common Operating Picture (COP) Geospatial Information (GIS) Systems

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INFORMATION ASSURANCE (IA) CERT. & ACCREDITATION (C&A)

Step 1
CATEGORIZE
Information System

Step 6
MONITOR
Security Controls

Step 2
SELECT
Security Controls

Dispose
Initiate
O&M
Risk Management Framework
Design
Implement

CEH, CISSP, CISM, Security +, INFOSEC

LINUX FOUNDATION CERTIFIED ENGINEER

Microsoft CERTIFIED Professional Developer

Step 5
AUTHORIZE
Information System

Step 4
ASSESS
Security Controls

Step 3
Implement
Security Controls

INFORMATION ASSURANCE — Defenders of the Domain

KEY FEATURES

- System-of-systems risk assessment & mitigation
- DIACAP and Risk Management Framework
- ATO certifications
- Risk Management Plan developments POA&M
- Requirements Implementation (FISMA, NIST, NISPOM, DIACAP, RMF)
- System IV&V and VV&A
- Integrity protection verification
- RMF Total Lifecycle implementation
- Compliance auditing
- Policy development and implementation
- Training and education
- Information Security
- Integration, Testing & Verification
- Retna, DISA, WASSP, Gold Disk, and SCAP toolsets

CUSTOMER: MISSILE DEFENSE AGENCY (MDA) / TENNESSEE VALLEY AUTHORITY (TVA)

Description: Paragon's IT Security & Cyber Solutions personnel have extensive Information Assurance and Certification & Accreditation (IA/C&A) experience supporting the Department of Defense, TVA, and other National critical infrastructure. For more than a decade, our certified information systems security professionals have provided the agencies with the technical expertise required to implement and maintain successful Cyber Security programs. Our IA/C&A support to the Ground-based Midcourse Defense (GMD) and TVA Certification and Accreditation (C&A) efforts have set the standard in preparing and delivering "Quality" accreditation packages and IA risk-related assessment documentation. Paragon also understands the ever-changing network defense landscape. As threats to the safeguarding of our nation's most sensitive information continue to become more sophisticated, we continue to research, develop, demonstrate, & deliver optimal security solutions to defend and protect against these threats. Paragon has recruited the staff and fostered relationships with R&D centers that collectively have the combined; understanding, experience and relationships necessary to accomplish the IA/CND program goals of the DoD & DOE Chief Information Officers.

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CYBER SECURITY

Security Monitoring

Malware Removal

Cyber Security

Indentify Cyber Missions

Penetration Testing

Missions/ Adversary ID

KEY FEATURES

- **Threat Mitigation & Resiliency**
- STIGs and IAVAs
- NERC Compliance
- **Supervisory Control and Data Acquisition (SCADA)**
- **Penetration testing**
- **Malicious Code Detection and Denial**
- **Insider Threat detection / Mitigation**
- **Firewall and OS patch Support**
- **Intrusion Detection Systems (IDS)**
- **Integration, Testing & Verification**
- **Policy development and implementation**
- **System-of-systems scanning**
- **Retna, DISA, WASSP, Gold Disk, and SCAP toolsets**
- **R&D efforts for DOD/MDA**

CUSTOMER: MISSILE DEFENSE AGENCY (MDA) / TENNESSEE VALLEY AUTHORITY (TVA)

Description: Paragon's IT Security & Cyber Solutions personnel have extensive Computer Network Defense (CND) experience supporting the Department of Defense, TVA, and other National critical infrastructure. Paragon is providing leadership within the Computer Network Defense (CND) R&D for next generation IT protection systems for national and world-wide IT deployments to enhance defense against outside and insider cyber threats. The goal is to provide un-interruptible operation for IT infrastructures by developing/deploying optimal security solutions to address the ever changing threat. The operational systems of our focus include: Command, Control, Communications, Computers (C4); Space assets; Ground Based systems; and deployed remote sites as the cyber threats enhance penetration approaches. Paragon is developing and implementing cybersecurity system-of-systems solutions that include: protection needs analysis, requirements development, systems engineering planning, cyber protection, test and evaluation (T&E), penetration risk mitigation, and penetration testing. We are also providing cyber policy guidance and formulation to enhance IT infrastructure defense as the threats continue to evolve.
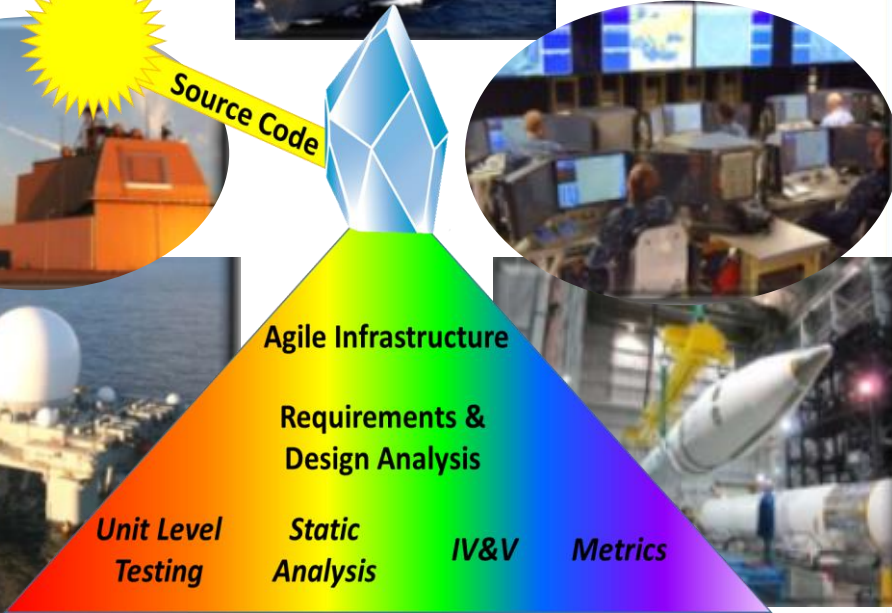
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FULL SPECTRUM SOFTWARE INDEPENDENT VERIFICATION & VALIDATION

The, Software Proving Ground

Source Code

Agile Infrastructure

Requirements & Design Analysis

Unit Level Testing   Static Analysis   IV&V   Metrics

CUSTOMER: U.S. ARMY MATERIEL COMMAND SYSTEM SIMULATION, SOFTWARE AND INTEGRATION DIRECTORATE/ CCDC

Description: Paragon is a key player in CCDC's efforts to support MDA and other DoD branches in its mission to identify, illuminate, and neutralize risks to software and firmware. Combining Earned Value Management, formal software proving methods, with the Agile Management system, our team is the last line of defense to independently verify and validate deployed industry developed software and firmware. Through requirements analysis, design analysis, static code analysis, and test with timing analysis, findings are fed back to the Prime Item Developers with suggested fixes. S.M.A.R.T. metrics are produced and tracked through the Agile Earned Value Management system (EAGiLE) to ensure our customer's vision to acquire reliable software and firmware free from errors and vulnerabilities to defend the Homeland and allies against attack.

*SMART - Specific, Measurable, Accurate, Reliable and Timely

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# Big Data Analytics & Machine Learning / AI*

Key Features

- Big Data Analytics

- Predictive model developments

- Classification and correlation analytics

- Forecast synthesis

- Real-time video object detection/discrimination

- Machine Prognostics and life expectancy synthesis

- Humanoid DNA disease classification & proliferation.

- Dashboard environment provides current metric status

- Statistical assessment in multiple timeframes

- Automated updates to centralized Command & Control

- Data collection from disparate systems.

- Built-in self diagnostics and troubleshooting.

- Command and Control functional testing plan and execution.

- Network interface to support secure high-bandwidth communications

- Large data set collection, analysis, & dissemination

- Business process analysis

AI* - Artificial Intelligence
CCDC – Combat Capability Development Command
IRAD – Internal Research and Development

Big Data Collection and Synthesis
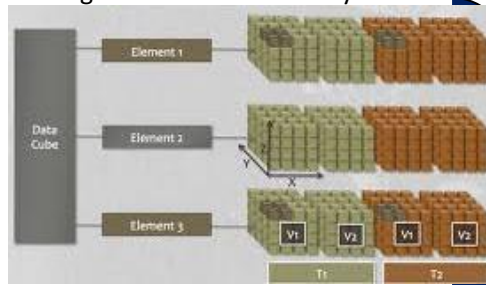
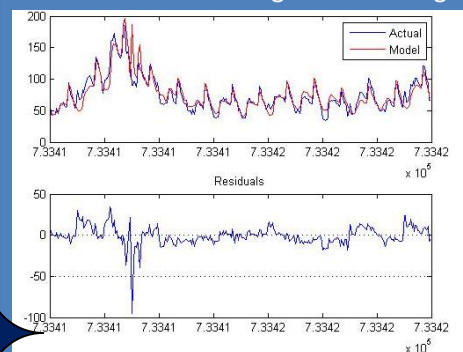Real-time Collection and Database Query

Weather
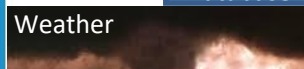
Energy Load & Pricing

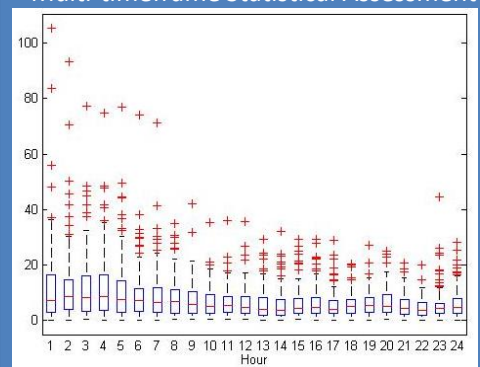Medical Diagnostics & Disease Identification

Complex Machines (Prognostics, CBM)

Decision Making Support
Predictive Modeling & Forecasting

Residuals

Multi-timeframe Statistical Assessment

Customer: TVA / CCDC* /IRAD

Paragon Research has developed and deployed tools and models that can rapidly extract pertinent feature set information from Big data time-series information for classification, prediction, and forecasting. Our engineers are leveraging artificial intelligence and decision tree theory technologies for rapid identification of the most efficient methodology for prediction/classification; based on the problem domain. These models are utilized for accurate forecasting and abnormality detection isolation for use by healthcare providers, nuclear power plant management, banking and finance; as well as any field that relies on time series information to make informed decisions.

Our engineers have developed predictive and classification models to detect Myocardial Infarction, Atrial Fibrillation, and other cardiac arrhythmias from ECG QRS and T-waves that are utilized for real-time monitoring of high-risk patients and alert healthcare providers to predictable future irregular arrhythmias from current patient conditions. Utilizing a 10-year span of hourly electric usage for the Greater New England area, Paragon developed accurate electric grid load and price predictive models for forecasting electric consumption requirements based on weather and population/industry growth forecasts.
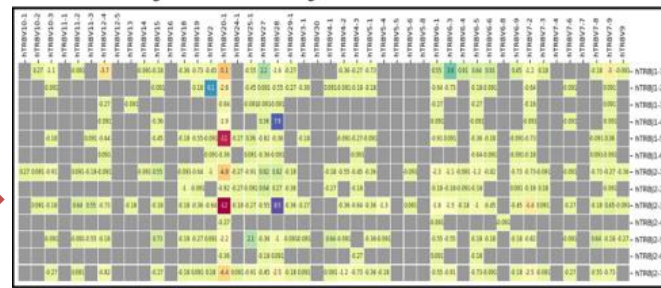
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Immunological Bioinformatics:
## -Disease Identification and Symptom Control-

Immune System Analysis and CDR3 Detection

One-Size-Fits-All Treatment

Immunological Dysfunction (PTSD)

Therapy

Positive Effect   No Effect   Negative Effect

Personalized Treatment

Immunological Dysfunction (PTSD)

Blood, DNA, urine and tissue analysis

Biomarker diagnostics

Therapy

Positive Effect

Key Features

- Machine Learning capture immune system response to various diseases

- Develop immune responses classifier for various diseases.

- Protein identification within effected immune system

- Derive protein sequence and bonding locations

- Identify pharmaceuticals which effectively interacts with identified proteins

- Alleviation of symptoms with targeted therapies and personalized medicine

- Identify protein receptors responsible for adaptive immune system impairment due to trauma

- Determine the repertoire of protein receptors related to this immune system impairment

- Utilize structural protein dynamics to determine appropriate vectors for targeted therapies
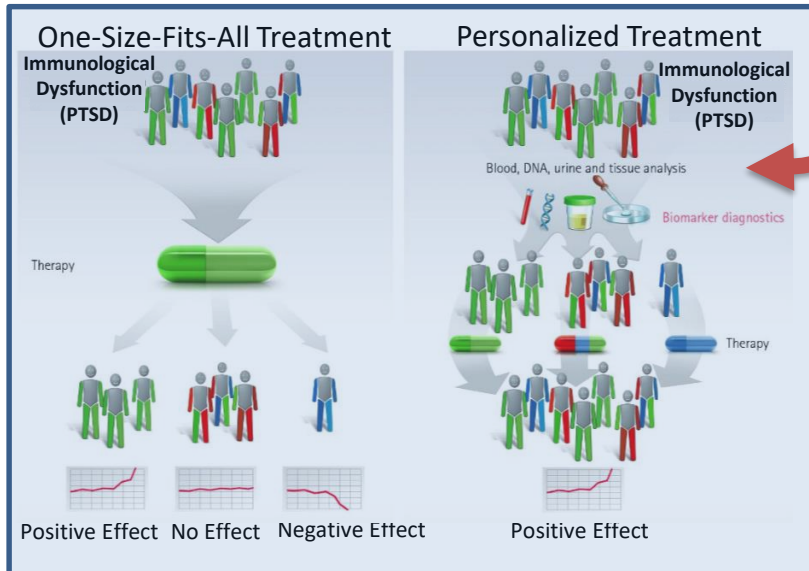
Customer: Internal Research and Development (IRAD)

Description: As of 2014, the conservative estimate of PTSD prevalence among Veterans of Iraq and Afghanistan is that 1 in 5 of these Veterans develops PTSD.
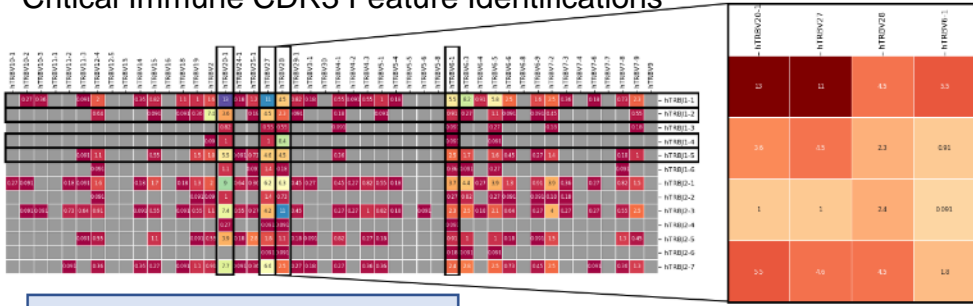
Veterans who are undiagnosed and untreated can and will likely experience life altering side effects including but not limited to: Severe depression, Hyperarousal, Panic attacks, and generally self-destructive thoughts and/or actions. It is therefore critical to not only accurately diagnose PTSD, but also provide targeted treatment.

Paragon has developed a unique approach to studying the immune system and its active responses. By leveraging our knowledge and expertise with various forms of machine learning, artificial intelligence, and bioinformatics principles, we have identified regions within the immune system that we hypothesize are partly responsible for the expression of PTSD symptoms. Through this research we have identified the structures of certain proteins that are responsible for initiating the immune system response when individuals are exposed to trauma. We postulate that, using targeted pharmaceuticals and therapies, we could alter the immune system of individuals suffering from PTSD symptoms to alleviate their symptoms.
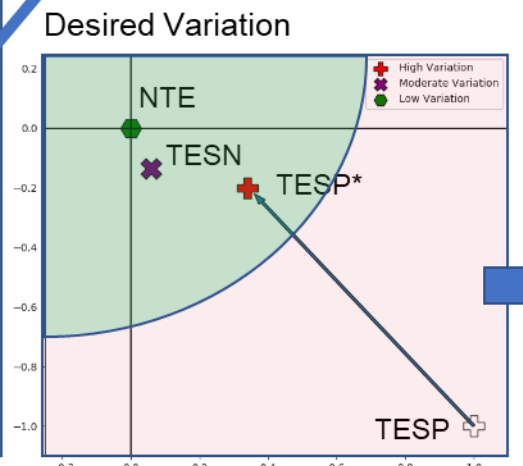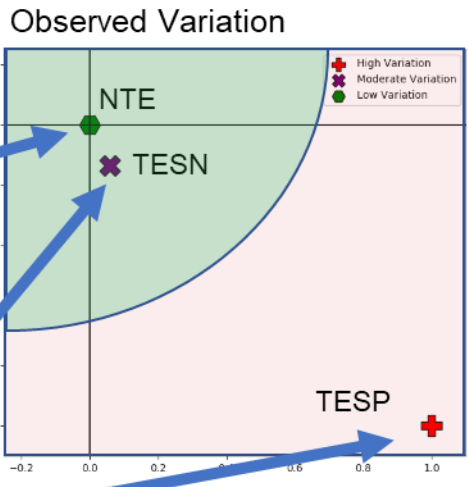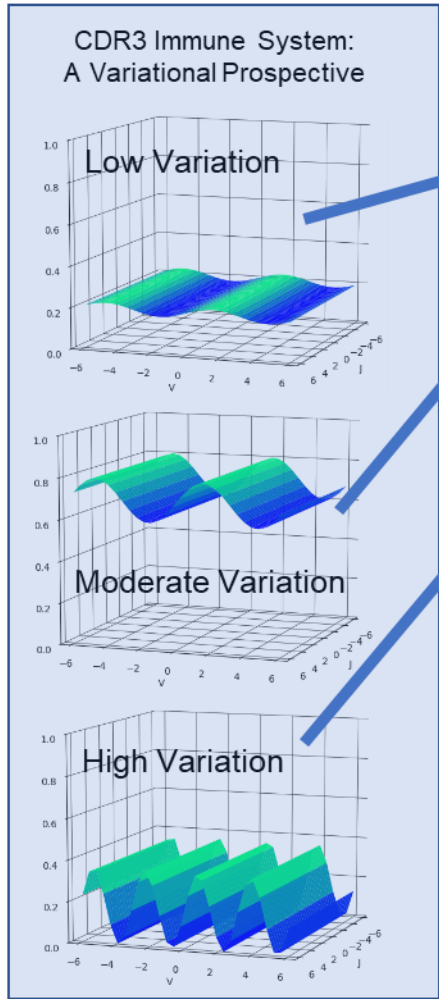

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Immunological Bioinformatics:
Post Traumatic Stress Syndrome - PTSD

Critical Immune CDR3 Feature Identifications

CDR3 Immune System: A Variational Prospective

Low Variation

Moderate Variation

High Variation

CDR3* – Unique immune antibodies
TESP – Trauma Exposed symptomatic
TESN – Trauma Exposed asymptomatic
NTE - No trauma exposure

Observed Variation

- High Variation
- Moderate Variation
- Low Variation

NTE

TESN

TESP

Desired Variation

- High Variation
- Moderate Variation
- Low Variation

NTE

TESN

TESP*

TESP

TESP* - Originally symptomatic Positive

Without Personalized Medicine:
Some Benefit, Some Do Not

Patients

Therapy   One size fits all approach

Benefit   No benefit   Adverse effects

With Personalized Medicine:
Each Patient Receives the Correct Medication

Patients

Biomarker Diagnostics

Therapy

Each Patient Benefits From Individualized Treatment

Identify CDR3* pairs driving variational space locations

- Machine learning to capture immune system response
- Remove non-contributing features
- Selection of critical features
- Protein identification within effected immune system
- Alleviation of symptoms with targeted therapies and personalized medicine
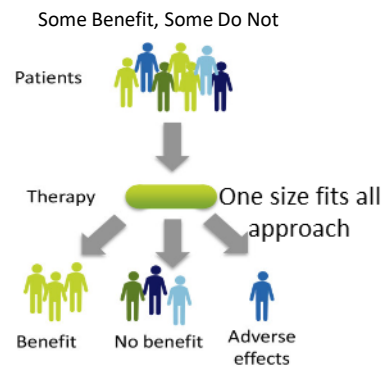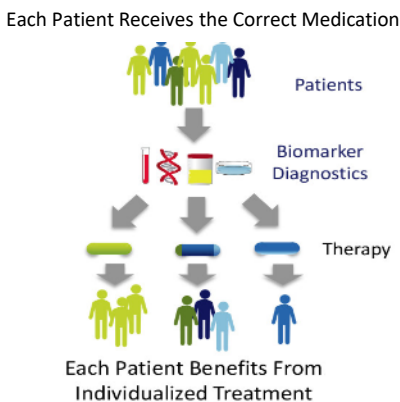- How can the TESP variation be forced to mimic the TESN variation?

Variational Immune System Response Control

- Initial research suggest the self variation of the immune response contains the relevant information
- Magnitude not adequate to discriminate
- Feature reduction permits ID of responsible for variational location
- Protein identification associated with variational location is readily available
- These protein chemical bonding's are identifiable
- Pharmaceutical bonds can be identified to increase or targeted antibodies
- Hypothesis - reduction in variation may reduce or eliminate PTSD symptoms

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R&D Machine Learning Technology Transfer (Mechanical to Human)

Key Features

- Predictive model developments

- Utilize current Paragon Machine Learning Technology across diverse technical domains

- Robust feature identification

- Complex model reduction with data validity

- Permits knowledge from domain expert to be included into prediction

- Supports model transfer learning from disparate systems, minimize training resource requirements.

- Deep dive into the complex immune system to ID protein molecules responsible for PTSD symptoms

- Supports supervised and unsupervised operational modes.

*PTSD – Post Traumatic Stress Disorder

From Mechanical Prognostics to PTSD Symptom Control

Mechanical Prognostics - Completed
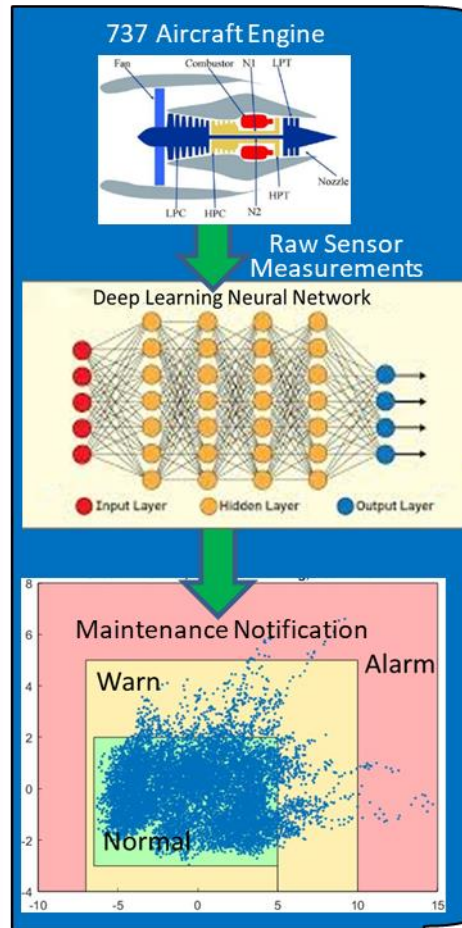
PTSD* Symptom Control
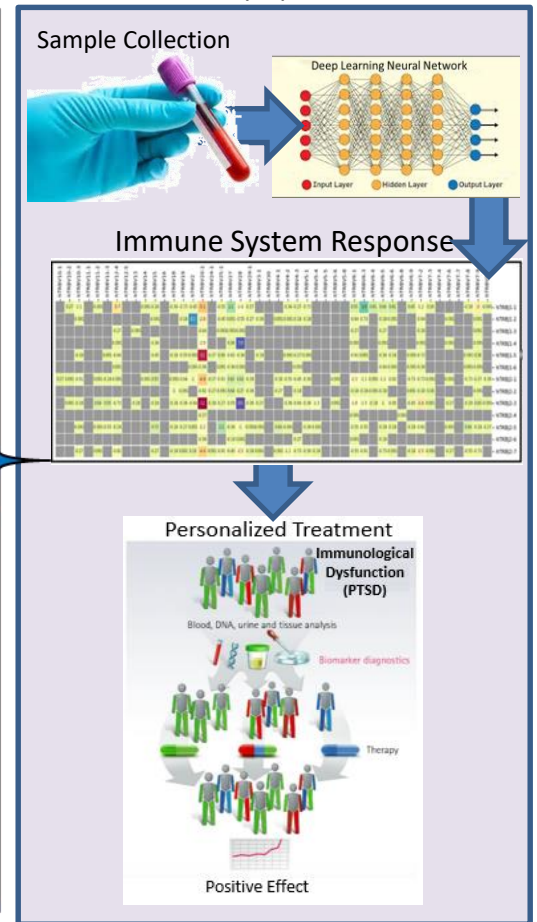
Transferring Paragon Machine Learning developments across diverse technical domains.

Customer: HudsonAlpha Institute for Biotechnology

Paragon Research is developing an unsupervised Machine Learning algorithm and processes that can support Post Traumatic Stress Disorder (PTSD) diagnosis along with:

- Identify the locations within the immune system that are responsible for the PTSD symptoms
- Identify the protein DNA sequences within the identified immune system regions
- Classify the locations within these sequences that can support chemical bonding's
- Use the chemical bonding information to identify **pharmaceuticals** that will stabilize the overall immune system.

The goal of this research is to permit pin-point individualized medicine to minimize PTSD symptoms and medication side effects.

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Unmanned Automated Cybersecurity (U_ACS)

Key Features

- Predictive and adaptive model developments

- Development an AI versus AI cybersecurity intrusion / prevention architecture

- Force a "zero-sum-gain" to be the only solution.

- Leverage AI developments from game theory

- Train the adversary AI against a Defender AI to penetrate a network

- Simultaneously the defender is trained to impede the adversary

- Detection of anomalies

- Automatic warn and block of adversary intrusion

- Proven capability to defeat worlds best humans across all tested domains.

Machine on Machine!

Customer: U.S. Army – CCDC Science and Technology (S&T)

There are multiple reasons current state-of-the-shelf cybersecurity practices on their own are not enough to protect businesses, government agencies, and our critical infrastructure:

- More security-related data than is humanly possible to characterize;
- Lack of qualified personnel to manage and detect intruder events
- False positives occupying analyst
- ID risks are not reported in timely manor

Machine Learning (ML) technologies and applications have exploded over the past 4 years and our adversaries are intelligent in this technology – we train most of them in our best universities; not to mention all the open source AI information that is available. Because of the easy access to this technology, it was enviable that ML would be used as a cyber-weapon. To defeat a sophisticated ML threat can only be achieved by employing an adaptive ML Defender – can adapt and execute millions of times faster than a human expert!
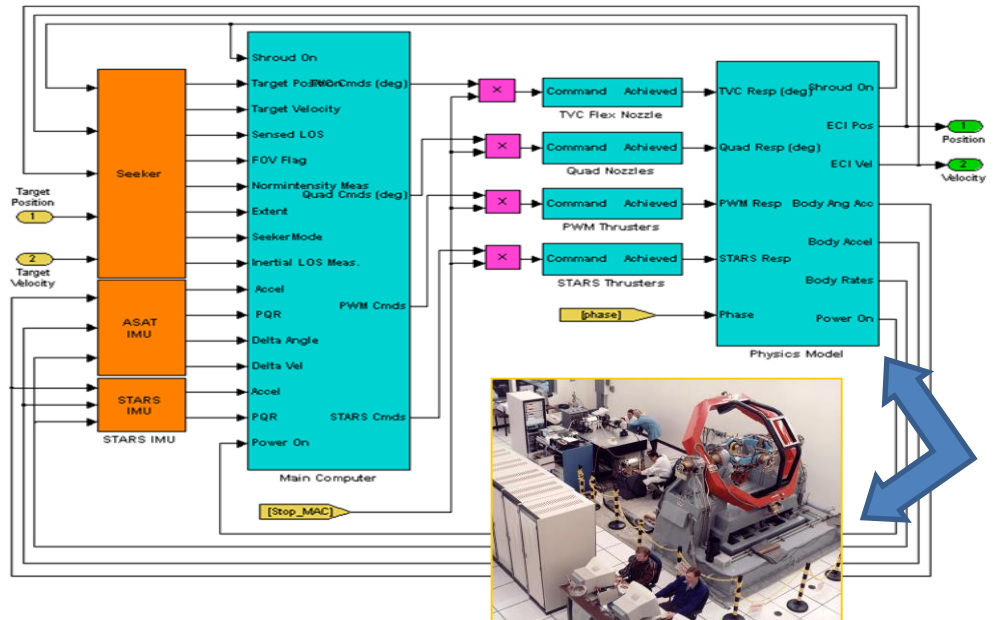
Paragon Research is developing the next generation cybersecurity adversarial - defender architecture utilizing the latest advances in ML, reinforcement learning (RL), and game theory – an approach that led to the ML defeat of the world chess and Chinese Go champions. These developments will provide for automated intrusion detection, prevention, and network resiliency from outside the wire and insider threats.

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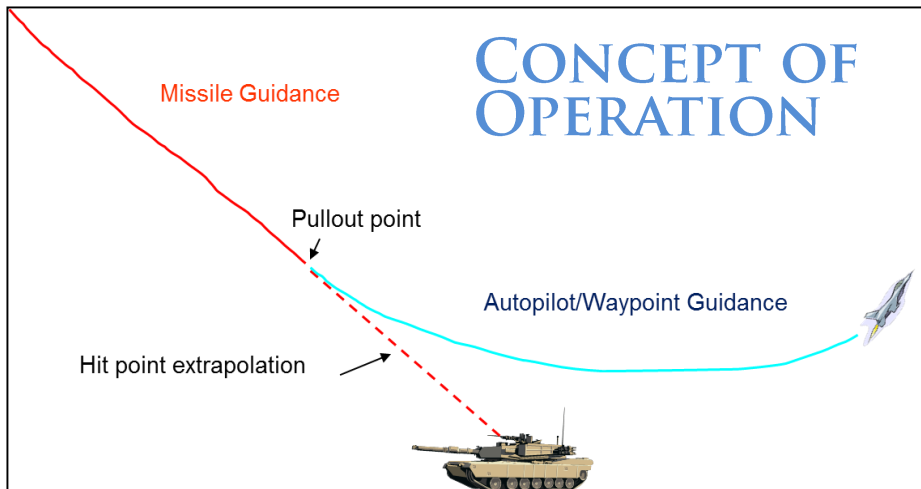# DYNAMIC SYSTEM DESIGN, TESTING, MODEL-BASED SIMULATION

CUSTOMER: ARMY MATERIEL COMMAND / MISSILE DEFENSE AGENCY

Description: Paragon has provided extensive dynamic modeling, simulation, and analysis capabilities in support of several flight vehicle programs including: GBI, PLV, Arrow, and the Captive Carry Sensor Testbed UAS vehicle. Our comprehensive simulation tool suites include a variety of models ranging from generic subsystem representations to high fidelity 6 degree-of-freedom kinematics and detailed component emulations and a broad library of subsystem and component models and engineering tools to provide the user a complete set of high fidelity simulation components to develop multiple simulations simultaneously. The models contain comprehensive error sources and a modular structure for easy understanding and modification. Our framework has a built in Monte Carlo and sensitivity analyses capability along with performance assessment tools. The individual model components as well as the simulation environment are GUI based providing an easy to understand interface mechanism to set up and execute the simulation framework. The framework also supports a wide variety of analyses that includes; trajectory evaluation, requirements development and assessment, performance evaluation, and design analysis.

Aerospace Toolbox®
High Fidelity Flight Dynamics Simulation & Control

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Captive Carry Sensor Testbed (CCST)

Key Features

- Sensor Integration
- Ground Control Station
- Vehicle M&S
- Autopilot Algorithm T&E
- Track and Navigation Kalman Filtering
- IMU Requirements and Navigation Algorithms
- Telemetry Systems
- Guidance Algorithm Development
- IV&V and VV&A
- Hi-Fi M&S
- HWIL Testing
- Ground Testing
- Communications integration and Test
- Sensitivity and Monte Carlo Synthesis

Concept of Operation

Missile Guidance

Pullout point

Autopilot/Waypoint Guidance

Hit point extrapolation

250+ Knot Jet Powered Captive Carry UAS

Customer: Army Materiel Command / AMRDEC

Problem: Current state of the art HWIL facilities not capable of capturing accurate multi-mode sensor operation and prohibits successful all weather operational testing.

Solution: Paragon is integrating a Captive Carry Sensor Testbed architecture into a jet powered unmanned air vehicle capable of performing several all-encompassing missions daily. The objective is to capture multi-mode sensor performance characteristics in all-weather environments to support "super" high-fidelity sensor modeling. This enhanced modeling plays a pivotal role in hardware-in-the-loop (HWIL) and war-game simulations and exercises to enhance the understanding and confidence of the weapon systems under battle field conditions and supports command decisions on usage doctrine.

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IT Network Segmentation, Management, & Safeguard
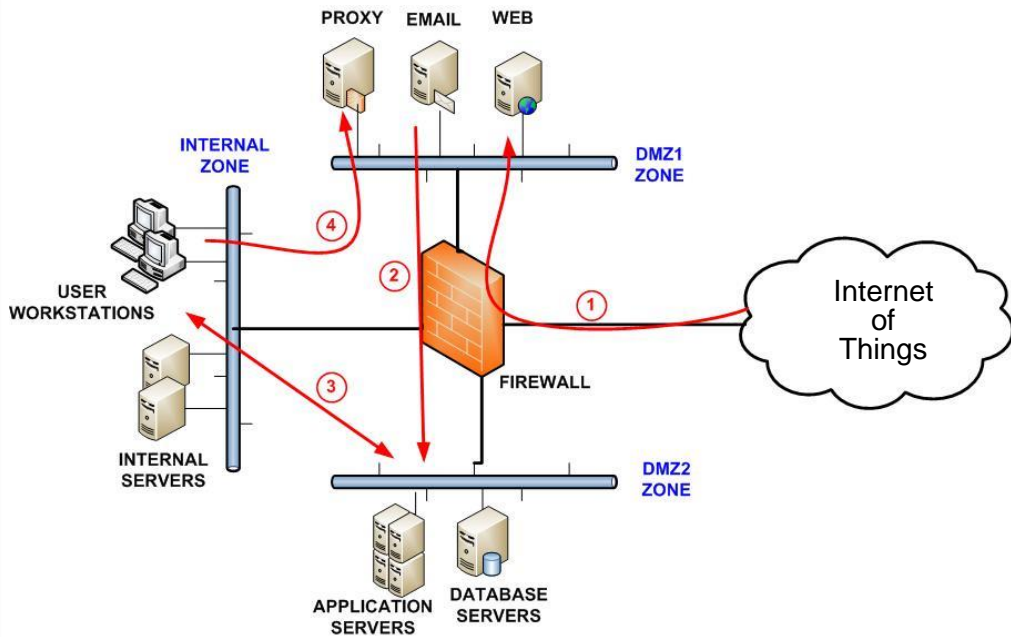
Customer: Tennessee Valley Authority (TVA)

Description: Perform network security IT segmentation across all TVA non-nuclear facilities, power generation, and power distribution assets. Perform data discovery, data classification, network architecture review and recommended upgrades necessary to meet the future TVA IT needs and cybersecurity requirements. Performing Data discovery to identifying data and classifying the processes impacting that data, escalation procedures, resources, risk impact and prioritization to the organization. Performance of data classification and categorizes all data and associated assets based on values according to sensitivity. Assets associated with the data are classified respective of the risk to unauthorized disclosure, modification or access. Perform comprehensive IT Systems Engineering for development of detailed engineering designs based on current and next-generation IT architectural requirements and functional, and non-functional requirements required by TVA for DOE mandated cybersecurity compliance.
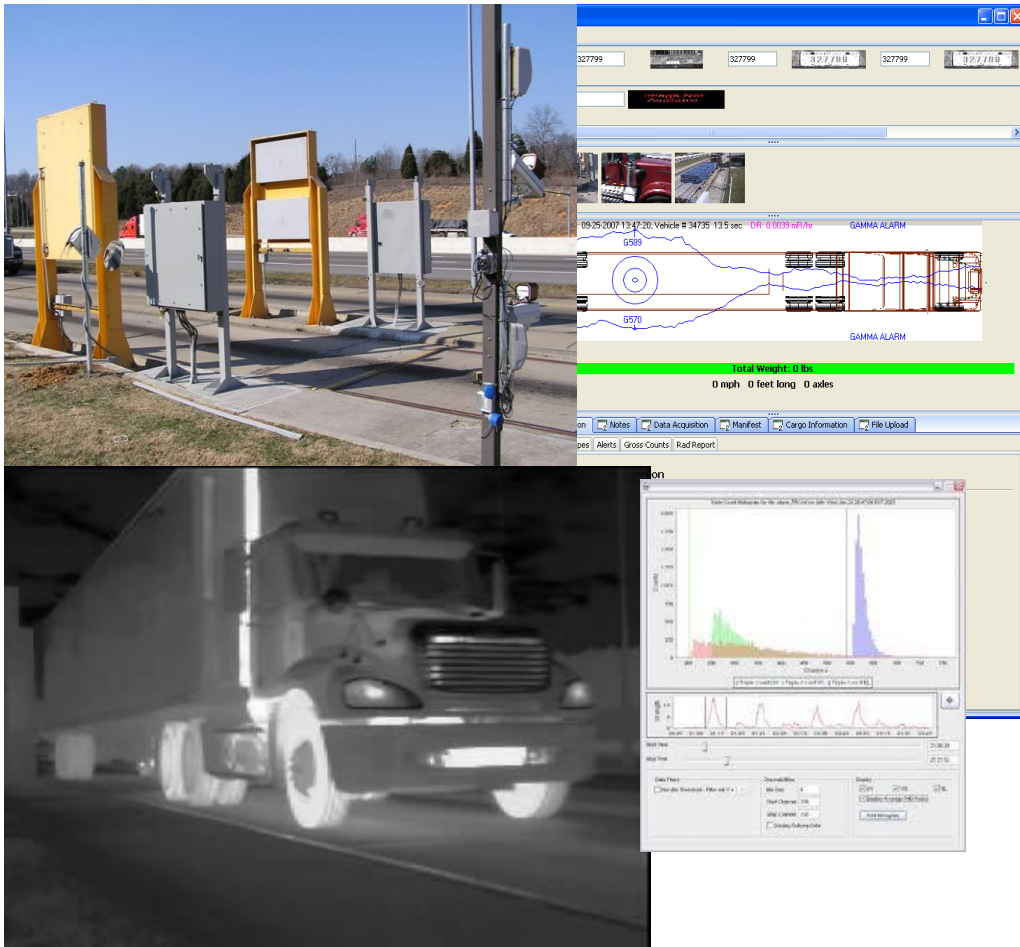
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SensorNet SETCP

Customer: South Eastern Transportation Corridor Project: Weigh Station Technologies (DNDO/DOT)

Description: Develop and deploy (TRL-9) fixed **CBRNE** situational awareness architecture over 6 Southeastern states to impede the transportation of radioactive and chemical material. Integrate a vehicle interrogation system capable of identifying temperature variations within the tractor and trailer tires for rapid identification of break failure. Leverage agile software development principles and provide a secure service oriented architecture to support additional sensor technologies and data fusion algorithms for exploitation of the next generation hardware (sensor and communication) and software advancements. Provide automatic license plate and DOT ID number scanning for NCIS and local law enforcement agencies database information to assess warrants against the driver or outstanding citations on the vehicle.

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Key Features

- A COTS based integration of modular components for portable C4ISR combat operational "plug and ISR" solution.

- Software development utilizing open architecture for rapid re-configuration to meet battlefield needs

- Comprehensive IT Cloud Based infrastructure development.

- Automated alarming technology utilizing video analytics for threat assessment.

- Provides Real-Time GIS based threat detection, tracking, and identification.

- Centralized Command and Control for mobile and fixed locations.

- High Bandwidth Self-healing Mesh Network ready.

- Plug-n-Play architecture for any future IP COTS or GFE sensor needs.

- Communications via: 3G/4G, WiFi, WiMAX, Satcom, Microwave.

- Integratable onto Android hand-held devices for "on-the-move" situational awareness and 24/7 combat operational needs.

Reduced Manning Situational Awareness (RMSA)
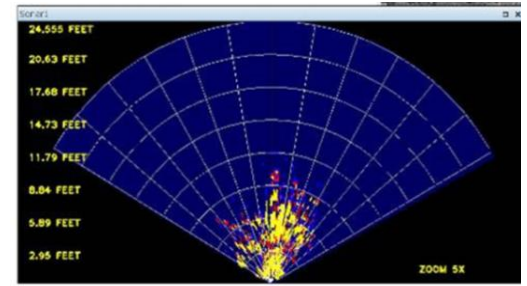
Operational awareness through Multi-sensor fusion

360-degree 3-D battlefield view
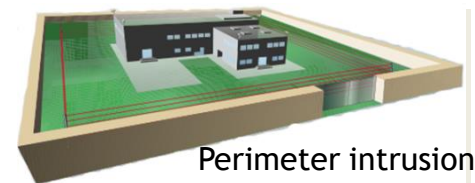
Perimeter intrusion detection & identification

Customer: U.S. Army Materiel Command / CERDEC

Description: Design, development, and deployment of a multifaceted sensor focused rapid deployable integrated tactical automated Integrated Base and Force protection situational awareness architecture to: enhance civilian and military battle space awareness and damage assessments; detect and track potential human, vehicle, and airborne threats; provide CBRNE detection, classification, and plume projection while minimizing manpower requirements. The architecture is being developed utilizing intelligent autonomous systems with 3D visualization and leveraged video analytics for threat detection, tracking, and identification from fused sensor information to provide real-time intrusion and enemy detection at various ranges and in all-weather conditions; while reducing the number of required personnel by leveraging intelligent agents for pre- and post-processing of sensor data. The deployed system is designed to function in various harsh environments in a forward area defense/awareness deployment and sustainment.

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WaterWATCH

Key Features

- A Totally integrated C4ISR (Air, Surface, Sub-surface, & Land) threat detection turn-key solution - Cloud based IT.

- TRL-9 Design and Deployment.

- Internet-Of-Things (IoT)

- Cloud Computing

- Automated alarming technology utilizing video analytics for threat assessment.

- Provides Real-Time GIS based sensor information.

- High Fidelity Agent Plume Modeling.

- Total Command and Control for mobile and fixed locations.

- High Bandwidth Self-healing Mesh Network.

- Plug-n-Play architecture for future sensor needs.

- Communications via: 3G/4G, Wi-Fi, WiMAX, Satcom, Microwave.

- Hand-held devices integration - "on-the-move" situational awareness and 24/7 operational needs.

Integrated C4ISR Architecture
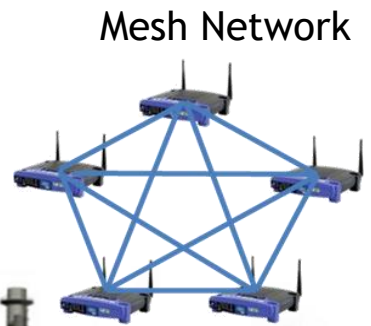
Mesh Network

Paragon's CBRNE Sensor Array
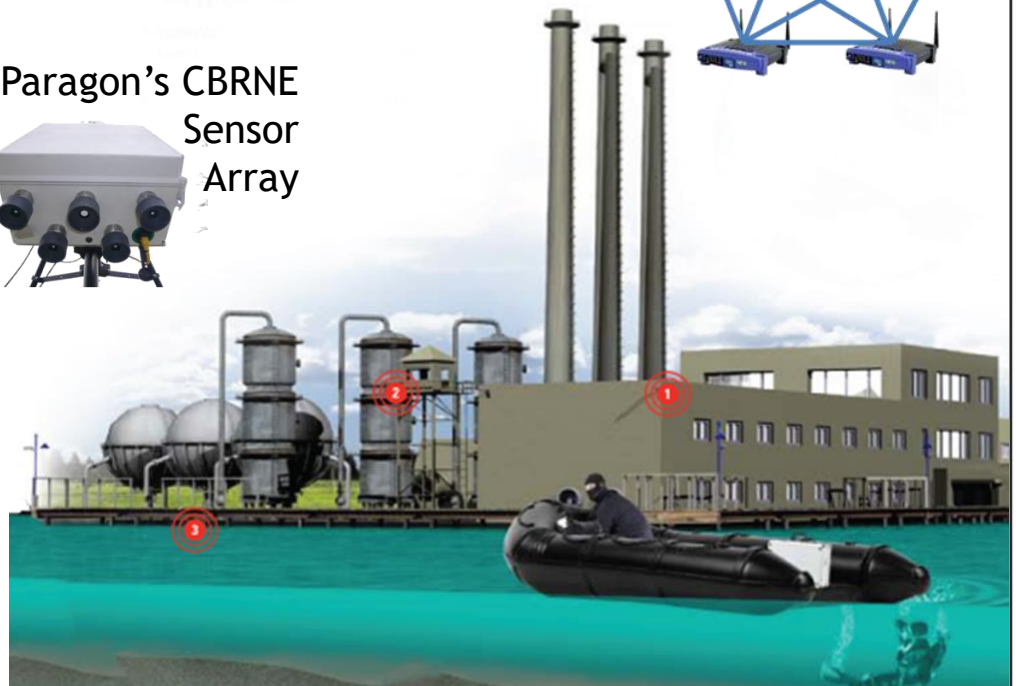
Customer: U.S. Army Materiel Command / AMRDEC

Description: Develop and deploy a comprehensive automated port and waterway security situational awareness system with a Common Operating Picture (COP) for intrusion/threat detection on land, surface, and sub-surface including: persons, swimmers with and without scuba equipment, small watercraft, mines, air-borne, semi-submersibles, and full submersibles. Provide real-time tracking and identification of multiple simultaneous intruders/threats. Our CBRNE Detection and Classification sensor integration has greatly enhanced the WaterWATCH system into a multifaceted robust solution for critical infrastructure that provides near real-time sensor data to any location with network access. Integration of hand-held devices provides enhanced mobility from any secure internet connection for observation, control, and assessment.

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RiverWATCH

CBRNE sensor integrated package onboard vessel for rapid event deployment

Real-time Command & Control information display for Port, Vessel, and Dam C4ISR

Array of tightly integrated **CBRNE** and intrusion detection sensors – vessel, port, and land based

Customer: Department of Homeland Security / FEMA & Guntersville, AL PD Department

Description: Develop and deploy (TRL-9) a high speed vessel based CBRNE rapid response capability for water borne detection and classification of CBRNE elements. Deploy (TRL-9) port based **CBRNE** and intrusion detection/classification situational awareness architecture to cover the entire Port of Guntersville – expandable to other water ba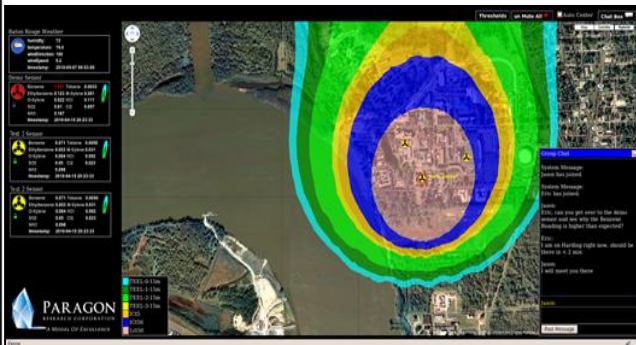sed critical infrastructure along the Tennessee River. Provide dynamic plume modeling based on agent identification and weather conditions in near real-time to mobile and fixed Command & Control (C2) station, and handheld (iPad, iPhone, and Android) devices. Develop self-healing mesh network for open source wireless communications between all sensors and multiple Command & Control Centers (C2). The software architecture utilizes an open Service Oriented Architecture (SOA) approach to avoid single point failures while providing robust closed loop performance.

KEY FEATURES

- A Totally Integrated mobile IT & CBRNE C4ISR Cloud Based Turn-key Solution.

- TRL-9 Design and Deployment.

- Artificial Intelligent threat classification.

- Internet-of-Things (IoT)

- Port based CBRNE and intrusion detection & prevention

- Critical infrastructure protection (Dam)

- Supports 24/7 Rapid Deployment and Sustainment Operations

- Provides Real-Time GIS based CBRNE sensor information.

- Total Command and Control for the Mobile and Fixed Locations.

- High Bandwidth Self-healing Mesh Network.

- Plug-n-Play for any IP Sensor Interface

- Communications via: 3G/4G, WiFi, WiMAX, Satcom.

- Integrated weather information for accurate plume modeling

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KEY FEATURES

- Surface and sub-surface C4ISR Cloud based integrated solution.

- TRL-9 Design and Deployment.

- Automated threat assessment utilizing video analytics.

- Provides Real-Time GIS based CBRNE sensor information.

- High Fidelity Agent Plume Modeling.

- Total Command and Control for mobile and fixed locations.

- High Bandwidth Self-healing Mesh Network.

- Plug-n-Play architecture support for future IP sensor needs.

- Support for IoT OPS.

- Communications via: 3G/4G, WiFi, WiMAX, Satcom.

- Hand-held devices operable for enhanced 24/7 operational situational awareness.

SECURE PORT
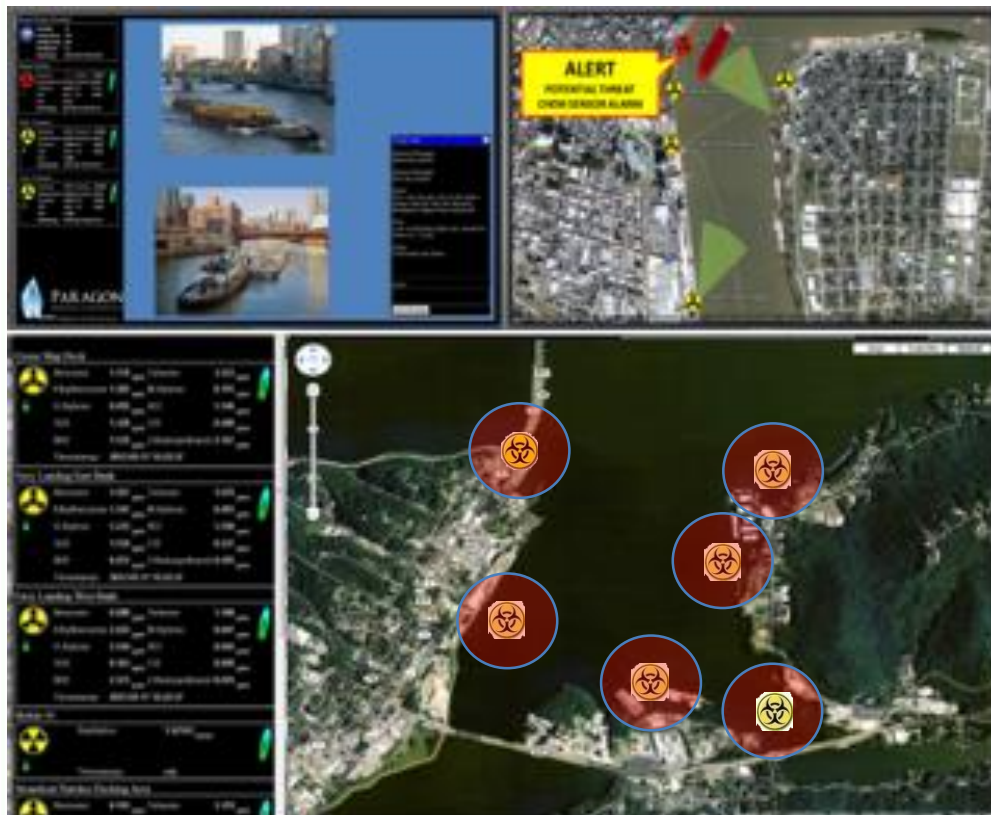
CUSTOMER: CITY OF GUNTERSVILLE POLICE DEPARTMENT & PORT OF GUNTERSVILLE – DHS

Description: Paragon is designing, developing, and deploying a comprehensive threat assessment/detection port security situational awareness system utilizing our open architecture Common Operating Picture (COP) with Geospatial Information System (GIS) support to provide real-time threat assessment/detection for river transport operations: within ports, docking locations, and open water. We are integrating and testing various sensor technologies (weather, GPS, radar, hydrophone, various chemicals, volatile organic combustibles (VOCs), chemical weapon agents (CWAs), and radiation), visible and IR cameras, communications architectures, and utilizing data fusion technologies together with high fidelity dynamic plume modeling for threat dispersion display onto the COP for Real-time monitoring to provide an all-inclusive turn-key intrusion detection and prevention C4ISR solution.

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SECURE BORDER

KEY FEATURES

- Independent T&E of a Totally integrated C4ISR boarder situational awareness solution.

- Develop test plans and execute full spectrum of verification test.

- Provided integration solutions for COTS cameras and UGS.

- Architecture software testing metric development and execution.

- Command and Control functional testing plan and execution.

- Network architecture T&E for short and long range operations.

- Plug-n-Play architecture for any IP sensor interface

- Provided enhanced solutions for identification and tracking of potential intrusion in various terrain environments.

- Development of signal processing algorithms to eliminate false positives.
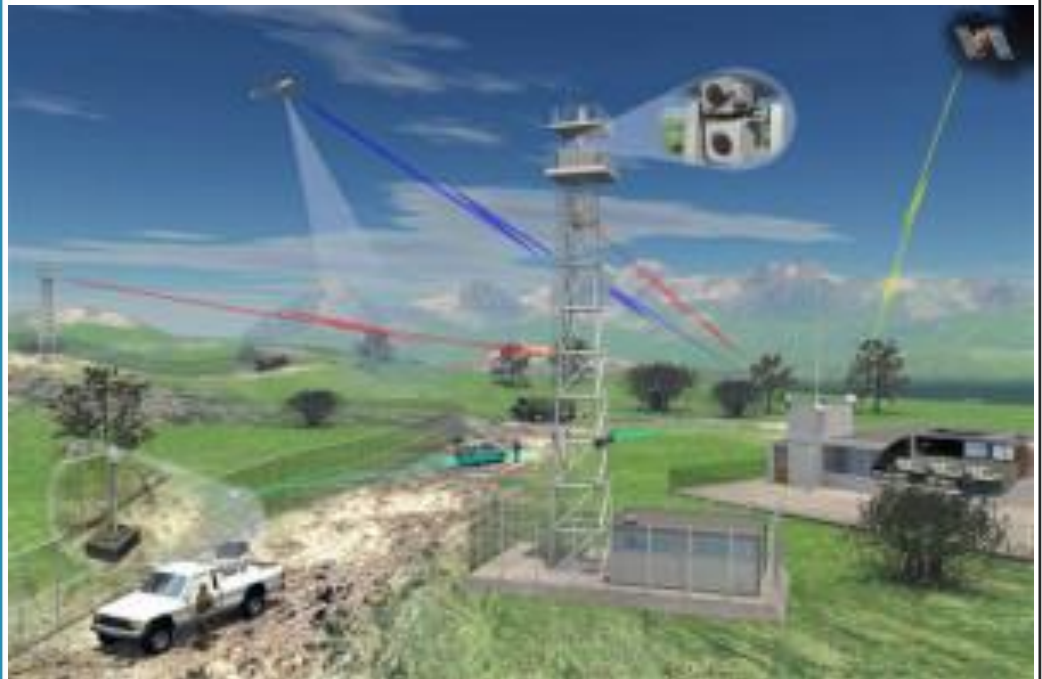
CUSTOMER: LOCKHEED MARTIN IS&GS CIVIL / DHS – CBP

Description: Perform Independent Verification & Validation (IV&V) and Verification, Validation, and Accreditation (VV&A) Test and Evaluation (T&E) for the Department of Homeland Security (DHS) Customs and Border Patrol (CBP) and the Hudspeth County Sheriff's Department, Hudspeth County Texas of a totally integrated C4ISR border intrusion detection, identification, tracking, and reduced manning architecture. Paragon was hand selected based on our vast experience with similar deployments (TRL-6 through TRL-9) to provide independent assessment, Test & Evaluation, test procedures, and design/integration solutions for the successful deployment of this system-of-systems architecture for the 24/7 Southern border situational awareness. The architecture is utilized for detection and defeat of: Illegal border crossings, narcotics smuggling, gun running, and other illicit acts against the United States.

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ALASKA PROJECT

KEY FEATURES

- Early fire detection through chemical signatures analysis.

- TRL-7 Design and Deployment.

- Each sensor node completely independent eliminating single-point failure.

- Investigating UAV deployment option.

- Provides Real-Time GIS based sensor information.

- High Fidelity Agent Plume Modeling.

- Total Command and Control for mobile and fixed locations.

- Communications via: 3G/4G, WiFi, WiMAX, Satcom.

- Hand-held devices operable for enhanced 24/7 operational situational awareness.

Permafrost in Alaska

- Continuous
- Discontinuous
- Sporadic
- Isolated
- No permafrost
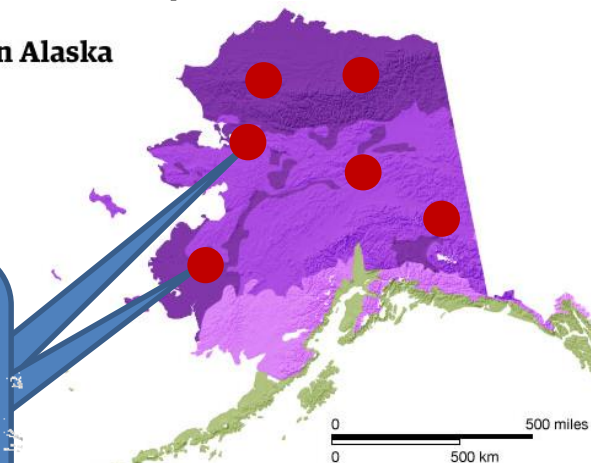
PRC CS5000™ Deployment

0   500 miles
0   500 km

CUSTOMER: U.S. ARMY / ARMY MATERIEL COMMAND

The State of Alaska provides an ideal environment for missile and large caliber weaponry to be tested because of the state's vast uninhibited regions. Permafrost covers the majority of Alaska and measures from a few feet to several hundred. In recent time, the U.S. Army and/or Air Force, through missile strikes, or the shooting of large caliber shells, have penetrated the permafrost and caused wild fires to ignite underneath. Paragon Research has developed a sensor suite based on its PRC CS5000 technology, RapidSense® to help pin-point the fire location beneath the permafrost allowing firefighters to begin eradicating these fires before they escape the permafrost and destroy Alaska's forest industry.

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Radar Digital Signal Injection System (RDSIS) Technology

Key Features

- Architecture designed to provide real-time signal injection/stimulation for a variety of radar systems.

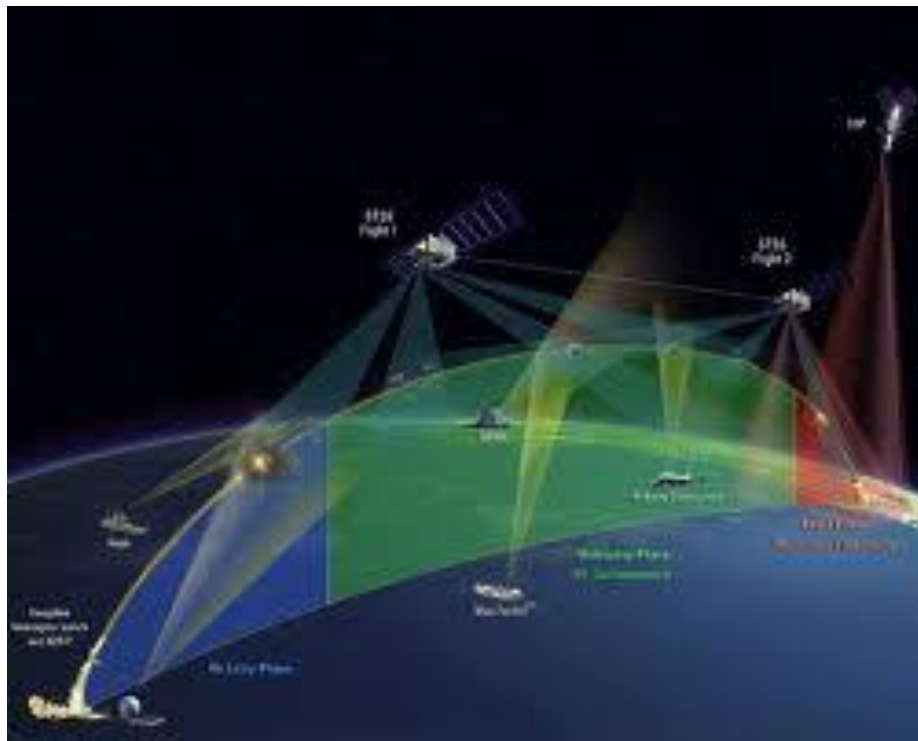- Software development utilizing open architecture for rapid modification and upgrades

- Provides real-time exercise of internal radar subsystems.

- Mechanism to validate and verify radar component operations.

- Supports Hi-Fi modeling and simulation developments without high cost of field testing.

- Developing threat models for real-time signal injection

- Providing software engineering and OT&E

- Enhancing natural environmental modeling (atmospheric absorption, cloud and precipitation attenuation, atmospheric lens loss/refraction)

Customer: Missile defense agency

Description: The BMDS AN/TPY-2 radar requires a high fidelity stimulator to adequately exercise critical software functions and processes such as advanced discrimination and distributed track processing. RDSIS program was developed to support the deployment of a multifaceted radar sensor threat signature injection for X-band class radar architectures to: minimize the need for costly field testing, provide realistic all aspect signatures for all known threat classes, support pretest readiness exercises, and avoid geographic dispersion testing complications.

RDSIS supports Monte Carlo M&S to evaluate: design modifications, hardware change evaluations, software verification check-out assessments, and emerging threat evaluations. It provides single and multi-beam search and frequency for Verification, Track, and Discrimination. The environment routinely supports signal injection modifications due to noise, antenna characteristics; as well as amplitude and phase error propagation.
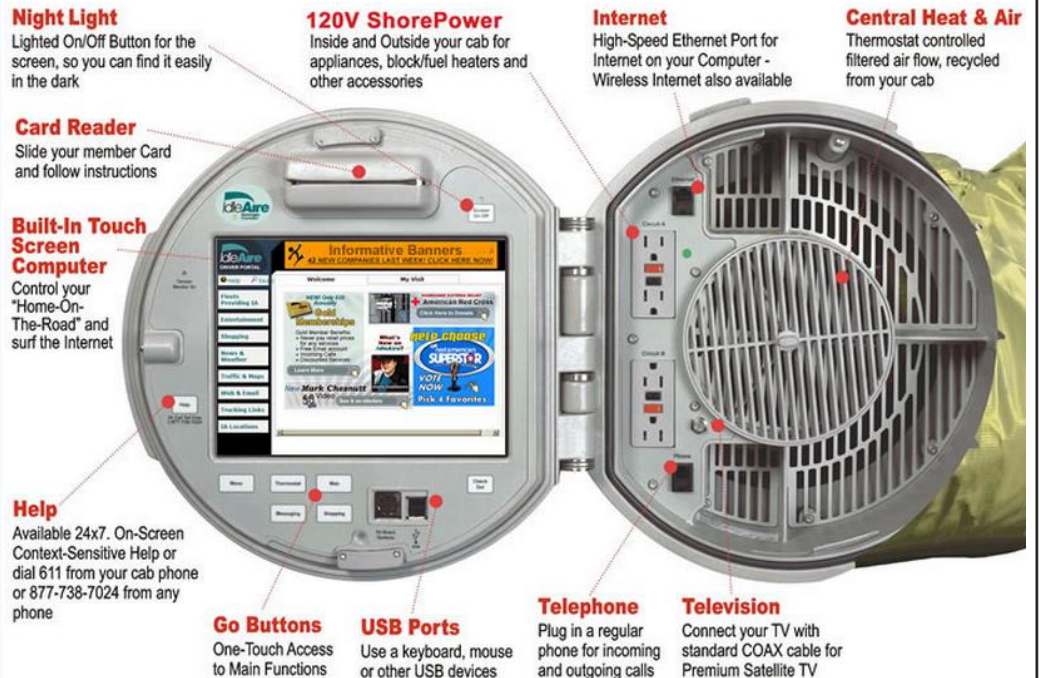
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IdleAIRE

Key Features

- Disparate sensor monitoring & control

- Real-time 24/7 sensor readings and fault identification

- ID theft protection through secure network protocols

- Automated firmware updates from centralized Command & Control

- Designed for national coverage and monitoring.

- Built-in self diagnostics and troubleshooting.

- Big data collection, Analytics, & Dissemination

- Internet of Things (IoT)

- Real-time Health status and sensor feedback

- Command and Control functional testing plan and execution.

- Network architecture for short and long range operations.

- Network interface to support high-bandwidth communications

- Automated billing to each individual user based on allotted time of usage.

- Development of national troubleshooting and help desk.

Night Light
Lighted On/Off Button for the screen, so you can find it easily in the dark

120V ShorePower
Inside and Outside your cab for appliances, block/fuel heaters and other accessories

Internet
High-Speed Ethernet Port for Internet on your Computer - Wireless Internet also available

Central Heat & Air
Thermostat controlled filtered air flow, recycled from your cab

Card Reader
Slide your member Card and follow instructions

Built-In Touch Screen Computer
Control your "Home-On-The-Road" and surf the Internet

Help
Available 24x7. On-Screen Context-Sensitive Help or dial 611 from your cab phone or 877-738-7024 from any phone

Go Buttons
One-Touch Access to Main Functions

USB Ports
Use a keyboard, mouse or other USB devices

Telephone
Plug in a regular phone for incoming and outgoing calls

Television
Connect your TV with standard COAX cable for Premium Satellite TV

Customer: Commercial Vendor

Description: Networking, communicating and collecting data from remotely deployed sensors and systems is a specialty of Paragon engineers. They have designed, developed, improved and deployed the latest and most efficient methodologies for data monitoring, dissemination, and analysis for various DOD and commercial clients. One system designed by our staff, IdleAIRE, is currently operating in over 200 locations across the United States. This system has over 66,000 sensors deployed throughout those locations and data from those sensors is being monitored in real-time to control and provide early warnings of maintenance/fault issues at each location. These types of systems show the true ability of our engineers to deploy, not only nationally, but globally networked sensors and systems for monitoring and control to minimize sustainment cost and energy consumption.

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COMPUTER NETWORK DEFENSE - SAFE

KEY FEATURES

- Impervious to top 25 cyber security threats

- Formal mathematical proofs for all 25 threats

- Developing stand-a-lone capability or use as a gateway to protect existing IT infrastructure

- SiOMetrics integrated into processor and memory to protect against insider threat and deep layer penetration - authentication

- PUF Technology to address plug-in penetration attempts - ID management

- Protects against high power RF attacks

- Assess vulnerabilities and exploitations.

- Utilize small Zero-Kernel Operating System (ZKOS) to prevent "root" or administrator privilege escalation at OS level

CCDC – Combat Capability Development Command
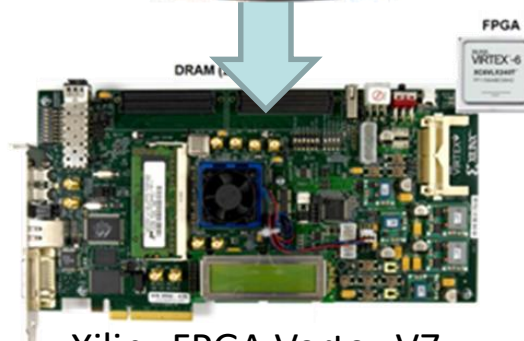
Designed from scratch using languages such as Coq and Haskell, the SAFE platform has been proven to be impervious to the top 25 cyber weaknesses through testing and formal mathematical proofs. QED!

Xilinx FPGA Vertex V7

CUSTOMER: ARMY MATERIEL COMMAND / CCDC

Paragon is advancing the Semantically Aware Foundation Environment (SAFE) architecture initially developed by DARPA. SAFE is a clean-slate, co-domain hardware and software computer chip design that defeats the top 25 cyber-attacks out-of-the-box. Paragon is using machine assisted mathematical proofs to ensure security policies are maintained. In 2017, Paragon and the U.S. Army Materiel Command / Aviation Missile Research Development & Engineering Center (AMRDEC) set out to mature the SAFE architecture to address the constant cybersecurity threats that continue to compromise deployed assets. Paragon and Team have successfully completed the clone phase of the program and we are developing software applications to support advanced uses for the SAFE architecture e.g. Air and Missile Defense.

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Featured Capabilities

Software Engineering & Integration

- Complete Software Development Lifecycle
- Independent Verification and Validation
- Hardware Interface Driver Developments
- Embedded single or multi-processor
- Dynamic & Static Modeling & Simulation
- Embedded and Deeply Embedded Systems
- Analysis Tool Development
- Database Architecture and Design
- Development/Testing for C4ISR platforms
- Graphical User Interface Developments
- Handheld device applications (**iOS, Android**)
- Information Assurance / Computer Network Defense

Hardware/Sensor Engineering & Integration (TRL-3 ⇒ TRL-9)

- System-of-System Engineering
- COTS / GOTS Sensor Technologies
- Modular System Designs and Deployments
- Communication systems
- Algorithm Deployment
- Operational Test & Evaluation (OT&E)
- Independent Verification & Validation
- Verification Validation & Accreditation
- Flight Systems HWIL Testing
- Rapid Prototyping and Evaluation
- System level integration
- Single/Multiple Computer Board Designs
- Turn-key Solution provider

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Featured Capabilities

System & System-of-Systems Engineering

- **Agile QFD Process**
- **Structured Trade Study Plans**
- **Managed Risk**
- **Balanced Requirements**

Design Products

Req's Products

Requirement Inputs

TRD

Desired Customer Operational Capabilities (DCOCs)

Concept of Operations

Component Level

Element Level

Sub-System Level

Mission/System Level

Requirements Analysis

Functional Analysis

Design Synthesis

Requirements Development, Analysis, and Design are Highly Interactive Processes
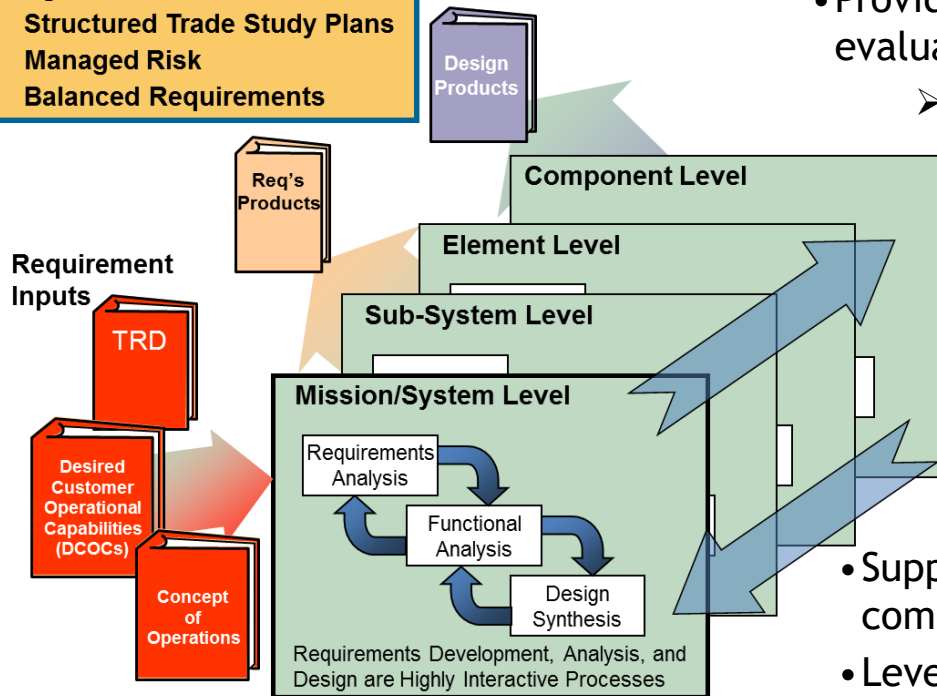
- Provides thorough requirements evaluation and balancing
  - ➢ Bottom-up and Top-Down
  - Supports CAIV principles
  - Agile methodology enhances early risk detection/mitigation
  - Customer requirements vetted at all levels of development & testing
- Supports rapid system through component level modifications
- Leverage optimization tools to produce families of solutions

Operational Test and Evaluation (OT&E)

System-of-Systems

WaterWATCH

System

Sub-System and Components

- Laboratory & Operational T&E
- Component through system T&E
- IV&V and VV&A developments
- Experimentation development/conduct
- Fielded operational SW Testing
- Rapid re-Prototyping and Evaluation
- Test Planning and Documentation
- Site Survey
- Test Scenario Development
- Test Development, Execution, Evaluation, and Analysis
- Post-test quick look and final reporting
- Fault tree analysis and solution provider

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Featured Capability

Engineering
- Systems
- Segmentation & Management

Communications
- Wired
- Wireless (Wi-Fi, WiMAX, 3G/4G, Sat)

Integration, Test & Evaluation (T&E)
- Component
- System
- System-of-Systems

Defense
- Information Assurance (IA)
- Computer Network Defense (CND)
- Biometrics

Data Analytics
- Predictive Modeling
- Classification
- Regression

Domain Engineering & Integration

Domain Defense

C4ISR Security Solutions

- Situational / Persistence Awareness
- Automated target recognition and tracking
- Critical Infrastructure
- Base/Area Defense
- CBRNE Detection, Classification & Alert
- Port Security
- Land, air, surface, sub-surface solutions
- Common Operations Picture
- Totally integrated turn-key solution providers
- Support for hand-held device monitoring and control

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Software Development

- Complete Software Development Lifecycle
  - Requirements Gathering
  - Architecture & testing
  - Design, Implementation & Testing
  - Deployment & Maintenance
- Database Architecture, Design & Admin
- Modeling & Simulation (HWIL and Analysis)
- Enterprise Portals
- Service Oriented Architecture (SOA)
- Intelligent User Interfaces

- J2ee Certified
- C/C++, Javascript
- XML, XHTML
- Perl, Python, PHP, TCL
- .Net (C#, VB, etc...)
- SharePoint

- ADA
- MATLAB
- FORTRAN

Communications

- RF / Telemetry
- 802.11a/b/g/n/I
- Wireless Mesh Networking
- Wired

- Infrared
- Optical
- Cellular
- Satellite
- WPA, WPA2, RSA Encryption

IT Systems & Services

- Information Assurance & Computer Network Defense Solutions
- Integrated risk-based program control: project, schedule and cost management
- Cost/Benefit analysis
- Cost estimating and uncertainty analysis
- Server Farms/IT Hosting Centers
- System Deployment and Training Services
- Advanced Multi-Media Systems
- Process Control
- Wireless Interference Studies and developments
- Facility Threat Assessments

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A Total Turn-Key Solution Provider

Sensor Systems

- Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE)
- Radar & Sonar
- Ultrasonic
- Infrared
- Laser Scanning
- Cameras (Still/Video)
- OCR
- GPS/Tracking
- Weather
- Pressure
- Flow
- Motion
- Trip Wire
- Fiber Optic
- Infrared Barriers

- Seismic
- Scales
- RFID
- Mag Cards
- iCards
- Smart Cards
- Proximity Cards
- Hydrophones
- Spectral
- License Plate
- Unattended Ground Sensors
- Cellular Phones
- Electro-Optical
- Electronics

Totally Integrated Turn-Key Solutions

- Force Protection and Intrusion Detection
- Intelligence, Surveillance & Reconnaissance (C4ISR)
- Waterway Security Systems
- Advanced Video Analytics
- Target Detection, Identification & Tracking
- Advanced Discrimination Algorithms
- Advanced Clutter Mitigation Techniques
- Integrated Sensor Security Systems
- Anti-tamper (Magnetic, Capacitance, Switch, MEMS)
- Virtual Fence Technologies
- Automated Alerting to any Communication Device
- Technical Surveillance Countermeasure

System Design & Integration

- Systems Engineering
- Flight & Water borne systems
- Space based vehicle
- Unmanned Air Systems
- Global Networked Sensor/Tracking Systems
- Mobile CBRNE Monitoring Systems
- Fixed and mobile C4ISR architectures
- Command and Control Operations
- Advanced Alerting Systems
- Port & Water Based Situational Awareness
- Harbor Patrol and Sea Deployable Systems
- Personnel Locator Systems
- Cellular Phone Detection and Location
- Military Base Monitoring and Situational Awareness Technologies
- Advanced Security Systems
- CAD & Prototype Design

Common Operations Picture (COP) Geospatial Information System