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Wind-profile Precision Air Delivery System (WindPADS)

Planning Systems Incorporated (PSI) is supporting the United States Air Force New World Vista Precision Aerial Delivery (NWV PAD) Program sponsored by the Air Force Office of Scientific Research. The objective of the program is to develop and apply technologies to improve the delivery accuracy of parachute loads, ballistic and guided, released from high-altitude, in all weather and terrain conditions. PSI supports the NWV-PAD Program through the component WindPADS project. The prototype, demonstration WindPADS is a briefcase size, portable data receiving and processing system operated aboard the airdrop aircraft. WindPADS integrates two state-of-the-art technologies to produce a high-resolution, three-dimensional (3-D) atmospheric field of wind and density. The 3-D fields are used by a trajectory algorithm to determine the computed air release point (CARP) for a desired drop zone. The integrated WindPADS technologies are: (1) mesoscale atmospheric modeling/data assimilation, and (2) atmospheric dropsondes.

Military weather centers, Air Force and Navy, operationally execute mesoscale models daily in support of worldwide operations. Depending on the intended application, these models can produce nested grid areas covering the area of operations at a horizontal grid resolution on the order of 0.5 to 1.0 kilometer (with appropriate/ balanced vertical resolution). High resolution is necessary to model/predict wind fields in rough, mountainous terrain. Mesoscale forecasts provide the first estimate of the wind and density field for the drop zone.

Dropsonde technology is fully mature. U.S. Air Force C-130 "Hurricane Hunters" use dropsondes for in-situ measurements in hurricanes and typhoons to support warning centers. BAE Systems developed a GPS-based Tactical Dropsonde (TDrop) capable of being ejected from both Air Force and Navy aircraft countermeasures dispensing systems (CMDS). In operational scenarios, the TDrop can be deployed from the airdrop aircraft itself, an unmanned aerial vehicle (UAV), or CMDS-equipped fighter aircraft, with line-of-sight UHF communications, during Tdrop descent from the TDrop to the WindPADS-equipped aircraft.

WindPADS integrates the meso-scale forecast field and TDrop in-situ data to produce a 3-D wind and density field consistent with the terrain, the larger-scale wind flow, and atmospheric vertical stability. The assimilation algorithm is an adaptation of the latest software developed by the National Oceanographic and Atmospheric Administration (NOAA) Forecast Systems Laboratory (FSL) normally used to assimilate observed data with modeled/forecast data at weather data processing and forecast centers, both civilian and military.

Follow-on Objectives: Transition to full-scale engineering development, produce a logistically supportable, portable Precision Air Delivery system to readily convert any airdrop aircraft into a high-altitude precision delivery system. Apply design to the development of a computer system configuration item (CSCI) for integration into aircraft onboard navigation systems.

PSI can provide systems engineering and prototype testing support for the development of tailored systems to support high-altitude delivery systems requiring accuracy improvement.

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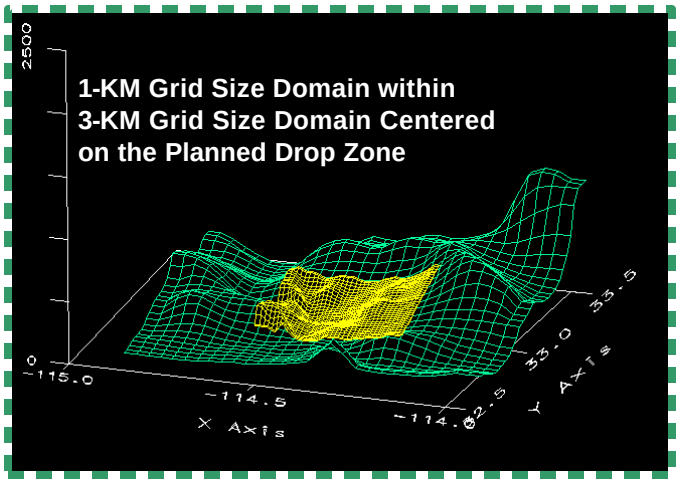
WindPADS Concept/Functional Outline

High-Resolution Atmospheric Forecast Model
- Executed at Operational Weather Central
- High-resolution Nested Grid Domain for Drop Zone
- Atmospheric Flow Driven by Mountainous Terrain



1-KM Grid Size Domain within 3-KM Grid Size Domain Centered on the Planned Drop Zone

Aircraft Antenna

GPS TDrop

WindPADS

Mesoscale Fields

Radio Receiver

Assimilation Processor

TDrop Processor

High-resolution 3D Wind/Density Field

Ejection/Trajectory Algorithm [CARP]

Aircraft Navigator or Navigation System

CARP = Computed Air Release Point

Green Light

Delivery Altitude up to 25,000 feet MSL

Roll-out

Descent Trajectory
Trajectory Algorithm + WindPADS Fields

WindPADS

- Snap-on/Snap-off System on Airdrop Aircraft
- TDrops from Standard Countermeasure Dispenser Systems on Airdrop, Tactical and/or Unmanned Aircraft
- TDrop Data Assimilated with Mesoscale Model Forecast Field - on Airdrop Aircraft Near Drop Zone
- Resultant Field to Paradrop Ejection/Trajectory Algorithm -- CARP for Desired Impact Point

Complex 3D Atmospheric Flow in Mountainous Terrain

Desired Impact Point

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