Raining Drones:
Mid-Air Release & Recover of Atmospheric Sensing Systems

University of Nebraska-Lincoln
PIs: Carrick Detweiler, Adam Houston

University of Virginia
PI: Sebastian Elbaum

Motivation

This research will transform mid-air interactions between aerial robots by developing the foundations, techniques and systems that will realize their collaborative aerial launch and recovery. This integrative research will significantly advance the way we measure rapidly evolving and sparsely modeled atmospheric phenomena. By concurrently deploying and auto-recovering aerial robotic teams at distributed locations near the atmospheric boundary layer (ABL), this work will upgrade our ability to obtain high-resolution temporal snapshots of the atmosphere. Our work on generalized runtime protocol inference and enforcement for our systems will also form fundamental contributions to truly scalable and dependable teams of mutually interacting robots.
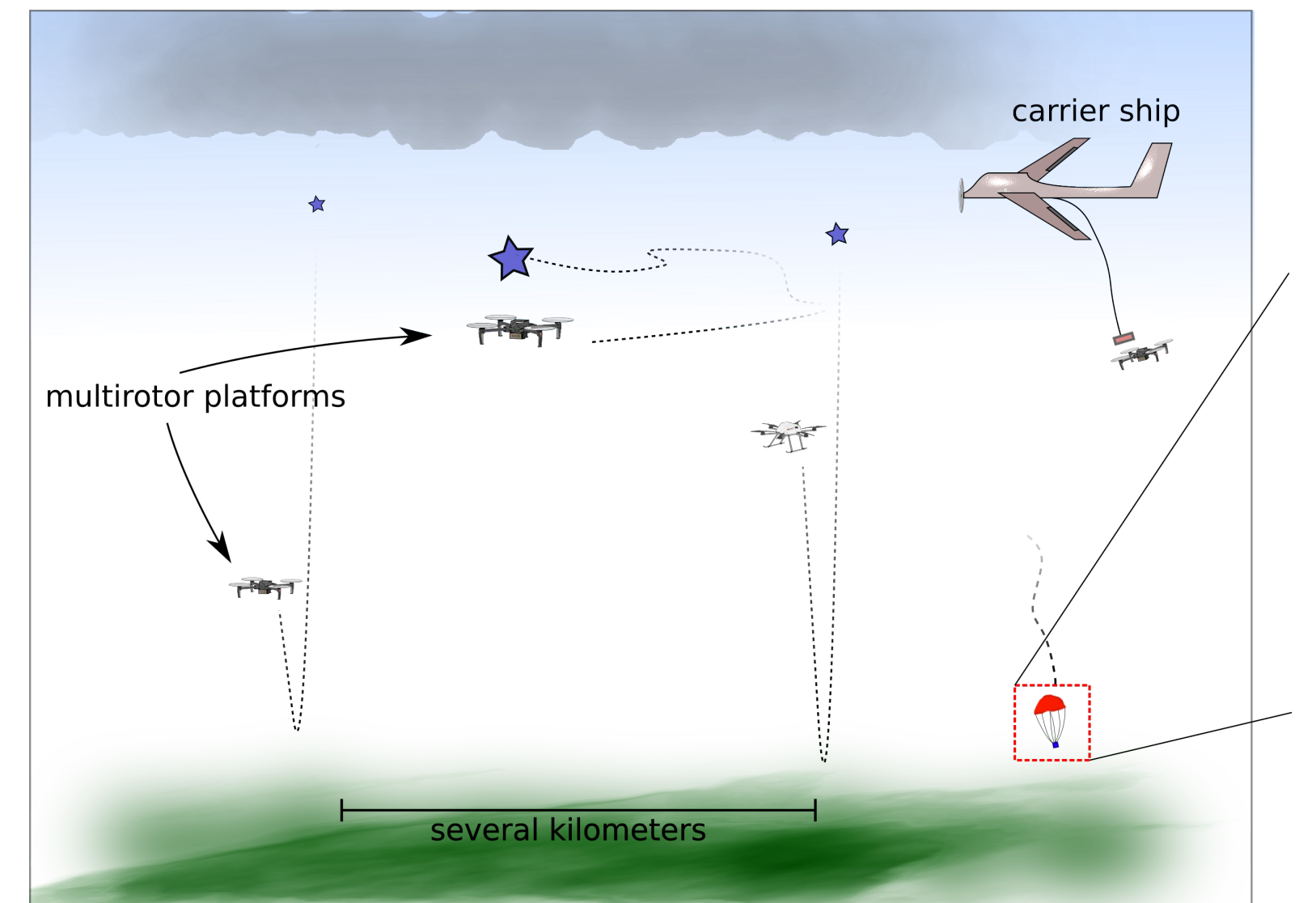

Vision showing heterogeneous systems releasing and recovering atmospheric sensing UAVs.

Goals and Objectives

This proposal will contribute techniques and systems to enable the development and deployment of teams of UASs that perform mid-air capture and release of other systems. More specifically, the expected intellectual merits of this work include:

- Planning and control methodologies for UASs intercepting airborne targets that have stochastic full 6-DOF motion.
- Foundational elements for matched maneuvers between heterogeneous classes of aerial robots to perform aerial docking.
- Strategies for rapid aerial deployment-capture-redeployment cycles for teams of UASs to enable observations over large geographic scales.
- Run-time inference and enforcement of protocols orchestrating the interactions between distributed, heterogeneous robotic systems.
- Improved atmospheric sensing and monitoring capabilities that will enhance understanding and forecasting of atmospheric phenomena.

Proposed Solution
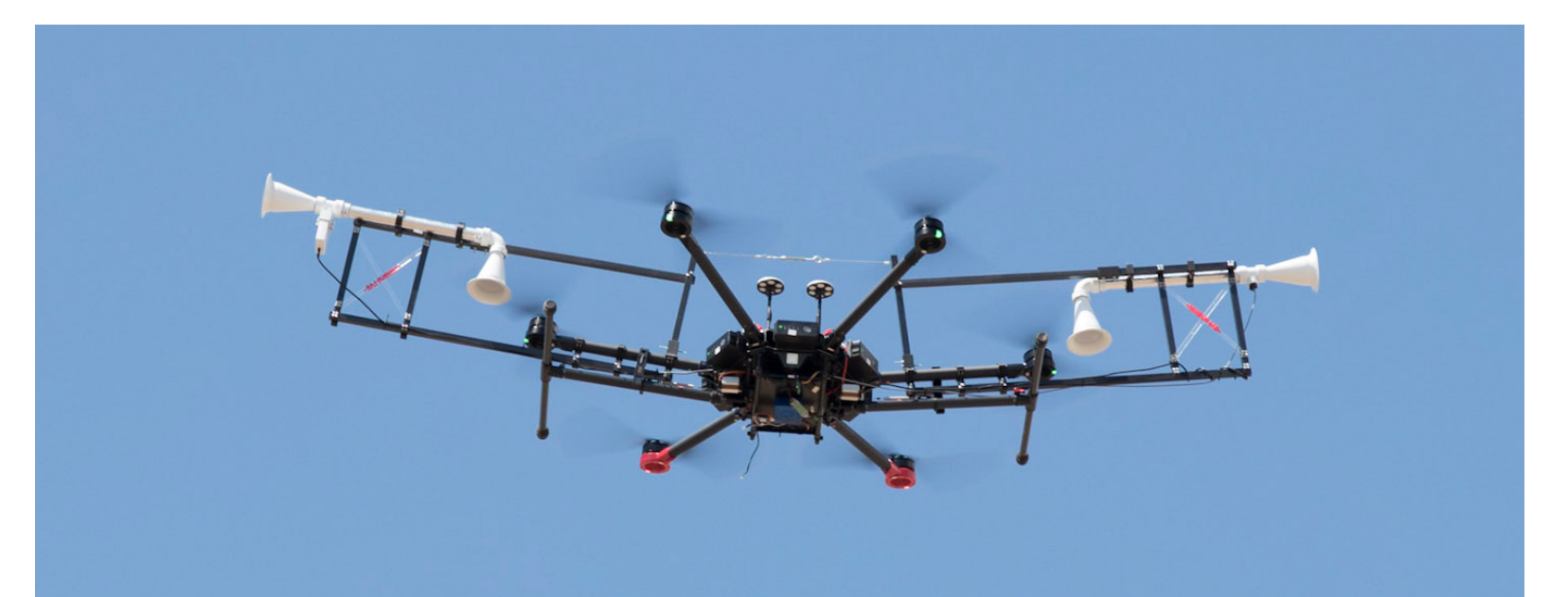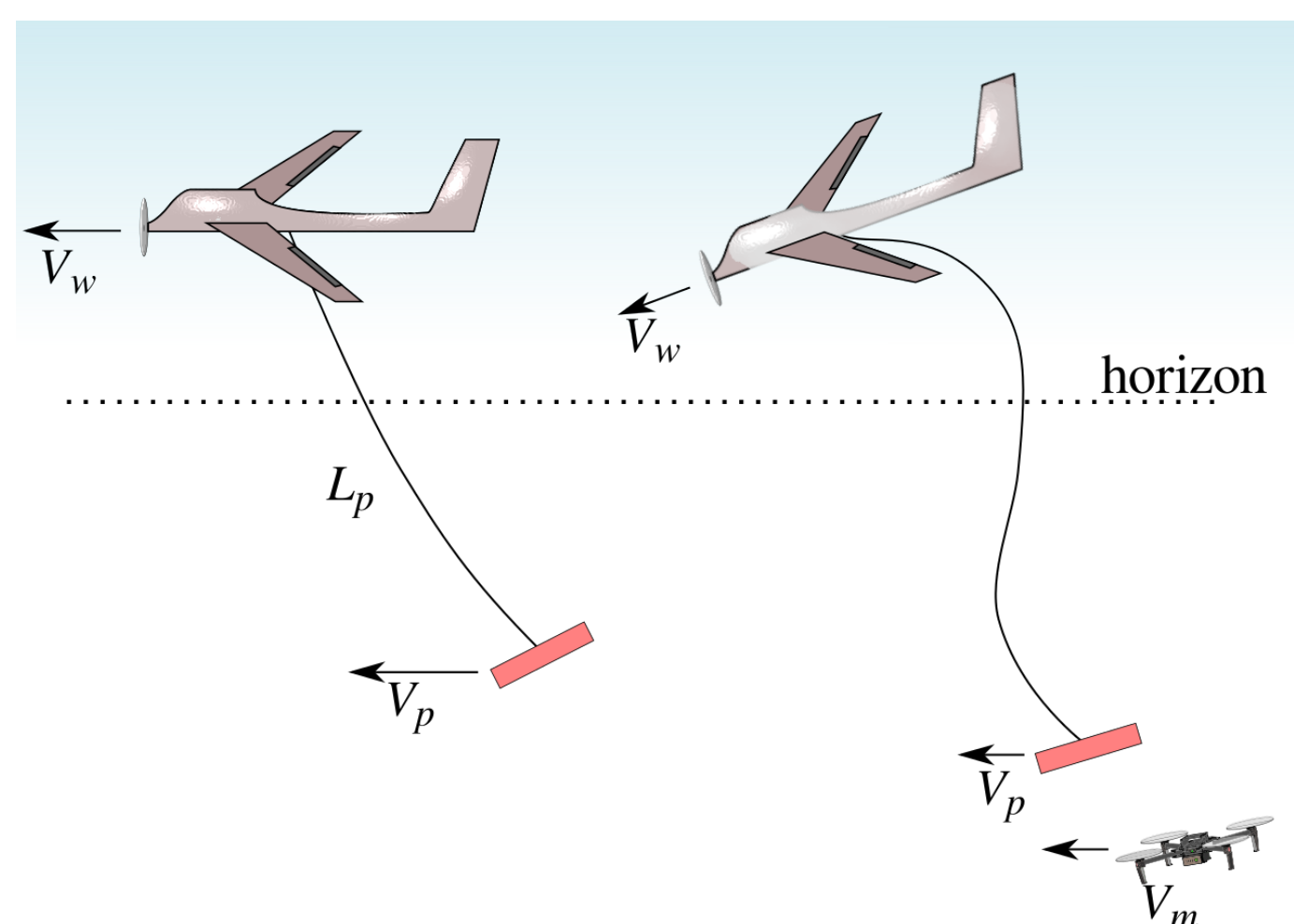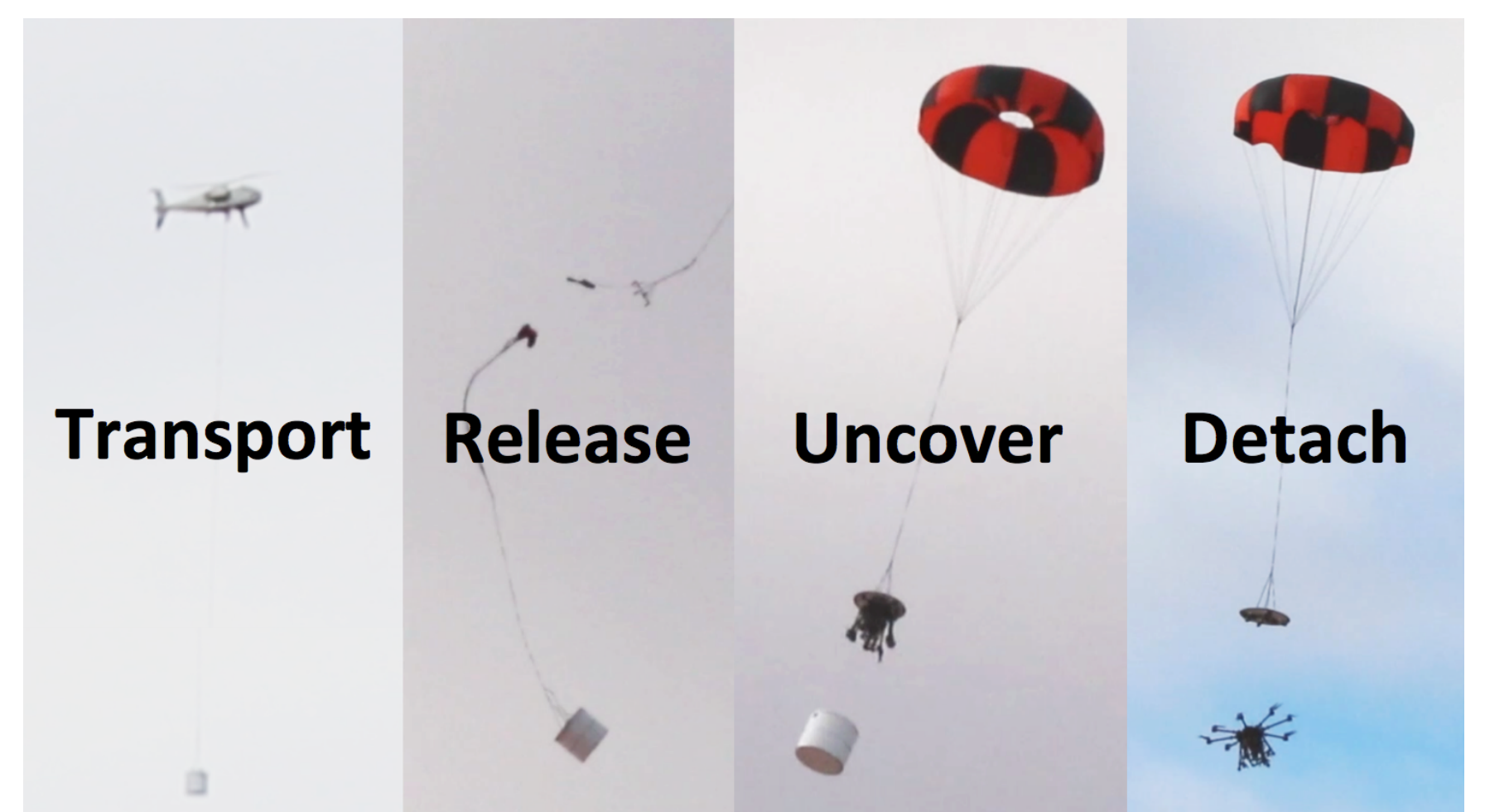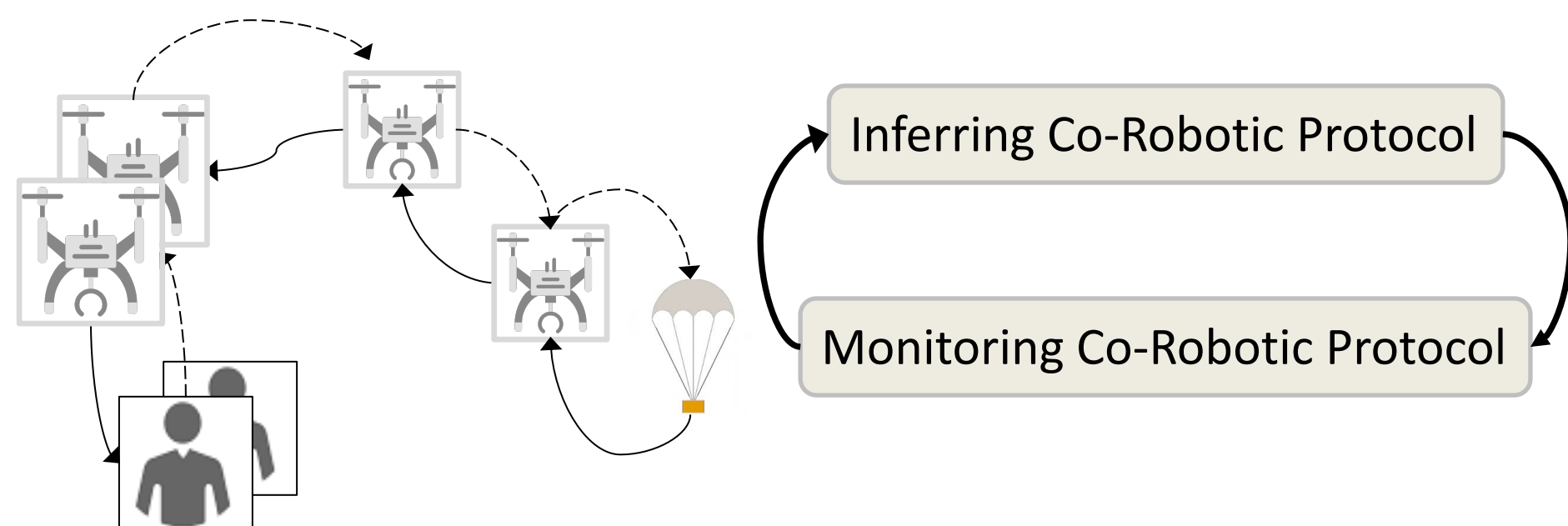
Broader Impact

- The proposed research will integrate teams of UASs into routine and periodic aerial profilings, directly impacting meteorological sciences and their ability to create accurate, descriptive and data-supported models of the atmosphere.
- This work will generate unprecedented datasets that capture atmospheric thermodynamics over large geographical scales.
- The underlying techniques and systems will be applicable to other domains such as surveillance, hazard assessment, reconnaissance and other forms of multimodal exploration.
- Educational and outreach programs will help in expanding the audience for this work by disseminating curated knowledge to students and to the general public.

Carrick Detweiler
Computer Science and Engineering - University of Nebraska Lincoln
carrick@cse.unl.edu

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