

REGIONAL FOCUS

Accident and Incident Investigation for the Latin America and Caribbean Region

Wednesday 21, 28 July and 4 August 2021

08:00 – 09:30 EDT



Mr. Shayne Campbell

Safety Programme Manager

CANSO



Mr. Jason Demagalski

Human Performance Team Manager

FAA

Reflection

“It is unacceptable to conclude an investigation of an event with the statement: ‘If only the flight crew or maintenance crew had done what they were supposed to do’”

**Phil Condit, Former CEO, Boeing
1994**

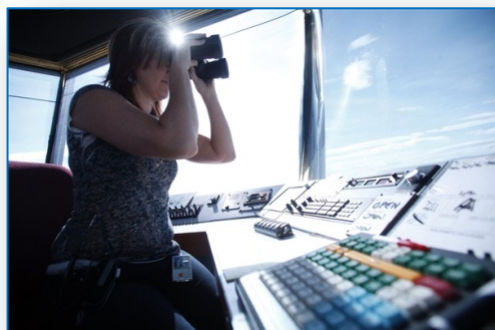
**JUST DO WHAT
YOU’RE SUPPOSED TO**

VERONICA ROTH



CANSO

Human Factors



Do we have the
right people

with the
right information

and the
right tools

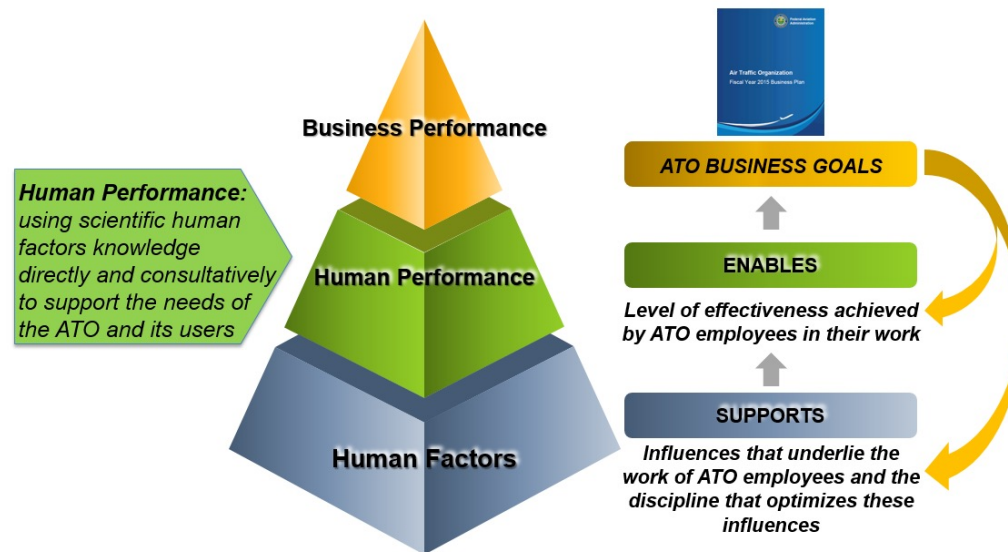
with the
right motivation

in the
right roles

and the
right skills

and the
right role models

to do the job?



Health and Wellness



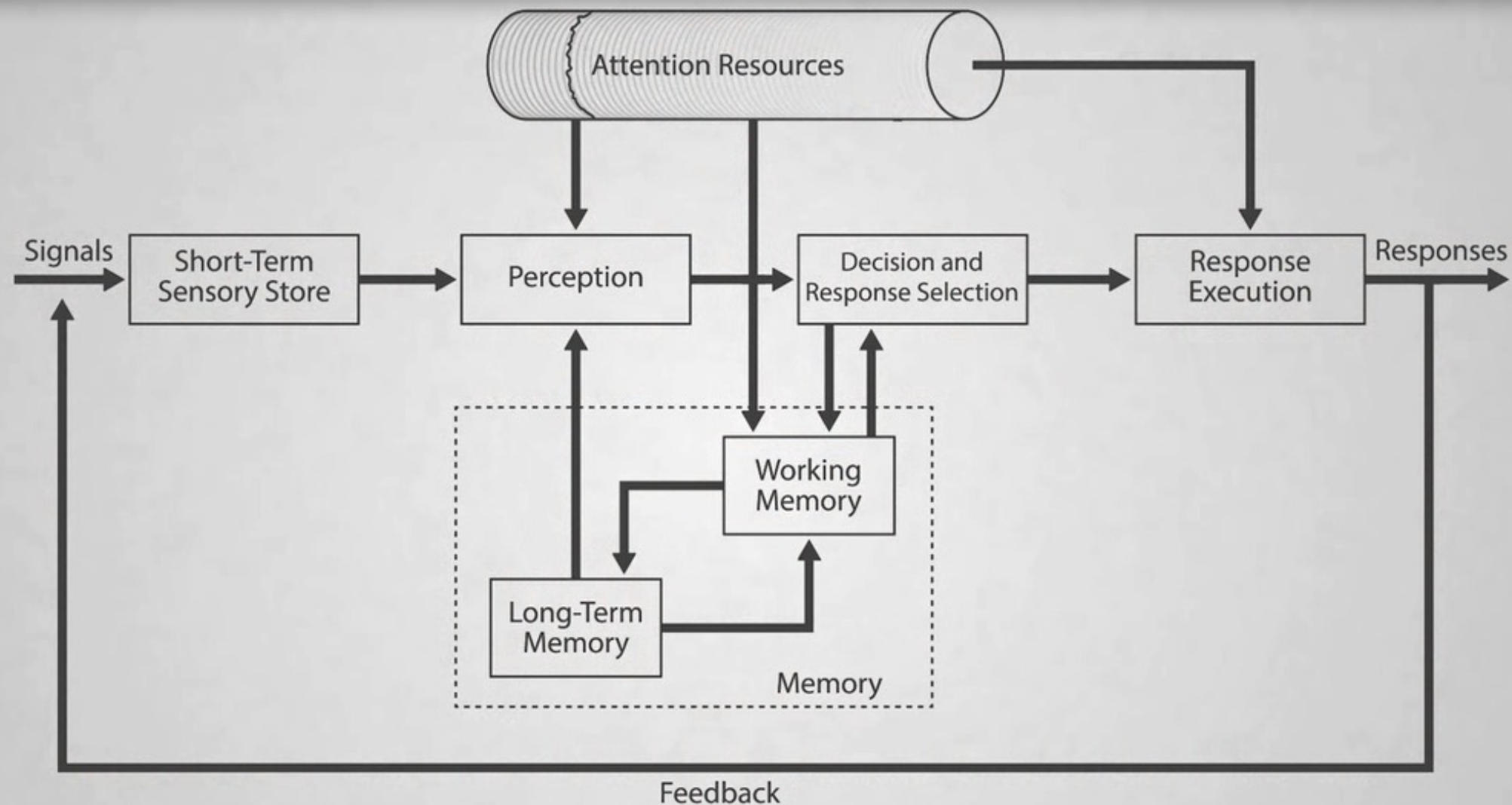
Fatigue Risk Management



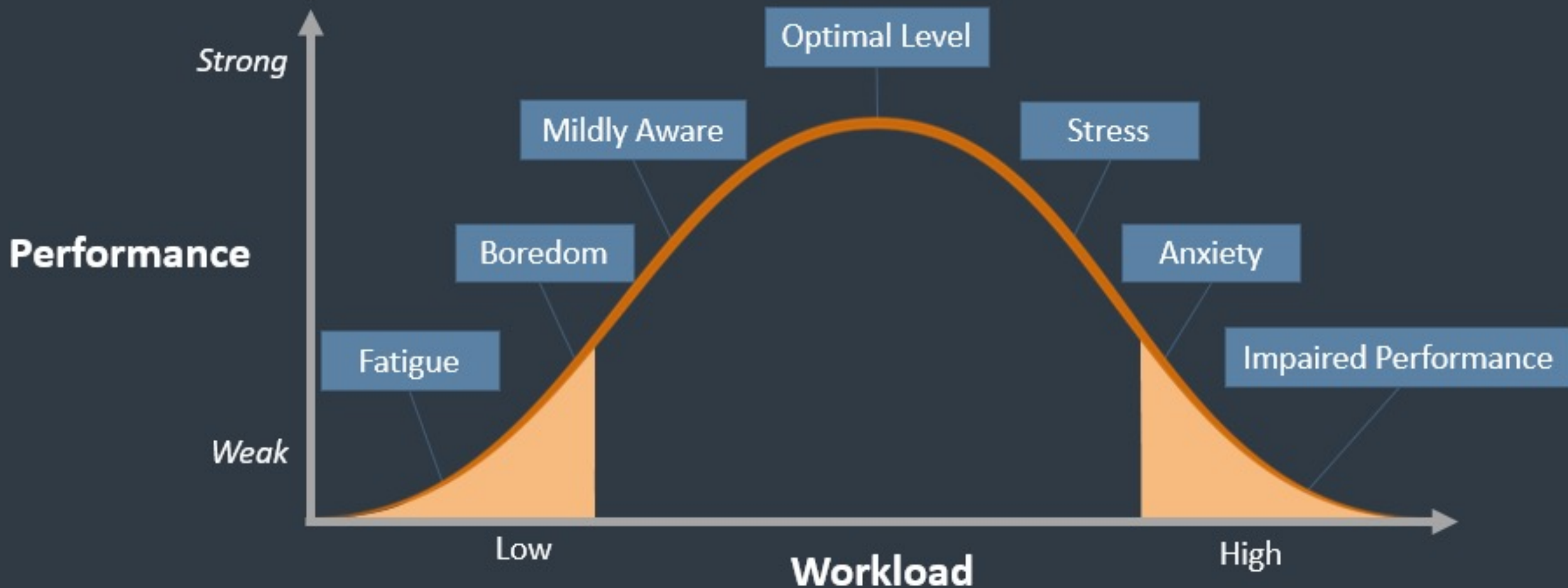
Fatigue Risk Management



Human Information Processing



Effects of Workload on Performance



Memory

- Memory is necessary to:
 - Perceive what our senses detect
 - Help us select the right decision
 - Implement actions
- The way you store information in memory influences how well, and how quickly, you can remember it later
- One type of memory is time and capacity limited



Long Term Memory

- Long term memory (LTM) has an almost unlimited capacity and has a time-frame from a few seconds to several years (perhaps permanently).
- Episodic LTM relates to personal narratives such as where you went on holiday last year, or what you had for breakfast.
- Semantic LTM holds general, factual information about the world, including concepts, rules and procedures, and language.



VIDEO


Cognitive Biases

Expectation Bias	Confirmation Bias	Automation Bias
Tendency to perceive what we expect to perceive	Tendency to search for information that confirms your preconceptions	Tendency to make errors when decisions are handled by automated aids
<p>You expect a pilot to repeat back the altitude you just provided</p> <p>"Climb and maintain 1500"</p> <p>The pilot actually repeats back a different altitude</p> <p>"Roger, climb and maintain 1900"</p> <p>But what you perceive is 1500, not 1900</p>	<p>You tell your supervisor all runways are clear, but he asks you to scan again</p> <p>You know the runways are clear, but you do the scan anyway...</p> <p>...and fail to see a maintenance truck moving onto the runway</p>	<p>Omission errors occur when you don't notice when the automation failed (e.g., TCAS does not alert you to a conflict)</p> <p>Commission errors occur when you don't notice an active mistake by the automation (e.g., TCAS incorrectly alerts a conflict and you respond without verifying the conflict)</p>

Human Error

- We all make errors of different kinds
 - An **unintentional** action
 - An **unintentional** decision
 - A **mistake** in processing information
 - A **lapse** in situation awareness
 - A **miscue** due to cognitive interruption
- Error is not intentional
- Errors often result from poor system design, procedures, or insufficient training

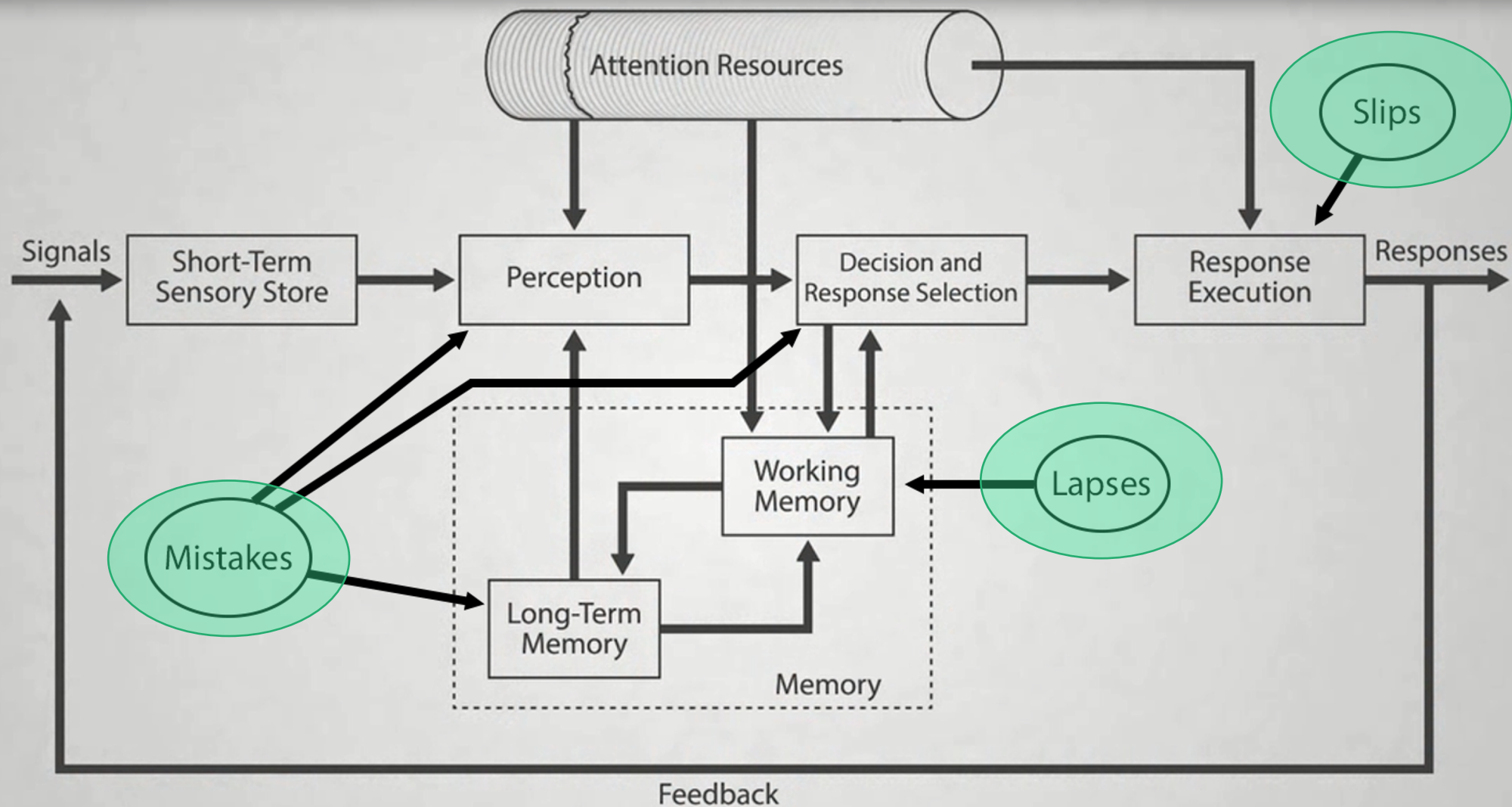


A tall, cylindrical air traffic control tower with a glass-enclosed observation deck at the top, set against a blue sky with scattered white clouds.

Errors are consequences not causes... Discovering an error is the beginning of a search for causes, not the end. Only by understanding the circumstances ... can we hope to limit the chances of their recurrence.

-James Reason


Human Information Processing



IT SAID PUT
IT IN THE
OVEN

AT 120
DEGREES

Why Do We Make

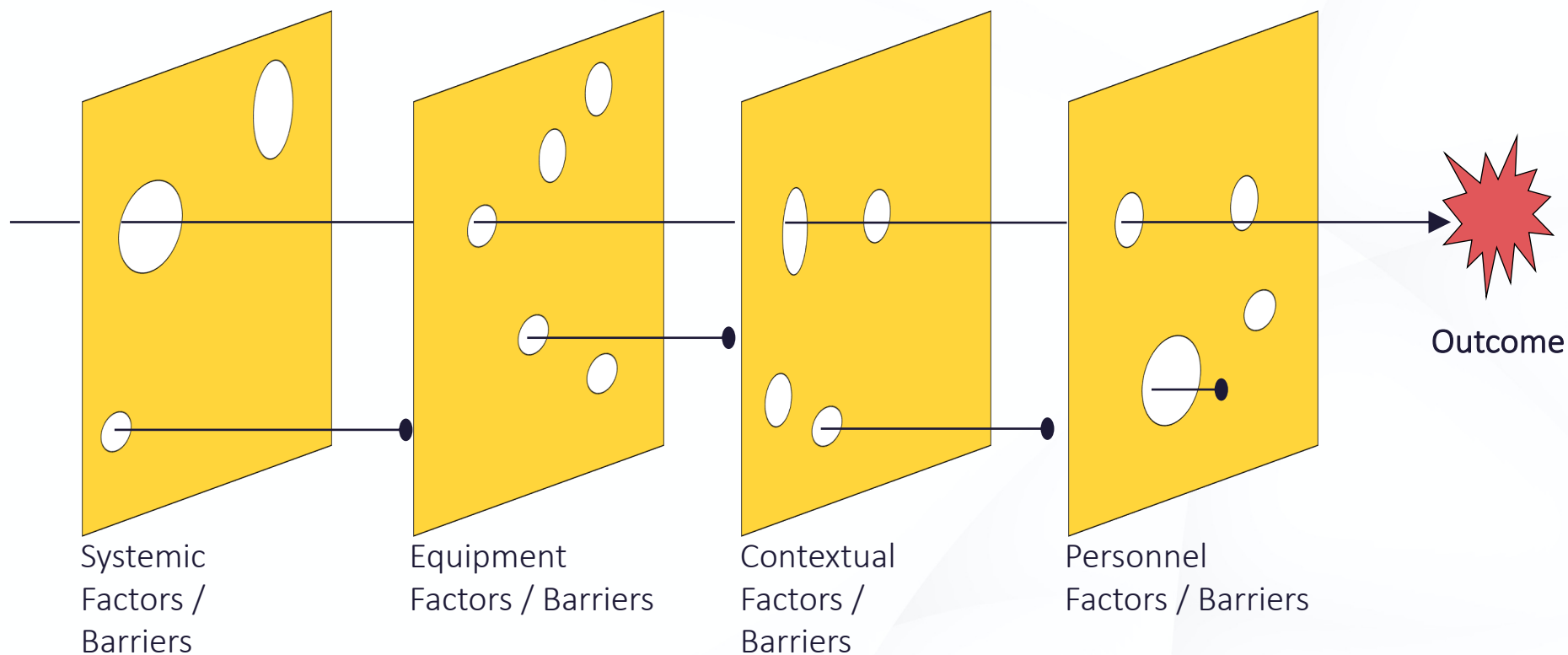
Internal Causes	External Causes
<ul style="list-style-type: none">• Communication• Complacency• Lack of knowledge• Distraction• Lack of teamwork• Fatigue• Competence• Recency• Incident involvement• Social pressure / Norms• Workload• Lack of assertiveness• Stress• Assumptions• Inadequate workspace or layout	<ul style="list-style-type: none">• Poor environmental conditions• Inadequate human engineering design• Inadequate training• Poor supervision• Technological changes• Task or procedure changes 

Fundamental Attribution Error:

Estimating the Influence of Situations on Behavior

	Failures	Successes
Other people	They are dumb, incompetent	They got lucky!
Ourselves	We were unlucky!	We are smart, competent

Reason's Swiss-Cheese Model



Human Factors Checklist

Feggetter, 1982

Cognitive System

- **1 Human Information Processing System**

- Senses
- Perception
- Attention
- Memory
- Decision
- Action
- Monitoring
- Feedback

- **2 Visual Illusions**

- **3 False Hypothesis**

- **4 Habits**

- **5 Motivation**

- **6 Training**

- **7 Personality**

- **8 Fear (Military)**

Social System

- **9 Social Pressure**

- **10 Role**

- **11 Life Stresses**

Human Factors Checklist Continued

Feggetter, 1982

•12 Physical Stress

- Physical Condition
- State of Nutrition
- Drugs
- Smoking
- Alcohol
- Fatigue
- Sleep

•14 Policy and Procedures

- Normal
- Non-normal

•13 Environmental Stress

- Altitude
- Speed and Motion
- Ambient light
- Glare
- Disorientation
- Temperature
- Lighting Levels
- Vibration

•15 Ergonomics Aspects

- Design of Controls
- Design of Displays
- Anthropometrics
- Presentation of Material



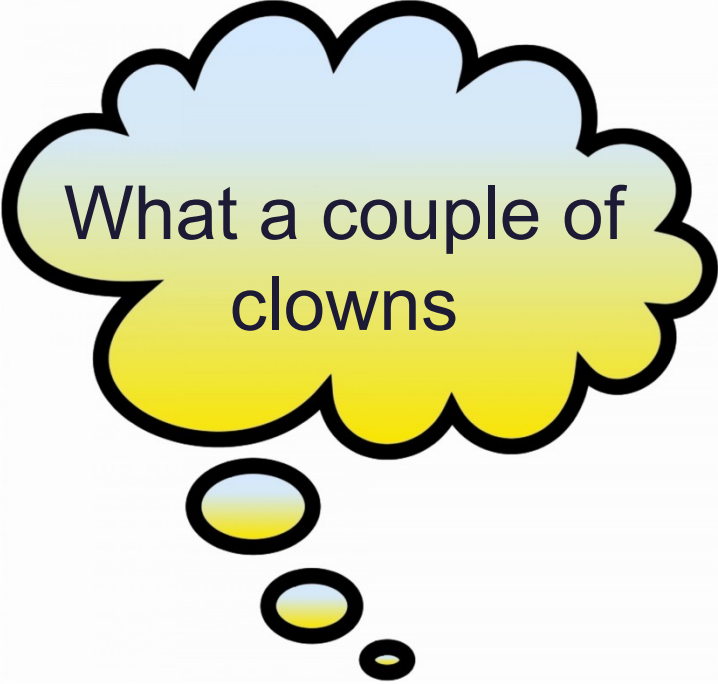
Willful Violations

- Willful and knowing disregard of the rules, regulations, policies, or procedures
- Deliberate intent and motivation
- Bending of the rules
- Adaptations

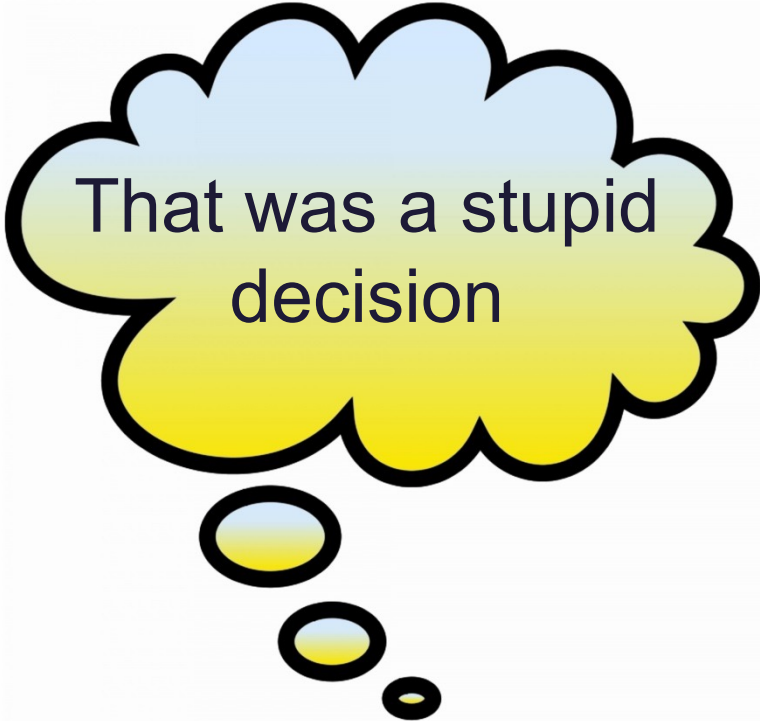


Signs of Potentially Biased Thinking by Investigators


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What a couple of clowns



That was a stupid decision



They should have seen that coming a mile away

Investigator Biases







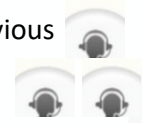
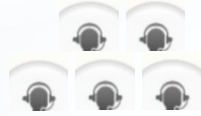




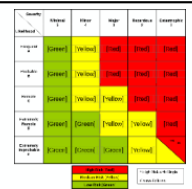
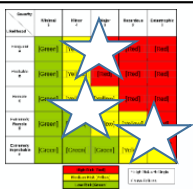
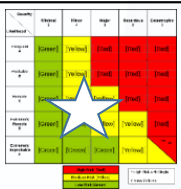
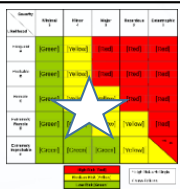

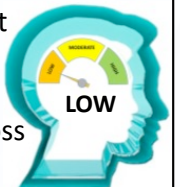
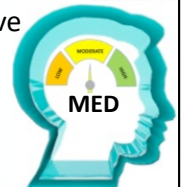

- **Hindsight bias:** Knowing the outcome of an event has an influence on the way the analysis is done.
- **Attribution bias:** A tendency to infer causes of behaviours (e.g., to link an operator's error to an operator's incompetence).
- **Frequency bias:** to over (or under) estimate the probability of occurrence of a particular event.
- **Selectivity bias:** to ignore those facts which do not quite fit the pattern expected.
- **Group conformity:** to agree with the majority decisions in the group of investigators

Outcome Bias

Our evaluations of others' decisions are disproportionately influenced by outcome

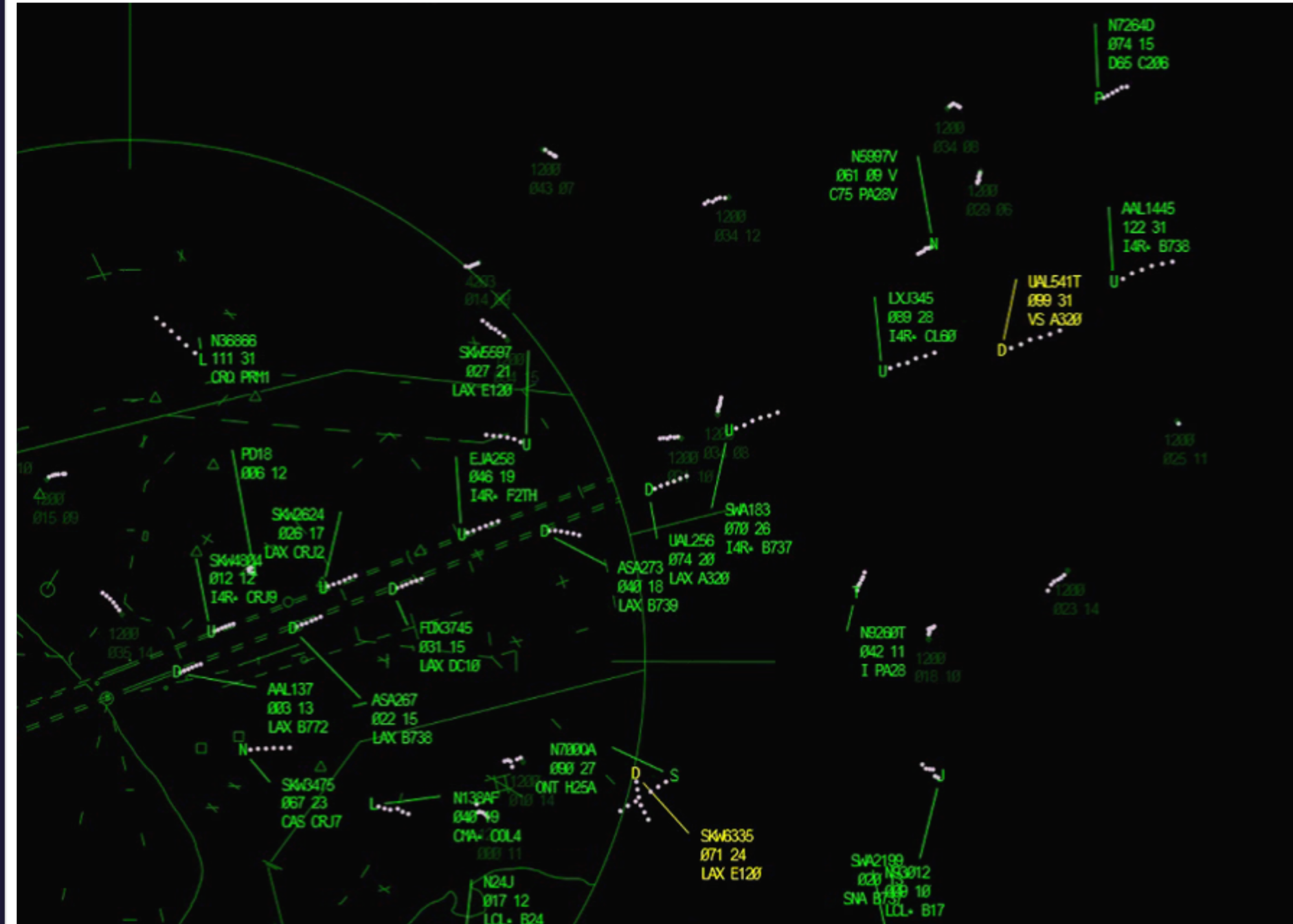
- Many decisions are sub-optimal, but...
- Sometimes a bad decision works out and
- Sometimes a good decision leads to disaster

Issues with Current and Future State Operational Levels

	Normal	Draw Down Posture	Near-Term Ramp Up	Long-Term Ramp Up
Traffic Levels & Complexity	 <ul style="list-style-type: none"> Normal traffic levels Normal complexity levels Normal GA/commercial mix 	 <ul style="list-style-type: none"> Reduced levels Reduced complexity Flipped GA/commercial mix 	 <ul style="list-style-type: none"> Ramp up in traffic levels Relative complexity increase Increased commercial 	 <ul style="list-style-type: none"> Slow return to increased traffic levels and complexity Increased commercial
Facility Staffing Levels	<ul style="list-style-type: none"> Normal/full op staffing Normal Team Resource Mgmt (TRM) mix 	<ul style="list-style-type: none"> Lower op staffing levels required Large combined sectors Different TRM mix 	<ul style="list-style-type: none"> Increase in op staffing levels Combined sectors Return to some previous TRM mix 	<ul style="list-style-type: none"> Full op staffing levels Return to normal TRM mix 
Work Schedules	 <ul style="list-style-type: none"> Rotating five day schedule Rotating six day schedule 	 <ul style="list-style-type: none"> Rotating, five in facility and ten out of facility 	 <ul style="list-style-type: none"> Rotating, five in facility and five out of facility 	 <ul style="list-style-type: none"> Rotating five day schedule Rotating six day schedule
Safety Risk Mgmt	<ul style="list-style-type: none"> Known hazards, managed risks Safety assurance 	<ul style="list-style-type: none"> Known hazards, managed risks New hazards, new risks New mitigations 	<ul style="list-style-type: none"> Known hazards, managed risks New hazards, new risks New mitigations 	<ul style="list-style-type: none"> Known hazards, managed risks New hazards, new risks New mitigations 
Controller Performance	<ul style="list-style-type: none"> High cognitive engagement High human performance 	<ul style="list-style-type: none"> Lower engagement Different teams Complacency Skill automation loss Slips, lapses Lifestyle changes 	<ul style="list-style-type: none"> Increasing cognitive engagement Skill/learning degradation Lifestyle changes Fatigue 	<ul style="list-style-type: none"> High cognitive engagement High human performance New habits Proficiency/currency drift 

Human Factors Analysis of Significant Event



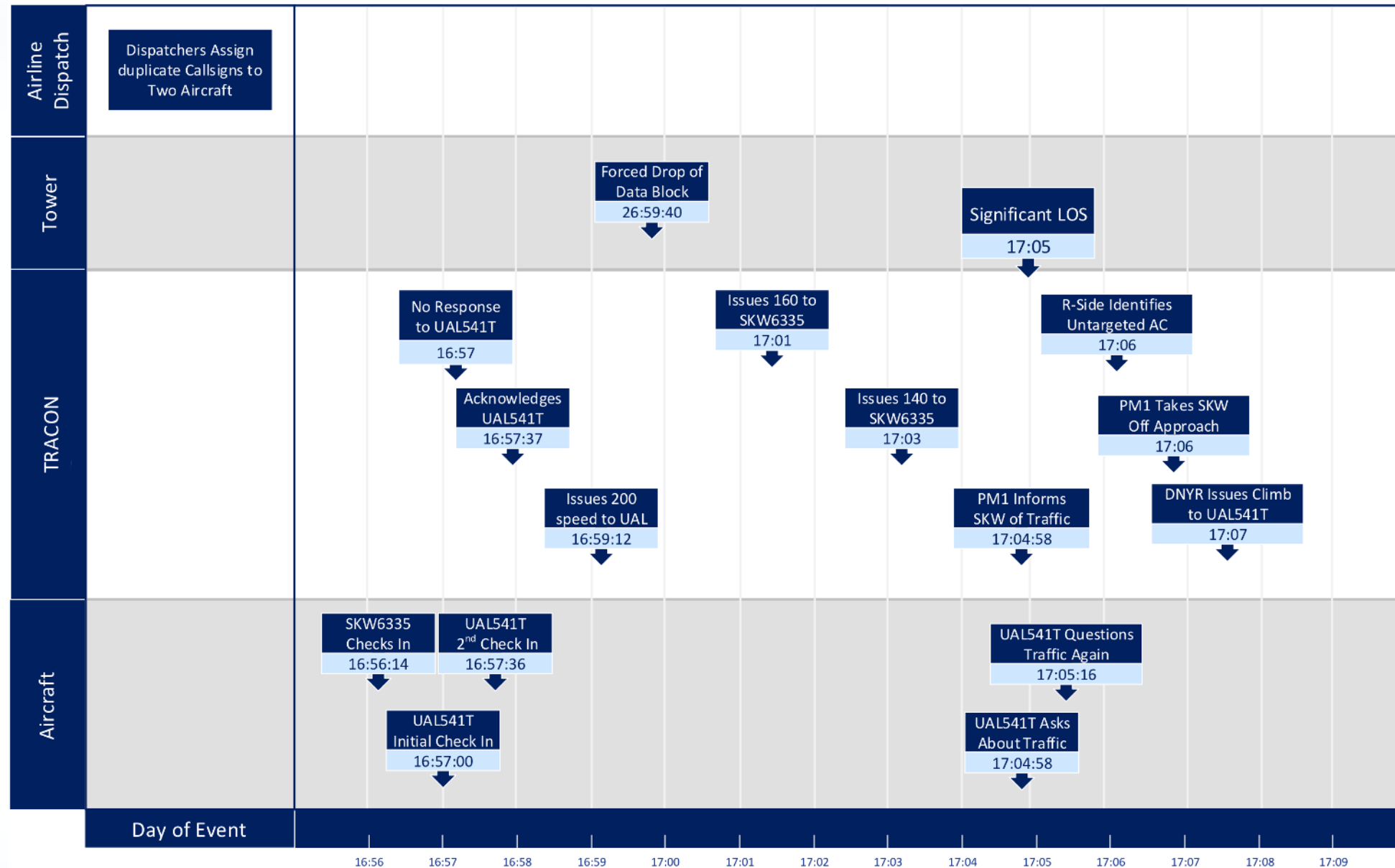


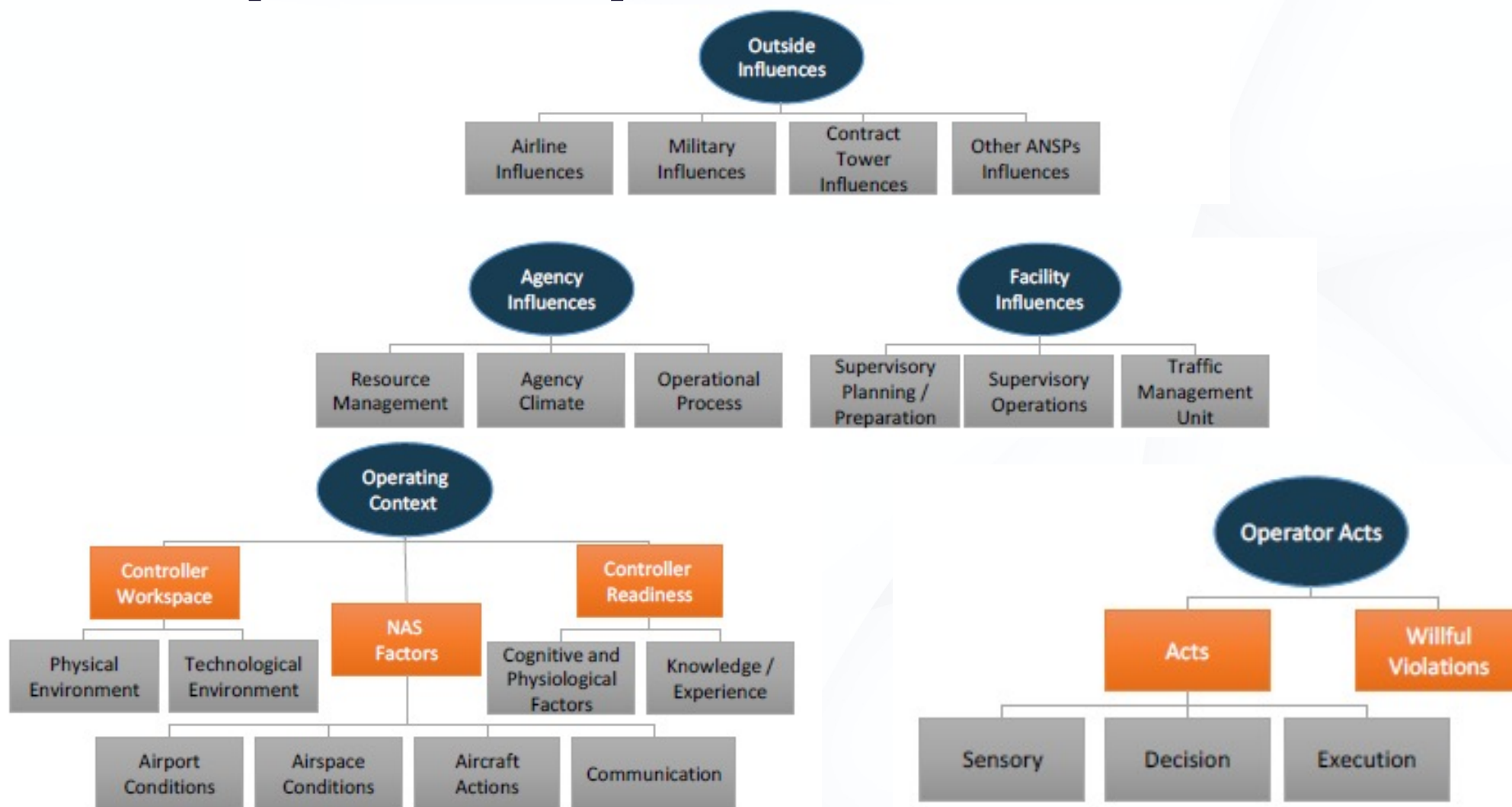




VIDEO

Factual Event Timeline





Operator Actions

Acts

Sensory

- Se01 Auditory Perception
- Se02 Visual Perception
- Se03 Temporal Perception

Decision

- De01 Alert Comprehension
- De02 Knowledge / Planning
- De03 Prioritization
- De04 Tool / Equipment Use

Execution

- Ex01 Controller Technique
- Ex02 Attention Act
- Ex03 Communication Act
- Ex04 Inadvertent Operation

Violation

Willful Violations

- VO1 Willful Violations

Outside Influence

- OI01 Airline Influences
- OI02 Military Influences
- OI03 Contract Towers
- OI04 Other ANSPs
- OI99 Other Influences

Outcome

- | Level | Description |
|-------|-------------------------|
| 0 | No Event |
| 1 | Near Airspace Violation |
| 2 | Airspace Violation |
| 3 | Near LOSS / RI |
| 4 | LOSS / RI |
| 5 | Collision |

Operator Context

Controller Workspace

Physical Environment

- PE01 Workstation / Work Area
- PE02 Lighting
- PE03 Noise Interference
- PE04 Vision Restricted

Technological Environment

- TE01 Communication Equipment
- TE02 Display / Interface
- TE03 Software / Automation
- TE04 Warnings / Alerts
- TE05 Data Block
- TE06 Flight Progress Strips
- TE07 Field Equipment

Controller Readiness

Cognitive and Physiological Factors

- CPF01 Working Memory / Distraction
- CPF02 Workload
 - a High Workload
 - b Low Workload
- CPF03 Complacency / Vigilance
- CPF04 Automation Reliance
- CPF05 Expectation Bias
- CPF06 Fatigue

Knowledge / Experience

- KE01 On-the-Job Training/Developmental
- KE02 Trainer Intervention
- KE03 CPC Experience
- KE04 Unfamiliar Task/Procedure

NAS Interactions

Airport Conditions

- APC01 Combined Positions
- APC02 Ground Vehicle Traffic
- APC03 Aircraft Traffic
- APC04 Airport Weather
 - a Visibility / IMC
 - b Wind
 - c Other Weather
- APC05 Signage/Lighting/Ground Markings
- APC06 Construction
- APC07 Layout/Design
- APC08 Runway Conditions

Airspace Conditions

- ASC01 Combined Sectors
- ASC02 Combined Positions
- ASC03 Sector Traffic
 - a Traffic Level
 - b Traffic Complexity
 - c VFR Traffic
 - d Restricted Airspace
- ASC04 Sector Weather/Turbulence
- ASC05 Sector Design

Aircraft Actions

- AA01 Deviation
 - a Procedures
 - b ATC Instructions / Clearance
- AA02 Unexpected Aircraft Performance
- AA03 Aircraft Equipment/System Operation
- AA04 Responding to Abnormal Situation
- AA05 Go Around
- AA06 Flight Planning
- AA07 TCAS RA Response

Communication

- CC01 Controller-Flight Deck Communication
 - a Readback / Hearback
 - b Phraseology / Call Sign
 - c Information / Clearance
 - d Frequency Congestion
 - e Responsiveness
- CC02 Controller-Controller Communication
 - a Position Relief Briefing
 - b Handoff / Point-Out
 - c Aircraft Information
 - d Phraseology

Facility Influences

Supervisory Planning / Preparation

- SP01 Facility Procedures
 - a SOPs
 - b LOAs
 - c Checklists / Manuals
- SP02 Staffing
- SP03 Equipment Readiness
- SP04 Training

Supervisory Operations

- SO01 Sector Combination
- SO02 Position Combination
- SO03 Controller Assignment
- SO04 Oversight / Assistance
- SO05 Sector/Airport Configuration
- SO06 Supervisory Coordination
 - a Intra-Facility
 - b Inter-Facility

Traffic Management Unit

- TM01 Weather Response
- TM02 Special Use Airspace
- TM03 Traffic Management Initiatives
- TM04 Traffic Regulation / Delivery

Agency Influences

Resource Management

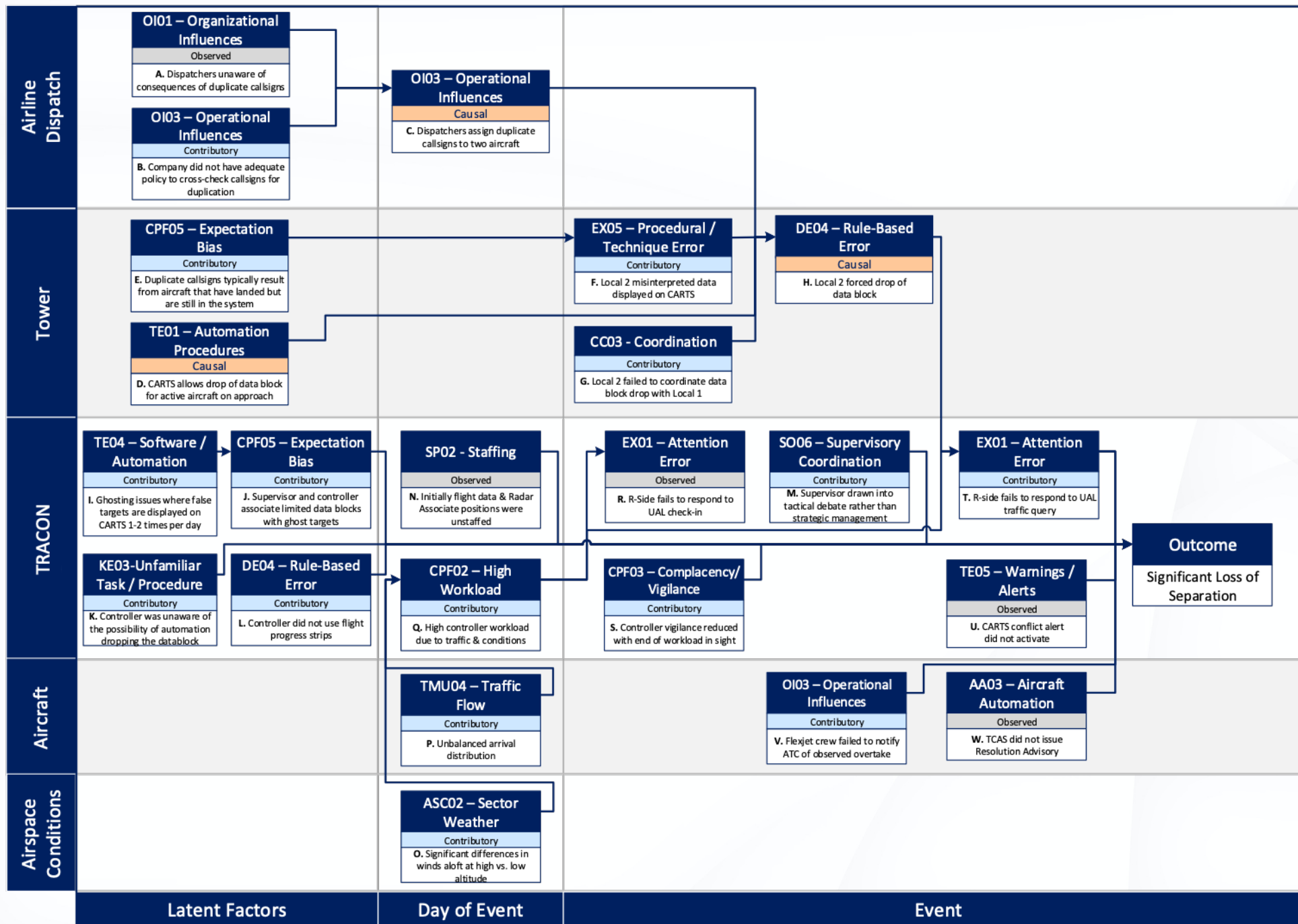
- RM01 Equipment/Facility Resources
- RM02 Human Resources

Agency Climate

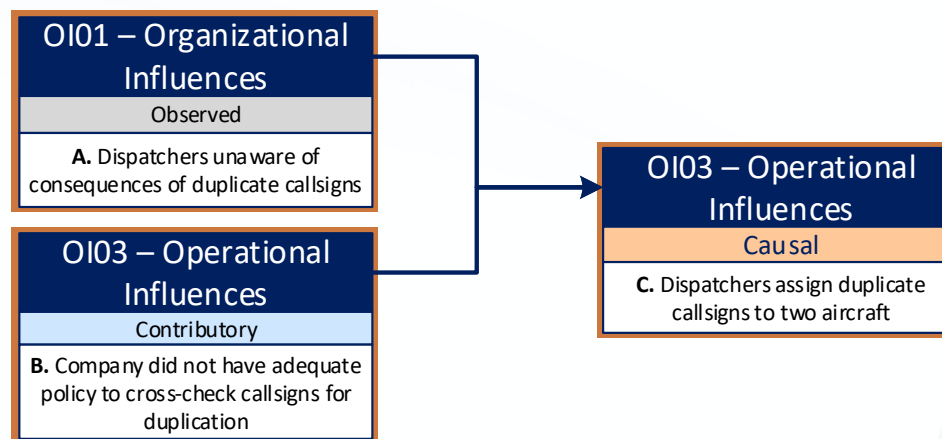
- AC01 Culture
- AC02 Policy

Operational Process

- OP01 Procedures / Operations
 - a NAS Procedures (7110.65)
 - b Charts / Routes (STAR, SID)
- OP02 Oversight
- OP03 Response to Event / Report

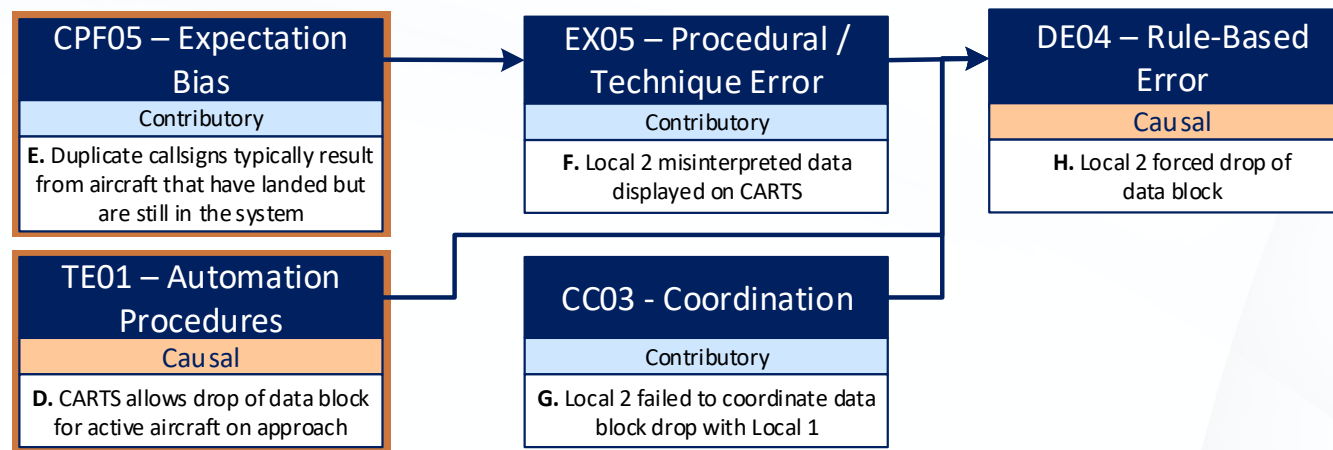


United Airlines Dispatch



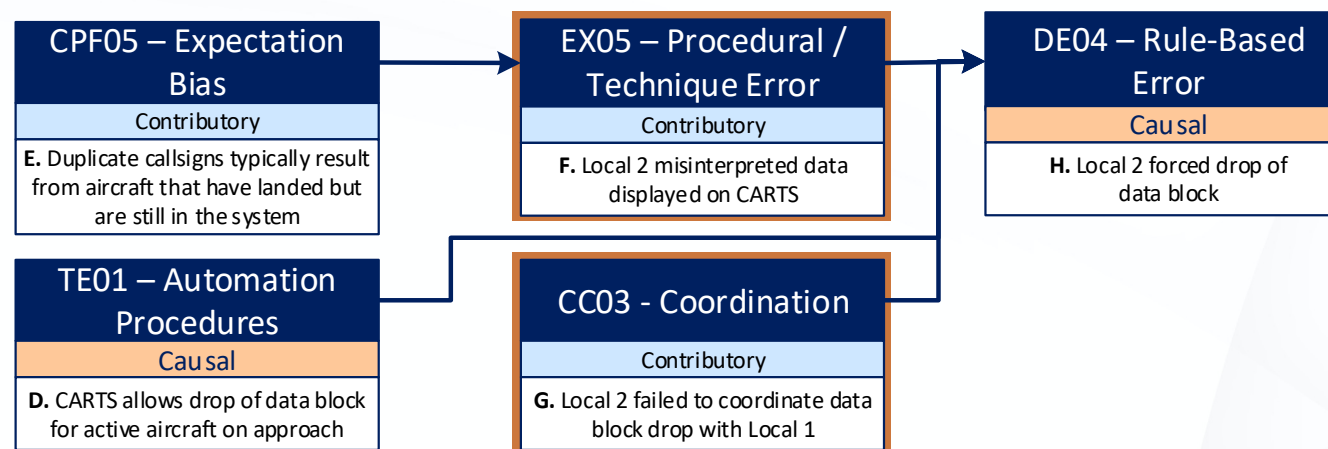
- Two UAL dispatchers independently assigned the same call sign of UAL541T to two different flights
- Lack of training on potential impact of assigning duplicate call signs
- Lack of procedures to crosscheck call signs for duplication

Tower



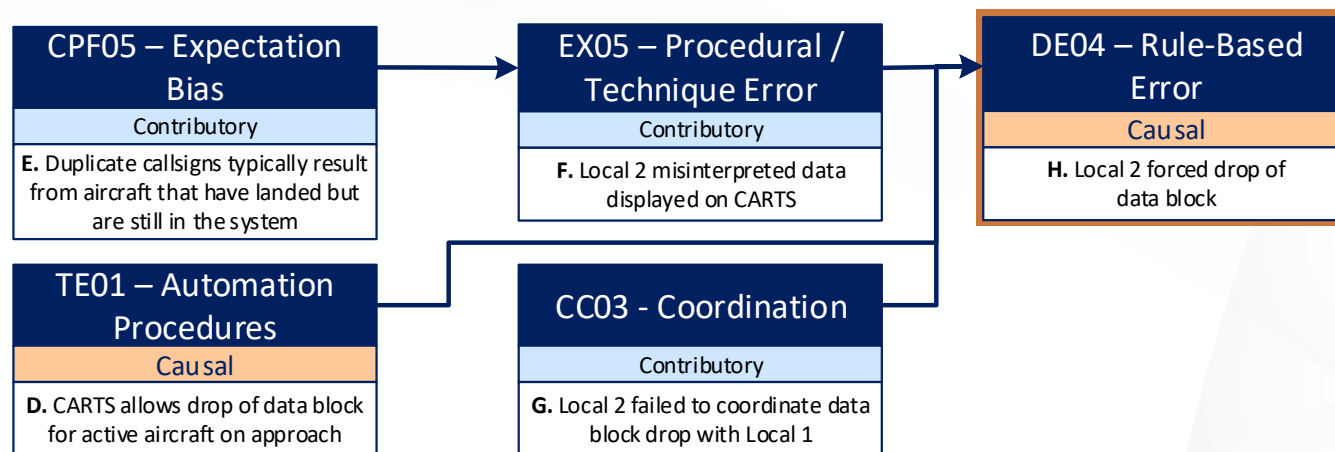
- Duplicate call signs occur frequently at the tower
 - Aircraft will remain in system after landing
 - Tower controllers force the system to drop the data block
- Lack of standard procedure for handling duplicate call signs or data blocks in CARTS
 - CARTS allows controllers at a facility to drop a data block not under his or her control

Tower



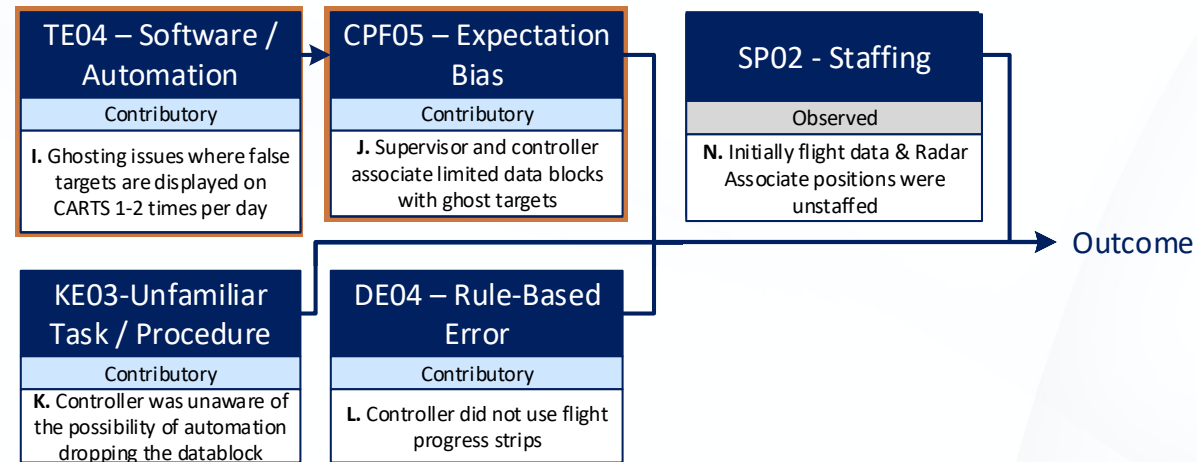
- Local 2 misinterpreted CARTS display of UAL541T duplicate call signs
 - Believed the UAL541T had already landed but remained in the system
- Local 2 did not coordinate UAL541T with Local 1
 - Local 1 was responsible but did not have time to investigate
 - Local 2 wanted to help Local 1 during a busy time

Tower



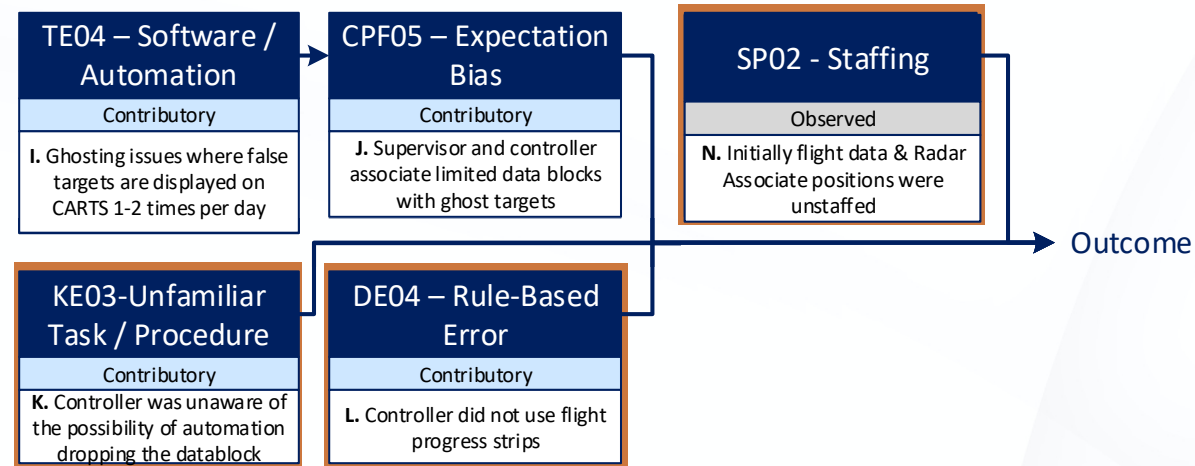
- Local 2 forced dropped the inbound UAL541T data block from CARTS
 - Performed a “track-drop-slant(\)-ok” command

TRACON



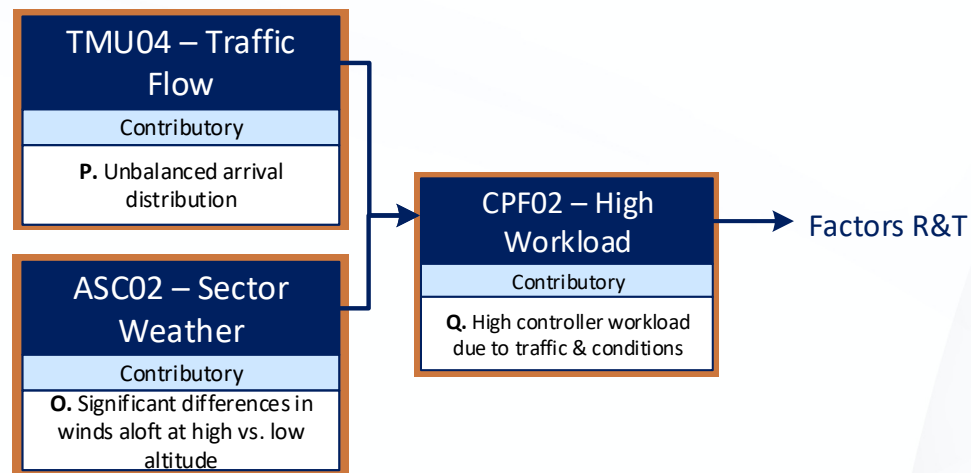
- Initial activation of Fusion system resulted in many issues of ghosting
 - Occurred approximately 1 to 2 times a day
- Ghosting issue coupled with frequency of occurrence resulted in TRACON controllers' expectation bias
 - Misdiagnosed UAL541T limited data block as ghost target

TRACON

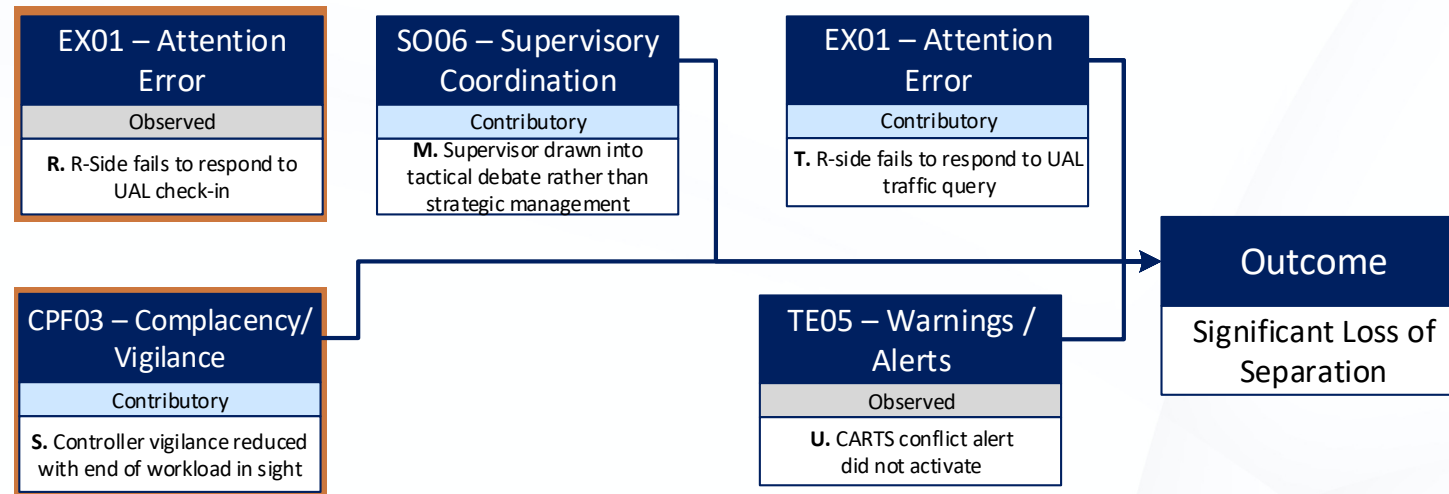


- Lack of TRACON controller training and briefings on automation reliability and limitations
 - Difficult for controller to adequately identify and respond to data block dropping out of system
- Radar Controller was not using flight progress strips
 - Flight progress strips serve as short-term memory aid
- FLM did not staff the flight data or radar associate positions
 - Primary airport Area is short-staffed
 - Primary airport Area controllers work more overtime than other TRACON areas

TRACON Controller

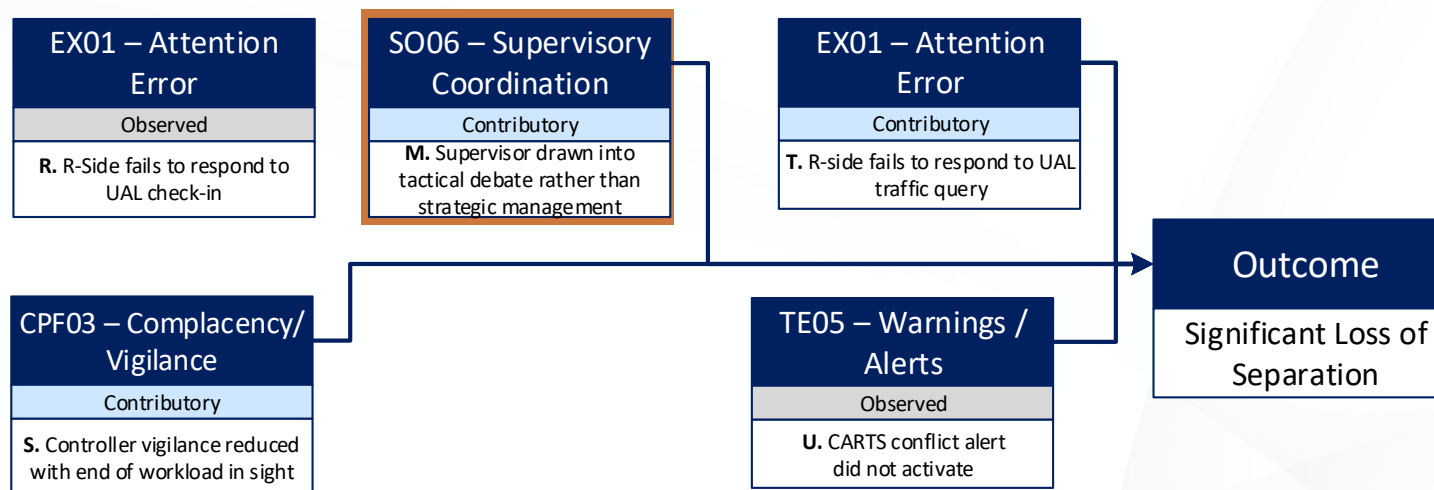


- Unbalanced arrival distribution of Radar Controller arrivals
 - Maximum of 60 aircraft per hour
 - Believed more than 15 aircraft entered sector in 15 minutes prior to event
- Sector weather led to compression of finals
- Resulting in high workload during busy period
 - Combination of weather and unbalanced arrival distribution



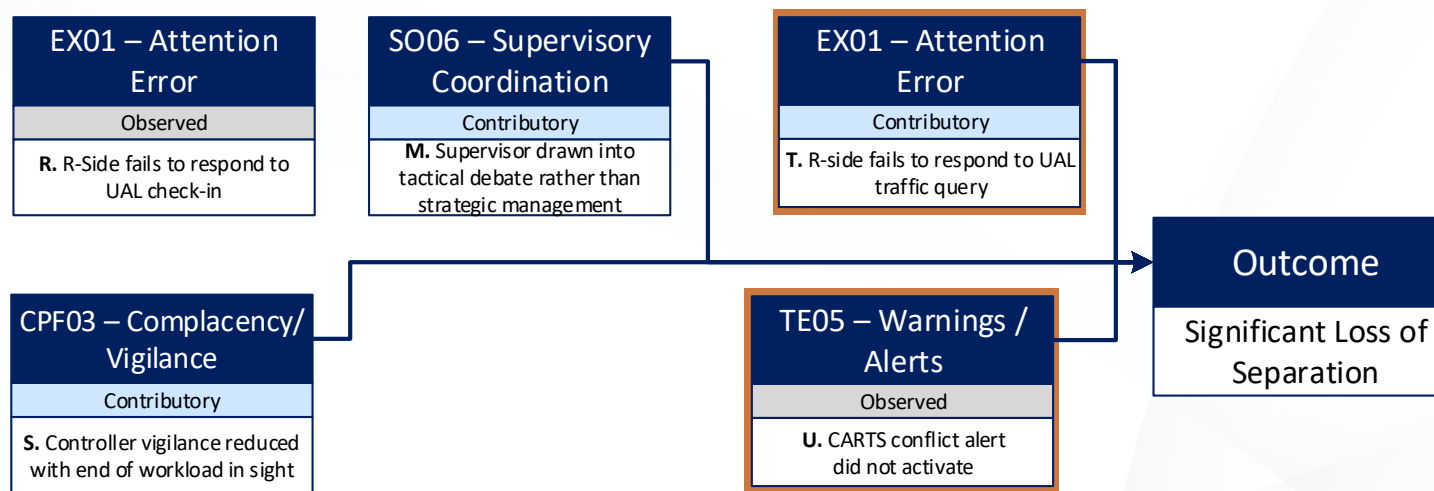
- Radar controller did not respond to initial UAL541T check-in
 - Attention was focused on compressed finals
- Radar controller was anticipating a reduction in workload with the end of a traffic rush
 - UAL541T was last in stream
 - Did not request radar associate assist

TRACON



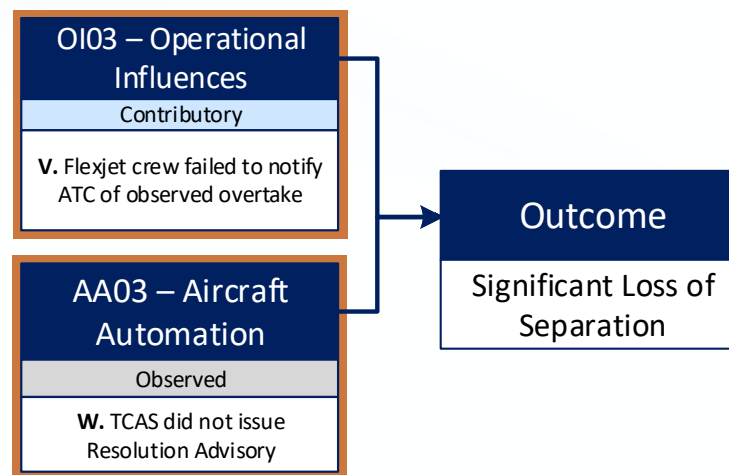
- Radar controllers were investigating the believed ghost target (UAL541T)
- FLM did not check the system to confirm or deny the status of ghost target
 - Drawn into tactical discussion with controllers

TRACON



- Radar controller did not respond to UAL541T traffic query
 - Attention was focused discussion of believed ghost target
- Conflict alert did not activate
 - None of the activation parameters were met
- Radar controller identified ghost target as UAL541T dropped data block
- UAL541T in slow overtake situation with SKY6335
 - Significant loss of separation minima event

Other Influences



- Flightcrew of Flexjet did not notify ACT of observed overtake
 - Informed ATC after the event of awareness of unsafe situation
- Neither UAL541T nor SKW6335 received a TCAS-RA
 - None of the activation parameters were met



THANK YOU





QUESTIONS AND ANSWERS



Mr. Shayne Campbell

Safety Programme Manager

CANSO

Next webinars

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- **Wednesday 28 July:** Event Investigation Process
(Microsoft Teams) – invitations sent by Chime Agu
- **Wednesday 4 August:** Accident Investigation and
Transition from Compliance to Risk

08:00-09:30 EDT // 12:00-13:30 UTC



THANK YOU

