

KSC ABFM 2000



A field program to facilitate safe relaxation of the lightning launch commit criteria for America's space program


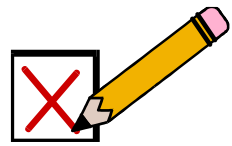
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September 2000



Overview - Background

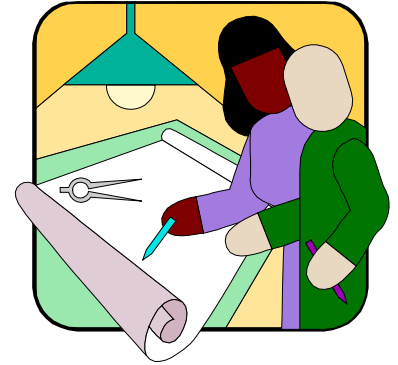
- Lightning Launch Commit Criteria (LLCC)
 - 9 Rules with parts and subparts 
 - Launch team must be **clearly convinced** all rules satisfied in order to launch 
 - Largest subset of weather LCC
- Weather is largest single cause of scrubs and delays – and LLCC are largest single recent cause of weather scrubs and delays

Overview - Why

- Threat of *triggered lightning*
- Launch rules conservative
 - Atmospheric electricity not well understood
 - Event consequences catastrophic
- Launch scrubs & delays result
- **GOAL:** *Eliminate unnecessary scrubs* & delays while maintaining or improving safety margins

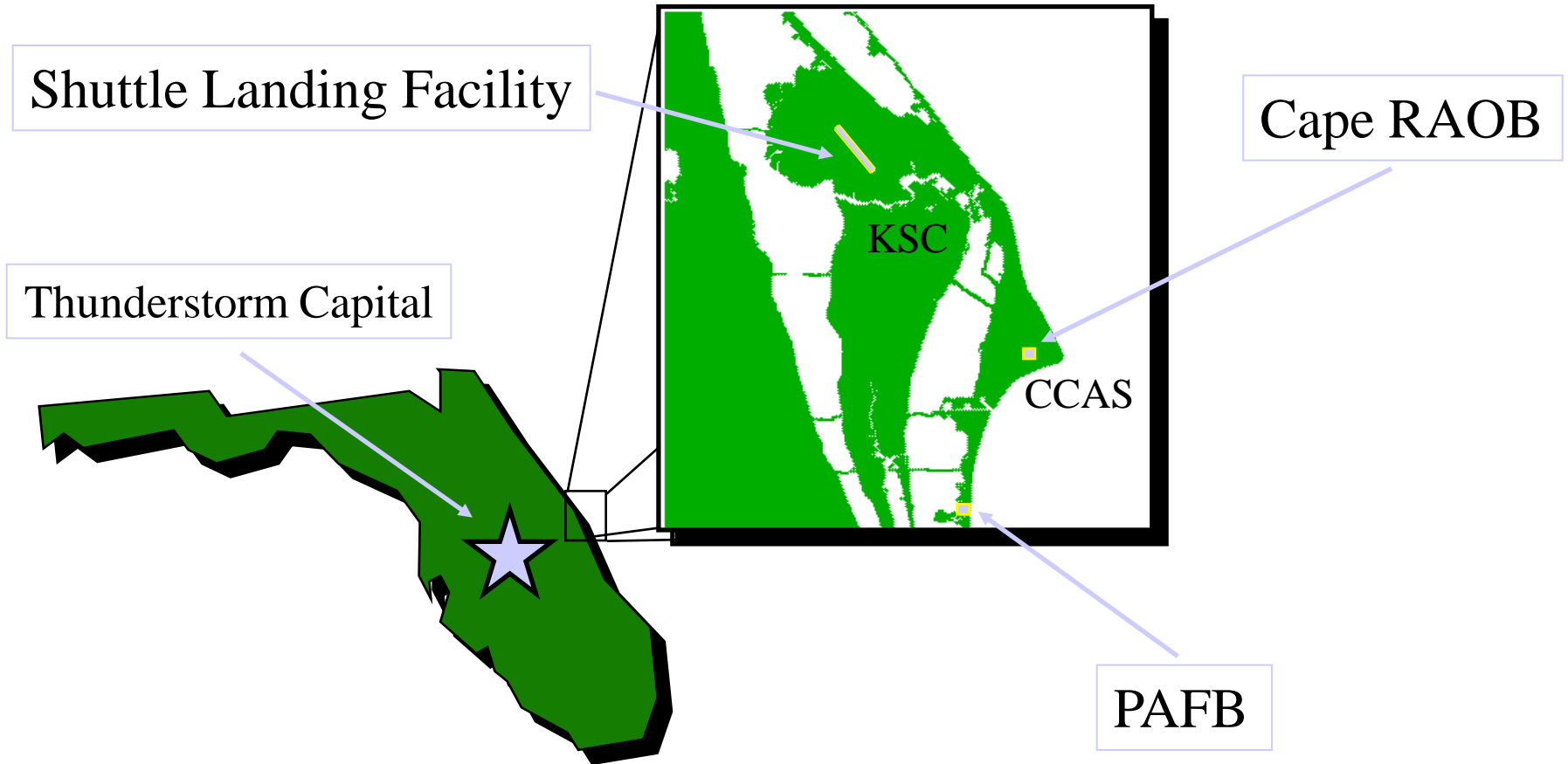


Overview - How



- Concentrate on rules ripe for improvement
 - Anvil rules
 - “Thick Cloud” rules
- Measure electric fields in cloud, in context
 - Simultaneous cloud physics data
 - Simultaneous ground based in-situ and remote sensing observations
 - Proposed theoretical models
- Revise rules based on measurements and analysis

Overview - Where



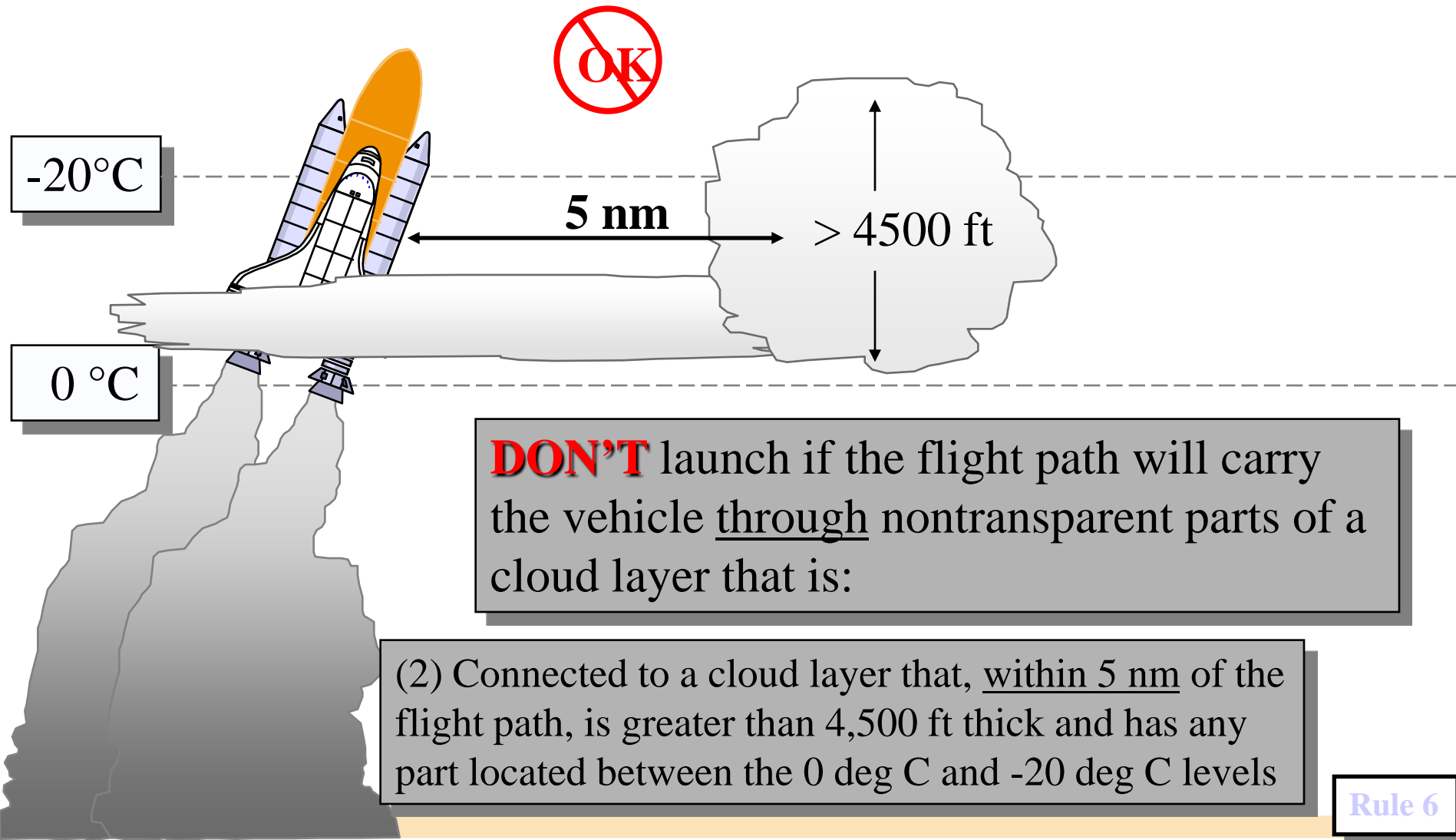
Outline of Details

- The “Thick Cloud” rules
- The “Anvil” rules
- The research aircraft
- The ground-based resources
- The June 00 campaign
 - Missions
 - Participants
- Current status & plans



Thick Cloud Rule - Example

Courtesy 45 WS LLCC Training Program



DON'T launch if the flight path will carry the vehicle through nontransparent parts of a cloud layer that is:

(2) Connected to a cloud layer that, within 5 nm of the flight path, is greater than 4,500 ft thick and has any part located between the 0 deg C and -20 deg C levels

Anvil Cloud Rule - Example

Detached Anvil



Courtesy 45 WS LLCC Training Program

DON'T launch if the flight path will carry the vehicle through nontransparent parts of a detached anvil cloud for the first 3 hours after the time that the anvil cloud is observed to have detached from the parent cloud

Rule 3b1

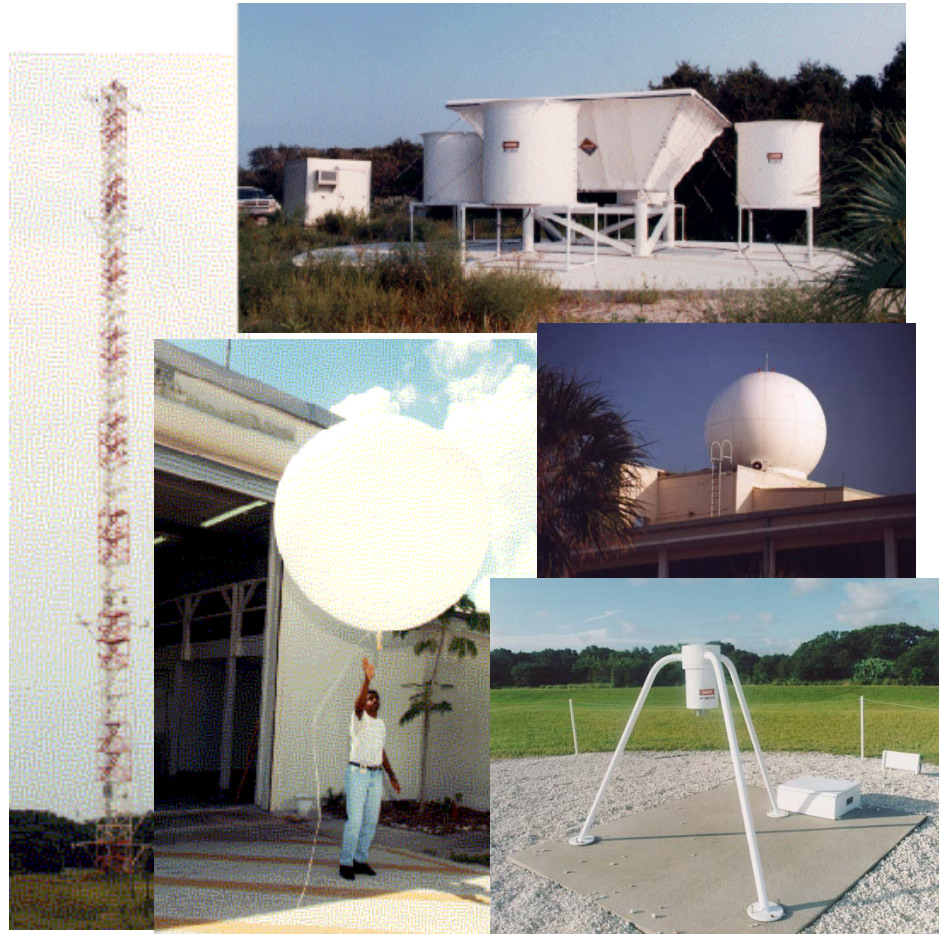
The Research Aircraft UND Citation II

- Six electric field mills
- Liquid water sensor
- Three PMS probes
- Two SPEC particle imagers
- Rosemount icing detector



Ground-based Resources

- Two weather radars
- Three lightning systems
- 31 field mills & rover
- 44 weather towers
- 50 & 915 MHz wind profilers
- Rawinsondes

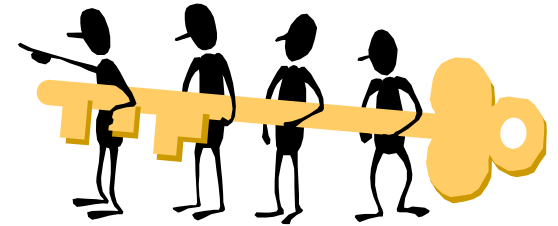


June 00 Campaign Missions

- 17 missions flown on 15 days
- Both anvil and thick clouds
- Includes calibration flight
 - low level overflight of surface mill
 - fair weather roll and pitch
- Includes maritime reference case
- 100+% of target hours, cases achieved



June 00 Campaign Participants



- 45 SW - 11 support for ground control and A/C
- CSR – 10 Range and ground control support
- ENSCO – 6 software and ground control support
- KSC – 8 program management, support for ground control & A/C
- MSFC – 7 Principal Investigator and science team
- NCAR – 2 including lead cloud physicist
- NOAA/HRD – cloud physicist
- JSC/SMG – software support
- U. Az. – 3 ground control & roving ground-based field mill
- U. N.D. – 6 including pilots, A/C support and lead aircraft scientist

50+ people from 10 organizations



Current Status & Plans

- June 2000 campaign data analysis in work-expect results in 12 to 18 months
- Planning session in October 2000 for February and June 2001 field campaigns
- Expect overall scientific results April 2002
- Expect revised LLCC June 2002



Summary

- Overview: why and how
- The rules
- The research aircraft
- The ground-based resources
- The June 00 campaign
 - Missions
 - Participants
- Current status

