

Topic: N142-118

HYPRES, Inc.

Wideband RF Digitizer with Integrated Filter

HYPRES, Inc. (HYPRES) – a superconducting electronics company – offers design, development, fabrication, testing and packaging services for their digital Radio Frequency (RF) product-lines. This Phase II effort develops Co-Site Interference Mitigation for Wideband Receivers. HYPRES Advanced Digital Receiver (ADR) enables full spectrum monitoring and maximizes signal reception for military satellite communication, signal intelligence, radar, electronic warfare systems and tactical data links, providing improved surveillance capabilities, detection of smaller targets, and superior range. Direct RF digitizing eliminates front-end analog components reducing size, weight, and power by 50%. A world leader in advanced digital RF superconductor technology development and production, HYPRES seeks program office and prime contractor support, and equity investors to transition ADR systems for DoD applications and commercial markets.

Technology Category Alignment:

Satellite Communications (SATCOM)

Robotics/Automated Material Handling Equipment

Shipyards/Shipbuilding

Supply; Storage

Satellite Communications (SATCOM)

Satellite Communications (SATCOM)

Supply; Storage

Supply; Storage

Satellite Communications (SATCOM)

Shipyards/Shipbuilding

Robotics/Automated Material Handling Equipment

Robotics/Automated Material Handling Equipment

Robotics/Automated Material Handling Equipment

Robotics/Automated Material Handling Equipment

Protection, Sustainment, and Warfighter Performance

Medical Chem-Bio Defense

Military Infectious Diseases

Propulsion and Extreme Environments

Fixed Wing Vehicles (includes UAS)

Survivability

Maintainability/Sustainability

Unmanned Ground and Sea Vehicles

Corrosion

Advanced Computing/Software Development

Networks and Communications

Modular/Open/Reconfigurable Architectures

RF Components for sensing, transmission and communication

Electronics Integration

Broadband/Multispectral Components and Systems

Sensors, Electronics and Photonics

Radio Frequency (RF) (non-EW)

Survivability

Broadband/Multispectral Components and Systems

RF Components for sensing, transmission and communication

Radio Frequency (RF) (non-EW)

Networks and Communications

Guidance, Navigation & Control (GN&C) and Data Links

RF Components for sensing, transmission and communication
Networks and Communications
Cognitive/Adaptive Capabilities
Preemptive/Proactive Effects
Broadband/Multispectral Components and Systems
Advanced Computing/Software Development
Networks and Communications
Personalized Assessment, Education, and Training
System Interfaces & Cognitive Processes
Aircraft Propulsion, Power and Thermal
Modeling, Simulation & Test Infrastructure
Rotary Wing Vehicles
Fixed Wing Vehicles (includes UAS)
Fixed Wing Vehicles (includes UAS)
Acoustic, Seismic and Magnetic
Rotary Wing Vehicles
Structures and Protection
Energy storage
Unmanned Ground and Sea Vehicles
Mobility
Power and Energy
Synthesis/Analytics/Decision Tools
Information Collection/Management
Advanced Computing/Software Development
Survivability
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Maintainability/Sustainability
Advanced Computing/Software Development
EO/IR Components for sensing, transmission and communication
Microelectronics and Nanoelectronics
Networks and Communications
Mobility
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Human/Autonomous System Interaction and Collaboration
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System Interfaces & Cognitive Processes
Aircraft Propulsion, Power and Thermal
Power Generation/Energy Conversion
High Energy Lasers (HEL)

Propulsion
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Protection, Sustainment, and Warfighter Performance
Modeling, Simulation & Test Infrastructure
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Protection, Sustainment, and Warfighter Performance

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Assuring Effective Missions
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Aircraft Propulsion, Power and Thermal

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High Energy Lasers (HEL)
EO/IR Components for sensing, transmission and communication

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Electro-Optical/Infrared (EO/IR)
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Power Control and Distribution
Acoustic, Seismic and Magnetic
Fixed Wing Vehicles (includes UAS)
Aircraft Propulsion, Power and Thermal
Rotary Wing Vehicles
EO/IR Components for sensing, transmission and communication
Satellite Communications (SATCOM)
Networks and Communications
Trust Foundations
Electro-Optical/Infrared (EO/IR)
Unmanned Ground and Sea Vehicles
Maintainability/Sustainability
Modularity
Survivability
Electro-Optical/Infrared (EO/IR)
Sensors, Electronics and Photonics
EO/IR Components for sensing, transmission and communication
RF Components for sensing, transmission and communication
Networks and Communications
Broadband/Multispectral Components and Systems
Electronics Integration
Protection, Sustainment, and Warfighter Performance
Clinical & Rehabilitative Medicine
Combat Casualty Care
Medical Chem-Bio Defense
Energy storage
Protection, Sustainment, and Warfighter Performance
Human Computer Interfaces (HCI) for Decision Making
Synthesis/Analytics/Decision Tools
Undersea Weapons
Human Computer Interfaces (HCI) for Decision Making
Information Collection/Management

Synthesis/Analytics/Decision Tools
Power and Energy
Propulsion and Extreme Environments
RF Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
Broadband/Multispectral Components and Systems
Preemptive/Proactive Effects
Radio Frequency (RF) (non-EW)
Energy storage
Manufacturing Technology for Affordability
Power and Energy
Structures and Protection
Synthesis/Analytics/Decision Tools
Fixed Wing Vehicles (includes UAS)
Advanced Computing/Software Development
Trust Foundations
Integrating Architecture and Capability Demonstrations
Unmanned Ground and Sea Vehicles
Aircraft Propulsion, Power and Thermal
Synthesis/Analytics/Decision Tools
EO/IR Components for sensing, transmission and communication
Networks and Communications
Preemptive/Proactive Effects
Electro-Optical/Infrared (EO/IR)
Sensors, Electronics and Photonics
Scalable Teaming of Autonomous Systems
Networks and Communications
Unmanned Ground and Sea Vehicles
Acoustic, Seismic and Magnetic
Test, Evaluation, Validation, and Verification
Propulsion and Extreme Environments
Fixed Wing Vehicles (includes UAS)
Networks and Communications
Mobility
Unmanned Ground and Sea Vehicles
Fixed Wing Vehicles (includes UAS)
Rotary Wing Vehicles
Manufacturing Technology for Affordability
Readiness
Aircraft Propulsion, Power and Thermal
Propulsion
Protection, Sustainment, and Warfighter Performance
Individual Warfighter
Synthesis/Analytics/Decision Tools
Collaborative Analysis and Decision-making
Survivability
Modeling, Simulation & Test Infrastructure

Fixed Wing Vehicles (includes UAS)
Human/Autonomous System Interaction and Collaboration
Scalable Teaming of Autonomous Systems
Synthesis/Analytics/Decision Tools
Acoustic, Seismic and Magnetic
Undersea Weapons
Frameworks for Interoperability
Information Collection/Management
Synthesis/Analytics/Decision Tools
Maintainability/Sustainability
Human/Autonomous System Interaction and Collaboration
Machine Perception, Reasoning and Intelligence
Protection, Sustainment, and Warfighter Performance
RF Components for sensing, transmission and communication
Networks and Communications
Advanced Electronic Protection Techniques and Technology
Survivability
Sensors, Electronics and Photonics
Information Collection/Management
Synthesis/Analytics/Decision Tools
EO/IR Components for sensing, transmission and communication
RF Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
High-Speed/Hypersonics
Synthesis/Analytics/Decision Tools
Electromechanical conversion
Energy storage
Power Control and Distribution
Power Generation/Energy Conversion
Electronics Integration
Energy storage
Power Control and Distribution
Power Generation/Energy Conversion
Survivability
Fixed Wing Vehicles (includes UAS)
Networks and Communications
Energy storage
Power Generation/Energy Conversion
Unmanned Ground and Sea Vehicles
Electromechanical conversion
Energy storage
Power Control and Distribution
Power Generation/Energy Conversion
Thermal Transport and Control
Thermal Transport and Control
Protection, Sustainment, and Warfighter Performance
Modeling, Simulation & Test Infrastructure

Microelectronics and Nanoelectronics
RF Components for sensing, transmission and communication
Modularity
Acoustic, Seismic and Magnetic
EO/IR Components for sensing, transmission and communication
Broadband/Multispectral Components and Systems
Guidance, Navigation & Control (GN&C) and Data Links
Sensors, Electronics and Photonics
Maintainability/Sustainability
Manufacturing Technology for Affordability
Corrosion
Readiness
Test, Evaluation, Validation, and Verification
Advanced Computing/Software Development
Synthesis/Analytics/Decision Tools
Distributed/Coordinated/Net-Enabled Systems
Aircraft Propulsion, Power and Thermal
Energy storage
Thermal Transport and Control
High Energy Lasers (HEL)
Power and Energy
Mobility
Modularity
Electronic Materials
RF Components for sensing, transmission and communication
Manufacturing Technology for Affordability
Personalized Assessment, Education, and Training
Protection, Sustainment, and Warfighter Performance
System Interfaces & Cognitive Processes
Propulsion and Extreme Environments
Structures and Protection
Test, Evaluation, Validation, and Verification
Electronics Integration
RF Components for sensing, transmission and communication
Acoustic, Seismic and Magnetic
Electro-Optical/Infrared (EO/IR)
Sensors, Electronics and Photonics
Electronics Integration
Information Collection/Management
Maintainability/Sustainability
Acoustic, Seismic and Magnetic
Structures and Protection
Protection, Sustainment, and Warfighter Performance
Manufacturing Technology for Affordability
Electronics Integration
Rotary Wing Vehicles
Test, Evaluation, Validation, and Verification

Maintainability/Sustainability
Acoustic, Seismic and Magnetic
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Broadband/Multispectral Components and Systems
Guidance, Navigation & Control (GN&C) and Data Links
Sensors, Electronics and Photonics
Fixed Wing Vehicles (includes UAS)
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Personalized Assessment, Education, and Training
EO/IR Components for sensing, transmission and communication
Electro-Optical/Infrared (EO/IR)
Radio Frequency Weapons (RFW)
Sensors, Electronics and Photonics
RF Components for sensing, transmission and communication
EO/IR Components for sensing, transmission and communication
Scalable Teaming of Autonomous Systems
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Biomedical Informatics / Health Information Systems & Technology
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Protection, Sustainment, and Warfighter Performance
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Fixed Wing Vehicles (includes UAS)
Rotary Wing Vehicles
Corrosion
Readiness
Structures and Protection
EO/IR Components for sensing, transmission and communication
RF Components for sensing, transmission and communication
Networks and Communications
Maintainability/Sustainability
Networks and Communications
Cognitive/Adaptive Capabilities
Unmanned Ground and Sea Vehicles
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Fixed Wing Vehicles (includes UAS)
Rotary Wing Vehicles
Test, Evaluation, Validation, and Verification
Maintainability/Sustainability
Fixed Wing Vehicles (includes UAS)
Rotary Wing Vehicles
Human Computer Interfaces (HCI) for Decision Making
Synthesis/Analytics/Decision Tools
Fixed Wing Vehicles (includes UAS)
Personalized Assessment, Education, and Training
Electronic Materials

RF Components for sensing, transmission and communication
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Sensors, Electronics and Photonics
RF Components for sensing, transmission and communication
EO/IR Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
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System Interfaces & Cognitive Processes
EO/IR Components for sensing, transmission and communication
Broadband/Multispectral Components and Systems
Survivability
High Energy Lasers (HEL)
EO/IR Components for sensing, transmission and communication
Broadband/Multispectral Components and Systems
Survivability
High Energy Lasers (HEL)
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Ordnance
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Assuring Effective Missions
Resilient Infrastructure
Trust Foundations
Advanced Computing/Software Development
Trust Foundations
Advanced Electronic Protection Techniques and Technology
EO/IR Components for sensing, transmission and communication
Human/Autonomous System Interaction and Collaboration
Machine Perception, Reasoning and Intelligence
Electro-Optical/Infrared (EO/IR)
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RF Components for sensing, transmission and communication
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Conceptual, Computational, and World-Wide Environmental Representation
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Radio Frequency Weapons (RFW)
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Rotary Wing Vehicles
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Maintainability/Sustainability
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EO/IR Components for sensing, transmission and communication
Microelectronics and Nanoelectronics
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Electronics Integration
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Sensors, Electronics and Photonics

Protection, Sustainment, and Warfighter Performance
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Acoustic, Seismic and Magnetic
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Electro-Optical/Infrared (EO/IR)
Human Computer Interfaces (HCI) for Decision Making
Synthesis/Analytics/Decision Tools
Synthesis/Analytics/Decision Tools
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Combat Casualty Care
Military Operational Medicine
Personalized Assessment, Education, and Training
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Ordnance
Propulsion
Propulsion and Extreme Environments
Electronic Materials
EO/IR Components for sensing, transmission and communication
Microelectronics and Nanoelectronics
Electro-Optical/Infrared (EO/IR)
Test, Evaluation, Validation, and Verification
EO/IR Components for sensing, transmission and communication
Microelectronics and Nanoelectronics
Networks and Communications
Networks and Communications
Aircraft Propulsion, Power and Thermal
Electro-Optical/Infrared (EO/IR)
EO/IR Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
Unmanned Ground and Sea Vehicles
Electro-Optical/Infrared (EO/IR)
Sensors, Electronics and Photonics
Broadband/Multispectral Components and Systems
Cognitive/Adaptive Capabilities

Electro-Optical/Infrared (EO/IR)
Biomedical Informatics / Health Information Systems & Technology
Advanced Computing/Software Development
Synthesis/Analytics/Decision Tools
Biomedical Informatics / Health Information Systems & Technology
Personalized Assessment, Education, and Training
Protection, Sustainment, and Warfighter Performance
Modeling, Simulation & Test Infrastructure
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Rotary Wing Vehicles
Human Computer Interfaces (HCI) for Decision Making
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Human Computer Interfaces (HCI) for Decision Making
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Synthesis/Analytics/Decision Tools
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System Interfaces & Cognitive Processes
Rotary Wing Vehicles
Machine Perception, Reasoning and Intelligence
Synthesis/Analytics/Decision Tools
Unmanned Ground and Sea Vehicles
Fixed Wing Vehicles (includes UAS)
Machine Perception, Reasoning and Intelligence
Scalable Teaming of Autonomous Systems
Unmanned Ground and Sea Vehicles
Personalized Assessment, Education, and Training
Electronics Integration
Power Control and Distribution
Design and Integration
Maintainability/Sustainability
Modularity
Biomedical Informatics / Health Information Systems & Technology
Survivability
Protection, Sustainment, and Warfighter Performance
EO/IR Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
Networks and Communications
Design and Integration
Mobility
Human Computer Interfaces (HCI) for Decision Making
Design and Integration
Modularity
Unmanned Ground and Sea Vehicles
System Interfaces & Cognitive Processes
Fixed Wing Vehicles (includes UAS)
Information Collection/Management
Electro-Optical/Infrared (EO/IR)

Broadband/Multispectral Components and Systems
Power Control and Distribution
Power Generation/Energy Conversion
Modeling, Simulation & Test Infrastructure
Radio Frequency Weapons (RFW)
EO/IR Components for sensing, transmission and communication
Networks and Communications
Electro-Optical/Infrared (EO/IR)
Sensors, Electronics and Photonics
EO/IR Components for sensing, transmission and communication
Survivability
Unmanned Ground and Sea Vehicles
Electro-Optical/Infrared (EO/IR)
Undersea Weapons
Personalized Assessment, Education, and Training
System Interfaces & Cognitive Processes
Acoustic, Seismic and Magnetic
Undersea Weapons
RF Components for sensing, transmission and communication
Networks and Communications
Networks and Communications
Electronic Materials
RF Components for sensing, transmission and communication
Broadband/Multispectral Components and Systems
Energy storage
RF Components for sensing, transmission and communication
Power Control and Distribution
Assuring Effective Missions
Resilient Infrastructure
EO/IR Components for sensing, transmission and communication
Preemptive/Proactive Effects
Electro-Optical/Infrared (EO/IR)
Guidance, Navigation & Control (GN&C) and Data Links
Scalable Teaming of Autonomous Systems
Networks and Communications
Trust Foundations
Guidance, Navigation & Control (GN&C) and Data Links
Electronics Integration
EO/IR Components for sensing, transmission and communication
Design and Integration
Mobility
Sensors, Electronics and Photonics
Machine Perception, Reasoning and Intelligence
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Synthesis/Analytics/Decision Tools
Collaborative Analysis and Decision-making
RF Components for sensing, transmission and communication

Information Collection/Management
Networks and Communications
Broadband/Multispectral Components and Systems
Radio Frequency (RF) (non-EW)
Microelectronics and Nanoelectronics
Broadband/Multispectral Components and Systems
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Sensors, Electronics and Photonics
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Rotary Wing Vehicles
Machine Perception, Reasoning and Intelligence
Collaborative Analysis and Decision-making
Human/Autonomous System Interaction and Collaboration
Machine Perception, Reasoning and Intelligence
Advanced Computing/Software Development
Information Collection/Management
Maintainability/Sustainability
Aircraft Propulsion, Power and Thermal
Combat Casualty Care
Military Infectious Diseases
Power Generation/Energy Conversion
Acoustic, Seismic and Magnetic
Fixed Wing Vehicles (includes UAS)
Networks and Communications
Machine Perception, Reasoning and Intelligence
Synthesis/Analytics/Decision Tools
Assuring Effective Missions
Survivability
Maintainability/Sustainability
EO/IR Components for sensing, transmission and communication
Machine Perception, Reasoning and Intelligence
Unmanned Ground and Sea Vehicles
Electro-Optical/Infrared (EO/IR)
Propulsion
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Propulsion and Extreme Environments
Machine Perception, Reasoning and Intelligence
Networks and Communications
Unmanned Ground and Sea Vehicles
Acoustic, Seismic and Magnetic
Protection, Sustainment, and Warfighter Performance
Machine Perception, Reasoning and Intelligence
Information Collection/Management
Maintainability/Sustainability
Electro-Optical/Infrared (EO/IR)
Integrated Weapon Demonstrators (IWD)
Fixed Wing Vehicles (includes UAS)

Networks and Communications
Cognitive/Adaptive Capabilities
Distributed/Coordinated/Net-Enabled Systems
Radio Frequency (RF) (non-EW)
Electronics Integration
Machine Perception, Reasoning and Intelligence
Scalable Teaming of Autonomous Systems
Test, Evaluation, Validation, and Verification
Information Collection/Management
Unmanned Ground and Sea Vehicles
Information Collection/Management
Biomedical Informatics / Health Information Systems & Technology
Human Computer Interfaces (HCI) for Decision Making
Information Collection/Management
Personalized Assessment, Education, and Training
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Modular/Open/Reconfigurable Architectures
Human Computer Interfaces (HCI) for Decision Making
Assuring Effective Missions
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Modeling, Simulation & Test Infrastructure
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RF Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
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Design and Integration
Modeling, Simulation & Test Infrastructure
EO/IR Components for sensing, transmission and communication
Fixed Wing Vehicles (includes UAS)
Electro-Optical/Infrared (EO/IR)
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Electro-Optical/Infrared (EO/IR)
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Fixed Wing Vehicles (includes UAS)
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Fixed Wing Vehicles (includes UAS)
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Protection, Sustainment, and Warfighter Performance
Aircraft Propulsion, Power and Thermal
Fixed Wing Vehicles (includes UAS)
Power Generation/Energy Conversion
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Protection, Sustainment, and Warfighter Performance
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Collaborative Analysis and Decision-making
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Structures and Protection
Aircraft Propulsion, Power and Thermal
Corrosion
Propulsion and Extreme Environments

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-4388-18

Topic # N142-118

Wideband RF Digitizer with Integrated Filter

HYPRES, Inc.

WHO

SYSCOM: ONR

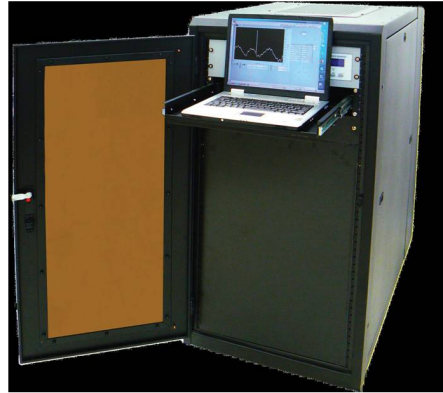
Sponsoring Program: SPAWAR
PMW 120, PMW 150, PMW/A 170,
PMW 770

Transition Target: Shipboard Signals
Exploitation Equipment next
generation, Navy Multi-band SATCOM
Terminal

TPOC:

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Other transition opportunities: Multi-
functional Information Distribution
System (MIDS) Link 16, Magnetic
Resonance Imaging (MRI) systems for
Traumatic Brain Injury



Modular, Multi-Function Digital-RF Receiver

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WHAT

Operational Need and Improvement: Naval radio frequency (RF) systems have a requirement to improve spectrum utilization by implementing high speed broadband analog to digital converters. Although great strides were made with the third generation Modular, Multi-Function Digital-RF Receiver systems in the hands of government labs, attention is now focused on the fourth generation, first delivered in 2018. The ability to simultaneously capture a wide range of signals of interest is now primarily limited by the immaturity of integration of the data output into appropriate backend DSP.

Specifications Required: This phase II is part of the program plan to develop a wideband receiver for applications such as electronic warfare. The objective of this Phase II is to integrate ADCs together with an analog filter/multiplexer as an integrated Nb technology single chip. If more capability is required, the system can be scaled up by combining chips into a multi-chip module (MCM).

Technology Developed: Technology developed utilizing the HYPRES advanced digital RF receiver (ADR) will eliminate many components, enhance toleration of co-located high power transmitters and enable dominance of the RF spectrum for naval multi-function RF applications, such as communications, Electronic Warfare (EW), Intelligence, Surveillance, and Reconnaissance (ISR) and Radar.

Warfighter Value: These Modular, Multi-Function Digital-RF Receiver systems maximize signal reception for communication, ISR and EW systems, enabling full broadband spectrum monitoring and precise emitter identification (ID) in a smaller form factor. Direct digitization at RF eliminates traditional analog RF components such as mixers, LO and many filters. High sensitivity allows many LNA to be eliminated. Digital reception allows many signals having different bandwidths and potentially overlapping frequency content to be collected from a single data stream and a single antenna. All these benefits reduce the size, weight, and power of full spectrum access systems by as much as 50 percent while simultaneously allowing facile real time adaptation.

WHEN

Contract Number: N00014-17-C-2001 **Ending on:** March 16, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Design and develop a multi ADC chip and a digital RF receiver concept	N/A	Test and evaluate a set of ADC chips per test plan, Completed	3	1st QTR FY18
Develop Cryocooled Testbed for Receiver chip	N/A	Demonstrate an MCM based, working ADC. Demonstrate a digital receiver with multiple coherently clocked ADC.	3	2nd QTR FY18
Design and develop Nb analog filter	N/A	Test analog filter chips per test plan. First development cycle completed. Second cycled started.	3	2nd QTR FY18
Option 1-Develop receiver MCM	High	Test system on a single, integrated chip per test plan.	4	2nd QTR FY20
Option 2-Build Digital RF Receiver with Filter ADC SoC MCM	High	Test and demonstrate the concept of a channelizing Digital RF Receiver	6	1st QTR FY20

HOW

Projected Business Model: The output of this Phase II will result in a product that will be incorporated into the HYPRES digital RF receiver product family which in turn will be inserted into military systems directly and through other DoD prime contractors. HYPRES has worked with L-3 Communications, Argon ST, and ViaSat on digital-RF receiver projects in the past.

Company Objectives: HYPRES seeks program office support for completion of development, test and evaluation, and transition to Ship's Signals Exploitation Equipment (SSEE) and Navy Multiband Terminal (NMT) as examples of relevant programs of record. HYPRES also seeks relationships with prime contractors, DoD program offices and equity investors for transition to major communications, EW, ISR and radar acquisition programs, and to the commercial market.

Potential Commercial Applications: HYPRES has identified commercial applications in MRI systems (ONR/OSD SBIR phase I/phase II contracts), avionics equipment and commercial SATCOM.

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