Threat & Error Mgt Training at JetBlue Airways

Captain Chris Reed
Manager, AQP
Outline

• What’s TEM at JetBlue?
  – TEM versus CRM – how we think about it
  – Description of TEM courses to we teach
  – Overview of our TEM courses

• How do we use TEM in our AQP?
  – Status of AQP at JetBlue
  – Our TEM-based AQP Grade Scale
  – Example of an LOE grade sheet

• How does it fit together?
  – TEM fully integrated in our CQT (recurrent)
TEM versus CRM

- What is TEM? …
- … and what is CRM?...
- … … and how do they relate??
- It seems to depend who you ask…
TEM versus CRM (at JetBlue)

• CRM
  – Personality profiles, styles of communication, etc
  – “Flavor” is conceptual
  – Joint Pilot & Flight Attendant Training

• TEM
  – Action oriented, presents specific skills which can be taught and measured, “Things you can do”
  – “Flavor” is practical
  – Pilot*-Specific Training: Focused on the Flight Deck
TEM Training at JetBlue

• Initial TEM Training → “Basic TEM”
  – Taught to new-hire pilots (and dispatchers) during basic indoc

• Recurrent TEM Training → “Applied TEM”
  – Taught to pilots during Continuing Qualification Training (CQT)
A brief overview of our Basic TEM Course
“Basic TEM”

- Course is 3 hrs in length, and is taught using a combination of lecture, discussion, and case studies.
- My overview for you will be much shorter (!)
- Course Outline
  - Foundational Philosophy
  - Basic TEM Model
  - Defenses - General
  - TEM “Tool-Kit” Defenses
Foundational Philosophy
Threats & Errors – The “Old School”

• Threats can be essentially eliminated…
  – … by better equipment, training, policies, etc.

• Human performance can be practically perfected…
  – … by strict discipline, enforcement of rules, etc.

• Errors are abnormal…
  – … hunt down and punish the guilty!
Foundational Philosophy
Threats & Errors – The “Old School”

• Threats can be essentially eliminated…
  – … by better equipment, training, policies, etc.
• Human performance can be practically perfected…
  – … by strict discipline, enforcement of rules, etc.
• Errors are abnormal…
  – … hunt down and punish the guilty!

• What a crock of fertilizer!
Foundational Philosophy
Threats & Errors – The TRUTH

• The world is full of threats.

• Humans make errors.

• This is perfectly normal.
Building Our Basic TEM Model

(We start with James Reason’s Swiss Cheese model)
Building Our Basic TEM Model

Threats

Defenses

Accident, Incident, Violation
Basic Threat & Error Management Model

Defenses

Threats

Error

Prevent

Trap

Undesired Consequence

Mitigate

Accident, Incident, Violation
Defenses

- Hardware
- Flows & Checklists
- External People
- "What If" Planning
- Situational Awareness
- LUCK!
- SOP's
- Communications & Briefings
- Automation Management
- Other Pilot
- Time Management
- Flying Skills
- Accident, Incident, Violation

Threats

- Teamwork
Defenses

Threats

Hardware

Flows & Checklists

External People

Teamwork

Situational Awareness

“What If” Planning

Automation Management

Communications & Briefings

Time Management

Flying Skills

SOP’s

Other Pilot

 Accident, Incident, Violation

Situational Awareness
T&EM “Toolkit” Defenses

- Communications & Briefings
- Time Management
- Automation Management

Threats → "What If" Planning → Teamwork → Situational Awareness

Accident, Incident, Violation
Basic T&EM Model

Defenses

Prevent
Trap
Mitigate

Communications & Briefings
Time Management
Automation Management

“What If” Planning
Teamwork
Situational Awareness

T&EM “Tool-Kit” Defenses

Accident, Incident, Violation

Threats
Error
Undesired Consequence
For Every Defense, Keeping the holes small is up to US!

Not Proficient or Disciplined

Highly Proficient and Disciplined

Which makes a better defense??
T&EM “Toolkit” Defenses

Communications & Briefings

Time Management

Automation Management

“What If” Planning

Teamwork

Situational Awareness

Accident, Incident, Violation

Threats
Communications
Summary of Tools

• Think Out Loud
  – When you recognize a threat, say something!

• Ask Questions
  – If you are wondering, ask!

• Be Specific
  – Use clear language
Briefings
Summary of Tools

• Brief the Exceptions
  – Discuss what’s different

• Brief the Bottom Lines
  – Set and communicate the limits
T&EM “Toolkit” Defenses

- Communications & Briefings
- Time Management
- Automation Management

“What If” Planning
Teamwork
Situational Awareness

Accident, Incident, Violation

Threats
“What If” Planning
Summary of Tools

• Be Skeptical
  – Challenge assumptions, ask “what if” questions

• Plan for the worst
  – Always have an out

• Choose conservatively
  – When in doubt, ask yourself, “Do we need to be doing this?”
T&EM “Toolkit” Defenses

Communications & Briefings

Time Management

Automation Management

“What If” Planning

Teamwork

Situational Awareness

Threats

Accident, Incident, Violation
Time Management
Summary of Tools

• **Budget Available Time**
  – Move tasks to low workload phases of flight when possible.

• **Add Time**
  – Slow Down horizontally, vertically, and operationally.

• **Set Priorities**
  – When time is limited, focus on the essentials. Fly the Airplane. Safety of Flight is always first.
T&EM “Toolkit” Defenses

- Communications & Briefings
- Time Management
- Automation Management

- "What If" Planning
- Teamwork
- Situational Awareness

Threats

Accident, Incident, Violation
Teamwork
Summary of Tools

• **Balance Task Loading**
  - Divide up the workload within the cockpit.
  - Be ready to reassign tasks.

• **Off-Load Tasks**
  - Get help from outside the cockpit.
  - ATC, In-Flight Crew, Dispatch, etc. may all be able to help
T&EM “Toolkit” Defenses

Communications & Briefings

Time Management

Automation Management

“What If” Planning

Teamwork

Situational Awareness

Threats

Accident, Incident, Violation
# Levels of Automation - Terminology

<table>
<thead>
<tr>
<th>Level</th>
<th>General Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>A/P, Controlled by FMS [Managed]</td>
</tr>
<tr>
<td>3</td>
<td>A/P, Controlled by GP (E190) or FCU (A320) [Selected]</td>
</tr>
<tr>
<td>2</td>
<td>F/D Only</td>
</tr>
<tr>
<td>1</td>
<td>No Automation at all. (A/P &amp; F/D Off)</td>
</tr>
</tbody>
</table>
Automation Management
Summary of Tools

• Use the “3 Rules of Thumb”
  – Immediate maneuvering → Reduce Level
  – Automation is the problem → Reduce Level
  – Workload high → Increase Level (if automation is not the problem)

• Use Active Monitoring
  – Visualize, Act, Compare
T&EM “Toolkit” Defenses

Communications & Briefings

Time Management

Automation Management

"What If" Planning

Teamwork

Situational Awareness

Accident, Incident, Violation

Threats
Situational Awareness
Summary of Tools

• Use “The 3 R’s” – SA Loss Defense

1. **Recognize** → Take your “Gut Feel” seriously
   • Look for the Flags

2. **React** → *Immediately ensure safe flight path & energy state*
   • Add Time

3. **Regain** → Rebuild your SA
   • Communicate
Situational Awareness
Summary of Tools

• **Use Memory Joggers** (physical, visual, or aural)
  - To remember to do something…
    • …in the future which is …
    • …outside of your normal habits

• **Use “The 3 R’s”** – SA Loss Defense
  1. **Recognize** → Take your “Gut Feel” seriously
     • Look for the Flags
  2. **React** → *Immediately ensure safe flight path & energy state*
     • Add Time
  3. **Regain** → Rebuild your SA
     • Communicate
Situational Awareness
Summary of Tools

- **SA Loss Defense (“3 R’s”)**
  1. **Recognize**
     - Take your “Gut Feel” seriously
     - Look for the Flags
  2. **React**
     - Immediately ensure safe flight path & energy state
     - Add Time (Slow Down)
  3. **Regain**
     - Rebuild your S.A.
     - Communicate (Ask Questions & Think Out Loud)

- **SA Flags**
  - Not Communicating
  - Not Addressing Discrepancies
  - Ambiguity
  - No One Flying the Aircraft (or not looking outside)
  - Failure to Meet Targets
  - Deviating From Standards, Violating Minimums
  - Preoccupation or Fixation
  - Confusion
Threat & Error Management

*Identify Threats, Place Defenses!*
Recurrent TEM Training
“Applied TEM”

- Course taught during CQT (recurrent) and is 2 hrs long
- Course Content
  - Begins with a brief review of the material from “Basic TEM”
  - For the rest of the class period, scenarios are presented to allow the class to practice applying TEM skills to real-world scenarios.
- Key point: The scenarios tie in with the CQT training objectives. I.e., we intentionally choose scenarios directly from the LOE.
- Here’s an example…
## Applied TEM Example

### Scenario 07-11 – Pre-Departure

- You’ve been assigned a late night ferry flight for aircraft repositioning.

<table>
<thead>
<tr>
<th>Threats</th>
<th>Defenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unfamiliarity with Ferry Flight tasks</td>
<td>Comm&amp;Brief: Verbalize the threat(s), brief the exceptions</td>
</tr>
<tr>
<td>Departing with incorrect performance calculations</td>
<td>Time Mgt: Slow down as needed to manage task loading</td>
</tr>
<tr>
<td>Task loading</td>
<td>Teamwork: Offload tasks – might want to get dispatcher on the phone?</td>
</tr>
</tbody>
</table>
TEM is the heart AQP at JetBlue
How goes our AQP transition?

• We are in phase IV (Initial Operations)
• We’re still “early in the game”… Just now completing our first year of operation
• We transitioned all of our recurrent training into AQP CQT for both of our fleets (A320 & E190) in the first year
• We conduct CQT on a 9/18 interval (9 month evaluation periods, 18 month qualification cycle)
• QT programs (Initial, transition, upgrade) still to be done
Using our TEM model to build our AQP Grade Scale
AQP requires grades to reflect CRM ...how should we deal with this?

• Some airlines grade CRM skills separately from technical skills

• Some airlines integrate CRM and technical skills into the grading scale
  – Allows for a single grade
  – Eliminates potential dilemmas when technical skills are great but CRM skills are deficient (or vice versa)

• JetBlue chose the integrated method. To do this, we used our Threat and Error Management model
Applying T&EM to Grading

Threats → Error → Undesired Consequence

Defenses:
- Prevent
- Trap
- Mitigate

Accident, Incident, Violation
Applying T&EM to Grading

5
No Errors

4
Errors occur, but are trapped

3
Errors not trapped

2
Consequences not mitigated

1
Consequences not mitigated

NO

ATTITUDE, SKILL, KNOWLEDGE?

YES

Accident, Incident, Violation
How does our grading model account for standards?

• The FARs, Practical Test Standards (PTS), OpSpec, Flight Ops Manual (FOM), and aircraft Flight Crew Ops Manual (FCOM), provide the basis for our standards

• Let’s go back to the model…
“Standard” maintains objectivity

- The FARs, Practical Test Standards (PTS), OpSpec, Flight Ops Manual (FOM), and aircraft Flight Crew Ops Manual (FCOM), provide the basis for our standards.
- The technical aspects of these standards are incorporated in our TEM model via the SOP and Flying Skills defenses.
- The “CRM” aspects of these standards are incorporated in our TEM model via the six “TEM Tool-Kit” defenses.
Our TEM model includes SOP’s & Flying Skills defenses…
…this covers the technical standards
Our TEM model includes our “Tool-Kit” defenses…
…this covers the “CRM” standards

- Flows & Checklists
- External People
- Teamwork
- “What If” Planning
- Situational Awareness
- Hardware
- SOP’s
- Communications & Briefings
- Automation Management
- Time Management
- Flying Skills
- Accident, Incident, Violation

Threats

Other Pilot
Applying T&EM to Grading

5. No Errors
   Prevent
   Threats

4. Errors occur, but are trapped
   Trap
   Error

3. Errors not trapped
   Mitigate
   Undesired Consequence

2. Consequences not mitigated
   Our Standard
   YES
   NO
   Consequences not mitigated

1. Consequences not mitigated
   Attitude, Skill, Knowledge?
   Accident, Incident, Violation
Scenario 07-12 – Approach & Landing

• Approaching KBTV late at night, tower is closed, weather is VMC.

<table>
<thead>
<tr>
<th>Threats</th>
<th>Defenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Terrain</td>
<td>➢ Time Mgt: Budget time in cruise to fully review the issues</td>
</tr>
<tr>
<td>➢ Lack of ATC vectoring capability</td>
<td>➢ Think Out Loud</td>
</tr>
<tr>
<td>➢ Responsibility for choosing own approach</td>
<td>➢ Teamwork: Watch for unbalanced task loading.</td>
</tr>
<tr>
<td>➢ Planning workload</td>
<td>➢ What If Planning: Be skeptical and conservative in choosing approach</td>
</tr>
</tbody>
</table>
### Specific Threats & Defenses Identified for each Event Set

#### Leg 1 – Event Set 7 – Approach

**Event Set Summary:** Crew cleared for chosen approach – from the BTV VOR, either (1) Visual, or (2) ILS 15 with PT, or (3) direct IAF for RNAV 15. Non-Towered airport operations

<table>
<thead>
<tr>
<th>Threats</th>
<th>Defenses - Technical</th>
<th>Defenses - TEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrain (CFIT)</td>
<td>SOP – non-tower operations, approach procedures</td>
<td></td>
</tr>
<tr>
<td>Night</td>
<td>Flying Skills – standards met; use of glide path information (PAPI and electronic if available)</td>
<td></td>
</tr>
<tr>
<td>Non-tower environment – workload</td>
<td>Hardware – EGPWS displayed, FMS properly set up and used.</td>
<td></td>
</tr>
<tr>
<td>Pilot-controlled lighting – distractions</td>
<td>Automation Management: use 3 “rules of thumb”, esp. workload high – increase level (AP left on as long as it’s helpful), and automation problem – decrease level (if automation problem, crew reduces level)</td>
<td></td>
</tr>
<tr>
<td>“Black Hole” approach</td>
<td>Time Management: Add time – slow down; go-around if in doubt</td>
<td></td>
</tr>
<tr>
<td>SA Loss (esp. position &amp; terrain awareness)</td>
<td>What If Planning: Make conservative choices – “Do we need to be doing this?”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SA: Use 3R’s – Recognize (Look for flags), if any are noted immediately React</td>
<td></td>
</tr>
</tbody>
</table>

#### Pilot 1 Flying
- **Seat:** ⬜️ Left  ⬜️ Right
Threat & Error Management

*Identify Threats, Place Defenses!*

**Basic T&EM Model**

**T&EM “Tool-Kit” Defenses**
How this all fits together in the LOE Grade-Sheet/Job Aid
## Excerpt from LOE Grade Sheet

### Leg 1 – Event Set 1 – Pre-Departure Planning

**Event Set Summary:** Crew preps for a middle-of-the-night ferry flight. Ballast fuel required.

<table>
<thead>
<tr>
<th>Threats</th>
<th>Defenses – Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Departing with incorrect performance calculations, departing without clear understanding of destination plan.</td>
<td></td>
</tr>
<tr>
<td>- Unfamiliarity with tasks (ferry flight, ballast fuel, and nontowered ops rarely done)</td>
<td></td>
</tr>
<tr>
<td>- Higher than normal task loading</td>
<td></td>
</tr>
<tr>
<td>- Night operations</td>
<td></td>
</tr>
<tr>
<td>- SOPs – use of FOM guidance – ferry flights, non-tower operations</td>
<td></td>
</tr>
<tr>
<td>- Flows and Checklists – use of QRH for Ballast fuel, use of QRH for ferry</td>
<td></td>
</tr>
<tr>
<td>- Hardware – hard-tune BOS for the SID</td>
<td></td>
</tr>
</tbody>
</table>

### Pilot 1 Flying

**Seat:**  ○ Left  ○ Right

### Graded Item

<table>
<thead>
<tr>
<th>Graded Item</th>
<th>Crew Grade 1-5</th>
<th>Reason Code Circle A, S and/or K</th>
<th>Database Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Departure Planning 1</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Receiving Checklist 2</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Cockpit Preparation 3</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Before Start (To the line) 4</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Before Start (Below the line) 5</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
</tbody>
</table>
# Crew Grade, Reason Code, & Comments

<table>
<thead>
<tr>
<th>Graded Item</th>
<th>Crew Grade 1-5</th>
<th>Reason Code Circle A, S and/or K</th>
<th>Database Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Departure Planning 1</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Receiving Checklist 2</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Cockpit Preparation 3</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Before Start (To the line) 4</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Before Start (Below the line) 5</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
</tbody>
</table>
## Excerpt from LOE Grade Sheet

### Leg 1 - Event Set 1 - Pre-Departure Planning

**Event Set Summary:** Crew preps for a middle-of-the-night ferry flight. Ballast fuel required.

### Threats:
- Departing with incorrect performance calculations, departing without clear understanding of destination plan.
- Unfamiliarity with tasks (ferry flight, ballast fuel, and non-towered ops rarely done).
- Higher than normal task loading.
- Night operations.

### Defenses - Technical:
- SOPs - use of FOM guidance - ferry flights, non-tower operations.
- Flows and Checklists - use of QRH for Ballast fuel, use of QRH for ferry.
- Hardware - hard-tune BOS for the SID.

### Defenses - TEM:
- Comm&Brief - think out loud about threats, brief exceptions (esp. SID, and unfamiliar procedures).
- Teamwork - contact with dispatcher for briefing.
- Time Mgt - Add time as necessary to manage pre-departure task loading.

### Graded Item Table

<table>
<thead>
<tr>
<th>Graded Item</th>
<th>Crew Grade 1-5</th>
<th>Reason Code</th>
<th>Database Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Departure Planning 1</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Receiving Checklist 2</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Cockpit Preparation 3</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Before Start (To the line) 4</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
<tr>
<td>Before Start (Below the line) 5</td>
<td></td>
<td>A S K</td>
<td></td>
</tr>
</tbody>
</table>
## Event-Set Header Section
### Specific Threats & Defenses Identified

### Leg 1 – Event Set 1 – Pre-Departure Planning

<table>
<thead>
<tr>
<th>Event Set Summary:</th>
<th>Crew preps for a middle-of-the-night ferry flight. Ballast fuel required.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Threats:</strong></td>
<td></td>
</tr>
<tr>
<td>– Departing with incorrect performance calculations, departing without clear understanding of destination plan.</td>
<td></td>
</tr>
<tr>
<td>– Unfamiliarity with tasks (ferry flight, ballast fuel, and non-towered ops rarely done)</td>
<td></td>
</tr>
<tr>
<td>– Higher than normal task loading</td>
<td></td>
</tr>
<tr>
<td>– Night operations</td>
<td></td>
</tr>
<tr>
<td><strong>Defenses – Technical:</strong></td>
<td></td>
</tr>
<tr>
<td>– SOPs – use of FOM guidance – ferry flights, non-tower operations</td>
<td></td>
</tr>
<tr>
<td>– Flows and Checklists – use of QRH for Ballast fuel, use of QRH for ferry</td>
<td></td>
</tr>
<tr>
<td>– Hardware – hard-tune BOS for the SID</td>
<td></td>
</tr>
<tr>
<td><strong>Defenses – TEM:</strong></td>
<td></td>
</tr>
<tr>
<td>– Comm&amp;Brief – think out loud about threats, brief exceptions (esp. SID, and unfamiliar procedures).</td>
<td></td>
</tr>
<tr>
<td>– Teamwork – contact with dispatcher for briefing</td>
<td></td>
</tr>
<tr>
<td>– Time Mgt – Add time as necessary to manage pre-departure task loading</td>
<td></td>
</tr>
</tbody>
</table>

Pilot 1 Flying  
Seat: ○ Left ○ Right
Next Steps for our TEM Program

• Integrating TEM into our QT development
  – Plan to follow the same strategy as we’re using in CQT

• “Identifying threats”… how do you do that?
  – Recognition-Primed Decision-Making, based on Experience-Primed Recognition

• Expansion of TEM outside of Flight Operations
  – Other departments interested…
    • Flight Attendants already using some of the material
    • Strong interest from Maintenance, Dispatch, and even HR!
Concluding Recap
Recap of Key Points

• At JetBlue, TEM is about “things you can do”

• Basic TEM course taught to new-hires during indoc
  – Concepts of TEM
  – TEM Tool-Kit

• Applied TEM taught during CQT (recurrent)
  – Brief review of the Basic TEM material
  – Scenarios (coordinated with LOE) used to practice use of the tool-kit

• TEM is the heart of our AQP
  – TEM model used to construct our Grade Scale
  – TEM skills taught and checked along with technical skills
Threat & Error Management

*Identify Threats, Place Defenses!*
Questions?

Chris.Reed@jetblue.com
Thank you

for your kind attention