Infrasound

MTV Kickoff Meeting

20 May 2019

Milton Garces
University of Hawaii

Introduction and Motivation

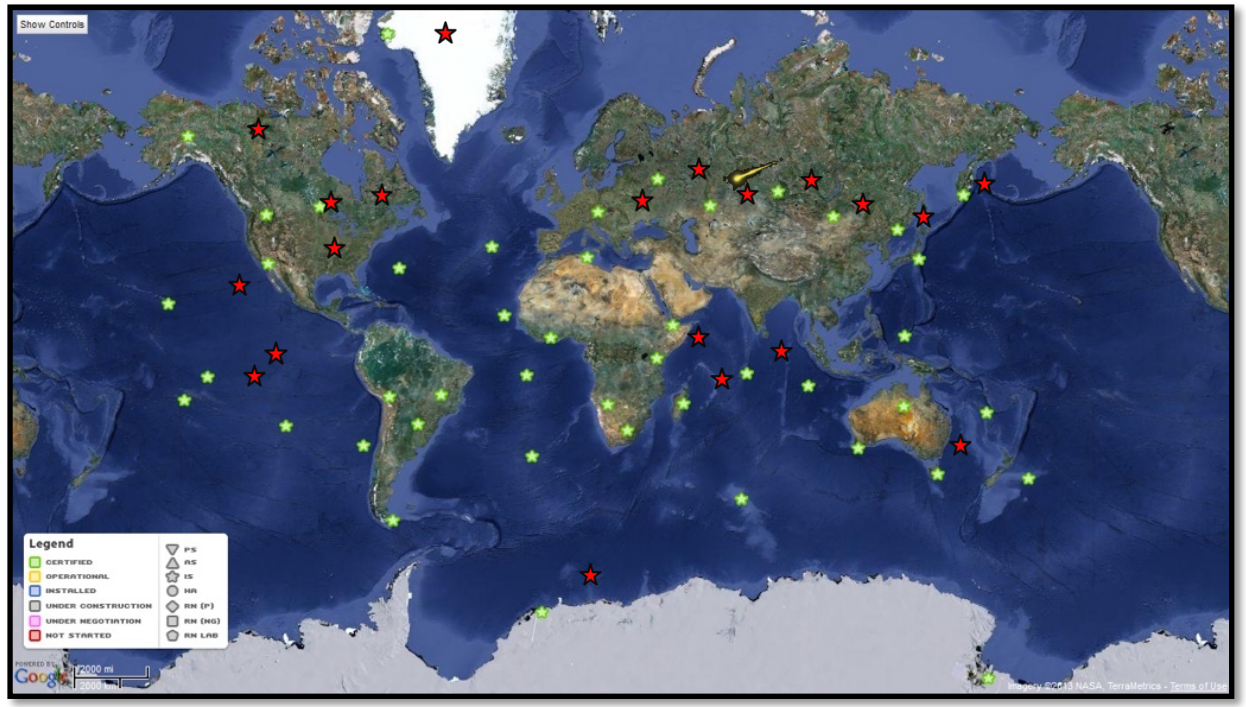
Infrasound and low-frequency acoustic signatures contain useful information of

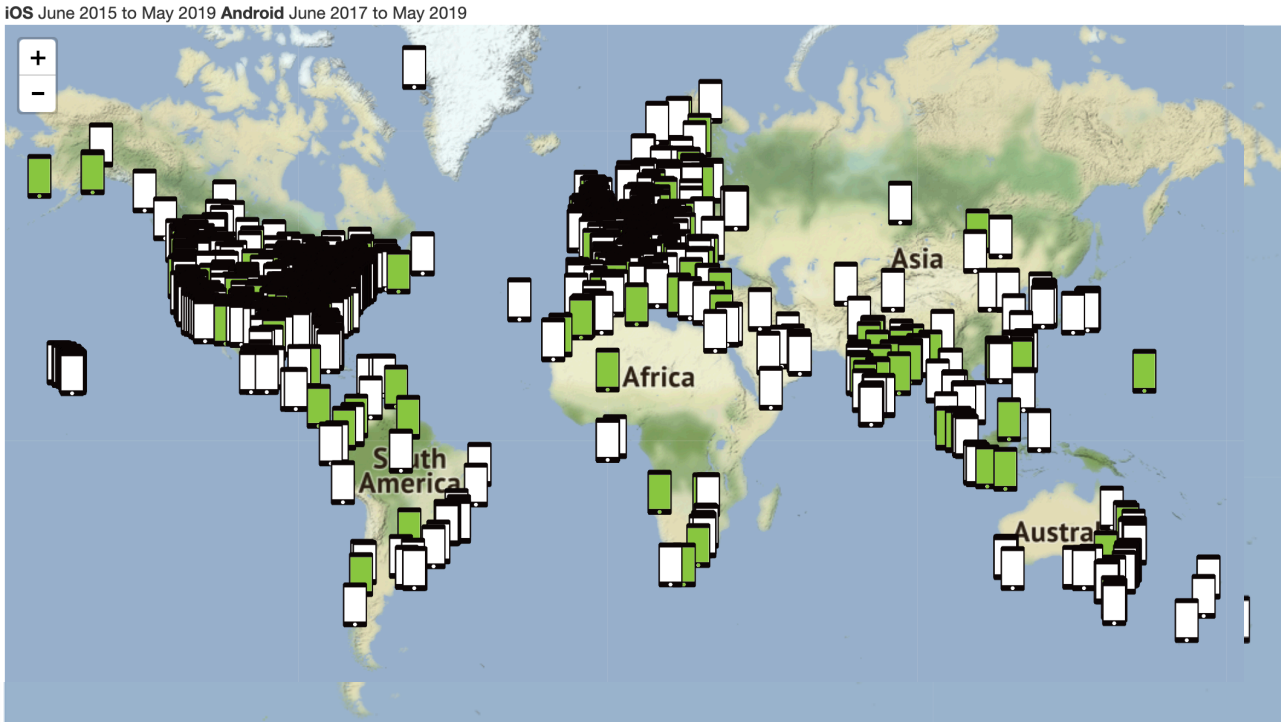
- Nuclear fuel cycle processes
- Nuclear test explosions
- Staging of nuclear tests and their delivery systems
- Nuclear weapon delivery systems

We explore emerging techniques and collection methods to estimate the location, magnitude/yield of these sources in the atmosphere or near the earth surface.

Mission Relevance: Vigilance

- Enhance persistent monitoring, detection, location, and signal identification technology and tools to improve situational awareness and early warning capabilities of present and emerging threats.





Statement of Work

PI for UH Team

TA3. Physics of Monitoring for Nonproliferation

R&D to improve the understanding of fundamental physics for signals generated from potential nuclear tests with lower yields and the subsequent propagation of those signals to sensor collections.

TA3.0. Coordination of TA3 Activities

TA3.0. *UH Project Title: MTV TA3 Lead*

Support the MTV Consortium in the coordination of the Physics of Monitoring for Nonproliferation (PMN) topic area.

TA3.1. Infrasound

Explore new and improved techniques for collection mechanisms used to estimate the location, magnitude/yield of explosive sources in the atmosphere or near the earth surface.

National Lab Collaborators

- LLNL: Keehun Kim, Jessie Gaylord and Steven Magana-Zook
- INL: David Chichester . SNL: Daniel Bowman. ORNL: Monica Maceira

Technical Work Plan

TA3.1. Infrasound

- Address diversity emplacement conditions and delivery systems for high explosives and nuclear explosives.
- Apply new blast pulse scaling and parametrization developed during CVT to airborne and near-surface stationary, subsonic, supersonic, and hypersonic explosive sources.
- Expand the diversity of seismo-acoustic signatures associated with nuclear weapon delivery systems and the nuclear fuel cycle that can be observed with smartphones.
- Deploy mobile sensor systems in high-altitude balloons, ocean surface gliders, and other non-conventional monitoring equipment to collect signals of interest in challenging environments.
- The detection, location, and signal classification capabilities of these emerging systems will be compared to legacy sensor systems.

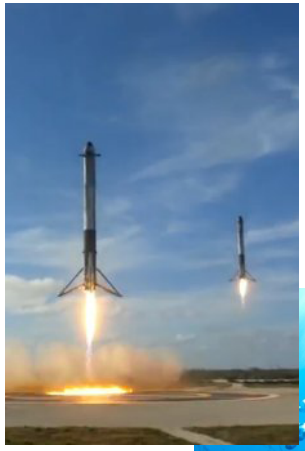
Expected Impact

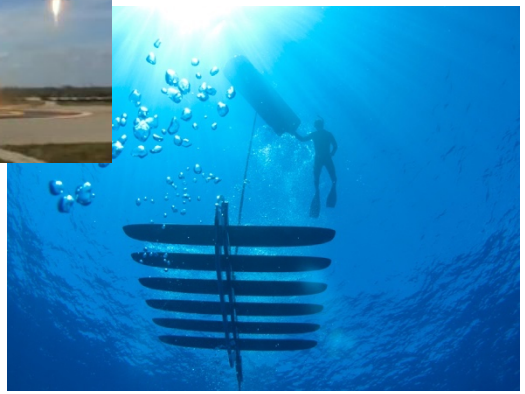
Modernize geophysical sensing systems and methods that can be deployed globally to effectively monitor explosive events and fuel cycle activity.

Oak Ridge, MINOS (via INL)

http://redvox.io/@/a3a8

Launch and photo by D. Bowman.





Adapt to new missions and concepts of operation

MTV Impact

- Ph.D. Students
- Cross-disciplinary collaborations with National Laboratories
- Laboratory Internships
- Laboratory Visitors
- Workshop participations
- Technology transitions
  - DOE/National Laboratories
  - DOD

Conclusion and Project Aims

- Develop new infrasonic and acoustic sensing methods to monitor explosive events and fuel cycle activity.

- Design a transition plan for these geophysical signatures to enhance global vigilance and early warning capabilities.

Acknowledgements

The Consortium for Monitoring, Technology, and Verification would like to thank the NNSA and DOE for the continued support of these research activities.

This work was funded by the Consortium for Monitoring, Technology, and Verification under Department of Energy National Nuclear Security Administration award number DE-FOA-0001875