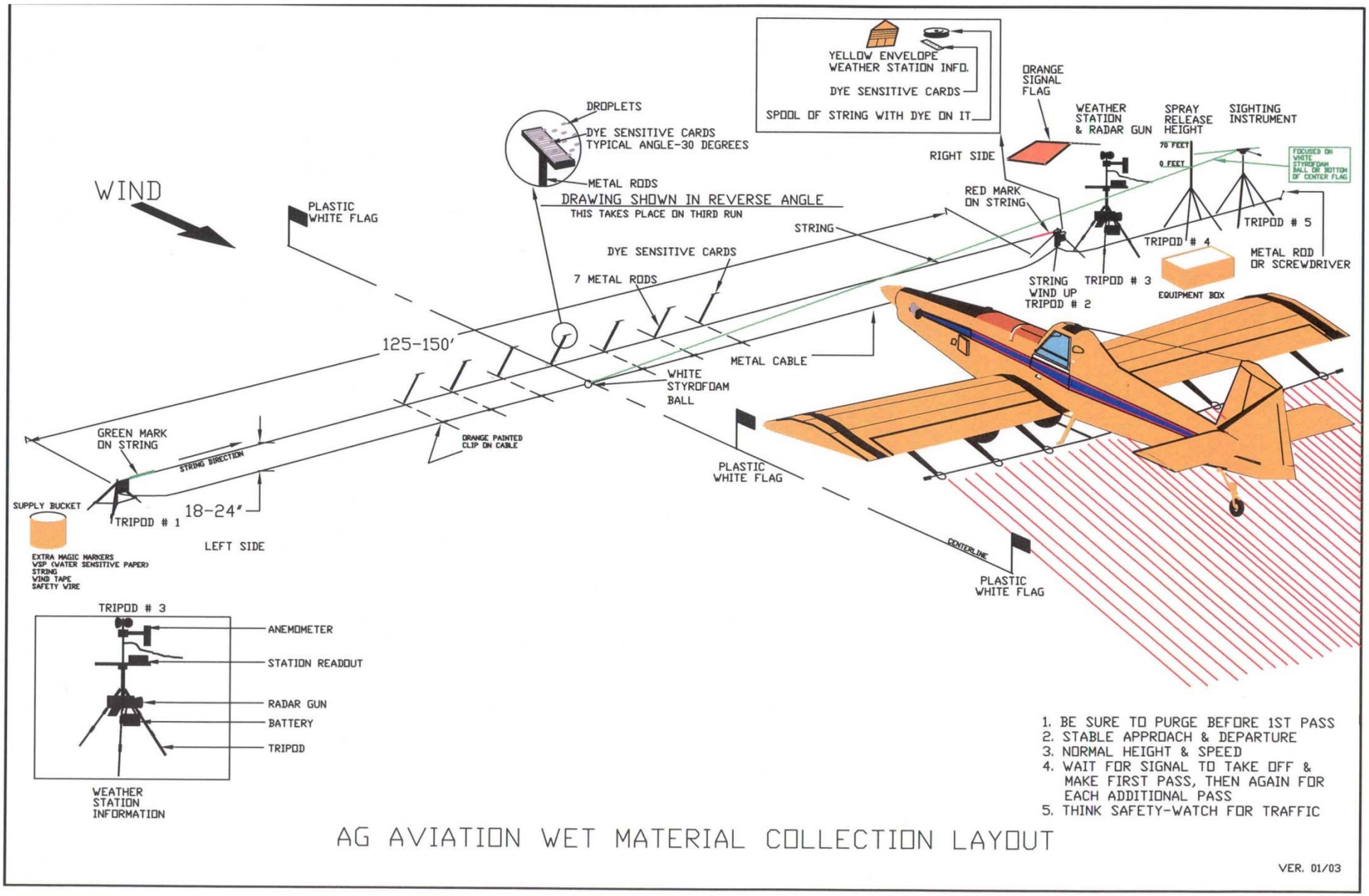
Automating Some Measurements During Operation S.A.F.E. Workshops

Roberto N. Barbosa, Ph.D.
Assistant Professor, BAE Department, LSU AgCenter, Baton Rouge, LA
rbarbosa@agcenter.lsu.edu
Yin-Lin "Jack" Chiu
Research Associate Coordinator, BAE Department, LSU AgCenter, Baton Rouge, LA
ychiu@agcenter.lsu.edu

OPERATION S.A.F.E.

- Flyins or clinics are offered nationwide
- Help pilots fine-tune spray gear, find best combination of swath width and spray method (back/forth, racetrack)
- Sponsored by NAAA and most state associations
- Several people involved during the flyin to collect data, manage the string, etc.



1. BE SURE TO PURGE BEFORE 1ST PASS
2. STABLE APPROACH & DEPARTURE
3. NORMAL HEIGHT & SPEED
4. WAIT FOR SIGNAL TO TAKE OFF & MAKE FIRST PASS, THEN AGAIN FOR EACH ADDITIONAL PASS
5. THINK SAFETY-WATCH FOR TRAFFIC

AG AVIATION WET MATERIAL COLLECTION LAYOUT

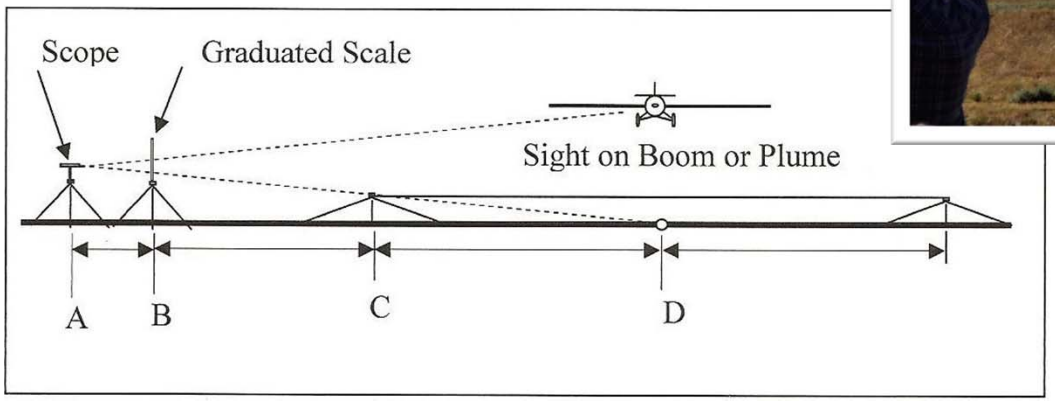
VER. 01/03

Problems

- Not enough people to help collect all data
- Sometimes too many people in the field, making it difficult to get everyone to concentrate on what they are suppose to do
- First timers: people come to help but don't know how to operate the equipment or common procedures

Objectives

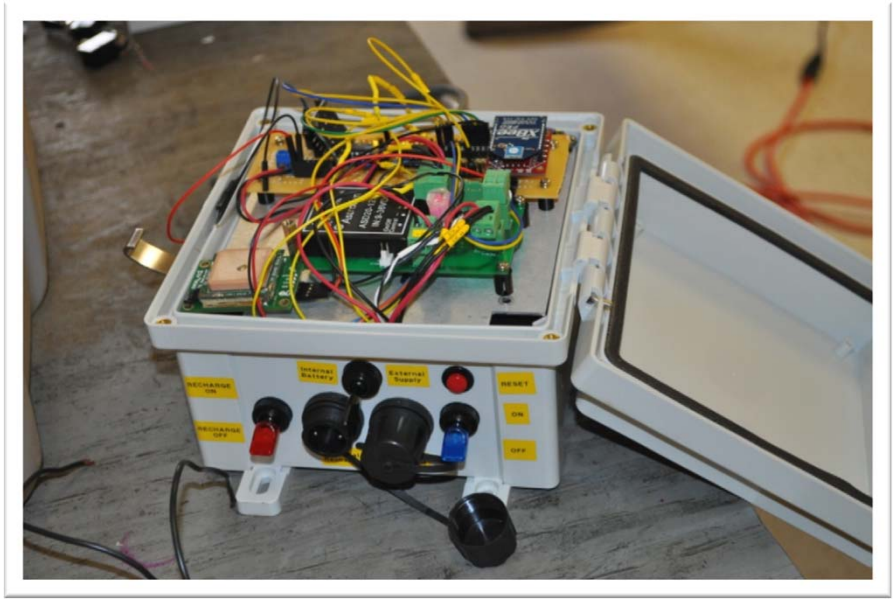
- Can we automate some measurements?
- Will automation increase accuracy?
- Start with aircraft speed and spray release height

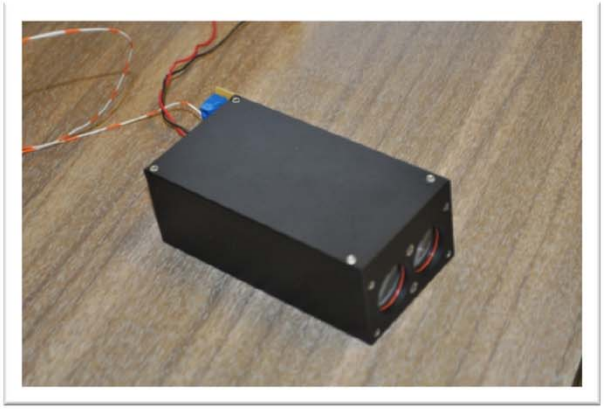


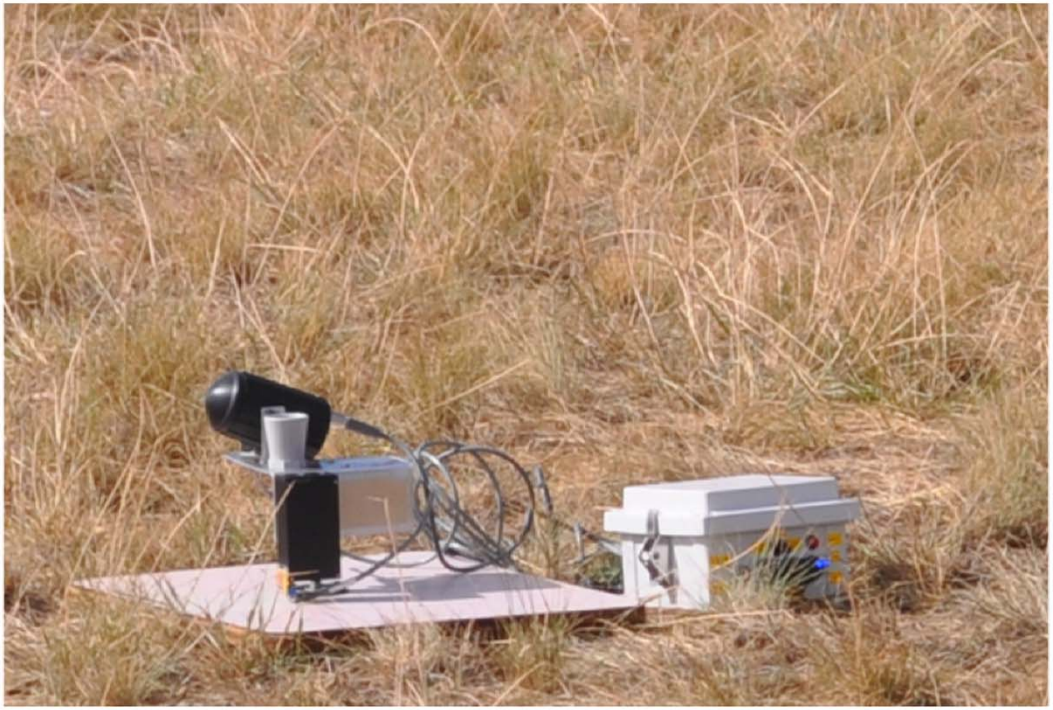
innovate . educate . improve lives
for the latest research-based information on just about anything, visit our Web site at www.lsuagcenter.com

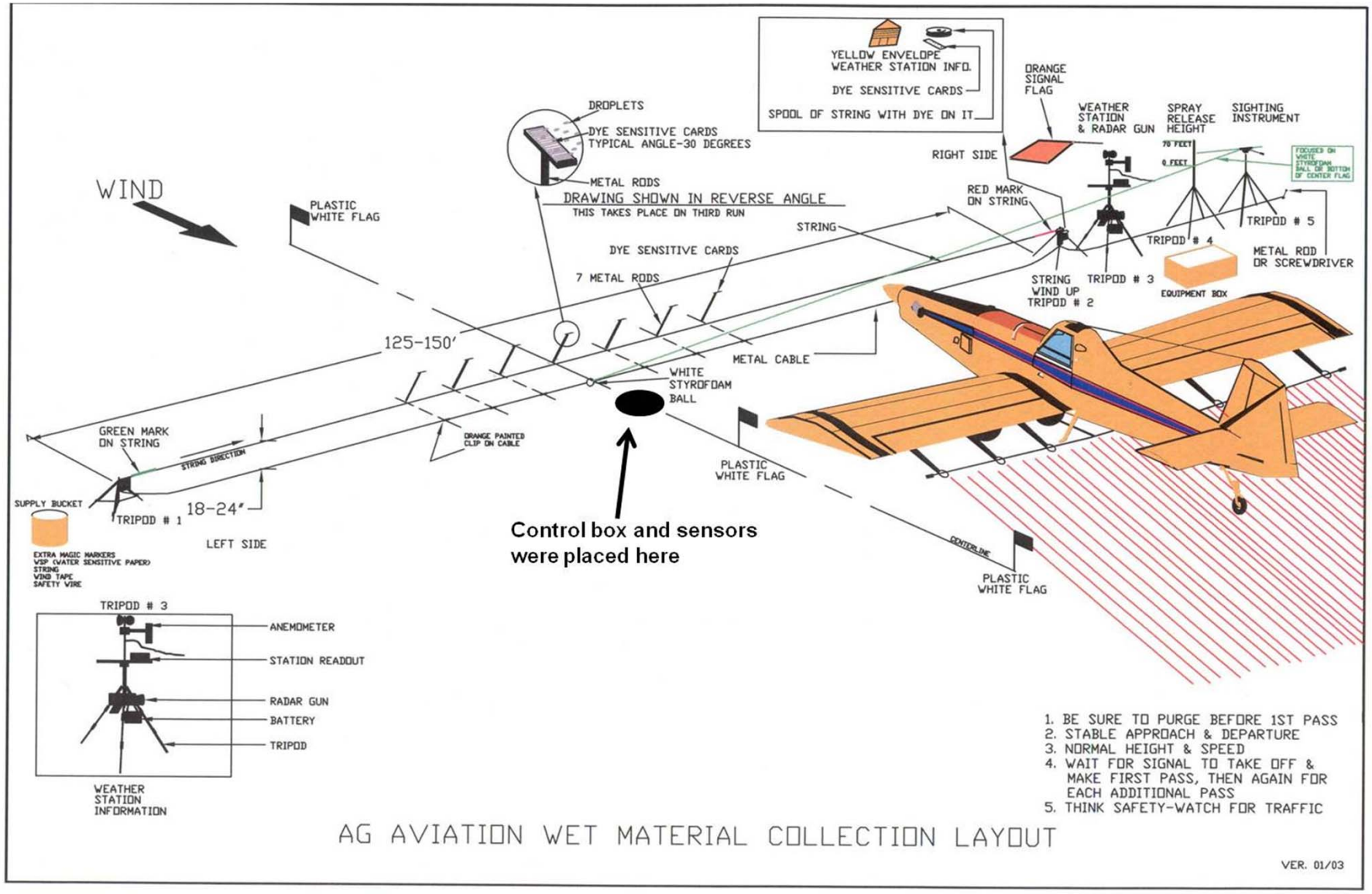
Objectives

- Build ‘wireless’ system
- Record measurements to be used later, if needed
- Used the LaserAce® ILM-150-R to measure spray release height
- Used the Stalker® stationary radar speed sensor to measure aircraft speed


RECHARGE ON
RECHARGE OFF
Internal Battery
External Supply
RESET
ON
OFF





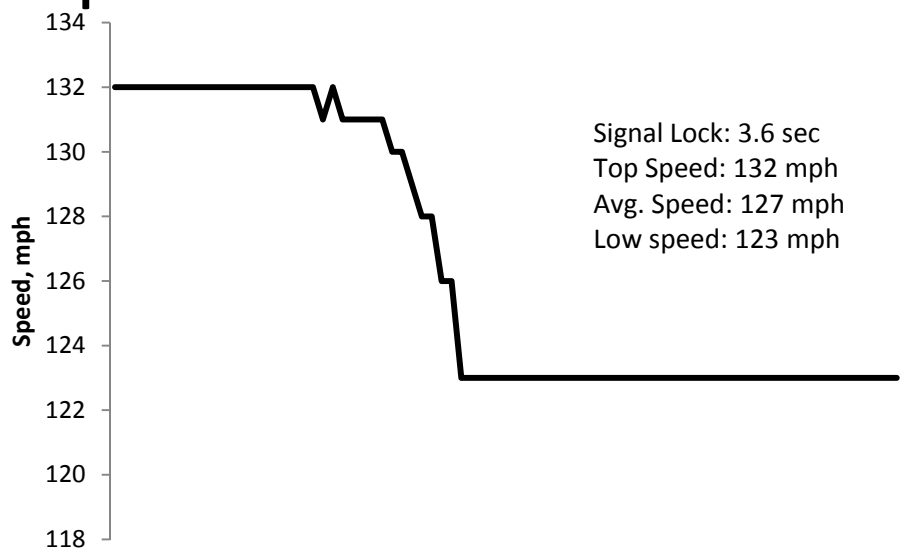

YELLOW ENVELOPE
WEATHER STATION INFO.
DYE SENSITIVE CARDS
SPOOL OF STRING WITH DYE ON IT
ORANGE SIGNAL FLAG
WEATHER STATION & RADAR GUN
SPRAY RELEASE HEIGHT
SIGHTING INSTRUMENT
70 FEET
0 FEET
FOCUSED ON WHITE STYROFOAM BALL OR BOTTOM OF CENTER FLAG
RIGHT SIDE
DROPLETS
DYE SENSITIVE CARDS
TYPICAL ANGLE-30 DEGREES
METAL RODS
DRAWING SHOWN IN REVERSE ANGLE
THIS TAKES PLACE ON THIRD RUN
WIND
PLASTIC WHITE FLAG
RED MARK ON STRING
STRING
DYE SENSITIVE CARDS
7 METAL RODS
TRIPOD # 5
TRIPOD # 4
METAL ROD OR SCREWDRIVER
STRING WIND UP TRIPOD # 2
TRIPOD # 3
EQUIPMENT BOX
125-150'
METAL CABLE
WHITE STYROFOAM BALL
GREEN MARK ON STRING
STRING DIRECTION
ORANGE PAINTED CLIP ON CABLE
PLASTIC WHITE FLAG
SUPPLY BUCKET
TRIPOD # 1
18-24"
LEFT SIDE
EXTRA MAGIC MARKERS
WSP (WATER SENSITIVE PAPER)
STRING
WIND TAPE
SAFETY WIRE
Control box and sensors were placed here
CENTERLINE
PLASTIC WHITE FLAG
TRIPOD # 3
ANEMOMETER
STATION READOUT
RADAR GUN
BATTERY
TRIPOD
WEATHER STATION INFORMATION
1. BE SURE TO PURGE BEFORE 1ST PASS
2. STABLE APPROACH & DEPARTURE
3. NORMAL HEIGHT & SPEED
4. WAIT FOR SIGNAL TO TAKE OFF & MAKE FIRST PASS, THEN AGAIN FOR EACH ADDITIONAL PASS
5. THINK SAFETY-WATCH FOR TRAFFIC
AG AVIATION WET MATERIAL COLLECTION LAYOUT
VER. 01/03

Field Test

- System tested during Colorado Flyin, September, 2010
- Radar gun used by flyin crew was a Bushnell Speedster II, accuracy ± 1 mph
- Spray release height measured by similar triangles
- Total of 11 aircrafts
- Sixty nine passes over the string

Aircraft Speed

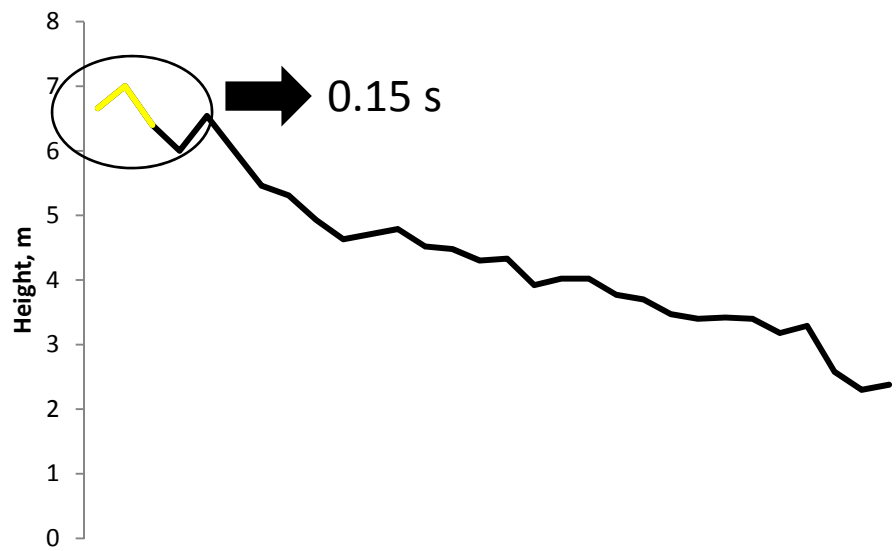
- Stalker radar locked in aircraft speed over 500 feet before aircraft crossed string
- Radar reports high speed when locked, and then lower speed numbers



Spray Release Height

- Aircraft takes only a fraction of a second to pass through the laser
- Laser does measure some of the plume after the aircraft has passed
- AT-502 (30’2” length) at 140 mph takes only 0.16 s to cross laser

Spray Release Height

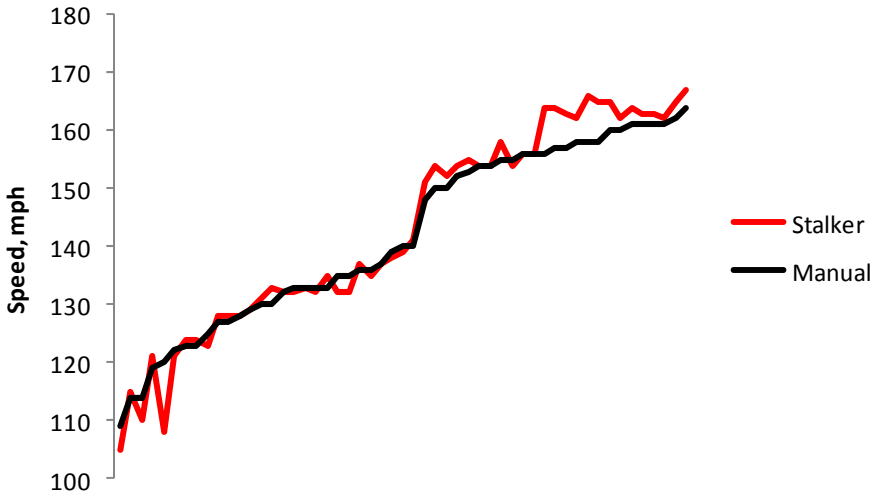


Signal Lock: 3.119 seconds
Average Height: 14.5 feet
Top Height: 22.9 feet
Low Height: 7.55 feet

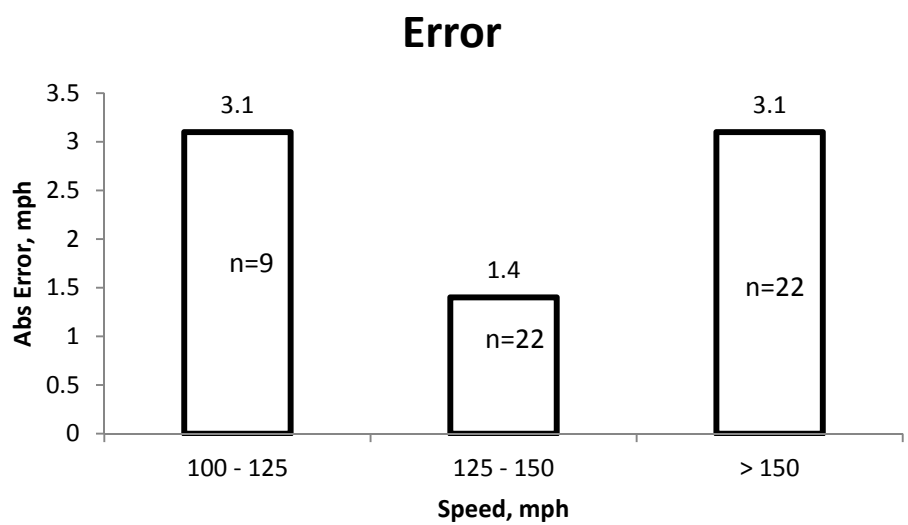
Comparisons

- Used only the top speed to compare to speed from Bushnell Speedster II
- Used the first laser measurement to represent spray release height

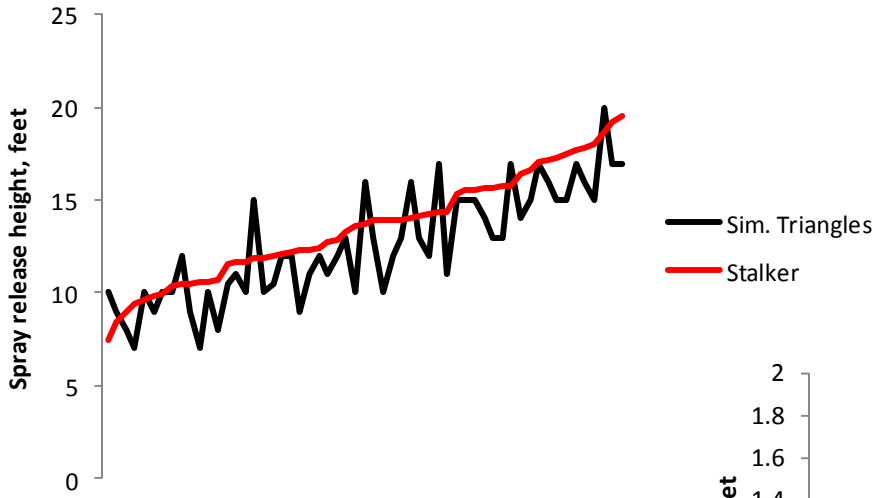
Aircraft Speed

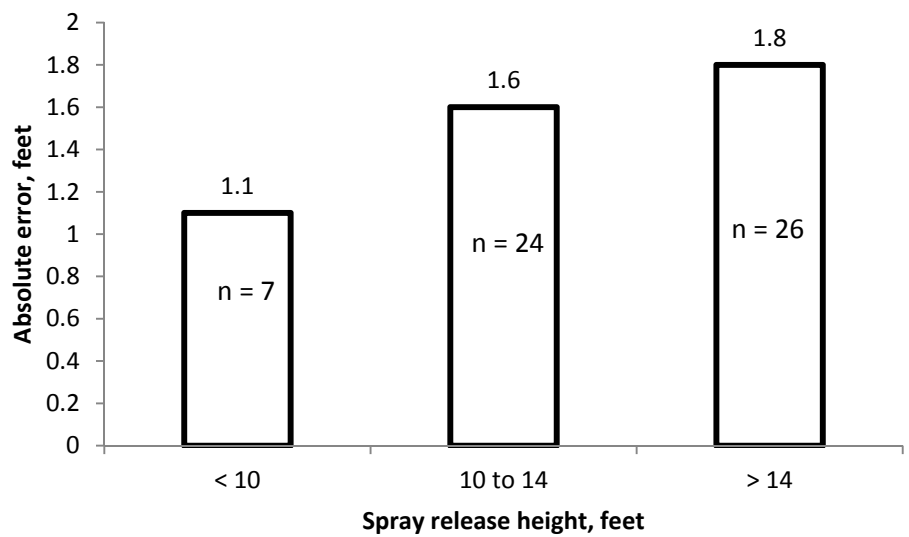


Average absolute error = 2.4 mph
Std. Dev. = 2.5 mph



Spray Release Height





Average Absolute Error = 1.6 ft
Std. Dev. = 1 ft
Largest Error = 3.9 ft

Conclusions

- Automating some of the measurements during a flyin is relatively simple
- Wireless terminal works really well
- System has the potential to allow the analyst to not be so dependent on extra workers
- Measurements are reliable

Questions?