HUMAN FACTOR INITIAL

REQUIREMENTS BY CAAM

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HUMAN FACTOR INITIAL

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HUMAN FACTOR INITIAL

THE NEED TO ADDRESS HUMAN FACTOR

HUMAN FACTOR INITIAL

- *CAAM Regulation*

-CAD 8601 5.2(e) - Application of human factors and human performance

- CAGM 3.5.8 All staff should be able to demonstrate an understanding of human factors and human performance issues in relation to their job function and be trained as per 3,6 of this CAGM.

-CAD 8601 5.2(2) - Application of human fasters and human performance

- CAGM 3.6.3 All personnel, including personnel being recruited from any other organisation should receive initial human factors training compliant with the organisation's training standards prior to commencing, actual job function, unless their competence assessment justifies that there is no need for such training. Newly directly employed personnel working under direct supervision may receive training within 6 months after joining the maintenance organisation.

-CAD 8601 8.3 Appendix 3 - Component certifying staff requirement

- 1.3.2.4 The C/S shall be able to demonstrate he/she received, as appropriate, training on Initial Human Factor training.

HUMAN FACTOR INITIAL

- *EASA Regulation*

EASA Part M.A.402 - Performance of Maintenance
Except for maintenance performed by a maintenance organisation approved in accordance with Annex II
(Part-145), any person or organisation performing maintenance shall:

- ensure that the risk of multiple errors during maintenance and the risk of errors being repeated in identical maintenance tasks are minimised.
- ensure that an error capturing method is implemented after the performance of any critical maintenance task.

EASA PART 145.A.48 - Performance of Maintenance
The organisation shall ensure that:

- An error-capturing method is implemented after the performance of any critical maintenance task.
- The risk of errors during maintenance and the risk of errors being repeated in identical maintenance tasks are minimised.

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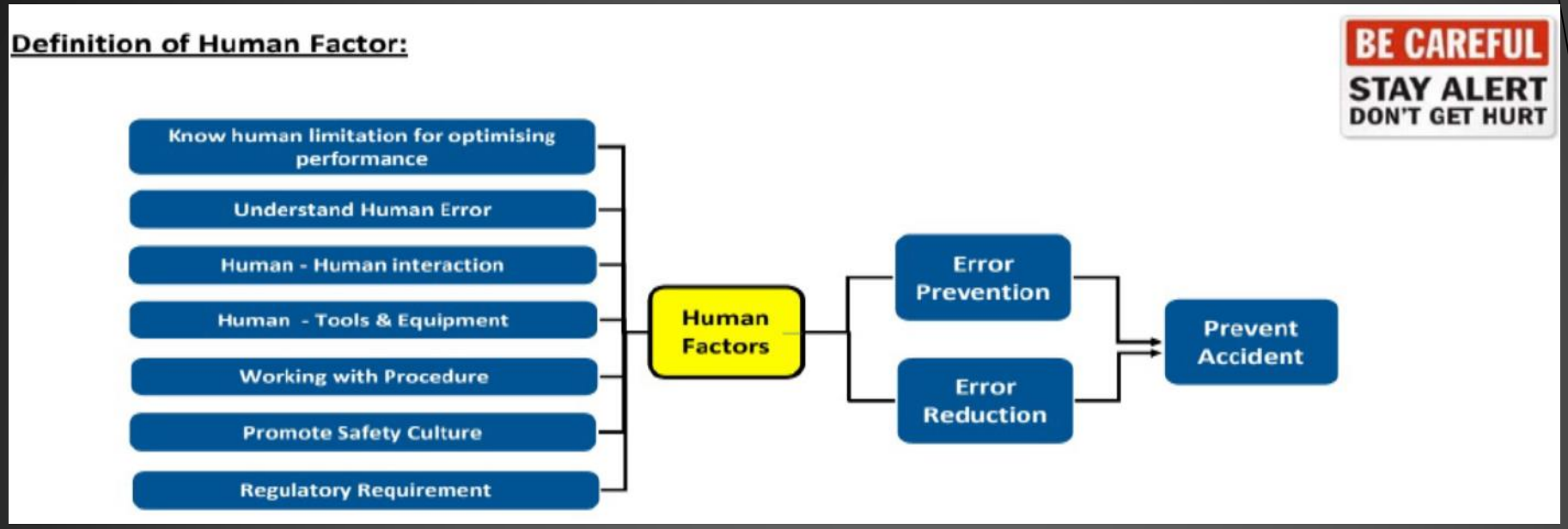

"Human Factors means principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration of human performance. "Human Performance" means human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations."

HUMAN FACTOR INITIAL

- In Human Factor We Aim To:

1. Learn the way we work
2. Why error occur ?
3. Design better ways

HUMAN FACTOR INITIAL

- Why are human conditions, such as fatigue, complacency, and stress, so important in aviation maintenance?

- Human factors directly cause or contribute to many aviation accidents.
- It is universally agreed that 80% of maintenance errors involve human factors.
- If they are not detected, they can cause wasted time, worker injuries, events, and even deaths.

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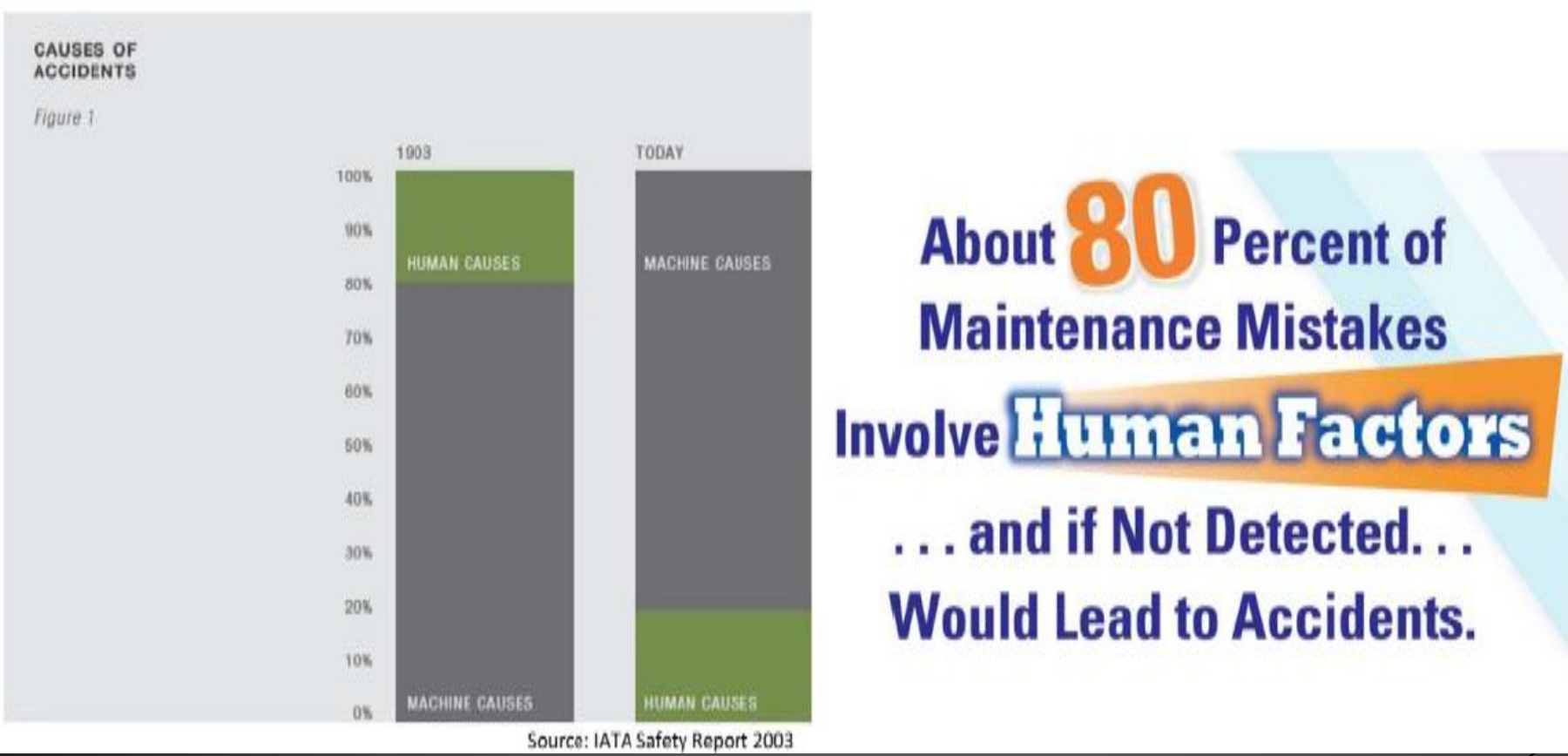

Source: IATA Safety Report 2003

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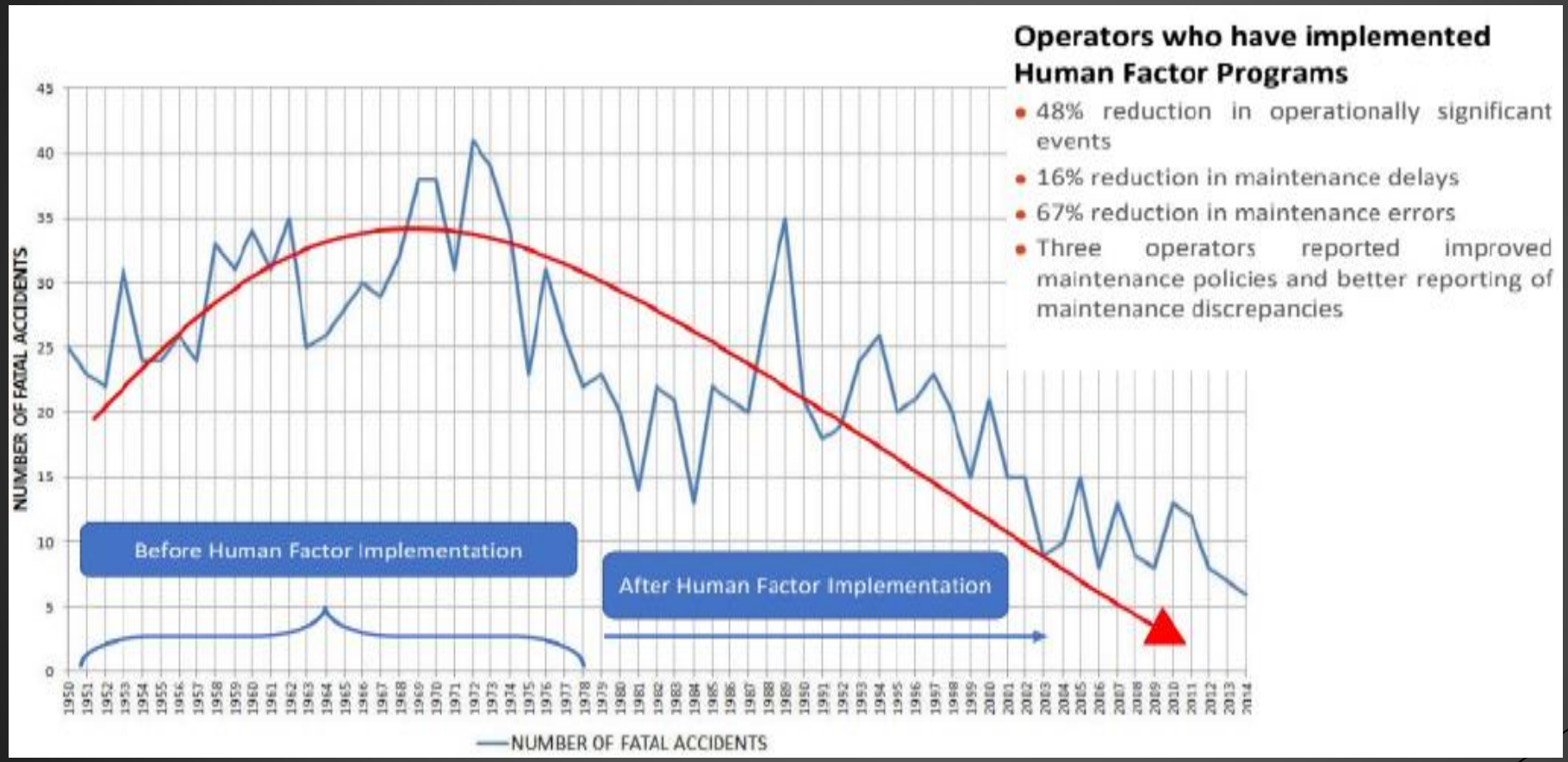

STATISTIC

HUMAN FACTOR INITIAL

Causes of air accidents
The top four ranked onboard fatalities (1982-1991)

1. Controlled flight into terrain (2169)
2. Maintenance and inspection (1481)
3. Loss of control (1387)
4. ATC and communication (1000)

Source, Janses Reason, 1936

- Maintenance and Inspection ranks second after CHIT. Aviation Industry has implemented a proactive approach to agree with the application of the lessons learned.

HUMAN FACTOR INITIAL

Top Eight Common Maintenance Error

- Incorrect installation of components
- Fitting of wrong parts
- Wrong electrical wiring of part (including cross connection)
- Loose object left on aircraft (FOD)
- Insufficient lubrications
- Cowling and/or refuel panel not secured
- Landing gear ground lock pin not removed before flight

- Some of the other related causes are:

- Complex maintenance related task
- Time pressure for delivering the aircraft
- Fatigue of the maintenance personnel
- Maintenance procedure not followed accordingly
- Usage of outdated maintenance manuals

HUMAN FACTOR INITIAL

Maintenance errors contribute to:

- About 15-40% of all major airline accidents
- 20-30% of all in-flight engine shutdowns at $500,000 per shutdown
- 50% of all flight delays at $10,000 per hour
- 50% of all flight cancellations at $50,000 each
- Errors also cost millions o doliars in reworks, Kround damage, lost time, etc.

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INCIDENTS/ACCIDENTS INVOLVING HUMAN ERROR

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- The aircraft climbed to FL120 where the crew tried to troubleshoot the problem. When they found out that the captain's side stick was reversed in roll, they returned to Frankfurt.
- Investigation revealed that maintenance had been performed on the Elevator Aileron Computer no. 1 (ELAC).
- Two pairs of pins inside the connector had accidentally been crossed during the repair.

HUMAN FACTOR INITIAL

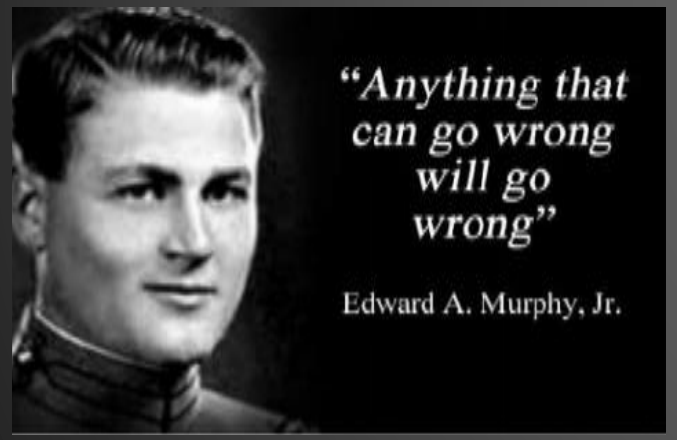
- The area of damaged skin in Section 46 was not removed (trimmed) and the repair doubler which was supposed to cover in excess of 30% of the damaged area did not extend beyond the entire damaged area enough to restore the overall structural strength
- Consequently, an explosive decompression of the aircraft occurred, once the crack opened up, causing the complete disintegration of the aircraft in mid-air

HUMAN FACTOR INITIAL

- The aircraft crashed on the bank of Seti River and partially ended up in a deep gorge, killing all 72 on board.
- The flight was operated by two captains, one captain was in the process of obtaining aerodrome familiarization for operating into Pokhara and the other captain being the instructor pilot
- The captain being familiarized who was occupying the left hand seat, was the Pilot Flying (PF) and the instructor pilot, occupying the right hand seat, was the Pilot Monitoring (PM)

HUMAN FACTOR INITIAL

- **Murphy's law** is a popular adage that states that "things will go wrong in any given situation, if you give them a chance," or more commonly, "whatever can go wrong, will go wrong"



How did it come about ?

- Murphy law was born at Edwards Air Force Base in 1949 at North Base.
- It was named after Capt. Edward A. Murphy, an engineer working on the Air Force Project MX981, (a project) designed to see how much sudden deceleration a person can stand in a crash.
- One day, after finding that a transducer was wired wrongly, he cursed the technician responsible and said, "If there is any way to do it wrong, he'll find it."
- The contractor's project manager kept a list of "laws" and added this one, which he called Murphy's Law.

HUMAN FACTOR INITIAL

CHAPTER 2

SAFETY CULTURE / ORGANISATIONAL'S FACTORS

HUMAN FACTOR INITIAL

- *Chapter 2 : Safety Culture/ Organisational's Factors*

-2.1 Organisation culture

-2.2 Safety culture

-2.3 Safety Management System

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WHAT IS A CULTURE ?

A culture is a way of life of a group of people

- *Involves the behaviors, beliefs, values,* and *symbols* that they accept.
- Generally, without thinking about them.
- They are passed along by communication ad imitation from one generation

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ORGANIZATIONAL CULTURE

- There can be an overall organizational culture, and several different sub-cultures, The prevailing culture of the industry as a whole also influences individual organizations.

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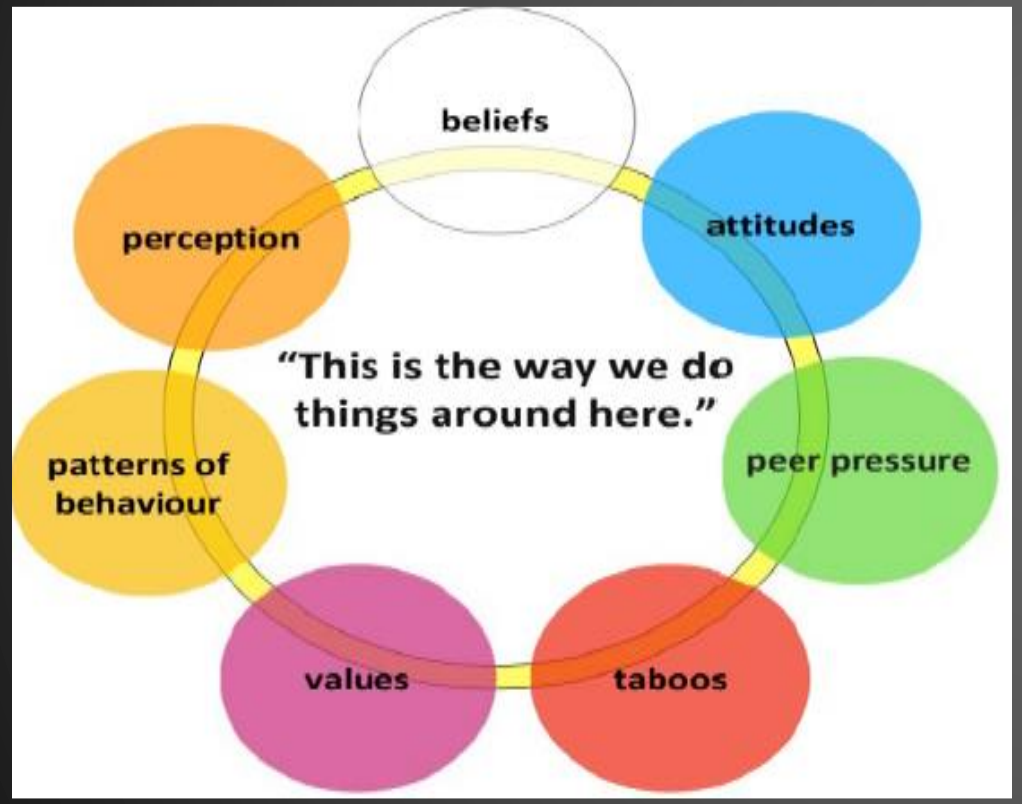
ORGANIZATIONAL CULTURE

- Culture can be best understood as "the way we do things around here".



- It is a mix of shared values, attitudes and patterns of behaviour that give the organisation its particular character.
- Culture forms the context within which people judge the appropriateness of their behaviour.
- An organisation's culture will influence human behaviour and human performance at work. However, some Safety and Health survey has shown that culture is very poor and does not encourage safe behaviour, rather, it encourages unsafe behaviour and blames employees when something goes wrong.
- Employees won't participate as a result of fear. There is low rust and credibility, and probably poor communication within the organization.

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SAFETY CULTURE

What is safety culture ?

- Natural consequences of having humans in the aviation system
- “How people behave in relation to safety and risk when no one is watching”

A safety culture Involves:

- aware of the risks and known hazards faced by the organization and its activities;
- continuously behaving to preserve and enhance safety;
- able to access the resources required for safe operations;
- willing and able to adapt when facing safety issues;
- willing to communicate safety issues; and
- consistently assessing the safety related behaviours throughout the organization

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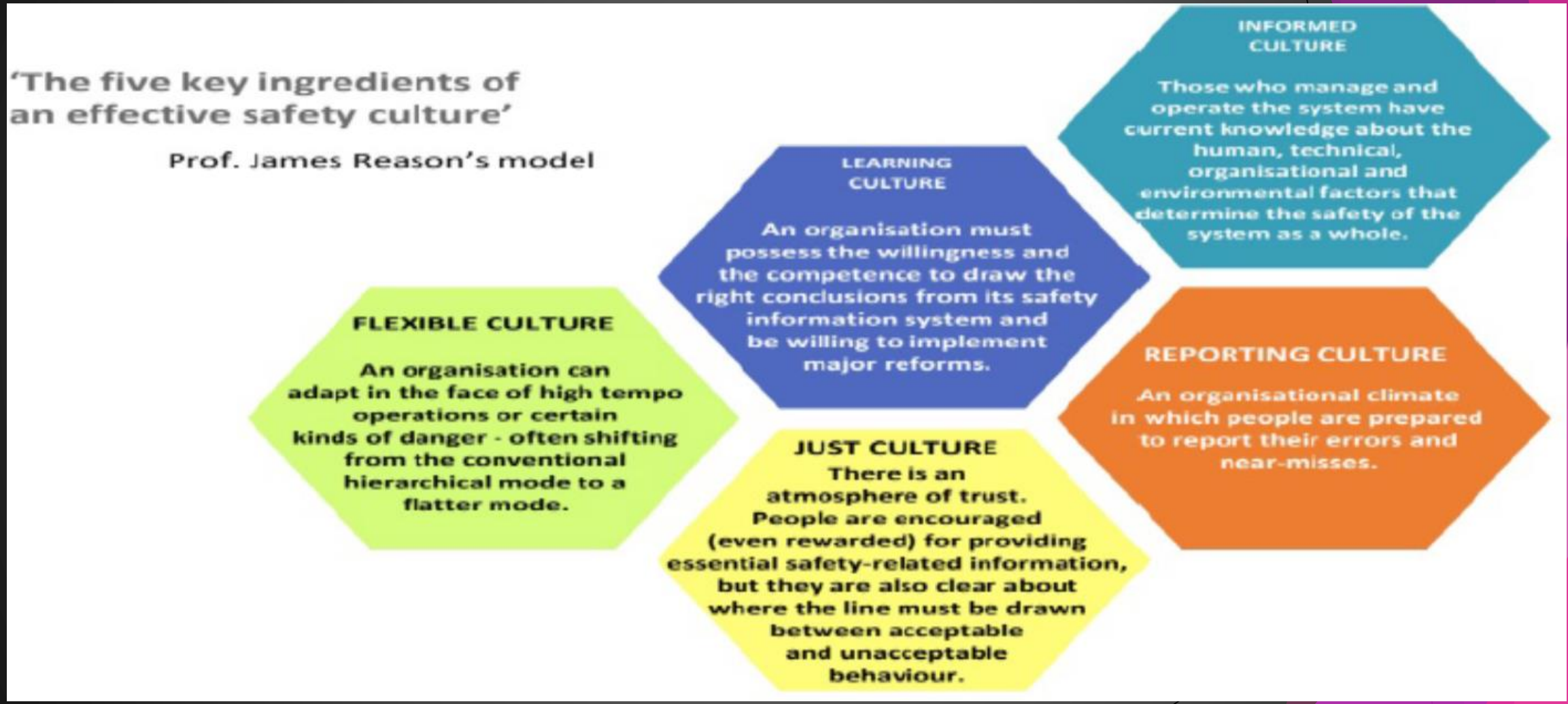
SAFETY CULTURE



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SAFETY CULTURE

The priority given to safety in organizational planning and day to day operations, both at the management and operational levels

Cooperation and coordination between team members (within a team across teams)

Acceptance at the organisational and individual levels of the responsibility of safety

People are willing to report safety occurrences, without fear of being blamed and the organization having the will and capability to learn from safety occurrences

Employees and the managers participation in safety discussion activities and improvement

Vertical and horizontal communication channels are efficient and people fave faith in the process their peers and managers

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SAFETY CULTURE

Safety culture...

- Involves every level of the organization
- Is a subset of the whole organization's culture
- Reduces accidents
- It is the ideas and beliefs that all members of the organization share about risk, accidents and ill health".

"When Safety and Health are part of the organization's way of life, everyone wins."

The largest influence on safety culture are:

The best Safety and Health Programs involve every level of the organization, instilling a safety culture that reduces accidents for workers and improves the bottom line for managers. When Safety and Health are part of the organization's way of life, everyone wins

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SAFETY CULTURE / ORGANISATIONAL FACTORS

Discussion

How does these organizational culture affect me?

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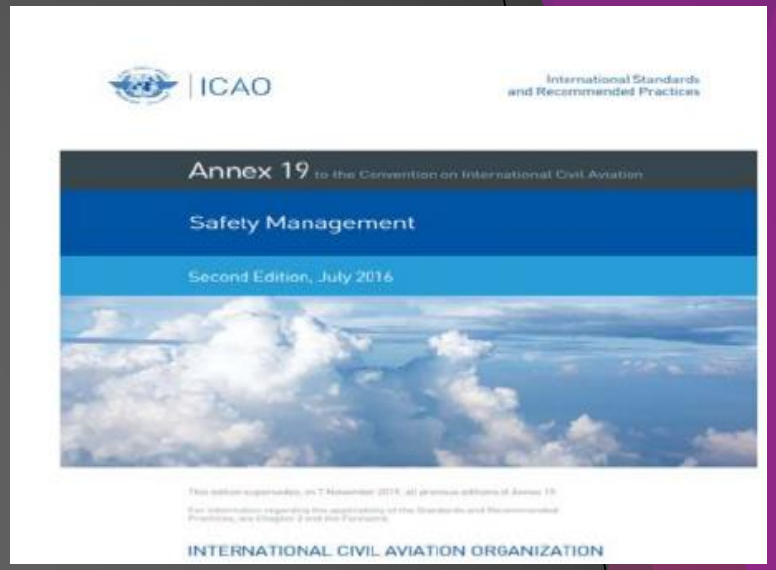
SAFETY MANAGEMENT SYSTEM (SMS)

AIROD Aerospace Technology Sdn Bhd

ICAO Annex 19 Safety Management

The benefits identified of this approach included:

- Address safety risks proactively;
- Manage and support strategic regulatory and infrastructure developments;
- Re-enforce the role played by the State in managing safety at the State level, in coordination with service providers;
- Stress the concept of overall safety performance in all domains.



Modern safety management principles lead to safety risks being addressed more strategically by regulators and aviation service providers. Since air traffic is projected to increase significantly in the next 15 years, safety risks must be addressed proactively to ensure that this significant capacity expansion is carefully managed and enabled through strategic regulatory and infrastructure developments.

The High-level Safety Conference held in 2010 recommended a new Annex dedicated to States safety management responsibilities and processes framed under the State safety programme (SSP)

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SAFETY MANAGEMENT SYSTEM (SMS)

CIVIL AVIATION AUTHORITY OF MALAYSIA (CAAM) has mandated all Approved Maintenance Organization (AMO) to implement Safety Management System (SMS), for improvement on existing levels of aviation safety in the light of the continuing growth of the industry.

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SAFETY MANAGEMENT SYSTEM (SMS)

- SMS PILLARS

- Management commitment
- Safety accountability and responsibilities
- Appointment of key safety personnel
- Coordination of emergency response planning
- SMS documentation

- Hazard identification
- Safety risk assessment and mitigation

- Safety performance monitoring and measurement
- The management of change
- Continuous Improvement of the SMS

- Training and education
- Safety communication

CHAPTER 3 HUMAN ERROR

HUMAN FACTOR INITIAL

Chapter 3 : Human Error

3.1 Error models and theories
3.2 Types of error in maintenance tasks
3.3 Violacion
3.4 implication of errors
3.5 Avoiding and managing errors
3.6 Human reliability

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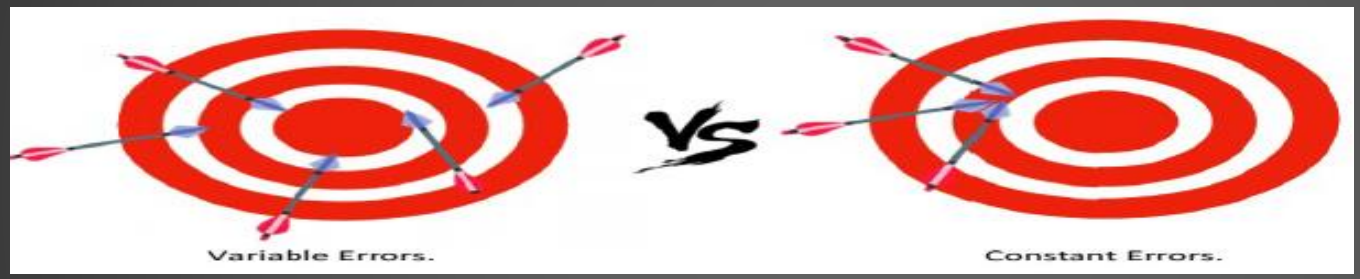
ERROR MODELS AND THEORIES VARIABLE VERSUS CONSTANT ERRORS

Errors can be variable or consistent

- Constant errors may be predicted and therefore controlled
- Variable errors cannot be predicted and are much difficult to deal with.



If we have enough knowledge about the nature of the task, the environment it is performed in, the factors governing performance, and the behavior of the individual, we have a greater chance of predicting an error. However, it is unlikely to have enough information to allow accurate predictions

Example:

We can generally only predict along the lines of "re-assembly tasks are more likely to incur errors than dismantling tasks," or "a technician is more likely to make an error at 1 A.M.. after having worked 12 hours, than at 10 A.M., after having worked only 2 hours." One may refine these predictions with more information, but there will always be random elements which are unpredictable

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ERROR MODELS AND THEORIES VARIABLE VERSUS CONSTANT ERRORS

Error can be reversible or irreversible.

-A well-designed system or procedure is a system which errors are reversible.

For example, if a pilot miscalculates the amount of fuel he should carry, he may divert to a closer airfield. but if he accidentally dumps his fuel inflight, he may not have options open to him.

A well-designed system or procedure should mean that errors made by aircraft maintenance technicians are reversible. Thus, if a technician installs a part incorrectly, it should be easily spotted and corrected before the aircraft is released to service by the supervisory procedures in place.

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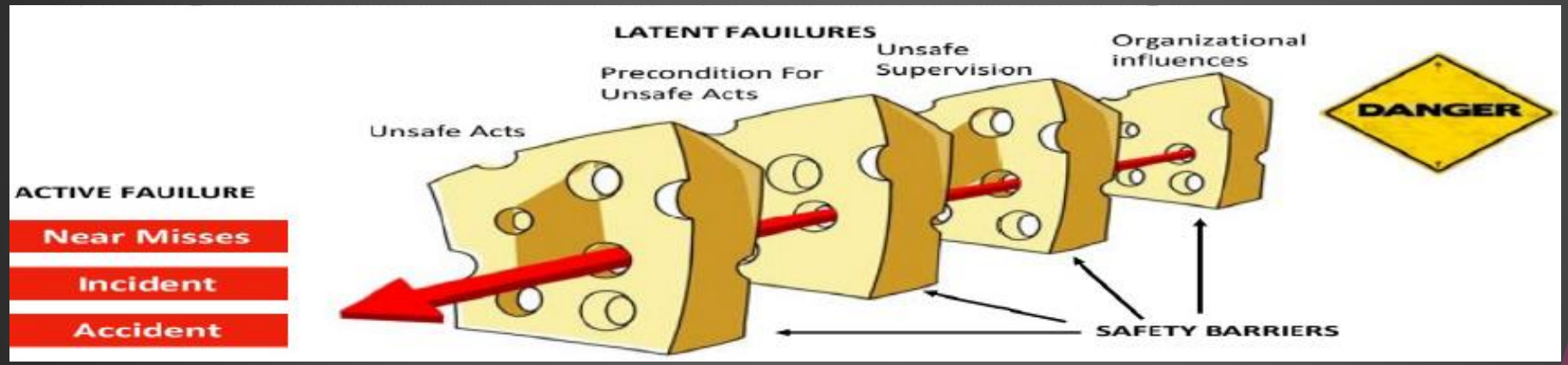
SWISS CHEESE MODEL

What is the Swiss Cheese Model?

- Is an organization's defenses against failure
- A series of barriers, represented as slices of the cheese.
- The holes in the cheese slices represent individual weaknesses in individual parts of the system.
- The holes are continually varying in size and position in all slices.
- Preventing errors that could lead to an accident, is to ensure the holes do not align.



The Swiss Cheese model of accident causation is a model used in risk analysis and risk **management in aviation safety**. Risk of a threat becoming a reality is mitigated by the differing layers and types of defenses which are "layered" behind each other. Therefore, in theory, lapses and weaknesses in one defense do not allow a risk to materialize, since other defences also exist, to prevent a single point of weakness.

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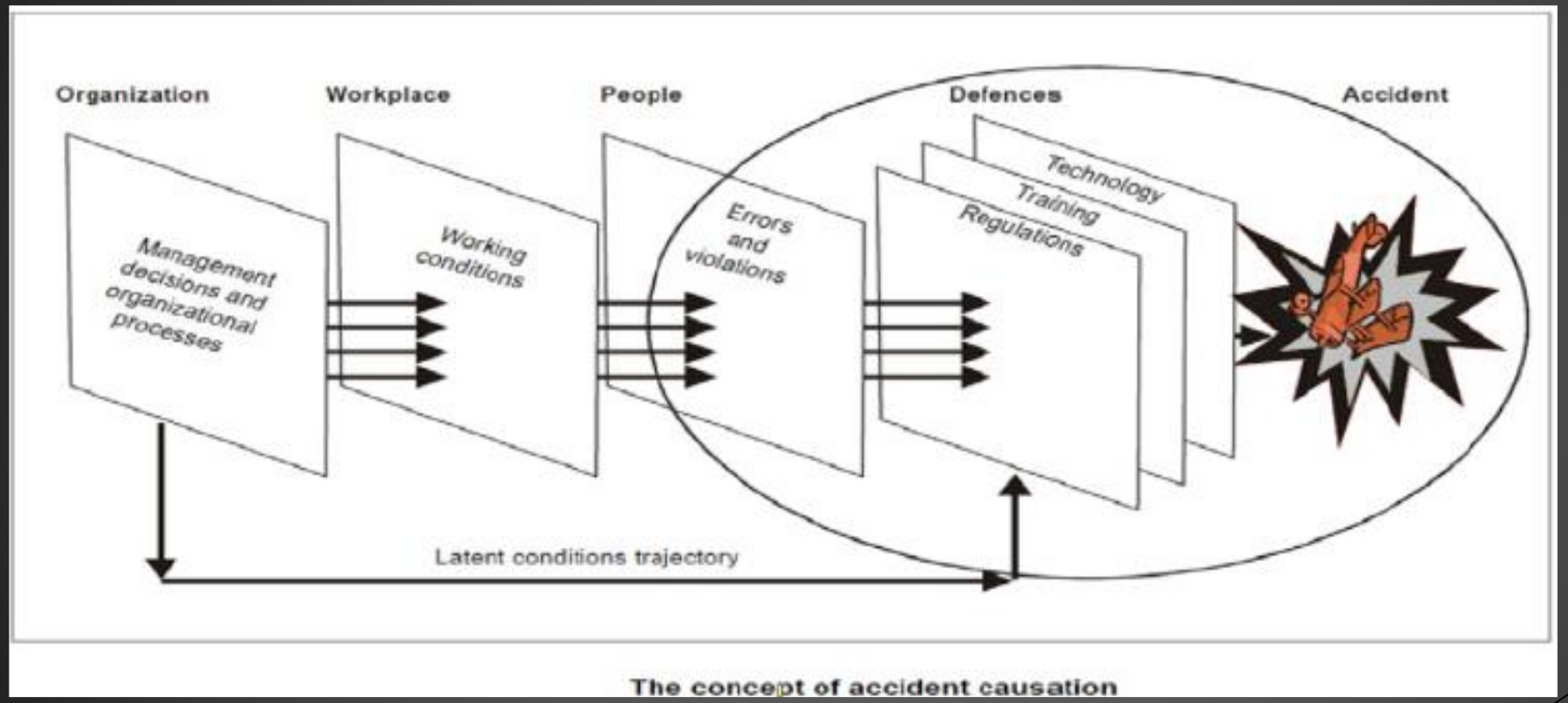
SWISS CHEESE MODEL



The concept of accident causation

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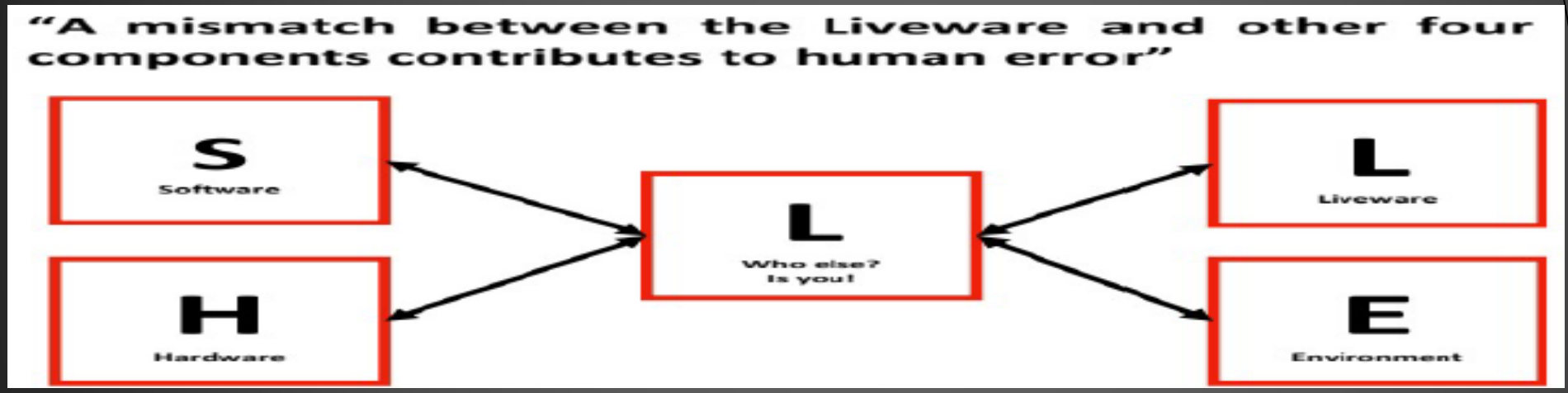
SHELL MODEL

The SHELL model

- conceptual model of human factors
- human factor relationships between aviation system resources/environment (the flying subsystem) and the human component in the aviation system (the human subsystem).



The SHELL model is a conceptual model of human factors that clarifies the scope of aviation human factors and assists in understanding the human factor relationships between aviation system resources/environment (the flying subsystem) and the human component in the aviation system (the human subsystem). The SHELL model adopts a systems perspective that suggests the human is rarely, if ever, the sole cause of an accident.

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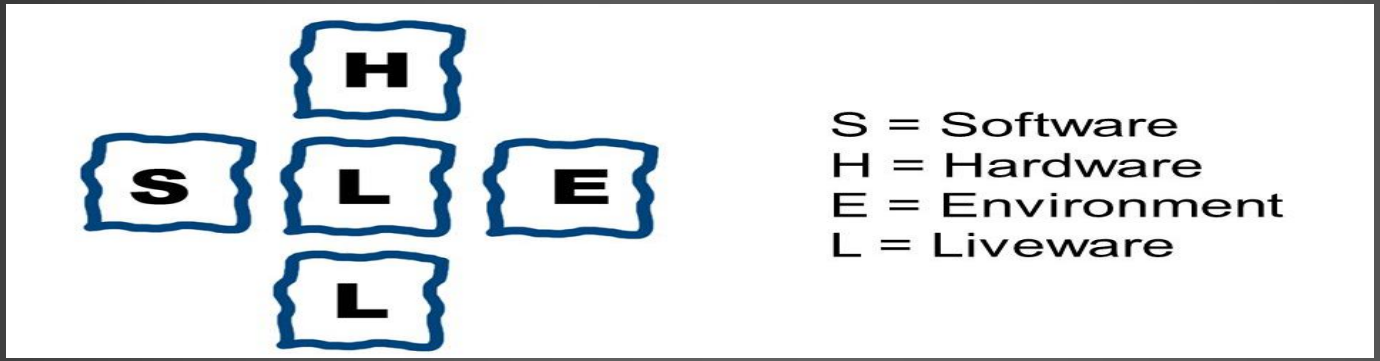
SHELL MODEL



Software includes rules, instructions, aviation regulations, policies, norms, laws, orders, safety procedures, standard operating procedures, customs, practices, conventions, habits, symbology, supervisor commands and computer programmes.
Human element or people in the aviation system.
For example, flight crew personnel who operate aircraft, cabin crew, ground crew, Management and administration personnel.
Environment includes the immediate physical work area such as weather, aircraft cabin, temperature, air pressure, humidity, noise, vibration and ambient light levels.
Physical elements of the aviation system such as aircraft (including controls, surfaces, displays, functional systems and seating), operator equipment, tools, materials, buildings, vehicles, computers, conveyor belts etc.

HUMAN FACTOR INITIAL

THE DIRTY DOZEN

The Dirty Dozen developed by Gordon Dupont in 1993, refers to twelve of the most common human error preconditions, or conditions that can act as precursors, to accidents or incidents. These twelve elements influence people to make mistakes. The Daim of the concept was to focus attention and resources towards reducing and capturing human error. Therefore, for each element on The Dirty Dozen list there are examples of typical countermeasures designed to reduce the possibility of any human error from causing a problem.

HUMAN FACTOR INITIAL

THE DIRTY DOZEN

1

Lack of Communication

Failure to transmit, receive, or provide enough information to complete a task. Never assume anything.

Only 30% of verbal communication is received and understood by either side in a conversation. Others usually remember the first and last part of what you say.

Improve your communication—

- Say the most important things in the beginning and repeat them at the end.
- Use checklists.

2

Complacency

Overconfidence from repeated experience performing a task.

Avoid the tendency to see what you expect to see—

- Expect to find errors.
- Don't sign it if you didn't do it.
- Use checklists.
- Learn from the mistakes of others.

HUMAN FACTOR INITIAL

THE DIRTY DOZEN

3

Lack of Knowledge

Shortage of the training, information, and/or ability to successfully perform.

Don't guess, know—

- Use current manuals.
- Ask when you don't know.
- Participate in training.

4

Distractions

Anything that draws your attention away from the task at hand.

Distractions are the #1 cause of forgetting things, including what has or has not been done in a maintenance task.

Get back in the groove after a distraction—

- Use checklists.
- Go back 3 steps when restarting the work.

HUMAN FACTOR INITIAL

THE DIRTY DOZEN

5

Lack of Teamwork

Failure to work together to complete a shared goal.

Build solid teamwork—

- Discuss how a task should be done.
- Make sure everyone understands and agrees.
- Trust your teammates.

6

Fatigue

Physical or mental exhaustion threatening work performance.

Eliminate fatigue-related performance issues—

- Watch for symptoms of fatigue in yourself and others.
- Have others check your work.

HUMAN FACTOR INITIAL

THE DIRTY DOZEN

7

Lack of Resources

Not having enough people, equipment, documentation, time, parts, etc., to complete a task.

Improve supply and support—

- Order parts before they are required.
- Have a plan for pooling or loaning parts.

8

Pressure

Real or perceived forces demanding high-level job performance.

Reduce the burden of physical or mental distress—

- Communicate concerns.
- Ask for extra help.
- Put safety first.

HUMAN FACTOR INITIAL

THE DIRTY DOZEN

Lack of Assertiveness

Failure to speak up or document concerns about instructions, orders, or the actions of others.

Express your feelings, opinions, beliefs, and needs in a positive, productive manner—

- Express concerns but offer positive solutions.
- Resolve one issue before addressing another.

Stress

A physical, chemical, or emotional factor that causes physical or mental tension.

Manage stress before it affects your work—

- Take a rational approach to problem solving.
- Take a short break when needed.
- Discuss the problem with someone who can help.

HUMAN FACTOR INITIAL

THE DIRTY DOZEN

11

Lack of Awareness

Failure to recognize a situation, understand what it is, and predict the possible results.

See the whole picture—

- Make sure there are no conflicts with an existing repair or modifications.
- Fully understand the procedures needed to complete a task.

12

Norms

Expected, yet unwritten, rules of behavior.

Help maintain a positive environment with your good attitude and work habits—

- Existing norms don't make procedures right.
- Follow good safety procedures.
- Identify and eliminate negative norms.

HUMAN FACTOR INITIAL

Office / Home work:

Make a record of "Accident Free Days" using a whiteboard of flipboard.

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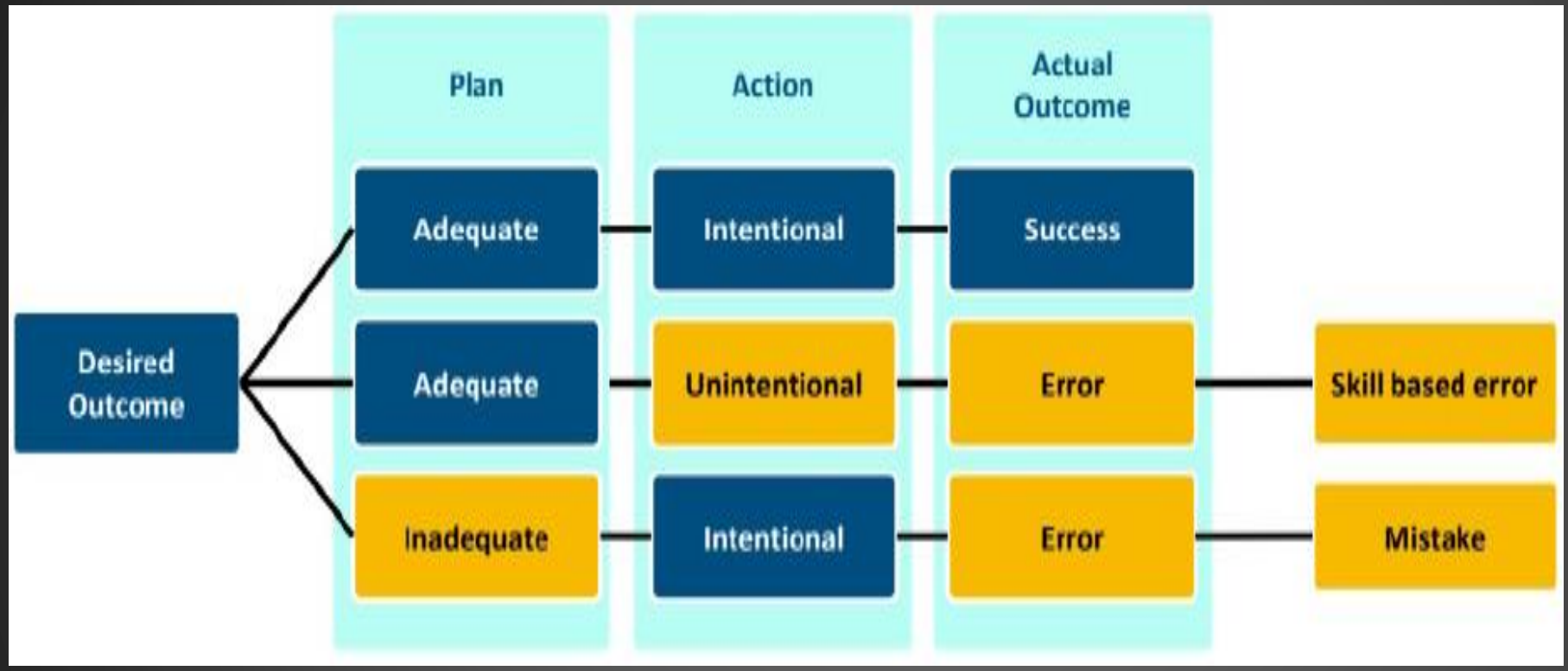
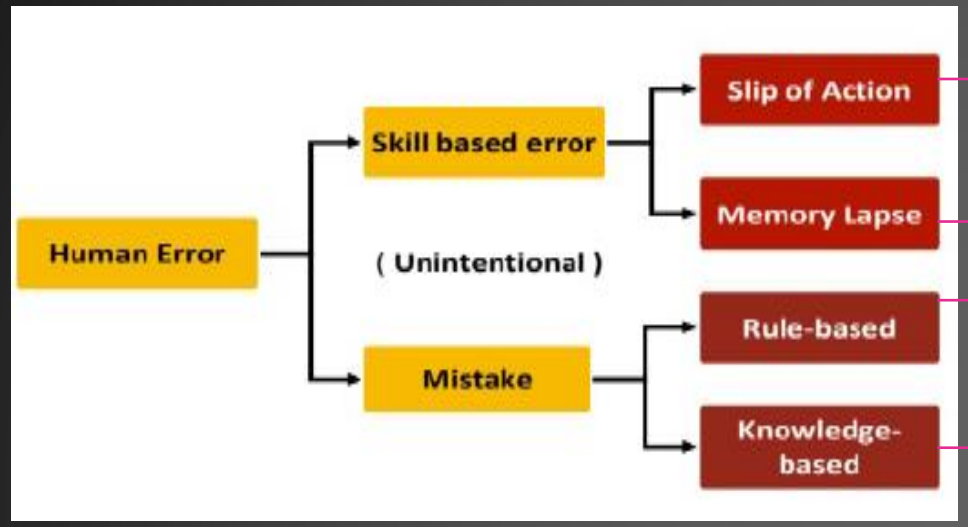
TYPES OF ERROR IN MAINTENANCE TASKS



- Human Error is commonly defined as a failure of planned action to achieve a desired outcome

HUMAN FACTOR INITIAL

TYPES OF ERROR IN MAINTENANCE TASKS



Example: Pressing the wrong button or pulling the wrong lever

Example: Forgetting to do pull the circuit breaker before removing component

Incorrect judgement. Example : Fuel overflows during manual refueling

'Trial and error'.Insufficient knowledge about how to perform a task.Dont know how to read troubleshooting manual,replace the wrong component

Slips and lapses can be minimised and mitigated through:

- workplace design
- effective fatigue management
- use of checklists
- independent checking of completed work
- discouraging interruptions
- reducing external distractions
- active supervision.

Mistakes can be minimised and mitigated through robust competency assurance processes, good quality training, proactive supervision, and a team climate in which co-workers are comfortable observing and challenging each other.

HUMAN FACTOR INITIAL

VIOLATION

VIOLATION

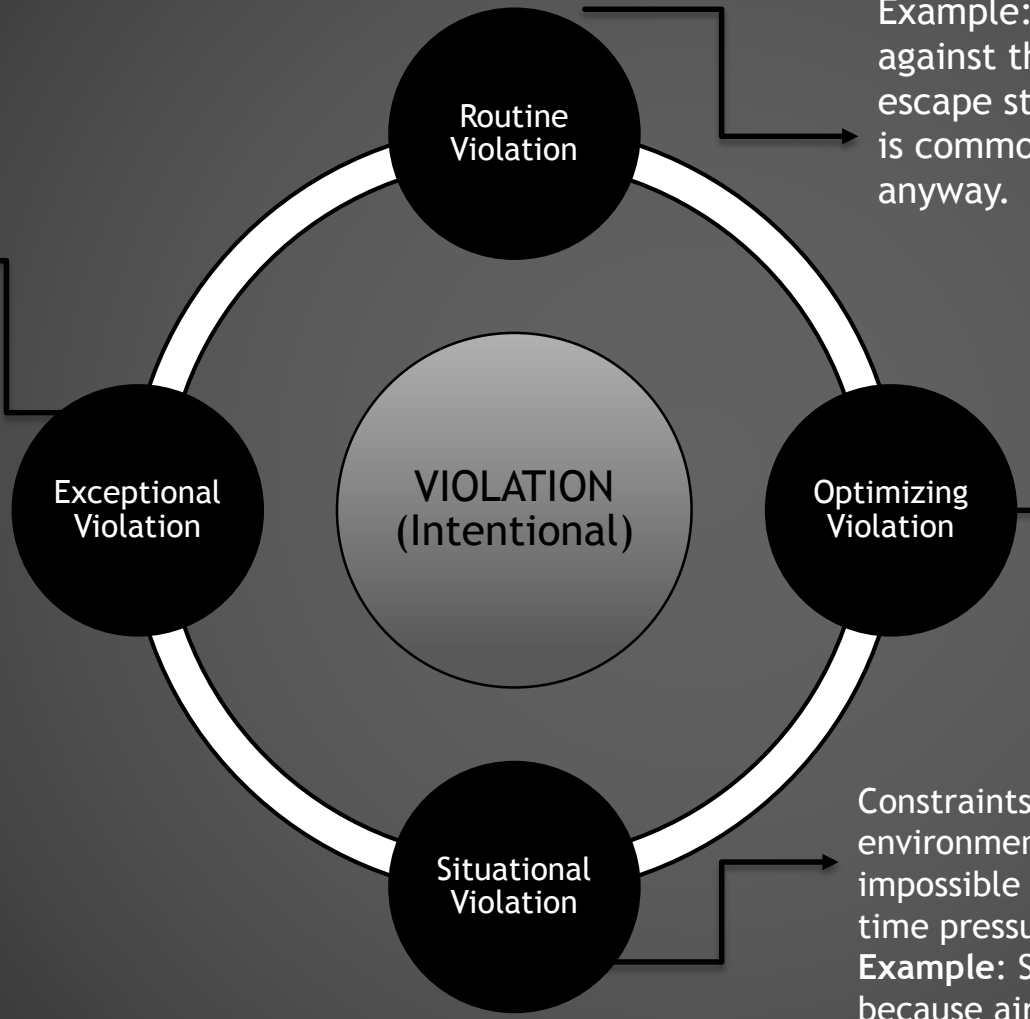
(Intentional)

Violation is an intentional action (or inaction) that results in noncompliance with known rules, policies, procedures or acceptable norms.

- Classified as human error only when they fail to achieve the desired outcome.
- When a violation does achieve the desired outcome, and does not cause any other undesired outcomes, this is not human error.
- Violations involve acts of sabotage is not human error as it was carried out deliberately

HUMAN FACTOR INITIAL

TYPES VIOLATION



Example: in a particular office building it is against the rules for personnel to use the fire escape stairwell to move between floors, but it is common practice for people to do so anyway.

Unsure of how to proceed when attempting solve problems in unusual or unique situation. It is then believed that violation is necessary to cope with the exceptional circumstances.
Example: Stealing signed job card because one was forced to sign off the task unwillingly.

The person just uses the opportunity to satisfy a personal need.
Example: Taxiing aircraft without approval just want know how it is like.

Constraints of workplace or environment make it difficult to impossible to work to rules or time pressures.
Example: Sign off missed job card because aircraft is going to depart.

HUMAN FACTOR INITIAL

VIOLATION

Why do people violate?

1.Expectation that the rules will have to be bent to get the work done.
2.The feeling that one has the ability and experience to do the job without
slavishly following the procedures.
3.Seeing opportunities for short cuts or to do things better.
4.Inadequate advance preparation, leading to working on the fly and solving problems as they arise.

Source : Patrick Hudson, et al. (2005)

HUMAN FACTOR INITIAL

VIOLATION

Violations can be minimized and prevented through:

- Education about risks and consequences
- Training in "why" not just "how"
- Allowing sufficient time for risk management activities
- The use of lead indicators as target
- Use of decentralized decision making structure
- Dedicated site-based roles of procedures modification approval
- Active workforce involvement in the development of rules and procedures that will affect them

NOTE:

- Violations are classified as human error only when they fail to achieve the desired outcome. When a violation does achieve the desired outcome, and does not cause any other undesired outcomes, this is not human error. These types of violations may include violation of a bad rule, such as a procedure that, if followed correctly, would trip the plant, in such cases, a review of the rules and procedures is advisable.

- Where violations involve acts of sabotage designed to cause damage, the planned action (violation) has achieved the desired outcome (damage). This type of behaviour does not constitute human error and, following investigation, should be managed through the application of appropriate disciplinary measures

HUMAN FACTOR INITIAL

ERROR & VIOLATION

Scenario :
John drives into water and the car begins to hydroplane

Slip - having a good plan, but bad execution: John's plan is to pump his brakes, but he misses the brake pedal and steps on the accelerator instead.

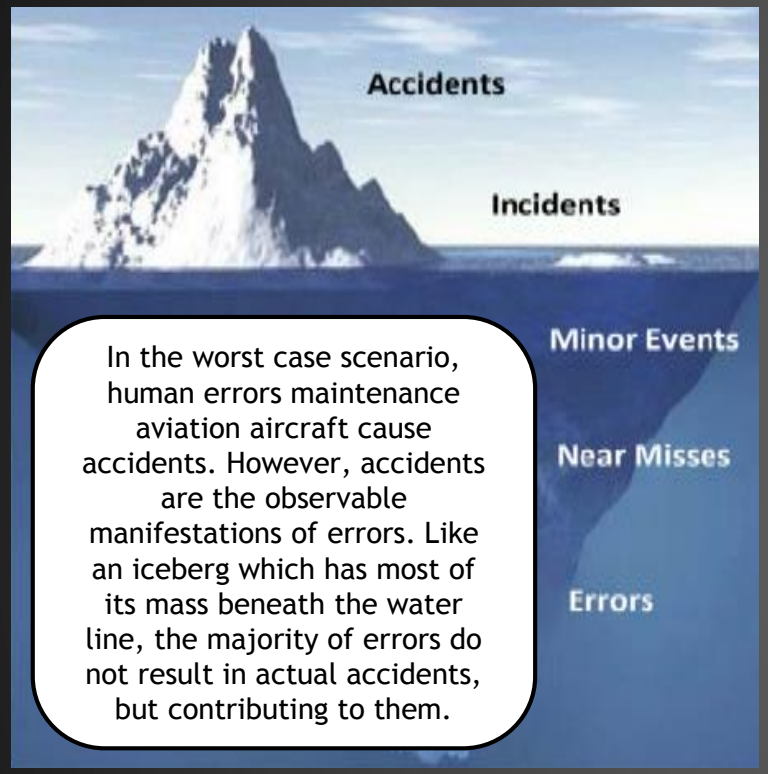
Lapse- having a good plan, but forgot execution: John forgot his driving teacher once told him that he should pump his brake in this situation.

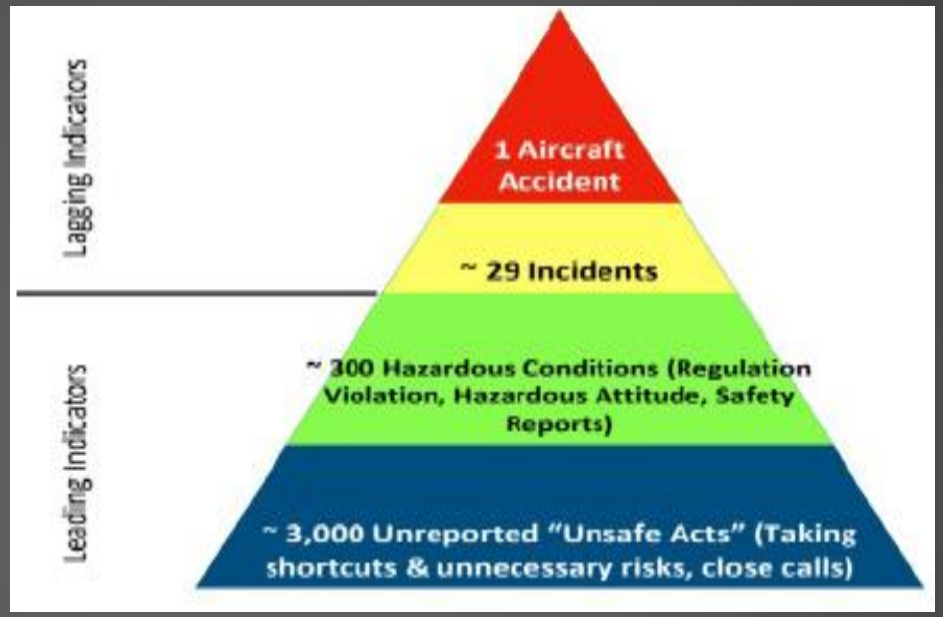
Mistake a bad plan is selected: John thinks that speeding up will give him control over his car so he accelerates.

Violation - the wrong procedure is performed intentionally: John learned from his driving teacher that he should pump his brakes in this situation, but his brother said that acceleration is best, so John steps on the accelerator.

HUMAN FACTOR INITIAL

IMPLICATION OF ERRORS





- Heinrich's Law: that in a workplace, for every accident that causes a major injury, there are 29 accidents that cause minor injuries and 300 accidents that cause no injuries. 95 percent of all workplace accidents are caused by unsafe acts.

HUMAN FACTOR INITIAL

AVOIDING & MANGING ERRORS

Safety Leader, Professor Reason refers to the two component of error management:

James T. Reason, Ph.D., graduated with First Class Honors from the University of Manchester in 1962 with a B.Sc. in Psychology. He received his Ph.D. from the University of Leicester in 1967 He and his co-workers have focused upon the development of error management technique in collaboration with Shell, British Railways, British Airways, Singapore and Investigation (Canberra). the Burea of Air Safety

Managing Error

Error containment

- To prevent error is to capture and prevent them.
- Implement Mandatory Occurrence Reporting Scheme(MORS) industry wide, to capture errors.
- Implement Safety Management
- System (SMS) in a maintenance organization

Error reduction

- **Motivational Campaigns** - Reward the safe operator.
- Increased Discipline - Punish those who violated rules.
- **Safety Audit** – regular checks safety features
- **Improved Training** - Create awareness of risk involved how people's actions affect safety.
- **Redesign the job, the Equipment, or the Procedures** - A simpler job wall reduce confusion, reduce stress and mistakes.
- **Increased Automation** - Remove the problems of human variability and unpredictability.

- To prevent errors from occurring, it is necessary to predict where they are most likely to happen and then put preventative measures in place. Incident reporting schemes, ***Mandatory Occurrence Reporting Scheme(MORS) do this for the industry as a whole.***
- ***Within a maintenance organization***, data on errors, incidents, and accidents should be captured with the ***Safety Management System (SMS),*** which in turn, provide mechanisms for identifying potential weak spots and error-prone activities or situations.

HUMAN FACTOR INITIAL

AVOIDING & MANGING ERRORS

- *Error management must include measures to:*

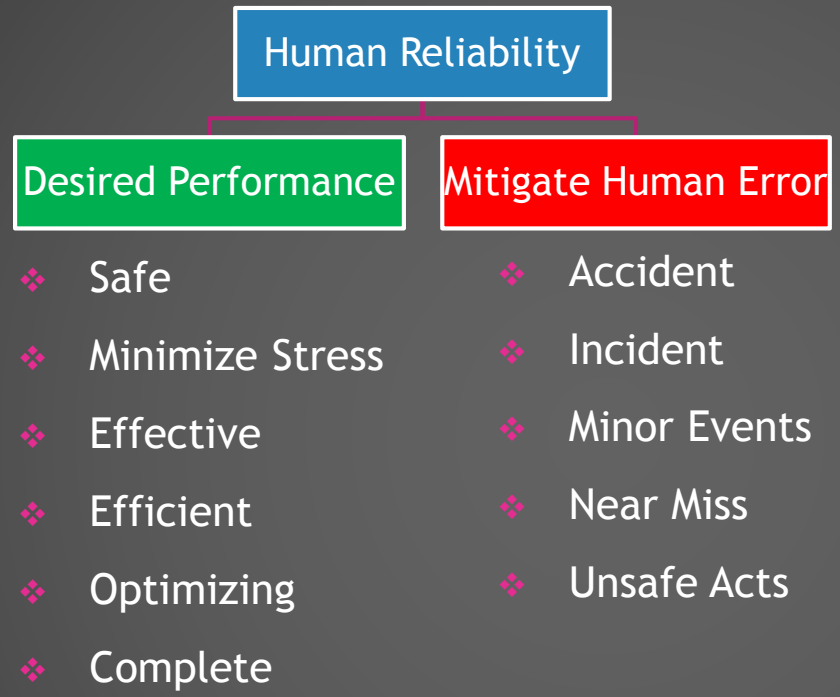
1. Reduce the error liability of the individual or the team
2. Minimize the error vulnerability of a particular tasks or task elements.
3. Discover, assess, and then eliminate error-producing (and violation-producing) factors within the workplace.
4. Diagnose organizational factors that create error-producing factors within the individual, the team, the task, or the workplace.
5. Improve error detection.
6. Increase the error tolerance of the workplace or the working system.
7. Make latent conditions more visible to those who operate and manage the system.
8. Improve the organization's intrinsic resistance to human fallibility and uncertainty.

- *Error management seeks to:*

1. Prevent errors from occurring/re-occuring.
2. Eliminate and learn the bad effects of errors.

HUMAN FACTOR INITIAL

HUMAN RELIABILITY



- ***Human Reliability*** in aircraft maintenance industry is to describe *human performance and contribution to the resilience of systems* and to *possible adverse consequences of human errors or oversights.*
- Which means ***the*** *probability of human completing the task successfully at any stage of operation* in a predetermined minimum time period (if there are time requirements).

HUMAN FACTOR INITIAL

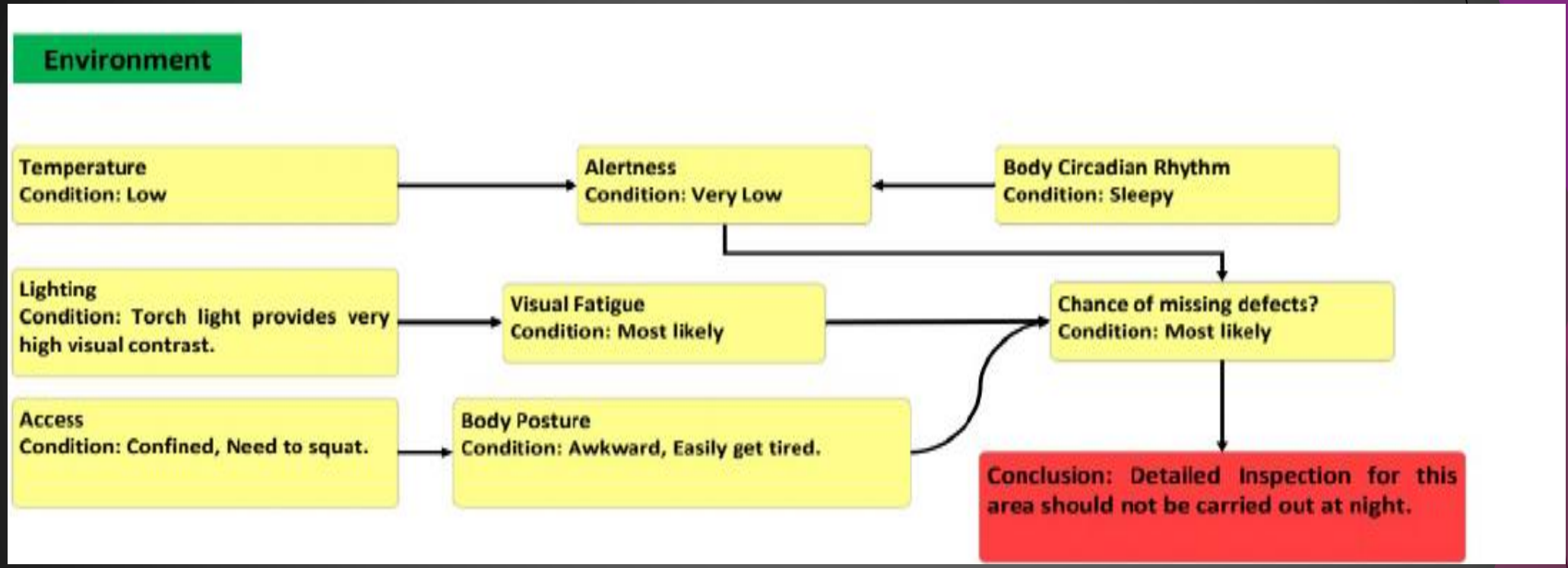
HUMAN RELIABILITY

Factors that affect technician performance in aircraft maintenance

HUMAN FACTOR INITIAL

HUMAN RELIABILITY

Suitability to carry out detailed inspection in cargo compartment in a Boeing 737-400 after 2300 hours (close to midnight)



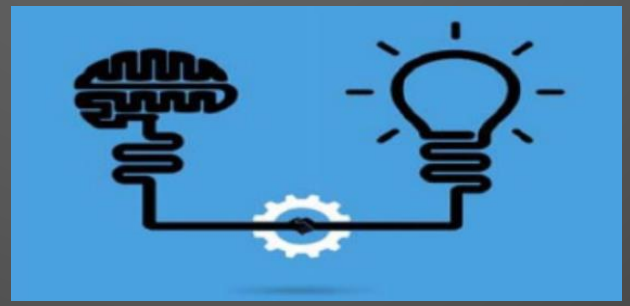
The *Human Reliability Analysis (HRA)* has been used to study the execution of human actions and their interactions with a system, taking into account their limitations and factors influencing the human performance. One of the method that is used is Bayesian Network (probabilistic graphical model).

CHAPTER 4 HUMAN PERFORMANCE & LIMITATION

HUMAN FACTOR INITIAL

- *CHAPTER 4 : HUMAN PERFORMANCE AND LIMITATION*

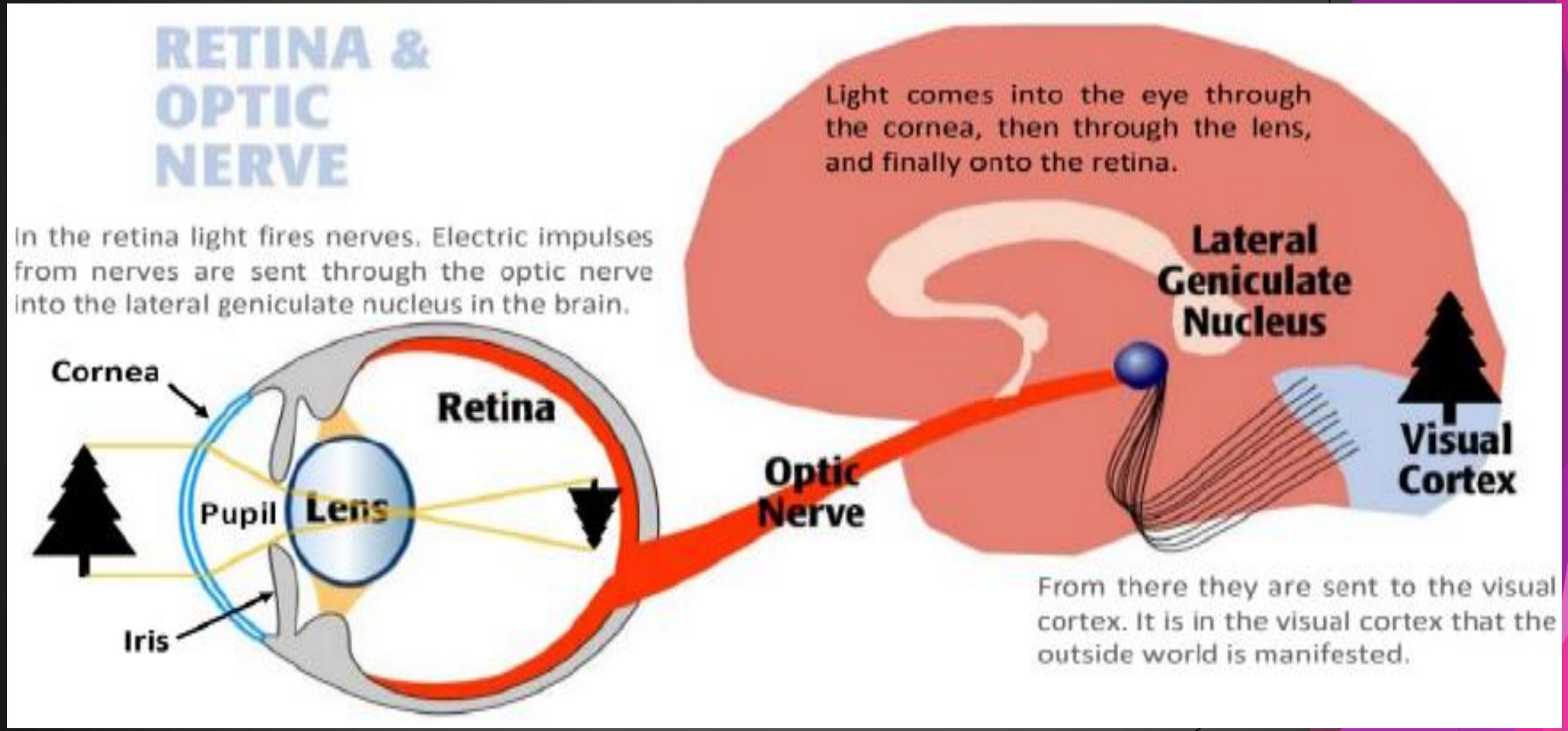
4.1 Vision
4.2 Hearing
4.3 Information-processing
4.4 Attention and perception
4.5 Situational awareness
4.6 Memory
4.7 Claustrophobia and physical access
4.8 Motivation
4.9 Fitness/Health
4.10 Stress
4.11 Workload management
4.12 Fatigue
4.13 Alcohol, medication, drug
4.14 Physical work
4.15 Repetitive task/complacency



HUMAN FACTOR INITIAL

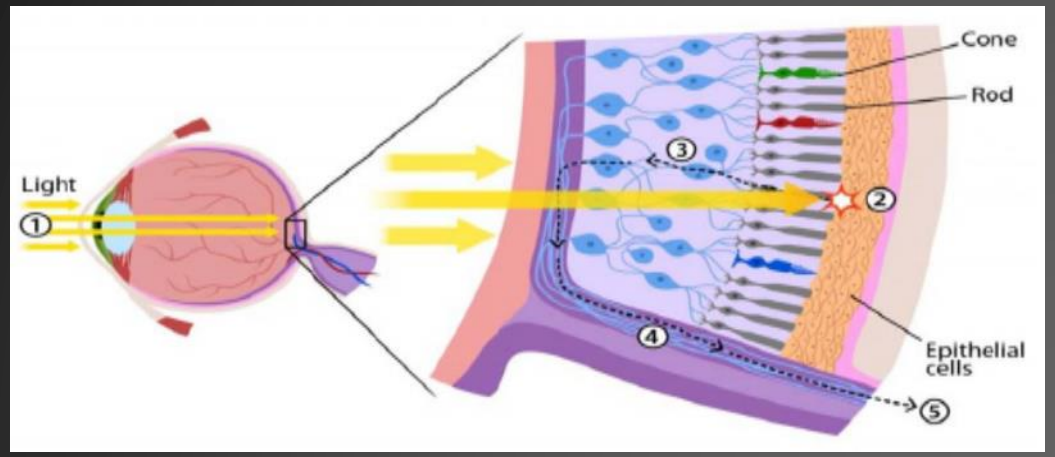
- To understand human performance fully the way we attend to things, perceive, think, remember, decide and act we first need to understand how human beings process information, how we use our brains. Maintenance engineers make many decisions every day and perform vital safety-critical tasks. Information processing is fundamental to doing these effectively.

HUMAN FACTOR INITIAL



HUMAN FACTOR INITIAL

The receptive field shown is where light hits the inside of our eyes.
Embedded in the receptive field are rod and cone cells



Rods work at very low levels of lights. We use these for ***monochromatic vision*** (night vision).

Cones require a lot more light and they are used ***colour vision*** of the eyes that ***helps with the sharpness of detail of image***

Rods work at very low levels of light. We use these for ***monochromatic vision*** (night vision) because only a few bits of light (photons) can activate a rod. Which is why at night, we see everything in a grey scale. The human eye has over 100 million rod cells. ***Cones require a lot more light*** and they are used ***colour vision***. We have three types of cones: ***blue, green, and red***. The human eye only has about 6 million cones. Many of these are packed into the fovea, a small pit in the back of the eye that ***helps with the sharpness or detail of images***

HUMAN FACTOR INITIAL

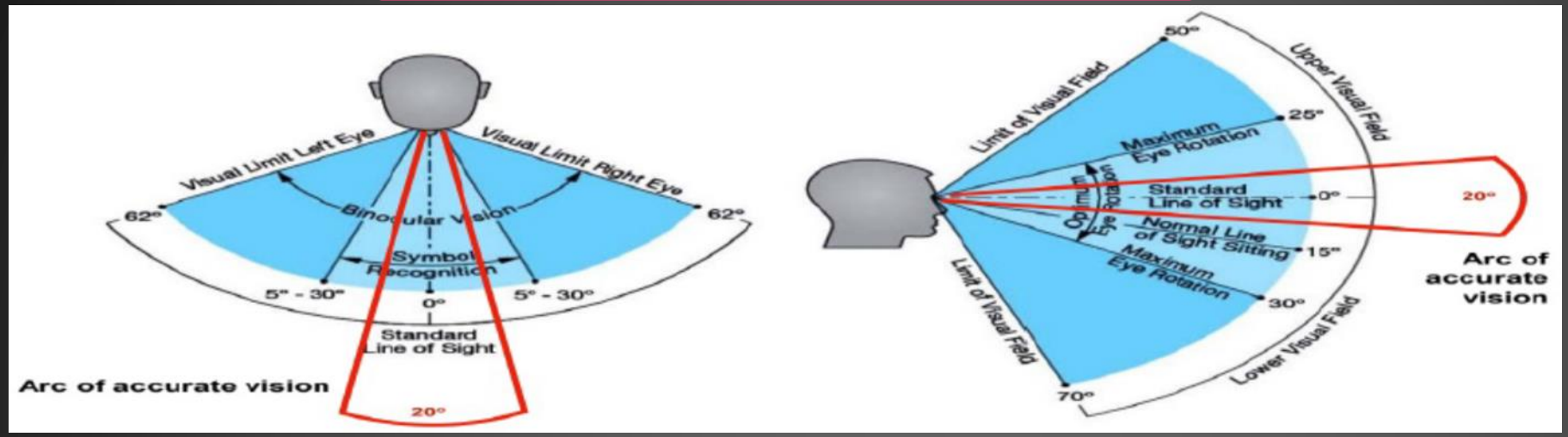
- 20-30 minutes are required to fully adapt from bright sunlight to complete darkness
- At least 5 minutes are required for the eyes to adapt from darkness to bright sunlight

CAUTION:
Inspector must do the change over adaption prior to perform visual inspection

The eye takes approximately ***20-30 minutes to fully adapt from bright sunlight to complete darkness*** and becomes 10,000 to 1,000,000 times more sensitive than at full daylight. In this process, the eye's perception of colour changes as well. However, it takes approximately ***five minutes for the eye to adapt from darkness to bright sunlight***. This is due to cones obtaining more sensitivity when first entering the dark for the first five minutes but the rods taking over after five or more minutes.

HUMAN FACTOR INITIAL

"10 degree – 2 second – repeat" rule



Human eye has the area of acute visual perception for most of us is about a ***20 degree arc of accurate vision.***

- Under normal circumstances, ***it takes about 1.5 seconds for the process of looking, seeing and recognising to occur.***
- ***Visual inspection*** (especially detailed visual inspection) should apply the ***10 degrees - 2 seconds rule 10 degrees-2 seconds rule.***
- Divide the inspection area into 10-degree segments and scan each for at ***least 2 seconds*** and repeat

HUMAN FACTOR INITIAL

At the point at which the optic nerve joins the back of the eye, a "***blind spot***" occurs.

- This is not evident when viewing things with both eyes (binocular vision)
- Since it is not possible for the image of an object to fall on the blind spots of both eyes at the same time

- ***Always use both eyes when carrying out inspection tasks.***

Even when viewing with one eye (monocular vision), the constant rapid movement of the eye (saccades) means that the image will not fall on the blind spot all the time. It is only when viewing a stimulus that appears very fleetingly (e.g. a light flashing), that the blind spot may result in something not being seen.
In maintenance engineering, tasks such as close visual inspection or crack detection should not cause such problems, as the eye or eyes move across and around the area of interest (visual scanning).

HUMAN FACTOR INITIAL

Find your Blind Spot!

Using the diagram below, fixate on the cross, close your right eye and hold the figure about 1.5 feet from your eye. When the filled circle disappears, its image is on your blind spot. Fixate on the lower cross. Note how the line appears continuous

HUMAN FACTOR INITIAL

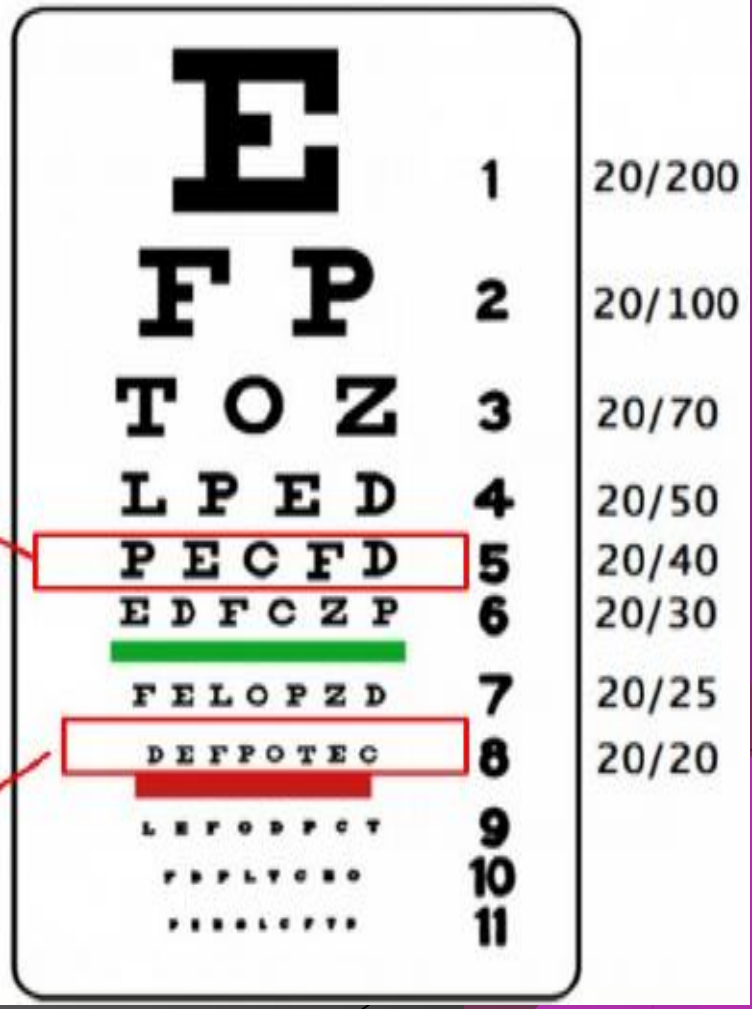
Visual acuity is the ability of the eye to **discriminate sharp detail** at **varying distances**. Visual acuity is often tested.

A tired person has less sharp vision (sharpness of vision is known as visual acuity).

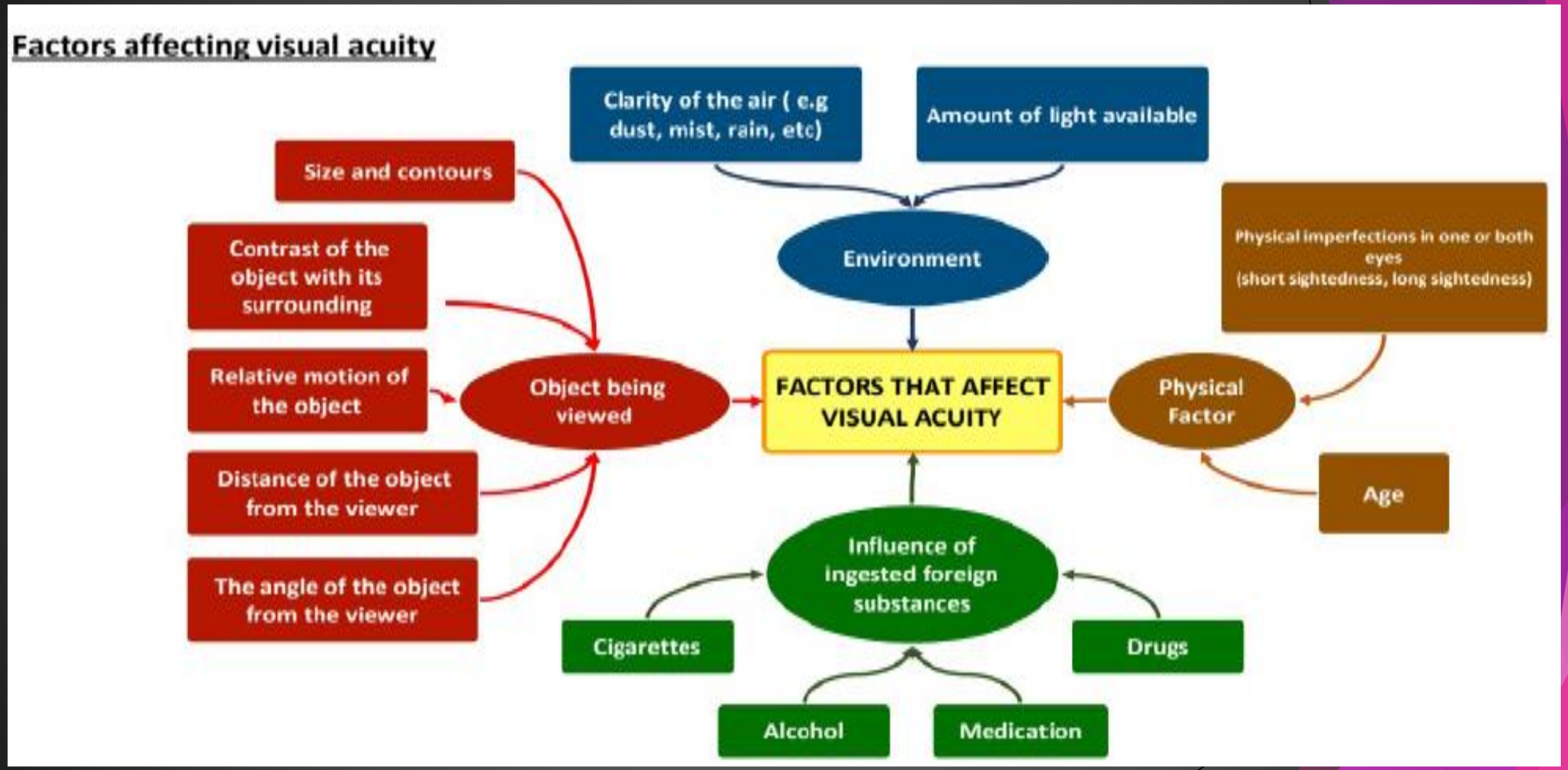
The Figures 20/40 mean that the observer can read at 20 feet what a non-impaired person can read at 40 feet

CAN YOU SEE ANY OF THIS??

The Figures 20/20 mean that the observer can read at 20 feet what a non impaired person can read at 20 feet. This is also expressed in meters as 6/6 vision



HUMAN FACTOR INITIAL

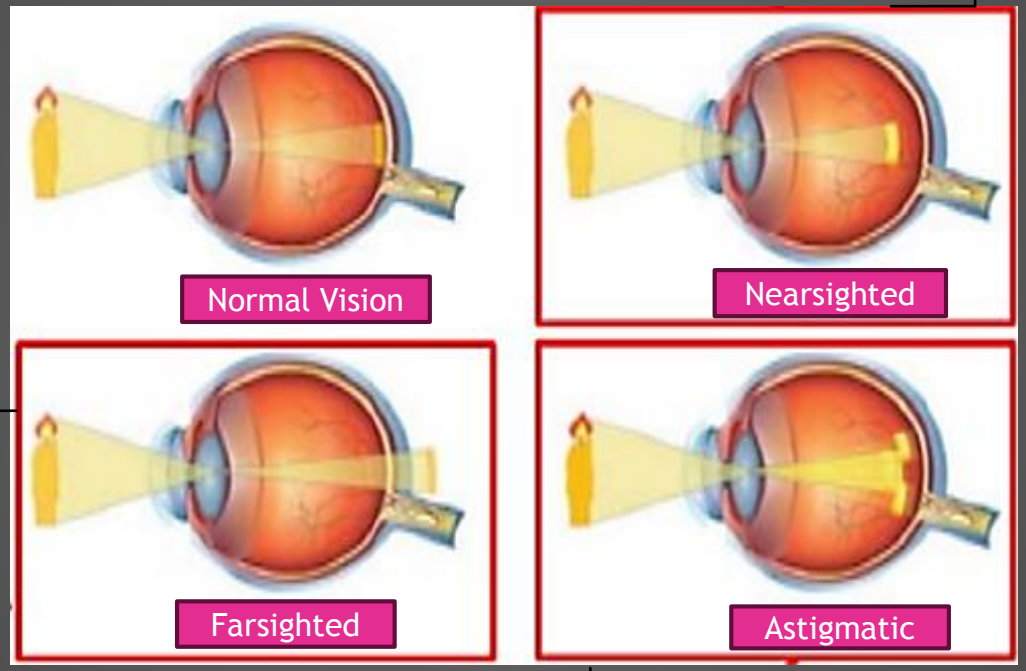


HUMAN FACTOR INITIAL

Eye defects:

The eye is a very sensitive and delicate organ and there are several defects that can affect the eye. The 3 most common are

- Long sightedness or Hypermetropia
- Short sightedness or Myopia
- Astigmatism



Hypermetropia – is caused by a shorten than normal eyeball which means that the image is formed behind the retina. Blurred vision will result when looking at close object

Myopia – is where the eyeball is longer than normal, causing the image to be formed in front of the retina. If the accommodation of the lens cannot counteract this then distant objects are blurred.

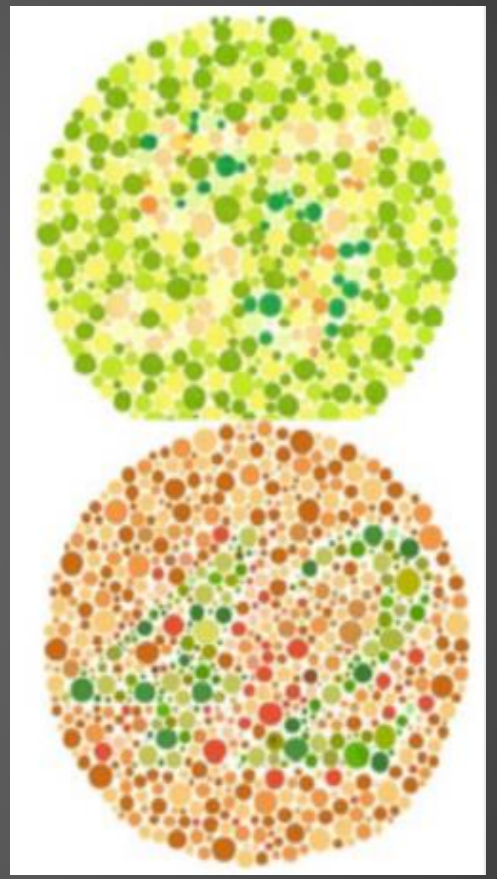
Astigmatism – a misshapen cornea causing objects to appear irregularly shaped

HUMAN FACTOR INITIAL

Eye defects

Colour defective vision (normally referred to incorrectly as colour blindness) is usually hereditary.

- The most common type is difficulty in distinguishing between red and green.
- More rarely, it is possible to confuse blues and yellows.



Aircraft maintenance technician requires good colour vision for:

- Recognizing components
- Using various diagnostic tools
- Distinguishing between wires
- Recognizing various lights on the airfield (e.g., warning lights)

HUMAN FACTOR INITIAL

National Airworthiness Authorities have produced guidance regarding vision:

"A reasonable standard of eyesight is needed for any aircraft technician to perform his duties to an acceptable level".

- Maintenance tasks require a combination of both distance and near vision.
- Especially when carrying out close visual inspection of structures or work related to small or miniature components.
- The use of glasses or contact lenses to correct any vision problems.
- Frequent checks should be made to ensure the is acceptable.
- Le.: Cannot differentiate the wire colour.
- "Organizations should put in place suitable procedures to address these issues."

Often, airline companies or airports will set the eyesight standards for aircraft maintenance safety, insurance purposes, or for driving on the airfield). It is important for a technician, particularly one who is involved in inspection tasks, to have adequate vision to meet the task requirements.

"A reasonable standard of eyesight is needed for any aircraft technician to perform his duties to an acceptable level. Many maintenance tasks require a combination of both distance and near vision.

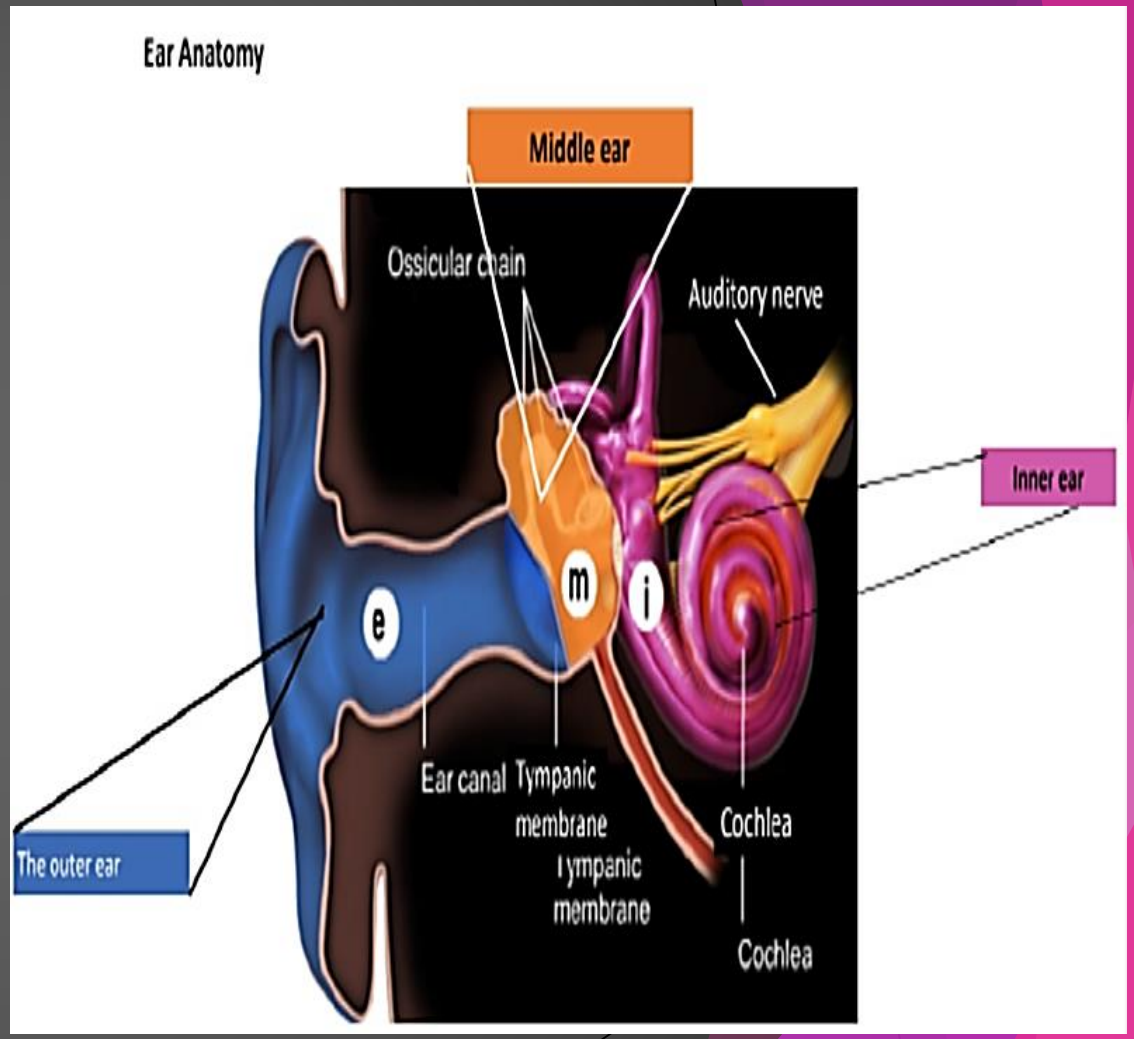
- In particular, such consideration must be made where there is a need for the close visual inspection of structures or work related to small or miniature components.
- The use of glasses or contact lenses to correct any vision problems is perfectly acceptable and indeed they must be worn as prescribed.
- Frequent checks should be made to ensure the continued adequacy of any glasses or contact lenses.
- In addition, colour discrimination may be necessary for an individual to drive in areas where aircraft manoeuvre or where colour coding is used, (e.g., in aircraft wiring) organizations should identify any specific eyesight requirement and put in place suitable procedures to address these issues."

HUMAN FACTOR INITIAL

The outer part of the ear directs sounds down the ***auditory canal***, and on to the ***eardrum***. The sound-waves will cause the eardrum to vibrate.

Middle ear which is beyond the ear drum, transmits vibrations from the eardrum by way of three small bones known as the ***ossicles***, to the fluid of the inner ear.. The middle ear is usually filled with air which is refreshed by way of the ***Eustachian tube*** which connects this part of the ear with the back of the nose and mouth.

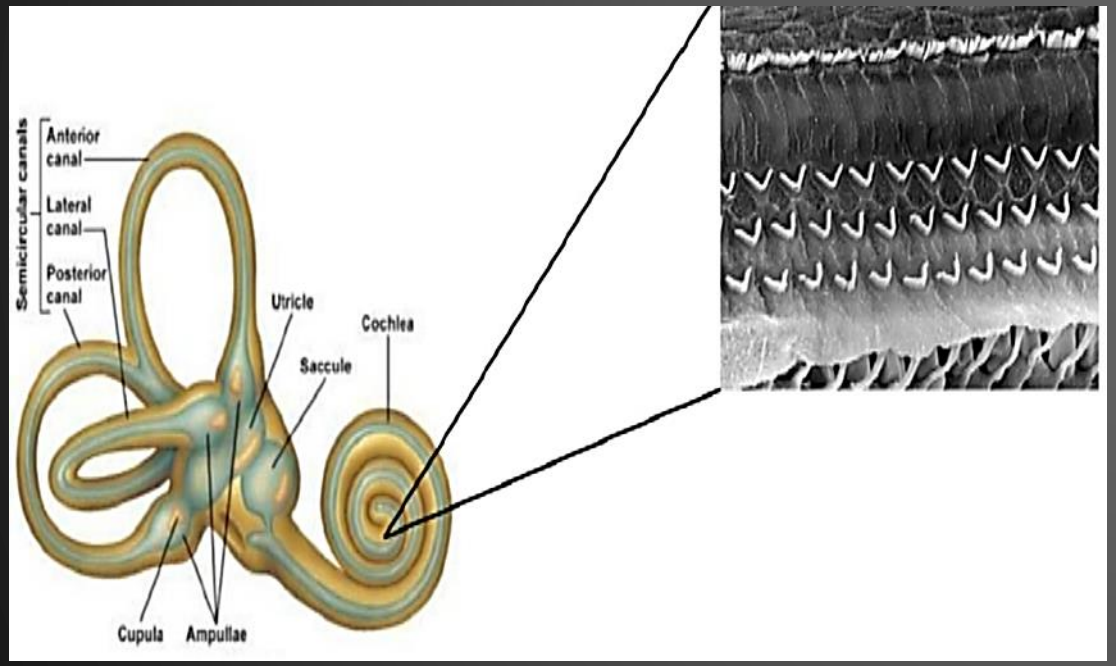
The inner ear is filled with fluid. The last of the ossicles in the middle ear is connected to the ***cochlea***. This contains a fine membrane (the ***basilar membrane***) covered in hair-like cells which are sensitive to movement in the fluid. Any vibrations they detect cause neural impulses to be transmitted to the brain via the ***auditory nerve***.



HUMAN FACTOR INITIAL

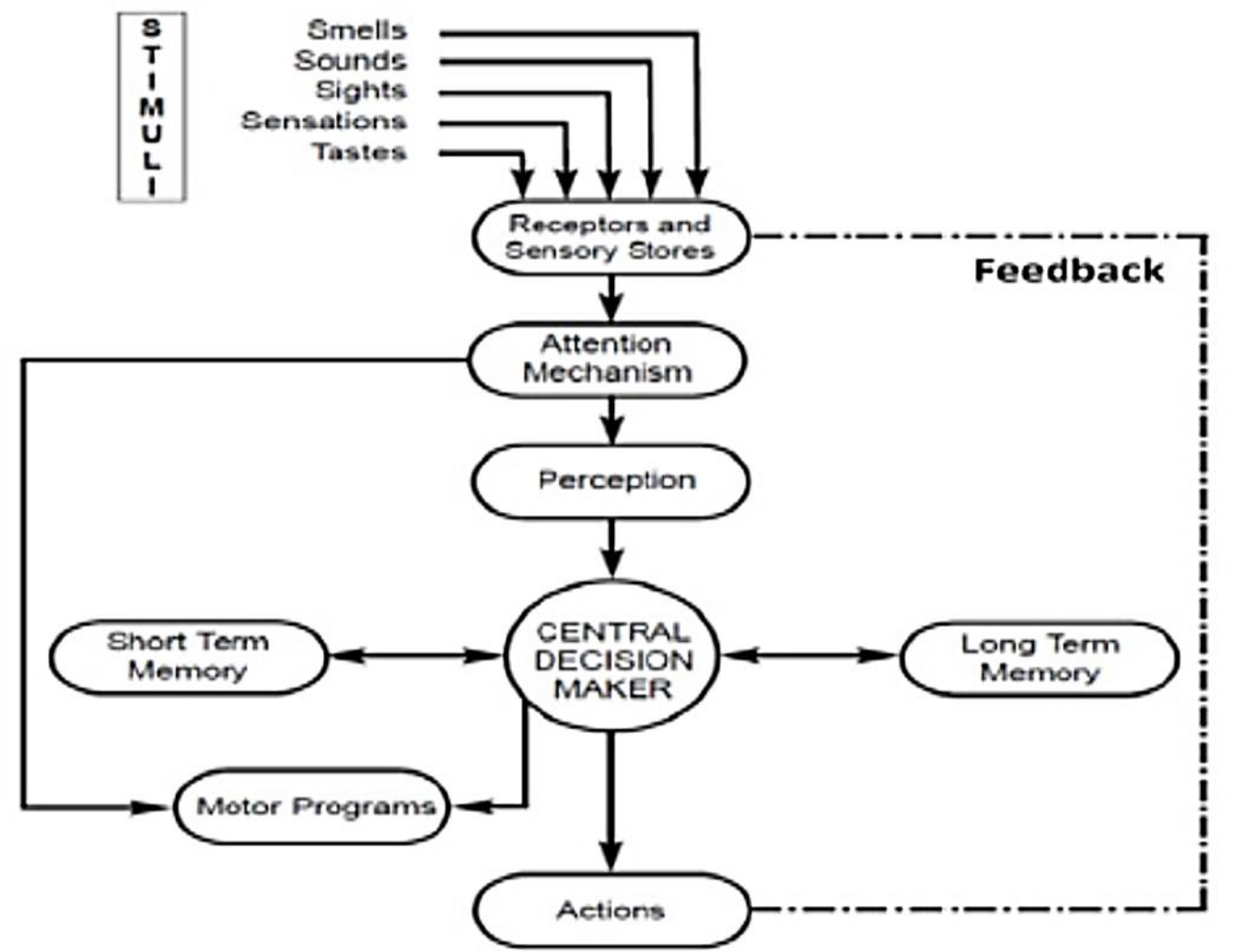
Inner Ear - Hearing

The ***inner ear*** contains the sensory organs for hearing and balance.
The ***cochlea*** is the hearing part of the inner ear.
The semicircular canals in the inner ear are part of our balance system.



The mechanical energy from movement of the middle ear bones pushes in a membrane (the oval window) in the cochlea. This force moves the cochlea's fluids that, in turn, stimulate tiny hair cells. Individual hair cells respond to specific sound frequencies (pitches) so that, depending on the pitch of the sound, only certain hair cells are stimulated. Signals from these hair cells are changed into nerve impulses. The nerve impulses are sent out to the brain by the cochlear portion of the auditory nerve.

HUMAN FACTOR INITIAL

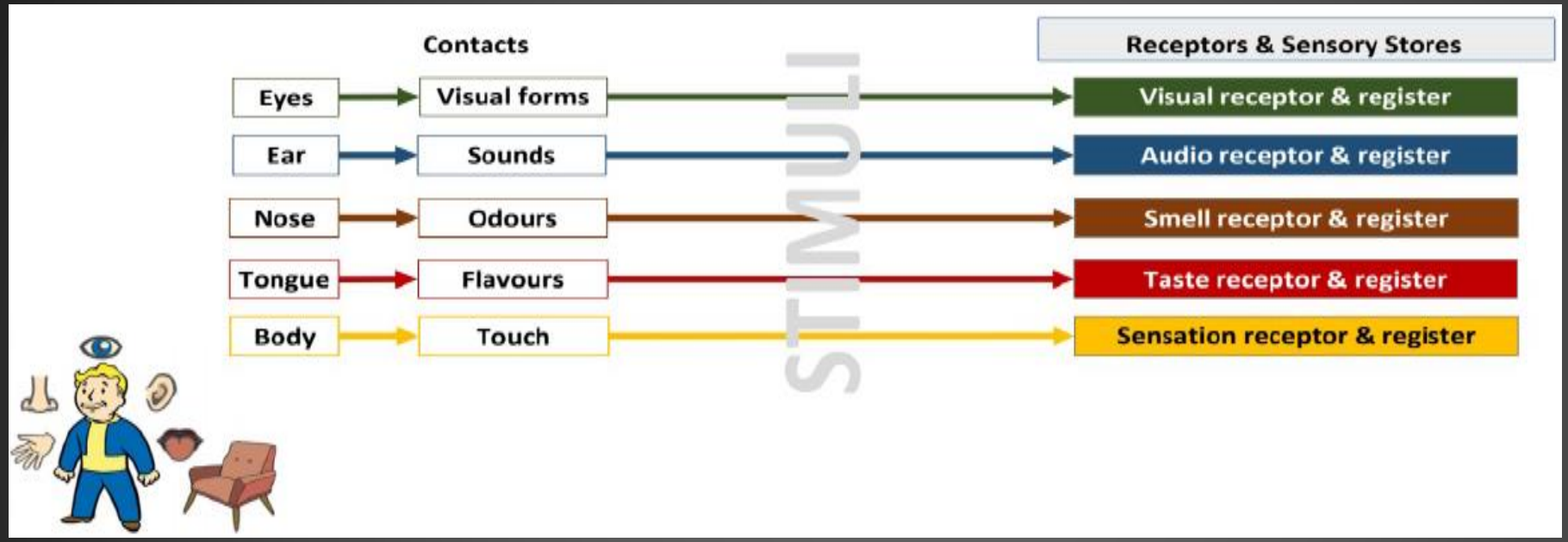


Source: Atkinson and Shiffrin, 1968
A functional model of human information processing

- There are many jobs within the aviation industry, such as pilots, air traffic controllers and maintenance technicians which require the individual to process information quickly and efficiently.
- It is important to be aware of how we process information, and what factors affect our ability to process information effectively.
- The human brain is extremely complex, and cannot be broken down into separate areas. Functional models have been developed however, to help explain how information is perceived, processed and used to make decisions.

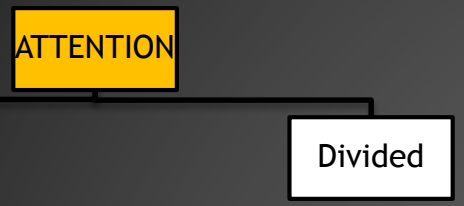
HUMAN FACTOR INITIAL

Stimuli (Sensing)



Information first enters via our sensory system. This includes ***sight, sound, touch, taste, smell*** and feel. This information is temporarily stored but decays very rapidly. Each sensory type has its ***own temporary memory store***, and this information lasts between ***0.2s and 2s***.

HUMAN FACTOR INITIAL



Monitor several source of information to decide whether a particular event has occurred.

Eg :
General visual inspection on aircraft component for condition and security of installation

Focus

Checking our one source od information and not paying attention to anything else

Performing two or more separate task simultaneously.

Eg :
Performing test in flight deck while communicating to ground crew

Selective Attention

Selective Attention describes the process where only inputs relating to the specific task at hand are processed in detail by the central processing unit. It is interesting to note that even when we are focused on a specific task, humans are relatively good at picking up other information relevant to them, such as their name or their aircraft call sign. This is called the 'cocktail party effect. Green et al. describe other stimuli which are helpful in drawing the users attention. These include loud noises and flashing red lights. This is important to consider in the design of warning systems.

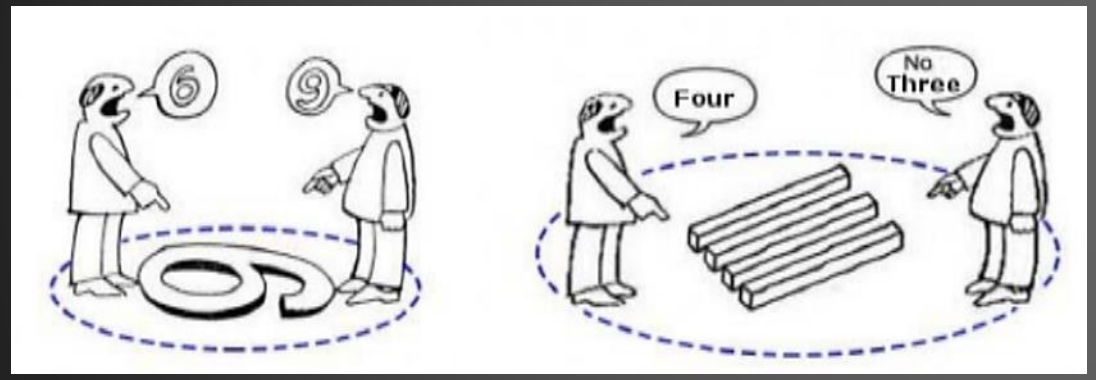
Divided Attention

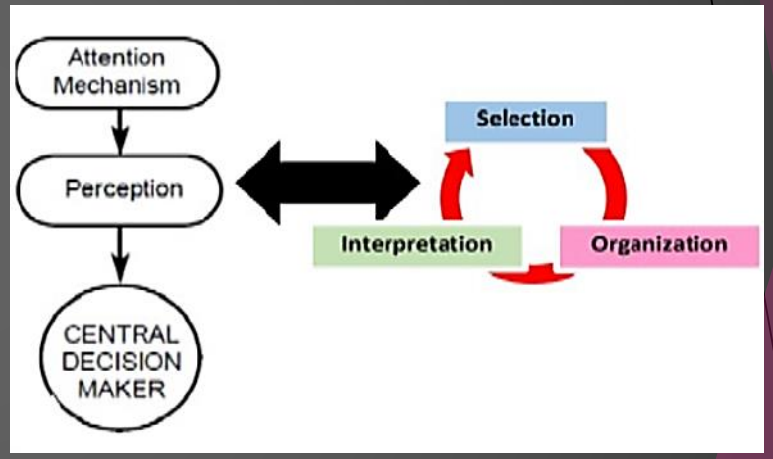
A pilot or air traffic controller is often required to undertake and monitor more than one task at a time. Divided attention means that although there will be a focus on a main task, attention is also paid to secondary tasks. For example a pilots primary task may be to fly an instrument approach, but attention is also required for radio calls, checklists etc. This type of attention ability is often tested in pilot selection testing and air traffic controller recruitment.

HUMAN FACTOR INITIAL

Perception

The brain ***Interprets*** and ***organizes*** sensory ***information***.
To make meaning of the world around us.
Uses our sensory senses, attention to the environment and memory.
Influenced by ***personal experiences***, ***emotions***, ***motivations*** and ***expectations***.
Often leads to ***misinterpretations.***





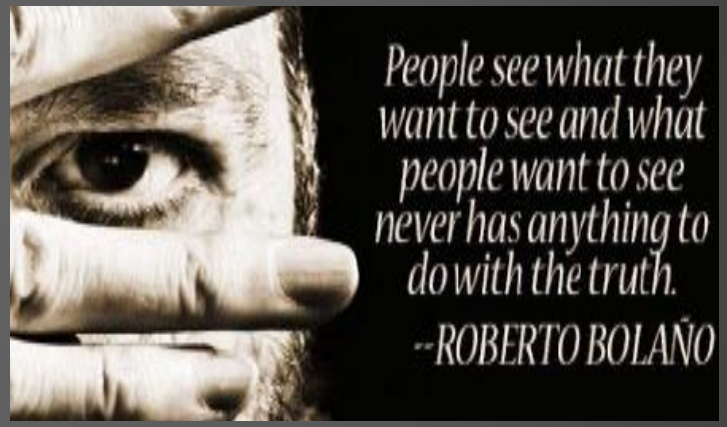
For example: A technician smiles at you after a walk around, you understands it as all is good, no defect found, however the technician was smiling because he thinks that this won't end well.

HUMAN FACTOR INITIAL

A lot of errors can occur during this process. This is affected by:

- Motivation
- Arousal/ Stress
- Lack of Information/Incomplete information
- Ambiguous Information
- Expectation
- Experience/Knowledge

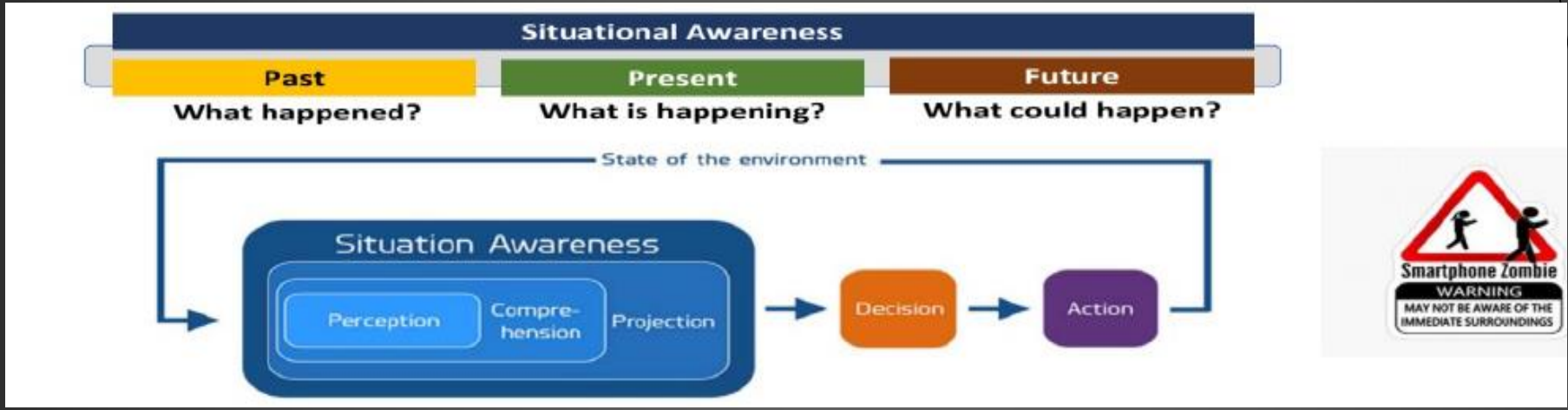
"We don't see things
as they are. We see them as we are."



HUMAN FACTOR INITIAL

According to SA(Situational Awareness) model as defined by Endsley in 1995, the first stage in the analysis of a situation consists of perceiving our environment through our senses.

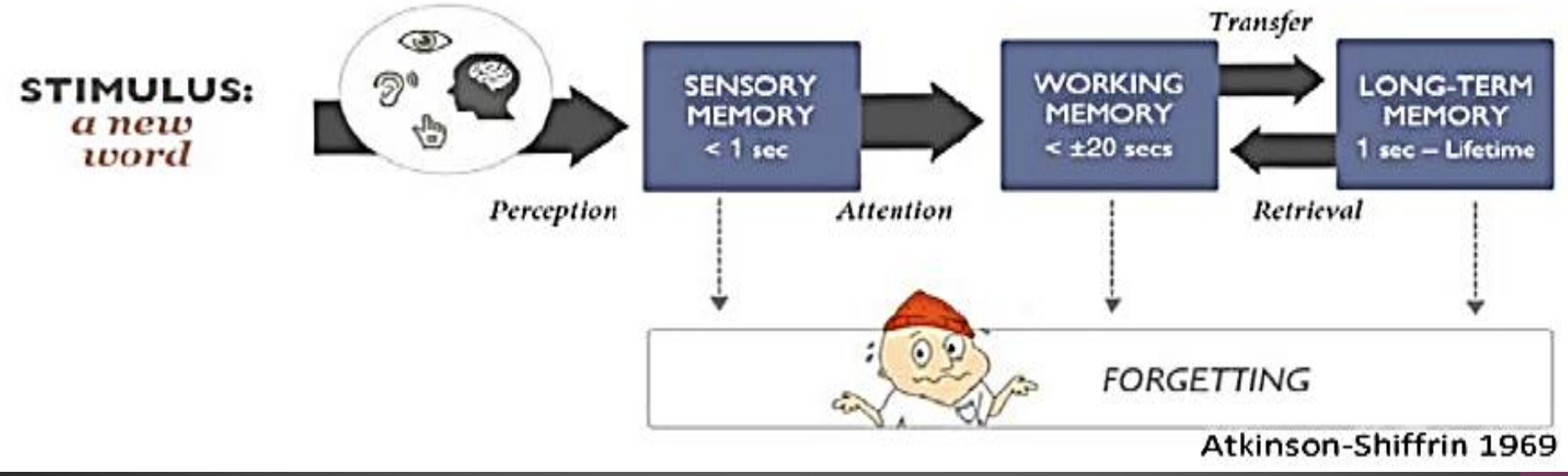
- ***What is happening around us?***



According to the SA (Situational Awareness) model as defined by Endsley in 1995, the first stage in the analysis of a situation consists of perceiving our environment through our senses. We then process the data we've received, and then we project a future state. These three steps together are called Situation Awareness. This is a dynamic process based on the actual state of the environment, subjected to cognitive handling, from which a particular output is probable. This output feeds the decision-making process that guides our actions.

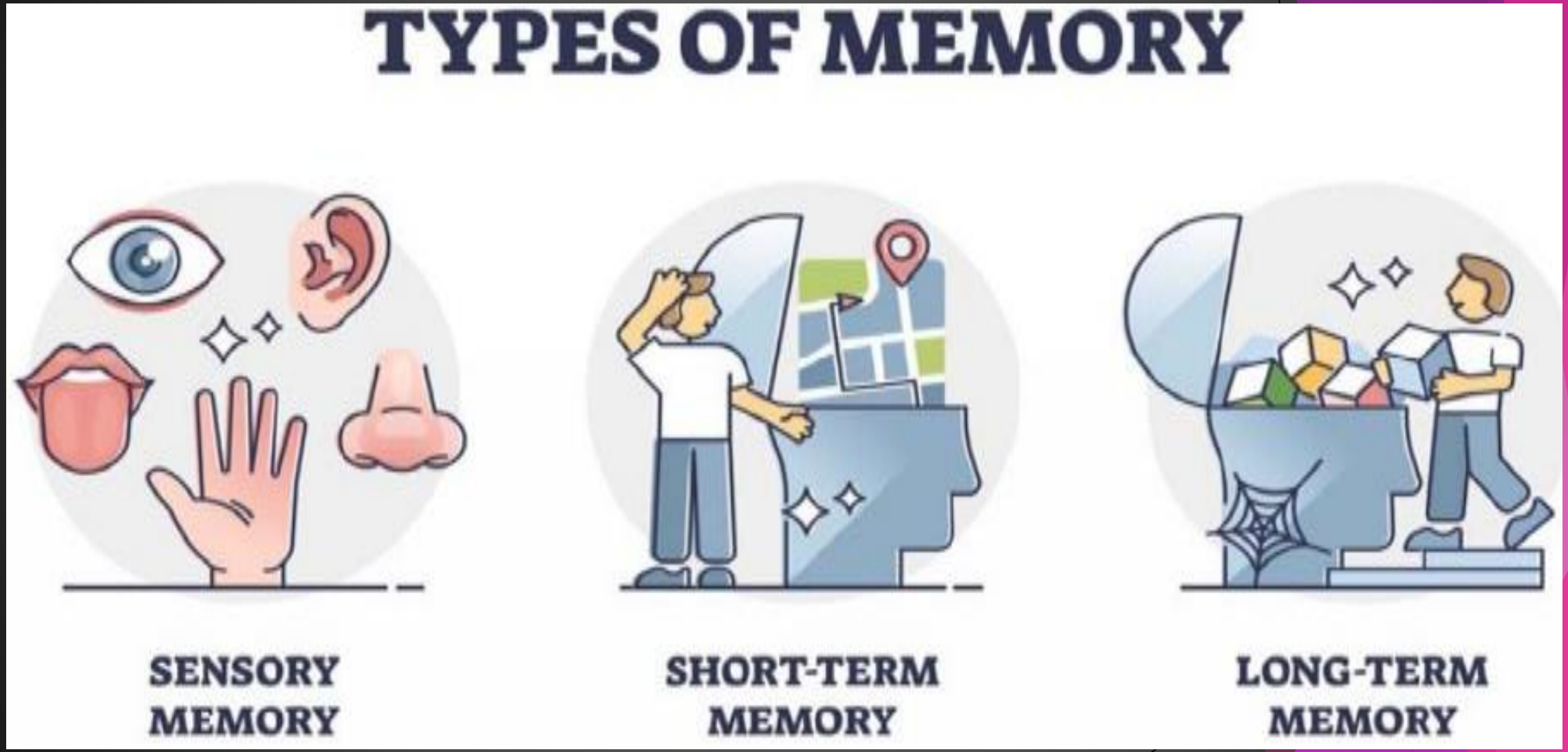
HUMAN FACTOR INITIAL

Memory is critical to our ability to act consistently and to learn new things.
The Atkinson-Shiffrin model is a common model that is used to demonstrate how each stage of our memory interacts with the others so that we can process information from our surrounding environment.



Without memory, we could not capture a 'stream' of information reaching our senses or draw on past experience and apply this knowledge when making decisions

HUMAN FACTOR INITIAL



HUMAN FACTOR INITIAL

Sensory memory

- Receives a large and continuous amount of information from all *five senses.*
- Only held there for a very short amount of time-usually for about *1 second*
- Able to recall information for a short period of time, even if not paying attention to it.
- The ability of the sensory memory to allow subconscious recall.

Short term memory (working memory)

- Often referred to as working memory.
- It is the place where all the 'work' is done.
- This is where a person's thinking, learning, understanding and decision making takes place.
- Capable of processing a large amount of Information
- Limited to only store and process 7 ± 2 pieces of data at any one time

HUMAN FACTOR INITIAL

Our sensory memory (sensory registry), receives a large and continuous amount of information from all five of our senses. Because of the large amount of information entering the sensory register it is only held there for a very short amount of time - usually for about ***1 second*** - and we cannot prolong this time by using memory expansion

However, one of the key benefits of the sensory memory is that it allows us to recall information for a short period of time, even if we have not been paying attention to it. The ability of the sensory memory to allow subconscious recall.

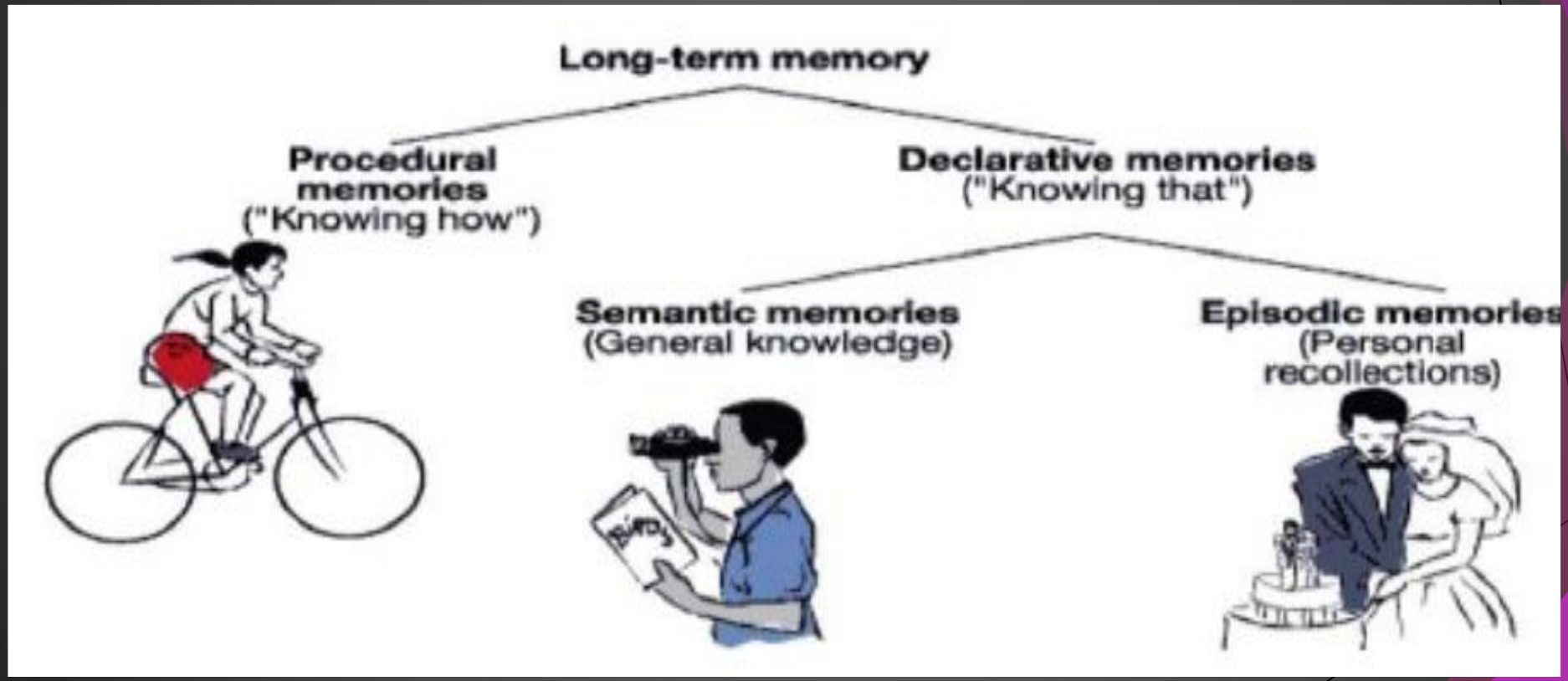
Short-term memory is often referred to as working memory because it is the place where all the ***'work'*** is done. This is where a person's thinking, learning, understanding and decision-making takes place. Our working memory is capable of processing a large amount of information, however it is limited by its capacity to only store and process ***7 ± 2 pieces*** of data at any one time. Working memory enables further processing by either initiating an immediate response or by integrating the information with other working memory or long- term memory information before initiating a delayed response based on internal processing.

For example, if an aircraft traffic avoidance warning goes off, the working memory will either initiate an immediate response - which may be to turn the warning off straight away - or it may integrate the warning with other information in the working memory - radio transmission of another aircraft in the area combined with details of current altitude, heading and airspeed to determine that there is no threat if they maintain their current course.

HUMAN FACTOR INITIAL

Long term memory

- Can be held in long-term memory is vast and can be stored for a very long time.
- Classified into two types: Semantic or Episodic.



HUMAN FACTOR INITIAL

Semantic memory

This is the memory that allows us to understand and apply meaning to our world. It is where we are able to store and retrieve ***all factual information and general knowledge*** that we have been taught. The knowledge that is stored in our semantic memory links to all other knowledge to create ideas and concepts that allow us to navigate through daily life. Information stored in our semantic memory can be recalled at short notice and is generally said to be stored there for a lifetime (when we think that we have forgotten something, it Lis often because we are unable to find where it is located in our memory system, not because it actually has been forgotten).

Episodic Memory

This is the memory that is gained through personal experience of events in our lives that have occurred at a specific time and place. Episodic memory is stored much like a video in our minds and allows us to recall specific events such as remembering where we were and what we were doing when the terrorist attacks on the World Trade Centre took place on September 11, 2001. Episodic memory is very malleable and can be influenced by what we thought should have happened, as opposed to what really did.

HUMAN FACTOR INITIAL

‘Chunking’ Information

One way to overcome the limitation of short term memory is by ‘chunking’ information.

Chunking helps to increase the amount of data that can be used by grouping clusters of individual data together to make one chunk. This can then be retained as one piece of information. For example the mobile telephone number 0-2-5-8-1-9-2-7-0 is right on the limit of the 7 ± 2 pieces of data that the working memory can effectively process at any one time. If trying to remember this number to make a call, no other new information would be able to be processed in the working memory. Any new piece of information that comes in would either replace old information (the last 2 digits of the phone number may be forgotten), or the new information itself may be forgotten immediately. However, if the digits are chunked together so that the number is recalled as 025-819-270 it will be much easier to remember and use. It will also allow new information to be processed in the working memory at the same time. Information can stay in working memory for around 10 -20 seconds, although this time limit can be extended if the data is repeated over and over again or if it is processed further.

HUMAN FACTOR INITIAL

How to avoid memory lapse in maintenance activity?

- ALWAYS carry the working instruction.
- CHECK the steps that has been completed.
- RECORD all the inspection findings, including FIGURES.
- PICTURE and GRAPHIC paint thousand words.
- STAGE CERTIFICATION for complex task.

HUMAN FACTOR INITIAL

Motor Programs

If a task is performed often enough, it may eventually become automatic and the required skills and actions are stored in long term memory. These are known as ***motor programs*** and are ingrained routines that have been established through practice.

Examples: safety wire locking skill, marshalling action.

The use of a motor program reduces the load on the central decision maker. An often quoted example is that of driving a car: at first, each individual action such as gear changing Dis demanding, but eventually the separate actions are combined into a motor program and can be performed with little or no awareness. These motor programs allow us to carry out simultaneous activities, such as having a conversation while driving.

HUMAN FACTOR INITIAL

Task:
Fuselage skin visual inspection

Sight → Visual receptor & register → Attention

Visually detected a fine line → Visually inspect in detail to confirm finding
Tactile inspection needed

Perception
- The line is not straight
- This is a highly stress area
- Catch finger nail when scratch through the line.

Memory Retrieval
- Have I seen this before?
- Does this match the crack criteria?

Decision
- It is a fatigue crack

Fatigue crack will extend over time

Comprehension

IT must be repaired or else this may lead to fuselage decomposition

Action

HUMAN FACTOR INITIAL

Claustrophobia (from Latin claustrum *"a shut in place"* and Greek φόβος, phobos, "fear") is the fear of having no escape and being closed in small spaces or rooms.

Two key symptoms.

- fear of restriction
- fear of suffocation.

Treatment: Cognitive Behaviour therapy (CBT)

Claustrophobia: It is typically classified as an ***anxiety disorder*** and often results in panic ***attack***, and can be the ***result of many situations or stimuli***, including elevators crowded to capacity, windowless rooms, and even tight-necked clothing

Treatment: ***Cognitive Behaviour therapy*** is a widely accepted form of treatment for most anxiety disorders. It is also thought to be particularly effective in combating disorders where the patient doesn't actually fear a situation but, rather, fears what could result from
being in said situation.
This method forces patients to face their fears by complete exposure to whatever fear they are experiencing. This is usually done in a progressive manner starting with lesser exposures and moving upward towards severe exposures.

HUMAN FACTOR INITIAL

Precaution entering in a confined space

1. Find the right person for the job
2. fie aware of your surroundings

Things to Remember

- Claustrophobia can be defined as abnormal fear of being in an enclosed space
- Susceptibility to claustrophobia may not be apparent at the start of employment
- Make colleagues and supervisors aware
- Engineers should work in a team and assist one another.

What to do

If an engineer suffers an attack of claustrophobia, he/she should make his colleagues and supervisor aware so that if tasks likely to generate claustrophobia cannot be avoided, at least the colleagues may be able to assist in extricating the engineer from the confined space quickly, and sympathetically.

Right Person for the Job

Engineers should work in a team and assist one another if necessary, making allowances for the fact that people come in all shape and sizes and that it may be easier for one person to access a space than another.

HUMAN FACTOR INITIAL

Sometimes, it is necessary to inspect the parts that is floors above ground such as upper fuselage and rudder surface. Inspector ***must wear safety harness*** for his own safety when carry out inspection at these areas as focusing during inspection might cause the inspector to forget about danger present in his surrounding.

HUMAN FACTOR INITIAL

MOTIVATION: **"THE DRIVING FORCE BY WHICH HUMAN ACHIEVE THEIR GOALS."**

Daniel Pink says once someone is paid sufficiently, 3 things impact motivation:

MASTERY: We want to get demonstrably better at what we do.

AUTONOMY: We want to do our job free of micromanagement and add our own personal flair.

PURPOSE: We want to do the work we find personally meaningful.

MOTIVATION = **Expectancy** X **Instumentality** X **Valance**

Will my hard work result in measureable progress toward the goal?

How likely is that I will be rewarded (or punished)?

What is the size of the reward ?

HUMAN FACTOR INITIAL

However just because someone is motivated, this does not mean to say that they are doing the right thing.

Many criminals are highly-motivated, for instance. Motivation is difficult to measure and predict. We are all motivated by different things; for example, an artist might strive over many months to complete a painting that he may never sell, whereas a businessman may forfeit all family life in pursuit of financial success.

HUMAN FACTOR INITIAL

AIROD Aerospace Technology Sdn Bhd (686702-A)
Formerly known as Subang Aviation Services Sdn Bhd

Fitness and health

- Physical and emotional well being
- Being fit for duty means you are expected to perform your job effectively and safely
- No alcohol during lunch or no smoking breaks during working hours.
- There are no medical standards for maintenance personnel.

MENTALY FIT

PHYSICALLY FIT

PROPER DIET

EXERCISE

SUFFICIENT & GOOD SLEEP

BE CONTENTED AND HAPPY

REGULAR CHECK UP

International Civil Aviation Organisation ICAO Annex 1 states:

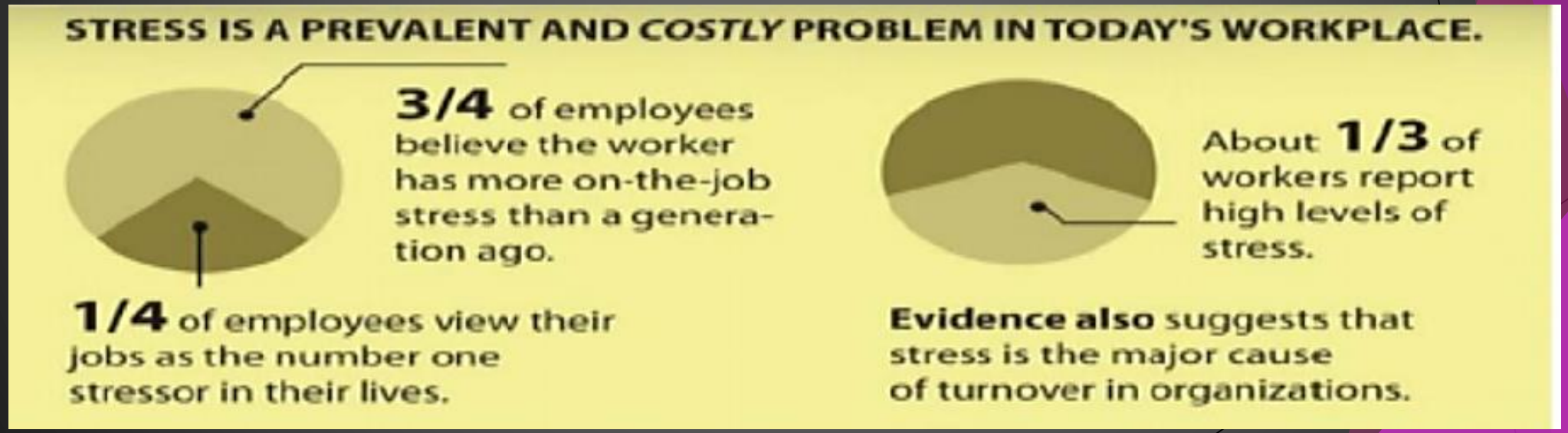
"An applicant shall, before being issued with any license or rating (for personal other than flight crew members), meet such requirement in respect of age, knowledge, experience and where appropriate, medical fitness and skill, as specified for that license or rating"

HUMAN FACTOR INITIAL

Workplace stress is the harmful physical and emotional response that occurs when there is a poor match between job demands and capabilities, resources or needs of the worker.

"Stress is the subconscious response to the demands placed on a person"

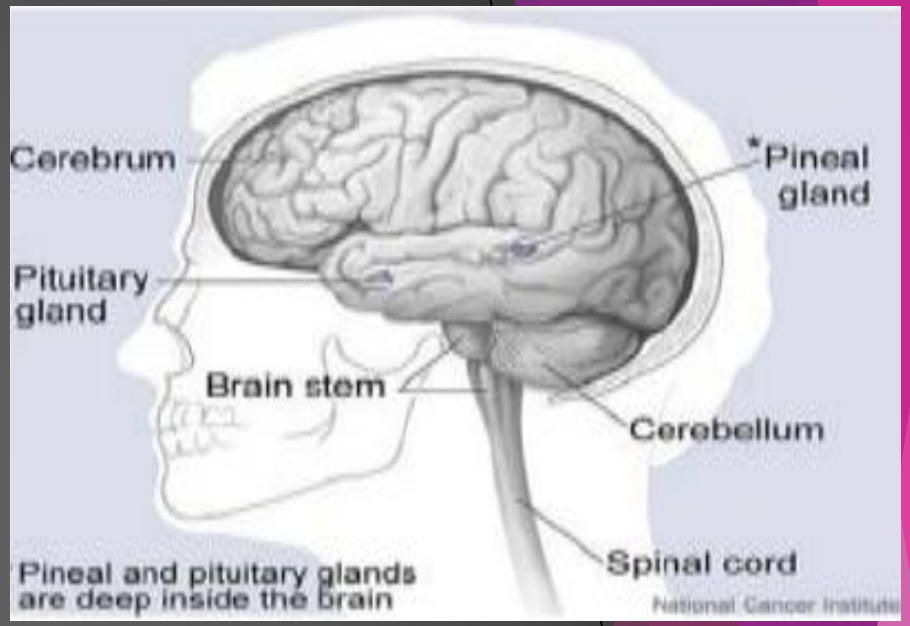
Up to a point, such demands are stimulating and useful, but if the demands are beyond our personal capacity to deal with them, the resulting stress is a problem.

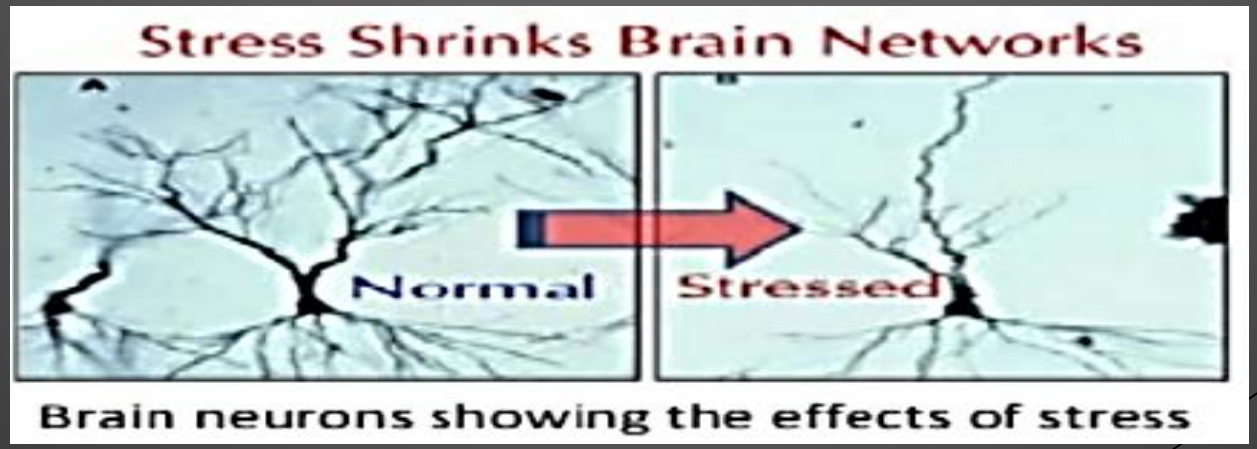


HUMAN FACTOR INITIAL

There are 4 main physiological reactions to stress:

1. An area near the brain stem, known as the reticular activating system, goes to work, causing a state of keen alertness as well as sharpening of hearing and vision.
2. Blood is shunted to the brain and Large muscle groups, and away from extremities, skins and organs that are not serving the body.
3. The immune and digestive system are temporary shut down. Pineal gland
4. Energy providing compounds of glucose and fatty acids are released into the bloodstream.





HUMAN FACTOR INITIAL

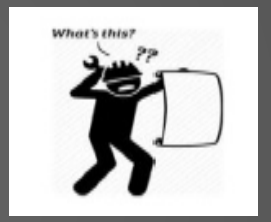
Excessive high workload, with unrealistic deadlines making people feel rushed, under pressure and overwhelmed.

Insufficient workloads, making people feel tat their skill are underused.

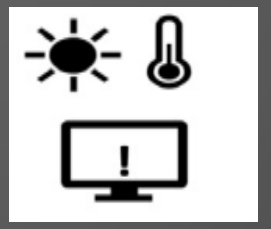
Lack of control over work activities.

Bullying or harassment.

Lack of interpersonal support or poor working relationships leading to a sense of isolation.



People being asked to a job for which they have insufficient experience or training.



Poor physical working environment, eg excessive heat, cold or noise, inadequate lighting, uncomfortable seating, malfunction equipment etc.

HUMAN FACTOR INITIAL

Signs of Stress

Individuals suffering from stress often display s range of signs that may be noticed by colleagues and other managers.

Tiredness and irritability.

Reduced work quality.

Indecisiveness and poor judgment

Loss of sense of humour.

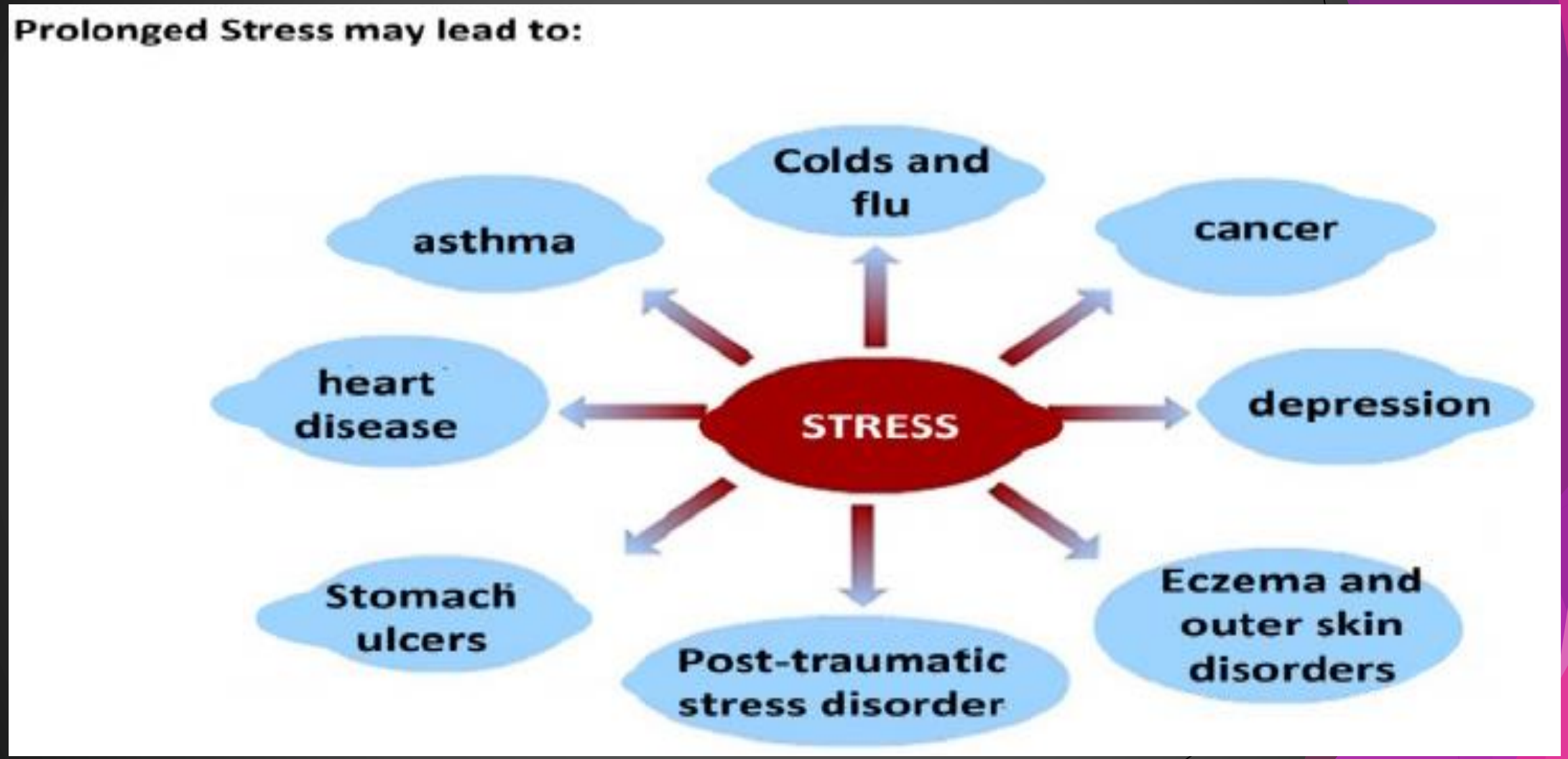
Physical illness such as headache, nausea, aches and pain.

Seeming jumpy or ill-at-ease, or admitting to sleep badly.

Increased sick leave.

Changes in working day pattern-perhaps by staying late or taking work home.

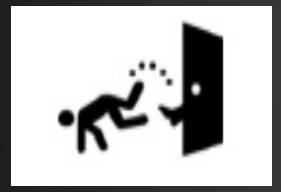
HUMAN FACTOR INITIAL



HUMAN FACTOR INITIAL

You need to be proactive if you want to cure your job stress. Here are some fixes that address the cause listed below:

Take a vacation, leave work on time as often as possible, and avoid taking work home.



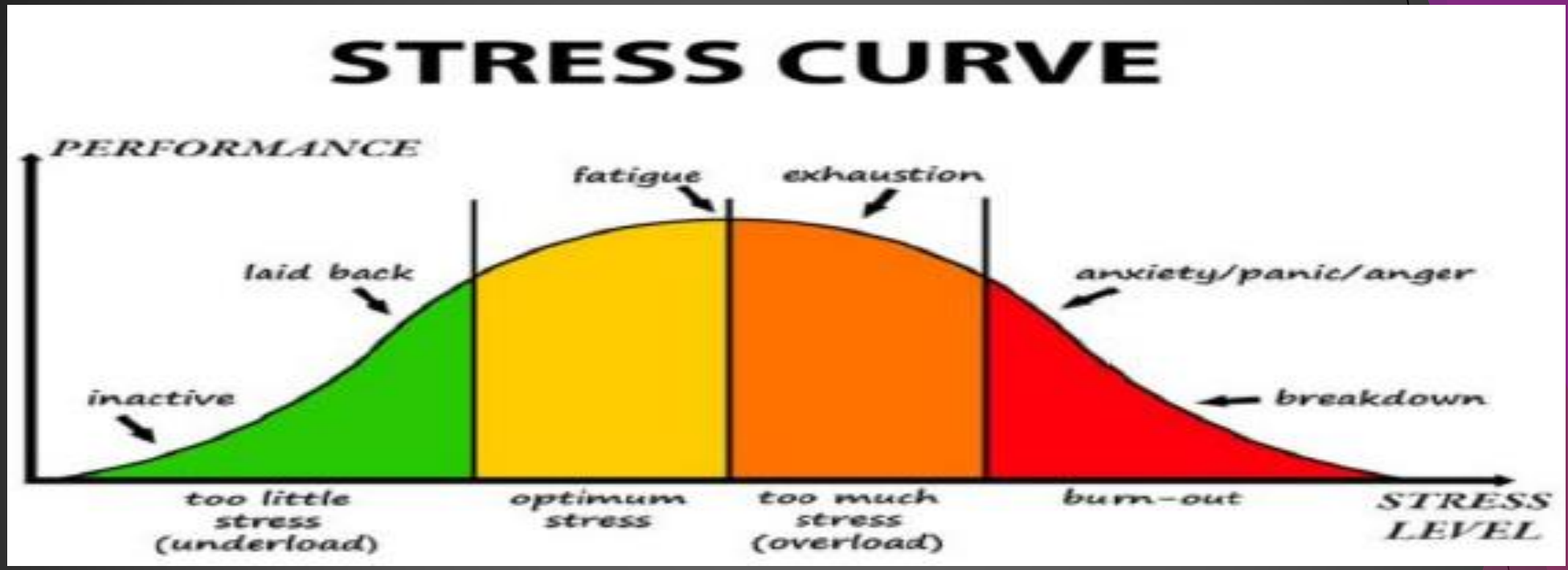
If you are worried about lay offs, all you can do is make sure you are prepared should that happened.

If you find that you made the wrong career choice, or your career is no longer fulfilling, it may be time for a change. Make your choice carefully.

If you are having conflict with your boss or co-workers, try to work them out. Although it maybe difficult to resolve personality differences, you can try to figure out a way to get along better.

If you stress is having a profound effect on your life, don't be afraid to get professional help.

HUMAN FACTOR INITIAL



Stress in itself is not necessarily bad. Psychological studies have shown that a positive level of stress leads to the best performance but too little or too much stress can have a negative affect on performance. The Yerk Dobson Law shows this phenomenon. As stress increases, so does performance. But this happens only up to a point. After the optimal point, stress starts to harm performance.

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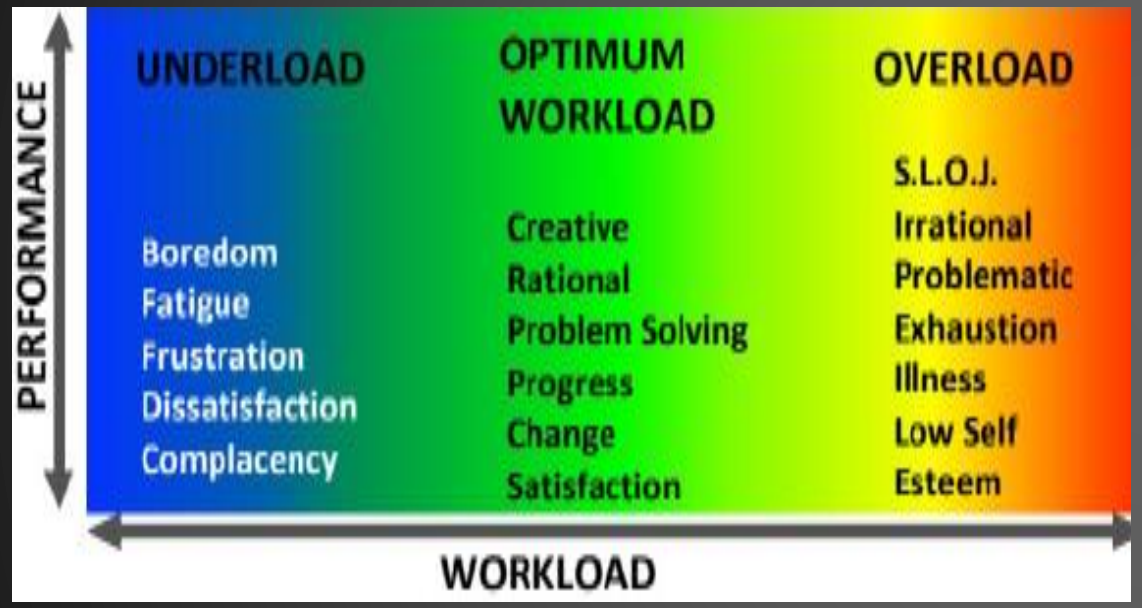
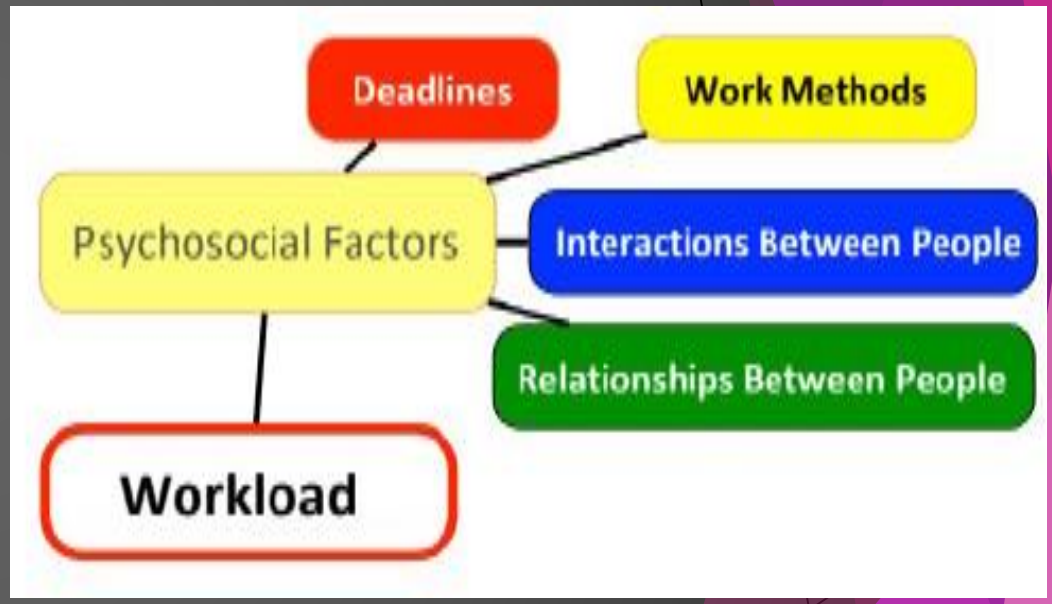
Psychosocial Factors

Psychosocial factors are element that impact employees psychological response to work and work condition, potentially causing psychological health problem





Psychosocial factors include the way work is carried out (deadlines, workload, work methods) and the context in which work occurs (including relationships and interactions with managers and supervisors, colleagues and co-workers, and clients or customers).

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Effect of High Workload

Omission and filtering	Ignoring some signal or responsibilities that are not seen as immediately relevant or necessary
Reduced ability to think logically	Limited capability for the consideration od other possibilities, or to process information correctly
Queuing	Delaying required actions/response in the hope that you will be able to catch up as the task progresses.
Confirmation bias	The tendency to automatically confirm a decision we have made, ignoring other information to the contrary.
Approximation	Near enough becomes good enough.
Regression	Reverting to a previously well-learnt procedure or action which may or may not be appropriate for the current task.

HUMAN FACTOR INITIAL

Time pressure refers to a ***limited amount of time*** available for a task.

Workload refers to the overall number of tasks to be done.

If the ***workload*** is ***heavy*** and combined with time ***pressure***, the result can be ***feeling of stress***.

Too little work, or under-load, is as stressful as overload. It can also lead to ***complacency***.

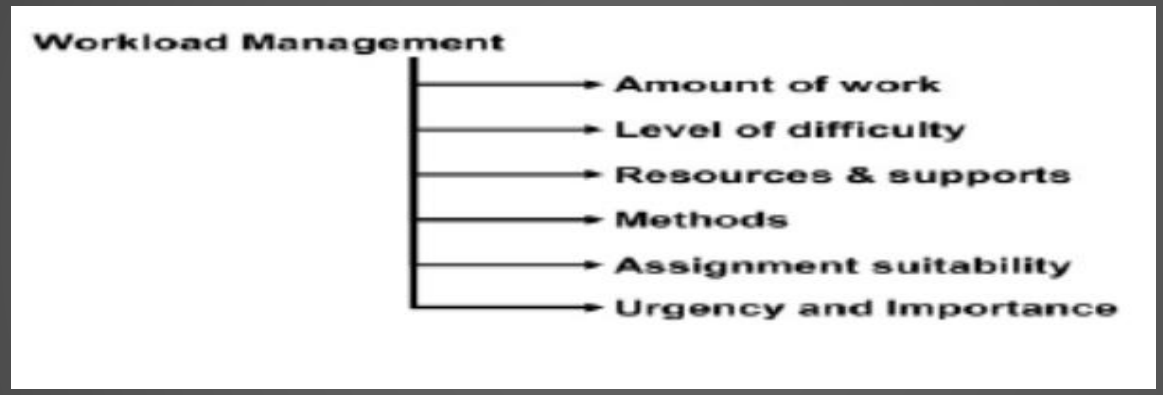
You can also be overloaded if you do not have the necessary knowledge or skills to do the task.

Being alternately overloaded and under-loaded in the same job is especially stressful. Fire fighters, for example, sit and wait for fires to occur (underload). When they are called to a fire, the work is dangerous and stressful (overload).

HUMAN FACTOR INITIAL

Workload management is a process for determining the ***proper workload distributions*** in order to provide optimal performance for engineers and technicians.

It provides the organization with the capacity to ***control or micromanage*** where each work request is run in order to ***maximize*** workload throughput and enhance performance by making sure everything works properly.



Workload Management brings tasks and responsibilities to be accomplished successfully within the time available and is important because there is a unique relationship between Job demands, intellectual demands and job satisfaction.

Research indicates that it is not just the amount of work that makes a difference in employee satisfaction and success, but also the extent to which employees have the resources (time, equipment and support) to do the work well.

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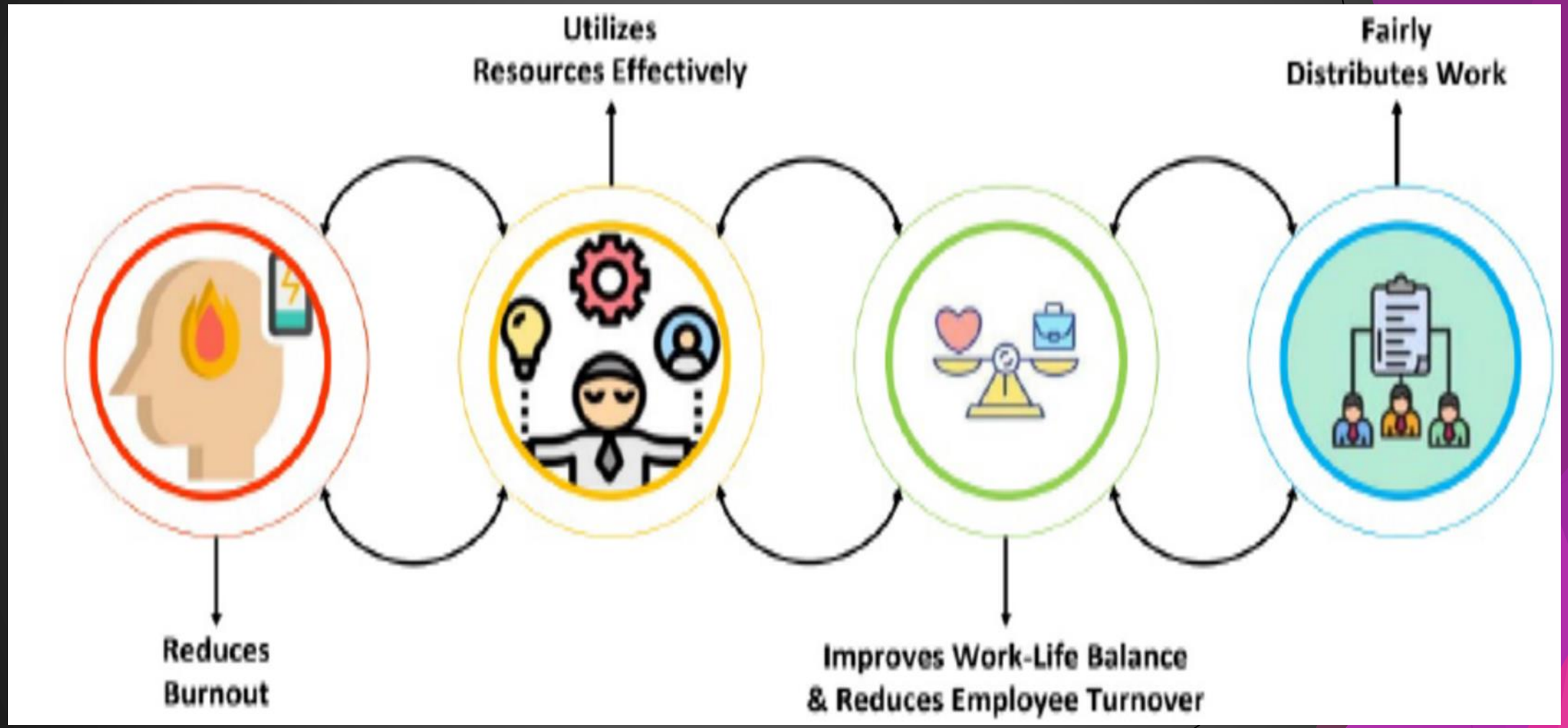
Benefits of Workload management



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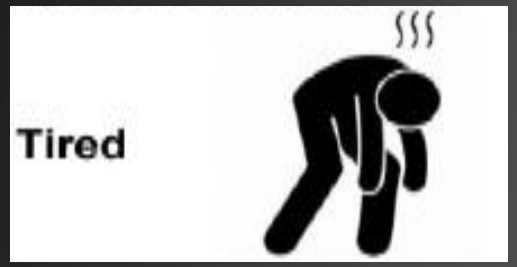
Fatigue is the state of feeling:



Resulting from

- Insufficient sleep
- Prolonged mental work
- Prolonged physical work
- Shift work
- Extended period of stress
- Extended period of anxiety

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The 10 most commonly described symptoms of fatigue

Described in 64% as feeling depressed, low mood, low confidence, low motivation, low interest and/or helplessness.

Described in 40% as exhaustion, sleepiness needing to sleep, lack of energy, lethargy and/or sluggishness

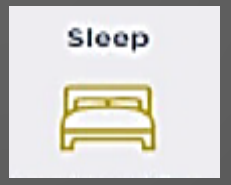
Described in 37% as sensation of heaviness, stiffness, movement difficulties, shortness of breath, no stamina, restricted and/or slow movement.

Described in 35%, mainly as felling anxious, anxiety, but also as stress.

Described in 25% as 'brain fog, feeling distant or dissociated, problems with focus, attention. concentration and/or memory

Described in 19% as spasms and cramps, twitches and/or weakness

Described in 17% as mood swings, irritability and/or frustration.



Described in 15% as difficulty sleeping, oversleeping, and/or not being refreshed from sleep.

Described in 10% as increased sensitivity to taste, light or sound and/ or localised tingling

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Tips for all:

- Eat healthy diet that promote long lasting energy. Avoid over eating. Choose healthy fat diets. Avoid sugars.
- Adopt steady exercise routine that includes cardiovascular, muscle strengthening and flexibility workout.
- Get enough sleep. 7-8 hours per night.
- Stay positive. Make a conscious effort not to be overwhelmed by negative circumstances.
- Avoid driving you are tired. Especially in inclement weather where vision is impaired and traffic jam condition.
- Avoid excessive noise.

Advise for management:

- Ensure working environment does not promote fatigue. Avoid dim lighting, toasty temperature and excessive noise.
- Vary job tasks to eliminate repetition or long periods of boring and monotonous work.
- Incorporate and encourage taking breaks.
- A Train workers of getting enough rest and how to achieve life-work balance.
- Introduce shorter shifts, and rotate shifts in the direction of sun (morning, afternoon, night, in that order).

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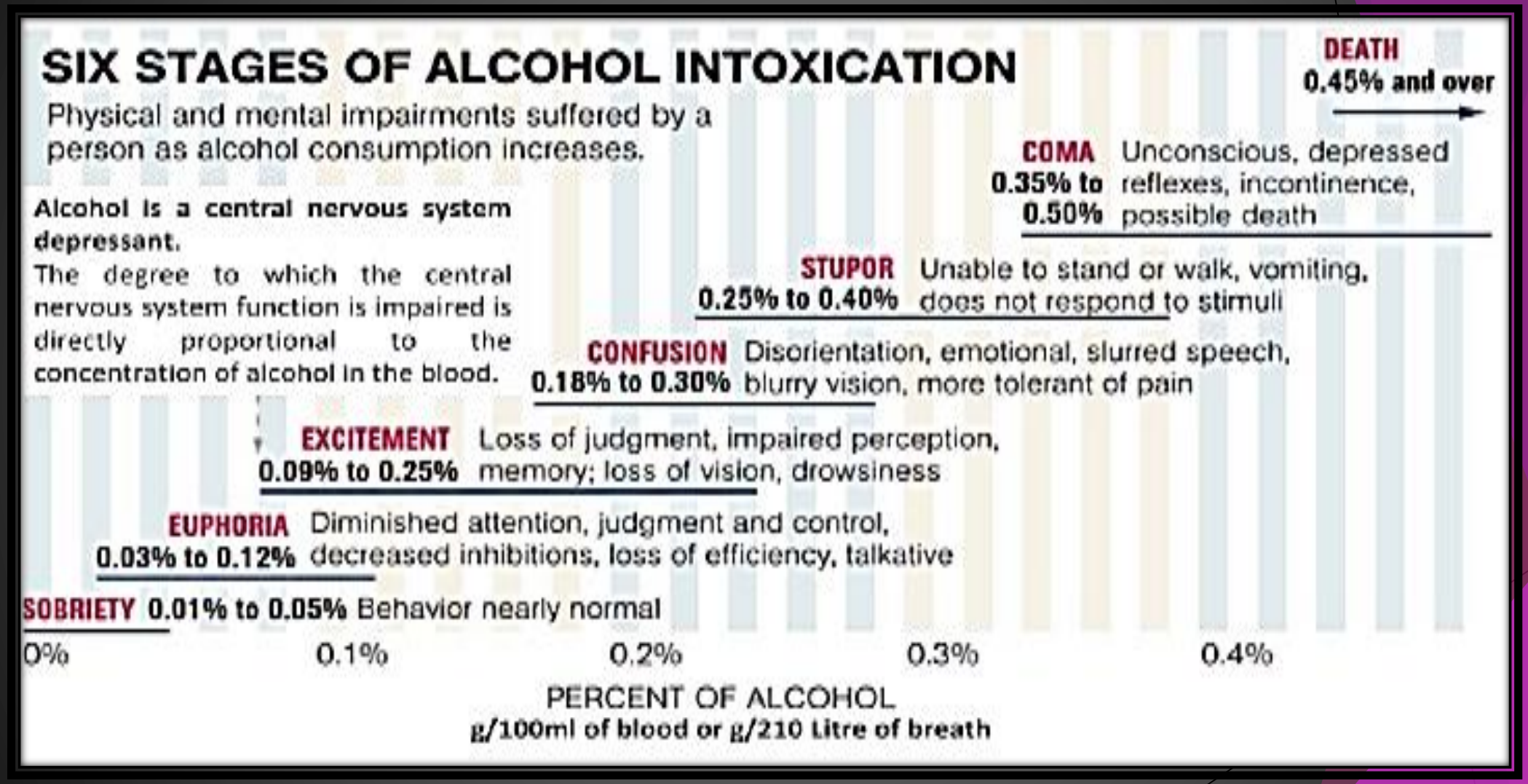

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The following are some of the types of medicine in common use which may impair work performance.

Sleeping Tablets : cause mental confusion and slow reaction times.
Anti-depressants : depress the alerting systems and have been a contributory cause of mistakes leading to fatal accidents.
Antibiotics : may have short term or delayed effects which affect work performances.
Anti-histamine : tend to make the taker feel drowsy.
'Pep' Pills : (e.g. containing Caffeine, Dexedrine, Benzedrine) used to maintain wakefulness are often habit forming. Over dosage may cause headaches, dizziness and mental disturbances.
Drugs for the relief of high blood pressure : antihypertensive agents all have some side effects. Some may increase the tendency to urinate.
'SUDAFED' : For relief of nasal congestion. Side effects reported however are anxiety, tremor, rapid pulse and headache.

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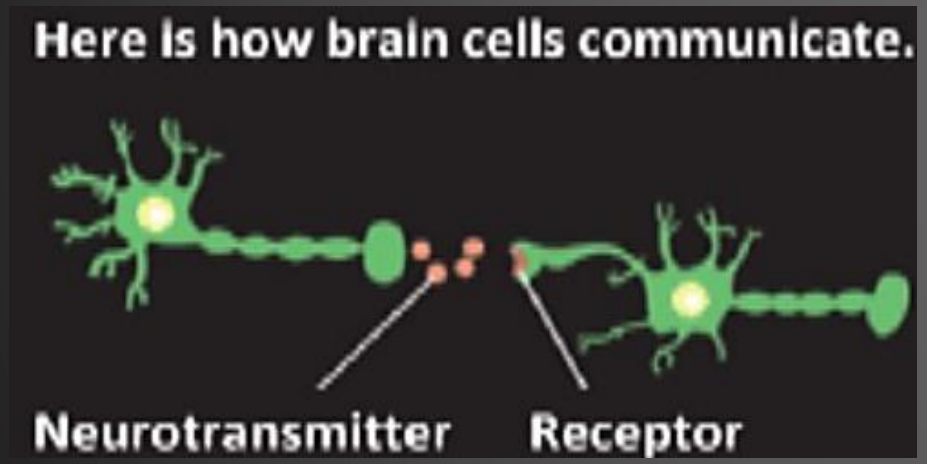
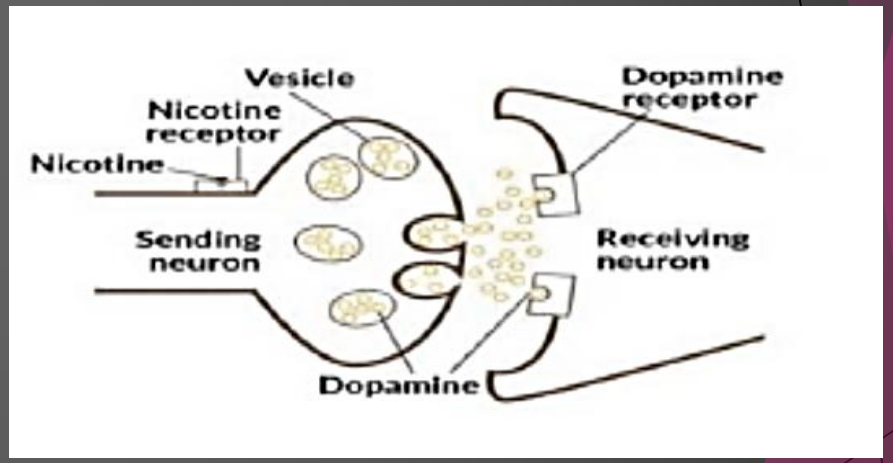
- To send a message, a brain cell (neuron) releases a chemical (neurotransmitter) into the space (synapse) between it and the next cell.
- The neurotransmitter crosses the synapse and attaches to proteins (receptor) on the receiving brain cell.
- This causes changes in the receiving cell – the message is delivered.





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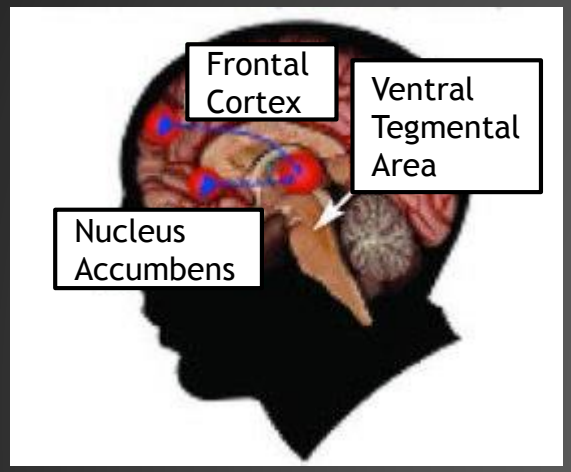
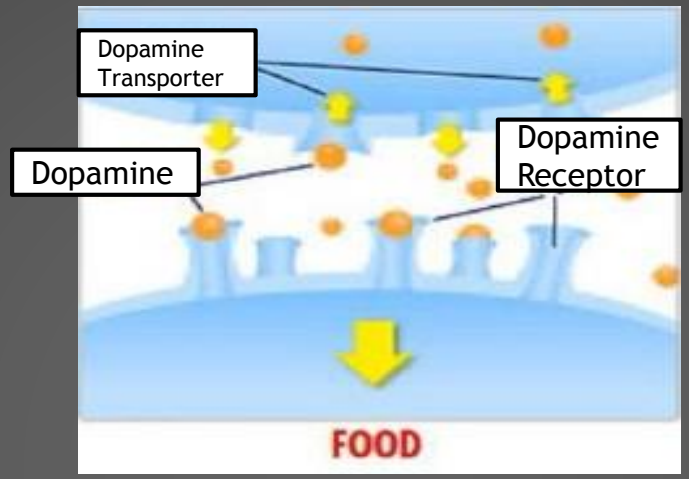
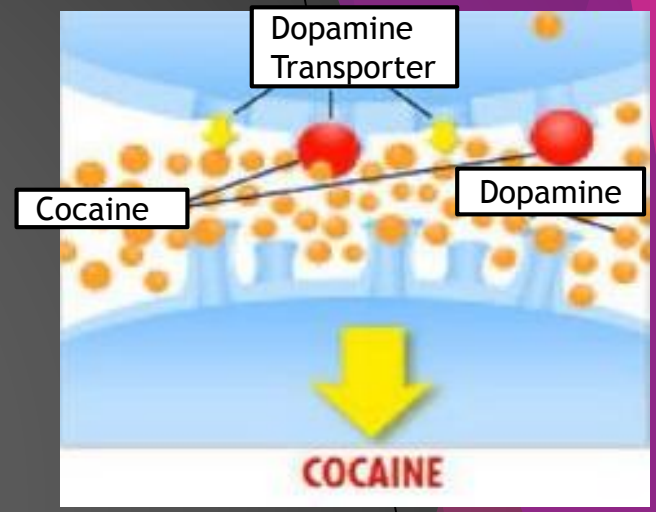
DRUGS OF ABUSE TARGET THE BRAIN'S PLEASURE CENTER

Brain reward (dopamine) pathways



These brain circuits are important for natural rewards such as food, music, and sex.





Typically, dopamine increases in response to natural rewards such as food. When cocaine is taken, dopamine increases are exaggerated, and communication is altered.

For the brain, the difference between normal rewards and drug rewards can be described as the difference between someone whispering into your ear and someone shouting into a microphone. Just as we turn down the volume on a radio that is too loud, the brain adjusts to the overwhelming surges in dopamine (and other neurotransmitters) by producing less dopamine or by reducing the number of receptors that can receive signals. As a result, dopamine's impact on the reward circuit of the brain of someone who abuses drugs can become abnormally low, and that person's ability to experience any pleasure is reduced. This is why a person who abuses drugs eventually feels flat, lifeless, and depressed, and is unable to enjoy things that were previously pleasurable.

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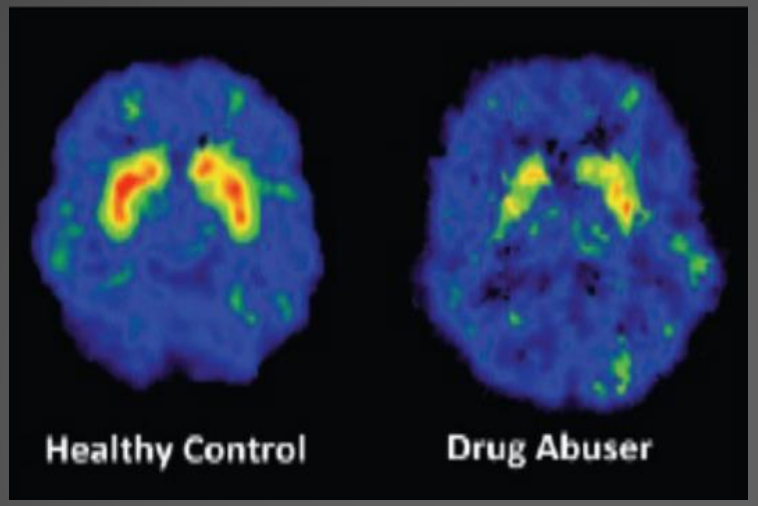
Long-term drug abuse impairs brain functioning.



Decrease Dopamine Transporters in a Methamphetamine Abuser.

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Drugs

Alcohol

Medication

Impair

Concentration
Perception
Judgement
Decision making
Body muscle coordination

Promote

Human Errors

Accident/
Incident

HUMAN FACTOR INITIAL

Muscles provide the motive force for all movements, and the bones support the reaction force. This is known as the **musculoskeletal system.**

Aircraft maintenance mainly deals with physical tasks, it is therefore important for maintenance personnel to know their performance limitations.

The force that can be applied in any given posture is dependent on the strength available from muscles and the mechanical advantage provided by the relative positions of the load, muscle connections, and joints.

It is important that maintenance tasks on aircraft are within the physical limitations of aircraft maintenance technicians.

Aircraft Manufacturers use a computerized tool based on human performance data (body sizes, strengths, leverages, pivots, etc.) to ensure that modern aircraft are designed such that the majority of maintenance technicians will be able to access aircraft equipment, apply the necessary strength to loosen or tighten objects, etc. (i.e., designed for **ease of maintainability**).

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How To Protect Yourself When Performing Physical Maintenance Task ?

1. Use correct postures for every aspects of work.
2. Use crane for lifting heavy objects.
3. Use working Pilate while working on irregular surfaces (on stringers, between frames).
4. If necessary, get sufficient access before start working.
5. Use special tools and equipment as specified in the maintenance manuals.
6. Use knee pad or joints pad as necessary.

How To Strengthen Yourself To Cope Up With Physical Maintenance Task?

1. Eat healthy diets.
2. Have sufficient sleep.
3. Suitable exercise to strengthen muscles.
4. Go for regular check-up.
5. Avoid bad habits such as smoking.
6. Stay away from harmful substance such as drugs and alcohol.
7. Attend courses to make yourself aware of human limitation and performance.

HUMAN FACTOR INITIAL

Repetitive task could be mentally demanding.

- ❖ Senses get tired, boredom takes place and performance drops.
- ❖ Especially during demanding visual inspections.
- ❖ Maintenance tasks that do not involve heavy physical exertion for long periods

Studies show that productivity improved dramatically when workers were allowed to alternate among different types of tasks during their shift.

HUMAN FACTOR INITIAL

Complacency……

"Self satisfaction leading to a loss of the awareness of danger…."

I've looked back there 1000 times and never found anything wrong!

Because of the large number of ***repetitive jobs*** in maintenance, there is a high risk of acting automatically. ***Once you do something frequently, you stop consciously thinking about it and forget about any related dangers.***

Self-satisfaction is often linked to ***over confidence.***

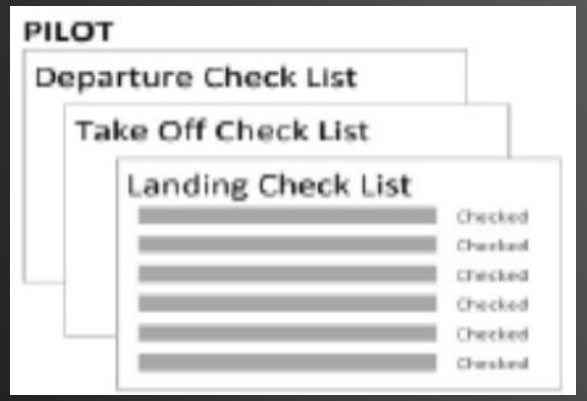
You are so sure of finding what you expect to find, that you see what you expect to see, even if it is not there. When you add such factors as missing tools, tiredness etc. there is a ***good chance of making a mistake.***

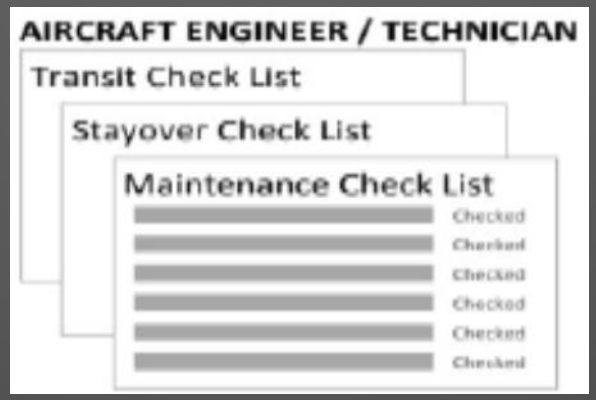
HUMAN FACTOR INITIAL

RULES FOR REPETITIVE TASK

1. Be conscious of what you are doing. → Be Conscious
2. Use the work instructions no matter how many times you have performed the job. → Avoid Complacency
3.Paying attention is the best protection against acting automatically → Stay Alert
4. Check the conditions every time you start and complete a job. → Error Prevention

Tools for Repetitive Task :



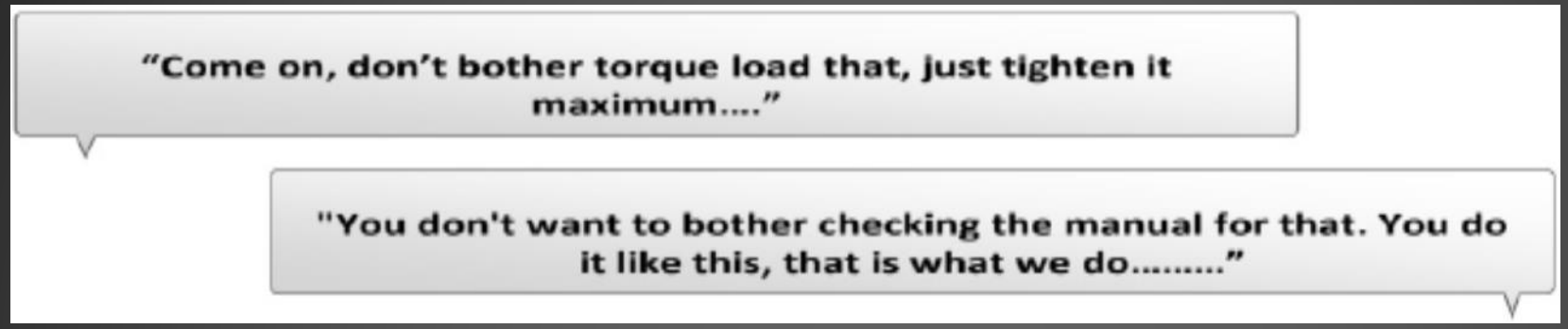


HUMAN FACTOR INITIAL

Chapter 5 : Environment

HUMAN FACTOR INITIAL

Peer pressure is when you are ***influenced*** by other people (you peers) to act in certain way.



Peer pressure happen most to inexperienced person where one is trying to allow one's opinions, attitudes, actions, and ever perceptions to be affected by prevailing one. This can be categorized under conformity.

In the working environment of aircraft maintenance, an individual technician may feel that there is pressure to cut corners in order to get an aircraft out by a certain time, in the belief that this is what their colleagues would do under similar circumstances. There may be no actual pressure from management to cut corners, but subtle pressure from peers. This is known as peer pressure.

Example: If you're with friends who are doing something that you typically would not do and they convince you to do what they are doing, that is an example of peer pressure.

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Aae/TRG/Hfi - 09

HUMAN FACTOR INITIAL

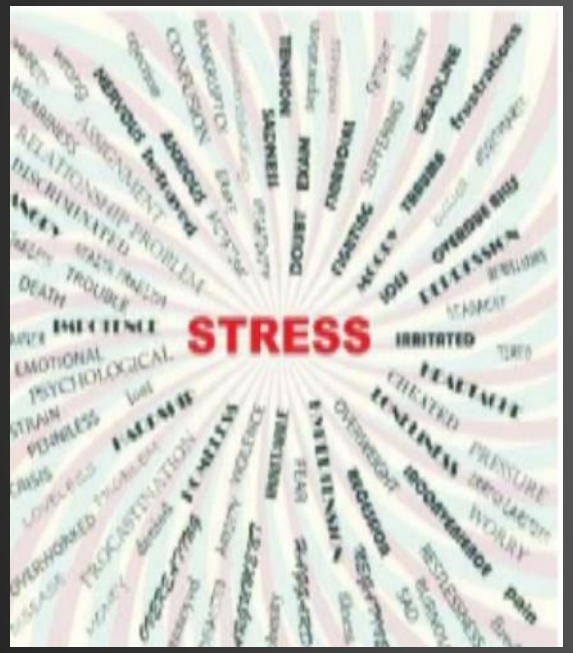
Countering Peer Pressure and Conformity

It is highly relevant in the aircraft maintenance environment where peer pressure can work for or against a safety culture, depending on the attitudes of the existing staff and their influence over newcomers.

HUMAN FACTOR INITIAL

A stressor can be a chemical or biological agent, environmental condition, external stimulus or an event that causes stress to human.

Aviation maintenance can be stressful due to environmental stressor:



- Time pressure and deadlines
- Workload
- Shift work
- Noise and fumes
- Illumination
- Climate and temperature
- Motion and vibration
- Complex system
- Hazard in the workplace
- Lack of manpower
- Distraction and interruption

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Time Pressure And Self-Imposed Pressure

There are two types of pressure that maintenance engineers or teams may experience-actual pressure and self-imposed pressure.

Actual pressure applied directly or indirectly for the task to be completed in a given time.
Self-imposed pressure is the pressure that comes from the inside

Actual and self-imposed pressure can be significant drivers for error and maintenance short cuts/work arounds.

There are two types of pressure that maintenance engineers or teams may experience- actual pressure and self-imposed pressure.
The first is actual pressure applied directly or indirectly for the task to be completed in a given time. On the other hand, individuals or teams may feel self-imposed pressure to complete a task within a given time, even when the time available may be unrealistic, or the task may not be achievable within the allocated resources and timeframe.

For an individual, the self-imposed pressure is real. For them it is no different from any actual pressure being applied to the completion of the task. All pressure (self imposed or otherwise) will affect the performance of those subjected to it.

Inappropriate pressure applied to an individual or maintenance team to achieve a task is a safety risk. Actual and self-imposed pressure can be significant drivers for error and maintenance short cuts/work arounds.
Inappropriate pressure applied to an individual or maintenance team to achieve a task is a safety risk.

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What to do if you are under PRESSURE?

Ask a second inspector to double check the repair thoroughly to ensure that all maintenance tasks were completed correctly.

You should **ask for help** if they feel overwhelmed and under a time constraint to get a repair fixed.

Bring it to the attention of the organization's **management** and **openly discuss** a different course of action.

FAA research has highlighted the need to insulate aircraft maintenance technicians from commercial pressures. They consider this would help to ensure that airworthiness issues will always take precedence over commercial and time pressures. Time pressures can make "corner-cutting" a cultural norm in an Organization. Sometimes, only an incident or accident reveals such norms

HUMAN FACTOR INITIAL

Managing Time Pressure and Deadlines

Those responsible for setting deadlines and allocating tasks should consider:

- Prioritizing various pieces of work that need to be done
- The actual time available to carry out work (considering breaks, shift hand overs, etc.)
- The personnel available throughout the whole job (allowing a contingency for illness)
- The most appropriate utilization of staff (considering an technician's specialization, and strengths and limitations)
- Availability of parts and spares

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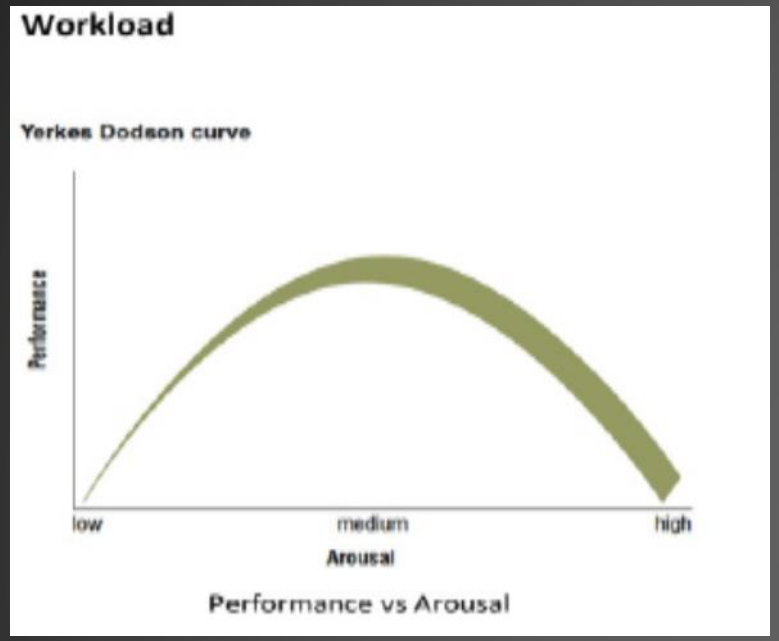

Both arousal and alertness are necessary for us to achieve our optimum performance, but too much, or too little, arousal can adversely affect our ability to function effectively.

It is therefore important for us to be aware of the symptoms of stress in ourselves and others we also need to understand the effect of stress on team performance as a whole.

The Yerkes Dodson curve demonstrates that our performance is directly related to the level of arousal. The graph below shows that there is typically a level of arousal which aligns with the optimum level of human or task performance. At very low levels of arousal (boredom) and very high levels of arousal (stress, anxiety and overload) our performance is very much degraded.

HUMAN FACTOR INITIAL

Work Underload

Although rare in the maintenance environment, work underload does occur. ***Work underload can result from menial, simple or very repetitive tasks that we find boring, or indeed from a lack of tasks to do***

We are likely to be less attentive when carrying out repetitive tasks; boredom may set in and we may begin to raise the level of mental stimulation by thinking about things not related to the task, (e.g. what to do at the weekend). Under these conditions, situational awareness is degraded and errors and omissions will increase.

HUMAN FACTOR INITIAL

Workload Management

It is seldom possible to make large amendments to maintenance schedules, nor eliminate time pressures. The essence of workload management in aircraft maintenance should include:

- Ensuring that staff have the skills, proficiency and experience to do the tasks within the timescales
- Making sure that staff have the tools and spares they need to do the tasks
- Allocating tasks to teams or individual technicians that can be accomplished without cutting corners, in the time available
- Providing human factors training to those responsible for planning so that the performance and limitations of their staff are taken into account
- Encouraging individual technicians, supervisors and managers to recognize when an overload situation is building up

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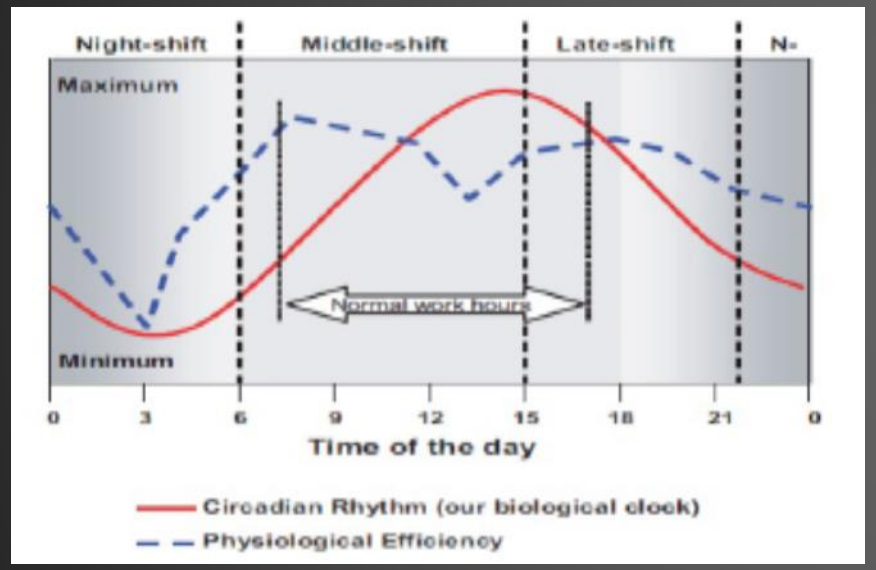
Shift work, shortage of sleep, etc. affect human performance through at least two mechanisms.

1. Disrupting the normal wake-sleep cycle causes various physical and psychological problems.
2. The **emotional stress caused by family tensions** can harm job performance every bit as much as the physical effects of shift work.



Humans have an inner clock which is set according to the degree of light and stark and this dock controls procedures like eating sleeping, activity, body temperature etc. in other words our physical functions are controlled by the light and shift work can lead to fatigue.

With shift work, they are exposed to light at a time their body needs darkness in order to produce the rightful amount of melatonin, and without the needed intake of darkness and melatonin their bodies can have very harmful reactions.

HUMAN FACTOR INITIAL

Ear is sensitive to sounds between certain frequencies ***(20 Hz to 20 KHz)***
Exposure more than ***115 dB without ear protection*** even for a short duration is not recommended
Short term exposure to loud noise can cause temporary change or hearing or ***ringing*** in ears (tinnitus).
Exposure to ***high levels*** of noise can cause ***permanent*** hearing loss.
Neither surgery nor a hearing aid can help correct this type of hearing loss.
Common areas with noise levels ***above 85dB.***
-Hangar
-Ramp
-Engine & APU running

The ***noise environment*** in which the aircraft maintenance technician works can vary considerably.

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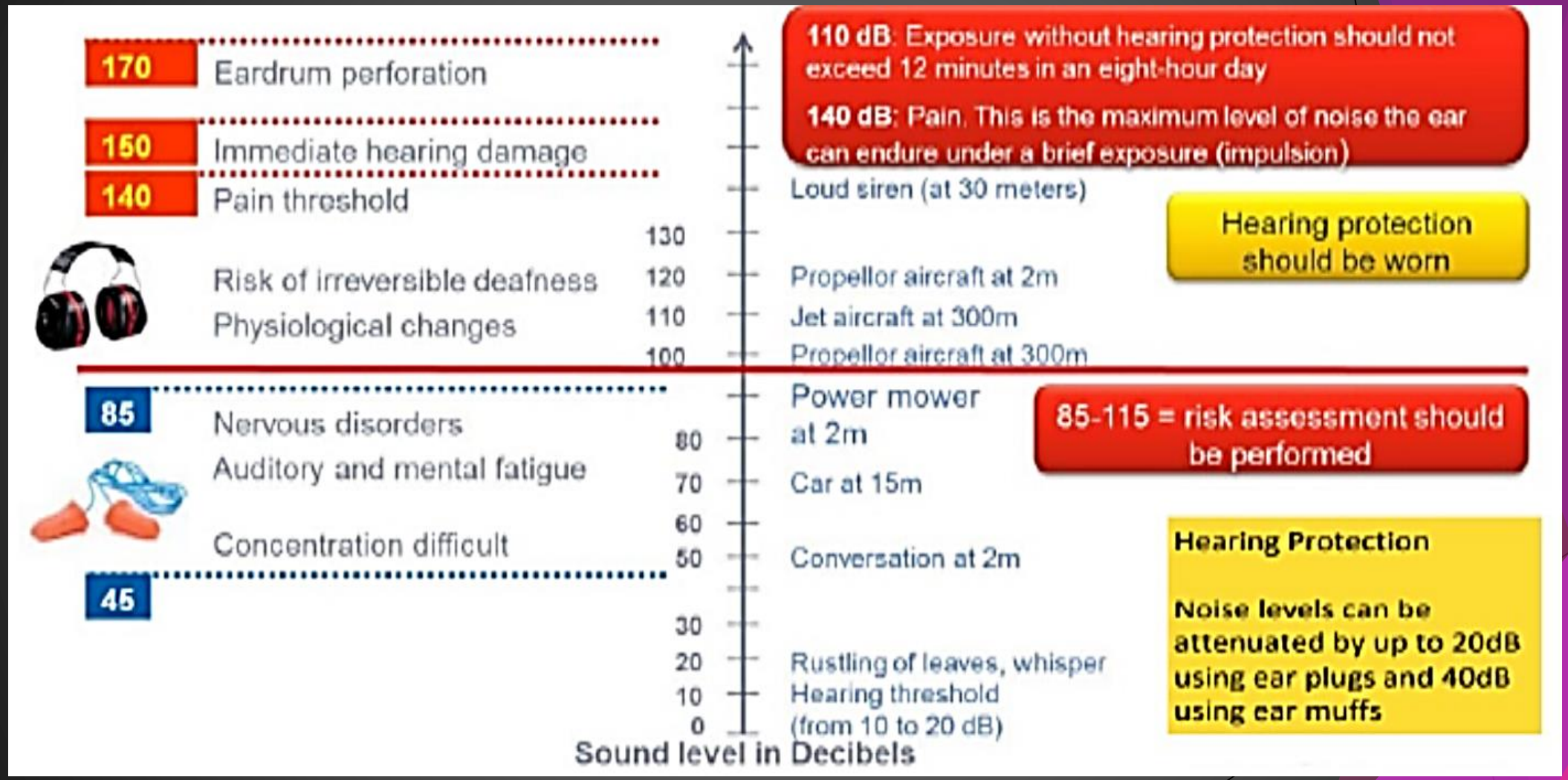

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ATTENTION

You must be aware that wearing hearing protection can affect the communication with your colleagues. The effectiveness of verbal communication is greatly reduced and must be supplemented with other forms of communication methods to ensure the message can be conveyed effectively.

HUMAN FACTOR INITIAL

Fumes cause problems for aircraft technicians when inhaled, but they can also cause other problems, such as eye irritation. The problem may be exaggerated when working in confined spaces such as fuel tank. Breathing apparatus are recommended when intent to work In confined area.

Before start working in a new environment, always know where is the location of emergency eye wash and safety shower in case of emergency.

HUMAN FACTOR INITIAL

➢ *Aircraft Painting*

It is recommended that to have separate paint hangar so that the aircraft painting shall not affect other hangar maintenance operation.

-Paint mist may cause:

- *breathing difficulty, skin irritation, inflammation*
- degrade inspection and maintenance quality due to *low visibility.*

Aircraft painters are compulsory to *wear overall, face-shielded respirator and glove* for overall protection.

➢ *Hydraulic Fume*

Phosphate ester based Skydrol fire resistant hydraulic fluid may cause choking sensation when inhaled.

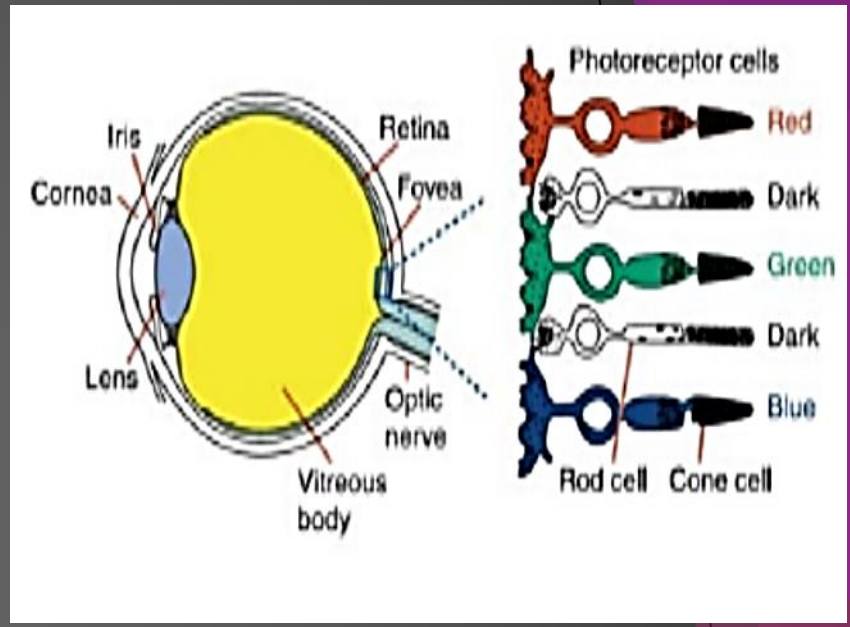
Wearing face shielded respirator when handling such fluids.

HUMAN FACTOR INITIAL

The *cones* in the retina of the eye require *good light* to resolve fine detail and colour.

Inappropriate or insufficient lighting can lead to *mistakes* in work tasks or can increase the time required to do the work.

-Lighting is such as to ensure each inspection and maintenance task can be carried out in an effective manner.



145.A.25(c)

"The working environment including aircraft hangars, component workshops and office accommodation is appropriate for the task carried out and in particular special requirements observed. Unless otherwise dictated by the particular task environment, the working environment must be such that the effectiveness of personnel is not impaired:

HUMAN FACTOR INITIAL

Generally, most maintenance tasks require between 75 foot candles and 100 foot- candles for aircraft hangar light levels. Although more detailed maintenance tasks may require additional illumination.

General line inspections (eg, easily noticeable dents) may only require 50 foot-candle. however, most inspection tasks demand much higher levels.

Hangar Illumination Requirements :

- Sufficient lights intensity
- Correct Colour
- Adequate Contrast
- Non glare
- Energy Efficient

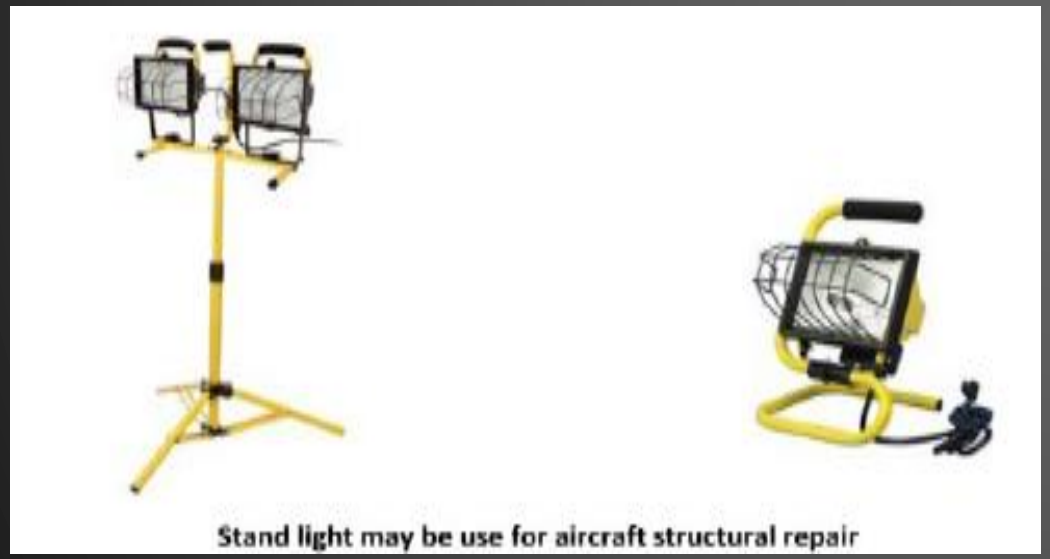
Visual inspection tasks constitute a large proportion of routine aircraft maintenance. Aircraft maintenance hangars must have high levels of visibility and good colour rendering in order for personnel to detect defects in airplanes and make repairs. Poor illumination levels and colour rendering can obscure or mask the appearance of items that would otherwise be perceptible.

HUMAN FACTOR INITIAL

Use additional lighting especially in dark areas, such as:

- Fuel tank
-Cargo Bay
Tall compartment

It is ***compulsory*** to use only ***explosion proof fuel tank light*** when inspecting interior of aircraft fuel tank to prevent fuel tank explosion.



Stand light may be use for aircraft structural repair

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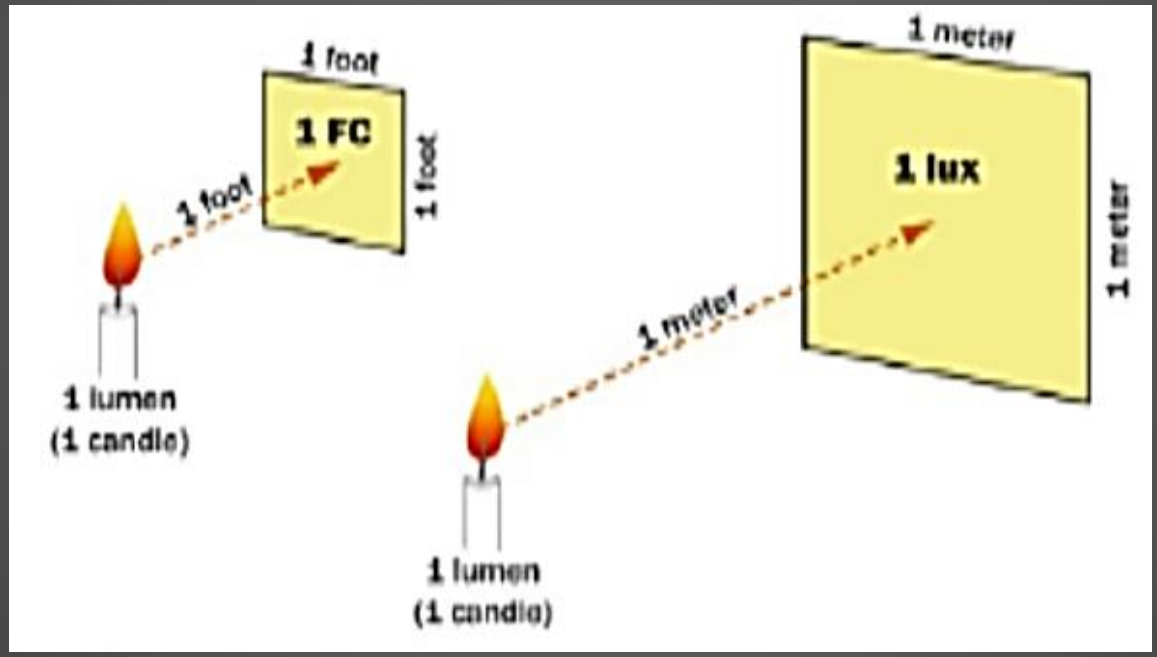
Aircraft inspectors and technicians are recommended to ***use professional grade*** torch light for inspection quality control.



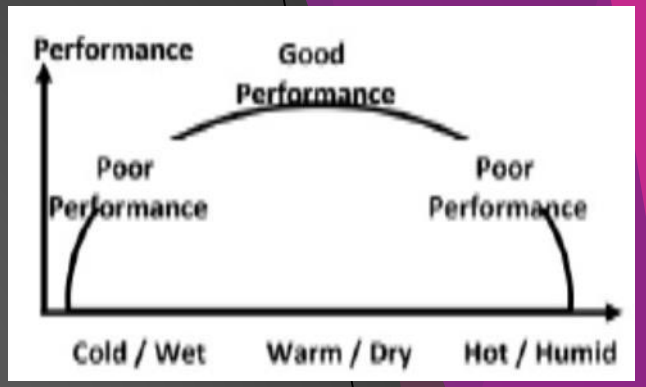
HUMAN FACTOR INITIAL

Improper illumination may cause :

- Missed defects in visual inspection
- Distraction (due to glare)
- Low productivity
- Eye fatigue
- Increase mistake in performing task

HUMAN FACTOR INITIAL

There are no simple solutions to the effects of temperature and climate on the engineer. Here are some ***issues for a maintenance engineer to be aware of*** when taking climate and temperature into consideration.



In the direct heat of the sun, it is difficult to set up a shelter when working outside

In the cold, gloves can be worn but will interfere with motor skills

Working in strong winds can be distracting especially at heights

In the cold, fingers can get numb and reduce ability to perform delicate tasks

Extreme conditions can be fatiguing, both physically and mentally

HUMAN FACTOR INITIAL

The Part 145 requirement:

EASA AMC 145.A.25 (c)1

"Hangars used to house aircraft together with office accommodation should be such as to ensure the working environment permits personnel to carry out work tasks in an ***effective manner***. Temperatures should be maintained such that personnel can carry out required tasks ***without undue discomfort***."
"The working environment for line maintenance should be such that the particular maintenance or inspection task can be carried out without undue ***distraction***. It therefore follows that where the working environment deteriorates to an unacceptable level in respect of temperature, moisture, hail, ice, snow, wind, light, dust/other airborne contamination, the particular maintenance or inspection tasks should ***be suspended*** until satisfactory conditions are re-established."

HUMAN FACTOR INITIAL

Vibration in aircraft maintenance engineering is usually associated with the use of rotating or percussive tools and ancillary equipment such as generators. How vibration affect maintenance activities :

- Balancing
- Vision
- Motion Sickness
- Distraction
- Vibratory – Induced White Finger Syndrome

1. Vibration can interfere with our vision. If the whole body is vibrating this increases both the time it takes to interpret what we see and the chance of making an error in that interpretation.

2. One form of vibration with relatively high magnitude but a very low frequency produces an unpleasant response in most of us - we call this motion sickness.

3. The range between 50-150 Hz is most troublesome for the hand and is associated with Vibratory-Induced White Finger Syndrome (VWF). This is particularly true for prolonged used of pneumatic tools that reduced local blood flow and pain. Long term exposure to vibration may lead to sensory nerve damage.

4. Any sensation of unsteadiness may distract a technician, for they may concentrate more on keeping their balance than the task.

5. Vibration can be annoying, possibly disrupting a technician's concentration.

HUMAN FACTOR INITIAL

Types of Vibration Exposure

Whole Body Vibration:
Vibration transmitted through a supporting area to whole body: sitting in a chair, standing on vibrating ground 0.5-80 Hz (150 2631-2)
Sea sickness 0.1-0.5 Hz, (ISO 2631-1)

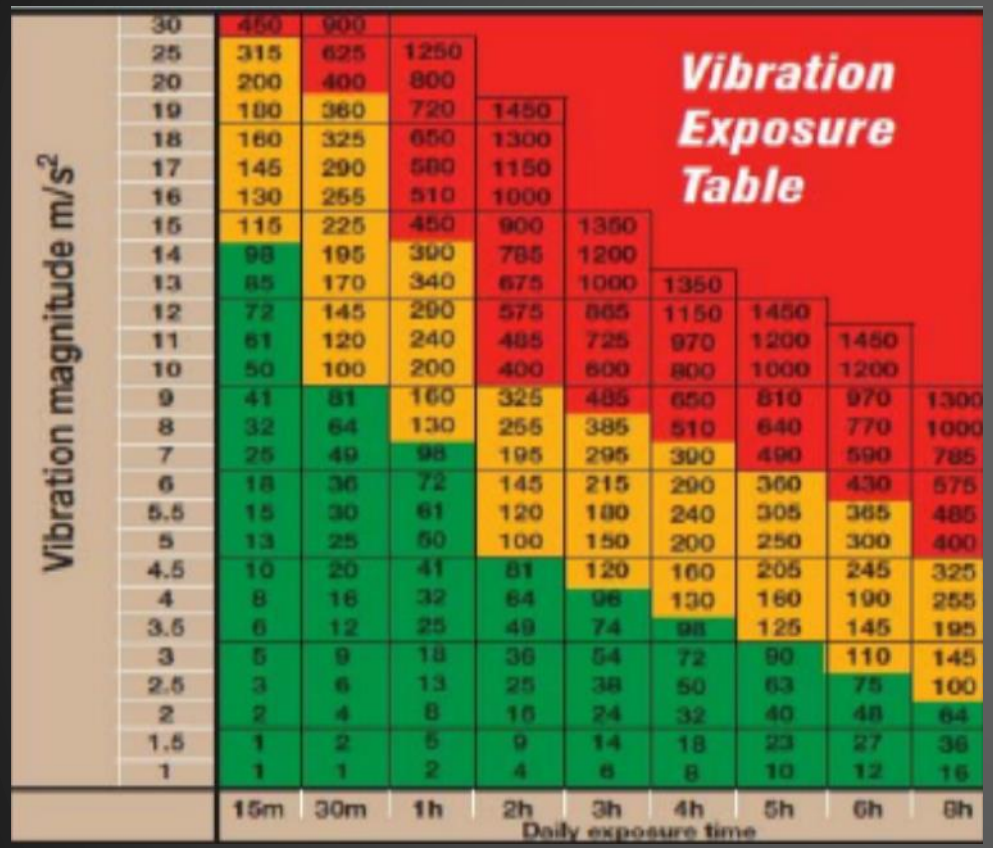
Hand Arm Vibration:
Vibration transmitted through hand: holding a vibrating tool, 5-1500 Hz, (ISO 5349-1)

The Exposure Limit

Employers should not consider reduction below the exposure limit value to be a target you must reduce exposure as low as you reasonably can. This may mean reducing the time for which the employee uses the machine each day, e.g. spreading that particular task over several days or sharing it between two or more employees (job rotation).

Vibratory – Induced White Finger Syndrome

HUMAN FACTOR INITIAL



Low Covers low vibration equipment, some of which can be used for up to 8 hours in a working day before the EAV is reached

Medium Covers medium vibration equipment, where the EAV and the ELV will be reached after a relatively short duration of use.

High Covers high vibration equipment where the EAV and the ELV will be reached after a short duration of ease

Note:

EAV (Exposure Action Value) - The EAV is the daily amount of vibration exposure above which employers are required to take action to control exposure. For hand-arm vibration the EAV is a daily exposure of 2.5 m/s2 (over an average 8 hour working day) or 100 points.

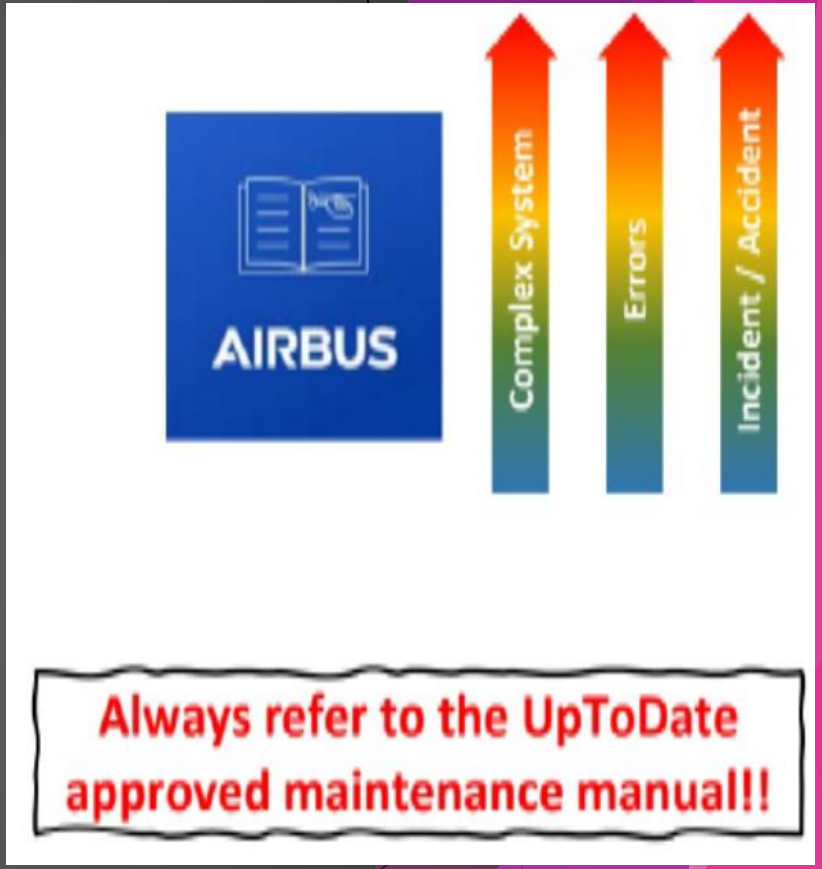
ELV (Exposure Limit Value) - The ELV is the maximum amount of vibration an employee should be exposed to on any single day For hand om vibration the ELV is a daily exposure of 5 m/s2 (over an average 8 hour working day) or 400 points

The Vibration Exposure Table below can be used to calculate daily vibration exposures. All you need is the vibration magnitude (level) and exposure time. The table covers a range of vibration magnitudes up to 30 m/s2 and a range of exposure times up to 8 hours. Where different types of equipment are being used in a working day. exposure points can be added together in order to assess the overall daily exposure to vibration.

HUMAN FACTOR INITIAL

Large modern aircraft systems are complicated and there are a myriad of separate systems, many of which themselves may be considered complex, (e.g.. flying controls, landing gear, air conditioning, flight management computers).

- ***System-specific training*** must be provided for working on these complex tasks.
- ***Reference to the maintenance manuals*** must be made during maintenance & troubleshooting.
- ***Never work alone*** when carrying out functional or operational tests.
- ***Do not perform*** complicated task or testing complex systems ***when fatigue.***
- ***Always be aware*** of what is happening when performing complex tasks.



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Recognizing and Avoiding Hazards

Physical hazards in Aircraft Maintenance Engineering may include:

- Very bright lights (e.g., from welding)
- Very loud sounds (sudden or continuous)
- Confined or enclosed areas (inside fuel tank)
- Working at significant heights (Rudder platform)
- Noxious substances (liquids, fumes, etc.)
- Excessive temperature (i.e., too cold or too hot)
- Moving equipment, moving vehicles and vibration

HUMAN FACTOR INITIAL

Relevant Legislation and the Maintenance Organization Responsibilities

The OSHA have responsibility for overseeing safety in the workplace. The Health and Safety Executive (HSE) or officer has this responsibility. In an aircraft maintenance organization, the ***health and safety policy*** might include statements applicable to the organization such as the need to:

- ❖Carry out inspection, assessments of work to determine Health and Safety risks.
- ❖Provide safe working practices and procedures for plant, machinery, work equipment, materials, and substances.
- ❖Inform employees, workers and other persons of any possible risk.
- ❖Provide suitable training and/or instruction to meet any Health and Safety requirement.
- ❖Develop and introduce practices and procedures to reduce risks including the provision of special protective devices and personal protective equipment.
- ❖Provision for the welfare of employees
- ❖Discuss with and consult employee representatives on Health and Safety matters.

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Maintenance organizations should appoint health and safety officers and display workplace hazard signs at the work areas. To be effective, warnings signs must:

- Clearly identify the hazard.
- Describe the danger (e.g., electric shock, radiation, etc.).
- Inform employees what to do or not to do.

HUMAN FACTOR INITIAL

Maintenance Technician's Individual Responsibilities

Health and safety policy might include statements applicable to technicians such as the need to:

- Take reasonable care of the health and safety of themselves and others who may be affected by their acts or omissions at work.
- Cooperate with the maintenance organization to ensure that statutory requirements concerning health and safety at work are met.
- Work in accordance with any safety instruction and/or training received.
- Inform their supervisor or management of work situations that represent an immediate or potential danger to health and safety at work and any shortcomings in protection arrangements.

HUMAN FACTOR INITIAL

Safety In the Working Environment

Before & after completion of maintenance, engineers and technicians must keep the working environment safe and clean.

Foreign Object Damage (FOD) is a risk to aircraft operating at an apron.

Safety When Working On Aircraft

- Before working on aircraft operating system, clearance checks must be carried out around moveable surfaces (eg, flying controls, landing gear, flaps, etc.).
- Deactivation procedures should be followed (eg. pull circuit beakers. isolate valves, disconnect power, etc.).
- Placard deactivated components or systems.

HUMAN FACTOR INITIAL

Dealing with Emergencies

However , should health and safety problems occur, all personnel should know as far as reasonably practical how to deal with emergency situations.

The basic actions is an emergency are too :

- Stay calm and assess the situation. Observe what has happened.
- Look for dangers to oneself and others.
- Call for help. Never put oneself at risk. Summon help from those nearby if it is safe for them to become involved.
- Make the area safe, protect any casualties from further danger.
- Remove the danger if it is safe to do so but be aware of ones own.
- Assess all casualties to the best of ones abilities (especially if one is a qualified in first aid).
- Call for local emergency equipment (e.g., fire extinguisher).
- Call for emergency services (ambulance or fire department, etc.).
- Provide assistance as far as one feels competent to do so.

HUMAN FACTOR INITIAL

Summary

In brief, a maintenance organization has a duty under health and safety legislation to :

S	pot the hazard
A	ssess the risk
M	ake the changes

Bringing physical hazards to attention and outlining their risks and protective measures greatly reduces the probability of accidents.

HUMAN FACTOR INITIAL

EASA 145.A.30 Personnel requirements

The organisation shall have a *maintenance man-hour plan showing that the organisation has sufficient staff* to plan, perform, supervise, inspect and quality monitor the organisation in accordance with the approval. In addition, the organisation shall have a *procedure to reassess work intended to be carried out when actual staff availability is less than the planned staffing level* for any particular work shift or period.

AMC 145.A.30(d) Personnel requirements

Has sufficient staff means that the organisation employs or contracts competent staff, as detailed in the man-hour plan, of which *at least half the staff that perform maintenance in each workshop, hangar or flight line on any shift should be employed to ensure organisational stability.*

For the purpose of meeting a specific operational necessity, a temporary increase of the proportion of contracted staff may be permitted to the organisation by the competent authority, in accordance with an approved procedure which should describe the extent, specific duties, and responsibilities for ensuring adequate organisation stability

HUMAN FACTOR INITIAL

Human performance under normal circumstances

Human performance when increase in workload

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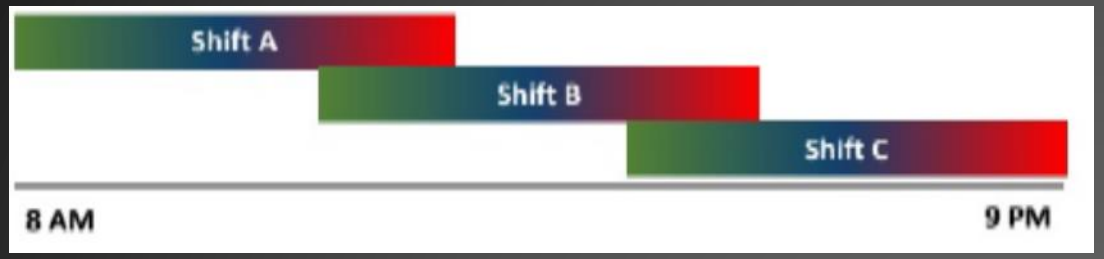


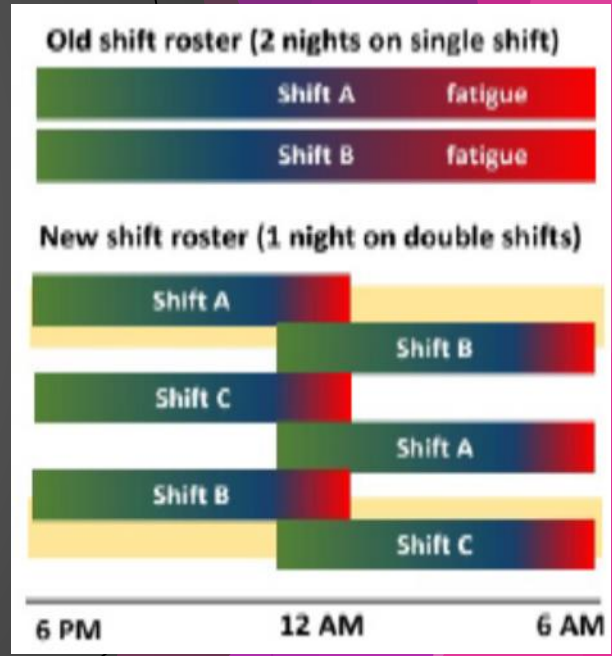
Effective shift rotation planning could be a way to overcome manpower shortage.

CASE STUDY:

An Airline MRO carried out NDT radiography services on third party Boeing 747 aircraft HMV. The NDT engineers use to be on 2 nights 12 hours shifts rotation, working form 6 PM to 6 AM next morning. This took them 21 days to compete the whole radiography tasks.

When their operation met peak demand, they do not have sufficient NDT engineers and technician to perform the radiography tasks. Other hangar production lines have Airbus 330 for radiography inspection as well.

The Chief NDT Engineer took a different approach to suggest a 7 hours 2 shifts rotation (with 1 hour overlap for handover) to the management after taking human factors into consideration. Eventually, the usual Boeing 747 x-ray NDT *tasks was completed within 14 days as compared to 21 days*. And later they also managed to completed the Airbus 330 tasks within 5 days.



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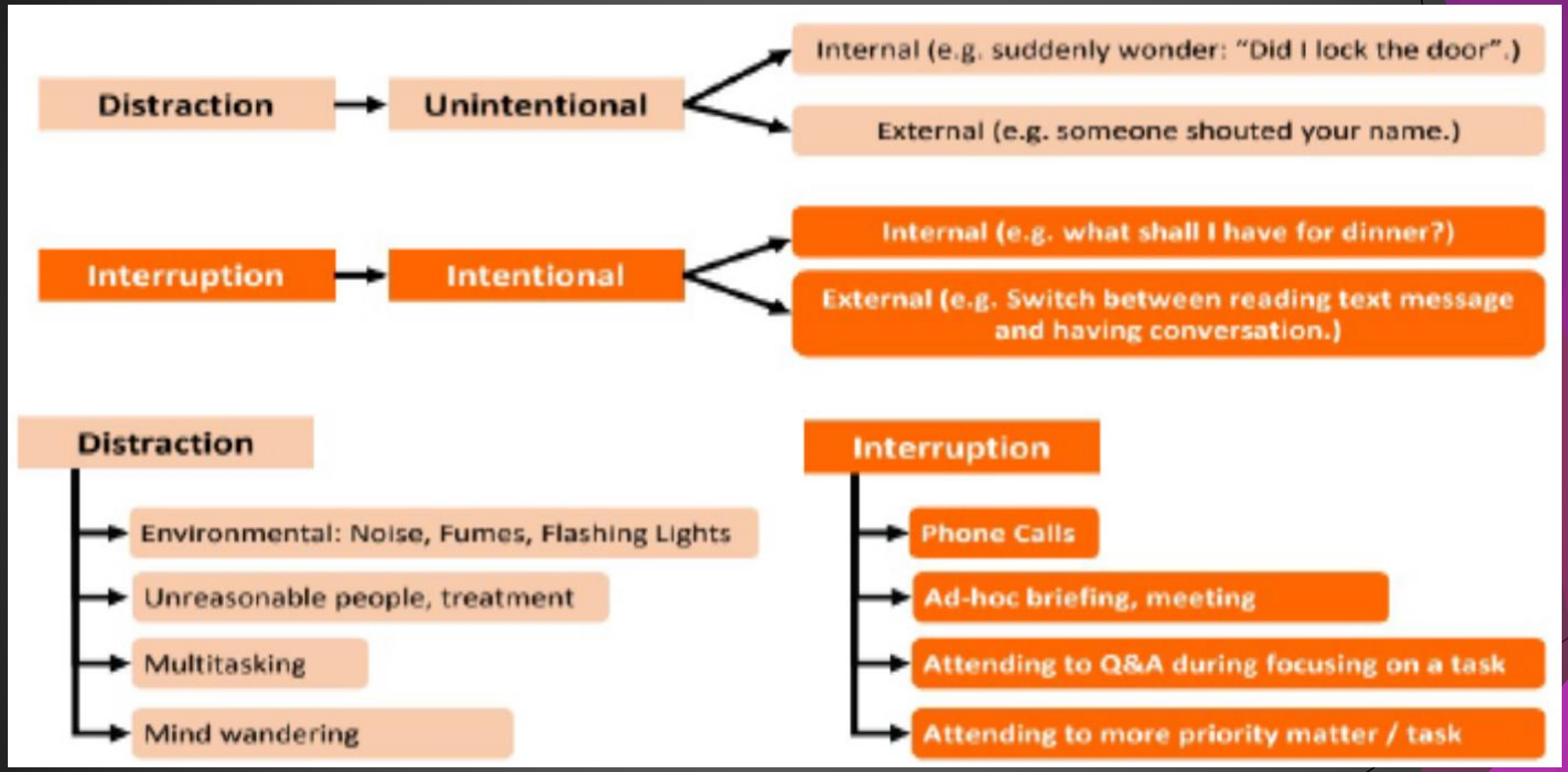

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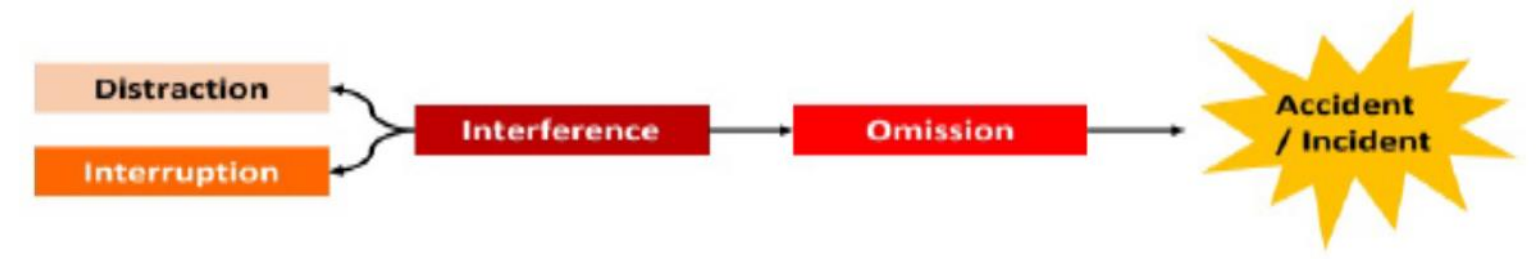
Distractions and interruptions are both a form of interference that can increase unhelpful form of stress, diminish our performance and prevent us from achieving our goals. Unfortunately, human beings are very susceptible. You may forget returning to the first matter after attending to the second matter.



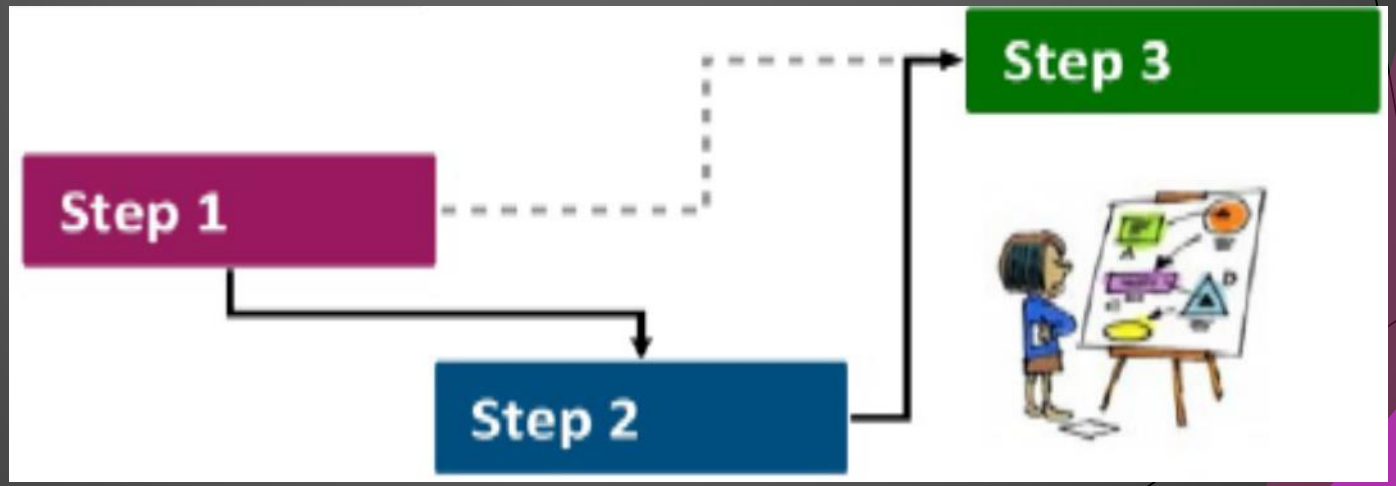
When you are interrupted during a maintenance task, ***go back at least three steps from where you were in the procedure before the interruption/distraction***, state accurately and to recheck your work before continuing.

Use your publications to keep track of where you are in the procedure. This technique should ensure that critical steps, actions or information have not been missed or bypassed as a result of the interruption or distraction. This recovery process should be trained and pre-briefed to ensure everyone in the maintenance team understands, and to consistently achieve the appropriate response. After completing a safety-critical maintenance task, there should be a comprehensive de-brief, to identify any interruptions or distractions that might have occurred during the procedure, and to ensure correct recovery actions were taken.

HUMAN FACTOR INITIAL

Chapter 6 Procedure, Information, Tools and Practices

6.1 Visual inspection
6.2 Work logging and recording
6.3 Procedure-Practice/Mismatch/Norms
6.4 Technical documentation access and quality



HUMAN FACTOR INITIAL

Visual Inspection

- Using raw human vision.
- Accompany by touching, hearing smelling etc.
- May use magnifiers and borescopes to enhance their visual capabilities.
- Must able to see the defect and recognize that it is a defect.
- Limited to surface defect only.
- Usually to inspect for condition and security of installation of aircraft component and system.

HUMAN FACTOR INITIAL

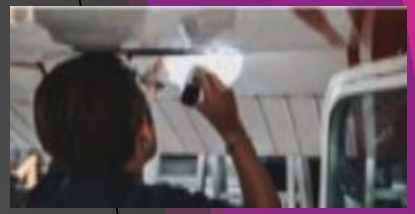
Visual inspection, generally can be categorized into 3 types :

Visual Inspection

General Visual Inspection

Under normal lightning conditions. Daylight, hangar lighting, flashlight or drop-light•

- May require removal or opening of access panels or doors.
- As a rule of thumb, inspection is usually within an arm length distance:



Detailed Visual Inspection

An ***intensive examination*** of an installation or assembly to detect damage, failure or irregularity.

- Surface cleaning and elaborate access procedures may be required.

Instrument / Equipment assisted Visual Inspection

A device that enables the inspector to see interior areas that could not otherwise be inspected without disassembly such as ***Borescope***

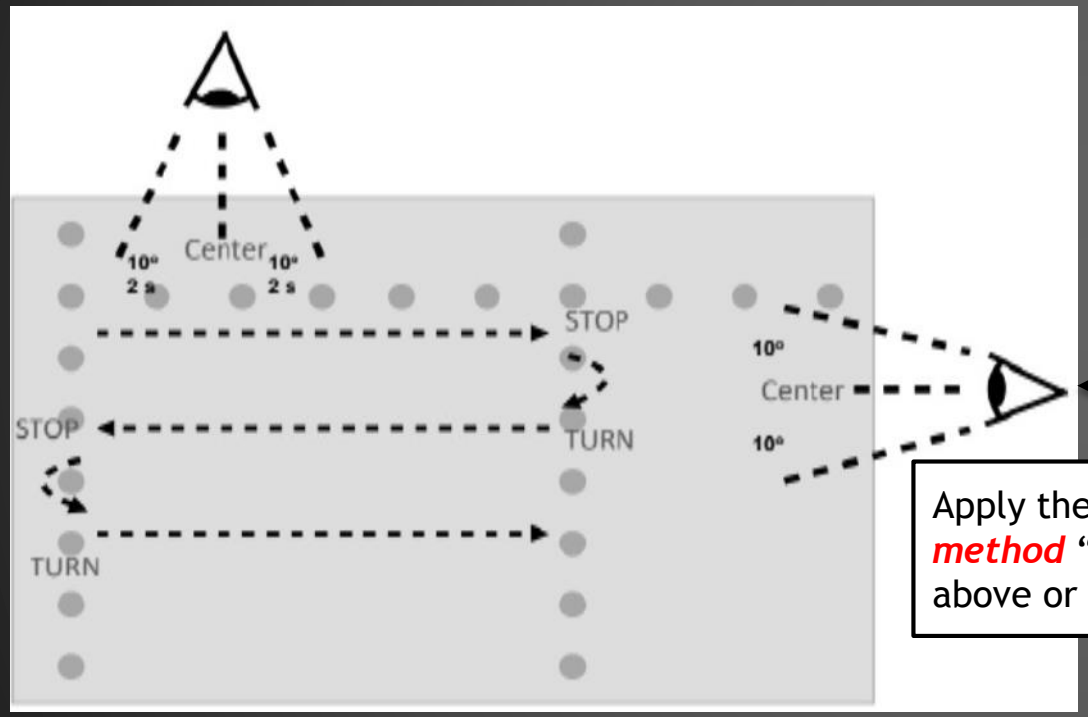
HUMAN FACTOR INITIAL

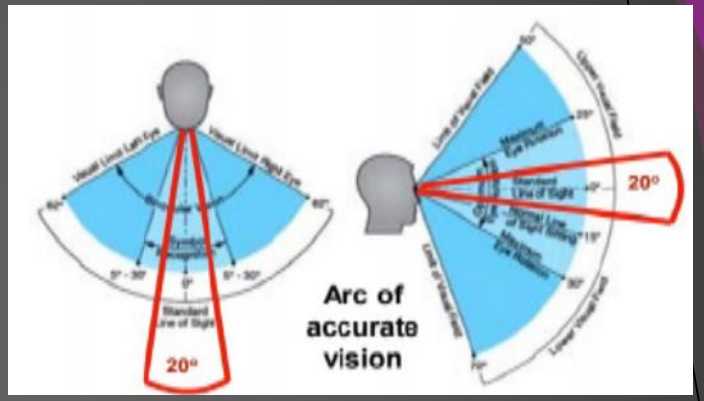
A reliable visual inspection will require the inspector to:

- Understand the area, component or system as specified on the work card, they have been asked to inspect.
- Locate the corresponding area, component, or system on the aircraft itself.
- Make sure the environment is conducive to the visual inspection task (lighting, cleanliness).
- Conduct a systematic visual search, moving their eyes carefully in a set pattern so that all parts are inspected.
- Examine thoroughly any potential degradation or defect that is seen and decide problem whether it constitutes a

HUMAN FACTOR INITIAL

Due to the limited 20” arc of accuracy vision, scanning of the inspection are should be carried out ***STOP-TURN-STOP-TURN*** sequence to avoid possibility of missing the defects.





Apply the “***off center viewing method*** “ by looking 10 degree above or below , or to either side.

HUMAN FACTOR INITIAL

Tools and Equipment normally used in Performing Visual Inspection:

Torch Light

Magnifying Glass

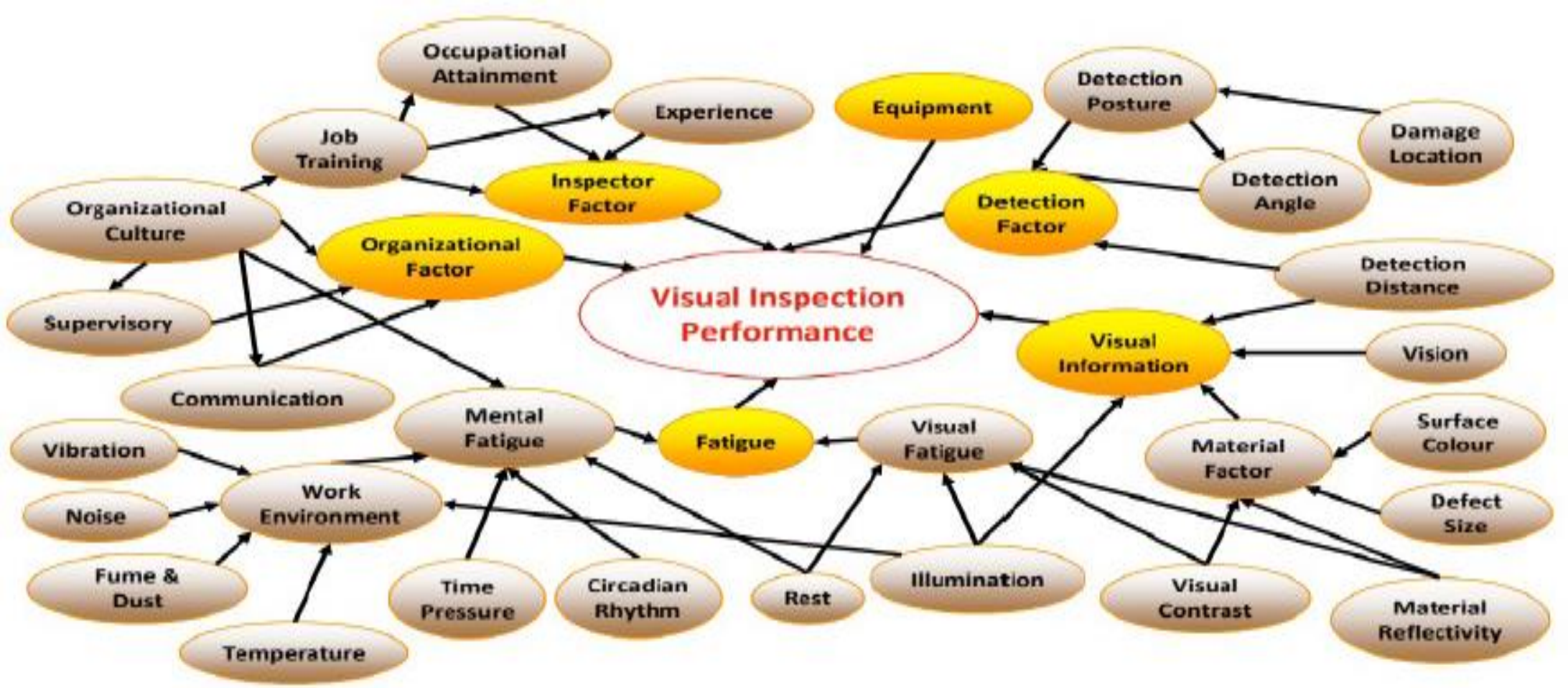
Inspection Mirror

Video Borescope Kit

Rigid Borescope

Flexible Borescope

HUMAN FACTOR INITIAL



Factors that affect visual inspection performance in aircraft maintenance.

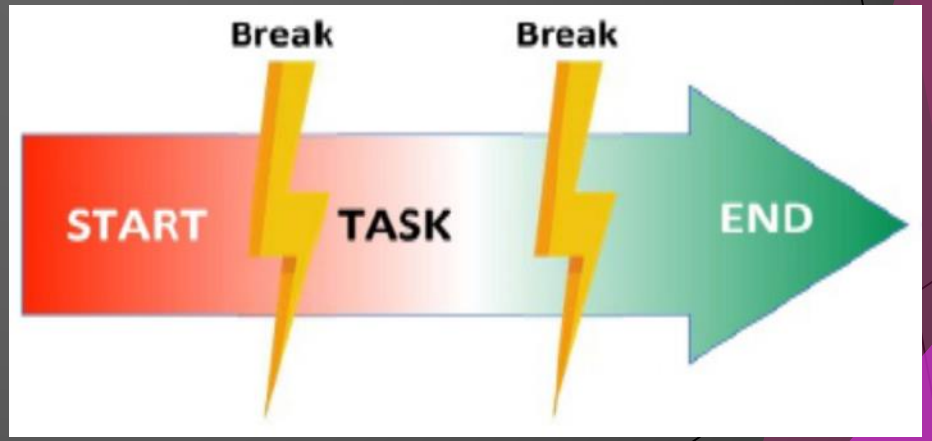
HUMAN FACTOR INITIAL

Work Logging and Recording is one of the most critical aspects of communication within aviation maintenance.

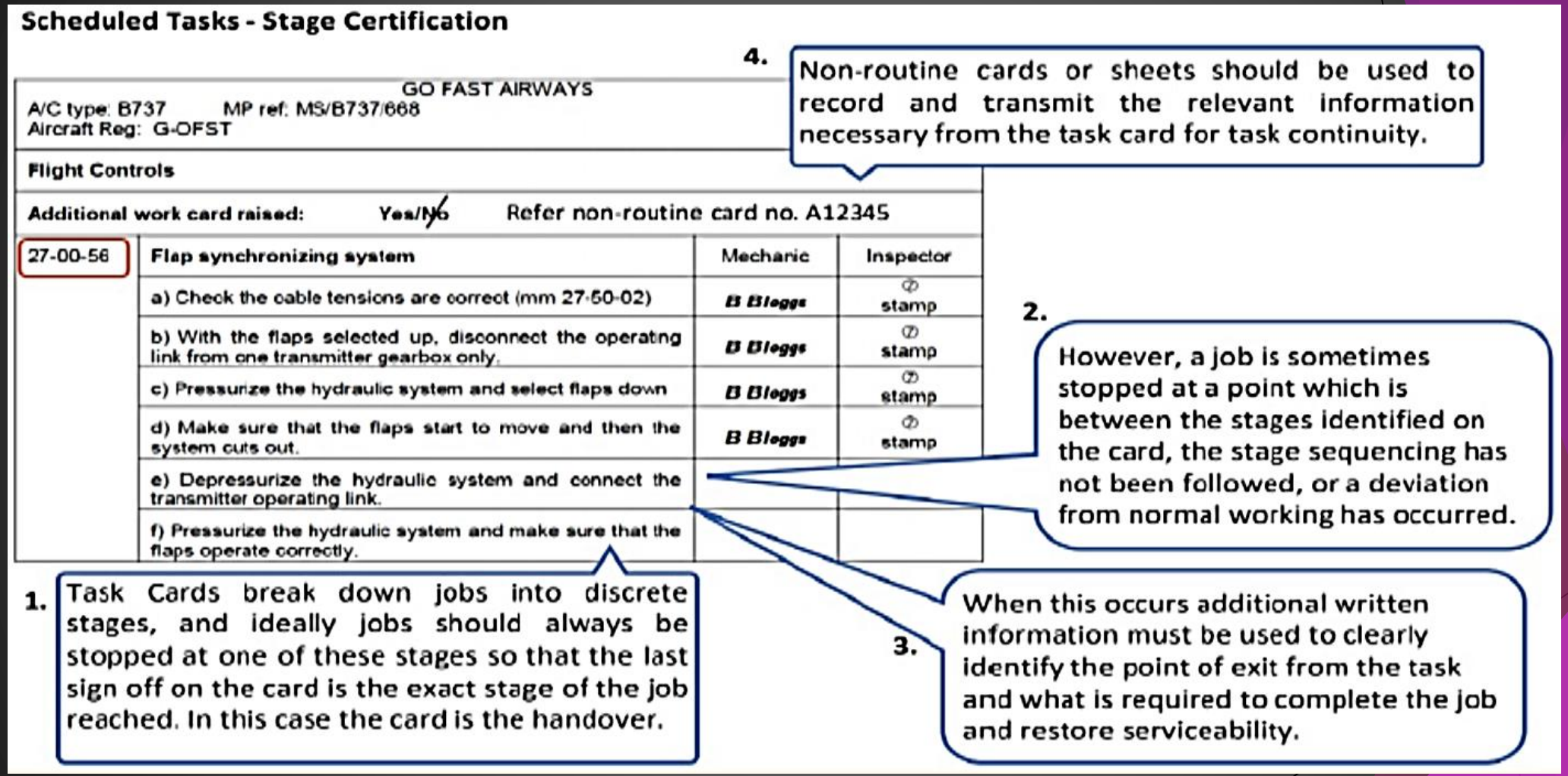
- It is necessary to keep the record of work up-to-date.
- Especially during a handed over, rest break, illness, the need to move to another (possibly more urgent) task.
- Refer to company procedure on work logging.

Keep the record of work up-to-date for:

- To be handed over
- Rest break
- Sudden illness
- The need to move to another task



HUMAN FACTOR INITIAL



Scheduled Tasks - Stage Certification

GO FAST AIRWAYS

A/C type: B737 MP ref: MS/B737/668
Aircraft Reg: G-OFST

Flight Controls

Additional work card raised: Yes/~~No~~ Refer non-routine card no. A12345

27-00-56	Flap synchronizing system	Mechanic	Inspector
	a) Check the cable tensions are correct (mm 27-50-02)	*B Bloggs*	stamp
	b) With the flaps selected up, disconnect the operating link from one transmitter gearbox only.	*B Bloggs*	stamp
	c) Pressurize the hydraulic system and select flaps down	*B Bloggs*	stamp
	d) Make sure that the flaps start to move and then the system cuts out.	*B Bloggs*	stamp
	e) Depressurize the hydraulic system and connect the transmitter operating link.		
	f) Pressurize the hydraulic system and make sure that the flaps operate correctly.		

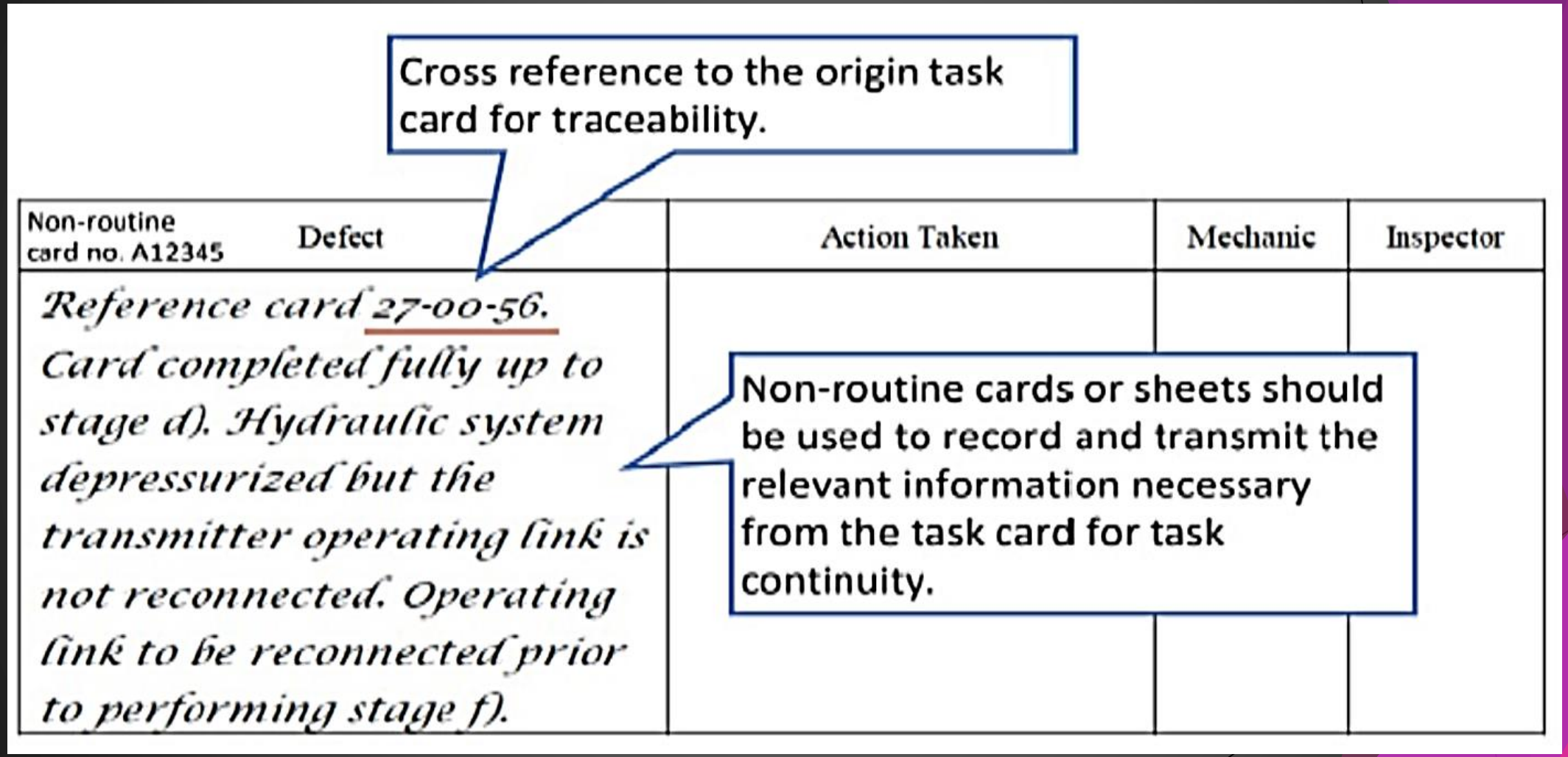
4. Non-routine cards or sheets should be used to record and transmit the relevant information necessary from the task card for task continuity.

2. However, a job is sometimes stopped at a point which is between the stages identified on the card, the stage sequencing has not been followed, or a deviation from normal working has occurred.

1. Task Cards break down jobs into discrete stages, and ideally jobs should always be stopped at one of these stages so that the last sign off on the card is the exact stage of the job reached. In this case the card is the handover.

3. When this occurs additional written information must be used to clearly identify the point of exit from the task and what is required to complete the job and restore serviceability.

HUMAN FACTOR INITIAL

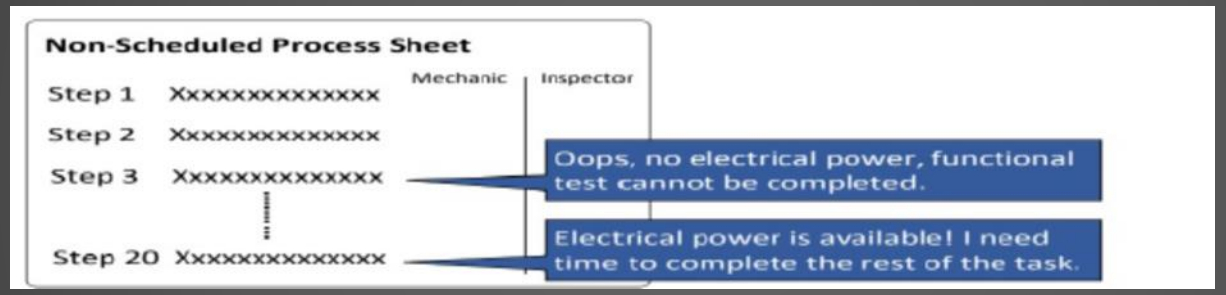


HUMAN FACTOR INITIAL

Non-Scheduled Tasks

Complex or *lengthy non-scheduled tasks* should always be broken down into *a few discrete* steps using stage or process sheets.

- Broken down into smaller steps.
- Adequate time is given to maintenance staff to record their work if the task is not completed for any reason.



Many incidents have occurred when people have started a straight forward job but had to *exit the task part way through without anybody to handover to*. These situations by their nature are *unplanned and are normally associated with time pressure or emergency situations*. In spite of this it is vital that time is taken by the person leaving the job to comprehensively record what activities have taken place and what is required to complete the job. This would *be recorded on stage sheets* and should *emphasize any deviations* from the normal or expected way of working (i.e., the maintenance manual).

HUMAN FACTOR INITIAL

Remember……

1. It is the *duty of all authorized persons to ensure that an adequate record of the work carried out is maintained.*

2. The work accomplished, particularly if only *disassembly or disturbance of components or aircraft systems*, should be *recorded as the work progresses* or prior to undertaking a disassociated task.

3. *Records should be completed no later than the end of the work period* or shift of the individual undertaking the work. *"Open" entries to reflect the remaining actions necessary* to restore the aircraft to a serviceable condition prior to release.

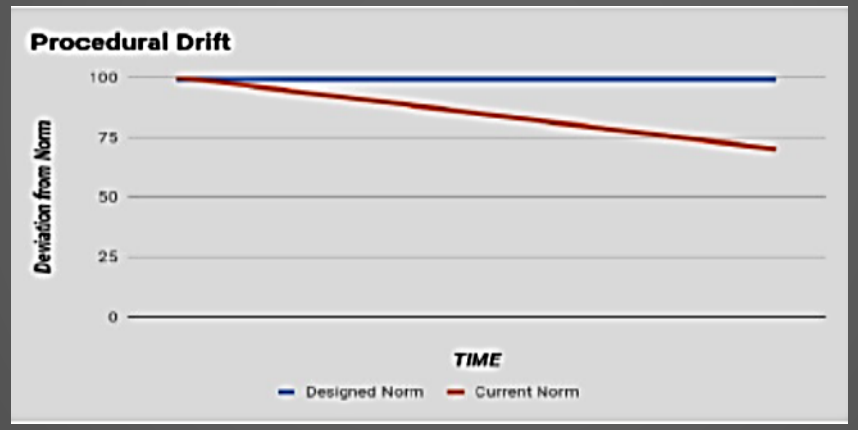
4. in the case of *complex tasks* which are undertaken frequently, consideration should be given to the *use of pre- planned stage sheets* to assist in the control, management and recording of these tasks.

HUMAN FACTOR INITIAL

Procedural Drift

Procedural drift increases the gap between how the system was designed or intended and how it works.

- It tends to be a slow, incremental departure from the designed or intended norm.
- Procedural drift (left unchecked) often results in an undesirable outcome.
- A defect may be created when work standards, procedures, or rules are not followed.
- Procedural drift could result in a ***personal injury.***



Sidney Dekker, author of The Field Guide to Understanding Human Behavior, discusses a specific type of entropy that he calls "procedural drift." He defines it as a mismatch between procedures or rules and actual practice. He claims that it almost always exists and that this mismatch can grow over time.

HUMAN FACTOR INITIAL

Dekker lists several potential reasons for procedural drift:

- Rules or procedures are over-designed and do not match up with the way work is really done.
- There are conflicting priorities which make it confusing about which procedure is most important.
- Past success (in deviating from the norm) is taken as a guarantee for safety. It becomes self-reinforcing.
- Departures from the routine become routine. Violations become compliant behavior with local norms.

HUMAN FACTOR INITIAL

The work standards need certain attributes to be successfully implemented. The procedures should:

- Be as simple as possible
- Be written and explained so that they are easy to understand
- Be within the worker's skill and ability
- Include basic mistake-proofing methods

HUMAN FACTOR INITIAL

The Need for Culture Change

Safety culture

- An expression of how safety is perceived, valued and prioritized by management and employees in the organization.
- Aware of the risks and known hazards faced by the organization and its activities.
- Continuously behaving to preserve and enhance safety
- Willing and able to adapt when facing safety issues
- Willing to communicate safety issues

HUMAN FACTOR INITIAL

EASA Part M Subpart D - Maintenance Standard M.A.401 Maintenance Data

"The person or organization maintaining an aircraft shall have access to and use only applicable current maintenance data in the performance of maintenance including modifications and repairs."

ICA-AMM, SRM, IPC.....
Service Bulletin
Airworthiness Directive
Service Letter

Need to be relevant

Only the applicable maintenance data should be distributed to the relevant department to avoid confusion.

Need to be current

To reflect the latest changes in technology, regulatory requirement and maintenance practices.

Need to be controlled

To liaise with the originator of maintenance data for currency and distribute to applicable department

HUMAN FACTOR INITIAL

The organization management will have to decide which is the best channel of communication to deliver the relevant technical datas to the executers.

- Regulatory Requirements
- Maintenance Planning Documents
- Technical Drawings
- Working Instructions
- Jobs Recording Documents

QA DEPARTMENT

ENGINEERING SERVICES DEPARTMENT

MAINTENANCE PLANNING DEPARTMENT

AMT
LINE / BASE MAINTENANCE

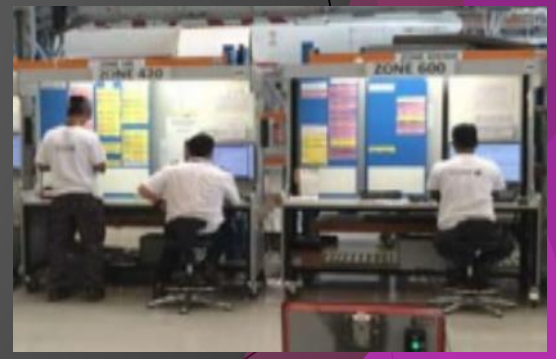
HUMAN FACTOR INITIAL

The selection of access channel will depend on :

- Ease of access
- Working environment
- Controllability

Portable access terminal such as laptop and tablet allow technician to refer to the technical information in-situ.

- Human Error Reduction
- Prevent Violation

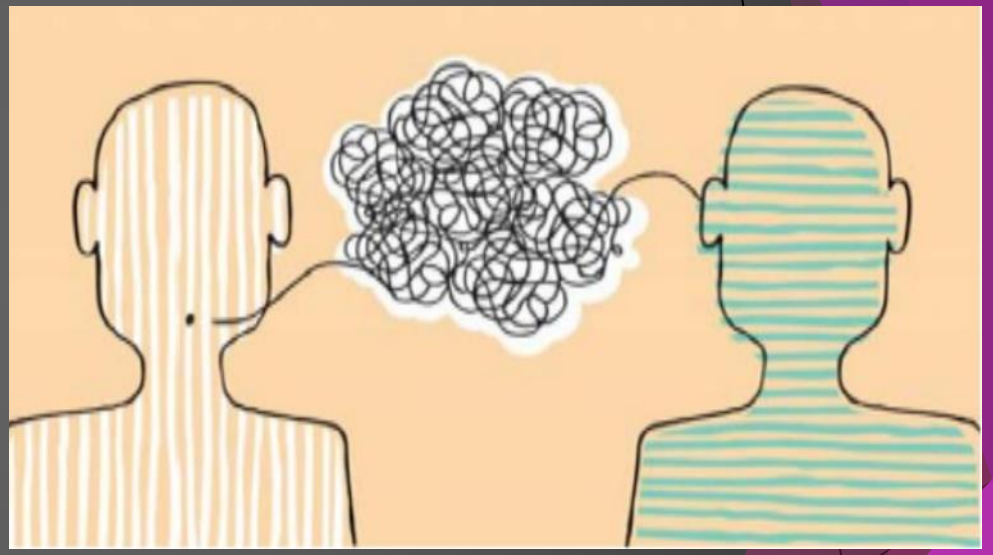


Zonal stationed maintenance data access terminal suites base maintenance environment.

HUMAN FACTOR INITIAL

Chapter 7 : Communication

7.1 Shift/Task handover
7.2 Dissemination of information
7.3 Cultural differences



HUMAN FACTOR INITIAL

An accident related to a shift handover

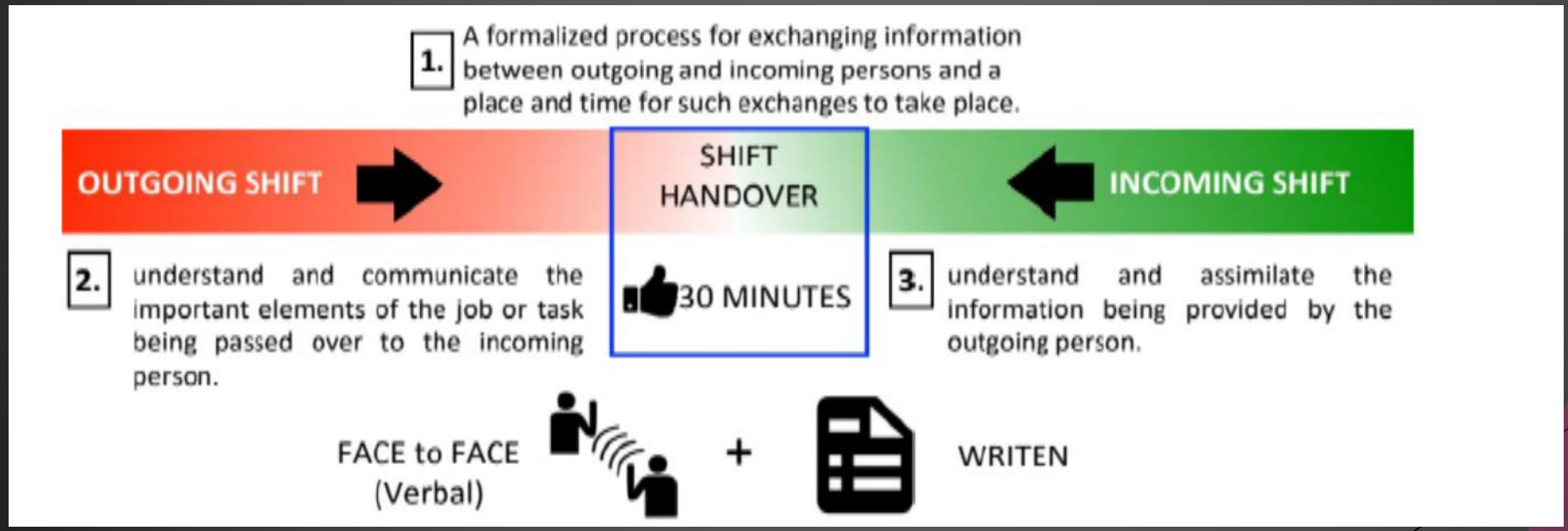
- In 1991, an Embraer 120 experienced a structural breakup in flight and crashed near Eagle Lake, Texas.
- Screw of left horizontal stabilizer were left removed and not recorded in the shift hand-over log.
- Subsequently, the aircraft was cleared for flight. The accident occurred on the next flight, resulting in 14 fatalities.

HUMAN FACTOR INITIAL

Accident and incident investigation data shows that ***shift and task handovers are one of the major contributing factors to error-*** caused events.

- Ensure all necessary information is communicated between the out-going and in coming personnel.

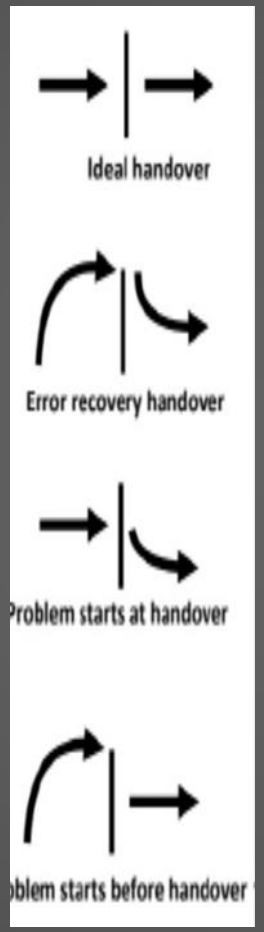
<u>Effective task and shift handover depends on three basic elements:</u>



HUMAN FACTOR INITIAL

Shift handovers are often focused on the transfer of information from one shift to the next, yet ***handovers also serve an important role as opportunities to catch and correct errors.***

A healthy level of scepticism can help to ensure that the incoming shift reviews the work of the outgoing shit, making is few assumptions at possible about its work.



Ideal handover. This is the ideal shift handover, where the task is proceeding normally before the handover and proceeds normally afterwards.

Error recovery handover. Although not ideal, this is also an example of an effective handover. The task had gone off track during the first shift, but the handover provided an opportunity to identify the problem and correct it.
An example is where an error made by the first shift is detected and corrected by the second shift.

Problem starts at handover. In this case, the task was performed correctly by the first shift, however, a problem began when the second shift took over. An example is a case where the first shift removed a faulty component for replacement. Instead of ordering and installing a serviceable component, the second shift then re-installed the faulty component.

Problem starts before handover. In this case, an error was made on the first shift, and personnel on the second shift continued the error.

HUMAN FACTOR INITIAL

The shift handover process starts with a meeting between the incoming and outgoing shift managers/supervisors.
Shift managers/supervisors need to discuss and up-date themselves on ***tactical and managerial matters affecting the continued and timely operation*** of the maintenance process.

Status of the Facility
Work stand/Docking
Visitors
Construction work
Health & Safety issues

Work Status
Aircraft being worked
Scheduled aircraft incoming/departing
Deadlines
Aircraft status against planned status

Staffing Levels and Stars
Authorization coverage
Certifying staff
Non certifying staff
Numbers and names of personnel working overtime
Numbers and names of contract staff
Sickness
Injuries
Training
Other personnel issues

Problems
Outstanding in work/status
Solved

Information
ADs SH, etc.
Company technical notices
Company policy notices

HUMAN FACTOR INITIAL

After the meeting between shift managers, and the assignment of tasks, there is a need for ***mutual inspection and discussion*** of this nature is called a ***"Walkthrough".***

Jobs/tasks in progress
Work cards being used
Last step(s) completed
Problems encountered
    Outstanding in work/status
    Solved
Unusual occurrences
Unusual defects
Resources required/available
Location of removed parts, tooling etc.
Parts and tools ordered and when expected
Parts shortages
Proposed next steps
Communication with Planners, Tech Services, workshops
Communication with managers etc.

Topics for the Supervisors/Certifying Staff Walkthrough Meeting

HUMAN FACTOR INITIAL

Good dissemination of information within an organization *forms part of its safety culture*.

- Supervisors play an important role by ensuring that all information relating to the task has been *gathered* and *properly understood*.
- That technicians must also familiarize themselves with new information (on notice boards, in maintenance manuals, etc.).

Health & Safety Notice Board to post and update safety related information to staffs.

Visual Board method should be used for maintenance activity to easily identified work progress.

Human Error Reduction

Prevent Violation

HUMAN FACTOR INITIAL

Example of Base Maintenance milestone check board.

MILESTONE	PLANNED DATE	STATUS	REMARKS
Dulydd#Dffhswdqfh#Fkhfn			
Suh0grfn#uxxedn#vkrrwqj			
Suh0grfn#Iqjlgh#Jurxqg#Jxq			
Suh0grfn#Exqfwdrqdd##Rshudwrqd# Whvw			
Ghsch#Dlfudw			
Grfn#Dlfudw			
Mdfn#Dlfudw			
Sdlqw#Vwdvslj			
Fdqdqj			
Dffhvv#Uhp ryeo			
Frp srqhqw#Uhp ryeo			
Iqvshfwru			
Uhsdl1#Iqg#Uhfwlilfdwru			
Uhvwrudwrq# #Iqvwdoorwru			
Sdlqwj			
Exqfwrqdd##Rshudwrqd#Whvw			
Gh0dfn#Dlfudw			
Uhsch#Dlfudw			
Srw#Grfn#Exqfwrqdd##Rshudwrqd# Whvw			
Srw#grfn#Iqjlgh#Jurxqg#Jxq			
Srw#grfn#uxxedn#vkrrw#Iqg# uhfwilfdwrq#			
Srw#Fkhfn#Dffhswdqfh			

HUMAN FACTOR INITIAL

Example of base maintenance zonal progress check job loading board layout.

HANDOVER BACKLOG	ZONE	WORK		DONE SQUARED
		TO DO	DOING	
	UPPER FUSALAGE			
	FORWARD LOWER FUSELAGE			
	AFT LOWER FUSELAGE			
	LEFT WING			
	RIGHT WING			
	EMPANAGE			
	LEFT ENGINE			
	RIGHT ENGINE			
	ELECTRICAL			
	INSTRUMENT			
	RADIO			
	COMPASS & NAVIGATION			

HUMAN FACTOR INITIAL

Example of base maintenance shift handover check board.

SHIFT HANDOVER HIGHLIGHT			
ZONE	TO DO	DOING	FINISHED SQUARE
UPPER FUSALAGE			
FORWARD LOWER FUSELAGE			
AFT LOWER FUSELAGE			
LEFT WING			
RIGHT WING			
EMPANAGE			
LEFT ENGINE			
RIGHT ENGINE			
ELECTRICAL			
INSTRUMENT			
RADIO			
COMPASS & NAVIGATION			

HUMAN FACTOR INITIAL

Example of line maintenance monitoring check board.

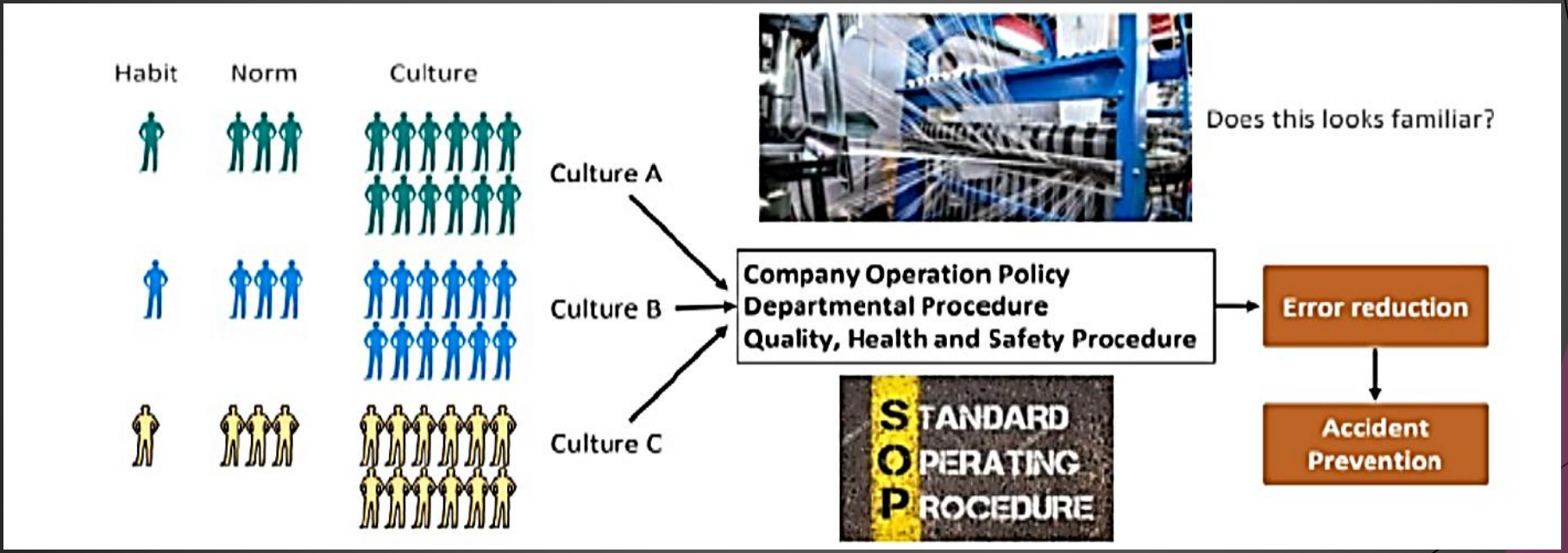
LINE MAINTENANCE HIGHLIGHTS					
AIRCRAFT REGISTRATION	AD COMPLIANCE TASK	OUTSTANDING DEFECTS	TASK		FINISHED SQUARE
			TO DO	DOING	
9M-API					
9M-AIR					
9M-AIS					
9M-APA					
9M-AIN					
9M-ATA					

HUMAN FACTOR INITIAL

HUMAN FACTOR INITIAL

Cultural differences is a form of *appreciating the differences in individuals.*

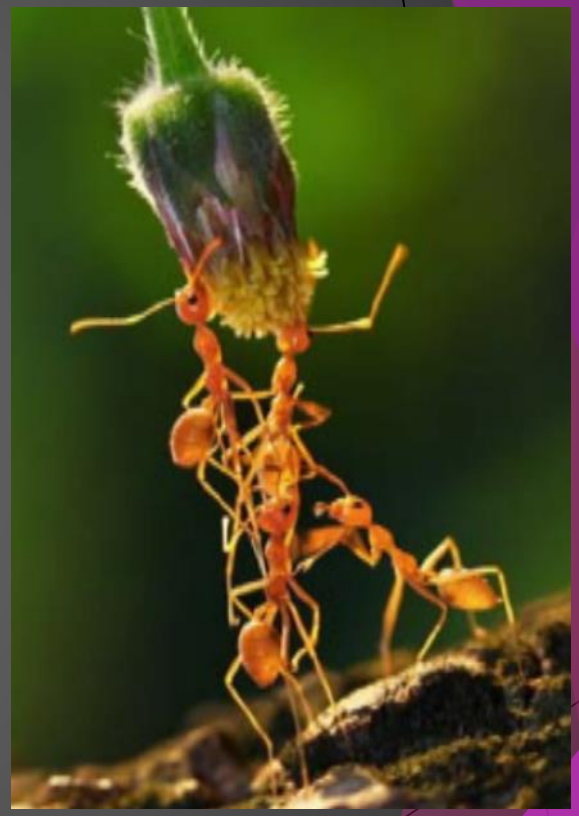
- The differences can be based on gender, age, sex, ethnicity, knowledge, and social status.
- This could be a barrier to be overcome to standardized working process and production at the same time preventing error in communication and nonstandard practices.



HUMAN FACTOR INITIAL

Chapter 8 : Teamwork

8.1 Responsibility.
8.2 Management, supervision and leadership.
8.3 Decision making.



HUMAN FACTOR INITIAL

Everyone is responsible for safe operation of the aircraft

ROLE	RESPONSIBILITY
Accountable manager	Formulates policy
Manager	Set procedures
Supervisors	Oversee and mentor the group
Technicians	Perform the maintenance correctly

HUMAN FACTOR INITIAL

As an individual, one is expected and should:

- Comply to laid down policy and procedure.
- Perform the tasks in accordance with the rules and regulations.
- Complete the work in the correct manner.
- Report to the supervisor or team leader.
- Act as a team to fulfil group responsibility.

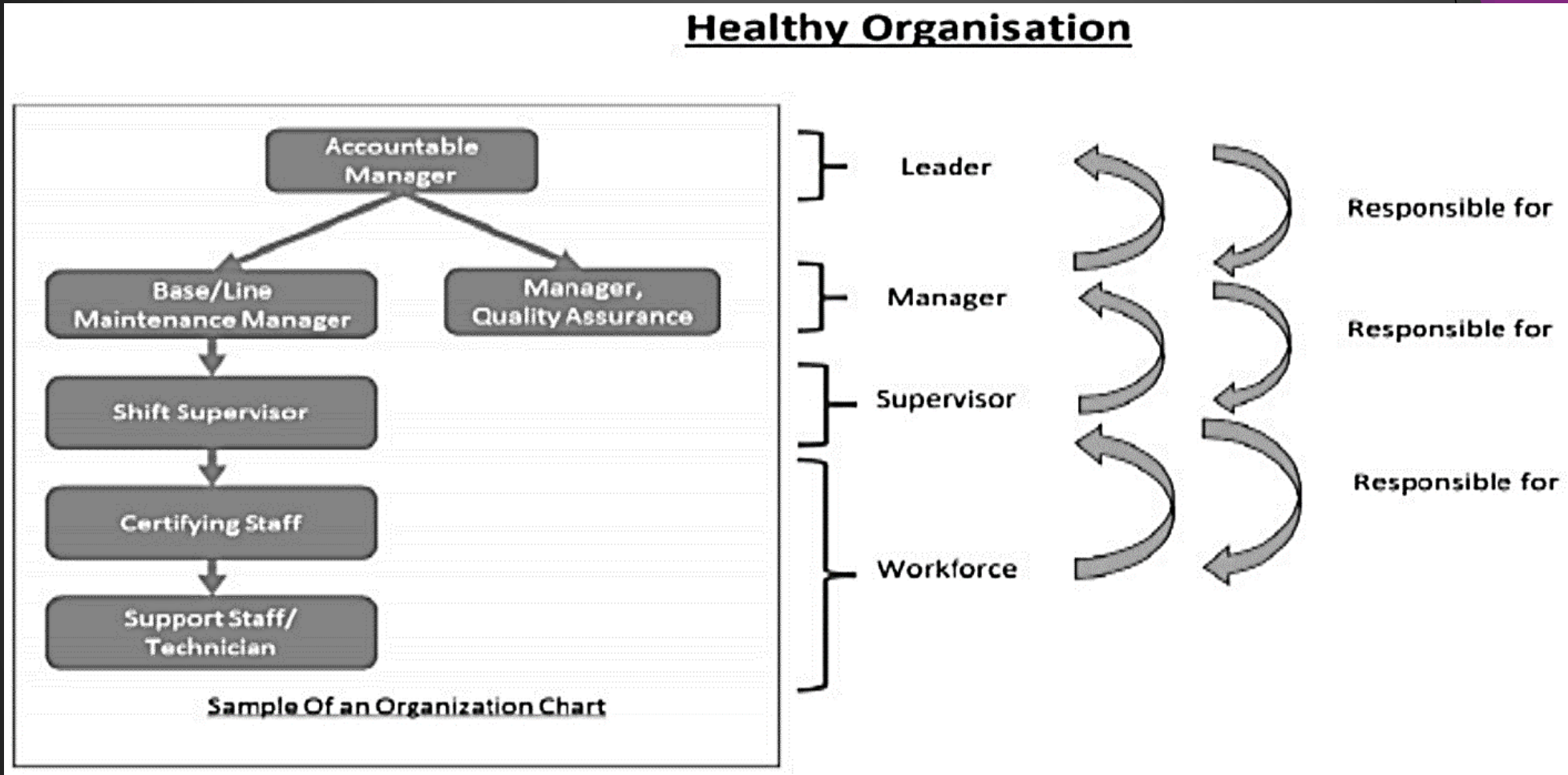
As a group, they are expected to:

- Comply to laid down policy and procedure.
- Perform the tasks in accordance with the rules and regulations.
- Deliver the product timely and safely.
- Look after and help each other when team member has difficulties.
- Report to Management any issue regarding operation, health & safety concern.

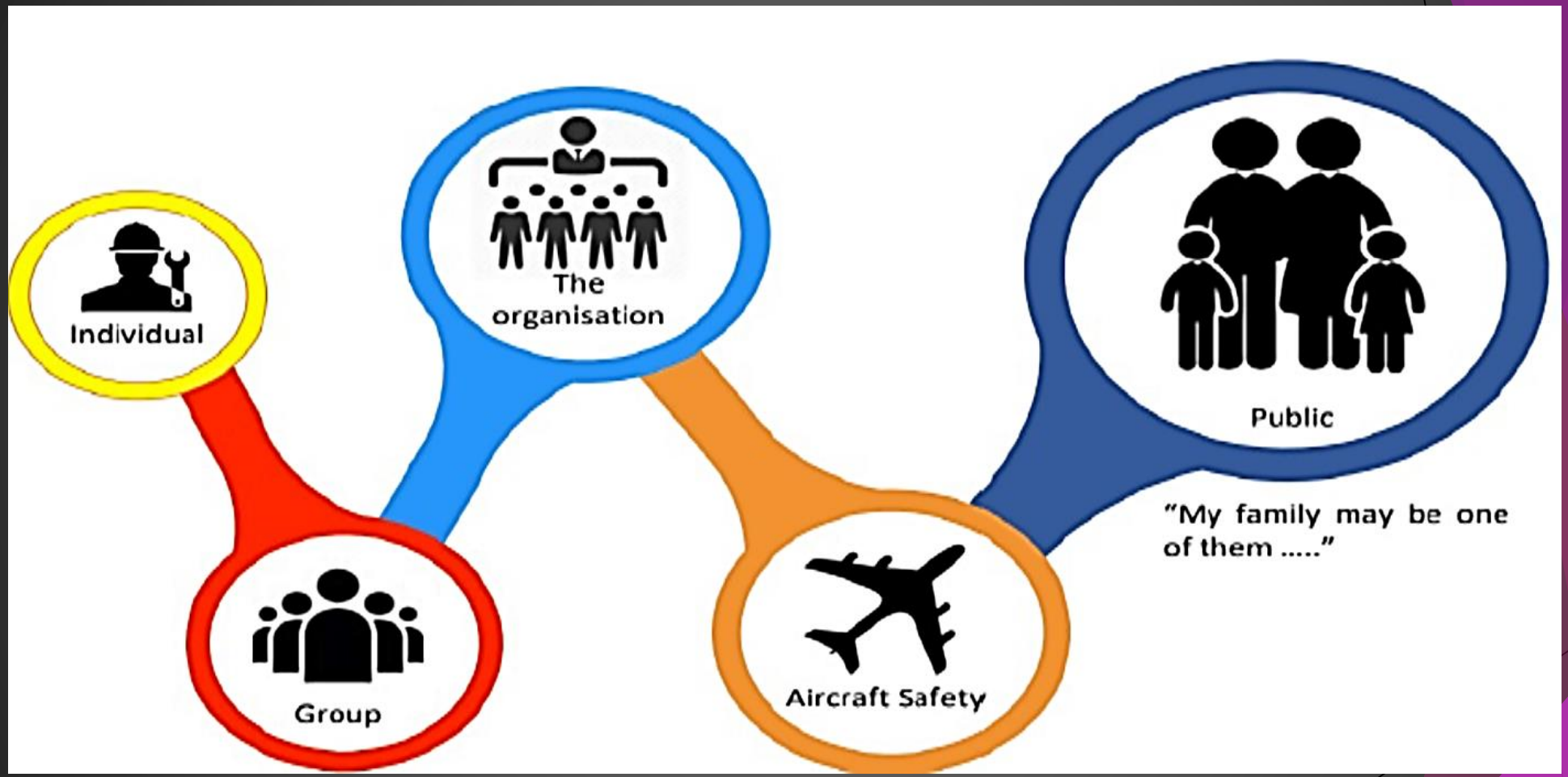
"I" = Smaller "We"

"We" = Bigger "I"

HUMAN FACTOR INITIAL



HUMAN FACTOR INITIAL



HUMAN FACTOR INITIAL

Some recognized *phenomena* associated with *group working* and responsibility for decisions and actions that aircraft maintenance personnel should be aware of are:

Diffusion of responsibility	Responsibility being devolved to such an extent that no one feels personally responsible for safety. "Someone else will do it kind of attitude.
Intergroup conflict	A small group may act cohesively as a team, but rivalries may arise between this team and others (e.g., between technicians and planners, between shifts, between teams at different sites, etc.).
Group polarization	The tendency for groups to make decisions that are more extreme than the individual member might pursue.
Free Loading	The tendency for some individuals to work less hard on a task when they believ others are working on it

HUMAN FACTOR INITIAL

Leadership is the activity of leading a group of people or an organization towards the *goals*.

Management is the administration of an organization in any level, setting the strategy of an organization and coordinating the efforts of its employees to *accomplish* its *objectives* through the application of available resources.

Supervision is the act or function of directing, *overseeing* something or somebody from deviation.

HUMAN FACTOR INITIAL

There are potentially *two types* of leader in aircraft maintenance:

- The person officially assigned as the *team leader* (possibly the Accountable Manager, Managers and Supervisors), or
- *An individual* within a group that the rest of the group members tend to follow (possibly due to a dominant personality, etc.)

A *good leader* in the maintenance engineering environment must posses a number of personal qualities which will assist him in:

- Motivating the team
- Reinforcing good attitudes and behavior
- Demonstrating by example
- Maintaining the group
- Fulfilling a management role

Ideally of course, the official team leader should also be the person the rest of the group defer to, because of recognition from the group.

HUMAN FACTOR INITIAL

Management roles in the maintenance organization are usually set based on the *regulations, functionality and company requirements*

in general, management operates through five basic functions:

Management	
Planning	Deciding what needs to happen in the future and generating plans for action.
Organizing	Creating a structure through which an organization's goals can be accomplished.
Coordinating	Making sure the human and nonhuman resource are put into place.
Commanding	Determining what must be done in a situation and getting people to do it.
Controlling	Checking progress against plans.

EASA Part 145.A.30 Personnel requirements

145.A.30 (a)
"The organization shall appoint an accountable manager who has corporate authority for ensuring that all maintenance required by the customer can be financed and carried out to the standard.

145.A.30 (b)
"The accountable manager shall nominate a person or group of persons representing the management structure fer the maintenance functions and with the responsibility to ensure that the organization works, in accordance with the MOE and pr procedures

145.A.30 (c)
"The accountable manager Shell group of persons with the responsibility to manage the compliance monitoring function as part of the management system.

HUMAN FACTOR INITIAL

What is the difference between a manager and a leader?

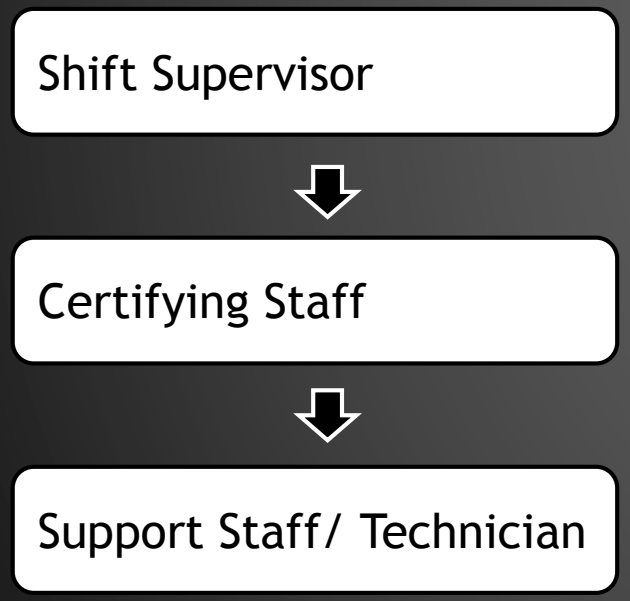
- ***A manager takes care of the team processes***, gathers and distributes resources and makes sure the team is functioning.
- ***A leader inspires and motivates the members*** to perform by creating a vision, communicating a sense of enthusiasm for completing the team's goal and leading by example.

HUMAN FACTOR INITIAL

Supervision may be a formal role or post (i.e., a Supervisor), or an informal arrangement that a more experienced technician *"keeps an eye on"* less experienced staff.

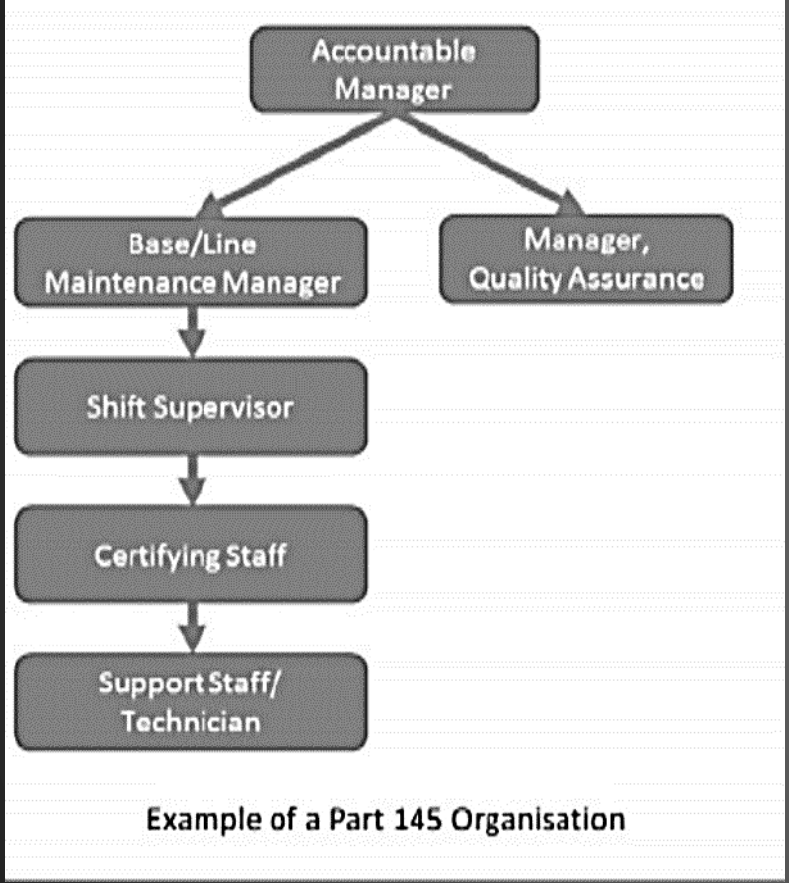
The Supervisor is able to:

- watch out for *errors* which might be made by technicians.
- have a good appreciation of an individual technician's *strengths* and *weaknesses*.
- appreciation of the norms and *safety culture* of the group which they supervise.



It is mainly the supervisor's job to prevent unsafe norms from developing, and to ensure that good safety practices are maintained.

HUMAN FACTOR INITIAL



Example of a Part 145 Organisation

Accountable Manager, apart from managing the organization, can also be considered the leader for the whole organization.

Managers, part from managing their own department, can also be the leader of their own team.

Aircraft foremen, leading engineers will have to engage in both the managing and supervisory jobs.

Certifying staffs manage their own tasks in a smaller scale as compared to the top, middle and junior management. They must supervise the support staffs/technicians reporting to them.

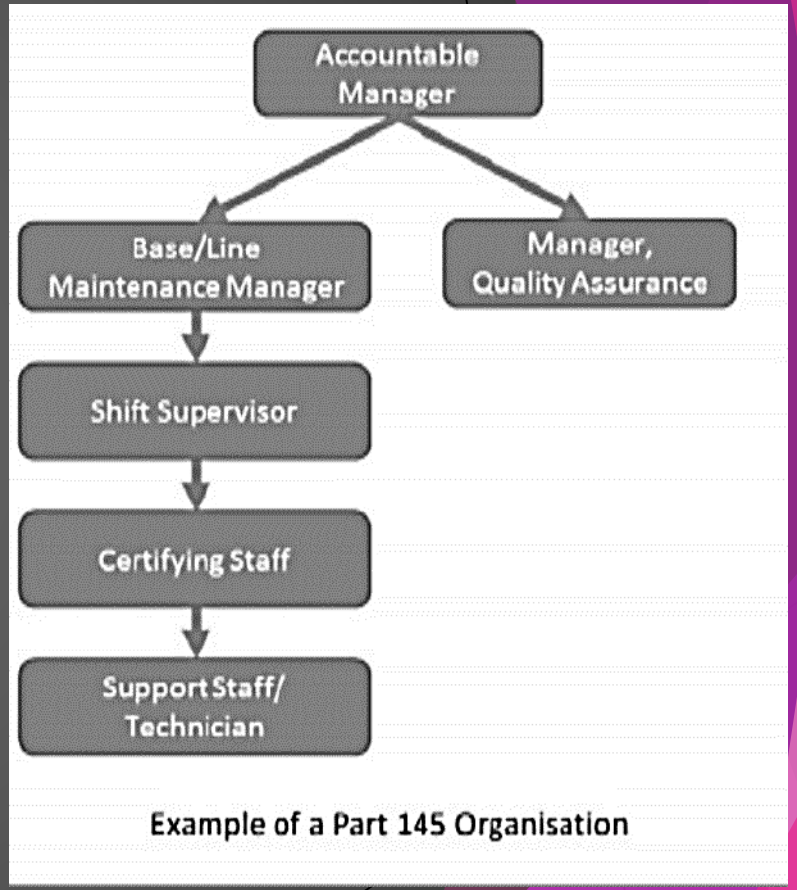
Support staffs/technicians usually have their own unofficial group leader. This leader usually oversee the group activities,

HUMAN FACTOR INITIAL

Each level of roles and positions have their *decision* to make based on their responsibilities. The decision they must decide, obviously depends on the *safety* and *severity* of impact if not being carried out correctly.

Decision based on:

- Responsibilities
- Safety
- Severity of Impact
- Operational Needs
- Regulatory Compliance
- Staffs Social Needs



Example of a Part 145 Organisation

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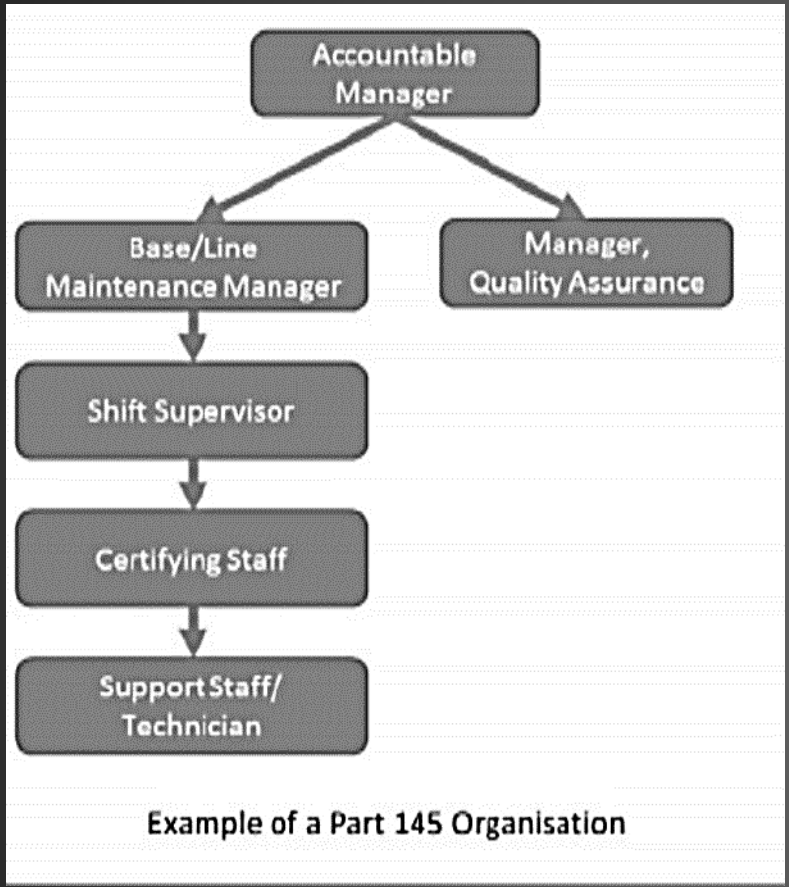

Example of a Part 145 Organisation

The Accountable Manager must decide *the policy* and the *direction* the entire organization is heading.

The Maintenance Manager must decide whether maintenance tasks can be safely carried out with reduced manpower, or they must decide whether a technician volunteering to work as a "moonlighter" to make up the numbers will be able to perform adequately.

Shift Supervisor may have to decide what to do when unsafe working condition happens in his/her shift.

Certifying Staff must decide to how to rectify the defects with limited resources (time, manpower & tools) or whether to release the aircraft to service when there is a grey area in maintenance documents.

Technician may have to decide if they can perform the task correctly and safely in extended working hours

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Factors influencing decision making:

Engineers are often confronted with unexpected situations when maintaining aircraft.

- *Previous experience and knowledge* will shape the extent to which individuals are able to know what information or feedback is relevant and how to make sense of it.
- *The quality of communication* used in order to gather information and inform your decisions will also affect the quality of your decision-making
- *Fatigue* can affect cognitive performance: reducing the ability to fully process all available information and increasing the possibility that essential information is missed.
- *Stress and time pressure* may encourage individuals or teams to 'grab at the first solution that comes to mind without looking at either potential consequences or other possibilities.

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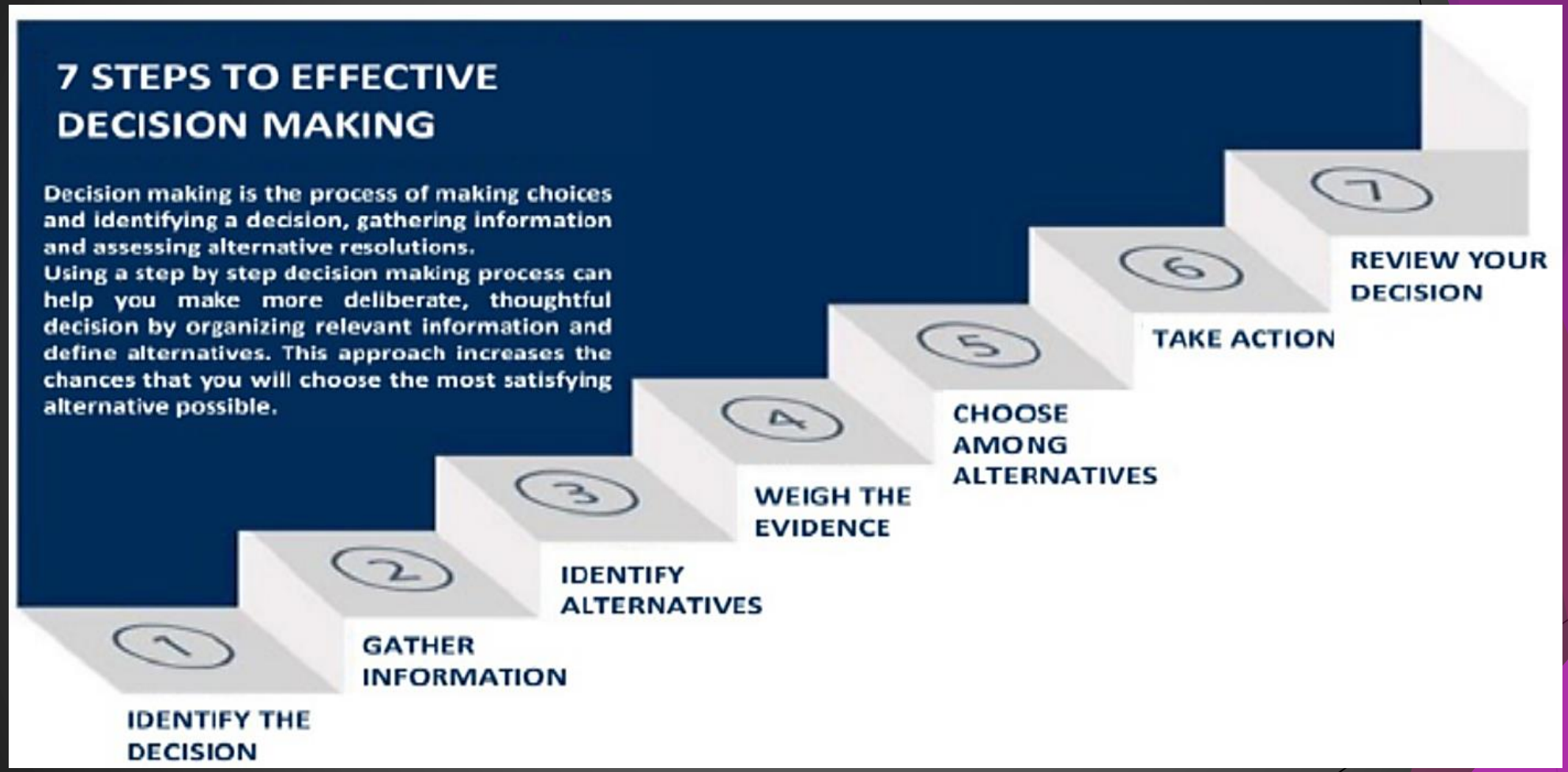

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Decision making in aircraft maintenance environment must take the following into account to avoid error and accident:

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Chapter 9 : Professionalism and Integrity

9.1 Keeping up to date; currency
9.2 Error provoking behaviour
9.3 Assertiveness

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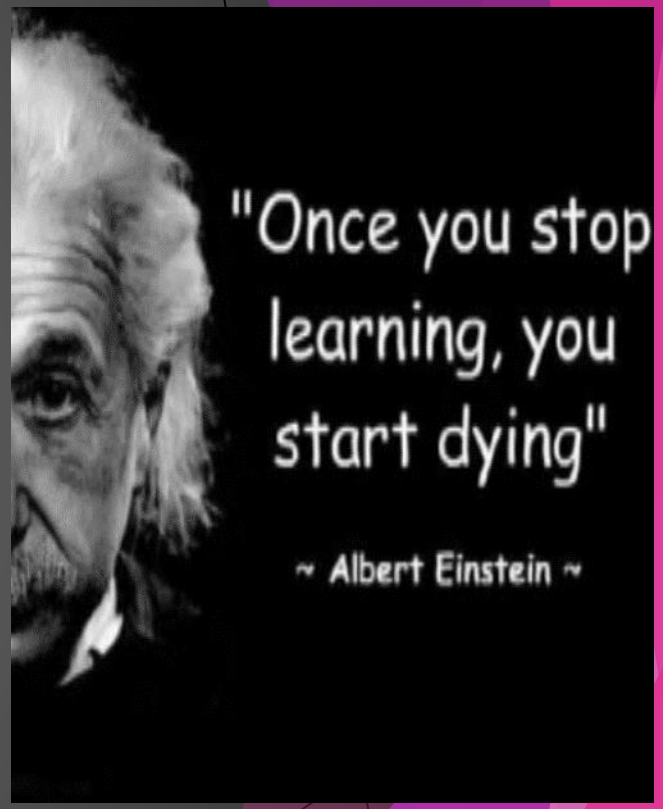
Organizations with an *EASA/CAAM Part 145* approval are required to ensure their certifying and support staff receive *continuation training within a two year period*. AMC145.A.35(d) specifically states that training should cover changes in relevant requirements such as Part 145.



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To maintain the currency in aircraft maintenance environment, he must keep abreast of pertinent Information relating to:

- New aircraft types or variants
- New technologies and new aircraft systems
- New tools and maintenance practices
- Modifications to current aircraft and systems he works on
- Revised maintenance procedures and practices.

Technicians are likely to keep up-to-date by:

- Undertaking update courses
- Reading briefing material, memos and bulletins
- Studying maintenance manual amendments

Knowledge Currency ⟷ Reduce Error & Mistake ⟷ Prevent Accident

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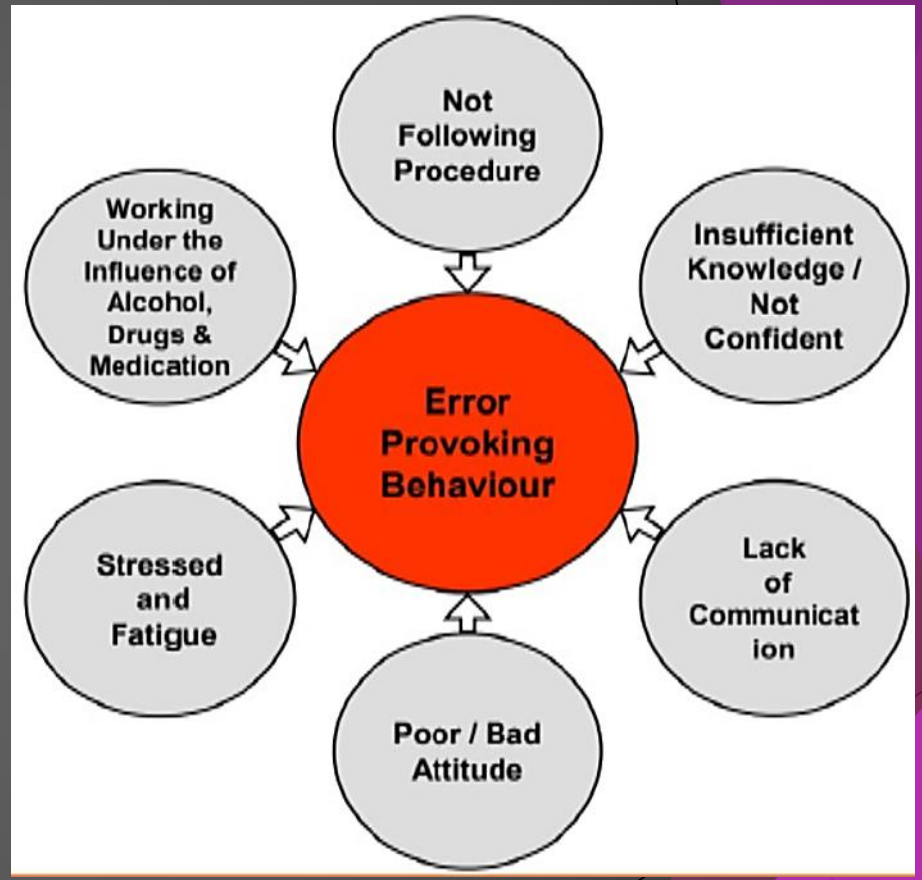
Attitudes about errors can, in themselves, be a line of defense in error provoking situations and environments. These types of attitudes can clearly influence, and actually exacerbate, error- provoking behavior.
E.g. Taking a shortcut instead of using the procedure in the AMM to complete a task, because it worked before.



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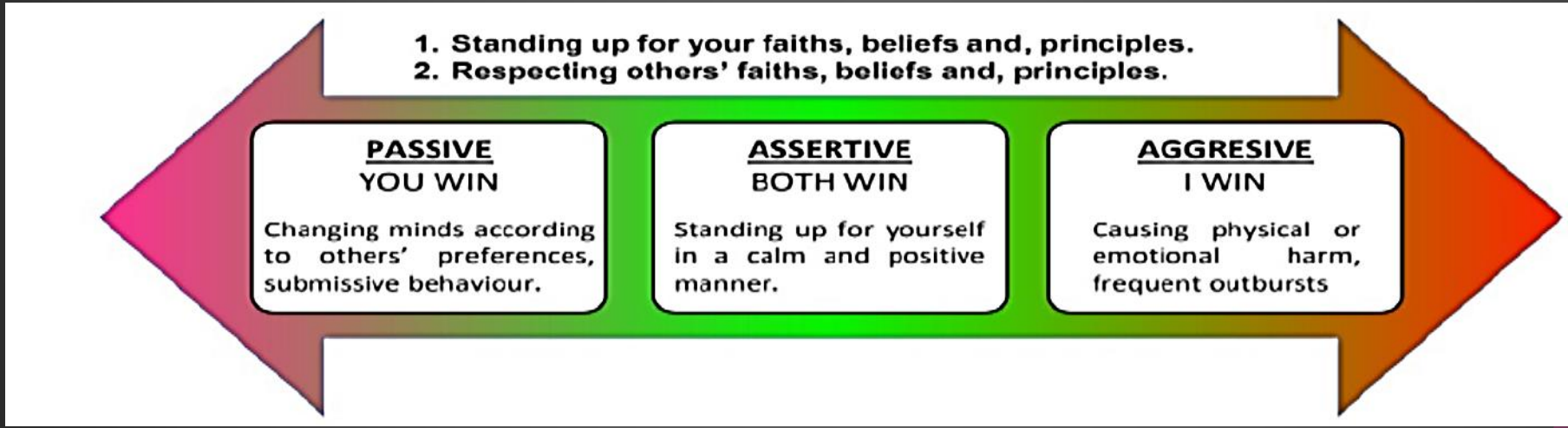
Assertiveness is a direct consequence of your confidence.

- Assertiveness works on *your ability to say 'no'*
- Most people have trouble saying "No", especially when a superior is concerned.
- *Assertive individuals are those who can get their point across without hurting or upsetting anyone and yourself*



One of the major myths revolving around this trait is that assertive people always have the "I'm always right" approach, it's time to bust that myth. Assertive people ARE NOT always right, instead they are always understanding.

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Here are certain tips that will help you develop your assertiveness –

- Don't just hear, listen. Listen to what others have to say and respond appropriately.
- Ask before assuming.
- Appreciate others' hard work and give them credit when due.
- Admit if you were wrong and apologies.
- Be responsible and accountable.
- Believe that you deserve to be treated with respect and dignity. Extend the same courtesy towards others.
- Identify your needs and work on them accordingly. Don't expect others to spoonfeed you.
- Maintain your individuality. Don't be submissive.
- Accept compliments and criticism politely. Be humble.
- Know your limits and learn to say a "NO".

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Chapter 10 : Organization's HF Program

10.1 Safety policy and objective, just culture principles
Reporting error and hazards, internal safety
10.2 Reporting scheme
10.3 Investigation process
10.4 Action to address problems
10.5 Feedback and Safety Promotion

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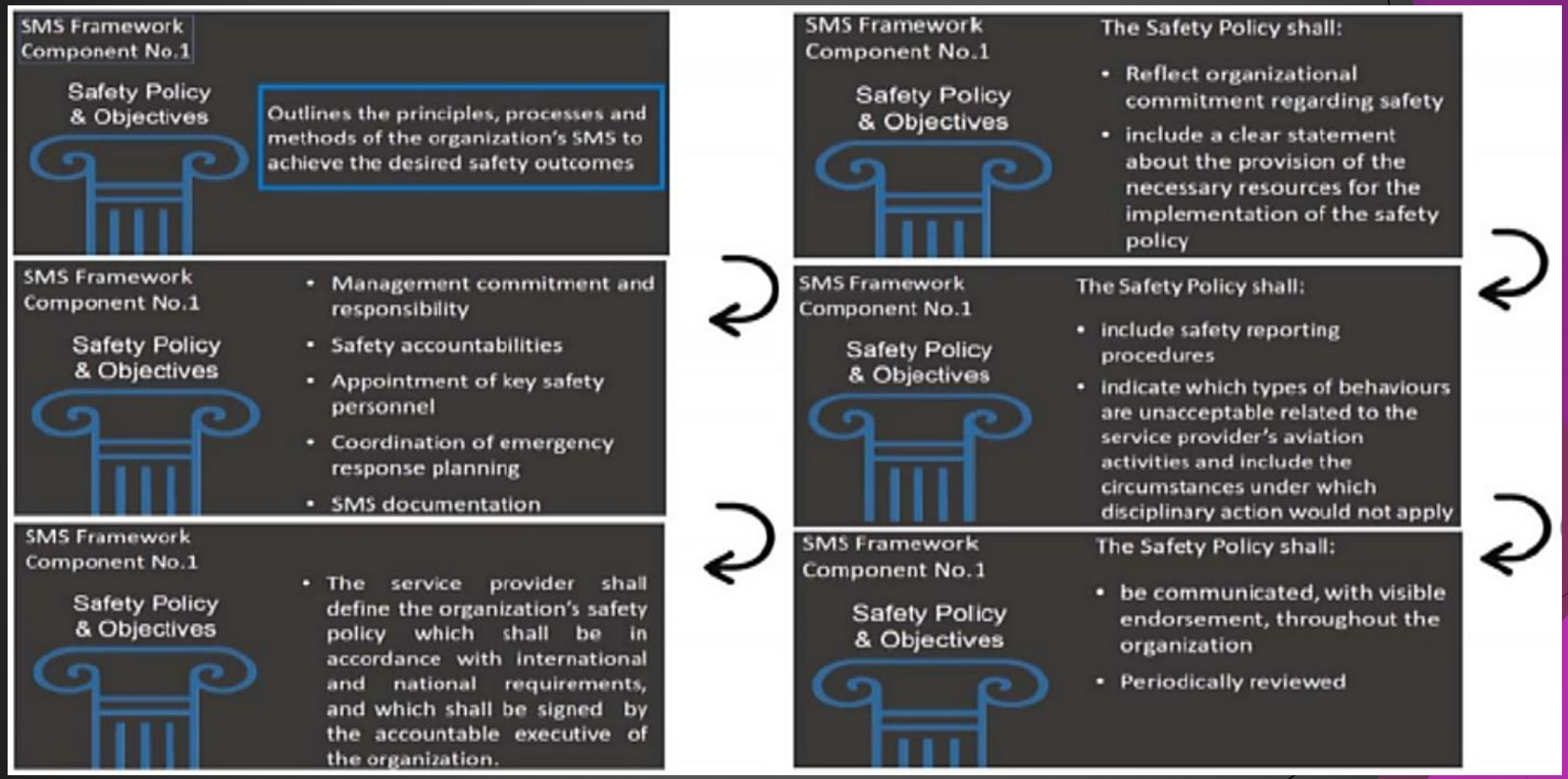

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The JUST culture

The *fair-but-accountable, reporting culture* arguably provides an appropriate balance between punitive and non-punitive reporting cultures. The fair-but-accountable culture *accepts that human error may occur*, but it also means *employees must perform their roles professionally*.

Professor Reason (1997) emphasized the importance of a strong reporting culture in order to sustain a resilient and supportive safety culture.

To set up an effective event and hazard reporting system an organization must establish a culture *where personnel are happy to speak up when things go wrong: one which encourages open and honest safety reporting focused on identifying causes rather than culprits.*

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Safety Reporting

A healthy reporting culture aims to differentiate between **INTENTIONAL** and **UNINTENTIONAL** deviations and determine the best course of action for both the organization as a whole and the individuals directly involved.

REPORTING CULTURE

A good reporting culture is one criterion for judging the effectiveness of a safety system

The success of a reporting system depends on the continuous flow of information.

REPORTING CULTURE

- It is greatly influenced by organizational, professional and national cultures and is one criterion for judging the effectiveness of a safety system.

Violations **REPORTING CULTURE** **Errors**

Must have clear policies that distinguish willful acts of misconduct from inadvertent errors, providing for an appropriate punitive or non-punitive response

Violations **REPORTING CULTURE** **Errors**

Voluntary reporting system should be

CONFIDENTIAL !

HUMAN FACTOR INITIAL

Investigation methodology

The investigation process should take place as soon as possible after the event. The objective of the investigation is to understand why an event happened and the contributing causes and not to apportion blame.

The investigation should include:

a) Review of documentation and processes:
b) Operational data monitoring.
c) Interviews:
d) Root cause analysis
e) Data analysis

An organization should have procedures to communicate the results of any safety investigations and where appropriate to address any identified hazards. This should include incorporating lessons learnt into procedures, training and safety promotion

The scale and scope of any investigation should be suitable to determine why an event occurred and validate or identify the underlying hazards. The level of investigation should be proportional to the identified hazard and risk.

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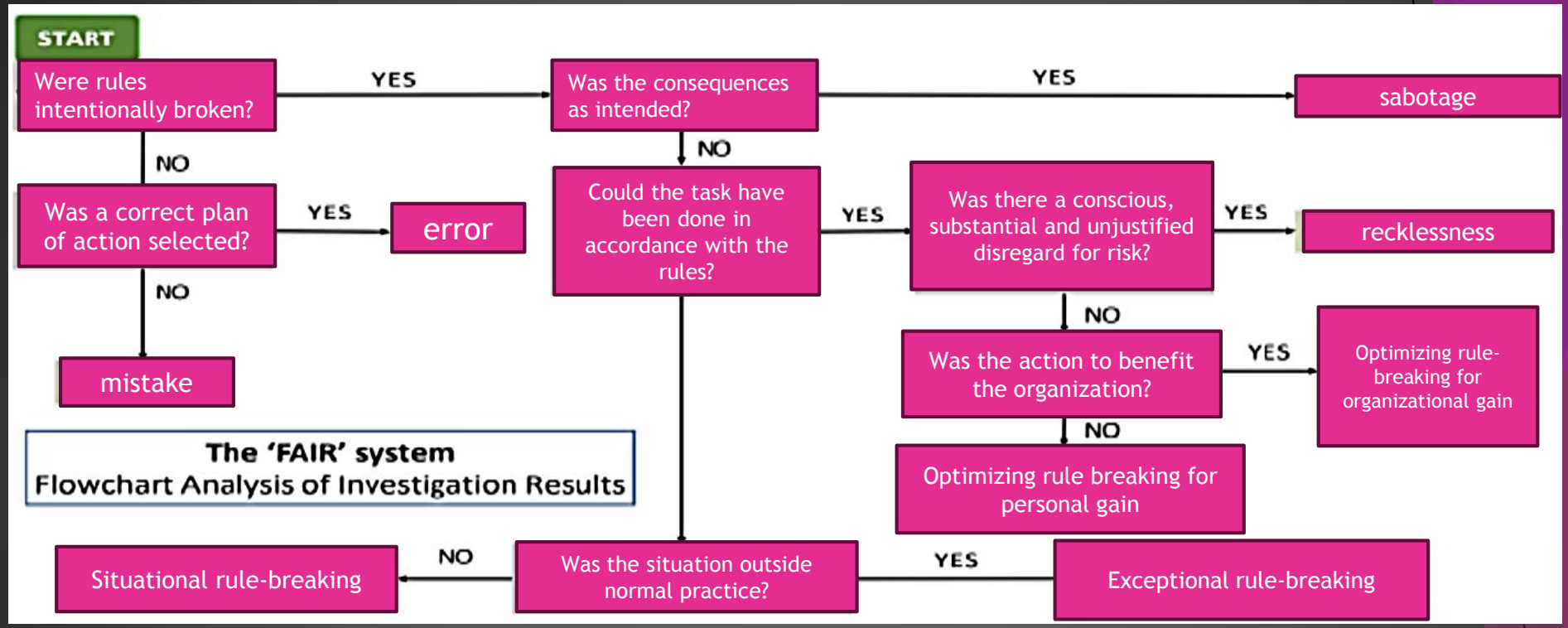

Organizations that actively use safety reporting concepts implement formal policies to ensure that the process is applied consistently. Often behavior is grey, not black or white, so you have to have a process to evaluate individuals' actions in context. The *FAIR* (flowchart analysis of investigation results) system is one such tool used in aviation maintenance.

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Depending the likelihood and the severity of the risk / error, suitable action / approach must be taken *to mitigate occurrence. error and prevent re-occurrence.*

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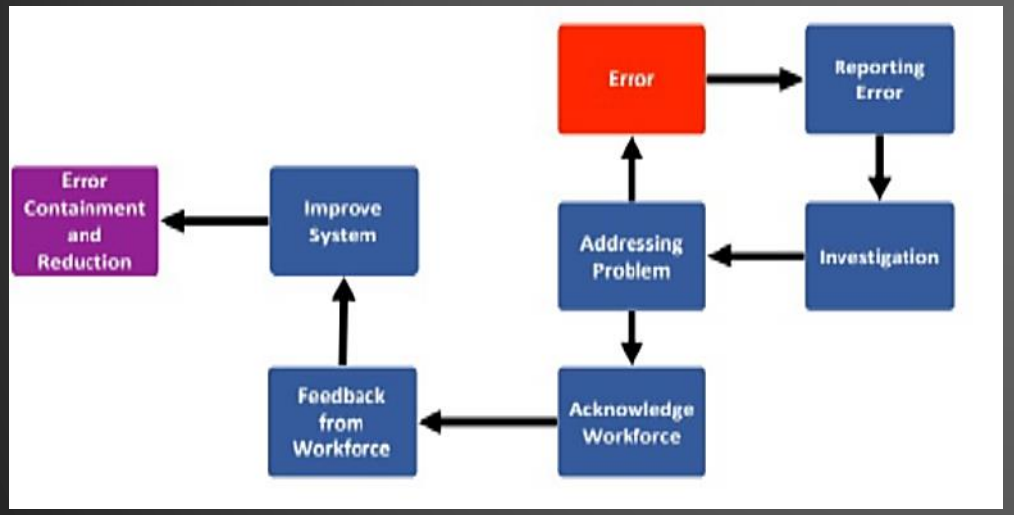
Feedback it is Integral to the management of safety.

- Effective feedback from incident reporting systems is to learn from failures in the delivery.
- Negative, critical feedback can lower workplace morale and productivity, since it leaves employees feeling under appreciated
- *Positive feedback*, an approach that emphasizes singling out positive behavior, *provides key advantages to organization in addressing employee performance*



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The End ☺

We hope you have enjoyed this training.

For any enquiries, please write to:
training@dviation.com

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