



# Human & Organizational Factors in Incident & Accident Investigation

## HOFIAI Course & Workshop

17<sup>th</sup> Nov. – 19<sup>th</sup> Nov. 2018

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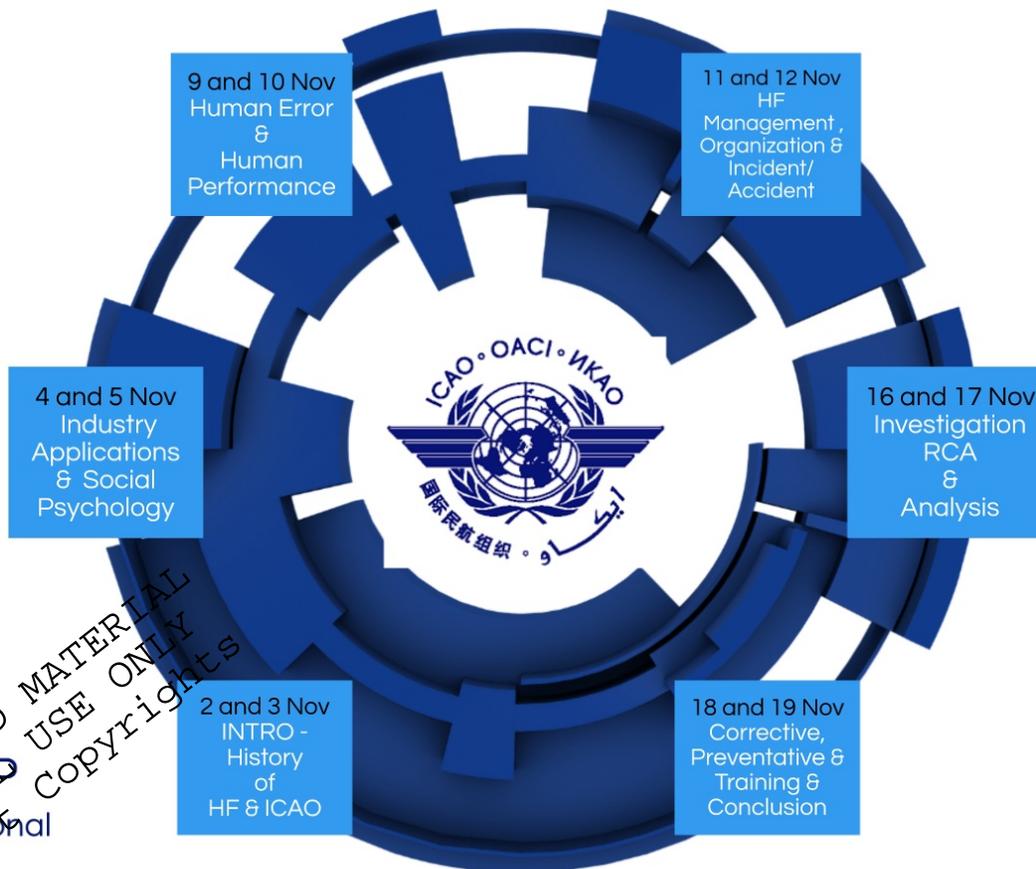
# WELCOME CANDIDATES

**Capt. Gabriele 'Gabe' Ascenzo**

**Instructor/Facilitator/Mentor/Learner**

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ICAO - COSTA  
 Human and Organizational  
 Factors in Incident &  
 Accident Investigation  
 02 Nov - 19 Nov

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# HF – Upset Recovery Training (UPRT)

The safety issue is also acknowledged by ICAO and other international aviation regulatory bodies, such as the FAA. In 2014, ICAO published amendments to Annex 1 and 6 detailing Standards and Recommended Practices (SARPs) related to Loss of Control Avoidance and Recovery Training (LOCART).

The amendments to ICAO Annex 1 mandate UPRT for MPL and multi-pilot aeroplane type rating training courses, and recommend UPRT in an aeroplane for CPL training courses.

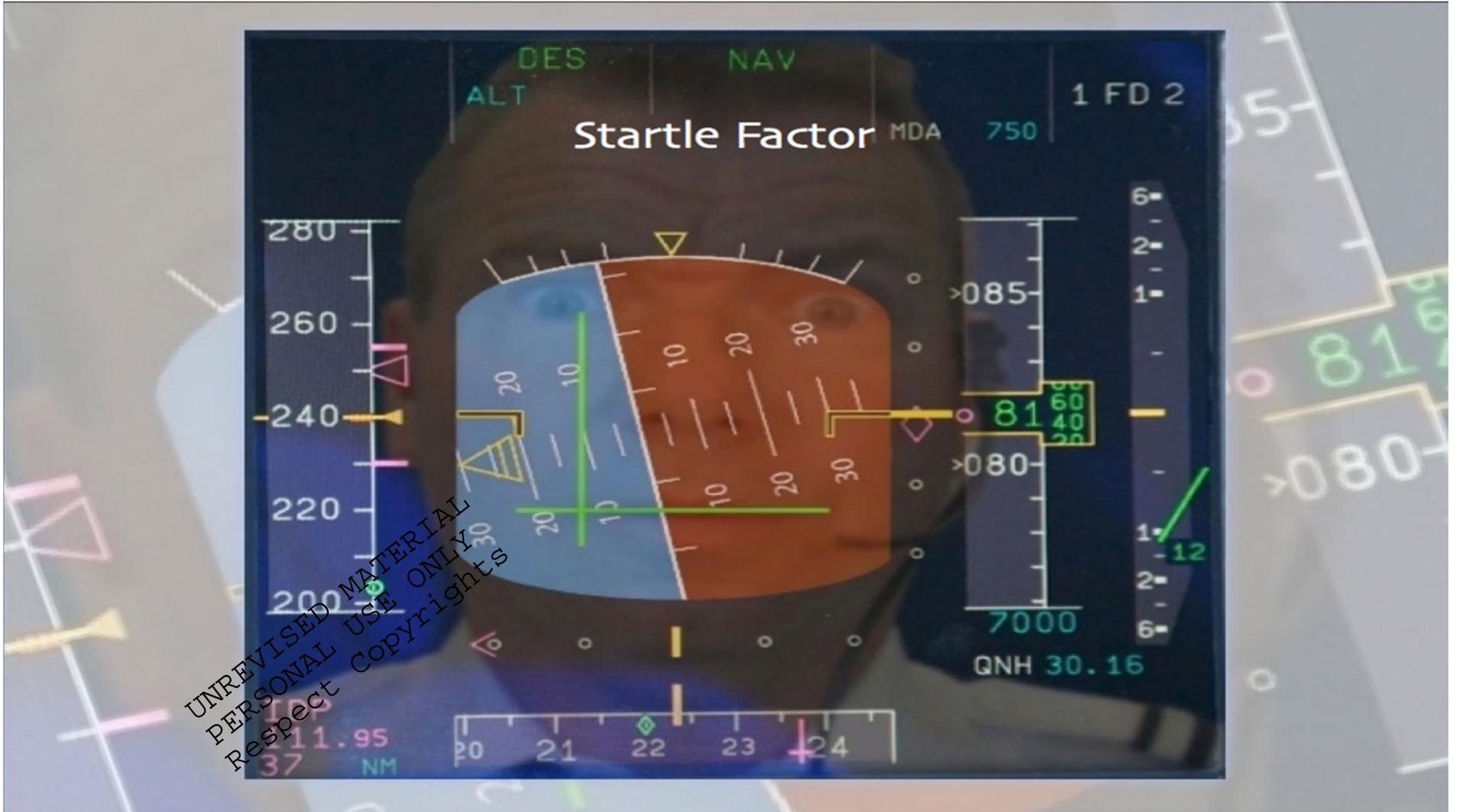
In addition, the amendments to ICAO Annex 6 contain requirements on UPRT training programmes for CAT operators using aeroplanes. The ICAO 'Procedures for Air Navigation Services — Training (PANS-TRG)' also include UPRT provisions for MPL, CPL, initial multi-pilot type rating, recurrent, as well as instructor and inspector qualifications.

In addition, ICAO published Doc 10011 'Manual on Aeroplane Upset Prevention and Recovery Training' which contains further Guidance Material.

In 2013, the FAA published the Code of Federal Regulations (CFR) 121.423 'Pilot: Extended Envelope Training' and the Advisory Circular (AC) 120-109 'Stall and Stick Pusher training', and in 2015 the AC 120-111 'Upset Prevention and Recovery Training'.

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# Mitigating Aviation's Most Lethal Threat... **Loss of Control In Flight**

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# Mitigating Aviation's Most Lethal Threat... **Loss of Control In Flight**

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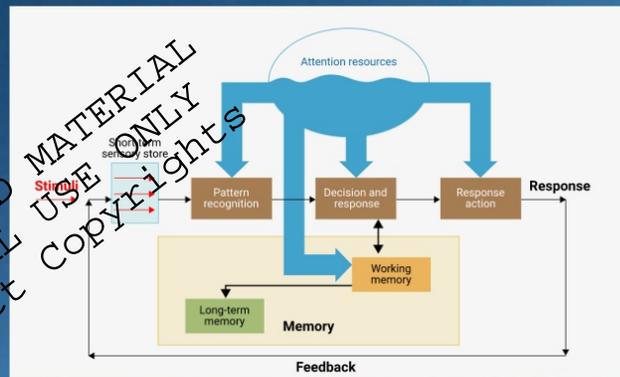
# Mitigating Aviation's Most Lethal Threat... **Loss of Control In Flight**



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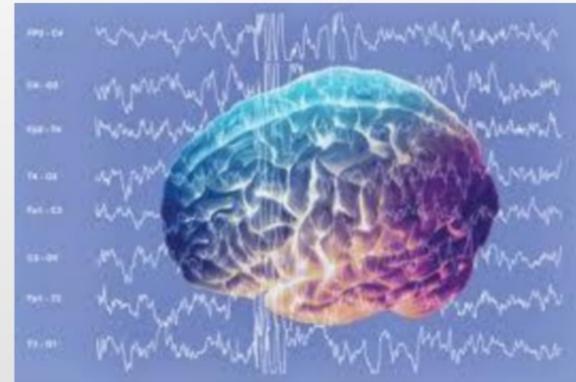


# Mitigating Aviation's Most Lethal Threat... Loss of Control In Flight



## The Cognitive Effects of Startle

- Research has shown significant impairment in information processing for up to 30 seconds
- Information processing tasks such as attention, perception, situational awareness, problem solving and decision making can be markedly impacted.



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- **Communication** is often disorganised and incoherent for some time.



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- **Psychomotor** impairment often occurs but generally lasts for only 5-10 seconds.

- upset prevention and recovery training (UPRT) (NEW issue)
- ATC training
- new instructor standards
- new Flight Simulation Training Device (FSTD) criteria, published in 2009 in ICAO Doc 9625
- embedded TEM strategies throughout the training process.

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Collaborating to address

## LOSS OF CONTROL IN-FLIGHT

Upset Prevention and Recovery Training Workshop



Module 7 Day 1  
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## URRT Provisions: What do they say?

## Thanks to:

### Content developers

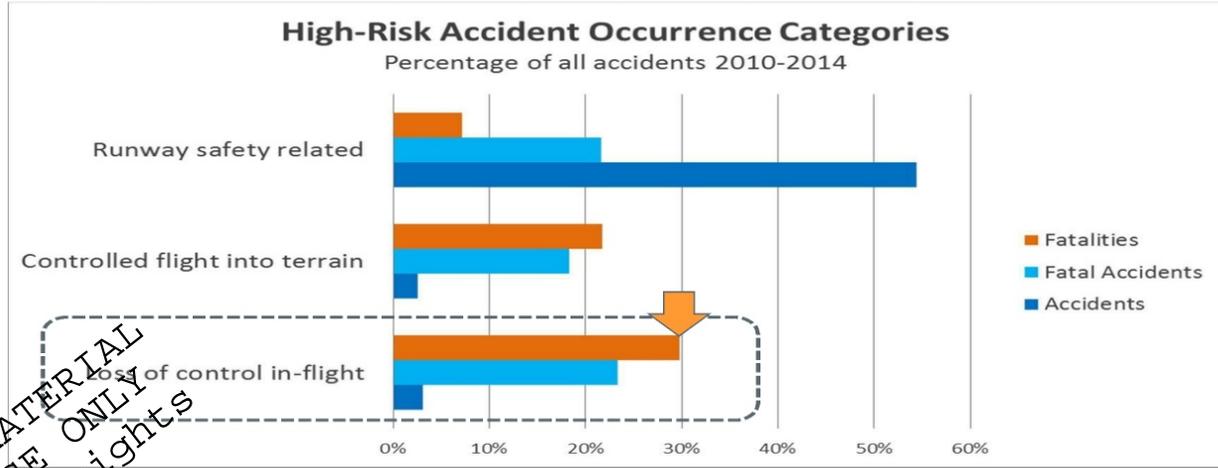


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## Top 3 Safety Priorities



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\* Accidents involving scheduled commercial air transport with maximum take-off weight exceeding 5 700kg

## How did we proceed?

- Identified training concerns:
  - Insufficient knowledge of high altitude aerodynamics and upset threats
  - Wrong emphasis on minimizing altitude loss during recovery from approach to stall
  - Current training concentrated in a small domain of the operational envelope

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## UPRT: One Aspect of a Global Approach



- Collaborative approach:

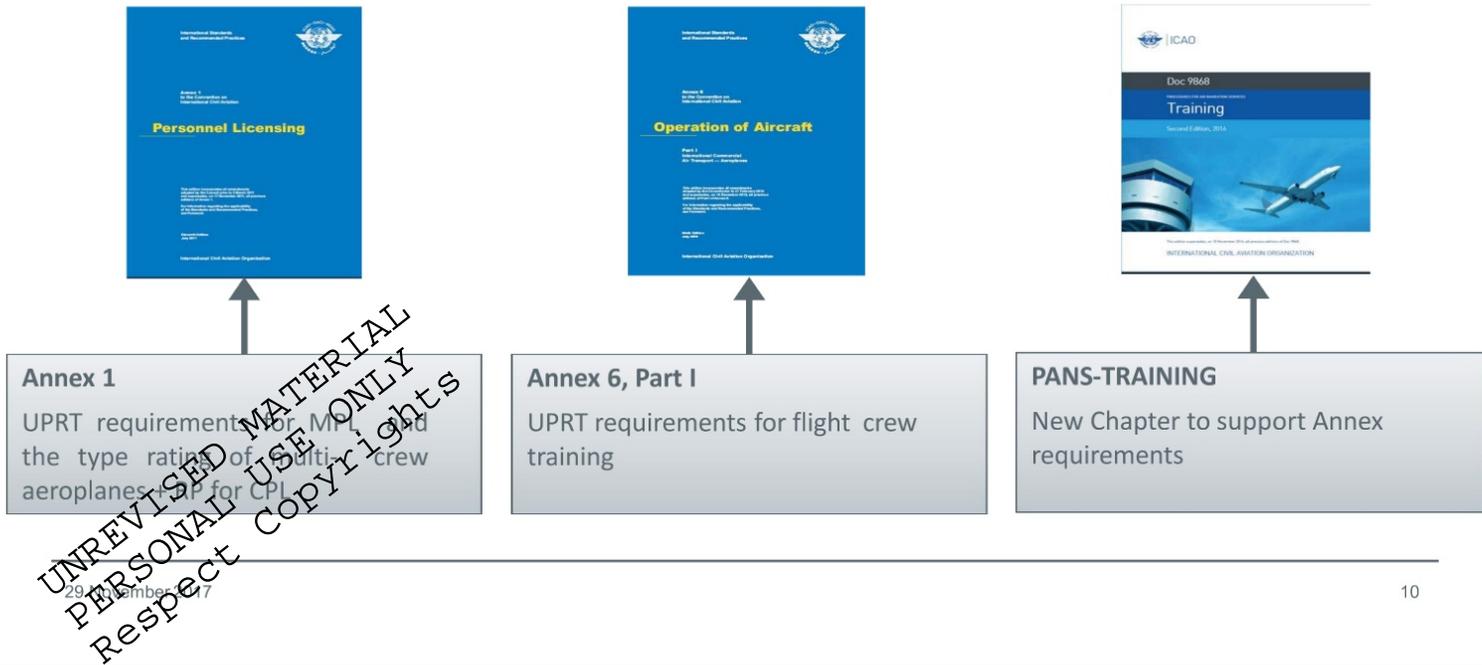
- Information sharing
- Lifecycle model for pilot training
- Implement UPRT
- Outreach

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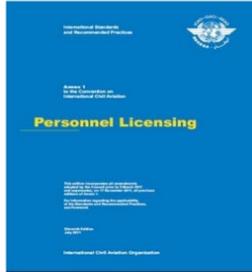
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## ICAO UPRT Provisions



## ICAO UPRT Provisions



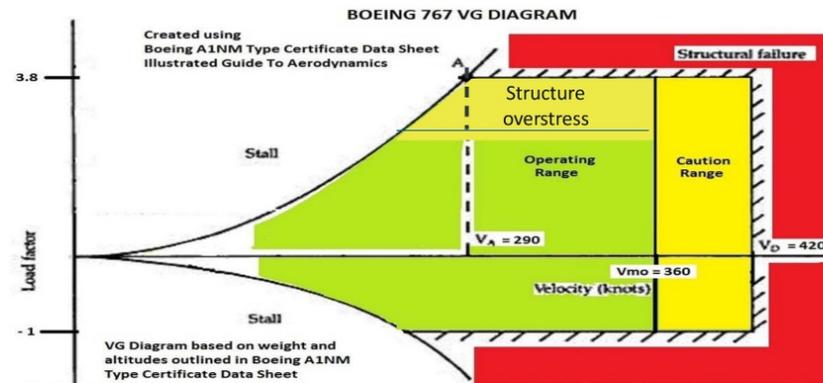
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## What are the big changes?

- Pilots must be trained *throughout* the normal flight envelope (green), including the outer edges.

- Approach to stall
- High Altitude



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## What are the big changes?

### 5. Safety considerations for on-aeroplane training

- Effective SMS
- Qualified instructors
- Aeroplane capabilities appropriate to the training tasks
- Operational control procedures

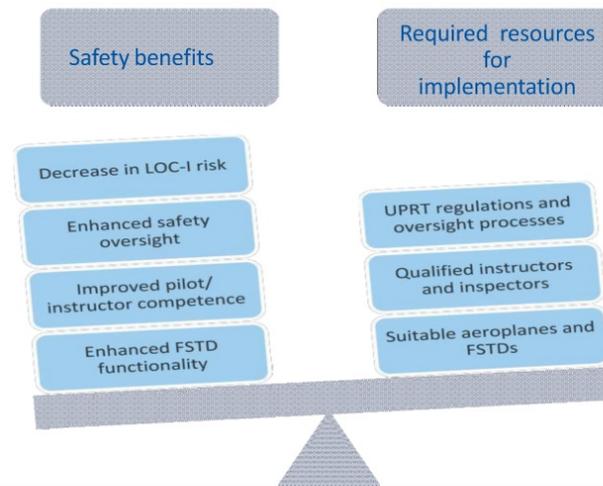
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## Implications

- Optimise safety outcomes within available resources



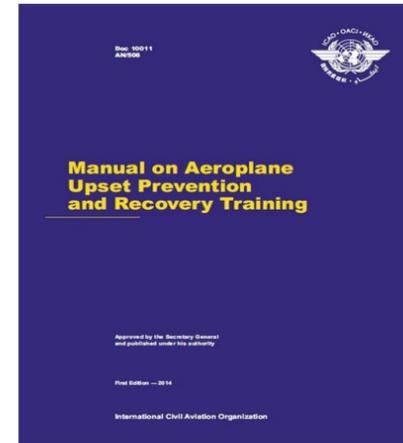
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## Manual on Aeroplane Upset Prevention and Recovery Training (Doc 10011)

- Introduction:
  - Upset defined, history & applicability
  - Training programme requirements
- Training:
  - Academic training
  - On-aeroplane training
  - FSTD training  
(non type-specific and type-specific FSTD)
  - CEMs:
    - Recommendations and training scenarios
    - Upset recovery techniques

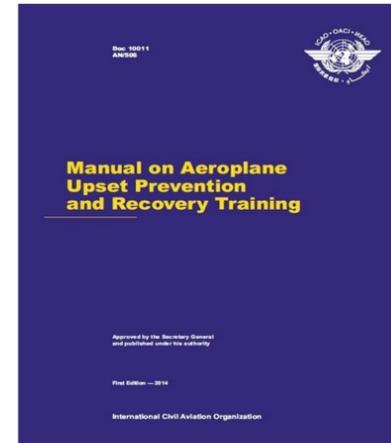


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## Manual on Aeroplane Upset Prevention and Recovery Training (Doc 10011)

- FSTD fidelity requirements for UPRT  
(see later)
- UPRT Instructors:
  - academic, on-aeroplane, FSTD
- Regulatory oversight
- Appendix 1
  - competency-based UPRT programmes

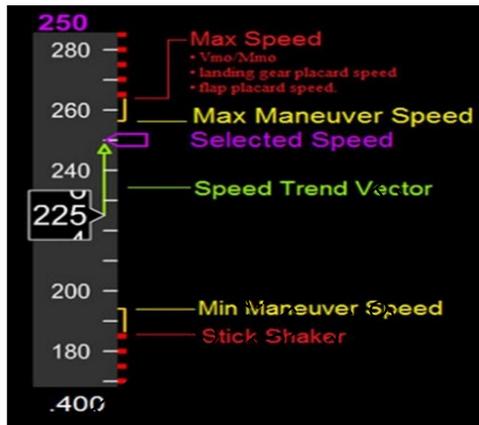


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## Examples of training –FSTD Manoeuvre Exercise

- To help in understanding the videos, here are symbols of the B737-800 PFD for the speed tape/ADI:



AOA (Cpt)

Pitch Limit Indicator

Flight Path Vector

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Collaborating to address

## LOSS OF CONTROL IN-FLIGHT

Upset Prevention and Recovery Training Workshop

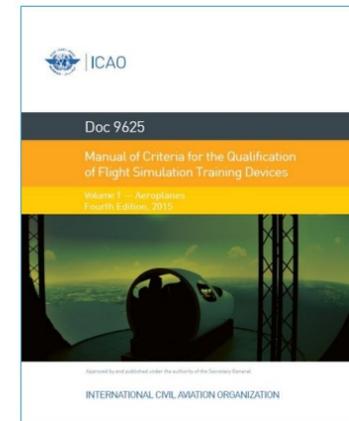


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## Manual of Criteria for the Qualification of FSTD (Doc 9625)

- 4<sup>th</sup> edition (August 2015)
- New attachment P has guidance for UPRT: Models and qualification tests or requirements for -
  - Aeroplane type-specific recognition cues of the first indication of the stall (stall warning, aerodynamic buffet...)
  - Aeroplane type-specific recognition cues of an impending aerodynamic stall
  - Exemplar recognition cues and handling qualities from the stall break through recovery *if prescribed by regulations*
  - Engine and airframe icing evaluation

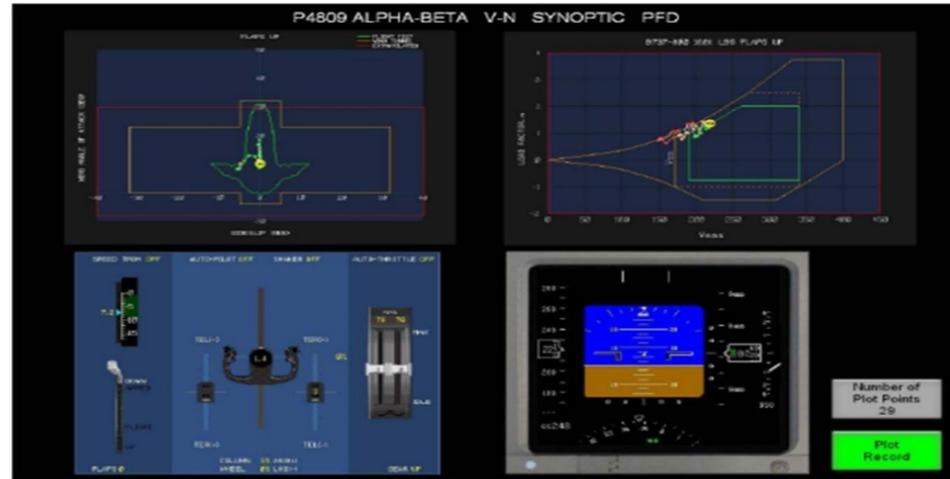


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# Manual of Criteria for the Qualification of FSTD (Doc 9625)

- UPRT instructor tools:
  - IOS



Example of instructor feedback display

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## Case Study: US FAA implementation

### New stall and UPRT requirements in the United States

- Congressional Direction
- Aviation Rulemaking Committee (International Harmonization)
- Public Comment
- Final Rule Publication
- Education (Public/Inspectors)

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## Inspector Education:

- Important and needed:
  - Briefings before the release of the final rule
  - On-line training sessions with field inspectors
  - Release of inspector guidance/job aids
  - Annual Principal Operations Inspector conference
  - POI Field Training (Stall and Upset Training)

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## 2019 FAA Requirements

### **Stall Prevention**

- At first maneuvers based
  - Takeoff
  - Clean
  - Landing
- Incorporate Scenarios
- **Checking/Testing**

### **Stall Recovery**

- Only maneuvers based
- Instructor led
- Hands on pilot experience through recovery

### **Upset Prevention**

- Manually controlled slow flight;
- Manually controlled loss of reliable airspeed;
- Manually controlled instrument departure and arrival

### **Upset Recovery**

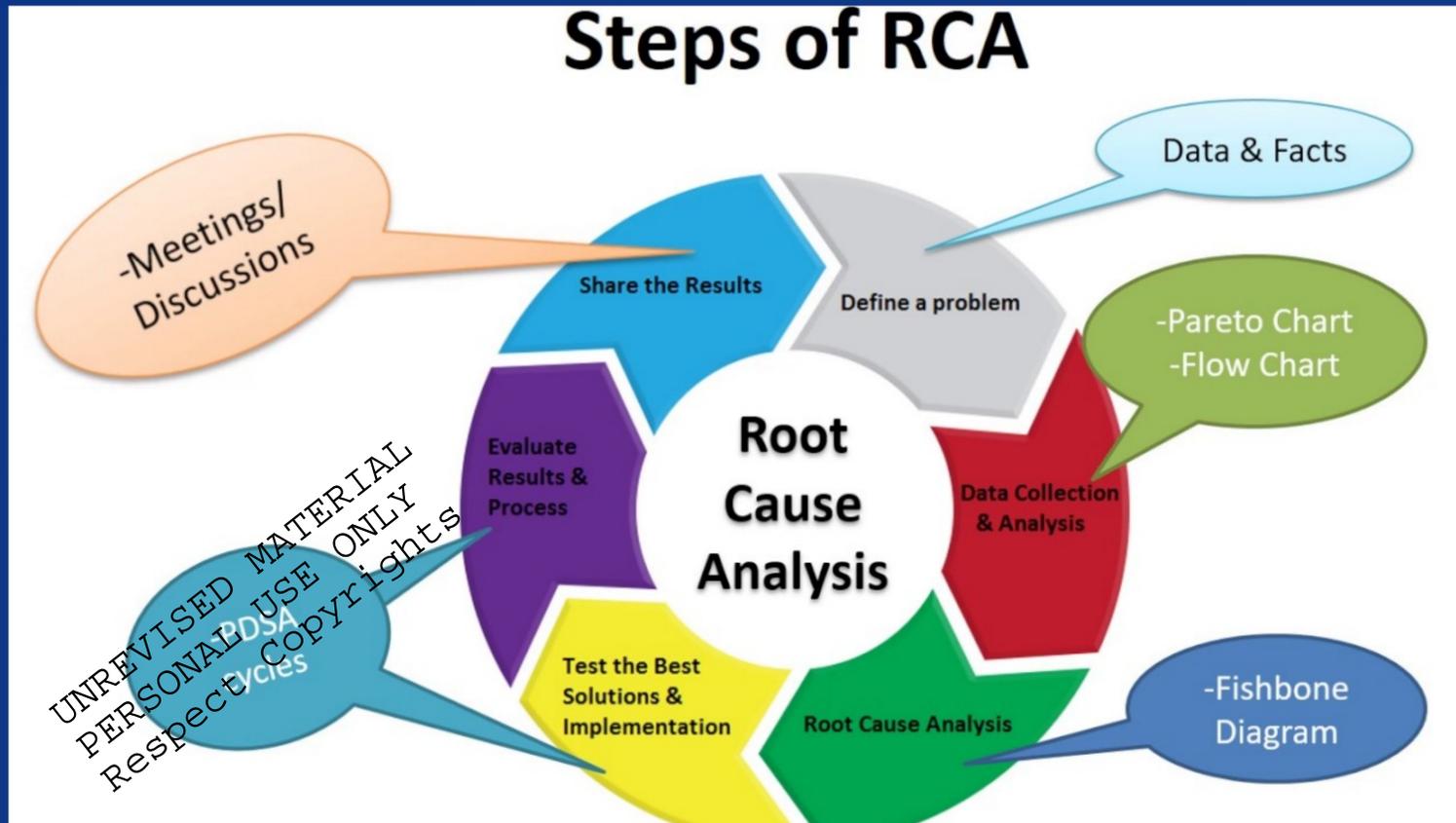
- Nose High
- Nose Low

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# Step by Step



Example:

(a) Situation – An airport operator did not have an effective system to identify, notify, and control conditions affecting aviation safety in the airport environment, evidenced by:

- (i) Trees and an unmarked tower obstructed the runway approach slope;
- (ii) Operator did not notify pilots, CAA, ASD, about these obstacles;
- (iii) Operator did not adjust the PAPI and runway threshold location to compensate for obstacles;
- (iv) Operator did not conduct obstacle surveys at intervals adequate for natural growth rate;
- (v) Operator conducted airside safety inspections with differing checklists, some versions did not include obstacle checks; and
- (vi) Staff did not realize the impact such obstacles outside the airport boundary could have on the airport's certification.

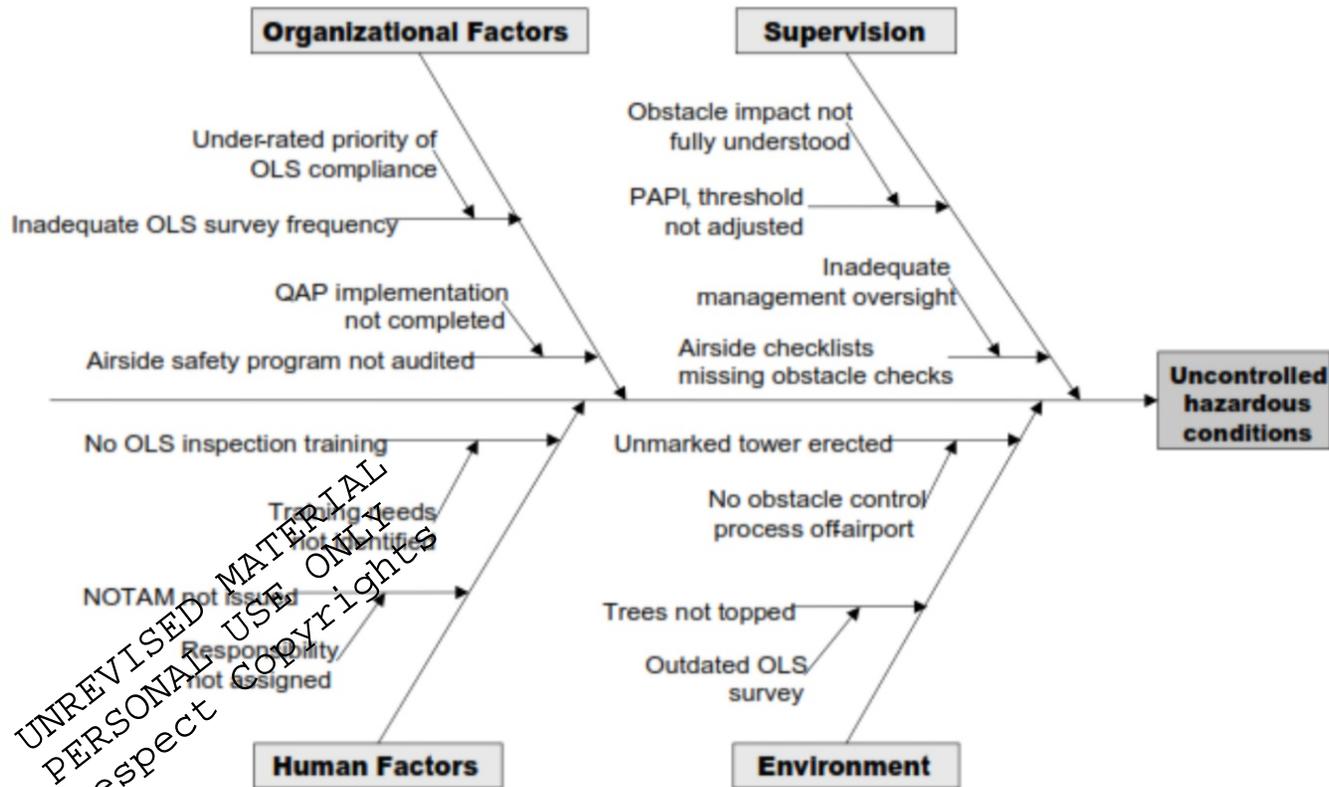
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(b) Problem Statement – Since July 15 last year, the airside safety program was not conducted in compliance with regulatory requirements, leading to uncontrolled and unreported conditions hazardous to aviation safety around the airport.

(c) Causal Analysis – The organization used a fishbone diagram to brainstorm possible factors and causes, as shown

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Figure 1 – Fishbone Diagram



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**Corrective Action** – Solutions adopted by this organization were:

(i) **Short-term** –

- (A) Issue NOTAM;
- (B) Notify CAA, ASD;
- (C) Displace threshold;
- (D) Turn off PAPI;
- (E) Top trees;
- (F) Work with tower owner to implement marking and lighting requirements;
- (G) Document the process for taking immediate safety actions to correct obstructions;
- (H) Update Operations Manager job description to document responsibility for managing impacts of obstructions;
- (I) Standardize airside inspection checklists to include obstacle checks, and establish forms control process; and
- (J) Develop audit checklists for, and audit, the airside safety program.

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**(ii) Longer-term -**

- (A) Analyze training needs for staff with airside safety responsibilities;
- (B) Develop training to monitor and assess potential obstacles; deliver to airside safety staff and include in initial training for new hires;
- (C) Conduct new obstacle survey;
- (D) Change frequency of obstacle surveys from 5 years to 2 years, and
- (E) Review corrective action to determine effectiveness during management review process.

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# Guidance

This manual is issued in four separate parts as follows:

Part I — Organization and Planning;

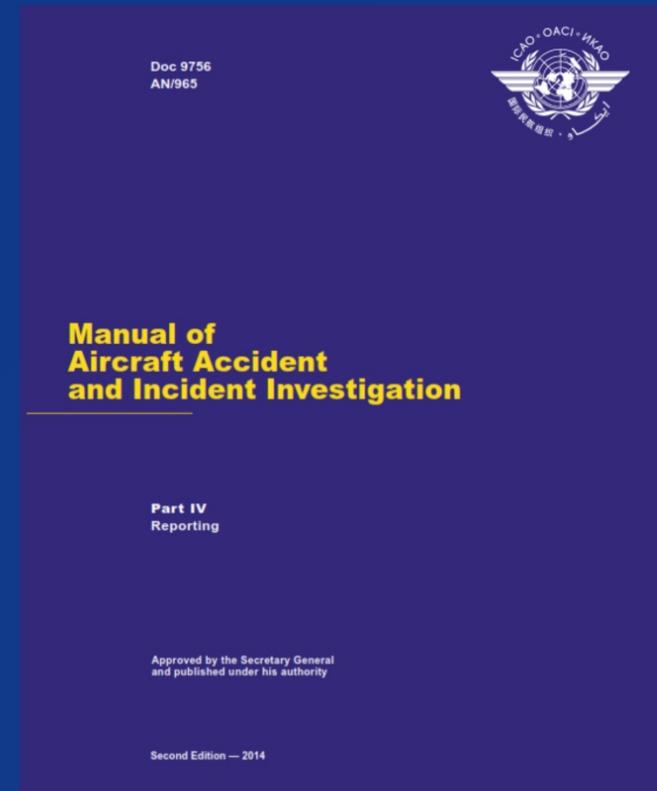
Part II — Procedures and Checklists;

Part III — Investigation; and

Part IV — Reporting.

Because this manual deals with accident, serious incident and incident investigations, for reasons of brevity, the terms “accidents” and “accident investigation” as used herein, apply equally to “incidents and incident investigation”.

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# Guidance

The following ICAO documents provide additional information and guidance material on related subjects:

- Annex 13 — Aircraft Accident and Incident Investigation;
- Manual on Accident and Incident Investigation Policies and Procedures (Doc 9962);
- Manual on Regional Accident and Incident Investigation Organization (Doc 9946);
- Human Factors Training Manual (Doc 9683);
- Manual of Civil Aviation Medicine (Doc 8984);
- Hazards at Aircraft Accident Sites (Circular 315);
- Training Guidelines for Aircraft Accident Investigators (Circular 298); and
- Human Factors Digest No. 7 — Investigation of Human Factors in Accidents and Incidents (Circular 240).

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# Human Factors

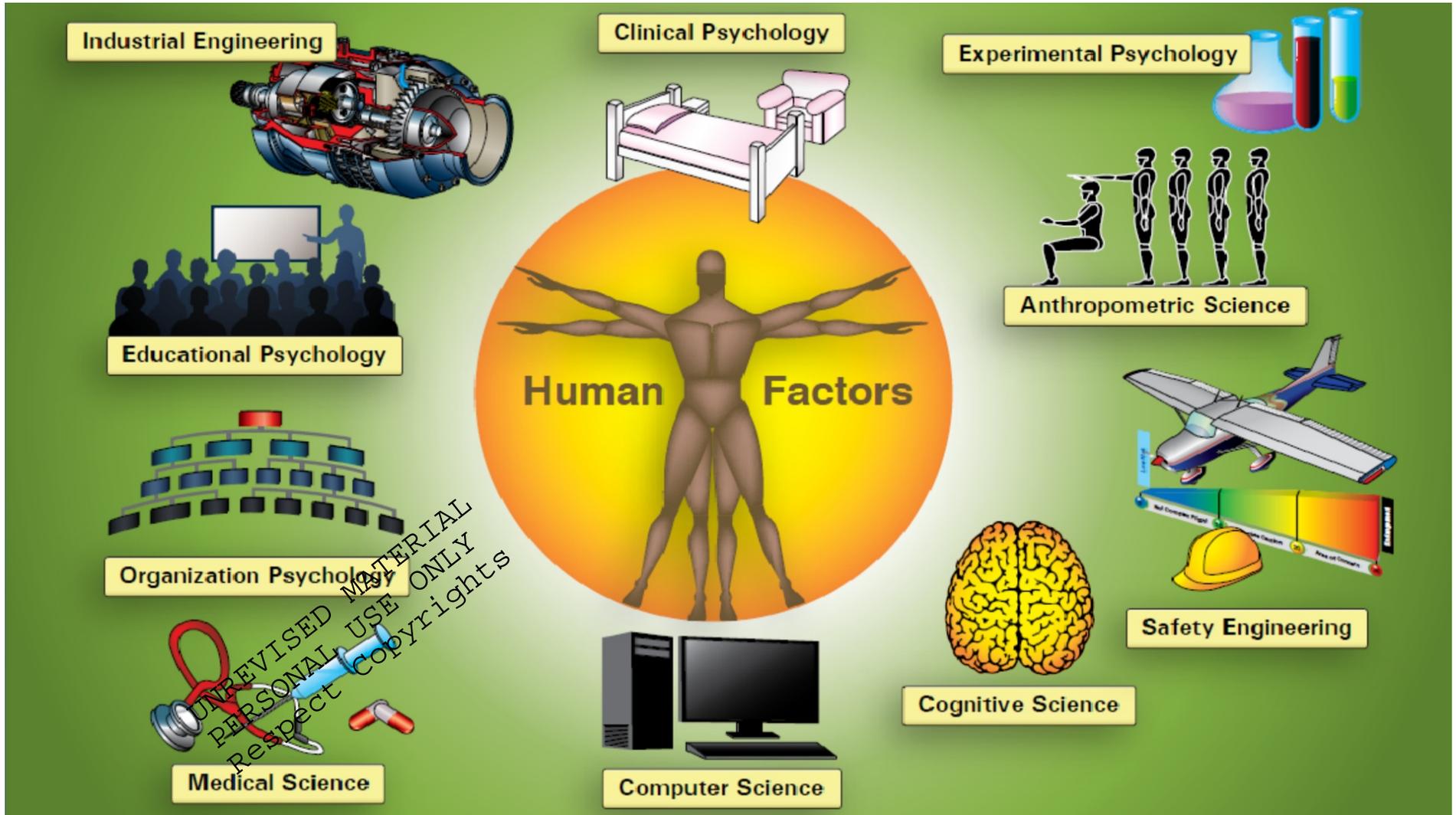
Human Factors is a science in its own right. (In the modern age is usually also associated with Non Technical Skills – HF/NTS.)

It has evolved from the early Cockpit Resource Management (CRM) in the 1980s, to Crew Resource Management in the 1990s – also CRM but now with a recognition that it was more than just pilots involved with the safe operation of an aircraft – to today's requirement to integrate HF/NTS into SMS.

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# Perspective for thought...

Human performance.

No accident investigation can be complete without a thorough consideration of Human Factors issues involved.

The demands of the environment and the aircraft on the human often approach the physiological and psychological limits of the

- flight crew,
- maintenance and servicing crews,
- air traffic services personnel and
- other personnel required to support aircraft operations.

The study of human limitations, communications, fatigue, decision-making processes, flight crew health and the information available from post-mortem examinations are vital components of this section of an investigation process.

An examination of the handling of the aircraft will encompass the areas of operations and training.

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# Perspective for thought...

Organizational information.

Organizational and management information is a section of the final report format and it concerns the organizations and the management involved in influencing the operation of the aircraft.

The organizations include, for example,

- the operator,
- the air traffic services,
- airway,
- aerodrome,
- weather service agencies and the
- regulatory authority.

Conducting a review of the organizational structure and functions as well as the management policies and practices of the agencies, authorities and aircraft operator involved is a subject that should be covered.

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# Perspective for thought...

For example, an investigator should have the competence to review an aircraft operator's;

- management functions,
- policies and practices
- in their entirety.

There are many aspects of the supervisory process which may have a direct bearing on the accident, such as acceptance of;

- inadequate flight crew qualifications,
- deficient guidance material,
- maintenance shortcuts,
- improper crew rostering,
- failure to provide proper training in aircraft type,
- shortcomings in crew resource management and
- unreasonable pressure to complete schedules on time.

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# Perspective for thought...

The methods of investigating management and organizational aspects of an organization to determine the presence of any risk factors or other shortcomings is a requirement of a well-rounded accident investigation process.

An examination of the means of supervision is very important and will include a review of;

- orders,
- regulations,
- manuals,
- independent audits,

as well as the performance of;

- supervisors,
- instructors and
- company management.

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# Perspective for thought...

Inadequate Supervision.

The role of any supervisor is to provide the opportunity to succeed. To do this, the supervisor, no matter at what level of operation, must provide guidance, training opportunities, leadership, and motivation, as well as the proper role model to be emulated. examples of inadequate supervision are (not limited to):

- Failed to provide guidance
- Failed to provide operational doctrine
- Failed to provide Oversight
- Failed to provide Training
- Failed to provide Qualifications
- Failed to provide Track performance

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# Perspective for thought...

Planned Inappropriate Operations.

Occasionally, the operational tempo and/or the scheduling of aircrew is such that individuals are put at unacceptable risk, crew rest is jeopardized, and ultimately performance is adversely affected.

Some examples of inappropriate planned operations are (not limited to):

- Failed to provide correct data
- Failed to provide adequate brief time
- Improper manning
- Mission not in accordance with rules/regulations
- Provided inadequate opportunity for crew rest

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# *Perspective for thought...*

Supervisory Violations.

Supervisory violations, on the other hand, are reserved for those instances when existing rules and regulations are willfully disregarded by supervisors.

Some examples of supervisory violations are (not limited to):

- Authorized unnecessary hazard
- Failed to enforce rules and regulations
- Authorized unqualified crew for flight

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# Perspective for thought...

2.4.9 What are, then, the traits of a safe organization? In general terms, safe organizations:

- pursue safety as one of the objectives of the organization and regard safety as a major contributor in achieving production goals;
- have developed appropriate risk management structures, which allow for an appropriate balance between production management and risk management;
- enjoy an open, good and healthy safety corporate culture;
- possess a structure which has been designed with a suitable degree of complexity, standardized procedures and centralized decision-making which is consistent with the objectives of the organization and the characteristics of the surrounding environment;
- rely on internal responsibility rather than regulatory compliance to achieve safety objectives; and
- respond to observed safety deficiencies with long-term measures in response to latent failures as well as short-term, localized actions in response to active failures.

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# *How to find the Human Factors...*

Information relevant to an aviation occurrence can be acquired from a variety of sources.

Primary sources relating specifically to Human Factors include hardware evidence, paper documentation, audio and flight recorder tapes and interviews, direct observation of aviation personnel activities and simulations.

Secondary sources include aviation occurrence data bases, reference literature and Human Factors professionals and specialists.

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# How to find the Human Factors...

Paper documentation spans the complete spectrum of SHELL interfaces.  
Specific sources include:

- personal records and logbooks;
- certificates and licenses;
- company personnel and training records;
- aircraft flight manuals;
- company manuals and standard operating procedures;
- training manuals and syllabi;
- company training and operational schedules;
- regulatory authority records;
- weather forecasts,
- records and briefing material;
- flight planning documents;
- medical records;

When necessary, medical and post-mortem examinations (see the ICAO Manual of Civil Aviation Medicine, Doc 8934).

# How to find the Human Factors...

Interviews conducted with individuals both directly and indirectly involved in the occurrence are also important. Examples of individuals from whom interviews may be required are:

- survivors (flight and cabin crew or passengers), next of kin, neighbours, friends, colleagues, air traffic controllers, eyewitnesses
- ground handlers, dispatchers, weather briefers, aircraft maintenance engineers, baggage handlers, de-icing personnel
- company owner, chief of flight operations, chief pilot, chief instructor, check-pilot, supervisor, former employers, training captains
- chief of maintenance, maintenance engineers, technical specialists, regulatory authorities
- family or personal physician, psychologist, aeromedical examiner.

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# *How to find the Human Factors...*

Direct observation of actions performed by aviation personnel in the real environment can reveal important information about Human Factors.

Observations can be made of;

- flight operations activities,
- flight training activities,
- maintenance activities and
- air traffic control activities.

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- maintenance activities and
- air traffic control activities.



# How to find the Human Factors...

At any time during an investigation, investigators must be willing to consult professionals outside their area of expertise. These professionals include, but are not restricted to:

- medical officers — to analyse the impact of any medical condition found in the flight crew or other relevant personnel;
- psychologists — to help analyse the impact of environmental, operational and situational factors on motivation and behaviour;
- sociologists — to help evaluate the factors that affect interactions and performance;
- sleep researchers and professionals — to evaluate the quality of rest available to the individual, and the impact on performance of a particular work-rest duty cycle or of circadian factors; and
- ergonomists — to assess the effect of design and layout on the user.

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# How to find the Human Factors...

Personnel in aviation are highly trained in Technical skills – flying or maintaining aircraft – but it is the cognitive ability of successful HF/NTS that allows them to be highly proficient in the employment of these skills. HF/NTS includes understanding and awareness of;

- Communication Mechanics work over assembly of aviation engine
- Leadership (and 'followership')
- Teamwork
- Stress
- Fatigue
- Alcohol and Other Drugs
- Situational Awareness
- Decision making
- Airmanship
- Threat and Error Management
- ... (others – this is not an exhaustive list)

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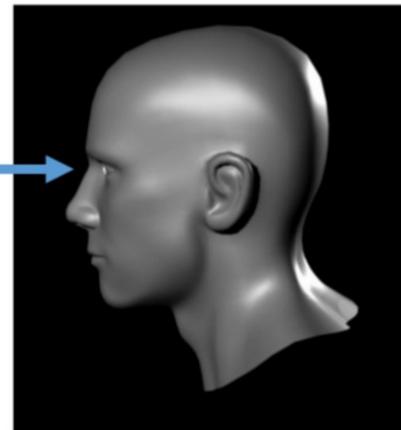
# How to find the Human Factors...



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Reality

## Human Factors



## Perception

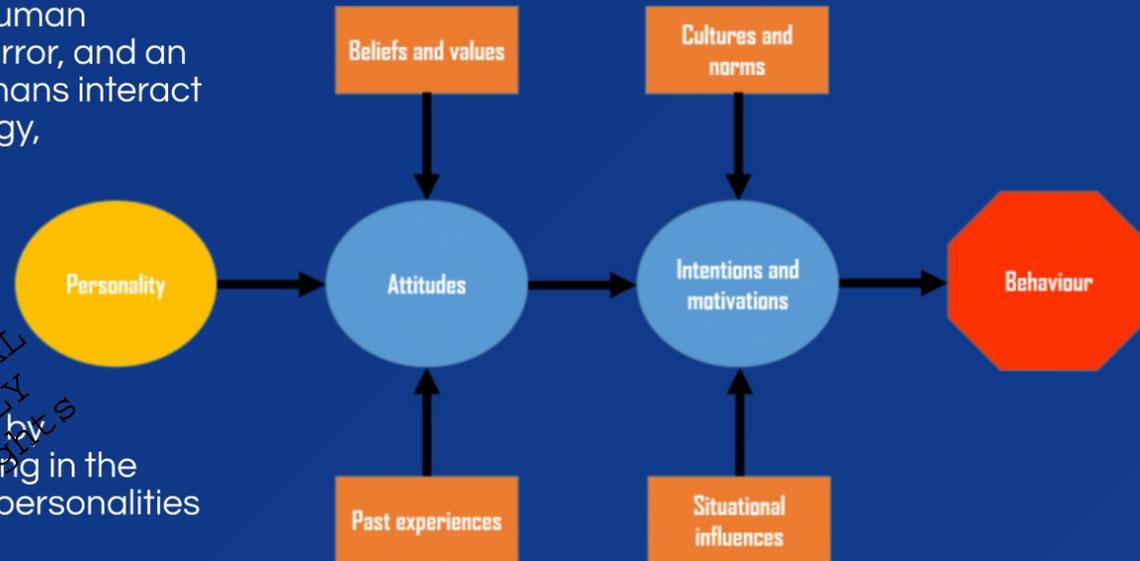
Leadership Stress Fatigue  
Situational Awareness  
Communication  
AoD Airmanship TEM  
Teamwork Decision making  
Assertiveness...etc

# How to find the Human Factors...

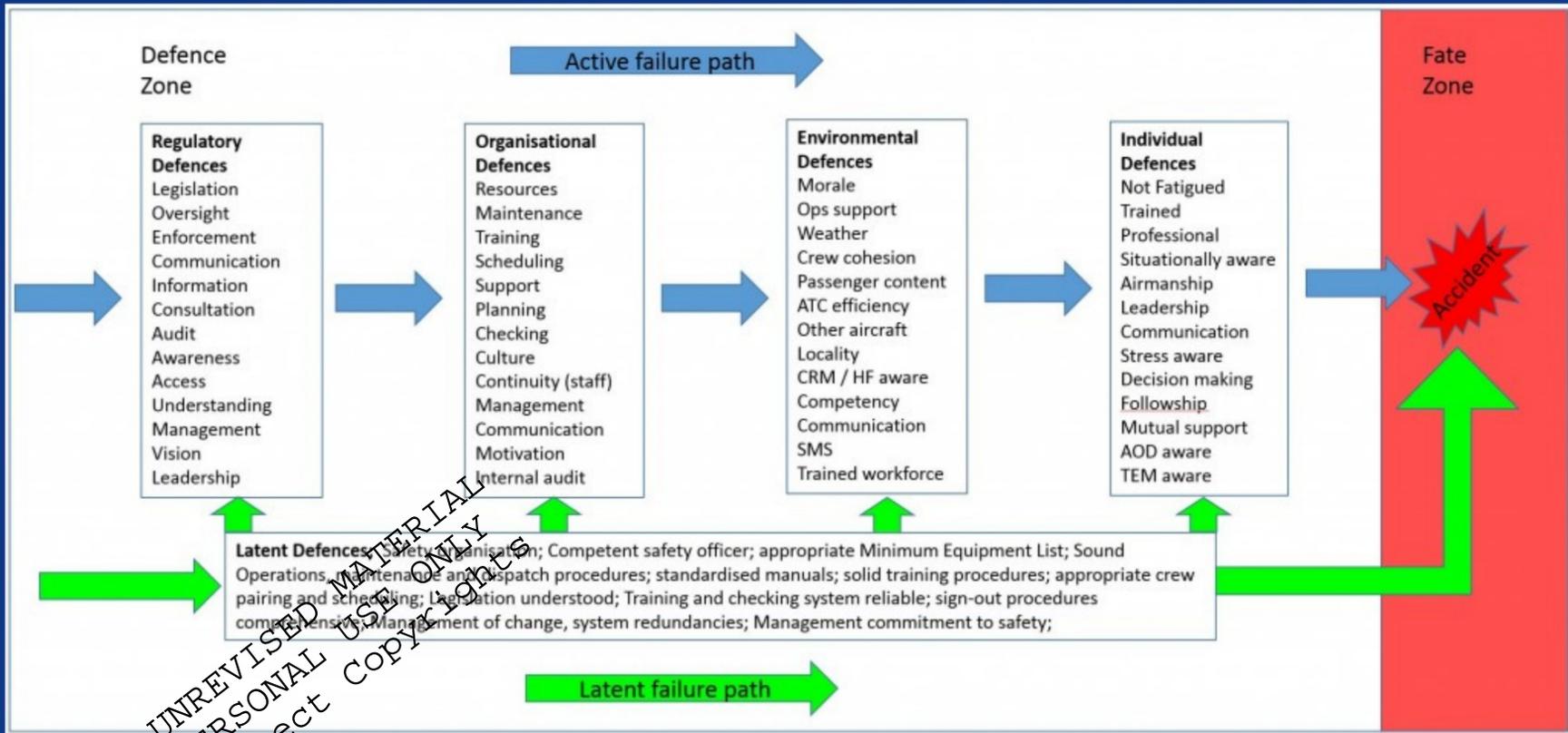
Human Factors is about human performance, behaviour, error, and an understanding of how humans interact with procedures, technology, environment and other humans.

Ultimately it is unsafe behaviours and actions that lead to accidents.

Behaviours are influenced by multiple inputs, commencing in the formative years when our personalities are being formed.

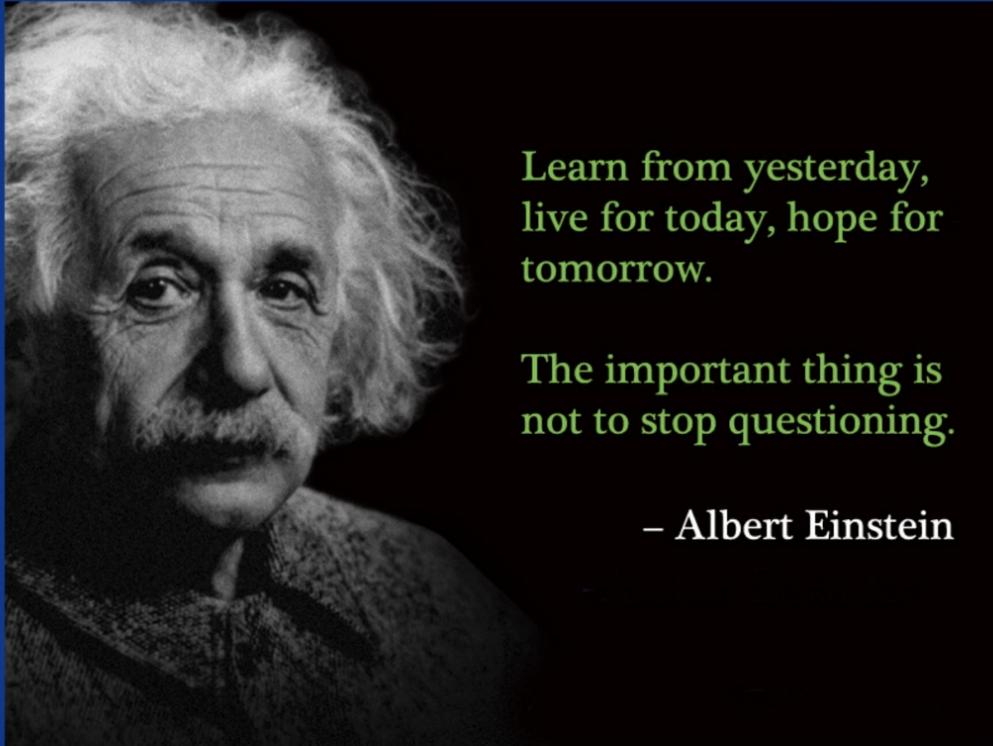


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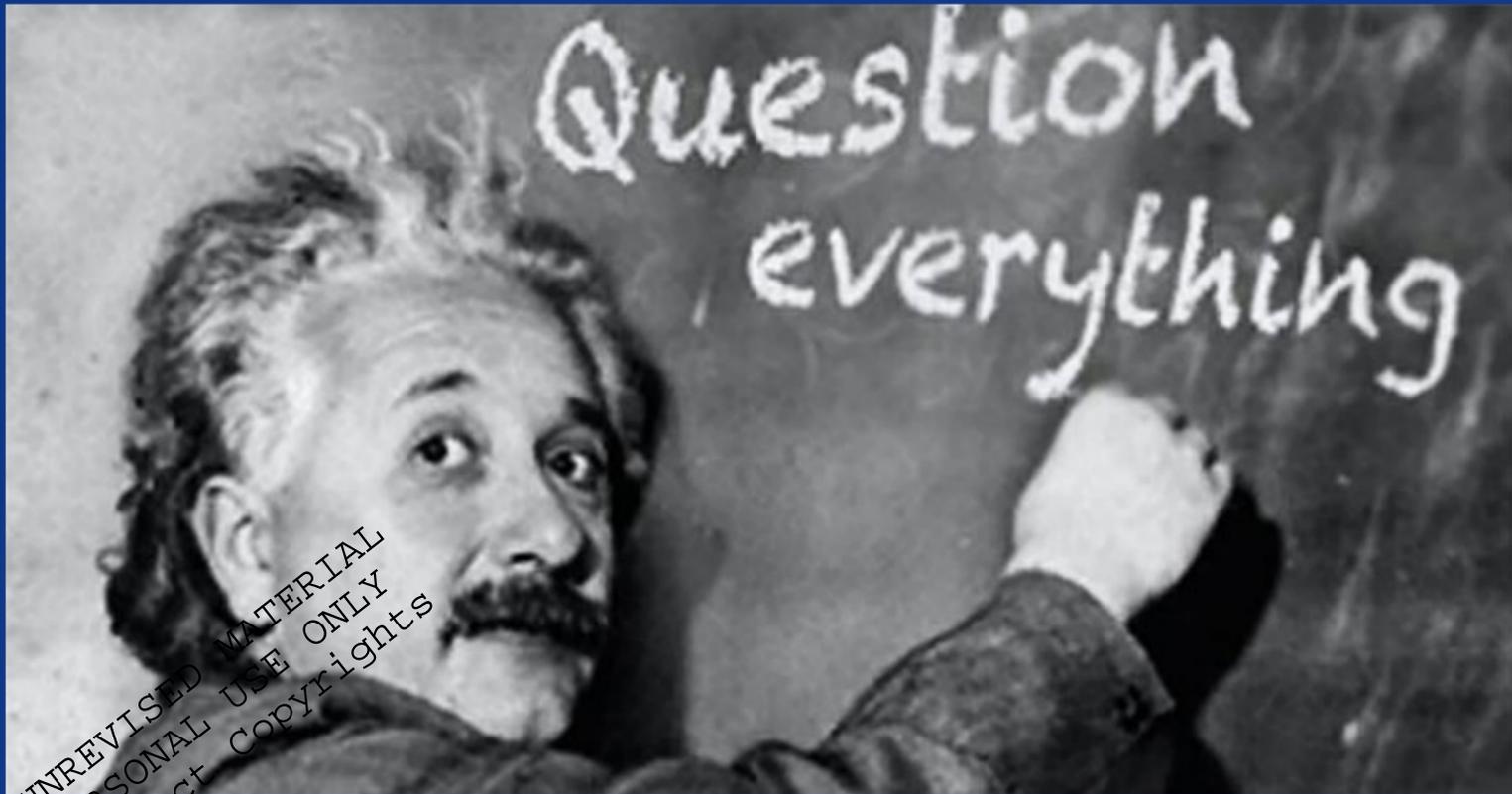
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Learn from yesterday,  
live for today, hope for  
tomorrow.

The important thing is  
not to stop questioning.

– Albert Einstein



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