



# The Applied Meteorology Unit Past, Present and Future



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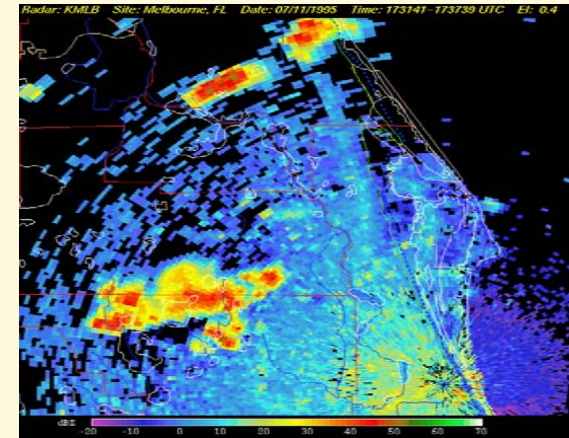
8 February 2007



# Overview



- What's an AMU?
  - Purpose
  - History
  - How it works
- Technology delivered: a sampler
  - Forecast tools
  - Numerical weather prediction
  - Sensors
  - Miscellaneous

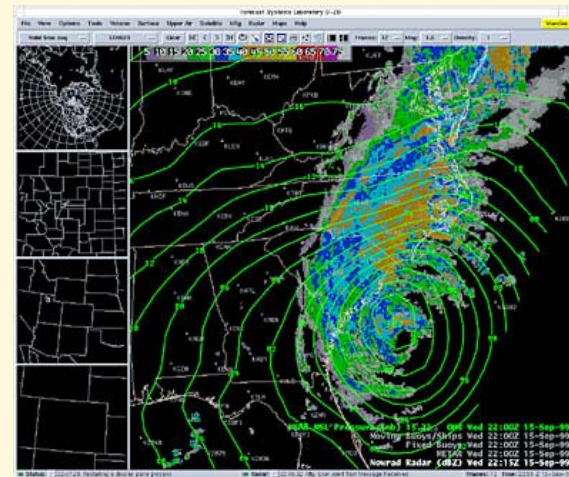




# Purpose of the AMU



- Goal: Improve weather support to Space Shuttle and America's space program
- Method: Bridge the gap between research and operations
- Technology Functions:
  - Develop
  - Evaluate
  - Tailor
  - Transition





## History of the AMU

- **Established Oct 1991** by NASA, USAF, NWS MOU
  - Co-located with Range Weather Operations
  - Operated by ENSCO, Inc. under NASA contract
- **Nationally recognized process** for tasking by customers
- **Outstanding performance**
  - Technical quality reflected in journal articles
  - Administrative quality reflected in corporate award
  - Customer satisfaction reflected in direct feed-back plus personal and group awards





## How We Work: Organization

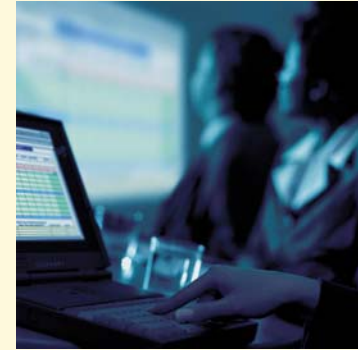
- Operated by ENSCO, Inc. under a competitively awarded contract to NASA/KSC
- Five full-time equivalent ENSCO professionals and one NASA civil servant professional half-time
- All have advanced degrees in meteorology or a related field and several have operational forecast experience
- Co-located with 45<sup>th</sup> Weather Squadron in the Range Operations Control Center at Cape Canaveral Air Force Station



## How We Work: Tasking



- **Customer-driven base-funded formal prioritized tasking**
  - Quasi-annual in-person meeting
  - Pre-meeting proposals and negotiations
  - Consensus process cited by Navy Best Manufacturing Practices Institute
  - Follow-up teleconferences as required
- **Customer-funded project tasking**
- **Customer-requested mission immediate tasking**





## How We Work: Task Execution



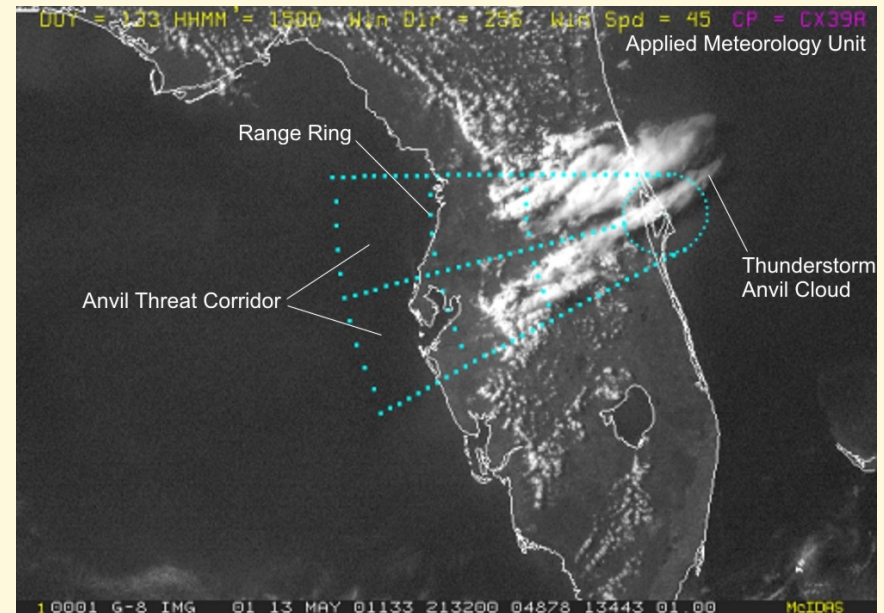
- **Customer involvement** throughout
  - Design of the approach to be taken
  - Determination of the deliverables
  - Detailed technical reports quarterly
  - Teleconferences at key decision points
  - Beta testing and document preview
  - Training and follow-up after delivery
- Also cited by Navy Best Manufacturing Practices Institute





# Example: Anvil Forecast Tool

- Requirement:
  - Lightning Launch Commit Criteria
  - Space Shuttle Flight Rules
  - Avoid natural and triggered lightning
- Provided:
  - Threat corridor:
    - if thunderstorms form here, their anvils will violate rules
      - Based on:
        - o Balloon observation
        - o Model forecast
  - Timing Rings: time until Launch & Flight Rules violated
    - Based on wind speed in anvil layer



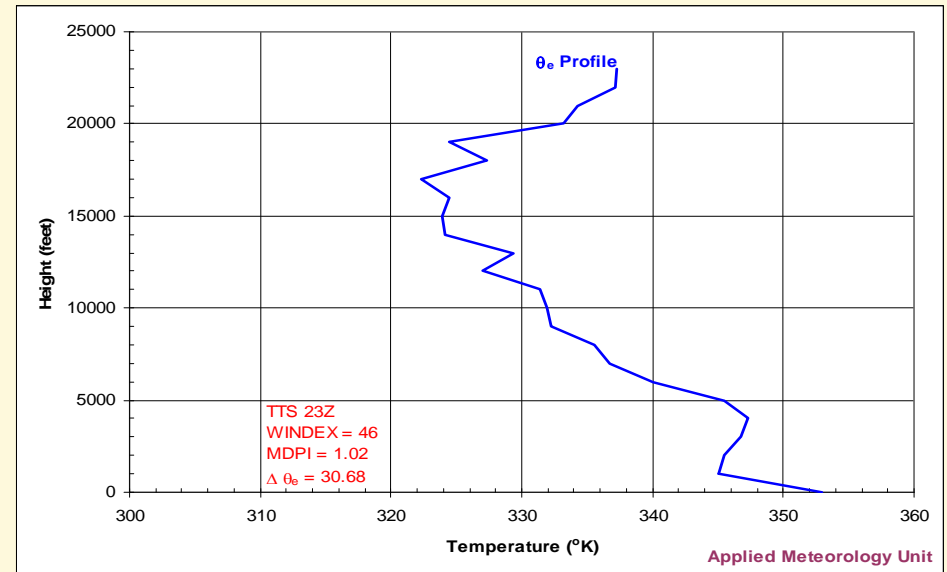




# Example: Microburst Prediction Tool



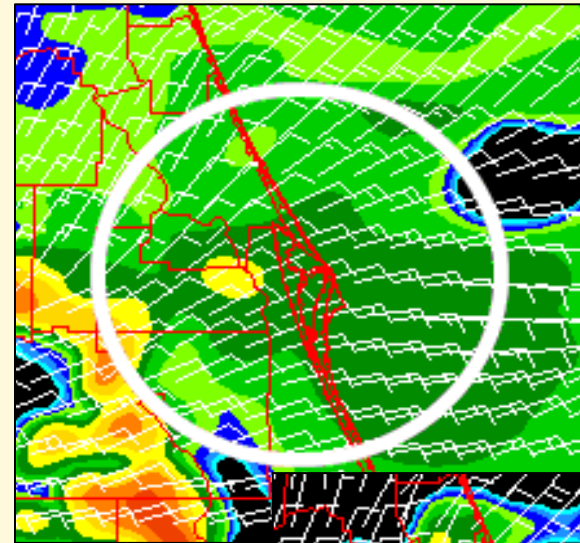
- Requirement: improve severe wind forecasts
- Provided:
  - Microburst-Day Potential Index
    - Downburst probability
  - Wind Index
    - Downburst maximum gust
  - Atmospheric stability chart



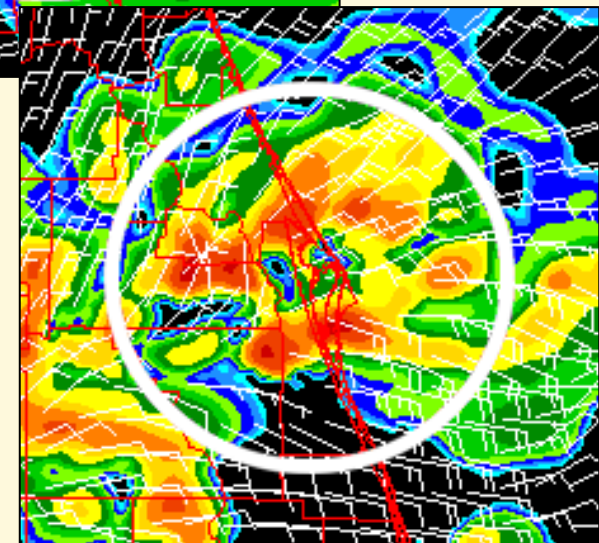


## Example: Numerical Weather Prediction

- Provided: local data assimilation software
  - All available data in one gridded database
  - Significant improvement in initialization of local forecast models
- Result:
  - Forecast improvement for all applications
  - Significant improvement in data visualization



Without  
radar  
data

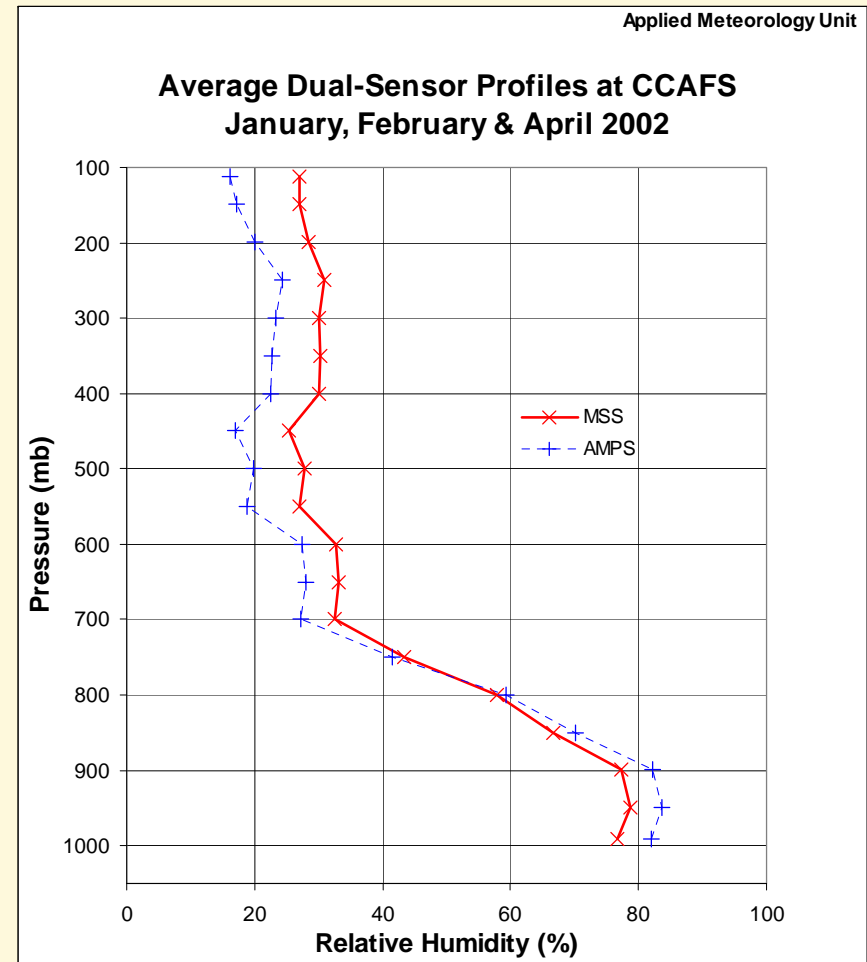


With  
radar  
data



# Example: Sensor Evaluation

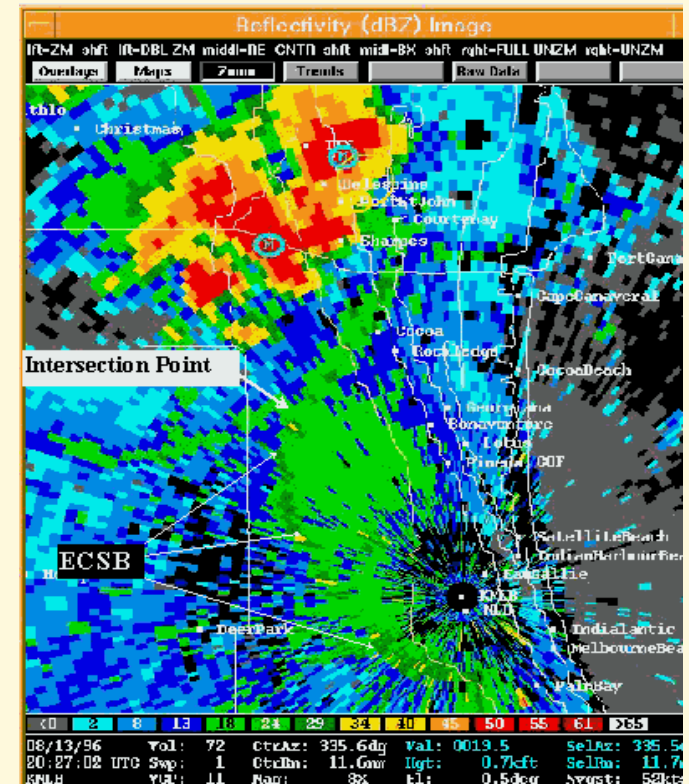
- Requirement: compare data from legacy upper air system with new one
  - Temperature and relative humidity differences
  - Changes in the measures of atmospheric stability
- Provided:
  - Documentation of relative humidity and temperature differences vs. altitude
  - Evaluation of impact on thunderstorm forecast indices





# Example: Severe Weather Event

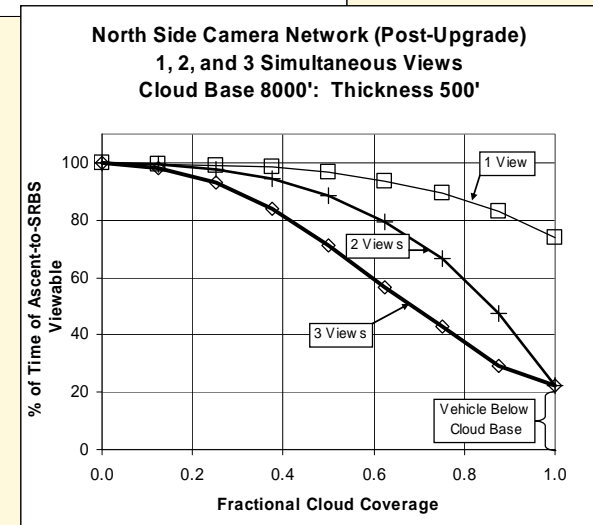
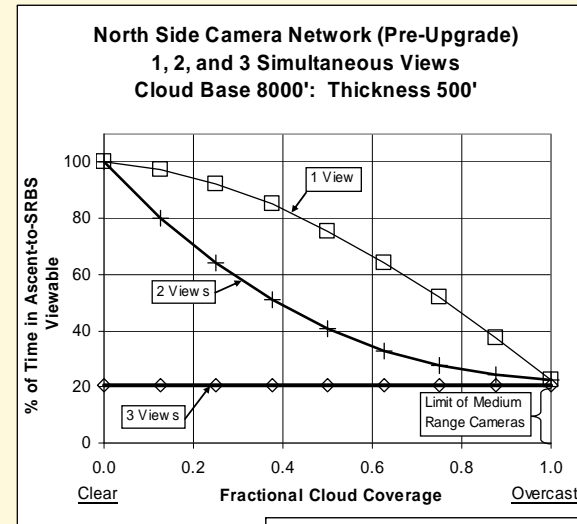
- Requirement: evaluate why tornadoes and downbursts of 13 Aug 96 were poorly forecast
  - ‘Mission Immediate’ tasking
  - Damage to many cars, several buildings, and one aircraft
- Provided:
  - In-depth case study
  - Several training briefings





# Example: Shuttle Optical Imaging

- Requirement:
  - CAIB Report: NASA needs “three useful” camera views of the Shuttle during launch
- Providing:
  - Statistical model of cloud field
  - Forecast decision aid for the Space Shuttle Launch Weather Officer?





# Conclusion

The AMU is a proven method to develop and transition technology to America's space program



<http://science.ksc.nasa.gov/amu>



## The Challenge of the Future

- From FY1992 through FY2006, AMU base funding, about \$750K/year, was 100% Shuttle supplied
- In FY06 and FY07, the Launch Services Program (LSP, NASA's ELV program) provided \$50K of the \$800K annual base funding
- In FY08, an additional \$50K is being requested from LSP
- Unless the Constellation Program and LSP can negotiate an agreement to pick up the full cost of the AMU between them, the AMU will cease operation at the end of FY 2010