

Topic: N171-096

Transparent Sky

Real Time Computation of Precision 3D Models Using Low Size, Weight, and Power (SWAP) Architectures

Transparent Sky, employing embedded hardware onboard small unmanned aircraft (sUAS), performs near real-time reconstruction of 3-dimensional scene models, in minutes, from aerial imagery. With a goal of real-time, frame-by-frame 3D reconstruction of collected imagery. The system expands upon Wide Area Motion Imagery (WAMI) technology providing advanced 3-D reconstruction capabilities. Transparent Sky's capability provides tactical advantage to small units, enabling them to become proactive, providing capability to observing battlespace events from any angle or perspective, study patterns of life, and measure scene object range. The system has low size, weight, power, and cost (SWaP-C), and is designed for simple operation and maintenance. Transparent Sky's seeks strategic partnerships with Department of Defense and Commercial entities interested in exploiting content derived from sUAS, immersive real-time 3-D WAMI surveillance.

Technology Category Alignment:

Satellite Communications (SATCOM)

Robotics/Automated Material Handling Equipment

Shipyards/Shipbuilding

Supply; Storage

Satellite Communications (SATCOM)

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Supply; Storage

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Satellite Communications (SATCOM)

Shipyards/Shipbuilding

Robotics/Automated Material Handling Equipment

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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
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Power Generation/Energy Conversion
Energy storage
Power and Energy
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Maintainability/Sustainability
Advanced Computing/Software Development
EO/IR Components for sensing, transmission and communication
Microelectronics and Nanoelectronics
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Human/Autonomous System Interaction and Collaboration
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Aircraft Propulsion, Power and Thermal
Power Generation/Energy Conversion

High Energy Lasers (HEL)
Propulsion
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Protection, Sustainment, and Warfighter Performance
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Assuring Effective Missions
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Biomedical Informatics / Health Information Systems & Technology
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High Energy Lasers (HEL)

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Fixed Wing Vehicles (includes UAS)
Machine Perception, Reasoning and Intelligence
Resilient Infrastructure
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Acoustic, Seismic and Magnetic
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)
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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
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Aircraft Propulsion, Power and Thermal
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EO/IR Components for sensing, transmission and communication
Networks and Communications
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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
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Aircraft Propulsion, Power and Thermal
Propulsion
Protection, Sustainment, and Warfighter Performance
Individual Warfighter
Synthesis/Analytics/Decision Tools
Collaborative Analysis and Decision-making
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Modeling, Simulation & Test Infrastructure
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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

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Acoustic, Seismic and Magnetic
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Design and Integration
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Undersea Weapons
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Networks and Communications
Networks and Communications
Electronic Materials
RF Components for sensing, transmission and communication
Broadband/Multispectral Components and Systems
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RF Components for sensing, transmission and communication
Power Control and Distribution
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Resilient Infrastructure
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RF Components for sensing, transmission and communication
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Structures and Protection
Aircraft Propulsion, Power and Thermal
Corrosion

Propulsion and Extreme Environments

Readiness

Sensors, Electronics and Photonics

Structures and Protection

Electronics Integration

Networks and Communications

None

None

None

None

None

None

None

None

None

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None

None

Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-5915-19/43-6031-19

Topic # N171-096

Real Time Computation of Precision 3D Models Using Low Size, Weight, and Power (SWAP) Architectures

Transparent Sky

WHO

SYSCOM: ONR

Sponsoring Program: ONR Code 30 Expeditionary Maneuver Warfare

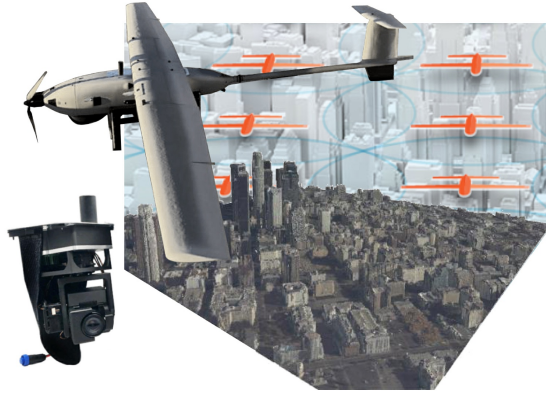
Transition Target: USMC small tactical unmanned aerial vehicles

TPOC:

Mr. Martin Kruger
martin.kruger1@navy.mil

Other transition opportunities:

- Current Advocacy
- US Marine Corps Warfighting Laboratory
- Precision Integrated Programs LLC (Navy Intelligence, Surveillance, and Reconnaissance (ISR) service operator)



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Our SBIR work is only a part of the solution

- Tactical ISR integration needed
- Existing systems need overall image quality improvements
- Practice and con-op development needed to uncover more integration lessons

Possible transition paths include

- Multi-Domain Operations
- SOCOM Program Executive Office Fixed Wing (PEO-FW)
- Navy and Marine Corps Small Tactical Unmanned Aircraft Systems (PMA-263)
- Direct (Retail) sales of solution

WHAT

Operational Need and Improvement: Embedded in the sensor we quickly construct a 3-dimensional model from aerial imagery. We can survey, take measurements, provide situational awareness, and augment security, instantly.

Specifications Required: The Navy target was to generate accurate 3D models:

1. With bandwidth limitations (4Mbps-10Mbps range)
2. Generated without return to ground (i.e. in flight)
3. With small, low-power hardware

Technology Developed: Sensor system with its embedded software algorithms generates a real-time 3D model of aerial imagery. This system will produce a 3D model in real-time frame-by-frame as imagery is collected, making a live map-in-time display, like a battlefield TiVO of 3D imagery.

- | | |
|---|---|
| 1. Current: Tactical data link: < 10 Mbps | - Planned: As low as 1.5 Mbps |
| 2. Current: During flight: 3D in 3 Minutes | - Planned: 3D Frame-by-Frame |
| 3. Current: Accuracy: Pixel size < 10 cm | - Planned: Variable to pixel size |
| 4. Current: Status: TRL 5 – prototype operational | - Planned: TRL 9 – routinely deployed |
| 5. Current: SWaP 1.5 kg & 15 W | - Planned: 3.5x higher resolution option at 2.5 kg & 25 W |

Warfighter Value: Measure what you cannot touch. Evaluate a position before you commit. See what is happening around you in 3D to gain better insight into the situation so you can respond more proactively.

WHEN

Contract Number: N68335-19-C-0188 **Ending on:** January 29, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototype '3D in 3 minutes'	Low	Algorithm routinely works	TRL 5	4th QTR FY19
Fielded '3D in 3 minutes'	Low	Fielded WAMICam units updated	TRL 7	1st QTR FY20
User interface fielded for sharing 3D models among operational team	Low	Sharable interface fielded	TRL 7	1st QTR FY20
Life frame-by-frame 3D modeling prototyped	Med	3D model updated after each frame	TRL 5	3rd QTR FY20
Live frame-by-frame 3D modeling	Med	Algorithm demonstrated robust	TRL 6	1st QTR FY21
Operational Test and Evaluation under ISR Services contract	Med	ISR services contractor deploys capability	TRL9	2nd QTR FY21

HOW

Projected Business Model: -

We produce unmanned aerial surveillance (UAS) payloads, capable of executing these algorithms now.

Business model is to build these units for operators, either commercial or government.

Retail sales to multiple customers, including military, civil, and commercial markets.

Company Objectives: -

Make Wide Area Motion Imagery (WAMI) practical and affordable for routine operations that can scale to metropolitan sized areas.

Leverage research and development (R&D) funding to enter commercial sales and scale.

Deliver a 3D persistent wide area surveillance "live map-in-time" as a canvas for overlaying other intelligence collection for improved situational awareness and a common operating picture to help organize operations.

Potential Commercial Applications: -

Near-Term: Urban planning, event monitoring (rallies, sports, riots), law enforcement, perimeter security.

Long-Term: Live metro viewing available to the general public. A "beyond GoogleEarth" capability.

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