



# Threat & Error Mgt Training at JetBlue Airways

Captain Chris Reed  
Manager, AQP



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# 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)



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# TEM versus CRM

- What is TEM? ...
- ... and what is CRM?...
- ... .. and how do they relate??
  
- It seems to depend who you ask...



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# 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



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# 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***



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# “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



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# 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!





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# Foundational Philosophy

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- 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!*



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# Foundational Philosophy Threats & Errors – The TRUTH

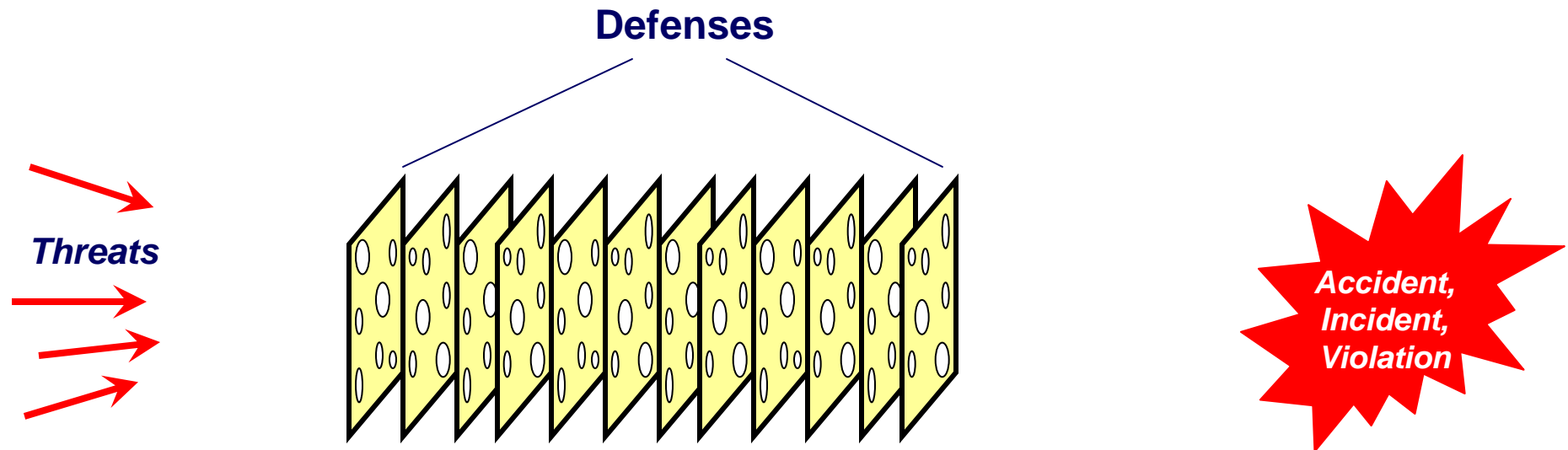
- The world is full of threats.
- Humans make errors.
- This is perfectly normal.



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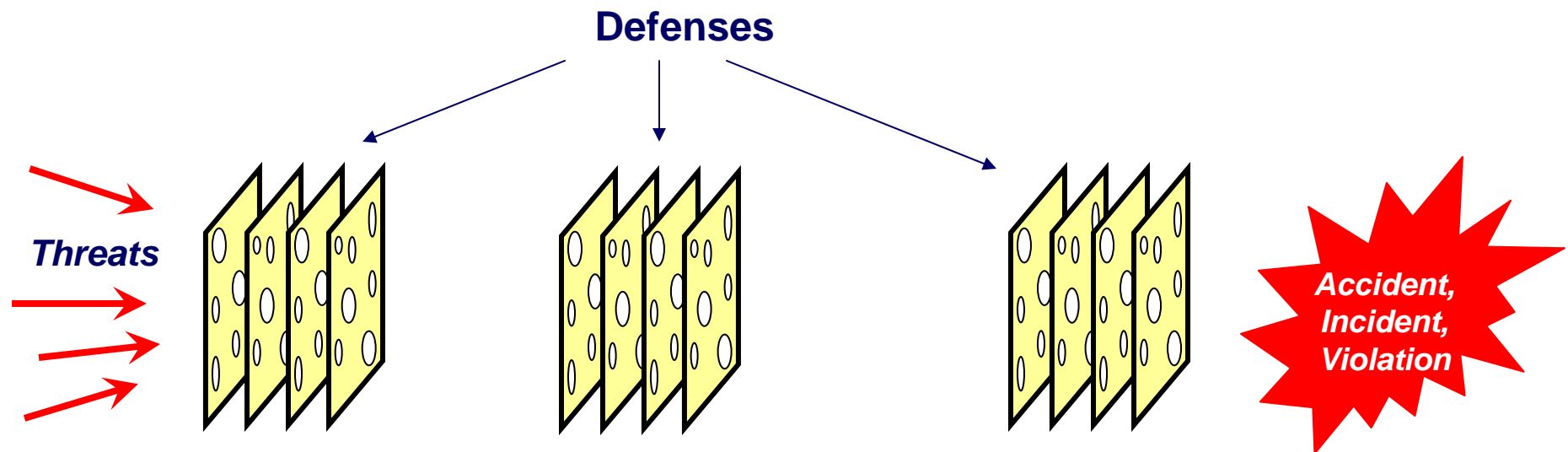
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# Building Our Basic TEM Model

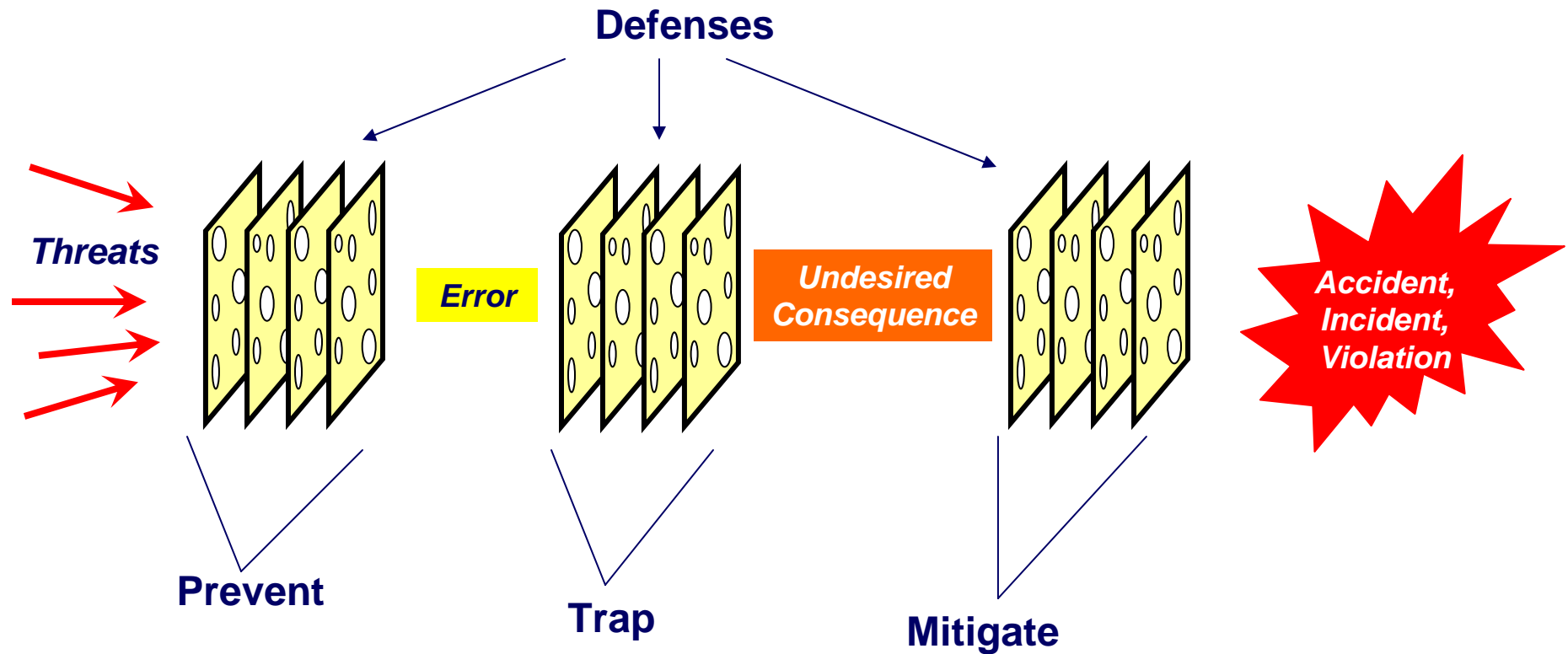


*(We start with James Reason's Swiss Cheese model)*

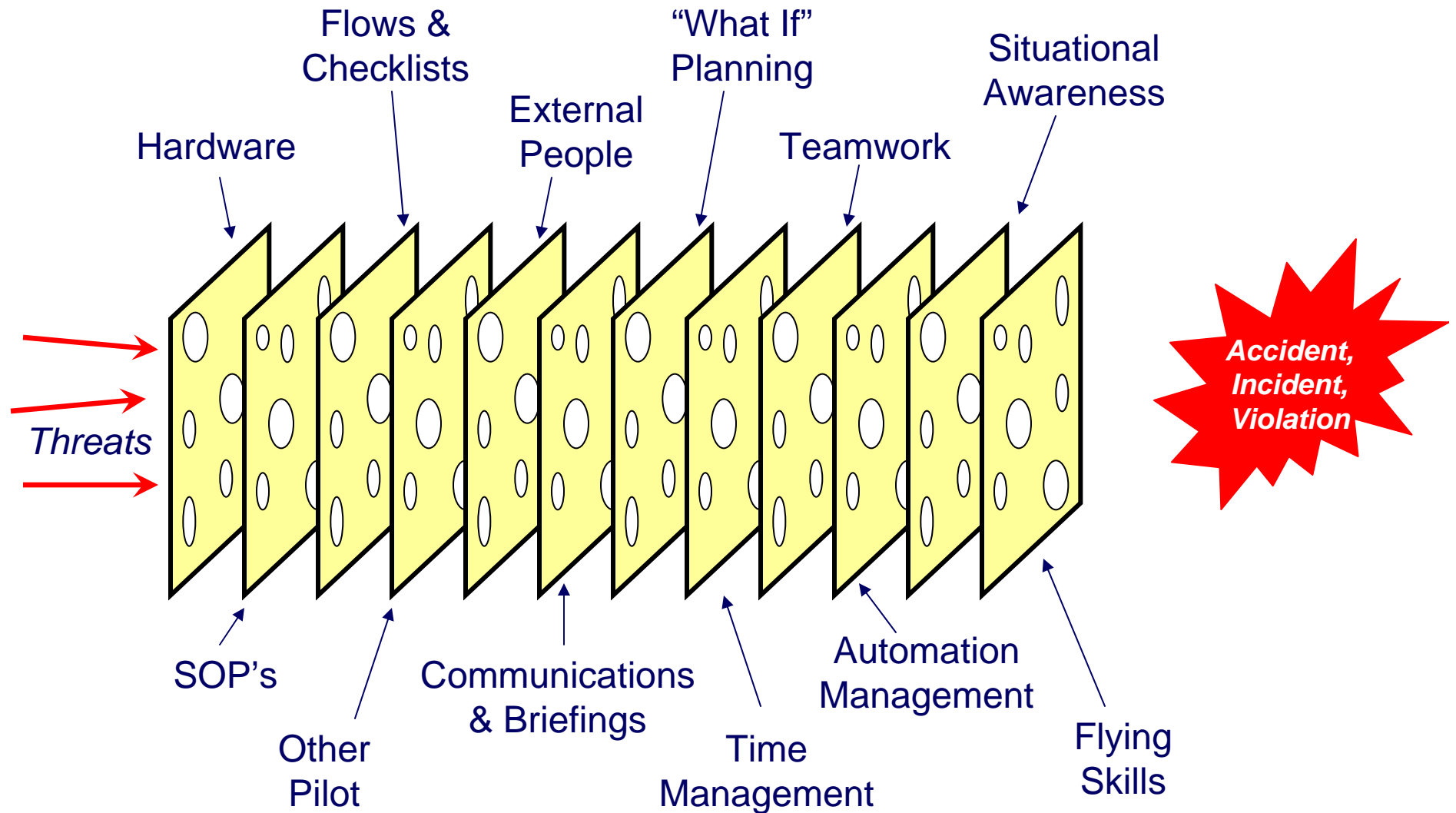
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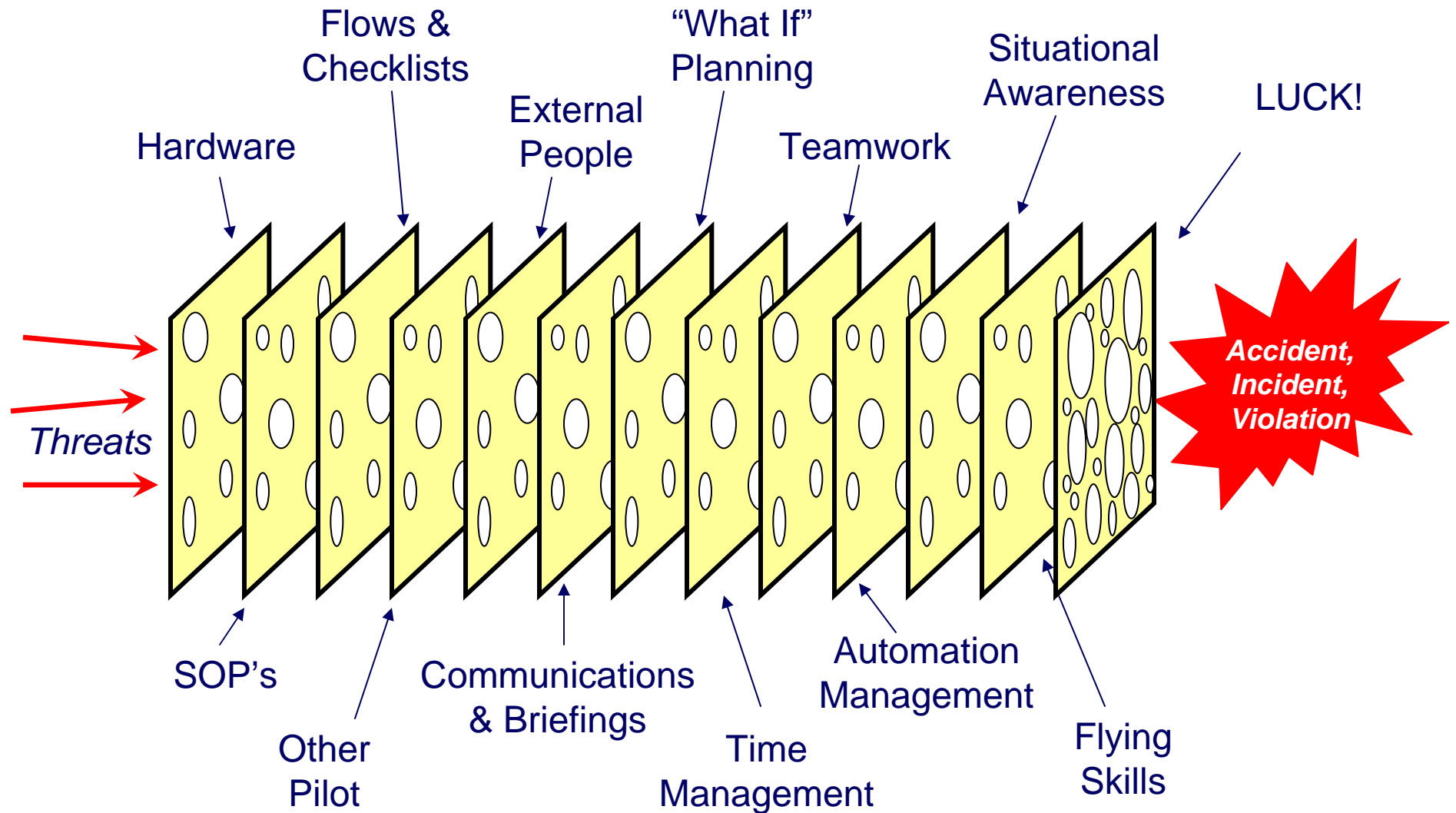
# Basic Threat & Error Management Model



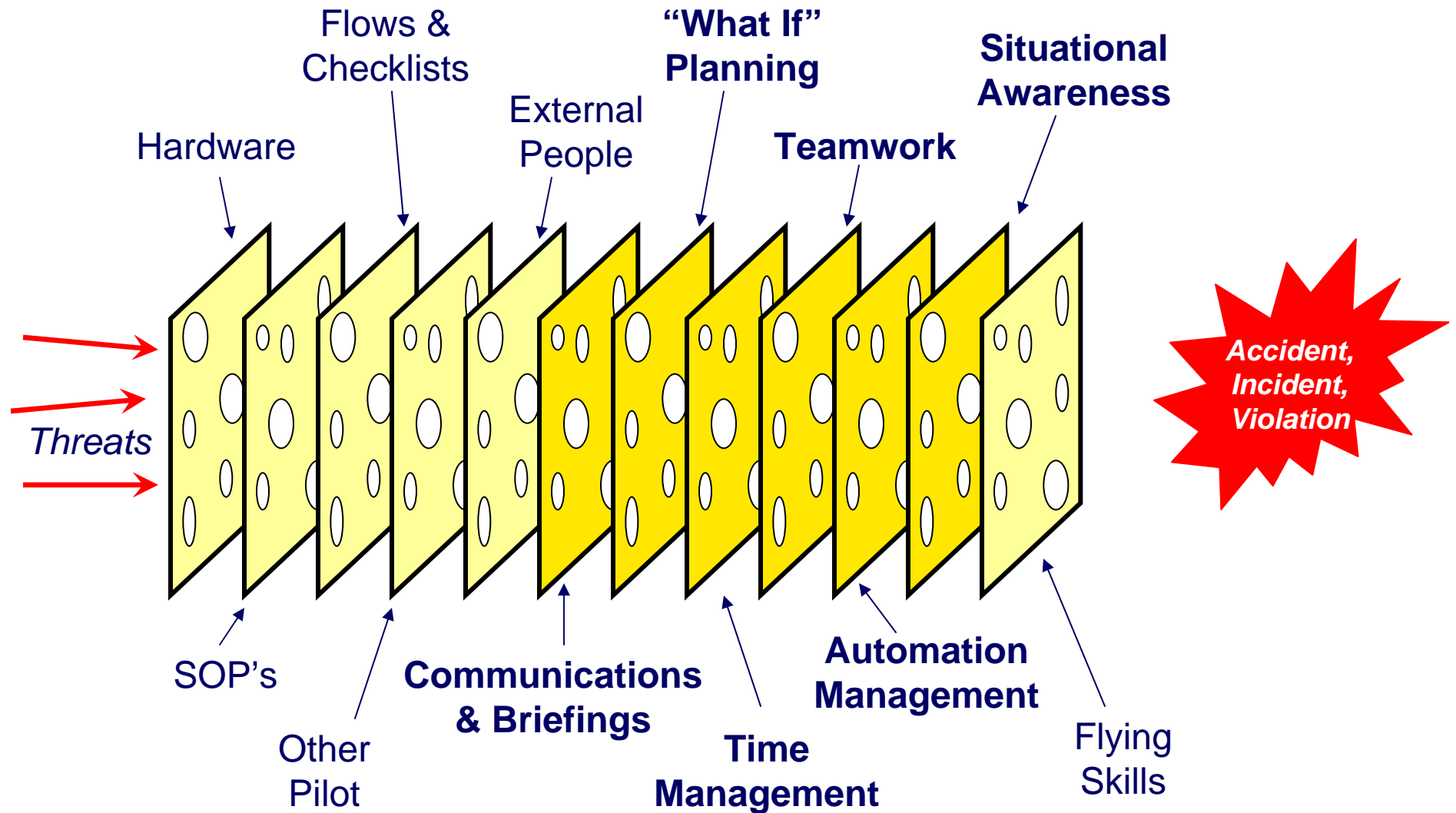
# Defenses



# Defenses

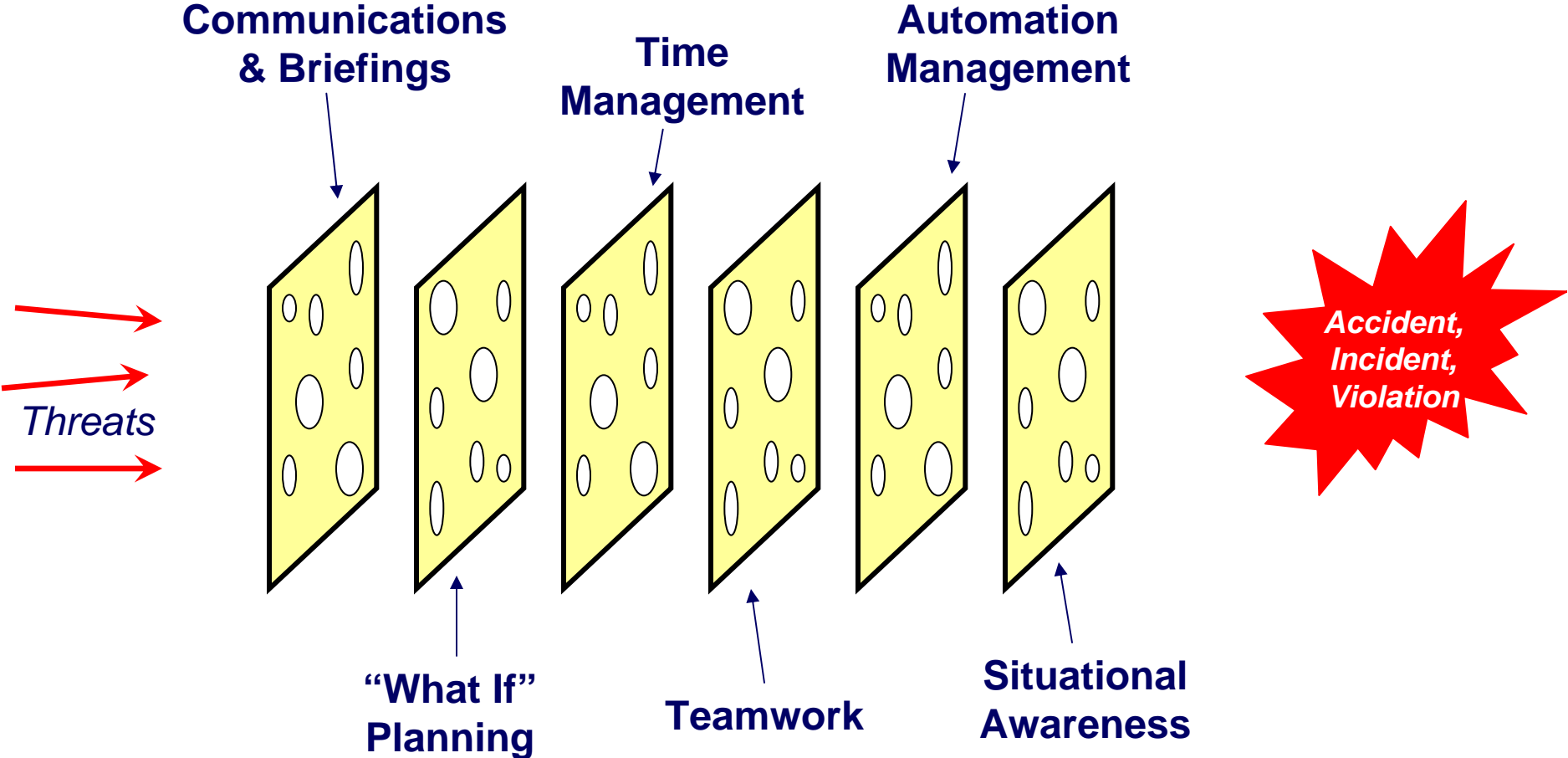


# Defenses

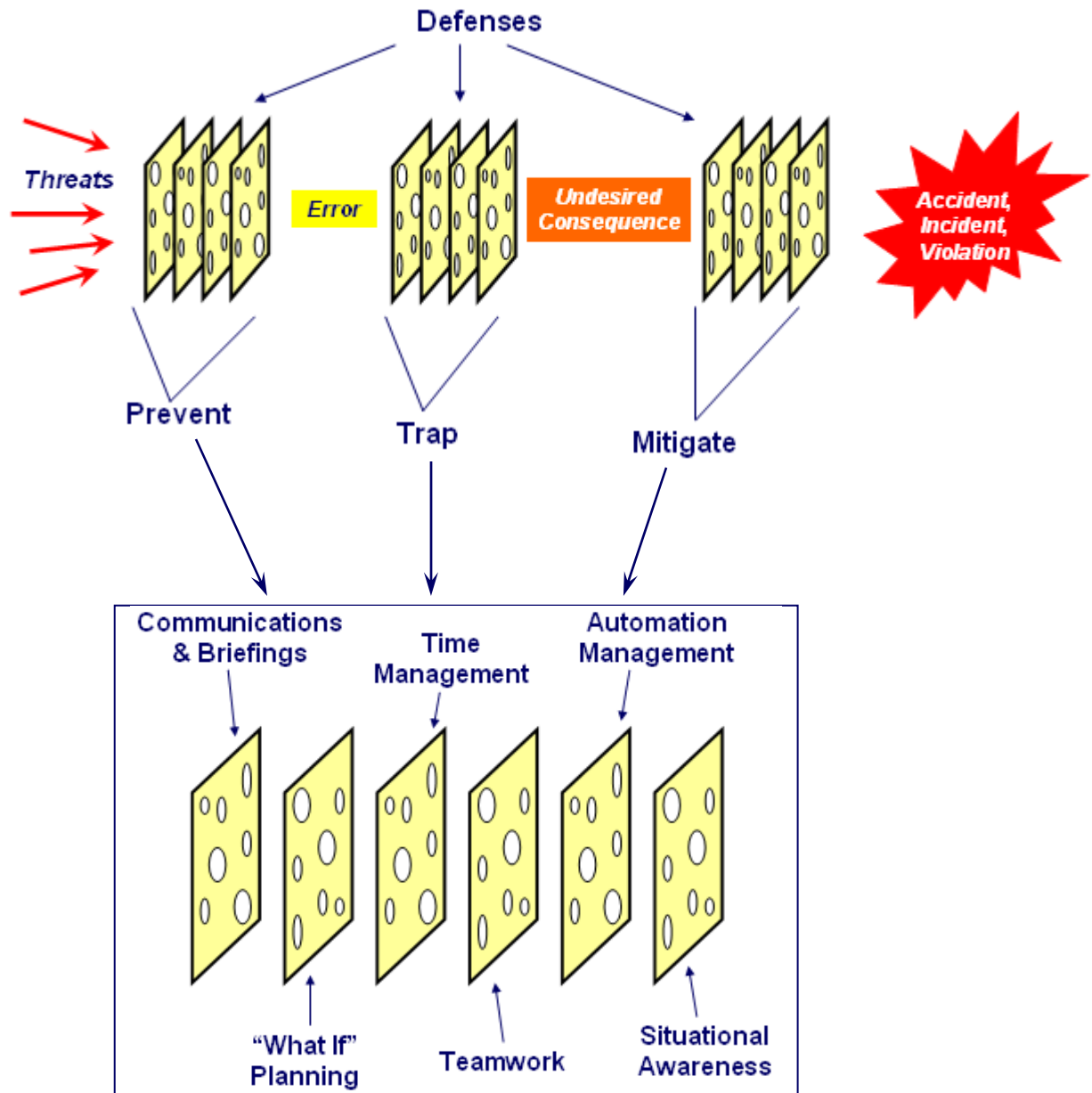




# T&EM “Toolkit” Defenses



**Basic T&EM Model**



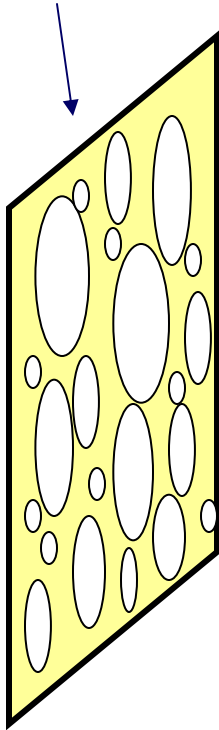
**T&EM  
"Tool-Kit"  
Defenses**



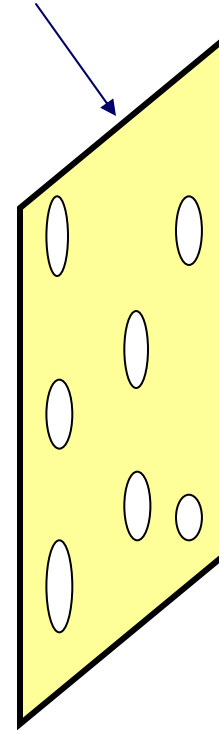
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# For Every Defense, Keeping the holes small is up to US!

Not Proficient  
or Disciplined



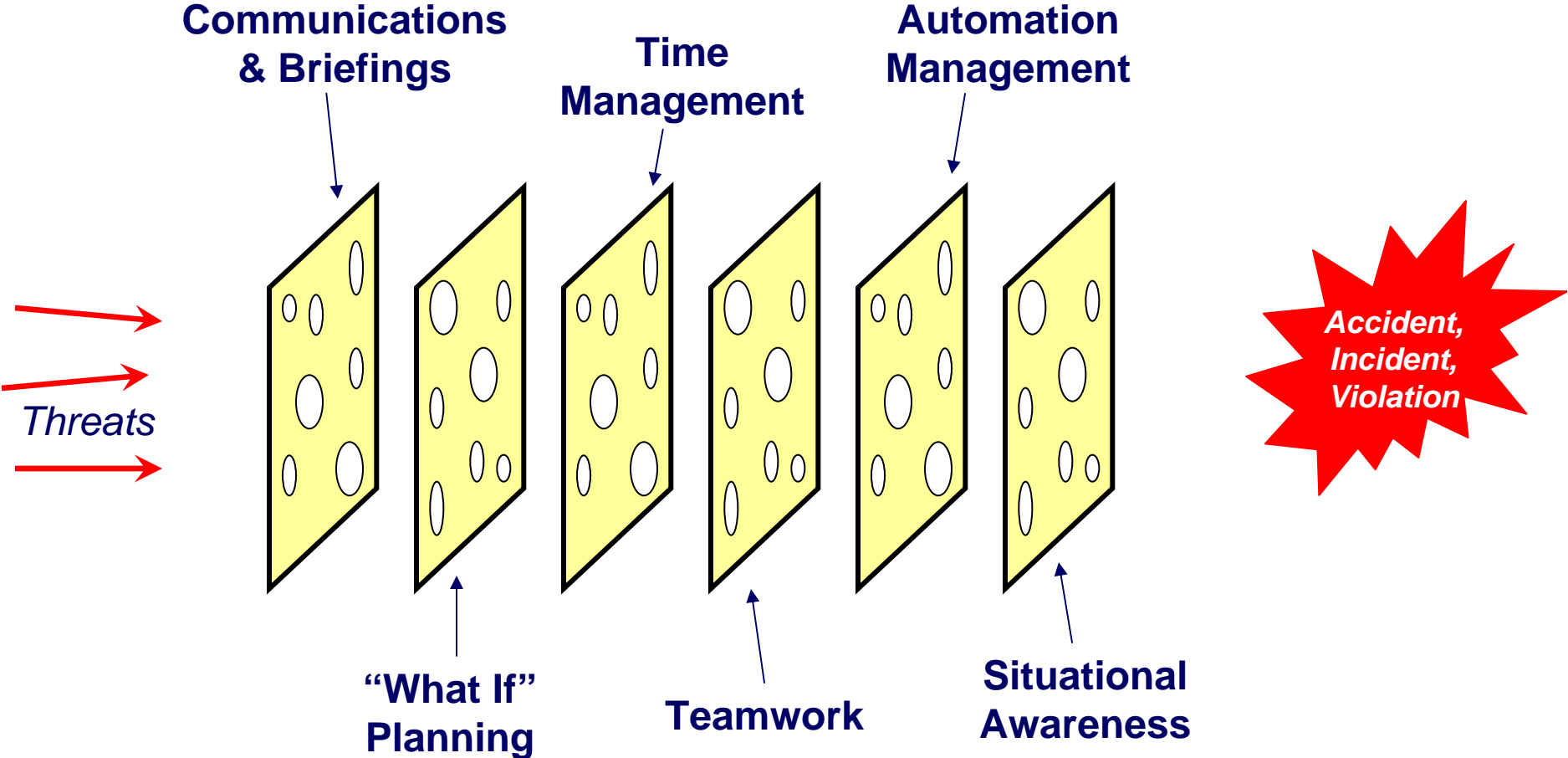
Highly Proficient  
and Disciplined



*Which makes a  
better defense??*



# T&EM “Toolkit” Defenses



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# 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



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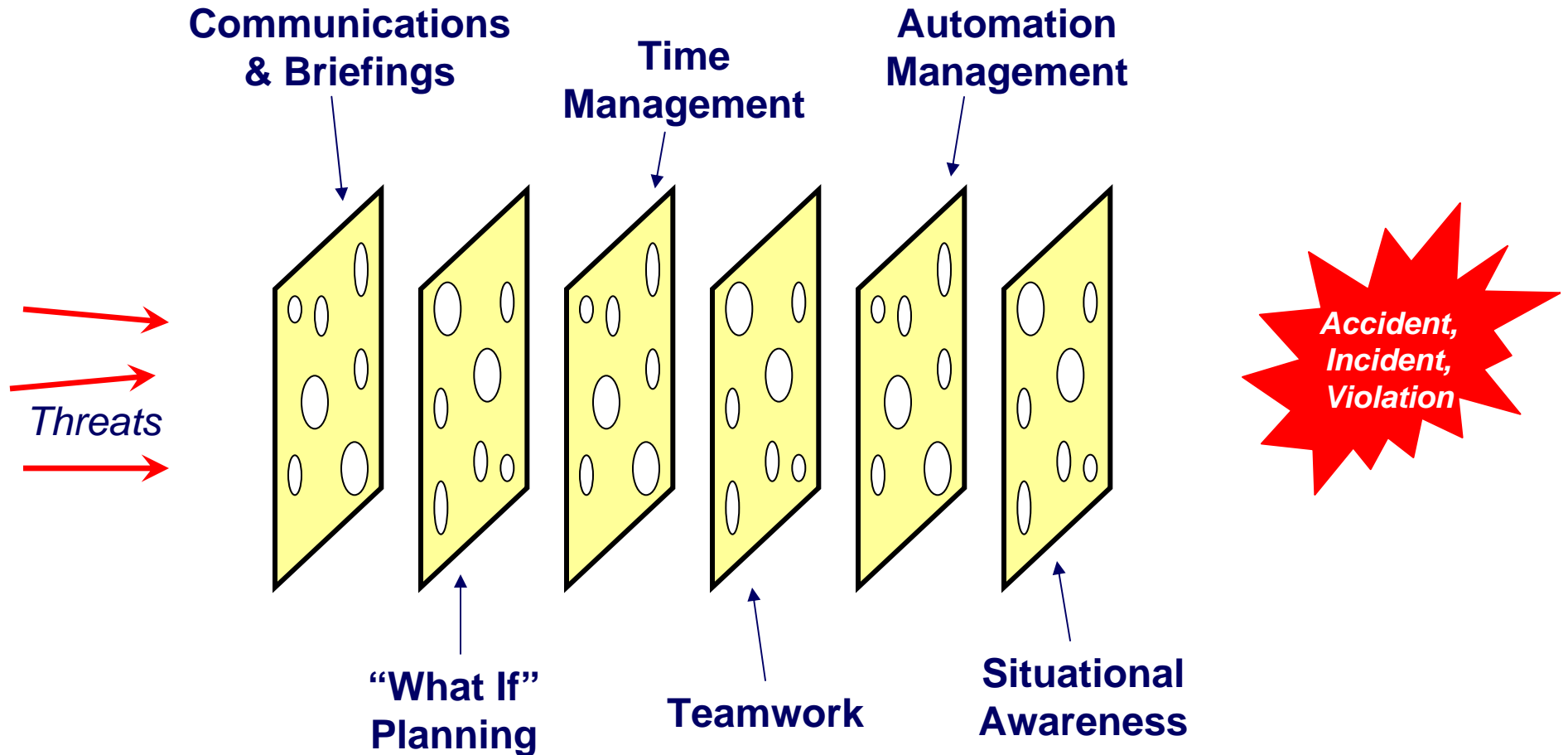
# Briefings

## Summary of Tools

- **Brief the Exceptions**
  - Discuss what's different
- **Brief the Bottom Lines**
  - Set and communicate the limits



# T&EM “Toolkit” Defenses



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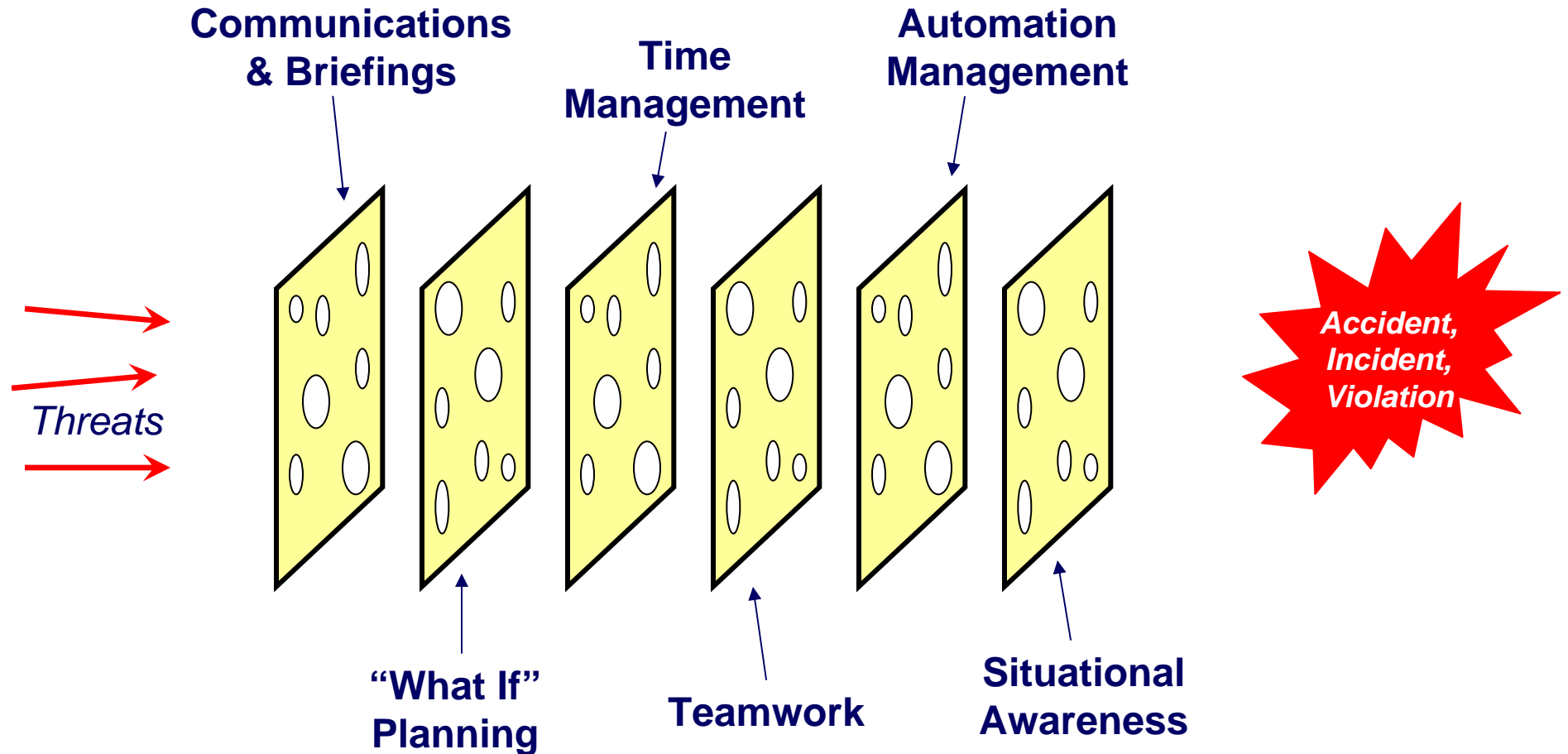
# “What If” Planning Summary of Tools

- **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



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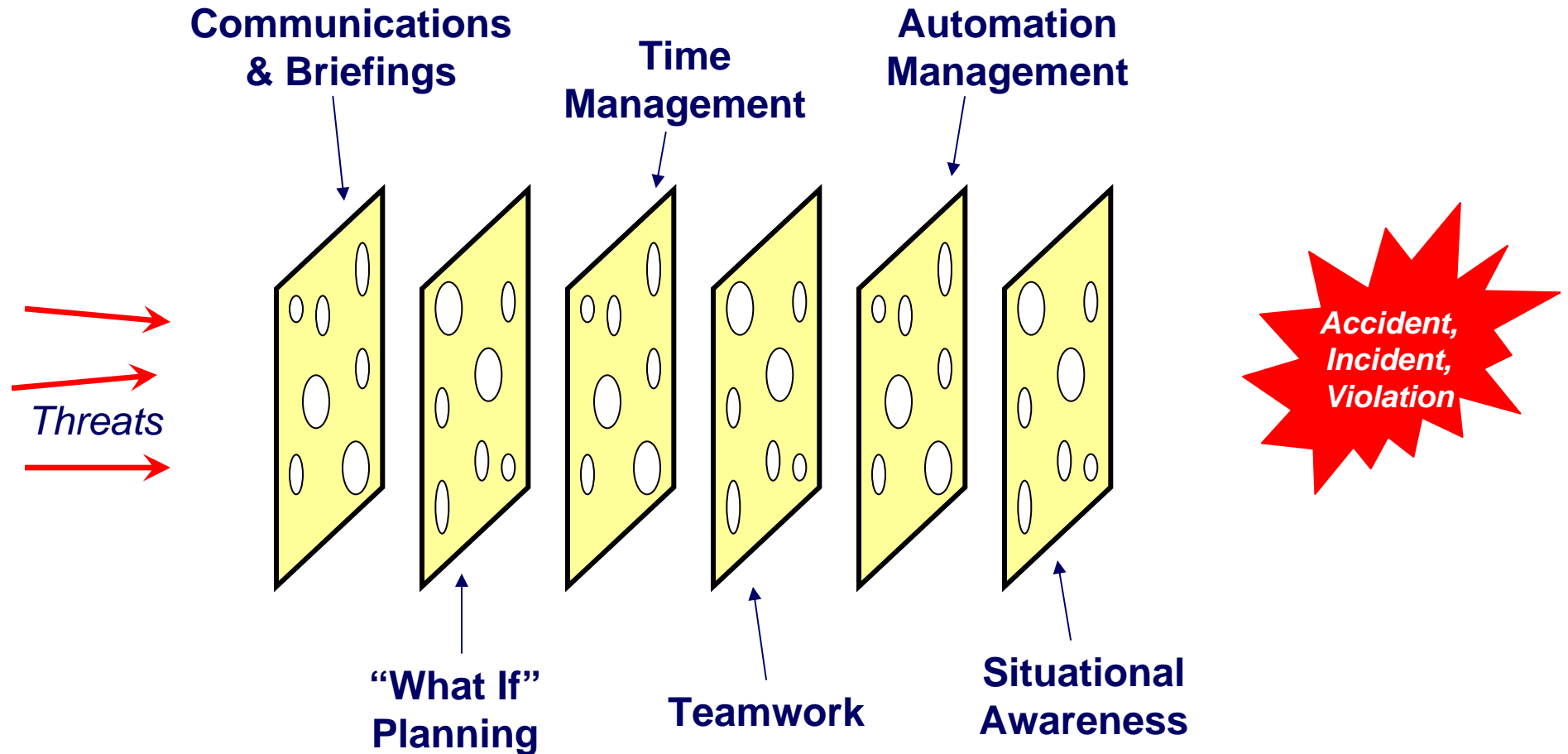
# Time Management

## 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



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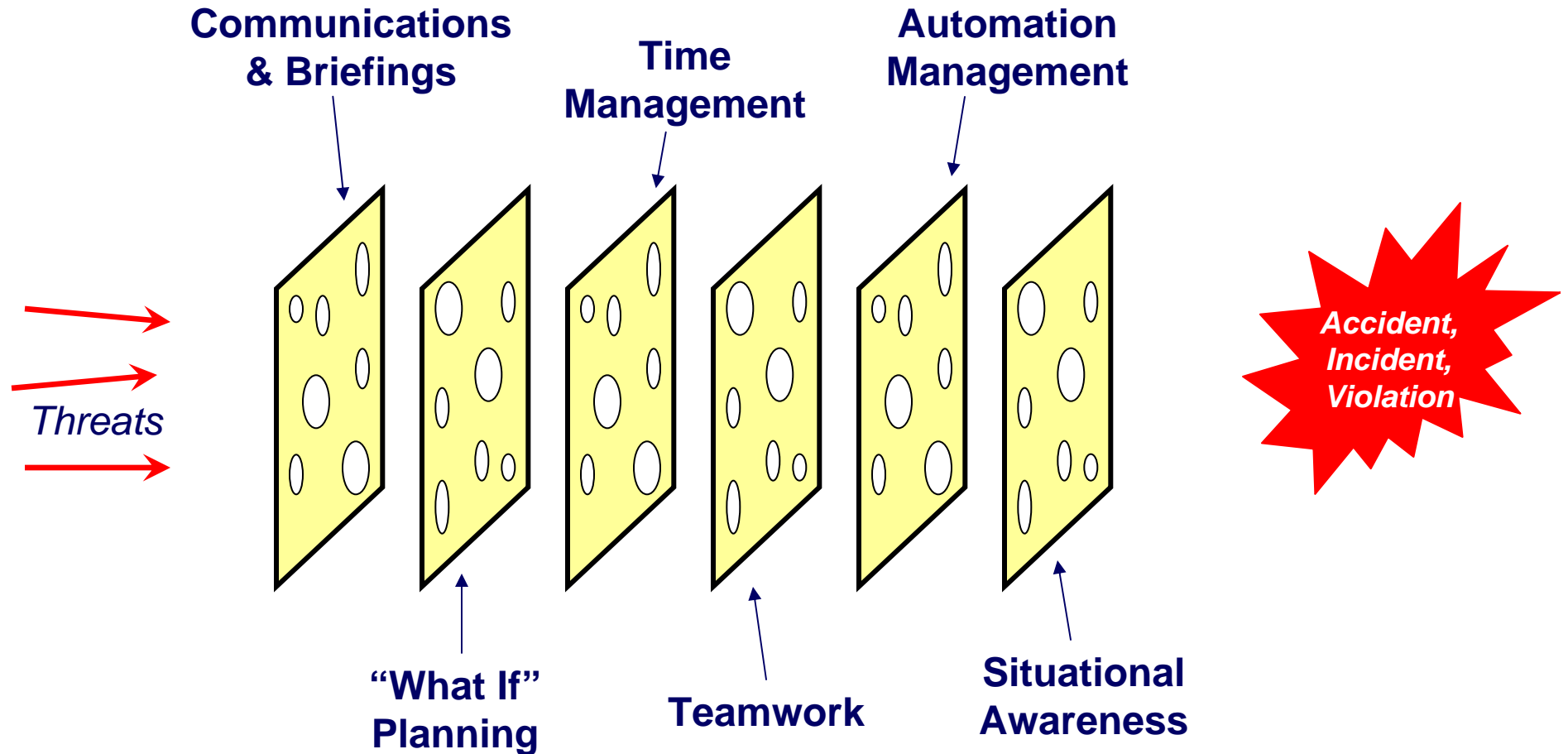
# Teamwork

## 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



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# Levels of Automation - Terminology

Level	General Definition
4	A/P, Controlled by FMS [Managed]
3	A/P, Controlled by GP (E190) or FCU (A320) [Selected]
2	F/D Only
1	No Automation at all. (A/P & F/D Off)



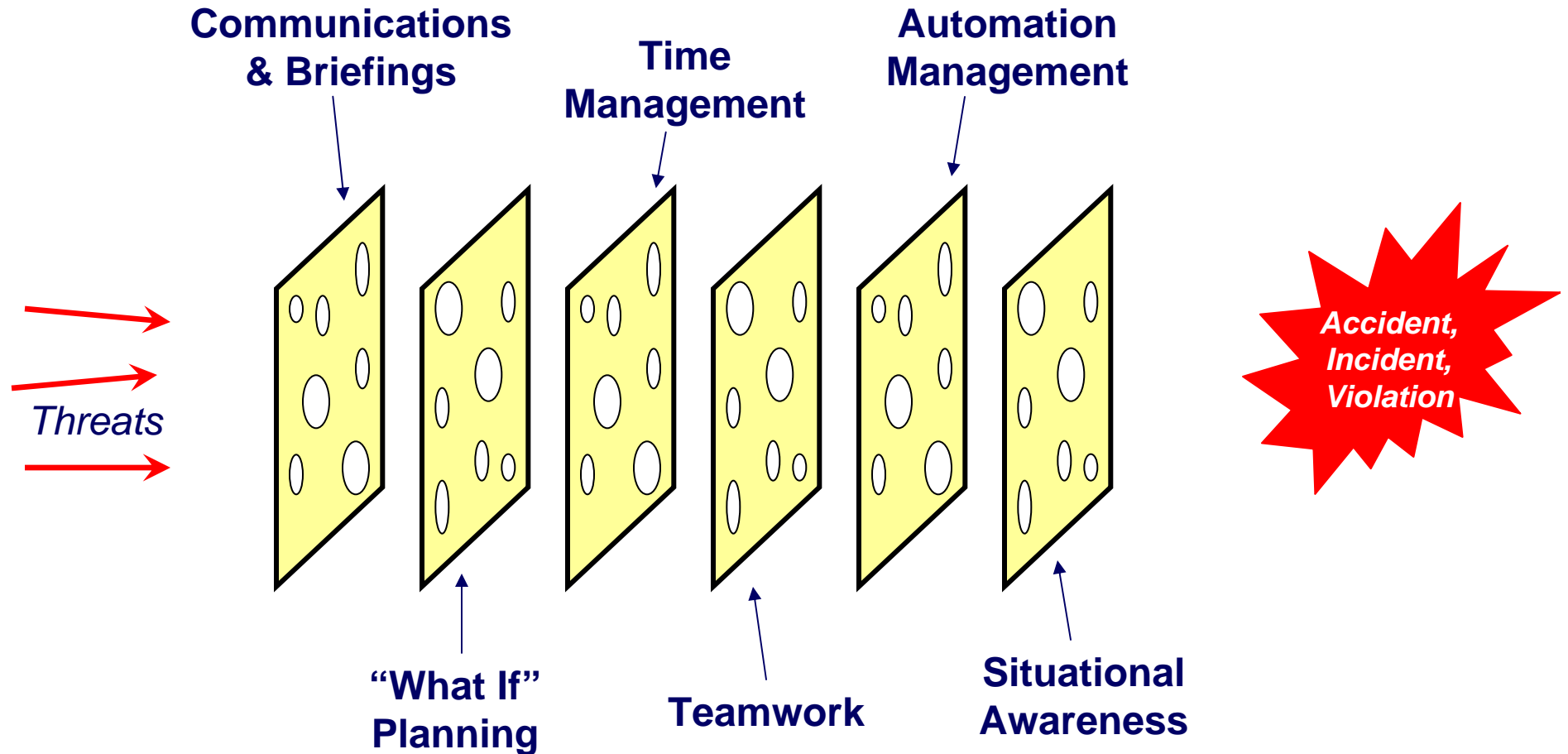
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# Automation Management Summary of Tools

- **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






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# 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



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# 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



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# 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**

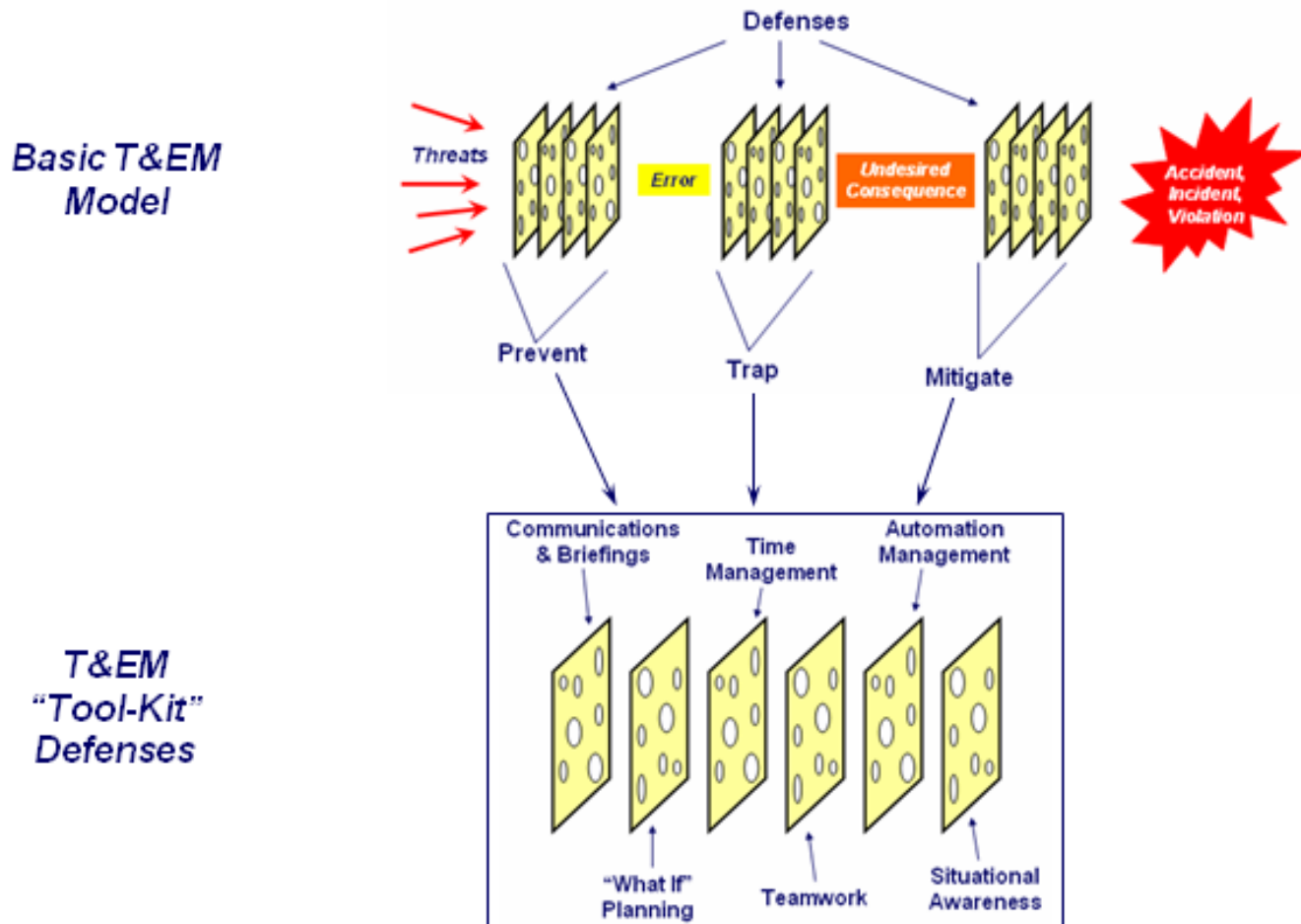


- Not Communicating
- Not Addressing Discrepancies
- Ambiguity
- No One Flying the Aircraft (or not looking outside)
- Failure to Meet Targets
- Deviating From Standards, Violating Minimums
- Preoccupation or Fixation
- Confusion



# Threat & Error Management

*Identify Threats, Place Defenses!*





# ***Recurrent TEM Training***



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# “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...



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# Applied TEM Example

## Scenario 07-11 – Pre-Departure

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

<u>Threats</u>	<u>Defenses</u>
<ul style="list-style-type: none"><li>➤ Unfamiliarity with Ferry Flight tasks</li><li>➤ Departing with incorrect performance calculations</li><li>➤ Task loading</li></ul>	<ul style="list-style-type: none"><li>■ Comm&amp;Brief: Verbalize the threat(s), brief the exceptions</li><li>■ Time Mgt: Slow down as needed to manage task loading</li><li>■ Teamwork: Offload tasks – might want to get dispatcher on the phone?</li></ul>





# ***TEM is the heart AQP at JetBlue***





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# 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*



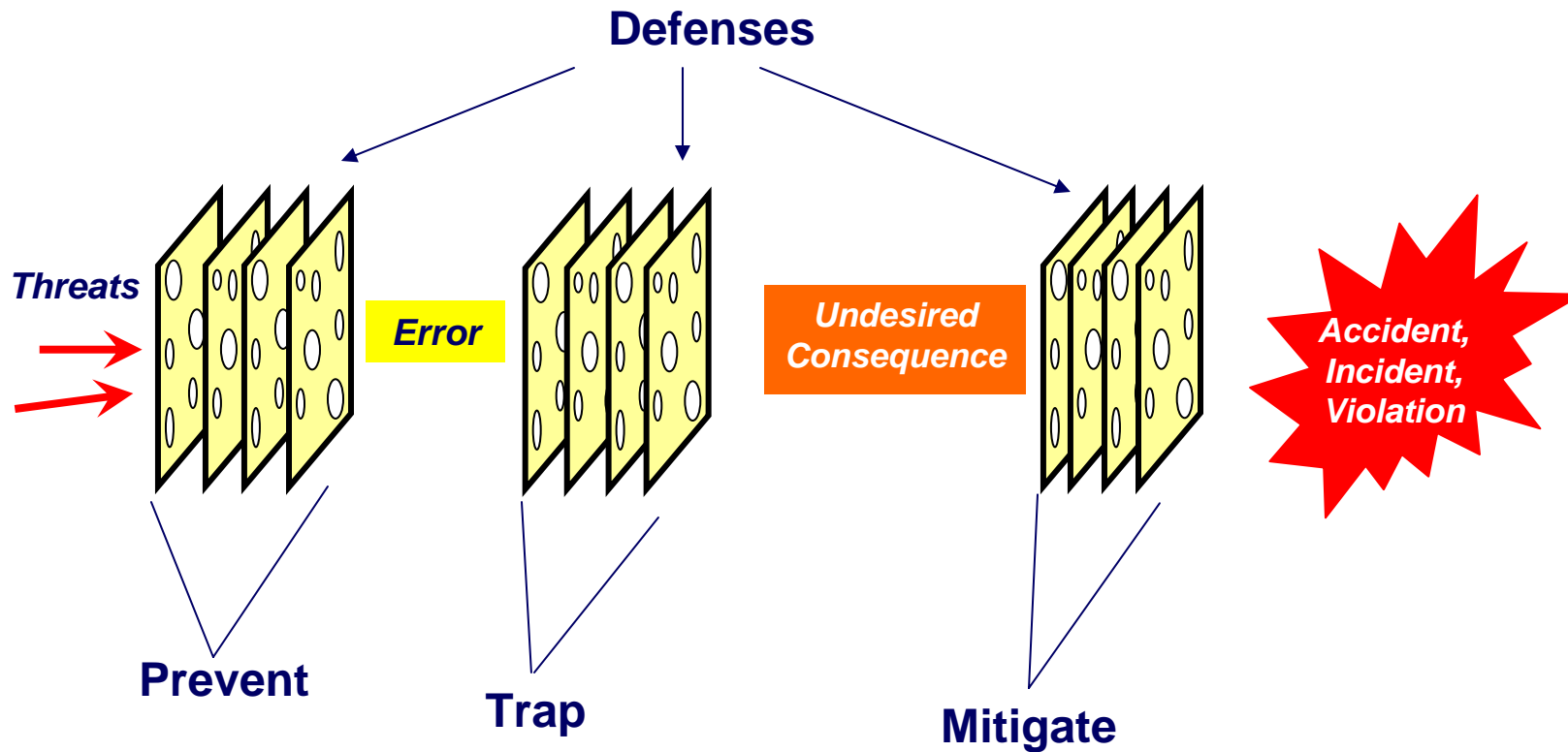
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# AQP requires grades to reflect CRM ...how should we deal with this?

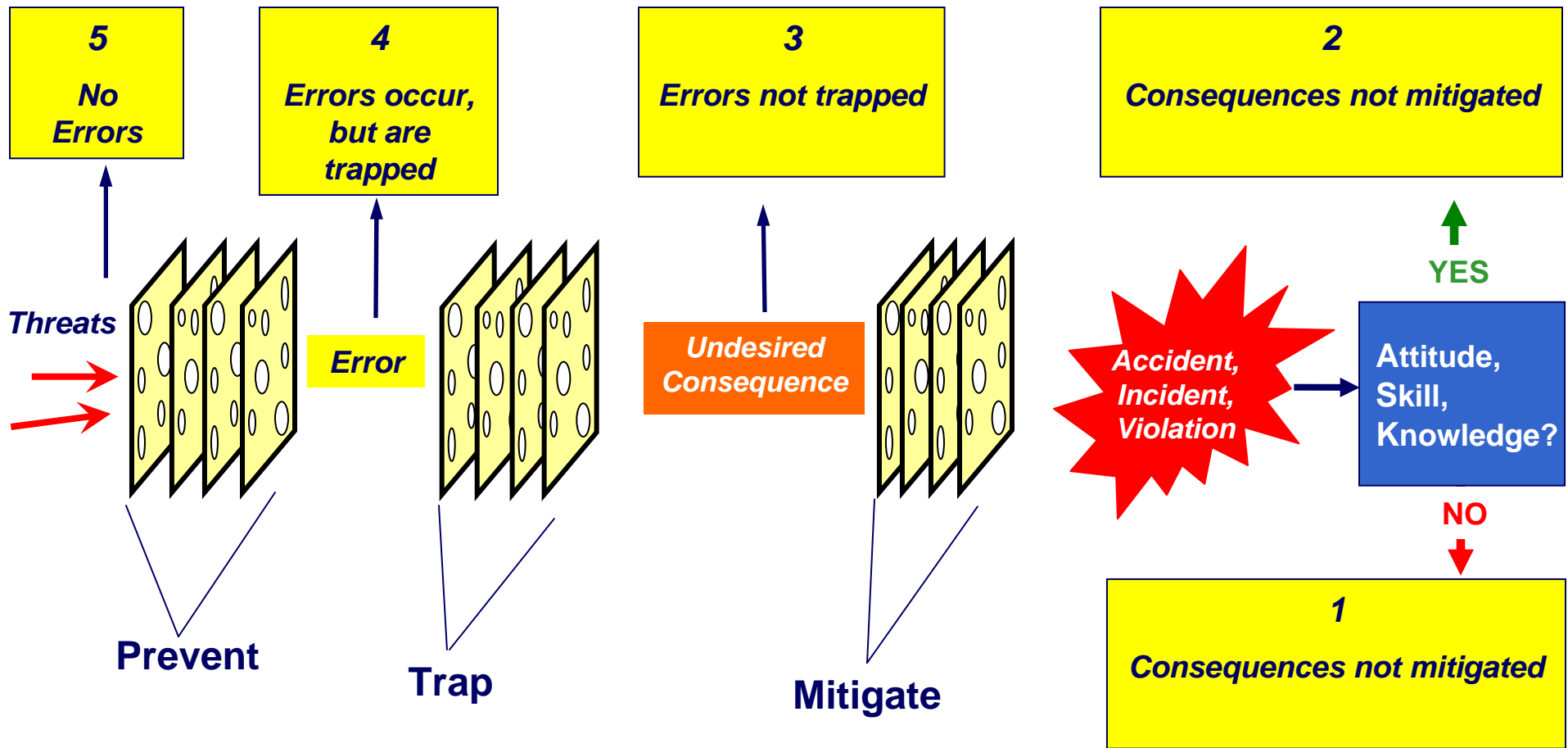
- Some airlines grade CRM skills separately from technical skills
- Some airlines integrate CRM and technical skills into the grading scale
  - Allows for a single grade
  - Eliminates potential dilemmas when technical skills are great but CRM skills are deficient (or vice versa)
- JetBlue chose the integrated method. To do this, we used our Threat and Error Management model



# Applying T&EM to Grading



# Applying T&EM to Grading



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# 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...



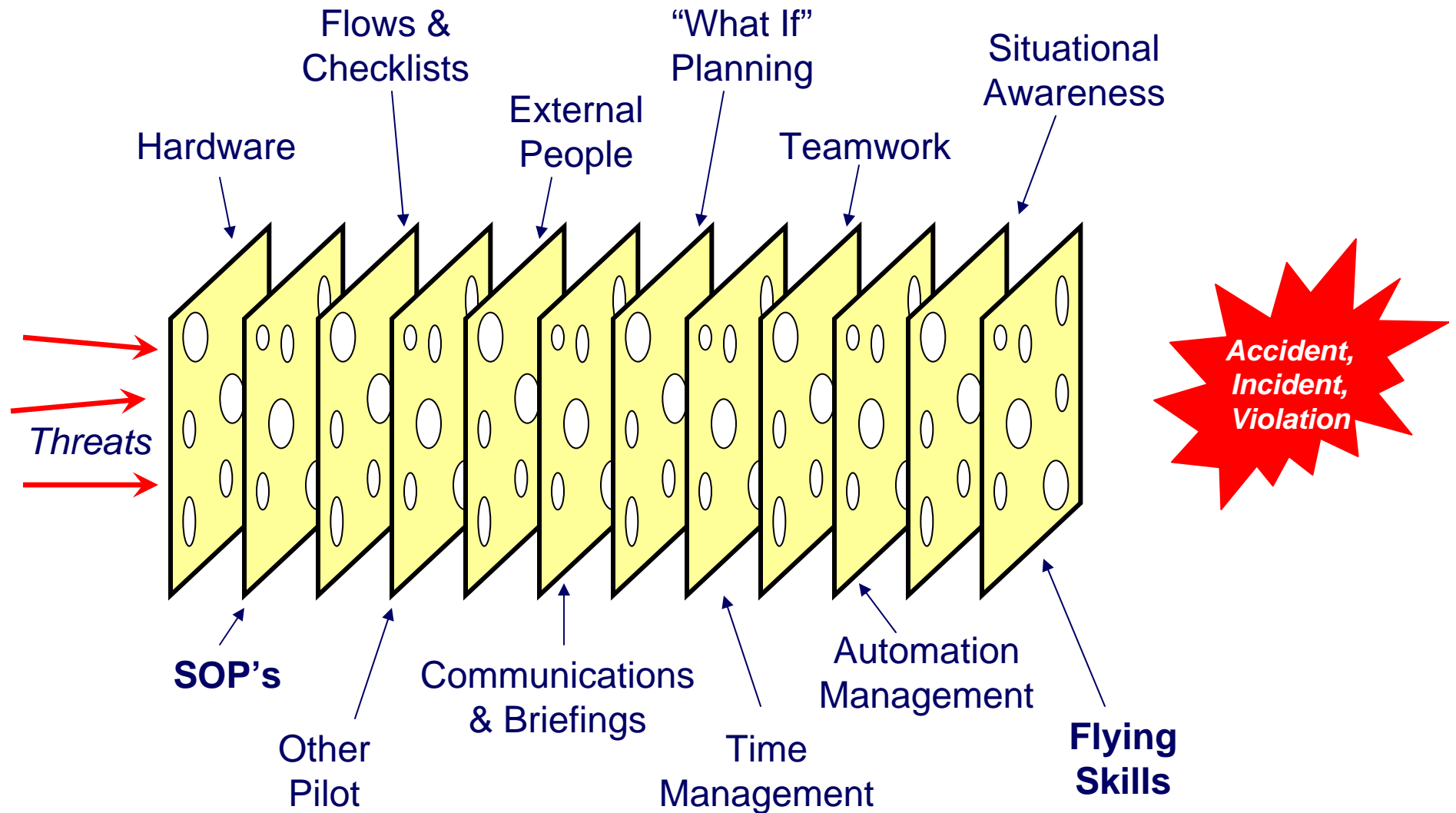
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## **“Standard” maintains objectivity**

- 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

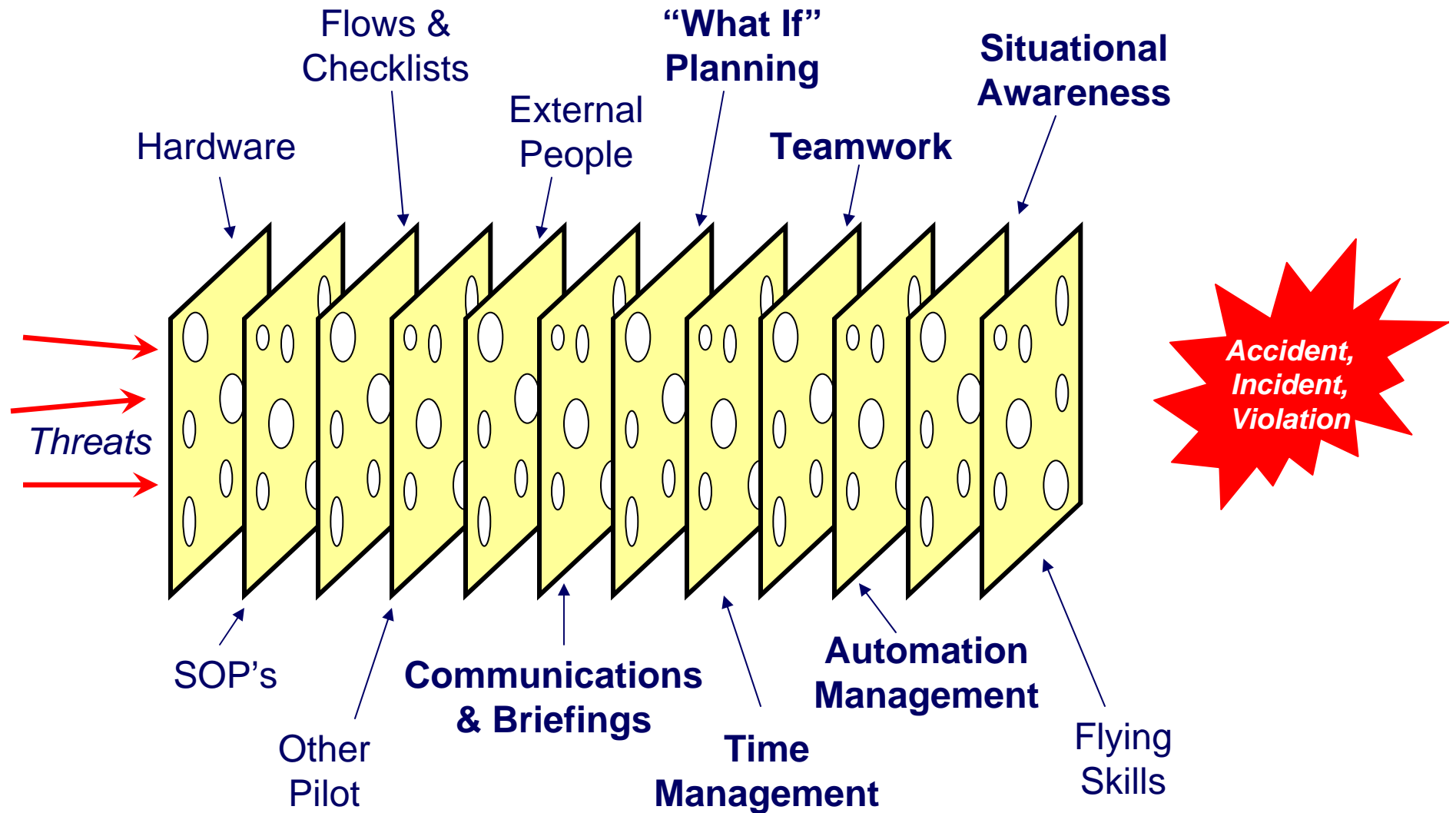


# Our TEM model includes SOP's & Flying Skills defenses... ...this covers the technical standards

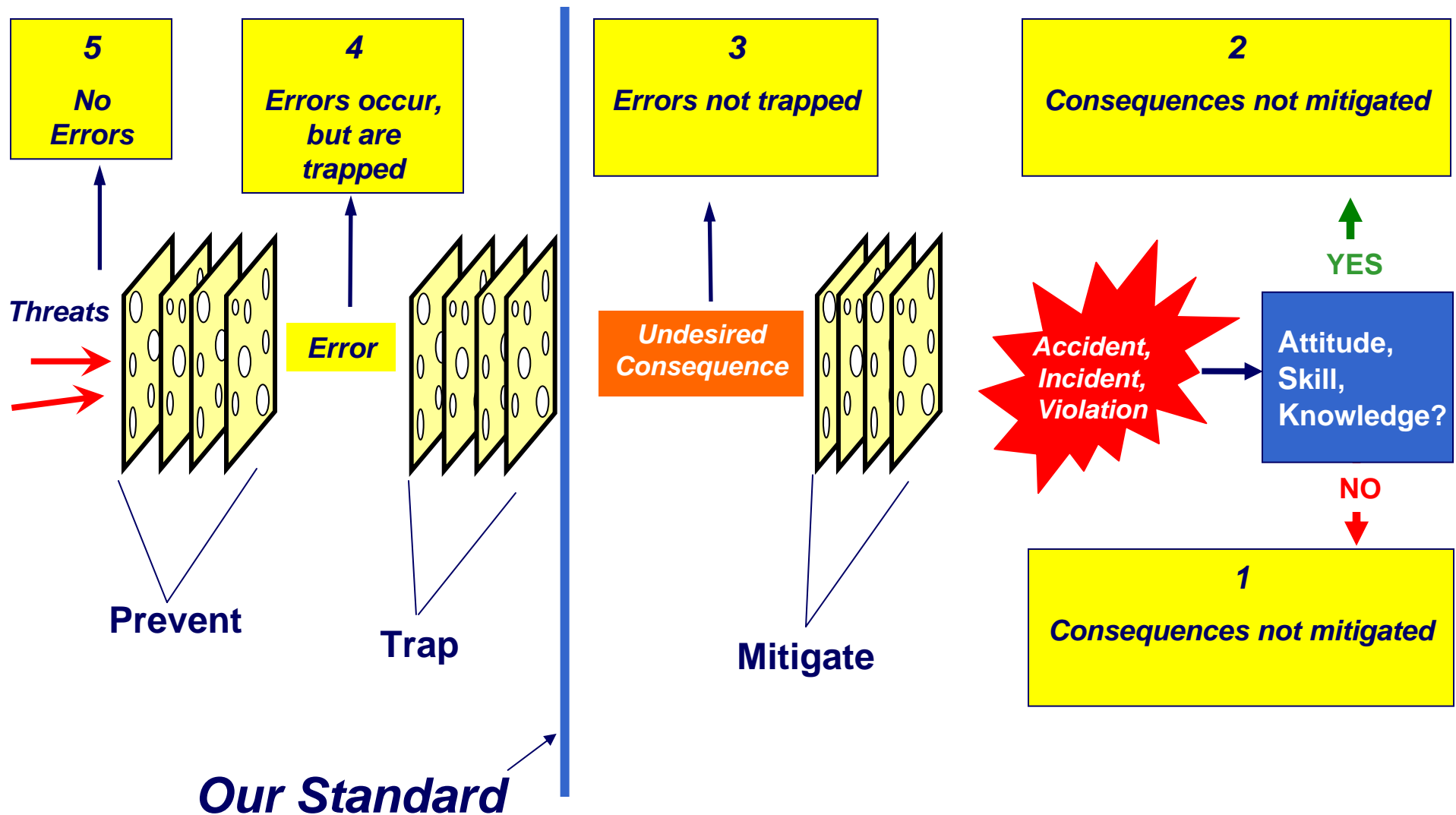




# Our TEM model includes our “Tool-Kit” defenses... ...this covers the “CRM” standards



# Applying T&EM to Grading



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# Scenario 07-12 – Approach & Landing

- Approaching KBTW late at night, tower is closed, weather is VMC.

<u>Threats</u>	<u>Defenses</u>
<ul style="list-style-type: none"><li>➤ Terrain</li><li>➤ Lack of ATC vectoring capability</li><li>➤ Responsibility for choosing own approach</li><li>➤ Planning workload</li></ul>	<ul style="list-style-type: none"><li>■ Time Mgt: Budget time in cruise to fully review the issues</li><li>■ Think Out Loud</li><li>■ Teamwork: Watch for unbalanced task loading.</li><li>■ What If Planning: Be skeptical and conservative in choosing approach</li></ul>



# 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

### Threats:

- Terrain (CFIT)
- Night
- Non-tower environment – workload
- Pilot-controlled lighting – distractions
- “Black Hole” approach
- SA Loss (esp. position & terrain awareness)

### Defenses - Technical:

- SOP – non-tower operations, approach procedures
- Flying Skills – standards met; use of glide path information (PAPI and electronic if available)
- Hardware – EGPWS displayed, FMS properly set up and used.

### Defenses – TEM:

- 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)
- Time Management: Add time – slow down; go-around if in doubt
- What If Planning: Make conservative choices – “Do we need to be doing this?”
- SA: Use 3R’s -- Recognize (Look for flags), if any are noted immediately React

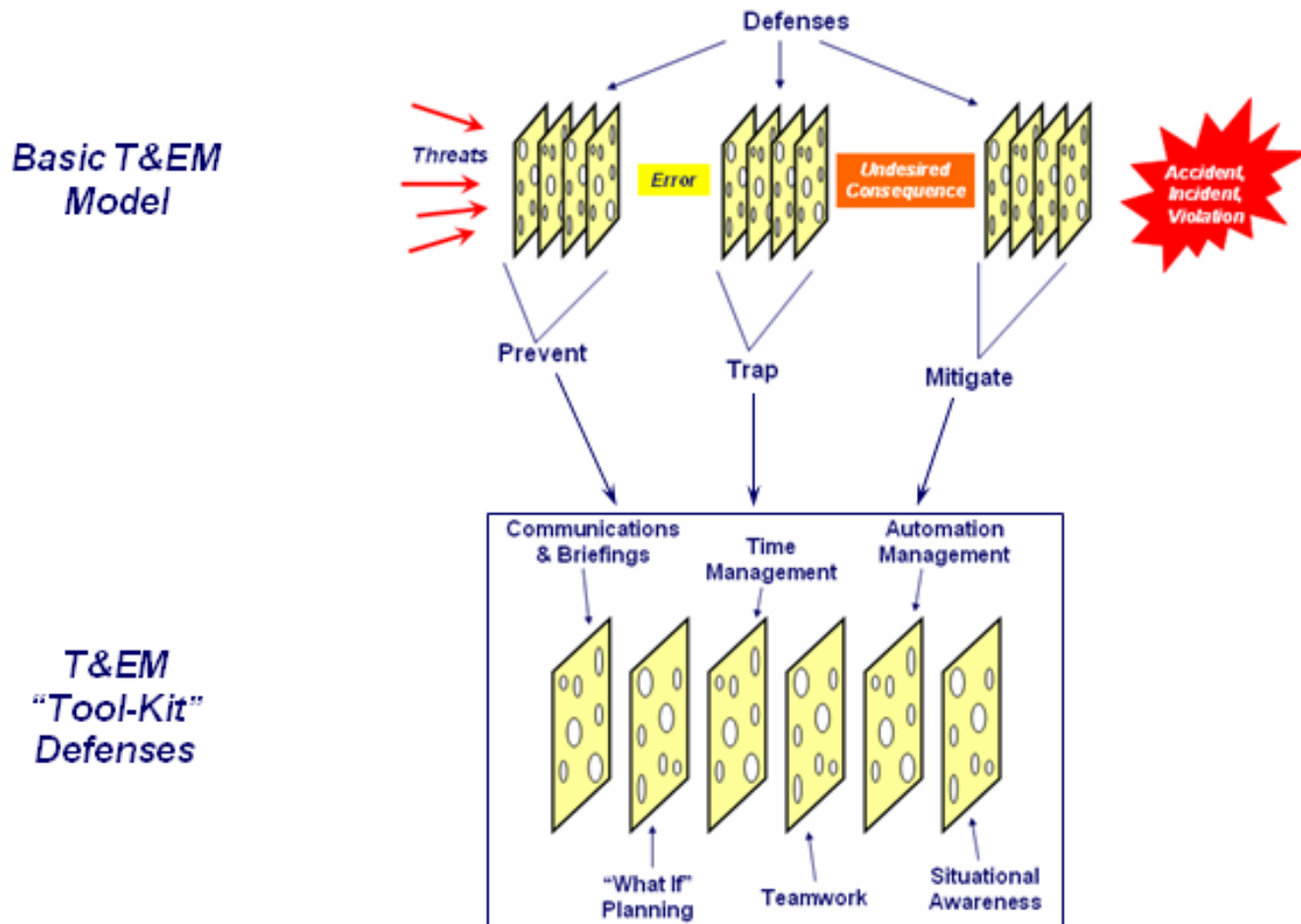
**Pilot 1 Flying**

Seat:  Left  Right



# Threat & Error Management

*Identify Threats, Place 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	
<b>Event Set Summary:</b> Crew preps for a middle-of-the-night ferry flight. Ballast fuel required.	
<b>Threats:</b> <ul style="list-style-type: none"> <li>- Departing with incorrect performance calculations, departing without clear understanding of destination plan.</li> <li>- Unfamiliarity with tasks (ferry flight, ballast fuel, and non-towered ops rarely done)</li> <li>- Higher than normal task loading</li> <li>- Night operations</li> </ul>	<b>Defenses – Technical:</b> <ul style="list-style-type: none"> <li>- SOPs – use of FOM guidance – ferry flights, non-tower operations</li> <li>- Flows and Checklists – use of QRH for Ballast fuel, use of QRH for ferry</li> <li>- Hardware – hard-tune BOS for the SID</li> </ul> <b>Defenses – TEM:</b> <ul style="list-style-type: none"> <li>- Comm&amp;Brief – think out loud about threats, brief exceptions (esp. SID, and unfamiliar procedures).</li> <li>- Teamwork – contact with dispatcher for briefing</li> <li>- Time Mgt – Add time as necessary to manage pre-departure task loading</li> </ul>
<b>Pilot 1 Flying</b>	
<b>Seat:</b> <input type="radio"/> Left <input type="radio"/> Right	

Graded Item	Crew Grade 1-5	Reason Code Circle A, S and/or K	Database Comments
Pre-Departure Planning 1		A S K	
Receiving Checklist 2		A S K	
Cockpit Preparation 3		A S K	
Before Start (To the line) 4		A S K	
Before Start (Below the line) 5		A S K	



# Crew Grade, Reason Code, & Comments

Graded Item	Crew Grade 1-5	Reason Code Circle A, S and/or K	Database Comments
Pre-Departure Planning 1		A S K	
Receiving Checklist 2		A S K	
Cockpit Preparation 3		A S K	
Before Start (To the line) 4		A S K	
Before Start (Below the line) 5		A S K	





# Excerpt from LOE Grade Sheet

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# Event-Set Header Section

## Specific Threats & Defenses Identified

### 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

**Pilot 1 Flying**

Seat:  Left  Right



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# 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*



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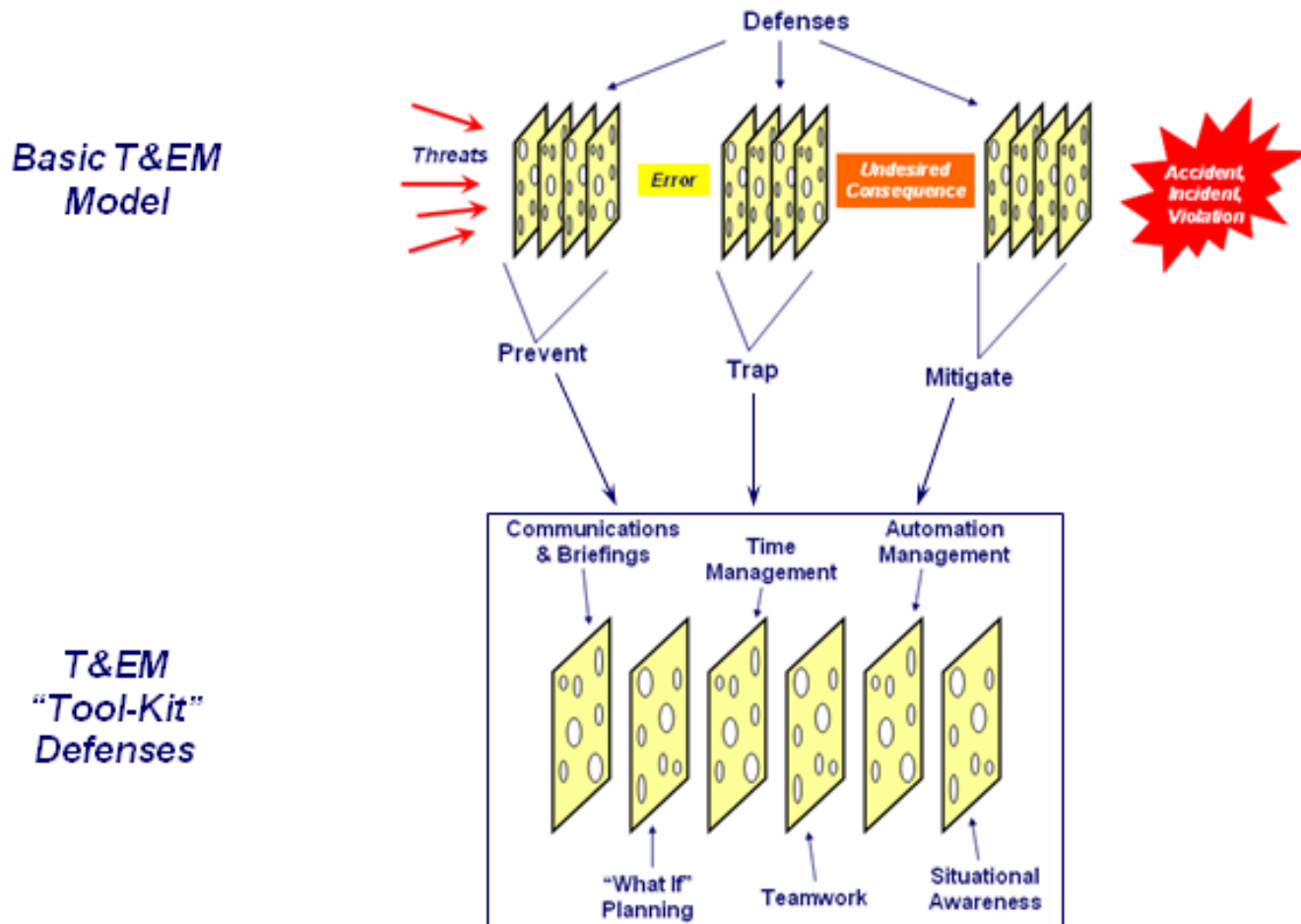
# Recap of Key Points

- 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***

