

Unplanned Discoveries in Flight Test

OR.....

**Test Support Events From Which
I Learned About Flight Test**
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THE VALUE OF PERFORMANCE.

NORTHROP GRUMMAN

Test Support Events

From Which I Learned About Flight Test



- OBJECTIVE
 - Prevention

- AGENDA
 - Introduction
 - 3 (4) Events
 - Task
 - Aircraft Considerations
 - Other Considerations
 - The Event
 - Lessons

- Summation
 - Lessons
 - Closing

Test Support Events From Which I Learned About Flight Test



- OBJECTIVE
 - Prevention (of similar risk encounters)
 - This is Open Kimono - my experience
 - Don't fix these specific mistakes - Focus on lessons
 - Don't be smug – this could be you?

Test Support Events

From Which I Learned About Flight Test



- Introduction
 - Would you do this (Kairys Bridge -you might like to, but...)
 - You might mistakenly fly too low on an airborne pickup – with a photog coaching you in closer...
 - The non-test aspect of test – support tasks (sometimes the real test)
 - The real challenge may not be so obvious**
 - There are them that have and them that will – make mistakes in a support task
 - Hidden objective:
 - Engender SA on the sometimes unseen real test at hand
- 3 (4) Events
 - 1: Photography of a Towed decoy; or Cracking the Whip
 - 2: Maneuvering Subject Photography – Ready, Set, GONE
 - 3: High Altitude Maneuvering Chase Follies
 - 4: Chasing Weather – the Blind Leading the Blind
 - These seemed simple because; but what we missed was...**

Test Support Events From Which I Learned About Flight Test



Test Support Events

From Which I Learned About Flight Test



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Test Support Events

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- 1: Photography of a Towed object; or Cracking the Whip
 - Task
 - Movie photography of a towed object during Tow turn maneuvering
 - Aircraft Considerations
 - Cramped quarters for photographer plus camera
 - Limited over-the-rail field of regard
 - Other Considerations
 - Object size (small)
 - Delay between maneuver and object movement

Test Support Events

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- 1: Photography of a Towed object; or Cracking the Whip
 - The Event
 - Join up and object acquisition no issue
 - Tendency to react as Tow maneuvers preemptively, and prematurely
 - Tendency to try to ‘fly’ off of object as it moves, precipitously
 - Tendency to lose position on object as compensation becomes impossible
 - Going high (safest direction) interferes with photographer’s line of sight to object
 - 1 of 5 attempts (estimate) result in possibly acceptable footage
 - All result in loss of position and need to reacquire

Test Support Events

From Which I Learned About Flight Test



- 1: Photography of a Towed object; or Cracking the Whip
 - Lessons
 - Extensive dry runs were needed
 - Develop a ‘sense’ of what’s going to happen
 - Develop technique
 - Team event – for Test, Chase and Photographer
 - Some aspects cannot be deciphered until in the airplane and in the event
 - » Photographer camera positioning
 - » Chase positioning dynamics
 - Don’t ‘fly’ off object; a la probe/drogue refueling instead
 - Consider the requirement for film – realistically required?

Test Support Events

From Which I Learned About Flight Test



- 3: High Altitude Maneuvering Chase Follies
 - Task
 - Hi and med altitude (30k+ an 40k+) maneuvering photo chase at mid – low Mach
 - Aircraft Considerations
 - Position keeping; Chase A vs. B
 - Performance
 - AB light off
 - Compressor stall
 - Time on station – 2 Seat chase
 - Other considerations
 - NA

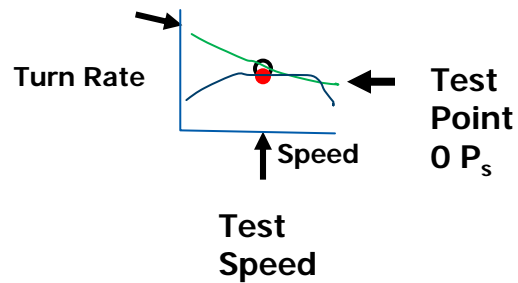
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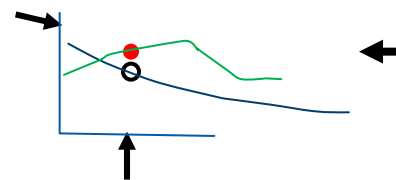
- Chase Performance

Turn Performance Chase A Medium Altitude

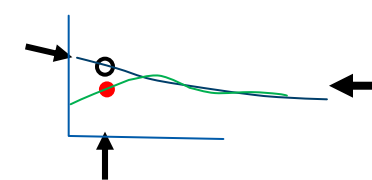
Test Point
Maneuvering
"g" need
estimate



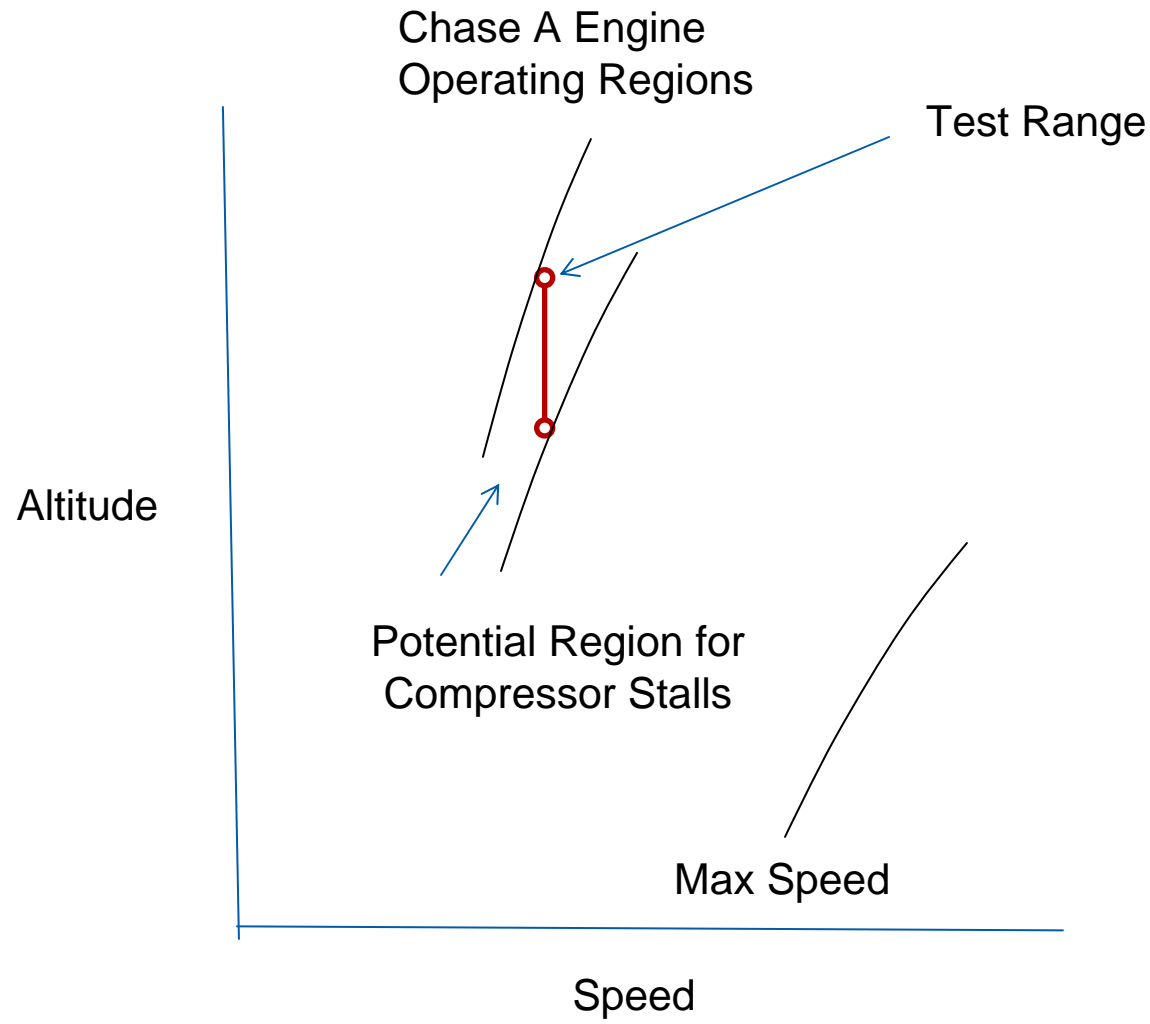
Turn Performance Chase B Medium Altitude



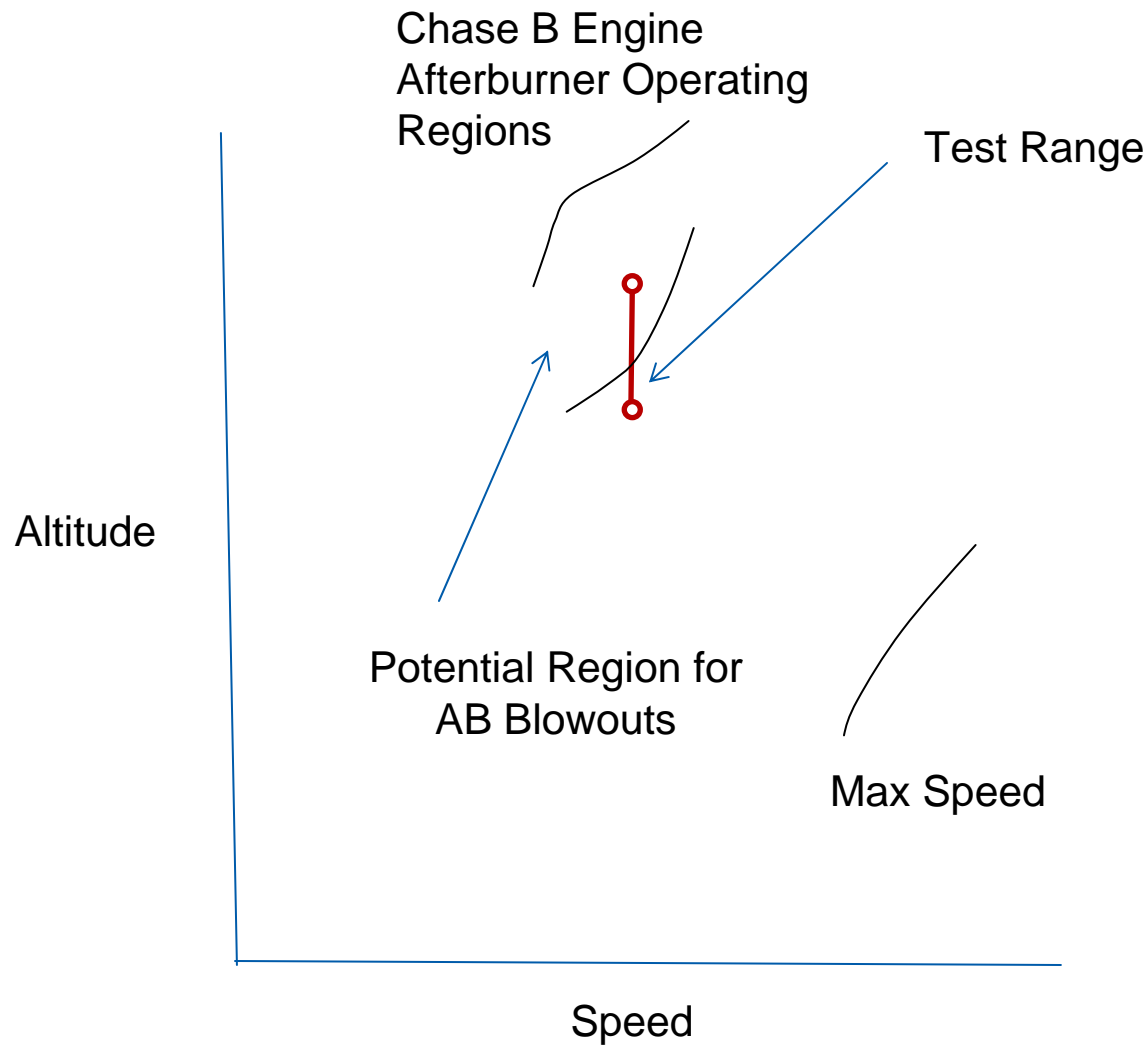
High Altitude



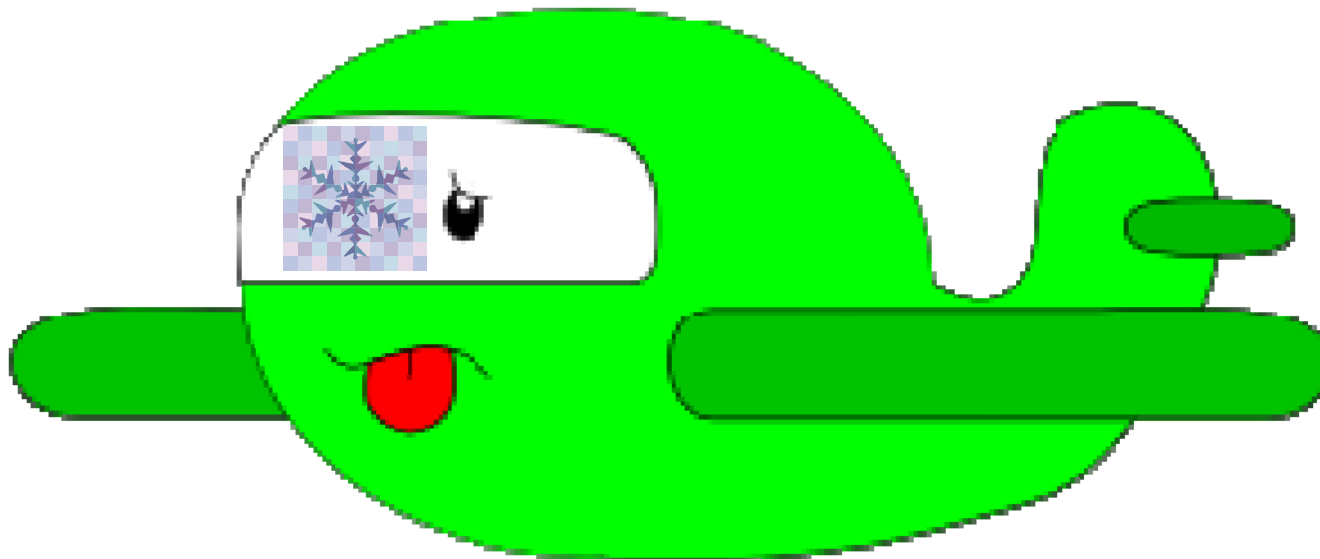
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Test Support Events

From Which I Learned About Flight Test



- 3: High Altitude Maneuvering Chase Follies
 - The Event
 - Test order med then hi for performance vs. chase GW
 - Chase A first
 - Reasonable to poor position keeping medium
 - Engine issues were prominent
 - Several compressor stalls (in understood region)
 - Chase B next
 - Poor success at position keeping hi
 - » AB in/out and position keeping delays
 - » AB pre select tried – deselected to compensate for mistiming
 - » Maneuver countdown shortened
 - » Maneuver entry technique altered (from WUT)
 - » Loooong recovery times from falling away during test
 - Icing rear cockpit high – one side of jet for view

Test Support Events

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- 3: High Altitude Maneuvering Chase Follies
 - Lessons
 - Chase engine types – was a choice!
 - Technique preplanning – needed better detail
 - Preplanned technique development in flight - allow for it!
 - Chase technique
 - Test technique
 - Consider necessity of hi alt maneuvering photography – sacrosanct?
 - Rejoin performance a major factor for test point production expectations
 - Icing unexpected factor – major; foreseeable?

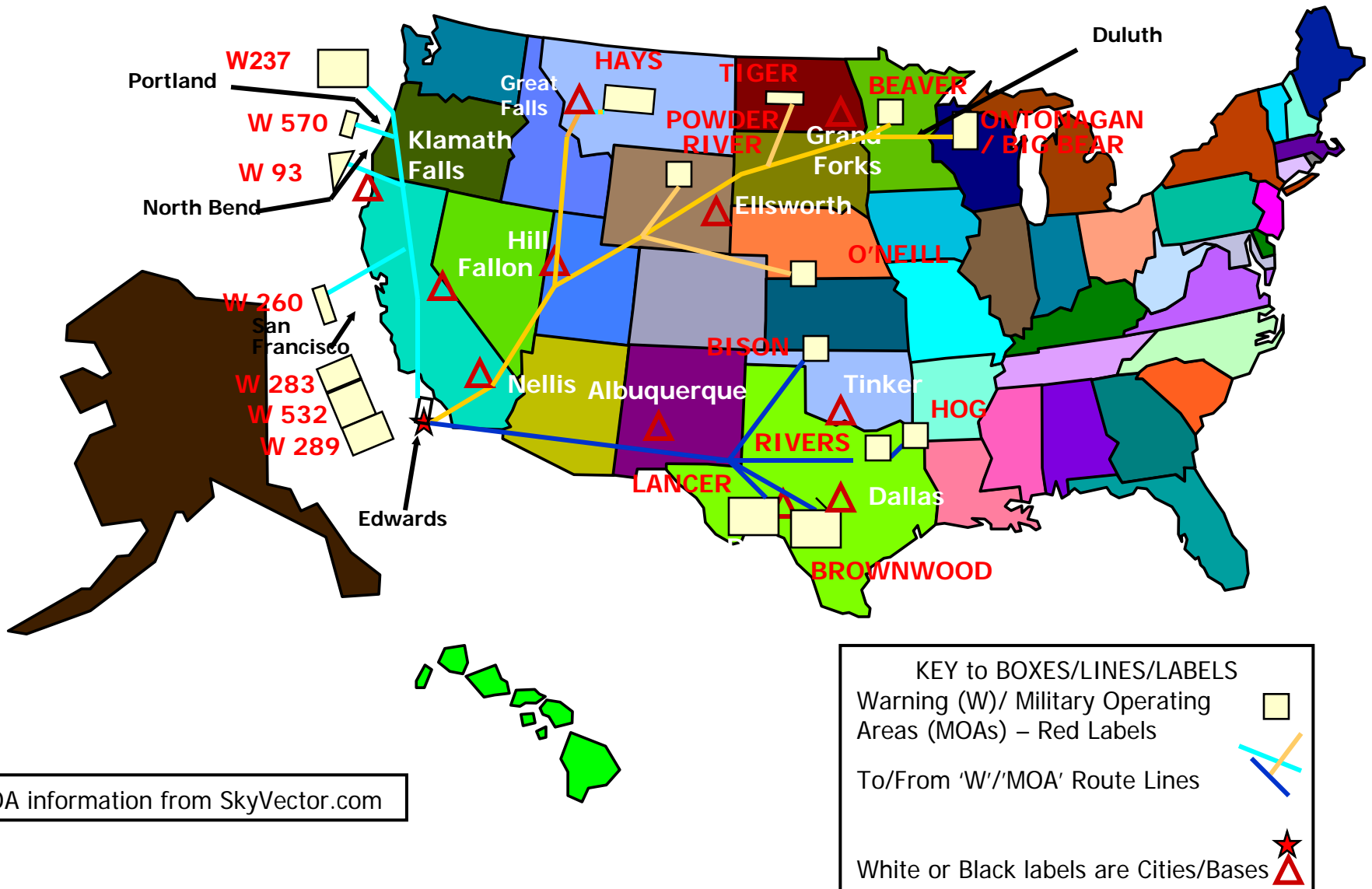
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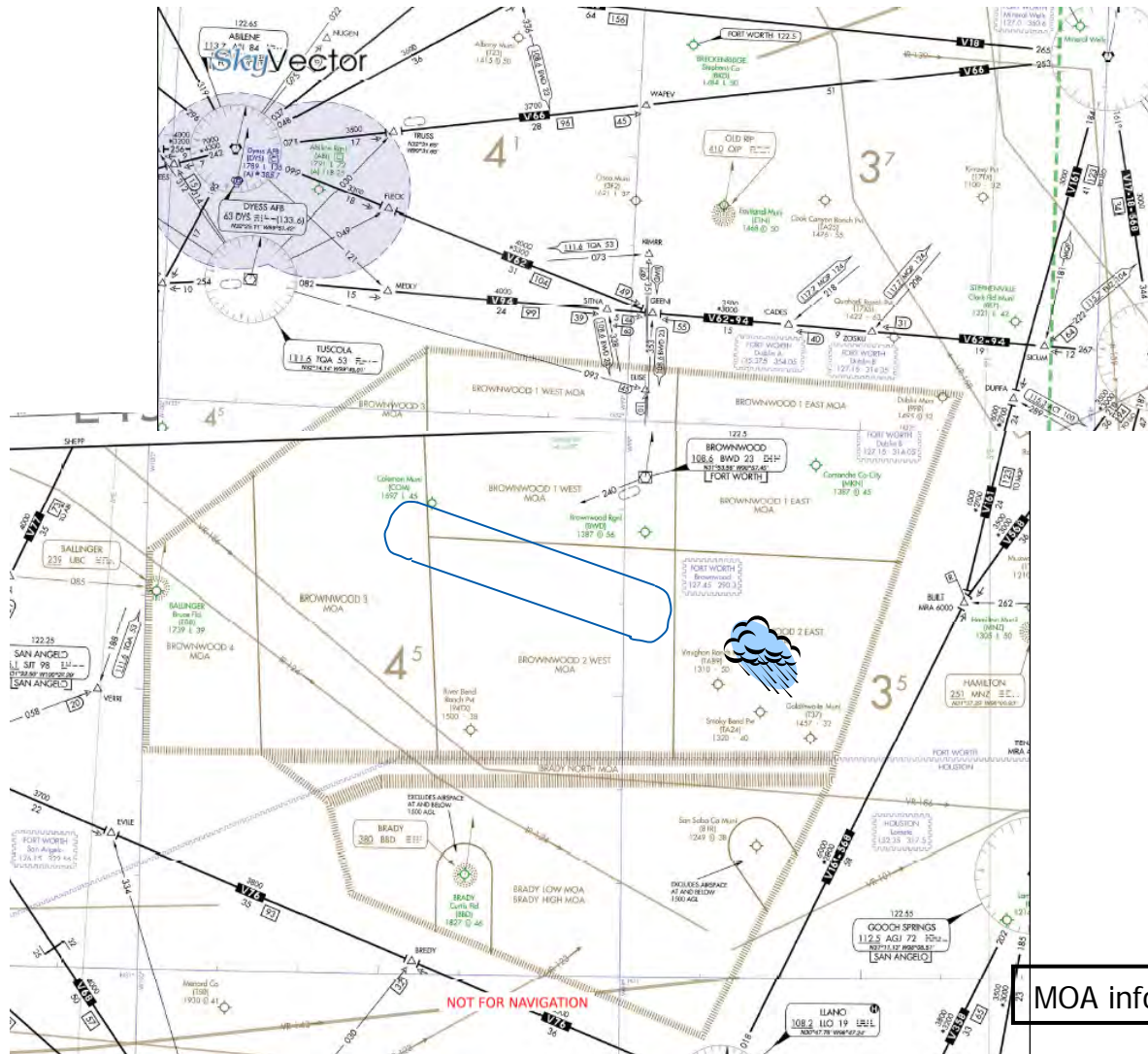


- 4: Chasing Weather – the Blind Leading the Blind
 - Task
 - WX storm radar imaging
 - 2 big airplanes in visual formation
 - At and away from storm cell repeated times
 - Coordinated radar system operations
 - Inside a MOA for ‘ease of maneuvering’
 - Aircraft Considerations
 - Low turn capability
 - Cumbersome formation maneuverability
 - Poor visual sense of weather proximity range/ altitude
 - Poor visual field of regard vis-à-vis forming and maneuvering space

Test Support Events From Which I Learned About Flight Test



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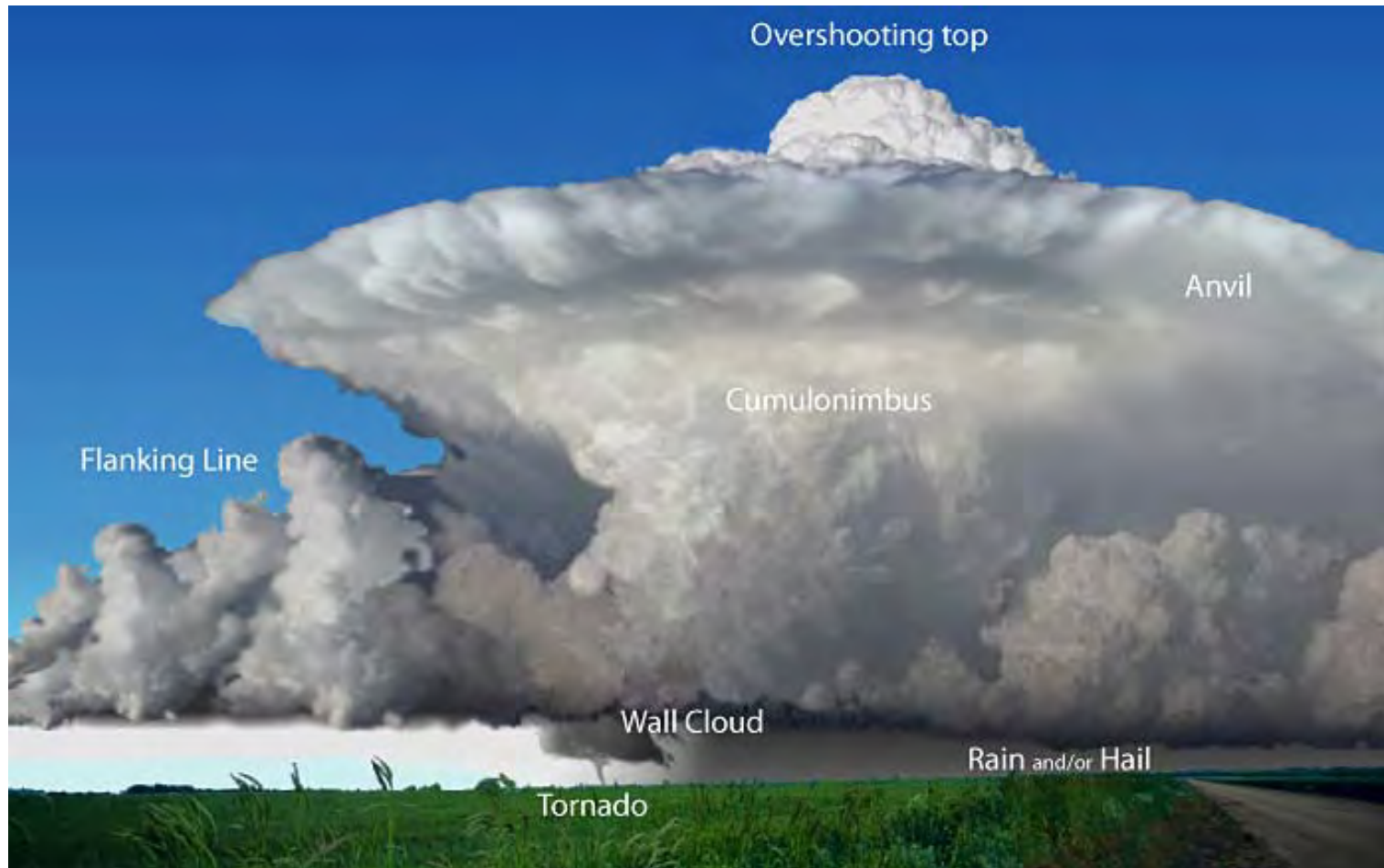


MOA information from SkyVector.com

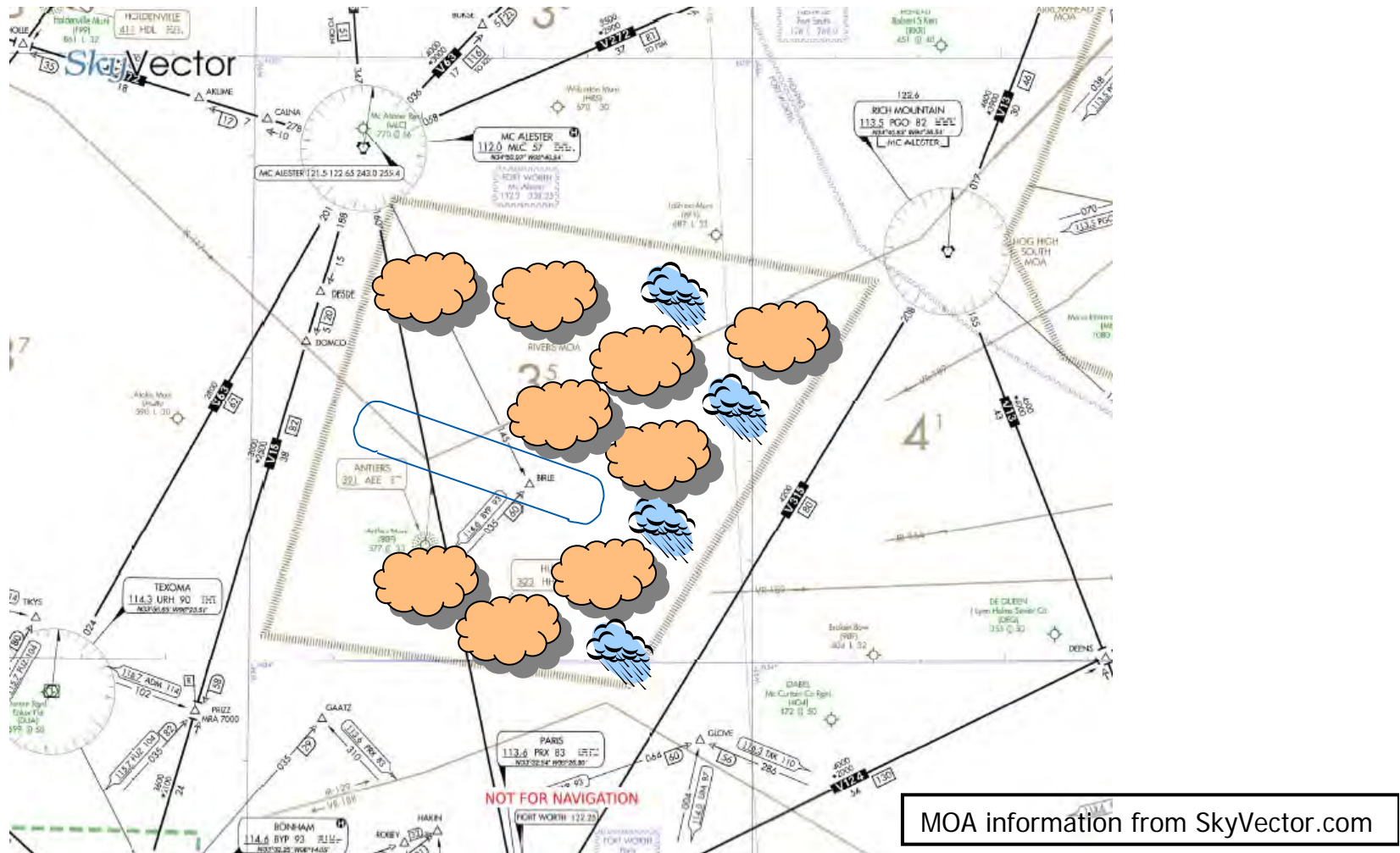
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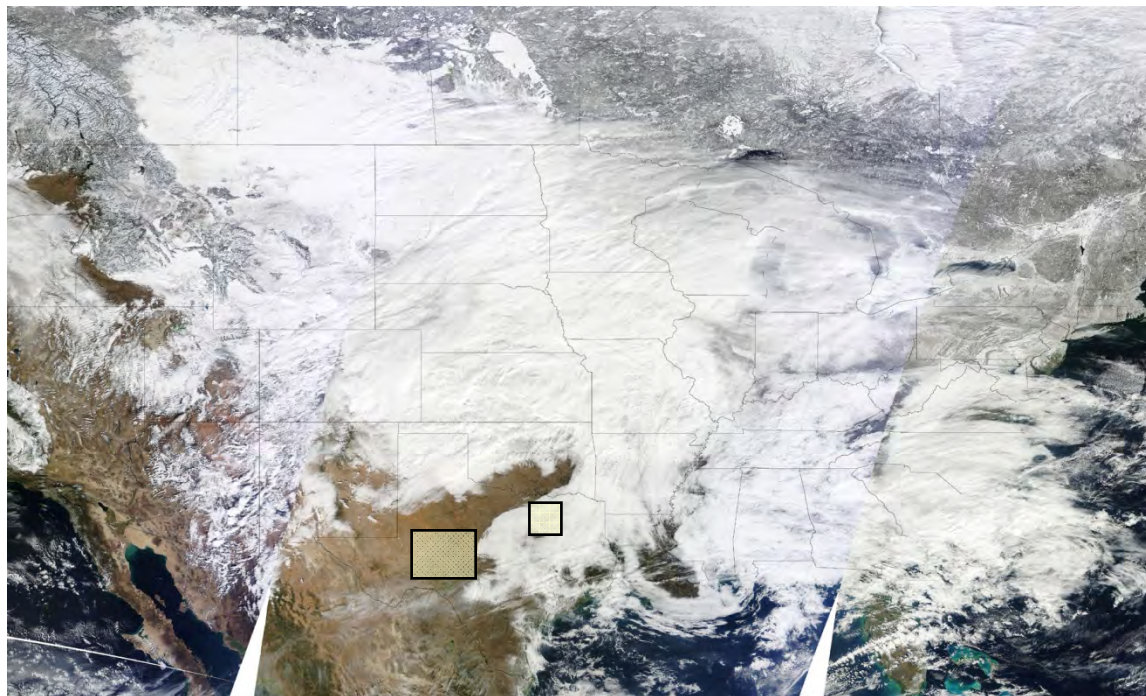


- 4: Chasing Weather – the Blind Leading the Blind
 - Other Considerations
 - Low collective crew experience in formation management
 - Limited maneuvering space if weather occupies MOA
 - Weather to formation separation rules
 - The Event
 - Early experience before a 2 ship requirement and with cells outside of MOA – good success (the hook is set)
 - Later times (s)
 - 2 ship requirement
 - Cells within MOA
 - MOAs layered
 - Late turns
 - Turns toward ‘crowded’ maneuvering area
 - Inadvertent IMC; Lead; Wing!

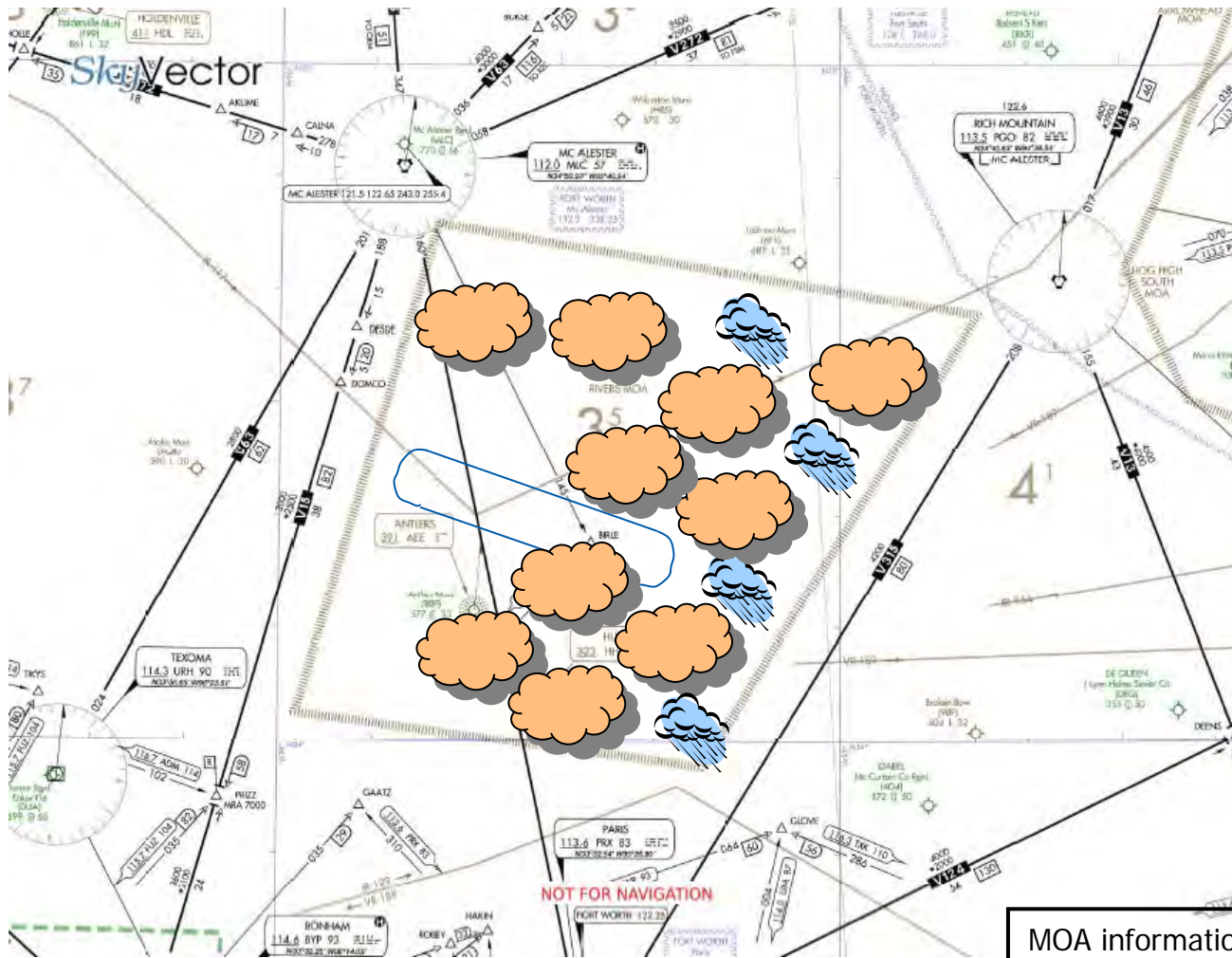
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Test Support Events

From Which I Learned About Flight Test



- **4: Chasing Weather – the Blind Leading the Blind**
 - **Lessons**
 - **Technique preplanning – What If**
 - **No ‘soup to nuts’ plan**
 - » **Escape**
 - » **Inadvertent IMC**
 - » **MOA ‘clobbered’**
 - **Alternate technique yes, but...**
 - » **Down played for ATC reasons**
 - » **Was ATC a big threat? (later experience said NO)?**
 - **Preplanned technique practice**
 - **Presumed this method to be intuitive but...**
 - **Crew forming familiarity**
 - **Escape/ What If trials**

Test Support Events

From Which I Learned About Flight Test



- Summation
 - Technique preplanning
 - Extensive thought to test methodology; Chase and Test
 - Plan immediate ‘outs’ and alternatives if things don’t work out
 - Question test steps and maneuvers : Requirement? Adapt to data requirement/chase?
 - Question support limitations
 - Chase engine types; big jet support...
 - Do you have to live with them?
 - Question photography/ test point support requirement
 - Plan for technique development
 - Chase and Test technique
 - Immediate and major alternatives
 - Instrumentation? (photography...)
 - Examine systems for potential issues (ex. ECS..)

Test Support Events From Which I Learned About Flight Test



- Summation
 - Closing
 - Expect support issues
 - Question all assumptions
 - Don't marginalize the support requirements
 - Allow for in flight support technique development time

QUESTIONS

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Test Support Events

From Which I Learned About Flight Test



- 2: Maneuvering Subject Photography – Ready, Set, GONE
 - Task
 - Detailed movie photography of a point on test's fuselage while test maneuvers
 - Aircraft Considerations
 - Cramped quarters for photographer plus camera
 - Limited over-the-rail field of regard
 - Other Considerations
 - Required proximity and limited depth of field restrict position
 - Test maneuver seemed to give chase 2 options – roll or pull and roll

Test Support Events

From Which I Learned About Flight Test



- 2: Maneuvering Subject Photography – Ready, Set, GONE
 - The Event
 - First attempt(s) roll and pull – lost position
 - Next attempts roll only - canopy rail and cramped quarters interfere with camera positioning
 - Ultimately some acceptable observation; as much by crew observation as by film

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- 2: Maneuvering Subject Photography – Ready, Set, GONE
 - Lessons
 - Extensive dry runs were needed
 - Develop a ‘sense’ of what’s going to happen
 - Develop technique
 - Team event – for Test, Chase and Photographer
 - Some aspects cannot be deciphered until in the airplane and in the event
 - » Photographer camera positioning
 - » Chase positioning dynamics
 - Don’t ‘fly’ off the point; a la probe/drogue refueling instead
 - Consider the test maneuver – roll and pull required? Could simplify chase maneuver