**StereoBit: Advanced Onboard Science Data Processing to Enable Future Earth Science**

**PI: James Carr**
Dr. Carr is a member of the TEMPO science team and a frequent collaborator with Code 600 and NOAA STAR in the area of atmospheric research. His training is in physics and he has played a lead role in weather satellite programs in the U.S. and internationally, including GOES-R and Meteosat.

**Co-I: Dong Wu**
Dr. Wu is an atmospheric scientist with broad experience including MISR, CMIS (as Co-I), SORCE/TSIS, and microwave remote sensing. He is a collaborator with Dr. Carr on stereo 3D winds and author on several paper on the subject. Dong will provide scientific guidance for our AIST effort.

**Co-I: Chris Wilson (GSFC Institutional PI)**
Dr. Wilson is an early-career computer engineering researcher in Code 587 specializing in high-performance and reconfigurable computing for space applications. Chris will lead the efforts of Code 587 in the execution of the AIST effort.

**Co-I: Matthew French**
Matthew French is a former 2x AIST PI. He provides continuity to earlier research efforts with SpaceCube hardware and is our lead SME for the Virtual Constellation Engine (VCE) and a High-Level Synthesis (HLS) SME.

**Collaborator: Michael Kelly**
Dr. Kelly is the CMIS PI and a collaborator with Dr. Wu and Dr. Carr on the development of stereo 3D-wind methods and mission concepts. The CMIS instrument is the model application for the application development to be pursued under this AIST award.
StereoBit Project Vision/Objectives

**Advance Onboard Science Data Processing Capabilities within CubeSat Size Weight and Power:**
*Develop a Specific Application for SpaceCube tied to High-Priority Decadal Survey Science*

- Vertically resolve winds using **Structure from Motion (SfM)** stereo tracking of clouds
- **Integrate operations** between platforms
- Disaggregate science processing to **alleviate downlink bottleneck** of constellation architectures
- **Infuse knowledge** into the Earth Science community from our experience developing a science application on SpaceCube

**Stereo 3D-Winds Constellation**

- **CubeSats in Low-Earth Orbit (LEO)**
- **Geostationary (GEO) Imager** (e.g., GOES-R)
- **Leader-Follower Configuration** works over the Poles too

**Stereo 3D-Winds Product**

- **Hurricane Florence**
- MISR+GOES

**LEO-LEO**

**LEO-GEO**
Project Technologies

**SpaceCube Processor**
- CPU and Reconfigurable Field Programmable Gate Arrays (FPGAs)
- Mini/Mini-Z: fits within CubeSat Resource Limits
- ESTO Funded

**Compact Midwave IR Sensor (CMIS)**
- Target for our science application
- Multi-angle push-broom with fore, nadir, aft views like MISR
- Type-2 Super Lattice (T2SL) detector
- ESTO Instrument Incubator Program

**Software & Synthesis**
- NASA core Flight System (cFS)/core Flight Executive (cFE)
- Tools to synthesize FPGA logic from C/Python
- Virtual Constellation Engine (VCE) from AIST-16

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<td>Multi-Spectral</td>
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<td>Multi-Angle</td>
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“Fly” StereoBit at GSFC

- Demonstration of a nearly Flight-Ready Application
- Best Practices for Science Application Development on SpaceCube