Progress Report
Southeast Texas Balloon Campaign

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TERC Science Advisory Committee
June 1-2, 2005 Planning Meeting

Review of Objective

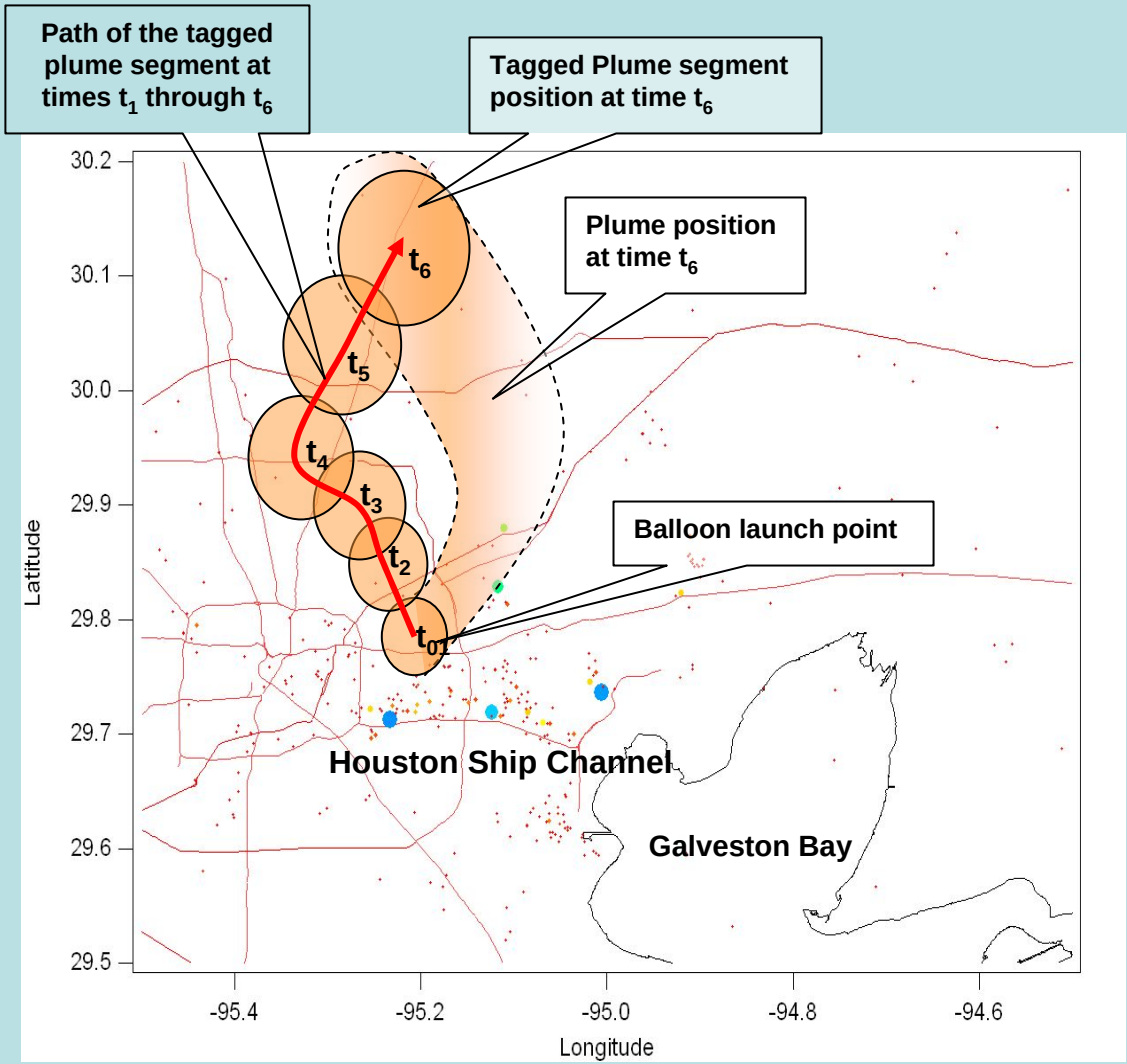
- *To develop and demonstrate improved strategies for tracking the transport and evolution of pollutants emitted in the Houston-Galveston area using newly developed controlled meteorological balloons in conjunction with an instrumented aircraft*

Review of Approach

- 2005 pilot study to demonstrate the proposed quasi-Lagrangian balloon-aircraft sampling strategies.
  - Development of lighter, safer and more reliable balloons
  - Development of flight planning software and communication protocol between surface/balloon/aircraft
  - Field Deployment
    - one mission to demonstrate safe operations to the FAA
    - two missions designed to test different aspects of the sampling strategy for daytime and nighttime conditions.

Motivation

snapshots of a plume ≠ parcel history



During the 2005 campaign, we will have…

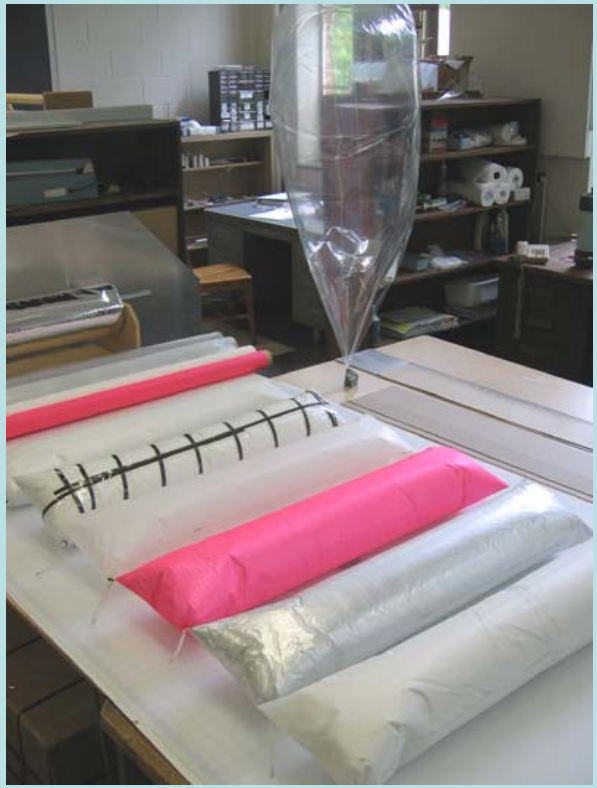
- Aircraft and surface links to and from balloons.
  - Install small external antenna, satellite modem and laptop .
  - plane will know exactly where the balloon is, which will be critical to sampling in the right place.
- Aircraft measurements near the balloon of
  - O_3, NO_x, NO_y, SO_2, CO
  - aerosol size distribution (from 0.1micron to ~3microns). (Hopefully!)
  - VOCs (canister samples and PTRMS)
  - winds, ambient temperature, dew point, pressure and position.
  - Aircraft observations supported by separate HARC funding to TVA (Ray Valente)

Activities to Date

- January:
  - Administrative issues (contracts, subcontracts, etc.)
  - Start redesign of balloon configuration
    - Safety issues: replace conductive coating with electrically non-conductive material
    - Reduced weight
    - Refine control algorithms for improved altitude control.

Activities to Date

- February
  - Balloon film delivered from Tokyo and coated with heat-sealable adhesive.
  - New microcontroller design tested and finalized
  - Control algorithms improved to allow for continuous soundings



- Six high pressure test balloons (above, foreground) and the new transparent zero-pressure balloon (above rear and left)
- Materials and fabrication techniques for the high-pressure balloon have been optimized tested successfully.
- Precise balloon size and geometry are under evaluation.

Activities to Date

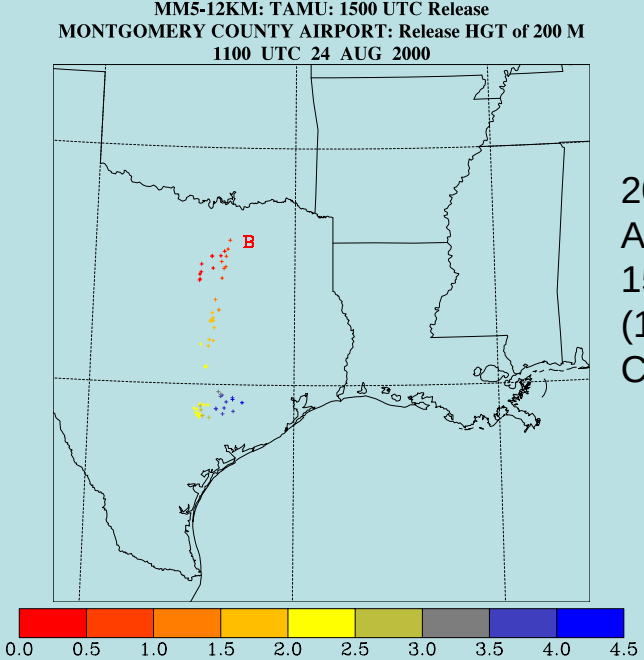
- March
  - Visited candidate airfields and launch sites
    - Initial contact with FAA and FBOs
  - Begin fabrication of balloon prototypes.
  - Start assembly of microcontroller boards for balloon control.
  - Procurement completed for state-of-the-art material for superpressure balloons
  - LED strobe lights added to balloons
  - March 15-16th Field Planning Meeting
    - Progress Report
    - Coordination of activities with TVA and others
    - Present software developed to coordinate aircraft/balloon motions
    - Plans: for Battelle to join TVA one week prior to campaign to install communication hardware and software

Base of Operations

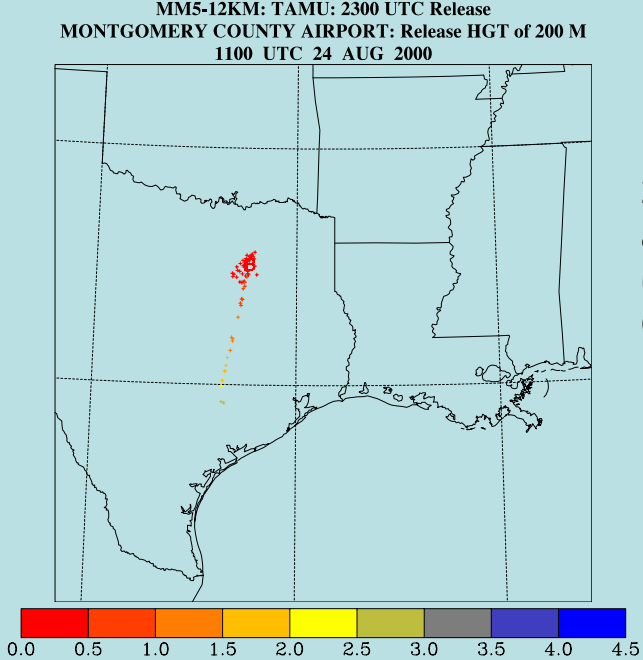
Flat surrounding terrain = easy launch capability

Activities to Date

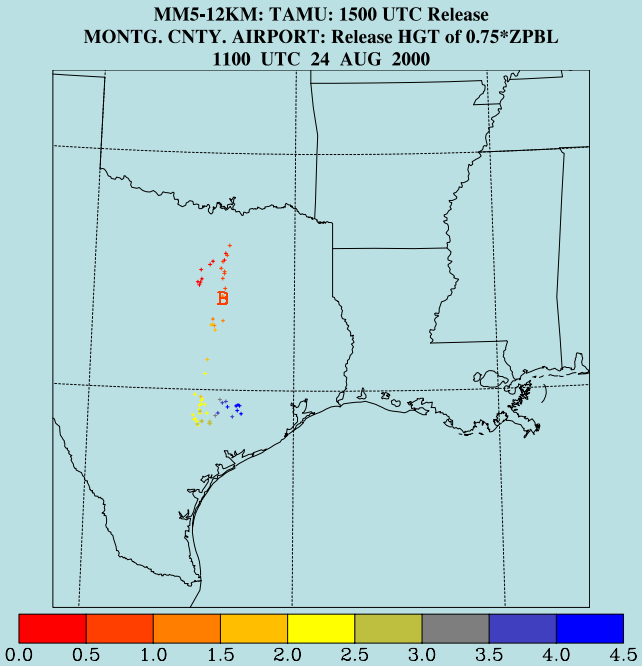
- April
  - Procurement of power adapter, modems and antenna for aircraft and balloons, with initial testing
  - 90% completion of new zero-pressure balloons (non-conductive, better helium retention, easier fabrication and transport)
  - Begin assembly of microcontroller boards.
  - Begin design of radar reflectors
  - Received and began studying particle dispersion simulations from University of Alabama



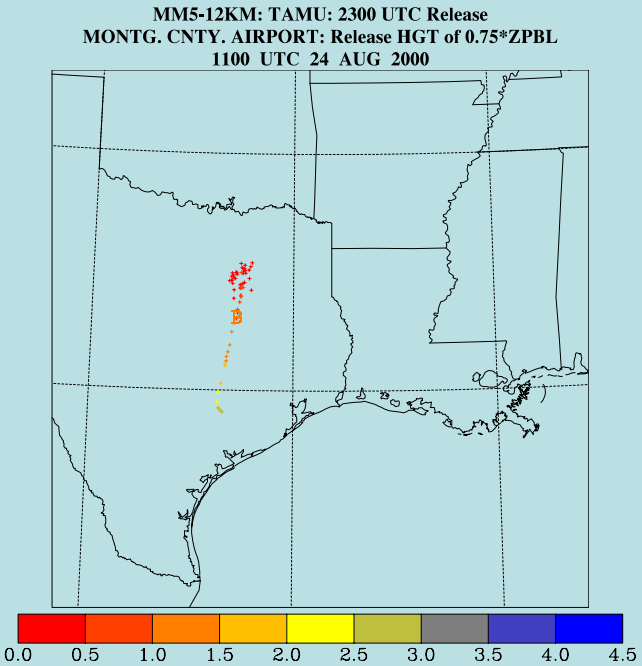
200m AGL at 15UTC (10 AM CDT)



200m AGL at 23UTC (6PM CDT)



0.75 zi at 15UTC (10 AM CDT)



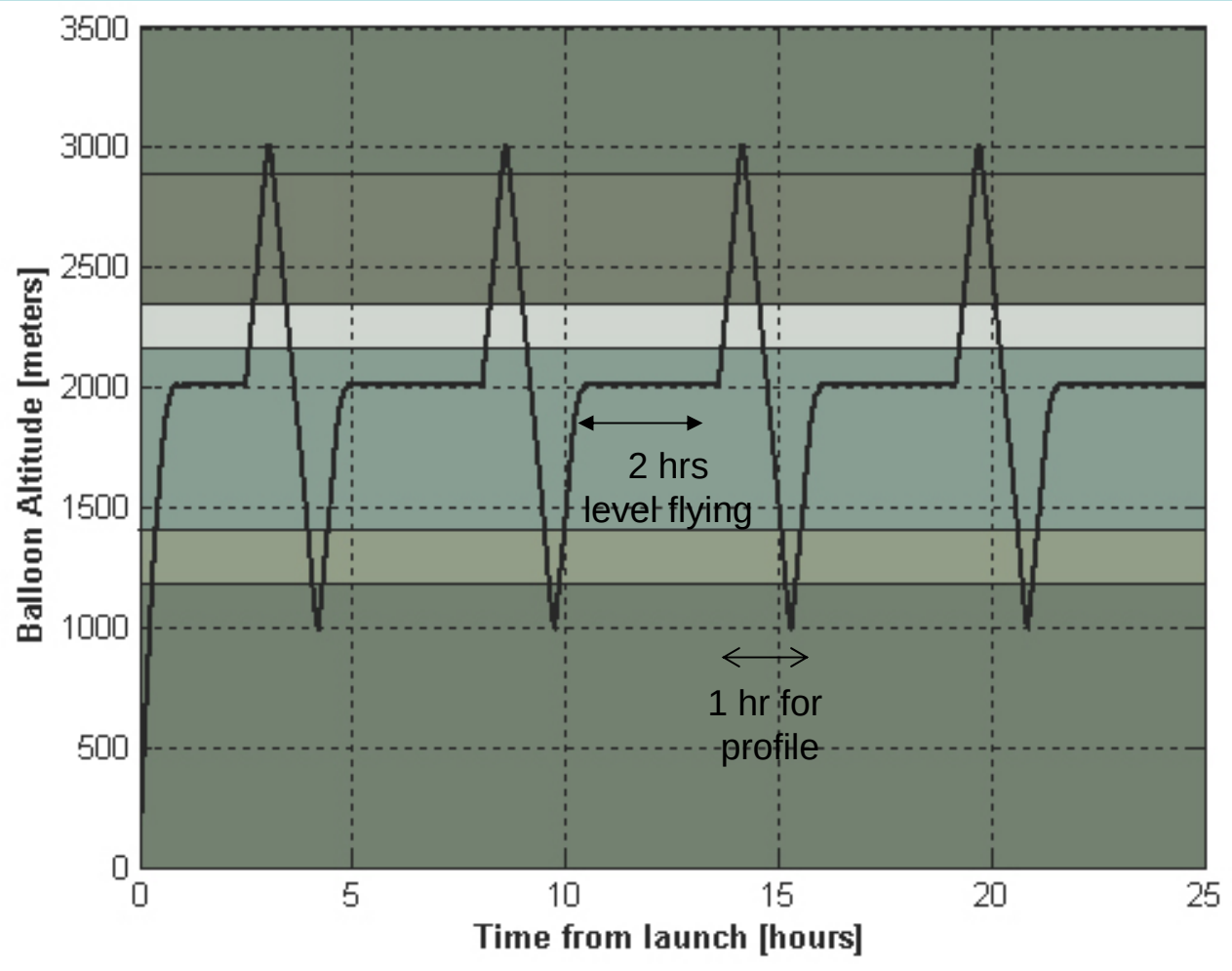
0.75 zi at 23UTC (6PM CDT)

LPDM Simulations by Kevin Doty, University of Alabama

Activities to Date

- May
  - Continued with balloon construction (all components)
    - Have made several prototype balloons over the weekend –
    - they need to set for a couple days
    - will be ready for burst tests this week.
    - Contract with GSSL in place to seal zero pressure balloons
  - Complete communication protocol for the 'Transmit to balloon' and 'Receive from balloon.'
    - reviewing modules for errors,
    - increasing fault tolerance and brainstorming anomalies that may occur during operation.
  - Have started formal discussions with FAA for approval of balloon launches
  - Extensive modification of flight planning software
    - Moving map with zoom feature
    - Displays information for 344 airports (contact numbers, altitude and lat/long) when balloon approaches ~ 10 n.m.
    - Development and testing of communication software for
      - balloon – satellite – ground
      - Balloon – satellite - aircraft
      - Ground <-> aircraft
      - **testing satellite modems (this week).**

Profile Design
power vs. information



- Observations of P, T, RH, lat./long./ alt every 10 sec
- Transmission to aircraft and surface every 6 minutes

Remaining Effort

- Finalize balloon design and construction
- Finalize and test flight planning software
  - Communication links
  - Finalize strategy for aircraft (e.g., safety and sampling issues)
- Join Twin Otter team for installation of communication electronics: July 11
- Balloon releases and sampling: July 18-30
- Summary Data to HARC and TCEQ: early August