Flight Operations Safety Awareness Seminar (FOSAS)

Human Factors (HF) and
Crew Resource Management (CRM)

Airbus Flight Operations Support and Training Standards
Nairobi, 19-21 Sep. 2017

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HF and CRM

The Importance of Human Factors

Human Factors

Threat & Error Management and CRM

CRM Best Practices

PM role

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Importance of Human Factors

+ *One event*

Tenerife 1977	Two B747 collided on the runway, due to Take Off without clearance, and poor visibility. › **Communication, teamwork, leadership, decision making**

+ *This accident had a huge influence on the industry, particularly in the area of **communication**.*
+ *Emphasis was placed on using **standardized phraseology** in ATC communication by both controllers and pilots.*
+ *The word "takeoff" was removed from general usage, and is only spoken by ATC when actually clearing an aircraft to take off.*
+ ***Less experienced flight crew members were encouraged to challenge** their captains when they believed something was not correct,*
+ ***Captains were instructed to listen** to their crew and evaluate all decisions in light of crew concerns.*
+ *Finally, was implemented what is known today as **Crew Resource Management (CRM).***

Importance of Human Factors

But every day there are good ones!

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Importance of Human Factors

Jakarta June 1982
B747-200

› **Successive Threats:**

Volcanic ash – loss of 4 engines – Loss of pressurization – ATC misunderstanding – F/O oxygen mask broken – Mountainous area – Windscreen pollution – Glide slope inoperative

› **Successive positive actions**

Flying: Gliding

Navigating: Keeping the high terrain in mind

Communicating (Distress message + A7700)

Managing remaining systems: Applying restart drills, using oxygen masks, etc…

Situation awareness (terrain, loss of pressurization, oxygen mask failure…)

Teamwork (3 crew members)

Captain leadership

Decision making (high V/S due to F/O oxygen mask failure, type of approach…)

See also Video "Falling from the Sky" from the TV series Mayday (Air Emergency, Air Crash Investigation) [documentary TV series].

Importance of Human Factors

+ *Near Jakarta 1982…*

- Cruising FL 370, **4 engines failed** due to **volcanic ash**.
- The flight crew quickly determined that the aircraft was capable of gliding for 23 minutes and covering 91 nautical miles (169 km) from its flight level of 37,000 feet.
- Emergency was declared. The crew squawked A7700. However, **Jakarta Area Control misunderstood** the message, interpreting the call as meaning that only engine number four had shut down.
- A Garuda Indonesia flight relayed the message to Air Traffic Control so that it was correctly understood.
- As **pressure dropped** in the cabin, **F/O oxygen mask was broken**; the delivery tube had detached from the rest of the mask. Captain decided to descend at 1,800 m per minute.
- Reaching 13500 ft, after several engine restart procedures, the crew finally re-started 4 engines.
- After a while, **engine number two surged again** and was shut down.
- As Flight 9 approached Jakarta, the **crew found it difficult to see anything** through the windscreen.
- An ILS approach was planned. However, the **glide slope was inoperative**, so the F/O monitored the descent using DME.
- After landing the **aircraft could not taxi** by its own, due to poor visibility through the wind screen. It was towed to the gate.

Source… WIKIPEDIA The Free Encyclopedia

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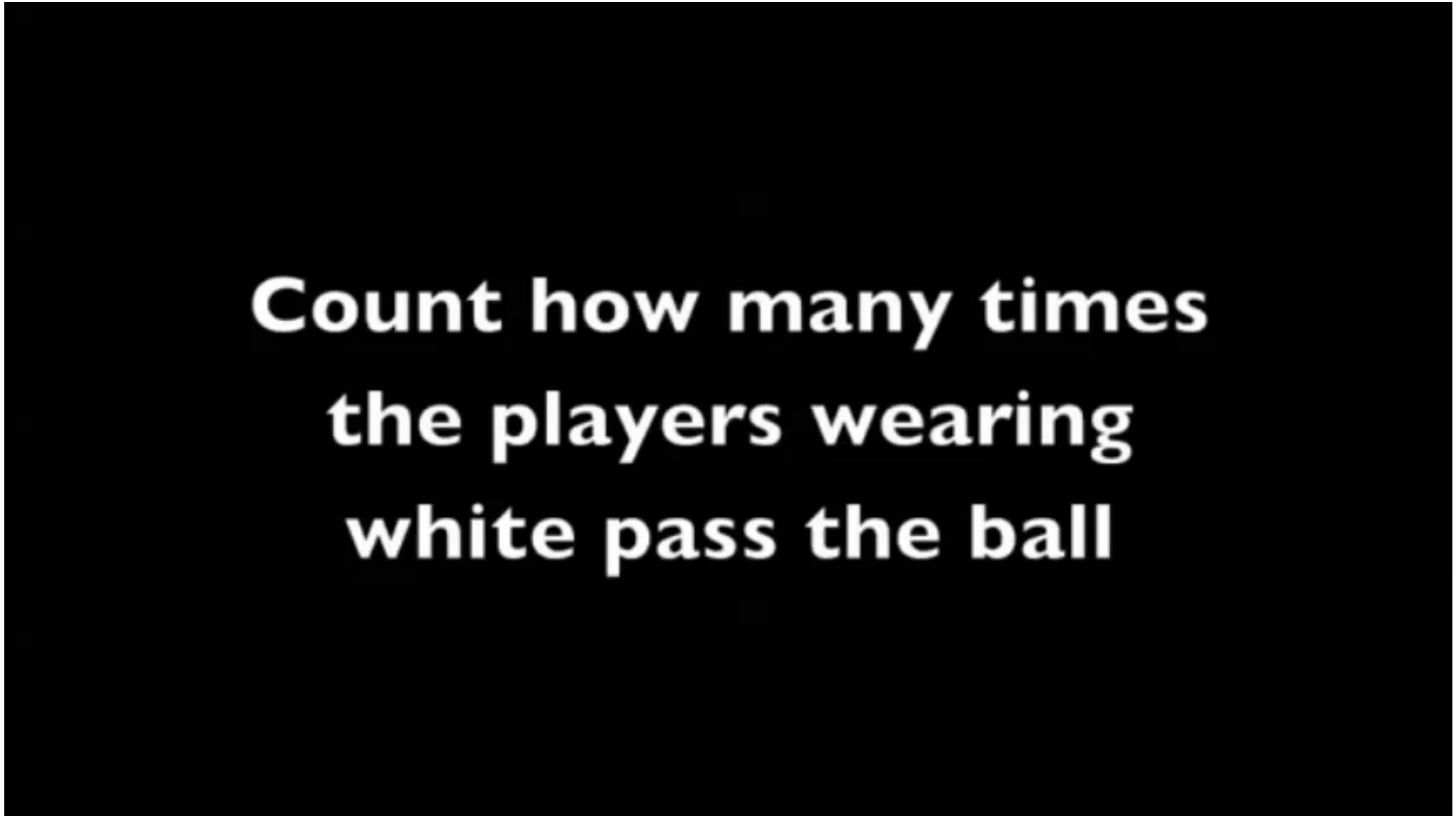
Human Factors Model



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Human Factors Model

+ Human Factors are:

Anything that affects a person's performance

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Human Factors Model

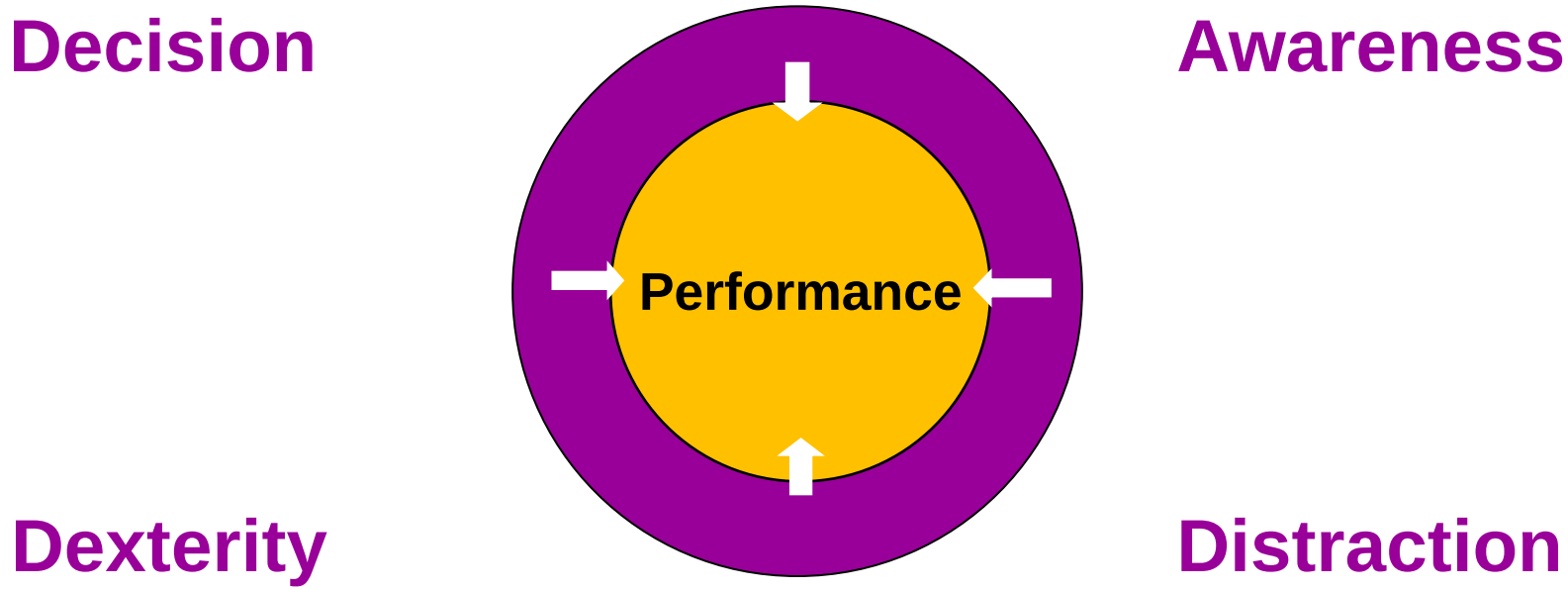
Good

Standard

Poor

Direct Factors

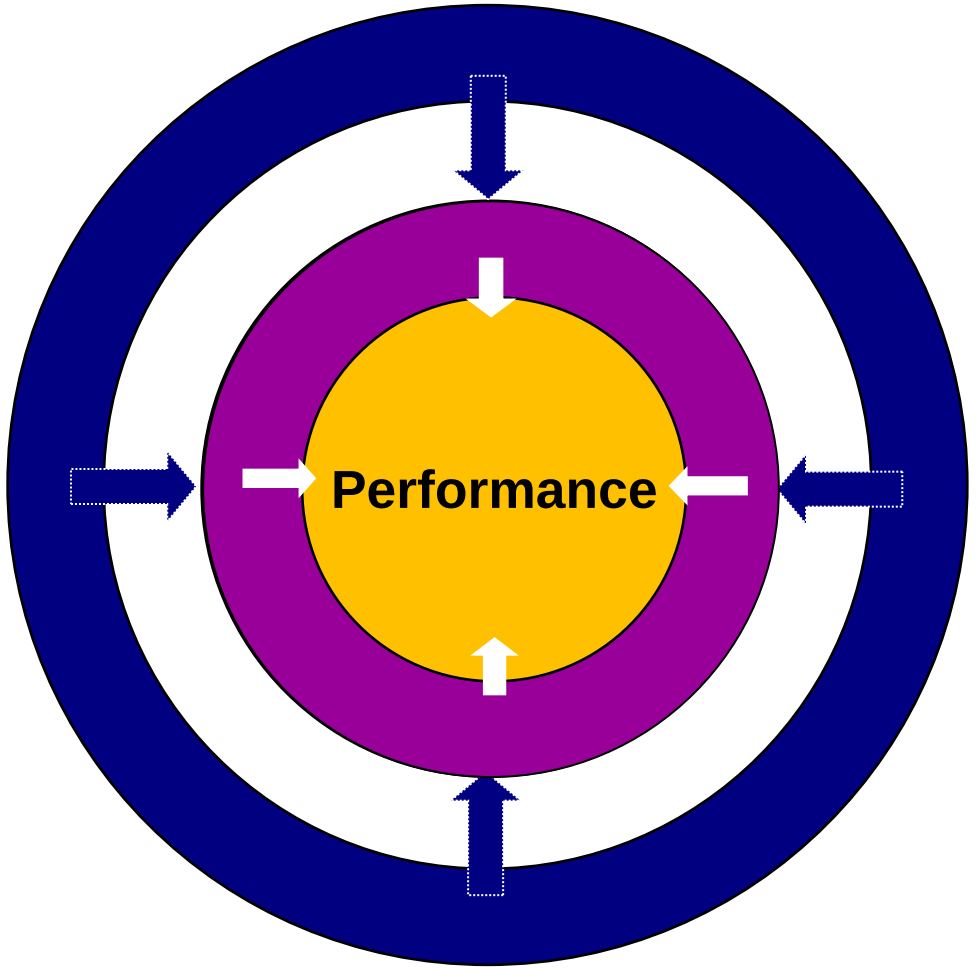
+ The acts or omissions that directly affect performance



Potential Factors

+ Things that have the potential to influence the direct factors

Design
Environmental
Fatigue
Illness
Visual illusions
Memory
Time
Ergonomic
Organizational
Commercial
Automation
Faulty equipment



System failures
Psychological
Negative attitudes
Physiological
Language
Procedures
Alert systems
Emergencies
Relationships
Documentation
Cultural
Stress

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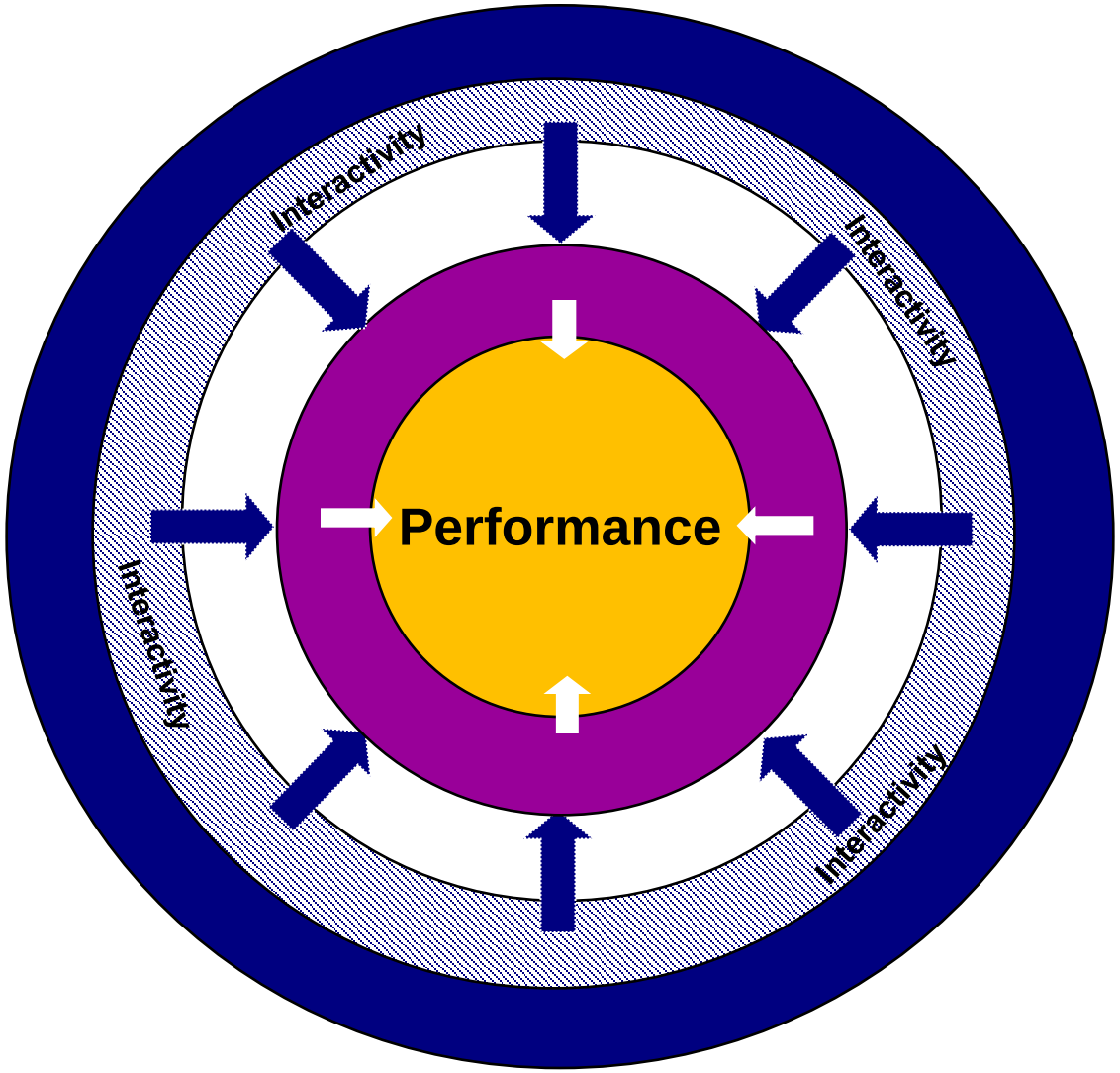
Potential Factors Interaction

+ Interactivity between Potential Factors will increase



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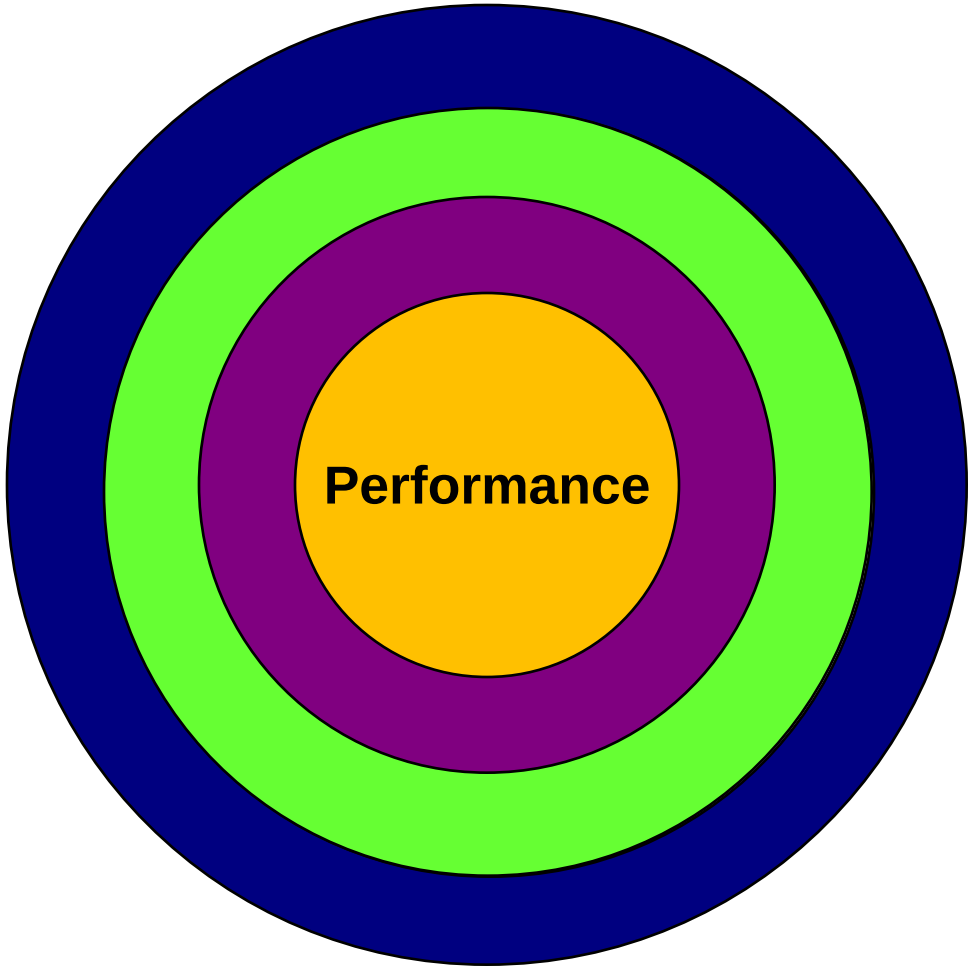
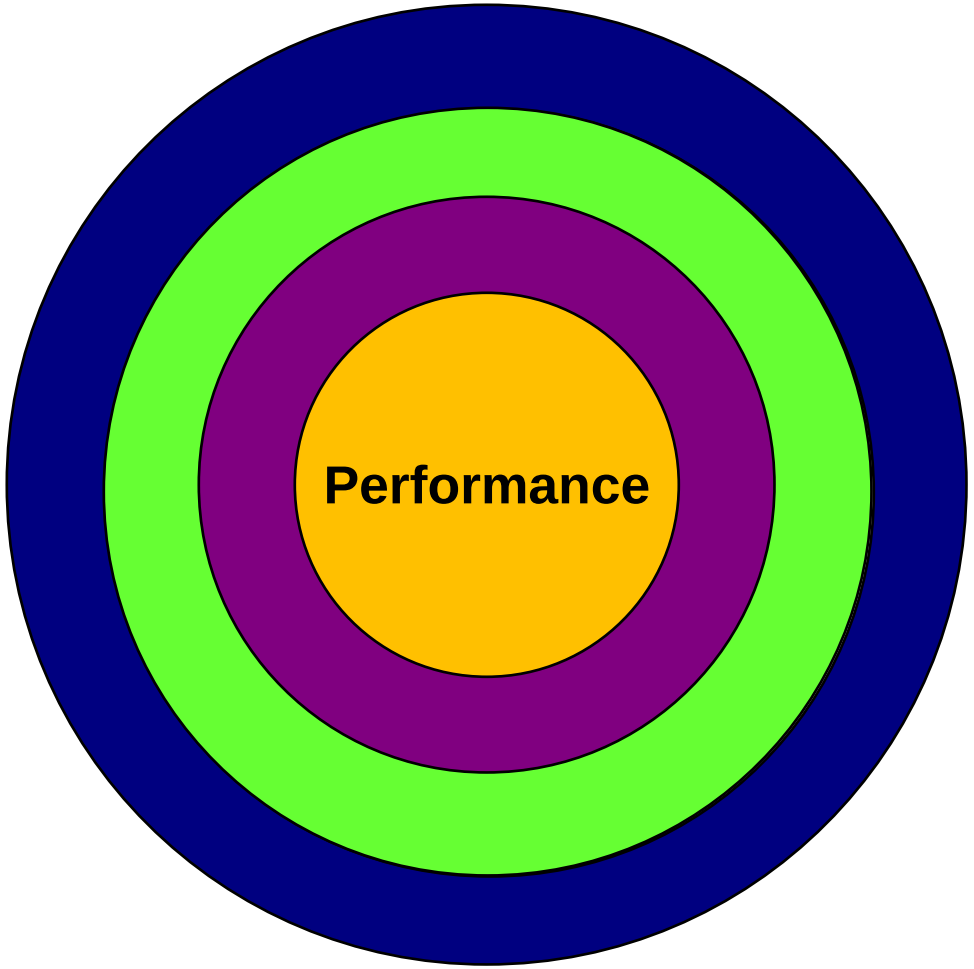
Managing Factors

+ Things that manage the effect of the Potential Factors and improve Direct Factors



Managing Factors - Organizational

Performance review
Training
SOPs
Checklists
System review

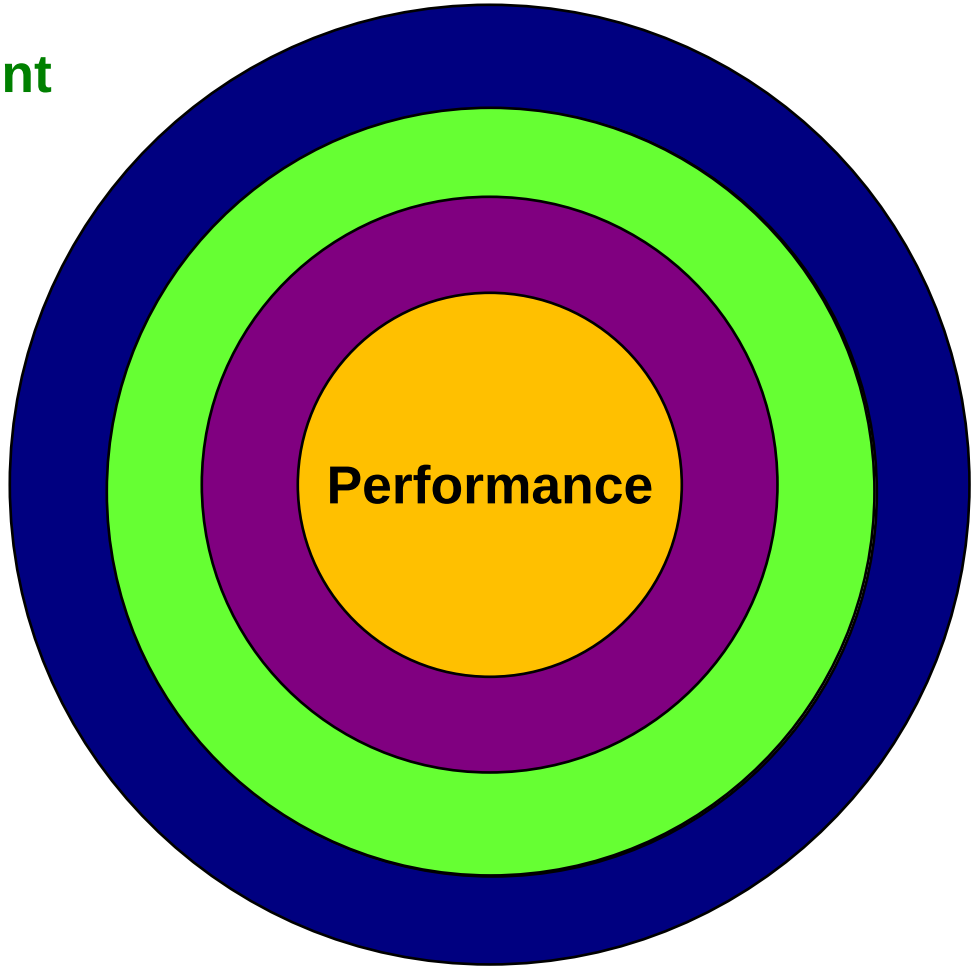


Briefings
Tools
Culture change
Motivation
…

Managing Factors - Individual

Threat & Error Management

Communication
Teamwork
Leadership
Positive attitudes
Behaviour
Planning
Problem prevention
Workload management
Situation awareness



Problem solving
Discipline
Decision making
Concentration
Stress
management
Monitoring

Fitness
Knowledge
Technical skills

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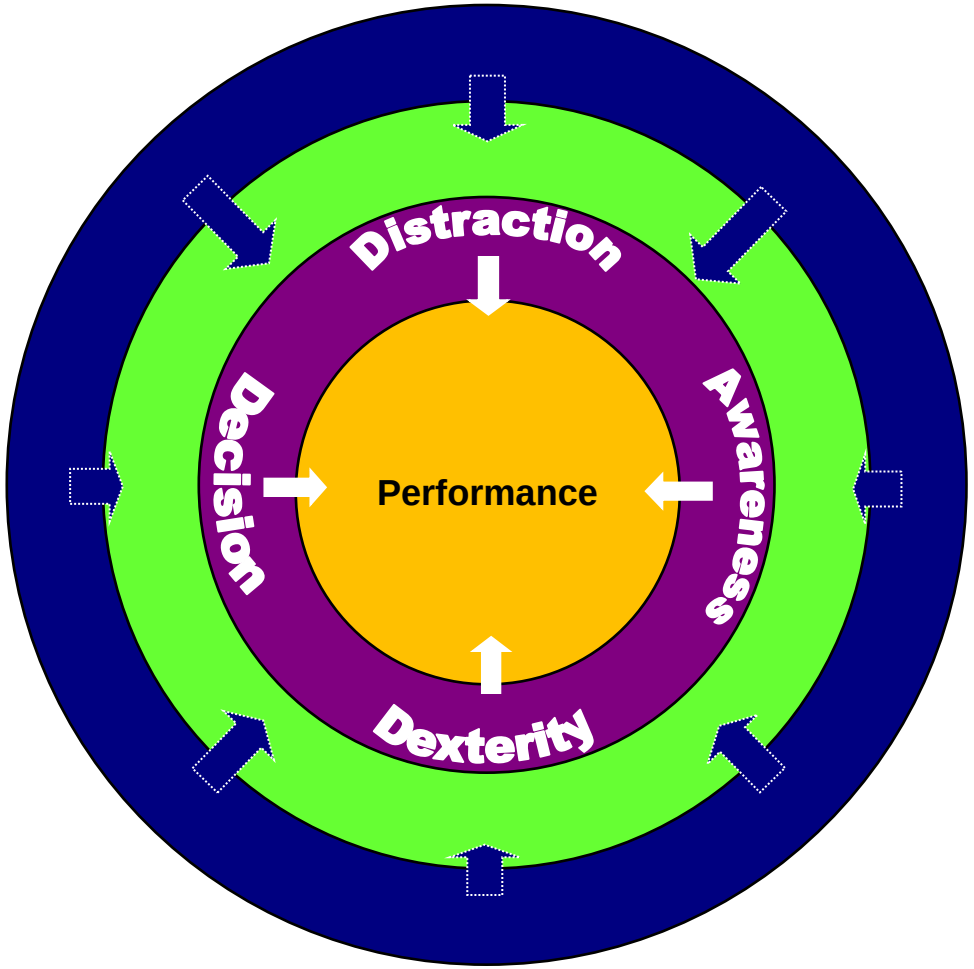
Human Factors Model

Direct Factors



Potential Factors

Managing Factors

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HF and CRM

The Importance of Human Factors

Human Factors

Threat & Error Management and CRM

CRM Best Practices

PM role

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CRM and Threat and Error Management

What is CRM?

+ We will develop, but **before**, let's explore **what is Airmanship**

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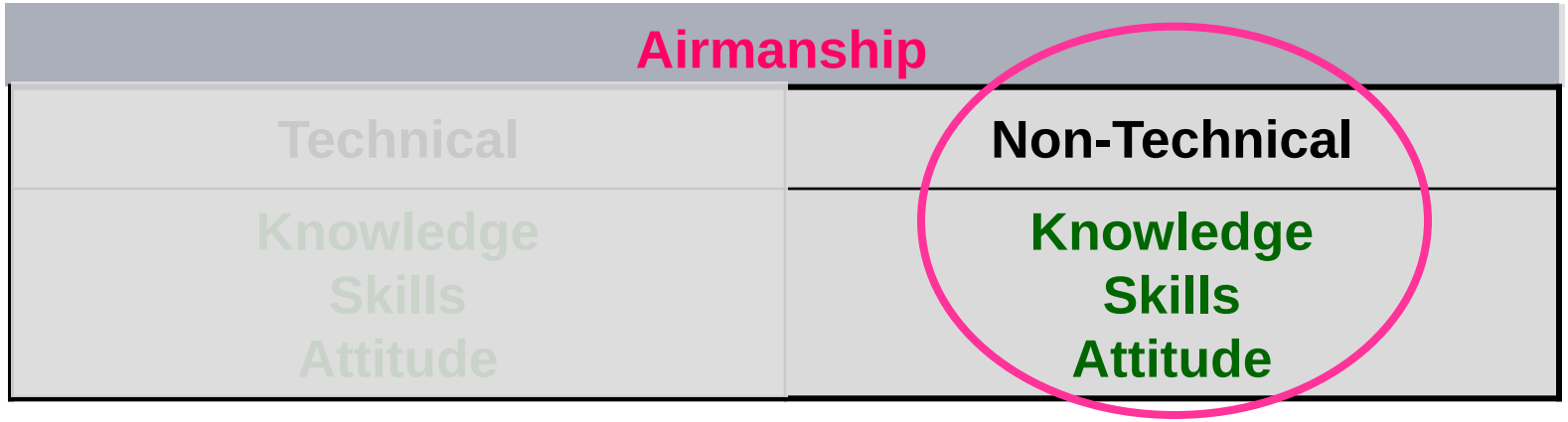
CRM and Threat and Error Management

What is Airmanship ?

+ Airmanship is the **Technical** and **Non technical Knowledge**, **Skills** and **Attitude** that pilots need to ensure that aircraft is operated:
  + **Safely,**
  + **Efficiently,**
  + **Effectively**



What is CRM?

+ CRM is the **Non-technical Knowledge** only

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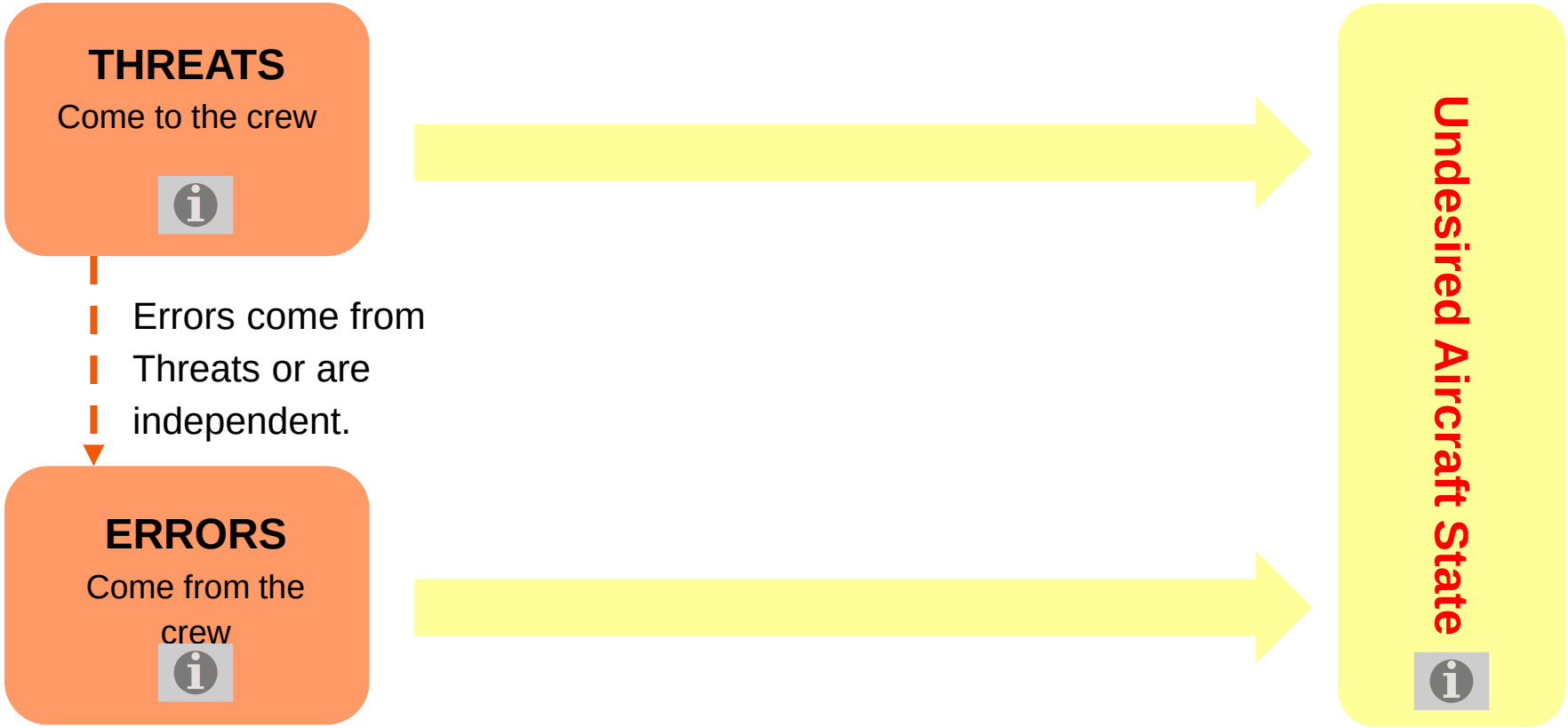
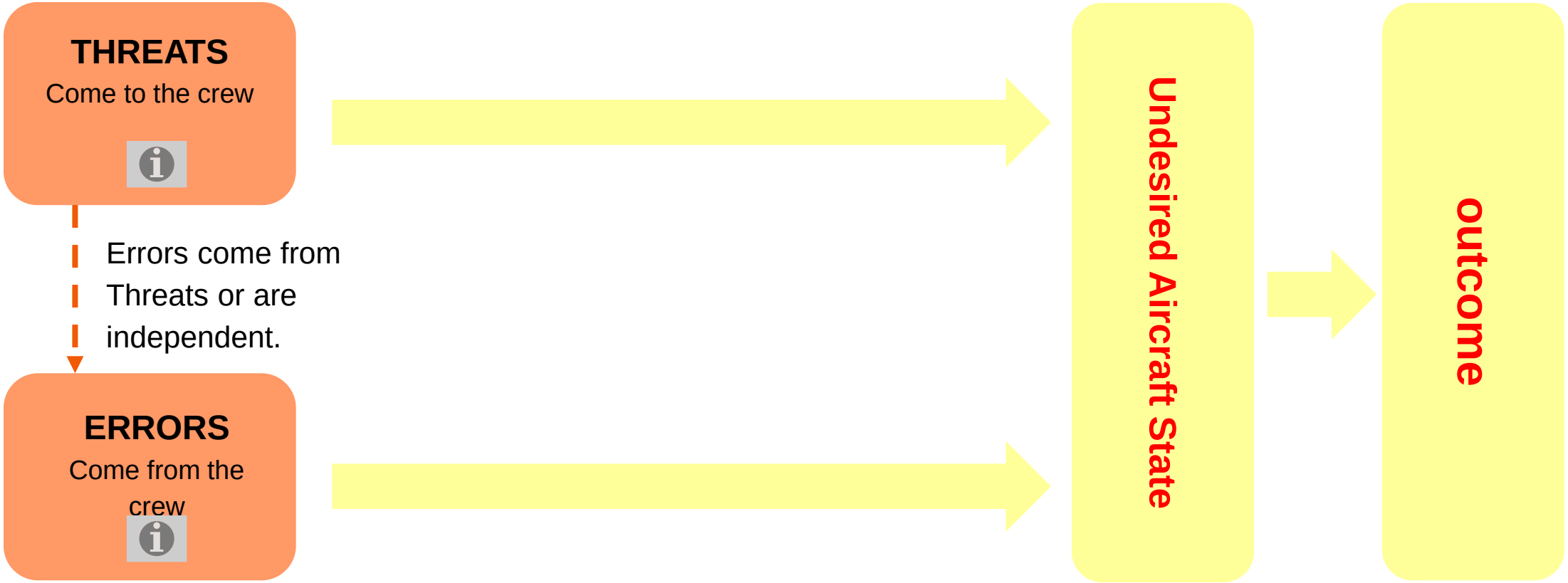
CRM and Threat and Error Management

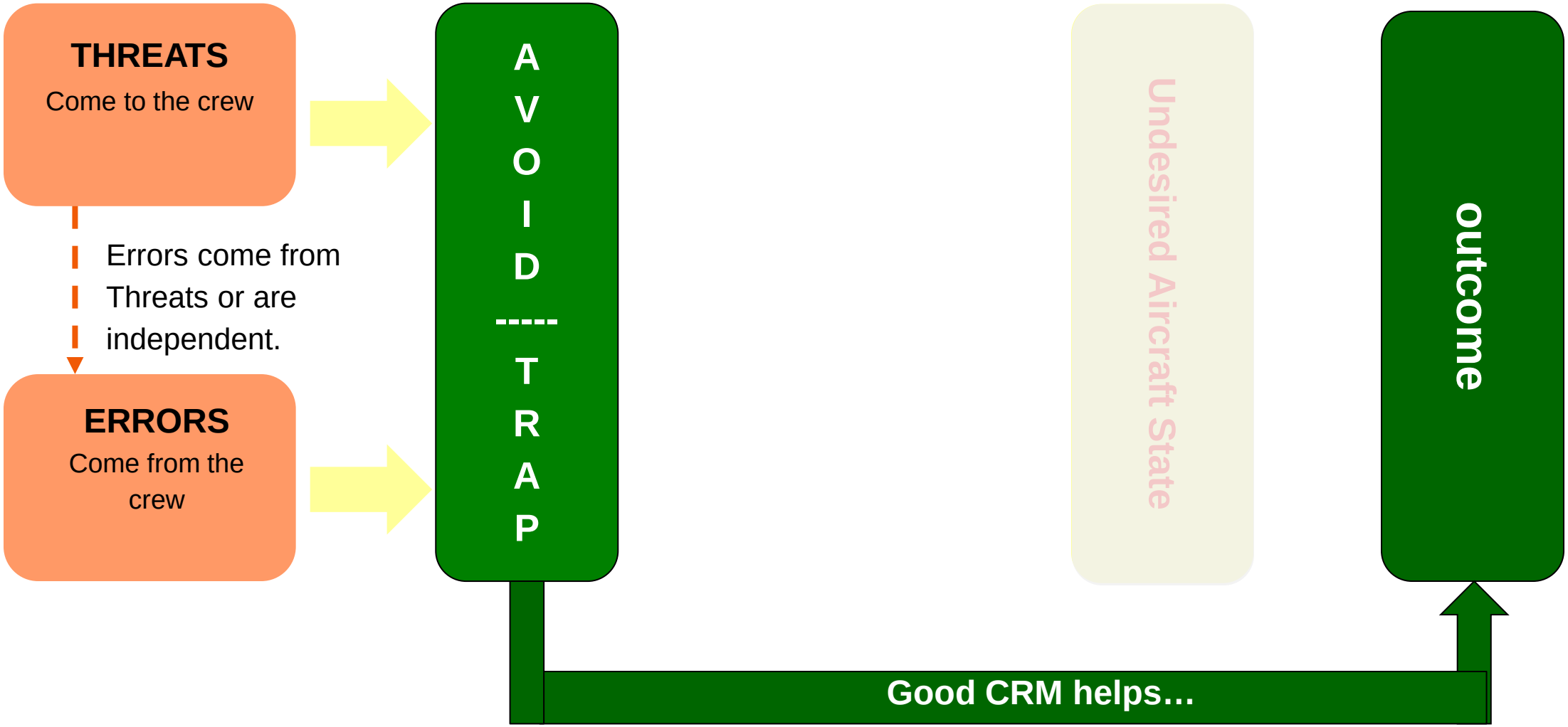


CRM and Threat and Error Management

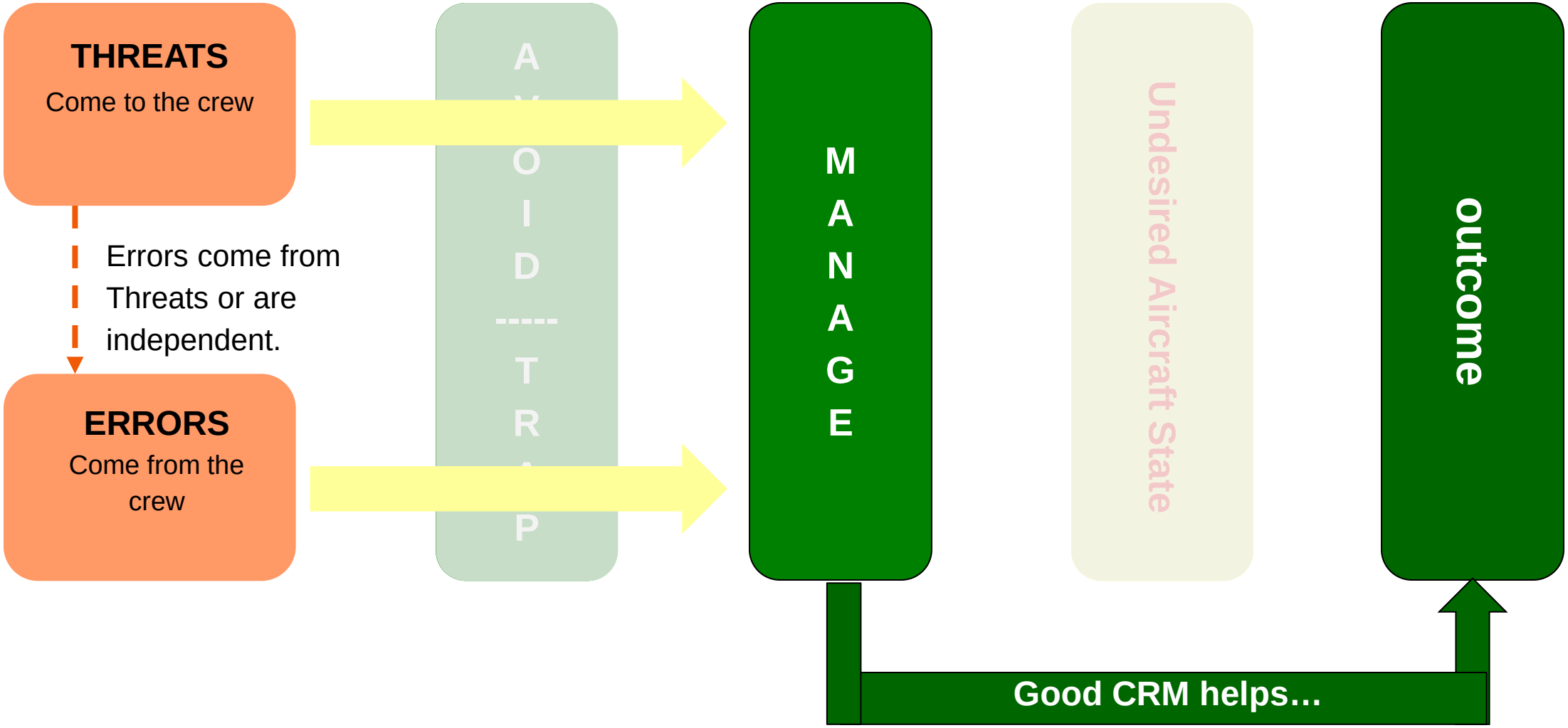


Not avoided, not managed, poor CRM….

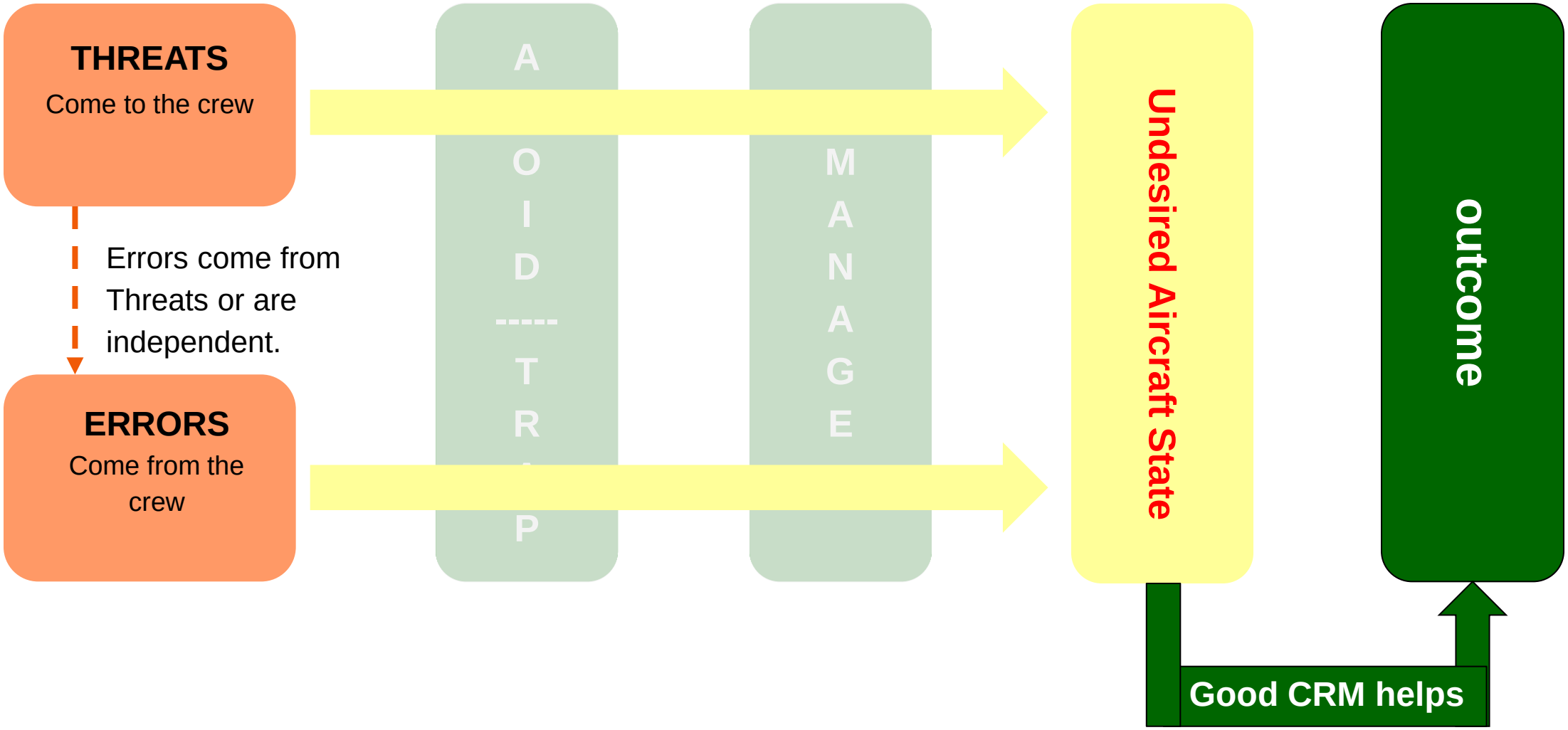
CRM and Threat and Error Management



CRM and Threat and Error Management



CRM and Threat and Error Management



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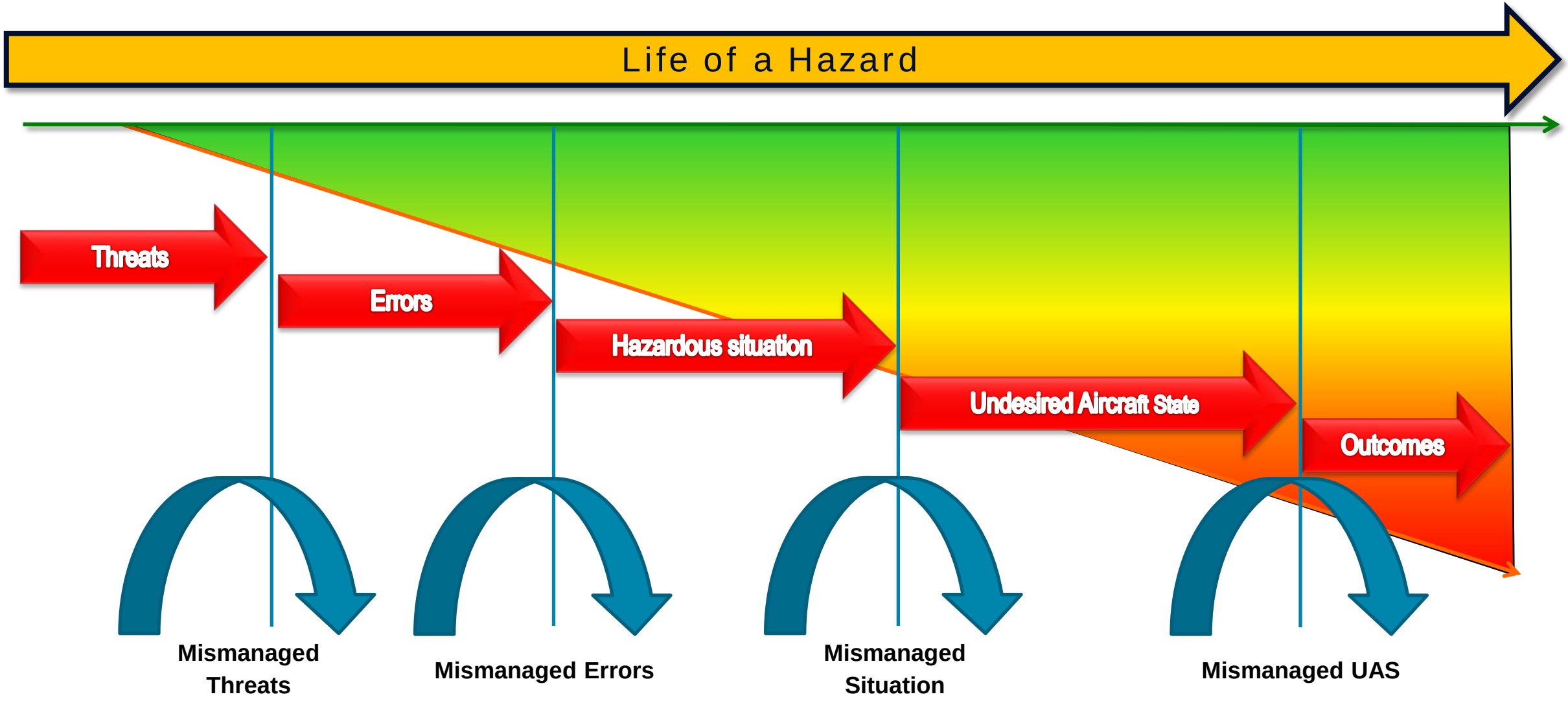
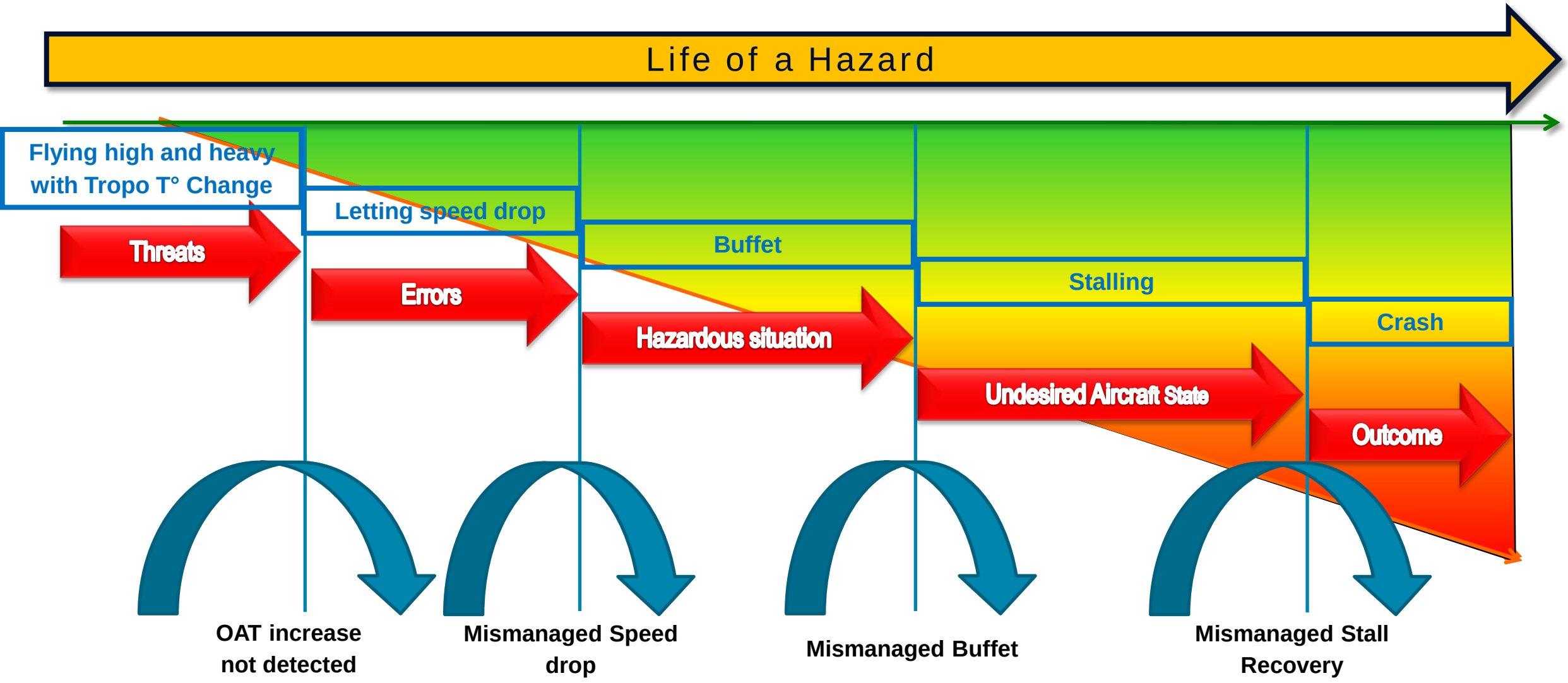
CRM and Threat and Error Management



CRM and Threat and Error Management



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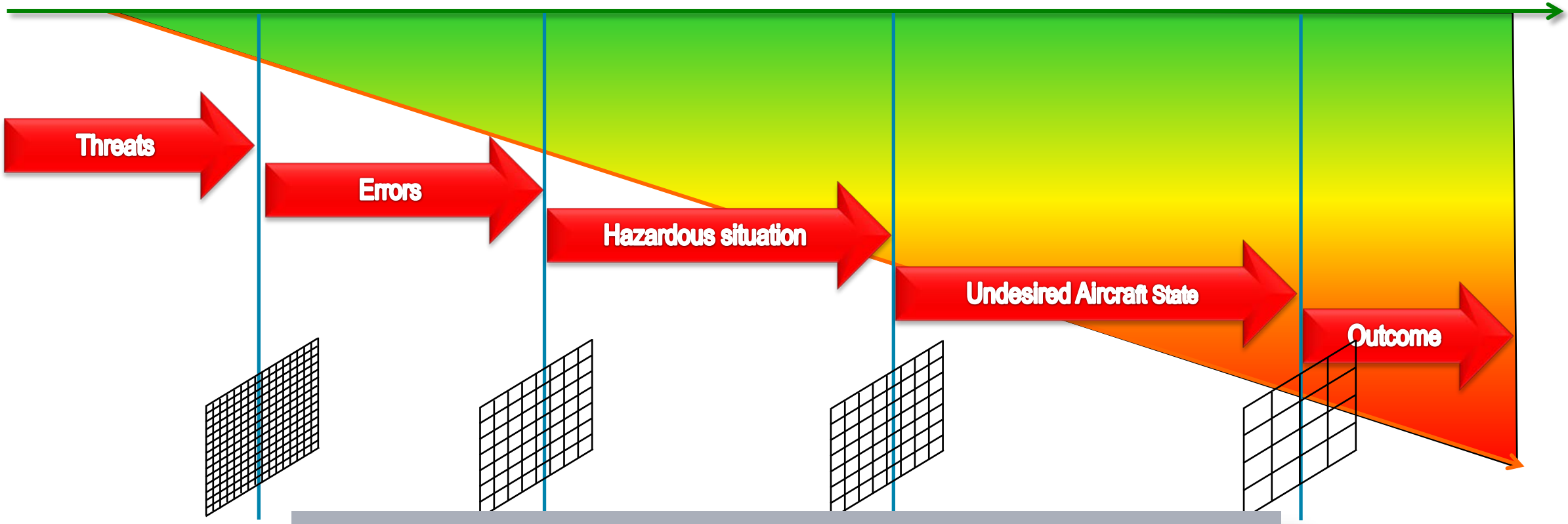
CRM and Threat and Error Management – Crew Perfomance

Safety Performance

+ SAFETY PERFORMANCE



› **Effectiveness** of the **Defence Barriers**

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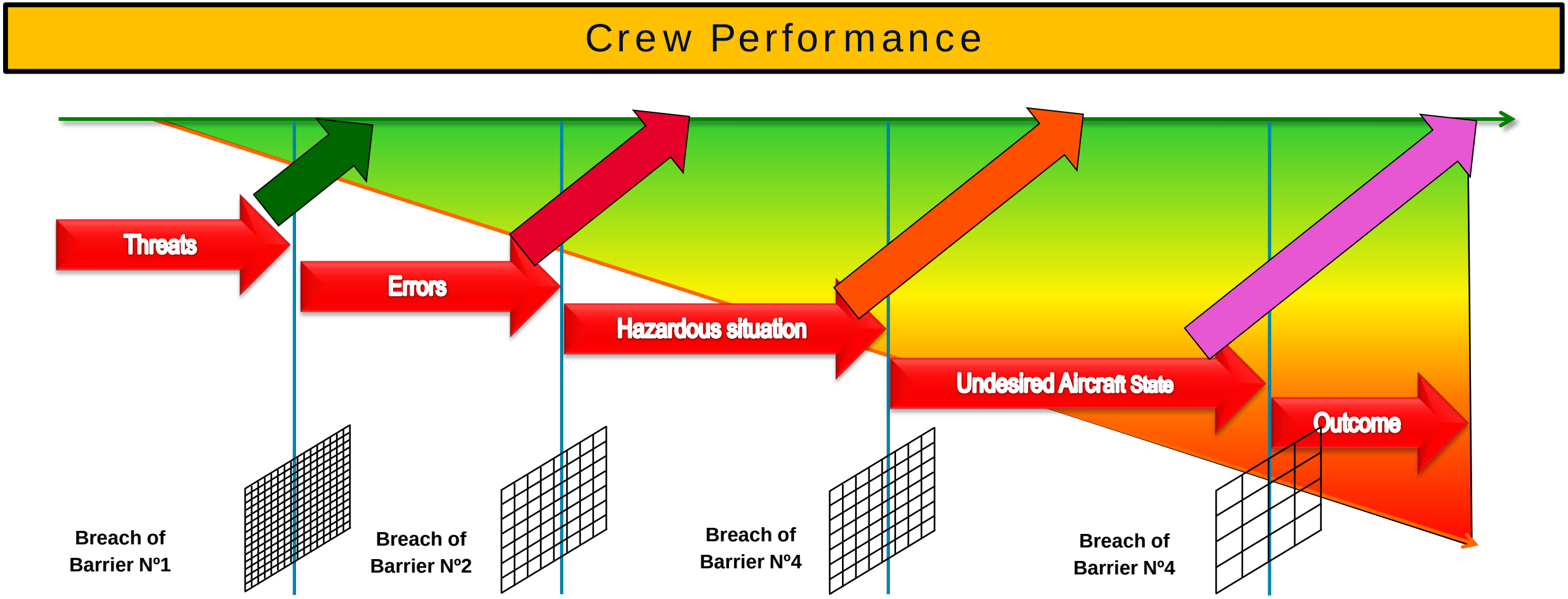
CRM and Threat and Error Management – Crew Perfomance



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How to recognize, avoid, trap and manage Threats and Errors

Communication

Leadership & Teamwork

Workload Management

Situation Awareness

Problem solving & Decision Making

HF and CRM

The Importance of Human Factors

Human Factors

Threat & Error Management and CRM

CRM Best Practices

PM role

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CRM Best Practices & PM role

CRM Best Practices

- **Ensure** clear **delegation of tasks**
- **Manage** competing activities (i.e., **prioritize**)
- Use all **appropriate system resources**
- Use on-board documentation
- **Assess time-critical** situations
- **Verbalize** with other crewmember
- **Manage** risk of **tunnel vision** (narrow-focus)

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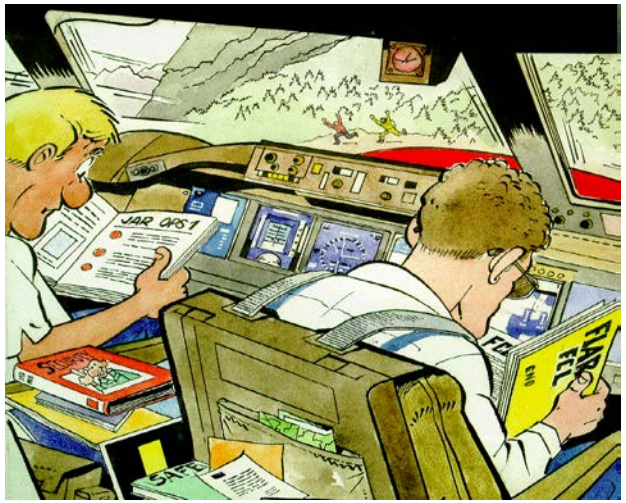
CRM Best Practices & PM role

Tasksharing - Captain

Leadership role of Captain :

- **Manage priorities**
- **Distribute** tasks
  (if non-standard task sharing)
- **Consult**
- **Share** situation **analysis**
- **Decide**
- Assure **final authority** and **decision making**
- **Ensure** that **everyone contributes** to communication / information and backup / crosscheck



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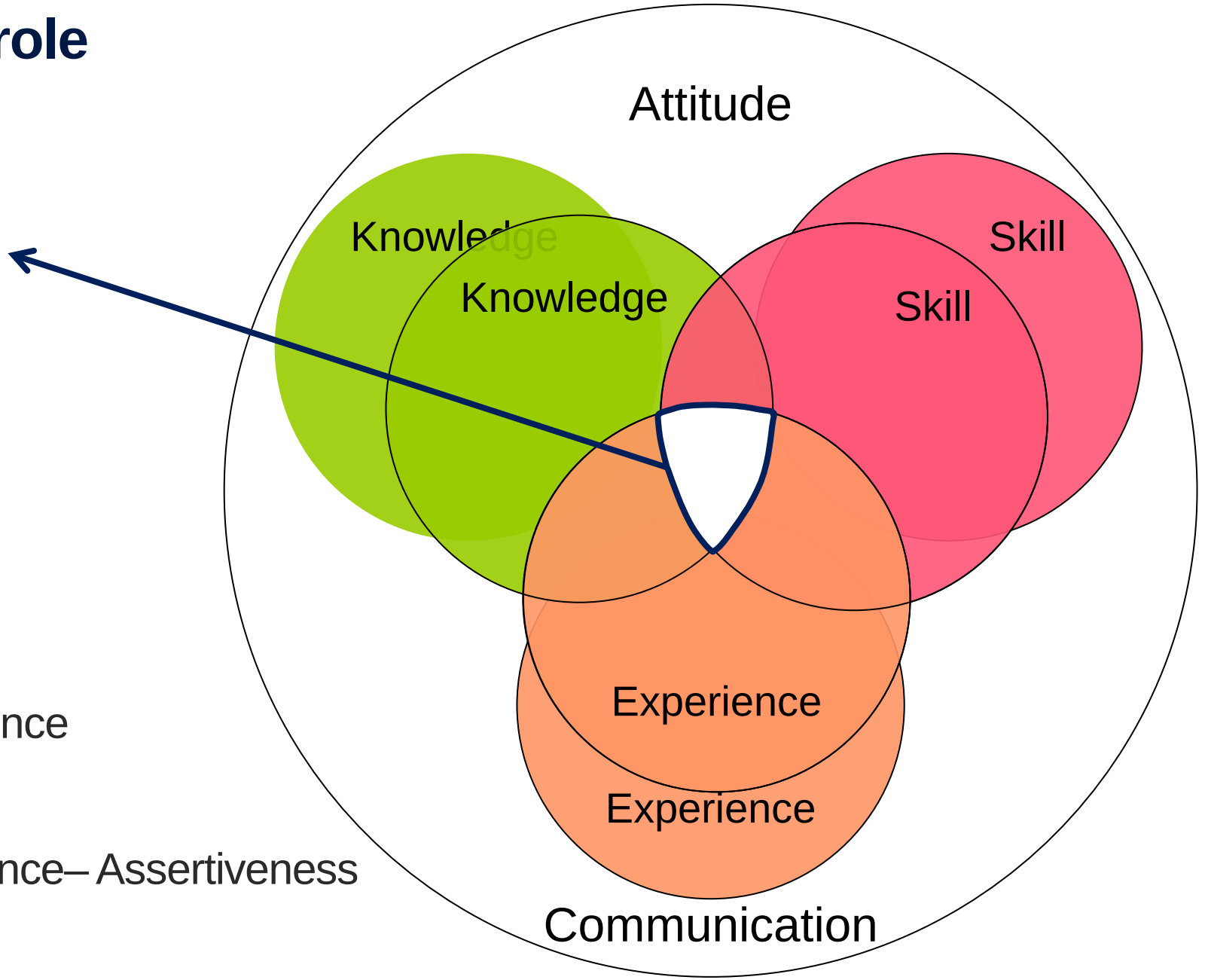
CRM Best Practices & PM role

Good Monitoring

Requires

- **+Knowledge**
  - + Through Training
- **+Experience**
  - + Application of Knowledge
- **+Skill**
  - + Both knowledge & Experience
- **+Attitude**
  - + Conscientiousness– Vigilance– Assertiveness
- **+Communication**
  - + Intra-cockpit / ATC / cabin – Sharing Goals & Intents



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CRM Best Practices & PM role

› A **Key Safety Element** in the J. Reason 'Swiss Cheese Model' of **Error Detection & Management**

Tasksharing - PM

Support and monitoring roles of PM:

+ Relay critical information for PF awareness
+ Provide timely inquiry statements before deviations develop
+ Provide standard and excessive deviation callouts (as applicable) and ensure PF response on intended corrective action(s)
+ Propose precise solutions if PF does not respond
+ Provide emergency statement if required
+ Take over control, if conditions warrant such action

CRM Best Practices & PM role

Tasksharing - PM

- Unexpected tailwind
- Runway condition
- Visibility change

"Don't you think we are high and fast ?"

"Shall we extend gear to reduce speed ?"

Information Statements

Inquiry Statements

Solution Statements

Callouts

Taking over "Go-around / flaps"

Take Over

Emergency Statement

"V DEV, airspeed and GS high, Sir"

"500 ft, not stabilized, Go-around !"

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CRM Best Practices & PM role

Training & Evaluating Monitoring Skills

Reinforce the responsibility of PM

+ Explain WHY inefficient monitoring reduces TEM performance

Develop clearly defined PM tasks, Training Objectives and proficiency standards. Ensure Instructors & Evaluators proficiency

+ Explain HOW clearly defined PM standards, training objectives, and instructor proficiency are necessary to enhance pilot's monitoring performance

Incorporate Monitoring training into training exercises

+ Suggests methods of incorporating monitoring training into training modules and instructors guides (Refer to Airbus OTT)

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CRM Best Practices & PM role

Training & Evaluating Monitoring Skills

CAA Paper 2013

Monitoring Matters

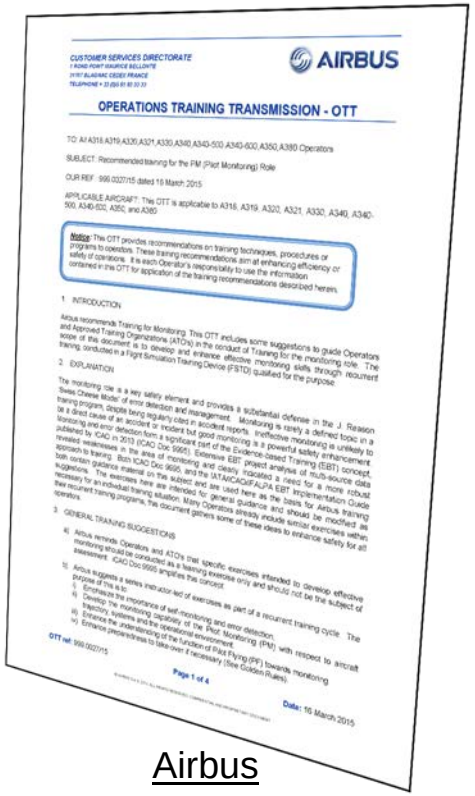
Guidance on the Development of Pilot Monitoring Skills

ICAO DOC 9995

EBT

Flight Safety Foundation

Flight Path Monitoring



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Operations Training Transmission (OTT) Ref. 999.0027/15

Recommended training for the PM Role

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CRM and Threat and Error Management

What is a Threat?

+ “Events, or errors, that occur **beyond the influence of the crew**, increase operational complexity and workload, and **which must be managed to maintain safety margin**”

› Threats come **to** the crew

CRM and Threat and Error Management

What is an Error?

Errors

+ "**Actions** or **inactions by the Flight Crew**, that lead to **deviations** from organizational or Flight Crew intentions or expectations"
  + Errors are: spontaneous, linked to threats, or can be part of error chains."

› Errors come **from** the crew

CRM and Threat and Error Management

What is a Hazard?

+ "A condition or an object with the **potential** of causing :
  + Injuries to personnel
  + Damage to equipment or structures
  + Loss of material, or
  + Reduction of ability to perform a prescribed function."

ICAO (SMM 3rd version)

› In TEM Concept **Threats** & **Errors** are considered as **Hazards**

What is an Undesired Aircraft State?

UAS

UNDESIRED AIRCRAFT STATE

+ "**Flight Crew-induced** aircraft position or speed deviations, misapplication of flight controls, or incorrect systems configuration, associated with a **reduction of safety margins**"

+ Undesired aircraft State is **not an outcome**:
  + It is a transitional situation between normal situation and outcome.
  + **Restoring margins of safety is still possible.**