Human Factors in Aviation

Gaining and Maintaining Situation Awareness

This presentation provides an overview of how to improve situation awareness. It is intended to enhance the reader's understanding, but it shall not supersede the applicable regulations or airline's operational documentation; should there be any discrepancy appear between this presentation and the airline's AFM / (M)MEL / FCOM / QRH / FCTM, the latter shall prevail at all times.

Gaining and Maintaining Situation Awareness

Introduction

This visual guide provides information on how to improve individual skills in gaining and maintaining situation awareness. The material may be used for self study or as part of a formal training presentation. The speaker notes provide additional information.

There are four sections:

1. What is Situation Awareness
2. Gaining Situation Awareness
   - Gathering data
   - Understanding
   - Thinking ahead
3. Maintaining Situation Awareness
4. Improving your situation awareness

Good airmanship requires pilots to have good situation awareness; this is the basis for decision making and action.

Speakers notes provide additional information, they can be selected by clicking the right mouse button **in Slideshow View**, select Screen, select Speakers notes. This presentation can be printed in the notes format to provide a personal reference document.

Situation Awareness

Situation Awareness is having an accurate understanding of your surroundings;
Situation Awareness is knowing what is going on around you.

what happened
where am I
what is happening
what could happen

Gaining and maintaining Situation Awareness is a major part of your thinking, but if awareness is absent or degraded then hazardous threats or errors may not be detected

The most frequent causal factor of all accidents (41 percent) was lack of positional awareness in the air.

UK CAA Global Fatal Accident Review 1980 -1996

The second most common primary causal factor was "lack of positional awareness in the air," generally resulting in controlled flight into terrain (CFIT).

Flight Safety Digest November 1998–February 1999. Special FSF Report: Killers in Aviation:

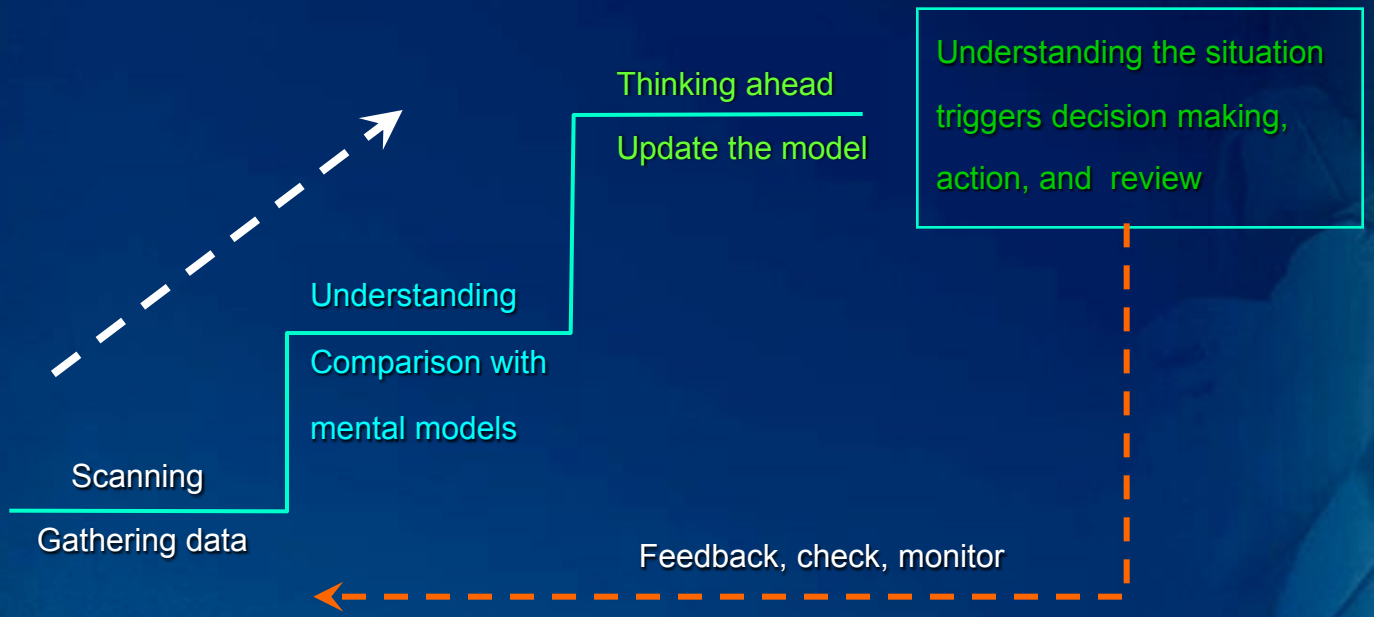
Levels of Situation Awareness

There are three increasing levels of situation awareness:

First we have to see (sense) something

Second we need to understand was has been seen

Finally, we have to use what we have understood in thinking ahead



Gaining Situation Awareness - Assessment

Situation assessment involves a continuous mental process of gathering data, combining data into information, comparing and assessing its relevance, and planning ahead.

Look for and gather data (sensing data)

Combine data into meaningful information (perception)

Understand what the information means (comprehension)

Use your understanding to think ahead and reconsider the plan (projection)

Situation awareness describes the pilot 's knowledge of what is going on around him; where he is, his orientation, what mode the aircraft is in, and what other people are doing.

Gathering data - What to look for, and When

We have to build the mental model from the components of the situation.
This is achieved by scanning the important aspects of our surroundings and then comparing it with experiences and knowledge in memory.

Plane – Control; attitude, altitude, vertical speed, heading, automation

Path – Navigation; terrain, airport, runway, future track, timing

People – Self and Others; shared awareness, workload, capability, stress

Manage: System and situation; status, level of automation, fuel

Now: current weather, runway conditions, windshear, turbulence, wake turbulence

Future: predicted position, flight path, fuel state, destination and diversion weather

Situation Awareness	Now	Future
Plane	SCAN	ANTICIPATE
Path		
People	EVALUATE	CONSIDER

Evaluate all aspects …

Knowing what to ‘see’

We gather information by knowing what to look for, this requires knowledge of:

- What to search for – driven by the purpose of requiring the information
- When to look at specific information, phase of flight or event timing
- Where the information can be found, source and reliability
- Why the information is relevant to the circumstances
  - What the information should indicate, how valuable is it
  - How the information relates to other sources of information
  - How the information should be used to improve our understanding

CAUTION Having more data does not mean more information.
Know what is important and why.
Manage the scanning task, balance scan time with quality of information.
Use procedure based scans.
Avoid interruptions, don’t rush.

Failing to ‘see’

Where data is not available or difficult to detect:

- Actively scan for new data, use alternative sources

Scanning and observing requires discipline:

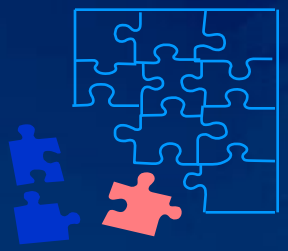
- Have a wide area of attention, avoid concentrating on one item
- Use checklists to reduce errors - forgetting an item
- Reduce workload, share tasks with other people
- If distracted, return to the starting point

Be aware of visual illusions:

- Take time to asses the visual scene, view it on several occasions
- Cross check with flight instruments, always believe the instruments

Do not ‘expect’ to see something:

- Do not change what is seen to fit the mental model
- Review and update the mental model
- Check alternative sources of data
- Check with other crew members



Sometimes you only see half of the picture

But you need all of it to understand the situation

Understanding - Creating the mental model

Mental models are formed by the combination of knowledge and experience recalled from memory, and the sensed information from the real world.

- What has been trained for – use SOPs
- What happened last time – experience and training
- What is the plan, what is intended – recall items from memory

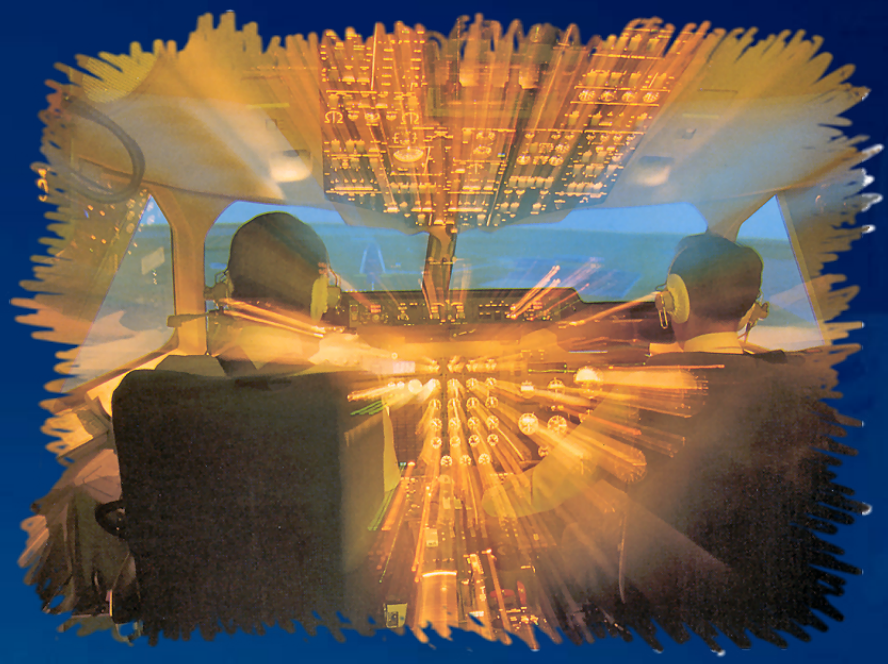
Memory

Recall

Training

Knowledge

Experiences



Understanding - Creating the mental model

Mental models are formed by the combination of knowledge and experience recalled from memory, and the sensed information from the real world.

- Scan for new data, use alternative sources
- Asses the visual scene, view it on several occasions
- Cross check with flight instruments, always believe the instruments

Real World

Searching

Plane, Path, People

What, When, Where,

Why (importance)

Understanding - Comparison and Analysis

We have to compare and update our mental models with the real world.

When they agree, then we have an understanding of the situation.

Pay attention to a wide range of information:-

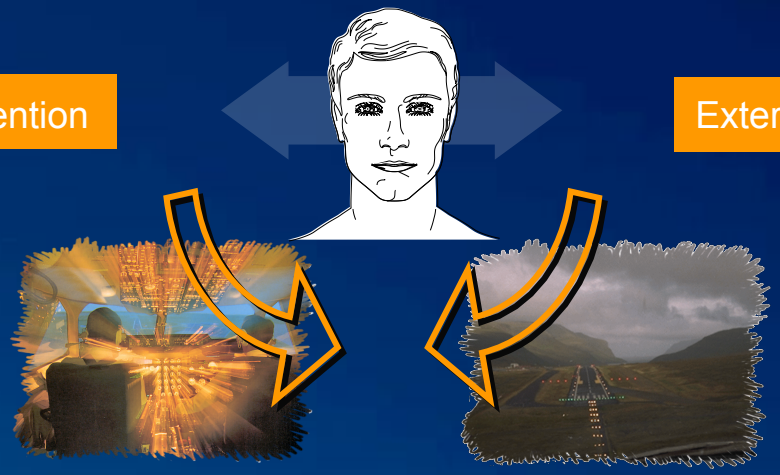
- A broad region - keep the big picture
- A narrow region - pay attention to detail
- On the right information - avoid distractions

Internal attention

Memory

Recall

Training
Knowledge
Experiences



External attention

Real World

Searching

Plane, Path, People
What, When, Where,
Why (importance)

Our understanding of the situation

Understanding - Control your thinking

Understanding is improved with experience because there will be more memory situations (patterns and associations) to use in the comparison.

Check all aspects of the mental model:

- those which agree with your understanding
- those which disagree with your understanding
- those which are not yet understood, but should provide information
- what information is still required, have all key sources of information been used

How does the situation compare with the plan:

- at this stage of flight
- the next stage of the flight
- for the remainder of the flight

How does the situation compare with previous or similar situations:

DO

Pay attention:

The single most frequent causal factor in situation awareness error (35%) were in situations where all of the information was present but it was not attended to; most often due to distraction.

(Jones & Endsley)

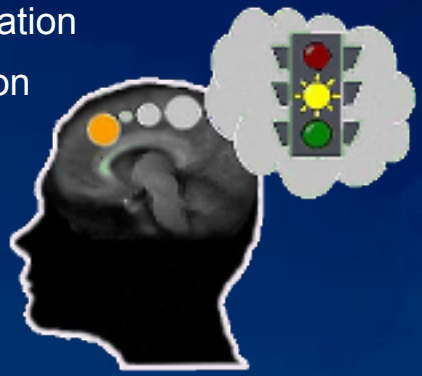
Not understanding

Information may be misinterpreted; a poor mental model

- Do not focus on the loud, bright, or easier to see information
- Relate the information to previous training and experience
- Beware of false memories and personal bias
- Cross check, use alternative sources of data

Failure to recognize that the mental model needs to change

- Compare with similar situations or the simplest situation
- Do not choose information that only supports the plan
- Avoid focus on the most recent trained for situation
- Check the reliability of each piece of information
- Cross check with SOPs and flight rules
- Do not expect a good outcome



Control the thinking process

- Do not rush assessments
- Manage workload and time pressure

Question yourself, monitor yourself, be aware of your own situation

SELF CONTROL

Thinking ahead - projection

An accurate understanding of the situation is essential for planning ahead; then you will be able to:

- Judge when will something could happen – time, place, or event
- 'Make' time for seeking options, choosing, and deciding
- Consider future hazards and make risk assessments
- Forecast the flight path, detect trends or errors
- Set objectives for the next phase of flight
- Plan and share workload
- Readjust the plan
- Think

Thinking ahead prepares for decision making

Thinking ahead – in practice

Set time or place markers for rechecking the situation

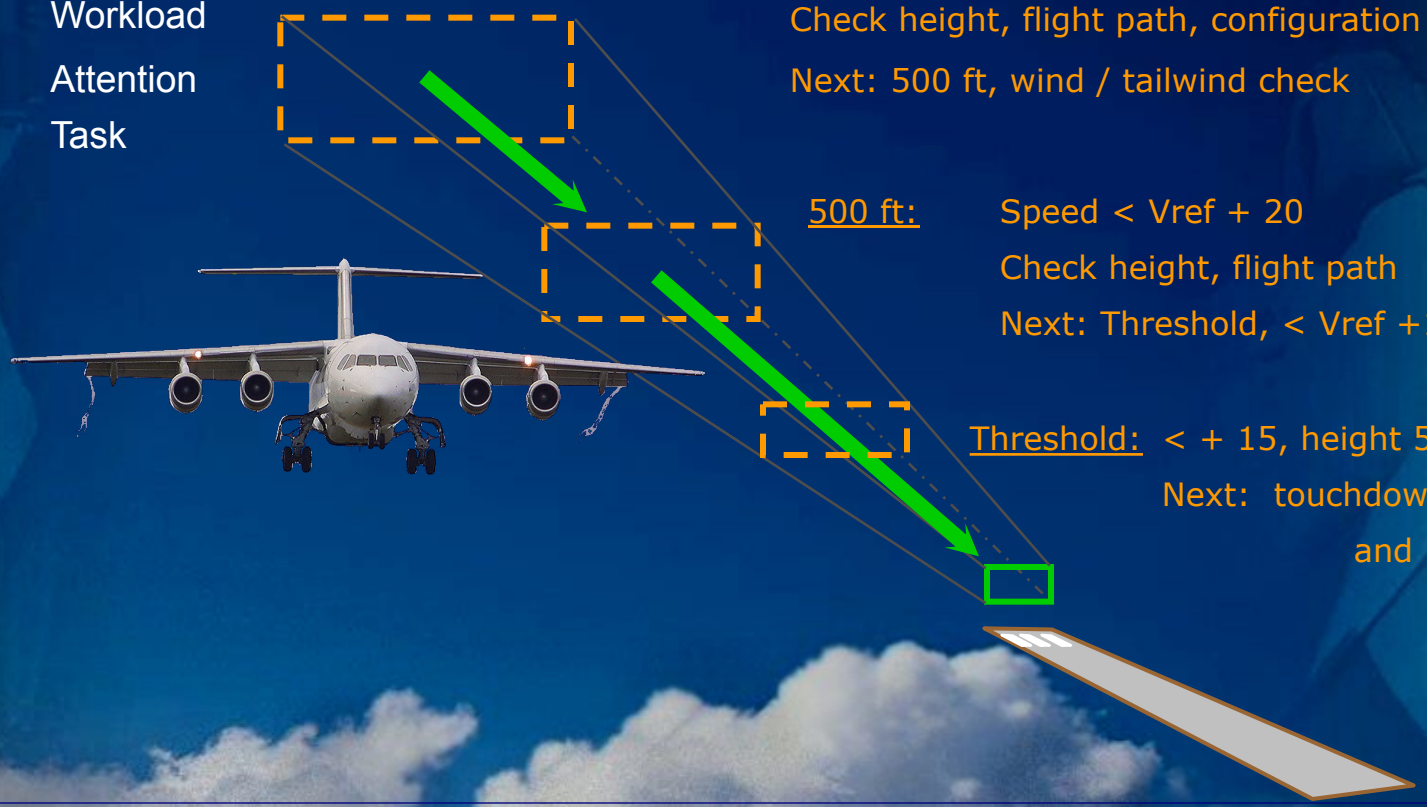
Confirm that the future situation agrees with the plan

Set priorities regarding the current situation

- Rules
- SOPs

Set priorities for thinking

- Workload
- Attention
- Task



1000 ft: Speed < Vref + 20

Check height, flight path, configuration

Next: 500 ft, wind / tailwind check

500 ft: Speed < Vref + 20

Check height, flight path

Next: Threshold, < Vref +15

Threshold: < + 15, height 50 ft

Next: touchdown speed and position

Failing to thinking ahead

Failures in thinking, not planning ahead; ‘what if’

Invulnerability - it could happen to you

Poor judgement - follow SOPs

Alternatives not considered

Failed to monitor and review

Continuing with the wrong action

Poor prediction of consequences

Reluctant to change plan / model

Recognise typical threat scenarios:

- Rushed briefings and checklists
- Fast changing weather
- Last leg of the day
- Runway change
- Unstable approach

Maintaining Situation Awareness

Monitor; focus and direct your attention

- Scan: Plane, Path, People 3Ps

Anticipate, stay ahead of the airplane

- Consider 'what if'

Remember:-

- Habits are hard to break
- Automation keeps its secrets
- Distractions come in many forms
- Expectations can reduce awareness
- Reliable systems aren't always reliable
- Watch out when you are busy or bored
- It's hard to detect something that isn't there
- Don't assume your partner is taking care of it
- Things that take longer are less likely to get done right
- If something doesn't look or feel right, then it probably isn't right

What don't we know that we need to know
What do they know that I need to know
What do I know that they need to know
What are we not paying attention to

Communicate

Clues to the loss of awareness

These "clues“ can warn of an error chain or loss of awareness:

Ambiguity - information from two or more sources doesn't agree

Fixation - focusing on one thing to the exclusion of everything else

Confusion - uncertainty or misunderstanding a situation or information

No-one ‘flying’ the aircraft - everyone is focussed on non-flying activities

Discrepancies not resolved - contradictory data or personal conflicts

Expected checkpoints not met - flight plan, profile, time, fuel burn

Breaking rules - limitations, minimums, regulatory requirements

Poor communications - vague or incomplete statements

Failure to follow to SOPs - doing things you know you shouldn’t

No time – omitting tasks because you feel there’s no time to complete them

DO

Ask questions:

of your self

of others

of the situation

Fly the aircraft;

Take over

change the automation level

Go back to the last stable situation

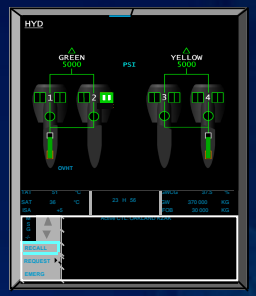
Check the navigation: speed, height

Plane, Path, People

Recovering awareness

Recover the ‘big picture’; Golden Rules.

FLY **NAVIGATE** **COMMUNICATE** **MANAGE**



Go to the nearest simple, stable, and safe situation; follow SOPs

Assess the current situation with different data

Go back to the last thing you were sure of

Avoid fixation on a past problem

Take time to think

Improving your Situation Awareness

Controlling your thinking

Preparation and Anticipation

- Define / plan priorities for each phase of flight
- Plan ahead, compare scenarios with training
- Brief expected situations - pre flight, descent

Information gathering and checking

- Use a number of sources of information
- Stay in the loop, scan your thoughts
- Validate by applying rules of thumb
- Improve scanning skills - practice

Knowledge and Behavior

- Manage your attention - set priorities
- Know what is important, when, and why
- Manage tasks - lower workload, delegate
- Adjust monitoring patterns to phase of flight
- Debrief – remember lessons learnt

Know your boundaries – how close to the edge of safety do you operate

Improving your Situation Awareness

Plan

Pre-flight planning is more than fuel and flight path, visualise your actions, consider all threats.

Know which tasks are required for each phase of the flight. Distribute your workload evenly.

Scan

Actively gather information from whatever source is available to you.

Clarify anything that seems ambiguous.

Attention

Develop a systematic pattern of shifting your attention from the aircraft to the flight path, the people around you, and back to the aircraft

Anticipate

Take the time to consider the possibility of something going wrong.

Constantly ask yourself “what if” and develop contingencies.

Reminders

Manage interruption and distractions

Set yourself reminders for tasks that may be either forgotten or interrupted

Communicate

Are you uncertain? Has your awareness become vague?

Communicate, and confirm the information you’ve gathered

Evaluate

During and after the flight, honestly assess your performance based on your pre-flight plan

Identify areas where you could improve, was there anything you felt uncertain or confused about?

Gain and Maintain Situation Awareness

Summary

- Scan to seek information
  - Know what is important, when, and where to find it
  - Plane, Path, People 3Ps
- Check understanding
  - Real world
  - Memory
- Plan ahead
  - What if
  - X-Check
- Manage
  - your
  - Attention

Fly, Navigate, Communicate, Manage the situation

before you decide