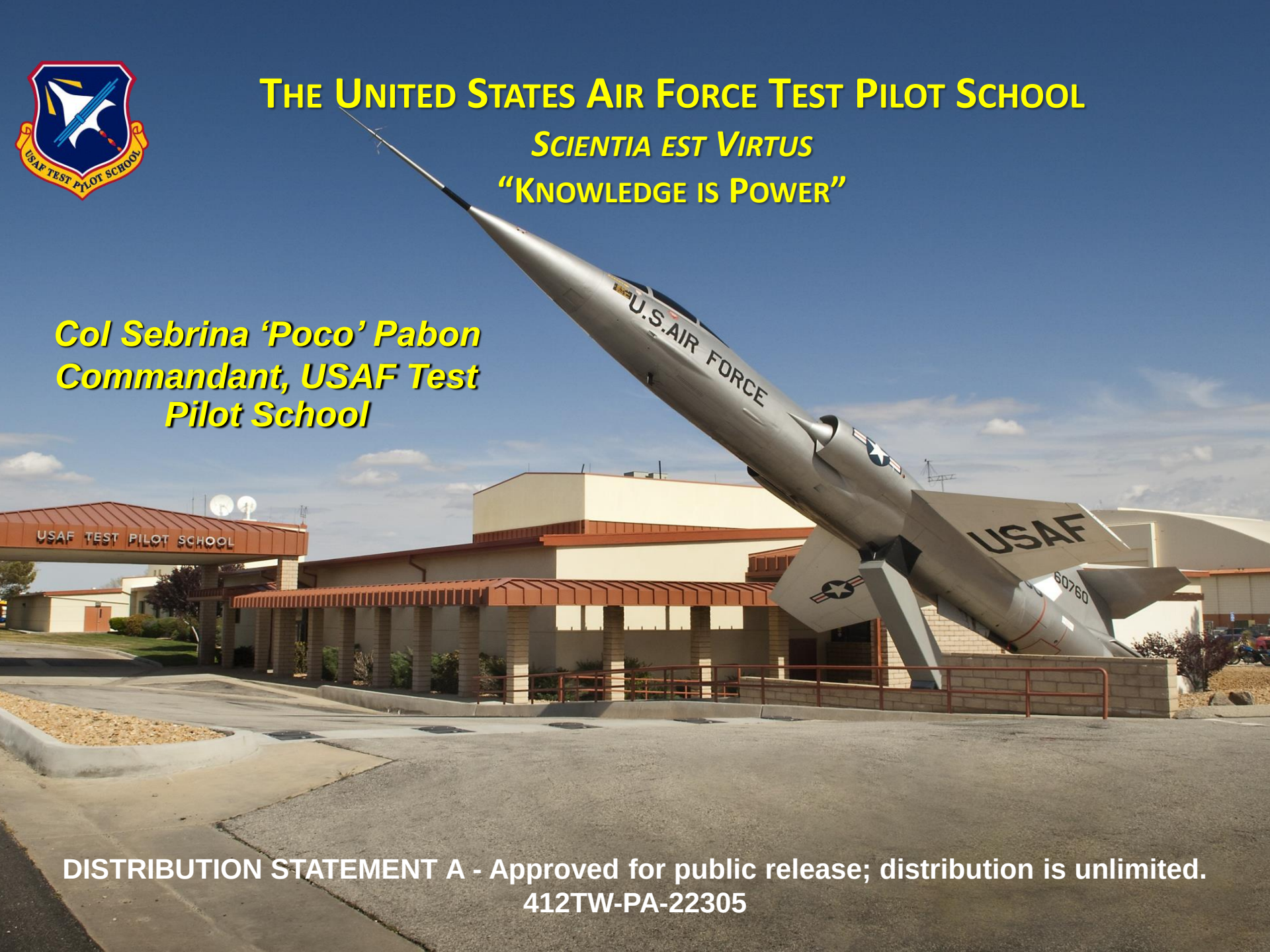
The United States Air Force Test Pilot School

Scientia est Virtus

"Knowledge is Power"



Col Sebrina 'Poco' Pabon
Commandant, USAF Test Pilot School

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USAF TPS Evolution

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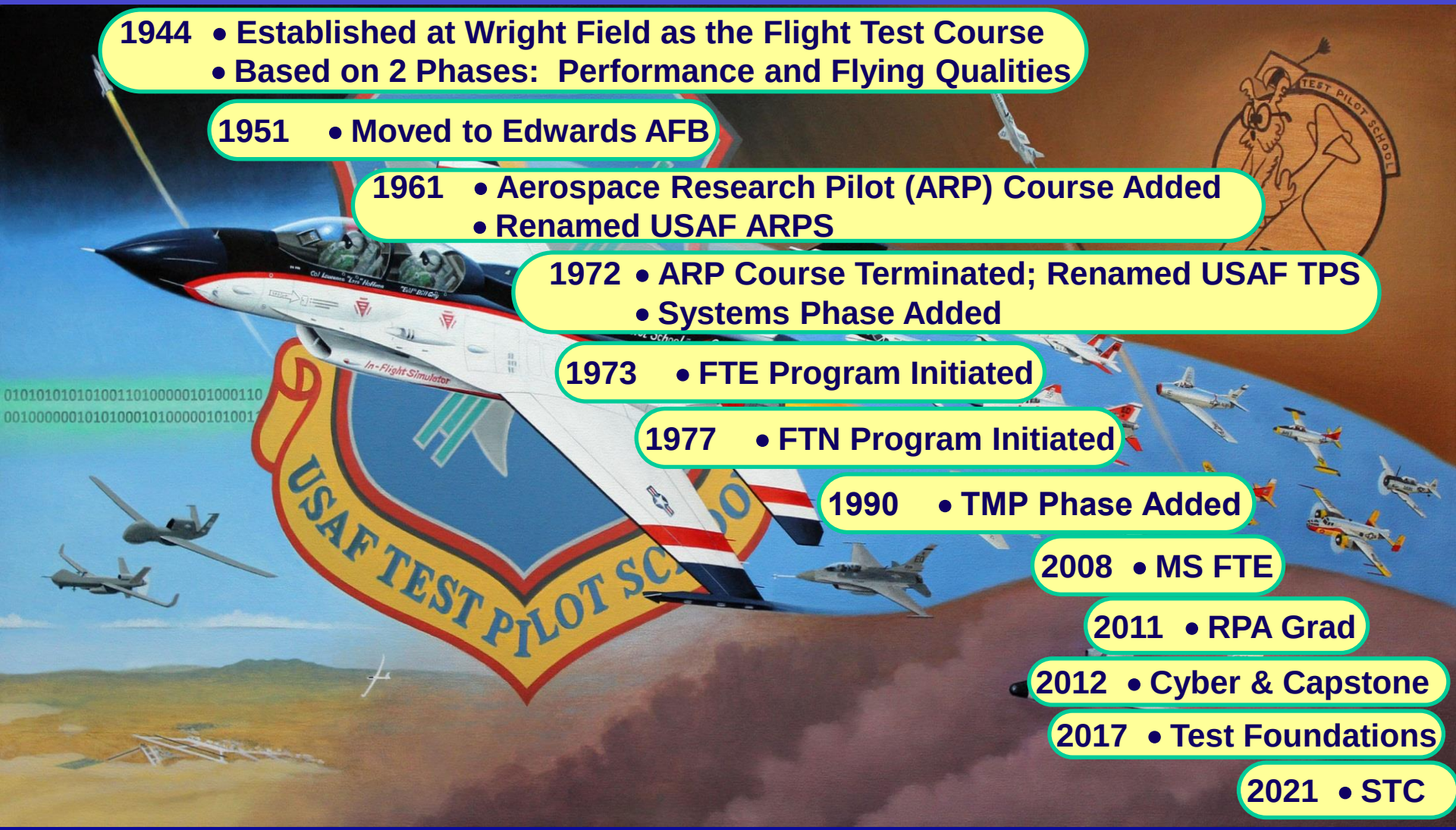
1940 1950 1960 1970 1980 1990 2000 2010 2020



1944 • Established at Wright Field as the Flight Test Course
• Based on 2 Phases: Performance and Flying Qualities

1951 • Moved to Edwards AFB

1961 • Aerospace Research Pilot (ARP) Course Added
• Renamed USAF ARPS

1972 • ARP Course Terminated; Renamed USAF TPS
• Systems Phase Added

1973 • FTE Program Initiated

1977 • FTN Program Initiated

1990 • TMP Phase Added

2008 • MS FTE

2011 • RPA Grad

2012 • Cyber & Capstone

2017 • Test Foundations

2021 • STC

USAF TPS Overview

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- **48-week Program, MS Degree in Flight Test Engineering**
- **2 classes per year (24 students per class)**
  - *A Class (Jan – Dec)*
  - *B Class (Jul – Jun)*
- **4 integrated courses**
  - *Manned Aircraft Pilot*
  - *Remotely Piloted Aircraft Pilot*
  - *Combat System Officer*
  - *Flight Test Engineer*

Course	Time in Service	Education	Experience
PILOT	< 9yr, 6 Mo	BS in Engr, Math or Physics (≥3.0 GPA)	IP or ≥ 750 / 1000 hours total time* ≥ 12 months AC
RPA/CSO	< 9yr, 6 Mo	BS in Engr, Math or Physics (≥3.0 GPA)	RPA: IP or ≥750 hours total time* CSO: IN or ≥500 hours total time
ENGINEER	< 8yr	BS in Engr, Math or Physics (≥3.0 GPA) Technical MS highly desired	≥ 2yr experience in: 13XX, 14NX, 21AX, 21CX, 21LX, 21MX, 33SX, 61SX, 62EX 63AX (civ: ≥ 2yr in T&E)

What Makes USAF TPS Unique?

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- **Flying Course + Graduate Engineering Course**
- **Rigorous Student Selection Process**
  - *Comprehensive Candidate Evaluation Program*
  - *Application -> Central Selection Board -> Week-Long Interview*
- **Master of Science in Flight Test Engineering**
  - *World-Class Instructor Cadre*
  - *9 PhDs on staff*
  - *7 PhD students in the pipeline*
- ***Airborne Laboratories***
  - *Curriculum Aircraft*
  - *Qualitative Evaluation (Qual/Eval) Aircraft*
- ***Test Management Projects (TMPs)***
  - *Cradle-to-Grave (Test Planning-to-Reporting) Test Project*
  - *Unique "Laboratory" Aircraft + Sims + Virtual*

Exchange Agreements

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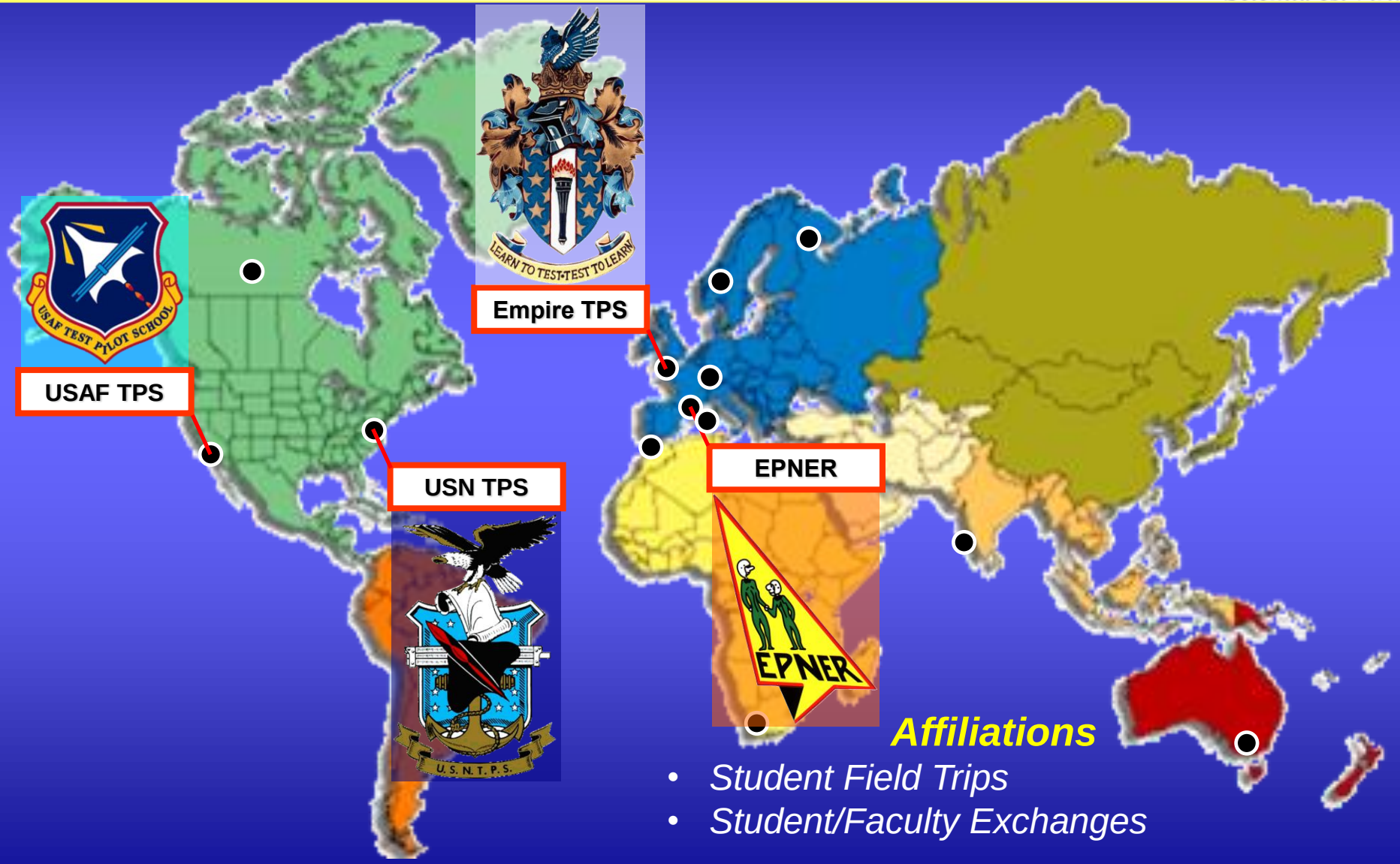

Affiliations

- *Student Field Trips*
- *Student/Faculty Exchanges*

TPS Graduate/Class Statistics

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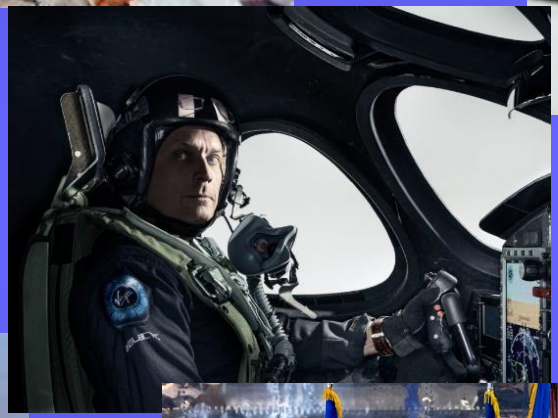
- *77 Years of History*
- *3,225 Total Graduates*
  - *112 General Officers*
  - *66 Astronauts*



USAF TPS Curriculum

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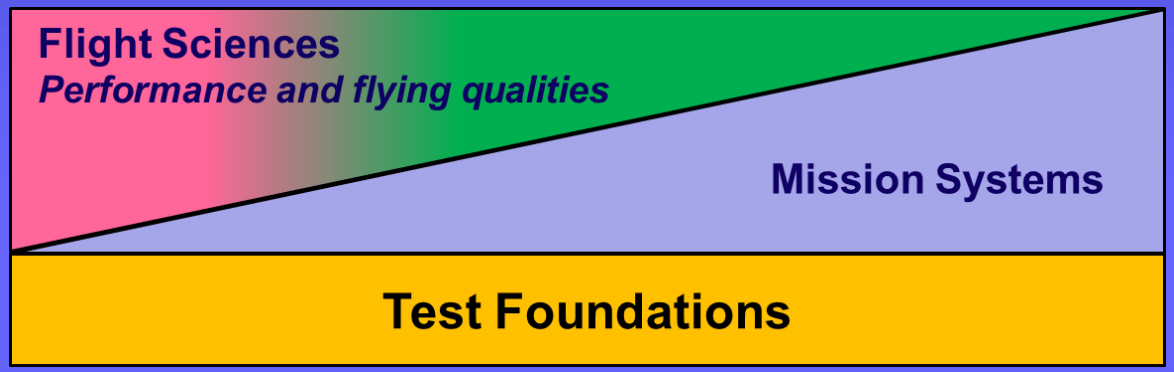
- ***3 "Big Blocks"***
  - ***Flight Sciences***
  - ***Test Foundations***
  - ***Mission Systems***



- **Three interdependent learning areas**
  - ***Skillset***
  - ***Theoretical Depth***
  - ***Mindset***
- **Our curriculum is constantly being updated to keep it current**

USAF TPS Curriculum Aircraft

Scientia est Virtus

USAF TPS Curriculum Aircraft

Scientia est Virtus

X-62A Variable Stability In-flight Simulator Test Aircraft (VISTA)

Variable Stability Learjet

USAF TPS Curriculum Aircraft

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Qualitative Evaluation Program

Scientia est Virtus

Control Rooms

Scientia est Virtus

Flight Sciences Simulators

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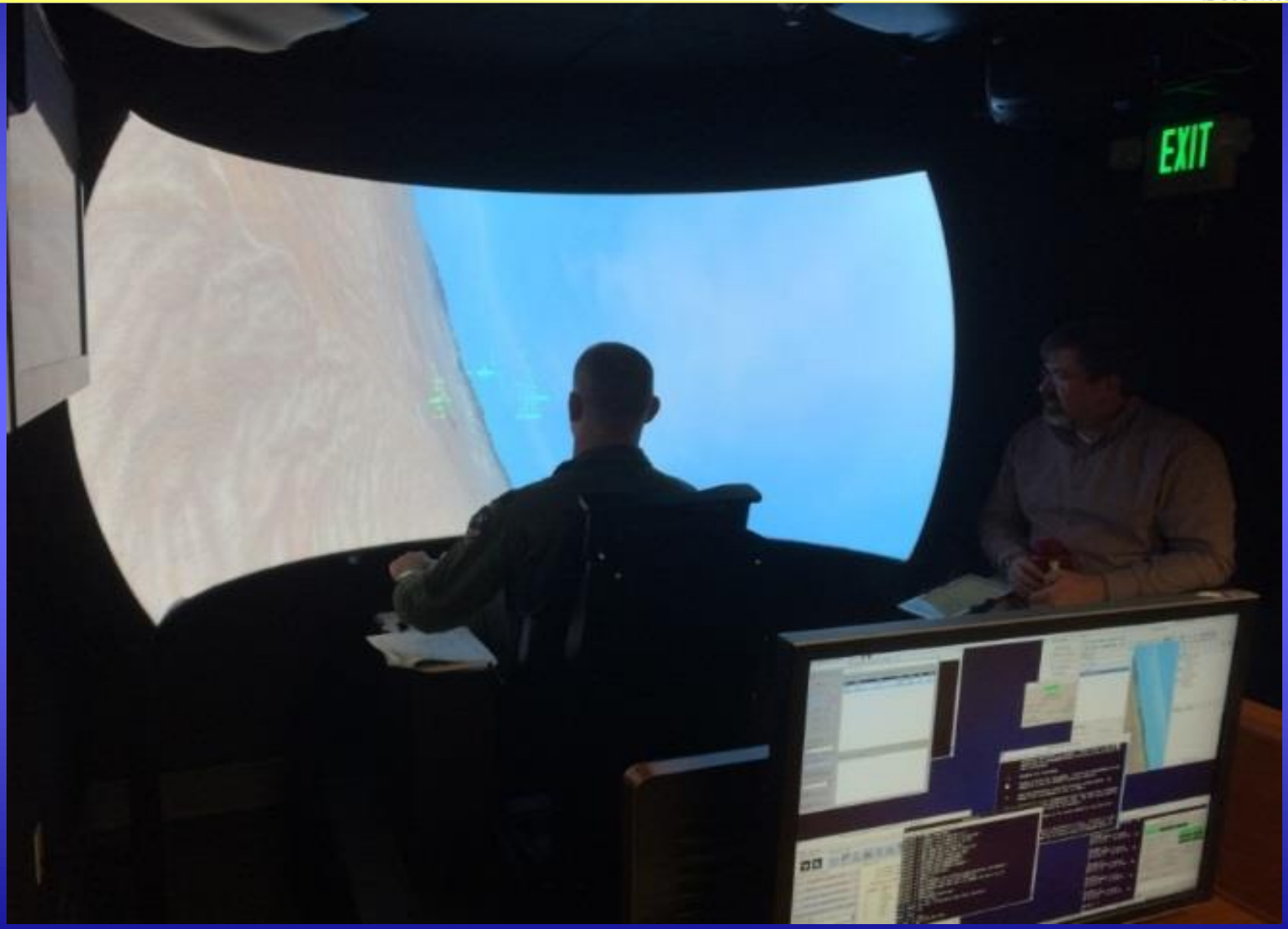

Test Management Projects

Scientia est Virtus

- **What are Test Management Projects (TMPs)?**
  - *End-to-End Staff/Student Real-World Flight Test Opportunities*
  - *Conduct ~ 8 Projects/Year (4 in Spring, 4 in Fall)*
  - *Peer-Reviewed, Published Written Report & Oral Defense*
- **Customer Provides:**
  - *Cutting edge research concept to be flight tested*
  - *Funding for any specialized support or major acft mods*
- **TPS Provides:**
  - *Test Aircraft - Usually flown on AFTC Assets*
  - *Dedicated Test Team of Pilots/Engineers (4-6 individuals)*
  - *Resources – range, clearances, mission support*
  - *Flight Test Data, Data Reduction, Data Analysis*

Test Management Projects

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Ex 1

- Tested a model-free adaptive control law on the Variable Stability Learjet-25 in partnership with Rochester Institute of Technology.
- The test team flew with the control law on and off to determine how well the control law changed the observed aircraft dynamics

Ex 2

- Tested a framework for measuring & displaying appropriate trust in an autonomy during a simulated within-visual-range dogfight.
- Flight tests were conducted in partnership with DARPA using two L-29 jet trainer aircraft owned by the University of Iowa's Operator Performance Lab.

Ex 3

- Investigated minimum required lateral and vertical sensor FOV needed for safe and effective rotorcraft takeoff and landing operations in a degraded virtual environment (DVE)
- Demonstrated suitability and military utility of high-ISO camera systems for operationally-representative tasks during low level flight in a DVE

Ex 4

- Demonstrated the SPHINX Payload's utility as an airborne surrogate test satellite for ground station testing
- Utilized the SCN Dedicated On-Orbit Test Asset (SPHINX) which provided basic satellite functionality for effective ground station testing

Transitioning from Test Pilot School to Test Professional School

CY 26 → Test Professional School

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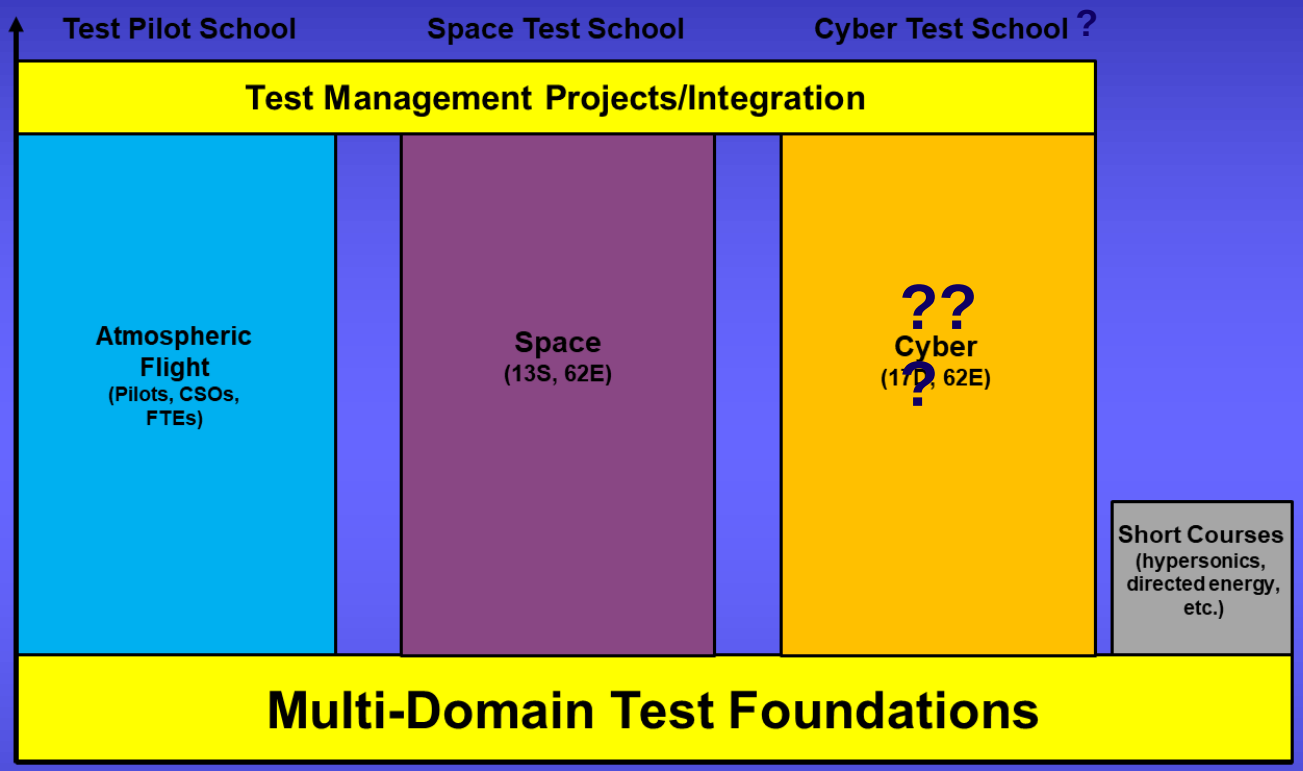

To support the National Defense Strategy, TPS needs to produce All-Domain Test Professionals

Space Test Course (STC) Mission

"Produce adaptive, critical-thinking test professionals to conduct full-spectrum test and evaluation of space weapon systems."

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Space Test Course

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- Hands-on program trains personnel in the fundamentals of space domain test and evaluation.

- The training is divided into 6 modules:
  - Introduction to Test Fundamentals
  - Introduction to Systems Testing
  - Space Science Application
  - Extended Field Trip
  - Capstone Project & Case Studies
  - Capstone Formal Outbrief & Organizational Briefs

- Administrative Details
  - Length = 3 months (CY21) → <u>4 months (CY22)</u>
  - Size = 15-20 students
  - Schedule = 3x/year (CY21) → <u>2x/year (CY22)</u>
  - Selection board 1x/year (USSF/TE and TPS/CC co-chair)

Roadmap

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CY21:
- Beta + 2 classes (~13 weeks)
- 45 students
- Independent of flight test course
- 1 USSF augmentee instructor
- "Hotwash"
- Contract = "course delivery"

CY24:
- 1 classes (~30 weeks, parallel TPS A Class)
- 25 students
- Continue integrating w/ flight test course
- Installation of ground-segment space vehicle comms
- 12 USSF Mil/Civ instructors
- Begin MS accreditation process

CY22:
- 2 classes (13-17 weeks)
- 43 students (21 in 1st class, 22 in 2nd)
- Begin to integrate w/ flight test course
- Expanded simulation capabilities
- 1-2x USSF augmentee instructors
- Contract = "TPS instructors"
- Seek DAU "Space T&E" Credential

CY26:
- 1x classes (~48 weeks, parallel TPS A Class)
- 25 students
- Integrated w/ flight test course
- Dedicated on-orbit assets for projects/exercises
- 13x USSF Mil/Civ instructors
- Grad Patch
- MS Test Engineering

Every year: Increased emphasis on hands-on data collection and evals

Questions?

ADDITIONAL TOPICS FOR DISCUSSION

COMPREHENSIVE CANDIDATE EVALUATION PROGRAM (CCEP)

TPS Student Selection Process

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Comprehensive Composite Scores

A3 Approval

TPS Students

- Pilot
- FTE
- RPA
- CSO

CCEP Interview

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- **The objectives**
  - *Professional skill*
  - *Technical skill*
  - *Desire to enter the field*
- **The interview panel**
  - *TPS Commandant/Deputy Commandant*
  - *Mix of TPS senior staff and CC/DO level guests*
- **The interview (standard questions)**
  - *Two questions answered in writing prior to arrival*
  - *Three questions with follow-up*
  - *Open forum*
- **Scoring**
  - *Each board member provides a score*
  - *Scores are adjudicated if required*

CCEP Flight Evaluation

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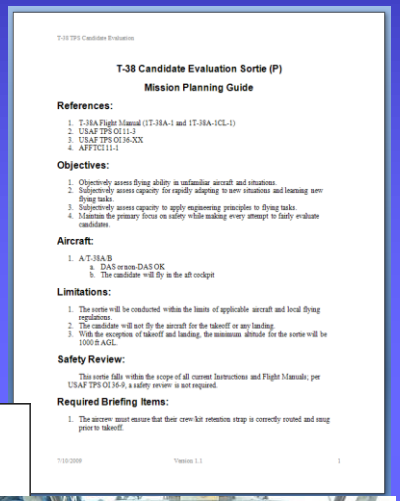
- **T-38, C-12, and sailplane**
- **Objectives**
  - *Objectively assess flying ability*
  - *Subjectively assess adaptability*
  - *Subjectively assess engineering focus*
- **Student Materials (Notebook)**
  - *Mission Planning Guide*
  - *Flight manual excerpts*
  - *NO additional instruction*
- **Evaluator pilots**
  - *Senior TPS IPs*
  - *2 evaluators per aircraft*



T-38 TPS Candidate Evaluation

T-38 Candidate Evaluation Sortie (P)

Mission Planning Guide

References:

1. T-38A Flight Manual (1T-38A-1 and 1T-38A-1CL-1)
2. USAF TPS OI 11-3
3. USAF TPS OI 36-XX
4. AFFTC I 11-1

Objectives:

1. Objectively assess flying ability in unfamiliar aircraft and situations.
2. Subjectively assess capacity for rapidly adapting to new situations and learning new flying tasks.
3. Subjectively assess capacity to apply engineering principles to flying tasks.
4. Maintain the primary focus on safety while making every attempt to fairly evaluate candidates.

Aircraft:

1. A/T-38A/B
   a. DAS or non-DAS OK
   b. The candidate will fly in the aft cockpit

Limitations:

1. The sortie will be conducted within the limits of applicable aircraft and local flying regulations.
2. The candidate will not fly the aircraft for the takeoff or any landing.
3. With the exception of takeoff and landing, the minimum altitude for the sortie will be 1000 ft AGL.

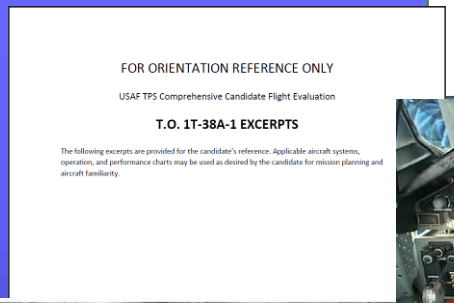
Safety Review:

This sortie falls within the scope of all current Instructions and Flight Manuals; per USAF TPS OI 36-9, a safety review is not required.

Required Briefing Items:

1. The aircrew must ensure that their crew kit retention strap is correctly routed and snug prior to takeoff.

7/10/2009 Version 1.1 1

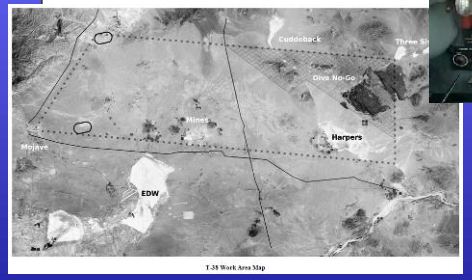


FOR ORIENTATION REFERENCE ONLY

USAF TPS Comprehensive Candidate Flight Evaluation

T.O. 1T-38A-1 EXCERPTS

The following excerpts are provided for the candidate's reference. Applicable aircraft systems, operation, and performance charts may be used as desired by the candidate for mission planning and aircraft familiarity.



T-38 Work Area Map

T-38 CCEP Profile

- **Roles**
  - *Candidate in back seat*
  - *IP flies takeoff and landing*

- **Profile**
  - *Flight test technique (FTT) block*
  - *Complex and difficult dynamic maneuvers*
  - *Repeat FTT block*
  - *Scripted non-standard T-38 straight-in approach*
  - *Emphasis on adaptability and response to stress/failure*

C-12 CCEP Profile

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- **Roles**
  - *Candidate in the left seat*
  - *IP helps with crew duties*
  - *Students flies takeoff and a landing*
- **Profile**
  - *FTTs*
  - *Engine failure emergency procedures*
  - *Pattern procedures*

Sailplane Profile

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- **Roles**
  - *Candidate flies in the front seat*
  - *Emphasis is on capacity to learn*

- **Profile**
  - *Sortie 1 (25% of grade)*
    - *Student flies*
    - *IP demos/instructs as required*
  - *Sortie 2 (75% of grade)*
    - *Student repeats Sortie 1 without IP aid*

ACCREDITATION

Accreditation

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- ***Southern Association of Colleges and Schools (SACS)***
  - ***New accreditation guidance in process***
  - ***Rebaseline for all AU schools in 2018***
  - ***Annual updates between reaccreditations***

- ***Three main areas of accreditation focus***
  - ***Learning Outcomes***
  - ***Resources***
  - ***Faculty***

Learning Outcomes

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- ***School Outcomes***
  - *(1) Mindset, (2) Theory, (3) Skillset*
  - *Other strategic planning outcomes as determined by CC and Advisory Board*
- ***Program Outcomes (MS-FTE)***
  - *Integrated Test Teaming (SO1)*
  - *Flight Test Planning (SO1 SO2)*
  - *Flight Test Execution (SO2 SO3)*
  - *Flight Test Reporting (SO1 SO2)*
  - *Risk Management (SO1)*
  - *Adaptability (SO1 SO3)*
- ***Course Outcomes (MS-FTE)***
  - *E.g., TF7000: Diverse air vehicle exposure (PO6-Adaptability)*
  - *These can be specific to P/RPA/CSO/FTE*
- ***Event Objectives (MS-FTE)***
  - *Lecture, lab, sim, flight, etc.*

Skillset

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- ***Test Execution***
  - *Airborne and control room*
  - *Test techniques and procedures*
  - *Team making real-time decisions and collecting data*

- ***"Flight training" aspect of TPS***
  - *Traditionally what granted the patch*
  - *Historically mostly focused on high-risk performance and flying qualities (P&FQ) testing*

Theoretical Depth

Scientia est Virtus

- ***Science and Technology***
  - ***Classroom lectures, laboratories, simulators, flights***

- ***The "graduate school" aspect of TPS***
  - ***Theory has grown out of the skillset realm, matured and formalized***
  - ***Accredited MS: many credit hours of significant scientific exposure***
  - ***Diverse, highly experienced and educated staff***

Mindset

- ***Systems Thinking***
  - ***Defining and approaching complex problems***
  - ***Decomposing requirements***
  - ***Test planning and reporting***
  - ***Big picture in mind during test conduct***

- ***The Flight Test Engineering education***
  - ***Sciences evolve, but the mindset is what makes TPS unique (beyond flight training and engineering-graduate school)***

Resources

- *Likely a low risk for accreditation*
- *Budget, IT, Facilities, Strategic Plan*

Faculty PhD Pipeline

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- *1-3 quotas per year*
- *3 year expectation when back on staff (5 year ADSC)*
- *Boarded in Aug for an early fall announcement*
- *Tech experts desire (and CS agrees) candidates propose research areas relevant to T&E curriculum advancement*

Curriculum Planning Council

Scientia est Virtus

- *3-Day "off-site"; CT, CP, Div Chiefs, Tech Experts*
  - *Every curriculum break (6 months)*
- *Vote on major changes*
  - *Course objectives*
  - *Resources*
  - *Prerequisites*
  - *Requirements for what events are needed for any student type*
  - *Hour trading between branches*
- *Develop actions for minor improvements*
  - *Individual event changes*
  - *Execution refinements*
  - *Hour movements within a branch*
  - *Data gathering efforts to support future CPCs*