Unplanned Discoveries in Flight Test

OR

Test Support Events From Which I Learned About Flight Test
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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
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• 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?
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• 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…
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  These seemed simple because; but what we missed was…
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
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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
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• 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?
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

Turn Performance Chase B
Medium Altitude
High Altitude
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Chase A Engine
Operating Regions

Test Range

Potential Region for
Compressor Stalls

Max Speed

Speed

Altitude
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- Chase B Engine Afterburner Operating Regions
- Test Range
- Potential Region for AB Blowouts
- Max Speed

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• 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
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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
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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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- **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
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- 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..)
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• Summation
  – Closing
    • Expect support issues
    • Question all assumptions
    • Don’t marginalize the support requirements
    • Allow for in flight support technique development time

QUESTIONS
THE VALUE OF PERFORMANCE.

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