



NATIONAL ASSOCIATION OF FLIGHT INSTRUCTORS

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TEM-Building

Adapting Threat and Error Management to GA

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Flight Plan

- What is TEM?
- Training Considerations
- Where did TEM come from?
- How does TEM relate to CRM (or SRM)?
- TEM Terms
- TEM Tools
- Application to General Aviation

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First Things First...

- Accidents rarely occur due to a single event or error; rather, they result from a chain of events or errors.
- If you break the chain, you can stop an accident.
- It is best to break the chain at the earliest point.
 - ...But that means you must become aware of threats and errors that constitute the beginning of the accident chain.

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What is TEM?

TEM = Threat and Error Management

- It is a safety management process that assumes pilots will make mistakes and be in situations with a certain level of risk.
- TEM teaches pilots how to manage threats, prevent errors, and maintain safety.

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Is it a Threat or an Error?

Threats come at the pilot



Errors come from the pilot



“Was I supposed to hold short of the runway?”

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TEM Training

- TEM training teaches you to:
 - Recognize threats and errors
 - Manage them before they create a second link in the accident chain
 - Prevent Undesired Aircraft States (UAS)
- TEM does not teach you to fly

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TEM Training

TEM training acknowledges that:

- Pilots operate in a complex environment
- “Hard” and “soft” safeguards are necessary, but not sufficient
 - Hard safeguards are equipment like ADS-B, autopilot
 - Soft safeguards are checklists, procedures, briefings
- There is no such thing as a perfect flight
- Every action you take may be critical

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Put another way

TEM is “defensive driving for pilots”



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The Ultimate in TEM



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Where Did TEM Come From?

- When: Mid-1990s
- Who: University of Texas-Austin + major airline
- Why: Look at CRM & procedural compliance
- What: Line Operations Safety Audit (LOSA)
TEM was the model used to measure errors.
- And then.....

Early in the observations, it became clear that TEM should be taught as a strategy to manage flight safety, not limited to use as a measuring tool.

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CRM vs TEM

- Crew Resource Management
 - Personality profiles, styles of communication
 - Conceptual in nature
- Threat & Error Management
 - Action oriented
 - Presents specific “things you can do” skills that can be taught and measured
 - Practical in nature

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TEM Terms - Threat

- A threat is an event or error that:
 - Occurs outside the pilot's ability to influence
 - Increases the operational complexity of a flight
 - Requires attention/management to maintain safety margins
- Threats come in three categories:
 - Operational Threats (malfunctions, poor procedures)
 - Environmental Threats (weather, ATC)
 - Mismanaged Threats (shutting down the wrong engine)

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TEM Terms - Threat

A pilot may not be able to see all threats:

- Observable
 - Known (thunderstorms)
 - Unexpected (engine failure)
- Latent
 - Equipment design issues
 - Air Traffic System
 - Organizational culture/individual mindset

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TEM Terms - Error

- An error is a pilot action or inaction that:
 - Leads to a deviation from intentions or expectations
 - Reduces safety margins
 - Increase the probability of adverse operational events on the ground or during flight
- Errors (like threats) come in three categories:
 - Aircraft Handling Errors (speed, configuration, automation)
 - Procedural Errors (deviation from regulations, POH/AFM)
 - Communication Errors (pilot/instructor or pilot/ATC errors)

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TEM Terms - UAS

- Another error or a safety-compromising event called Undesired Aircraft State (UAS).
- UAS is an aircraft position, speed, altitude or configuration that:
 - Results from pilot error, actions, or inactions and
 - Clearly reduces safety margins



TEM Tools

- Human beings are the problem:
 - Most threats are caused by other humans' errors.
 - Most errors (especially our own) are often undetected or mismanaged.
 - TEM training recognizes that elimination of all errors is Mission Impossible.
- Human beings are also the solution:
 - Pilots are the last line of defense

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TEM Tools

- Anticipation
 - Something is likely to go wrong
 - You can not know exactly what or when
 - Uneasiness leads to vigilance
- Recognition
 - Must recognize the problem in order to mitigate
 - Recover first
- Recovery
 - For example: If the autopilot is not doing what you want, disconnect and hand-fly to re-establish safety margin
 - Then you can analyze and ask why.

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TEM Tools

- Anticipation

Anticipation is a type of *strategy*.

- Strategies prepare us for what threats and errors may be coming.
- Other strategies include briefings and planning.

- Recognition

Recognition & Recovery are *countermeasures*.

- Recovery

Countermeasures are how we act to:

- “Trap” a threat or error
- Keep it from compounding

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Trapped versus Un-trapped Errors

- A trapped error is the first step in reducing an error chain
- An un-trapped error could lead to
 - Safety issues
 - Or not, depending on the situation

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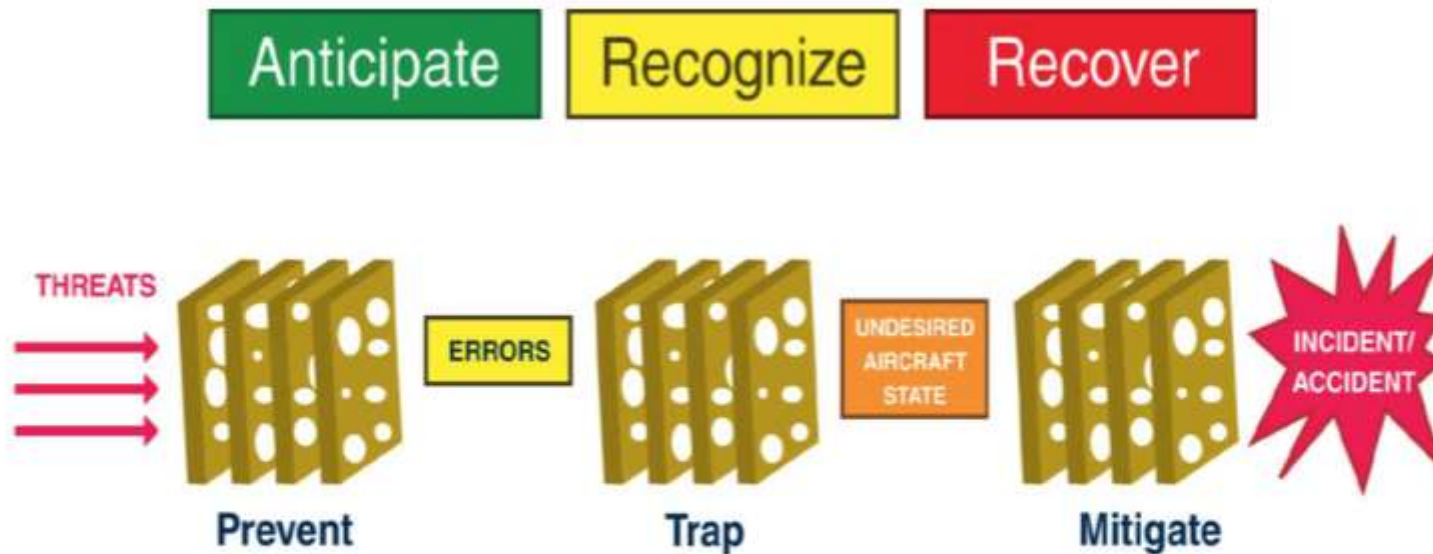
Un-trapped Error Example

You fail to note, brief, or program the missed approach altitude for an instrument approach.

- If you miss or go-around, you might climb to the wrong altitude, creating a safety issue
- If you do not miss, then there is no safety consequence.

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TEM Model





TEM for General Aviation

TEM has wide adaptability to GA operations.

- Flight instruction
- Single-pilot
- Multi-pilot

Focus tonight on flight instruction

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TEM for Instructors

Threats in flight instruction environment include:

- Pilot - student skill (or lack thereof)
- Aircraft – mechanical malfunctions
- Environment – weather, airport
- External Pressures – completion pressure from student, school

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Threats from Pilots

- Experience level
- Language skills
- Behavior, attitudes, learning styles



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Threats from Aircraft

- Mechanical problems
- Teaching in an unfamiliar aircraft or situation



Threats from Environment

- Weather
- ATC and airspace challenges
- Airport conditions



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Threats from External Pressures

- Pressure from student to get signed off
 - Financial constraints; need sign off for a new job
- Pressure from flight school schedules
- Student volume can contribute to fatigue



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The Error Challenge

- The errors from our students become our threats...which we then have to manage to prevent them from becoming our errors.
- Instructor ACS will focus on how to teach risk management to our students, while maintaining our own skills in managing risk while instructing.

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