

SRM:

Single Pilot Resource Management



A BMAA Wings Course

Objective



- ✧ The aim of this module is to draw together the fundamentals of Single Pilot Resource management
- ✧ Commercial operations have been teaching Crew resource Management (CRM) for decades.
- ✧ This course applies these principles to the microlight world and focuses on
 - ✧ learning from others' experience and
 - ✧ developing good practice
- ✧ The material has been written by microlight pilots with decades of experience in the commercial & military aviation environments

Syllabus



The course is in 6 sections and can be studied online or in a club/flight school setting

- ✈ Introduction & Concept;
 - how SRM applies to Microlighting
- ✈ Threat and Error Management (TEM)
- ✈ Intro to Aeronautical Decision Making (ADM)
- ✈ Situational Awareness (SA)
- ✈ Intro to Human Factors
- ✈ Programming - GPS/Moving Map (MM)
- ✈ Summary

Slides which form part of the printout/handout have a Green text box outline like this one

Introduction



There But For the Grace of God Go I?

- ✈️ All the examples used in this material are real
- ✈️ They're included so we can all learn from each other but with details omitted for anonymity
- ✈️ No desire to embarrass anyone or apportion blame



***Flying is too
expensive & dangerous
to learn everything ourselves,

We must learn from others***



Swiss Cheese Slices & Safety



- ✈️ Model for avoiding the 'if only' in microlight accidents/incidents
- ✈️ Developed 1990's by Prof James Reason (University of Manchester)
- ✈️ Widely used in many professions where harm can be caused, e.g. aviation & medical profession

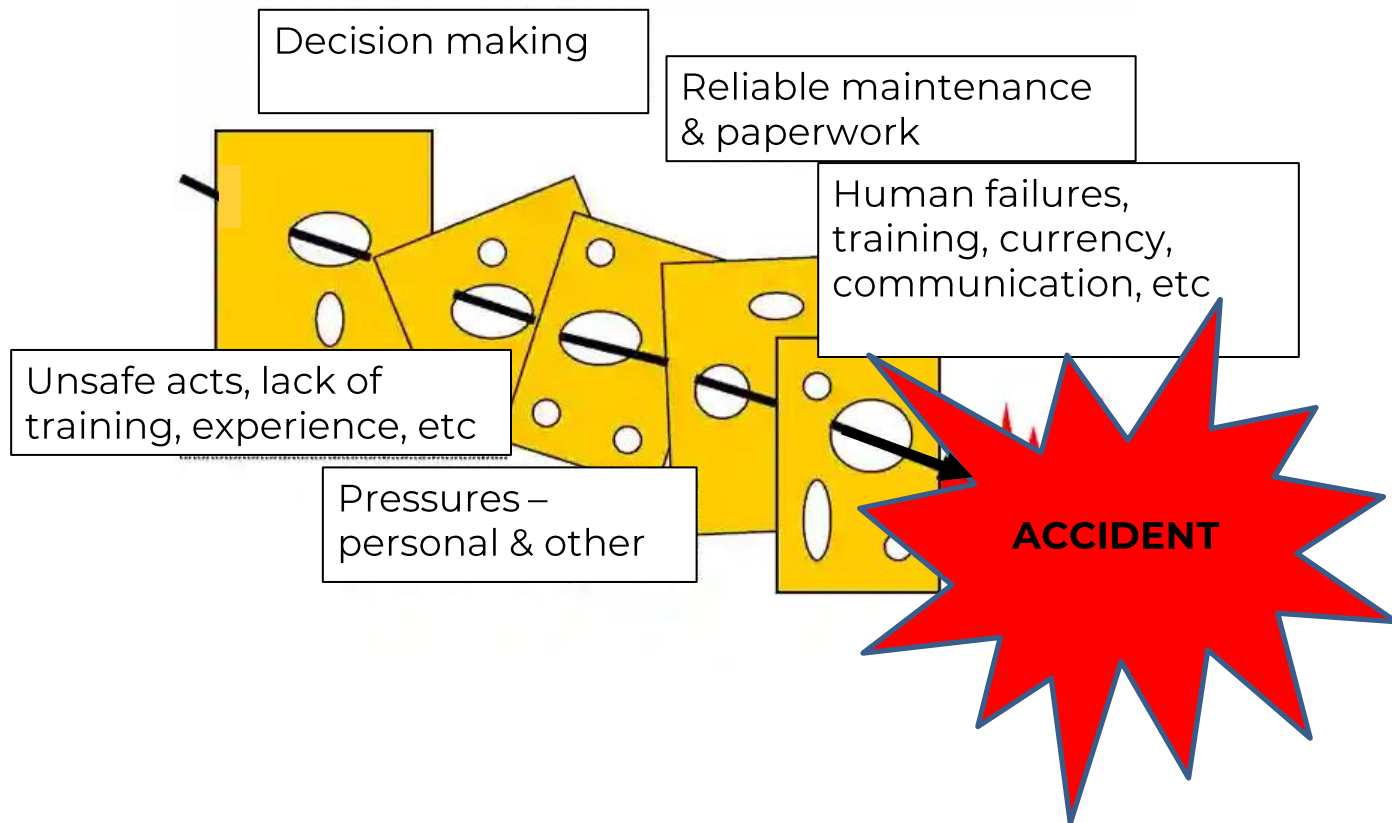


Swiss Cheese Slices & Safety



- ✈️ Microlight aviation is generally well-protected by **layers of defences** ('slices of Swiss Cheese') eg Permit to Fly (PtF), POH, training, etc
- ✈️ Accidents are VERY RARELY the result of one event but are result of a **series of errors**
- ✈️ At each step someone **leaves a hole** in their work (their 'slice' of Swiss Cheese) and something slips through
- ✈️ When **holes align** the incident/accident occurs
- ✈️ SRM helps to close AT LEAST one of the holes so...
- ✈️ **Safe flight is the result**

Swiss Cheese Slices & Safety



Surece: Maged Saeed Al-Hadabi, 23 Jun 2021, Human Factors

Does it Apply to Microlights?



These Holes Align ...

Hole 1: Self-maintenance, was pilot capable?

Hole 2: NO maintenance schedule - why did Inspector not note this?

Hole 3: PtF passed but with compression check by 'feel' - adequate inspection?
Rough running/lack of power for several months, fuel flow issue?

Hole 4: Diagnosed as mechanical fuel pump (inadequate investigation?)

Hole 5: Elec fuel pump fitted,
no mod application,
no inspector involvement,
no tech help sought.

Partial power loss after take-off

Hole 6: Turn-back attempted - CAA Safety Leaflet 1e,
'land straight ahead'.



OUTCOME: Crash resulted, due to crack in seal giving lean mixture & low compression on 2 cylinders



Section 1.

SRM Introduction & Concept

Because no matter what you fly

“the moment of take-off is a bad time to be considering alternative strategies”

John Cleese



Human Error, What Me?

- ✈️ **Pilot error** causes half of preventable deaths in aviation
- ✈️ But **formalised approach** to threat assessment, risk management & appropriate decision making (= SRM) produces 54% reduction in accident rate
- ✈️ By **personality type** we pilots tend to be calculated risk takers and confident in our own abilities
- ✈️ And we regularly exist in a flying club or **group environment** with similar thinking people
- ✈️ These can **combine** to raise the overall level of machismo to one where we feel compelled to suppress our weaknesses and project our self-confidence and reliance
- ✈️ Or at the very least **“laugh off”** our errors when amongst our peers

Human Error, What Me?

Be brutally honest..



**Are
really as good as you think you
are?**

**Our level of successful use of the
following SRM techniques and
ultimately our own safety
requires *exactly the opposite
kind of thinking.***

Single Pilot Resource Management (SRM)



***SRM is the art and science of managing
all the resources
(both onboard the microlight aircraft and
from outside sources)
available to a single pilot
(prior to and during flight)
to ensure that the
successful outcome of the flight
is never in doubt***

Single Pilot Resource Management (SRM)



- Single Pilot Resource Management is *not* a physical flying skill but a series of human factors which combine to provide techniques for pro-actively maximising flight
- Thinking ahead to...

“Be Prepared... the meaning of the motto is that a scout (pilot) must prepare himself by previous thinking out and practicing how to act on any accident or emergency so that he is never taken by surprise”

Robert Baden-Powell, founder of the Scout Movement

Resources at Our disposal

‘HARDWARE’ – the equipment

- ✈ VFR charts
- ✈ NOTAMS*
- ✈ Airfield guides and “plates”
- ✈ Aviation and conventional weather sources*
- ✈ Tablet-based planning software

‘SOFTWARE’ - the people

- ✈ Airfield and ATC unit telephone/email contact or R/T in flight
- ✈ The BMAA - queries, rules, regulations and best practice*
- ✈ Your local flying instructor*
- ✈ Your syndicate members or club members*
- ✈ Passengers to assist with lookout

* One of the main issues is however that *once airborne* we effectively lose over half of our potential information sources

SRM Introduction & Concept Summary



- 🔄 SRM NOT a physical flying skill, it is...
- 🔄 Series of human factors which combine to pro-actively maximising flight safety
- 🔄 In essence 'Thinking ahead to be better prepared'



Section 2.

Threat & Error Management (TEM)

‘The practice of thinking ahead to predict/identify & avoid threats & errors, and to manage safely any that occur’

Or more simply ‘Thinking ahead to be better prepared’



What is TEM?



- ✈️ TEM is NOT new, we do it every day in normal lives, & it is NOT about teaching you to fly
- ✈️ Application to aviation developed in late '90s. Now adopted worldwide in airline industry, and has real application to microlight and other GA flying
- ✈️ Because it is designed so it does not detract from the fun of flying

Threat Management



A decision making process used to systematically

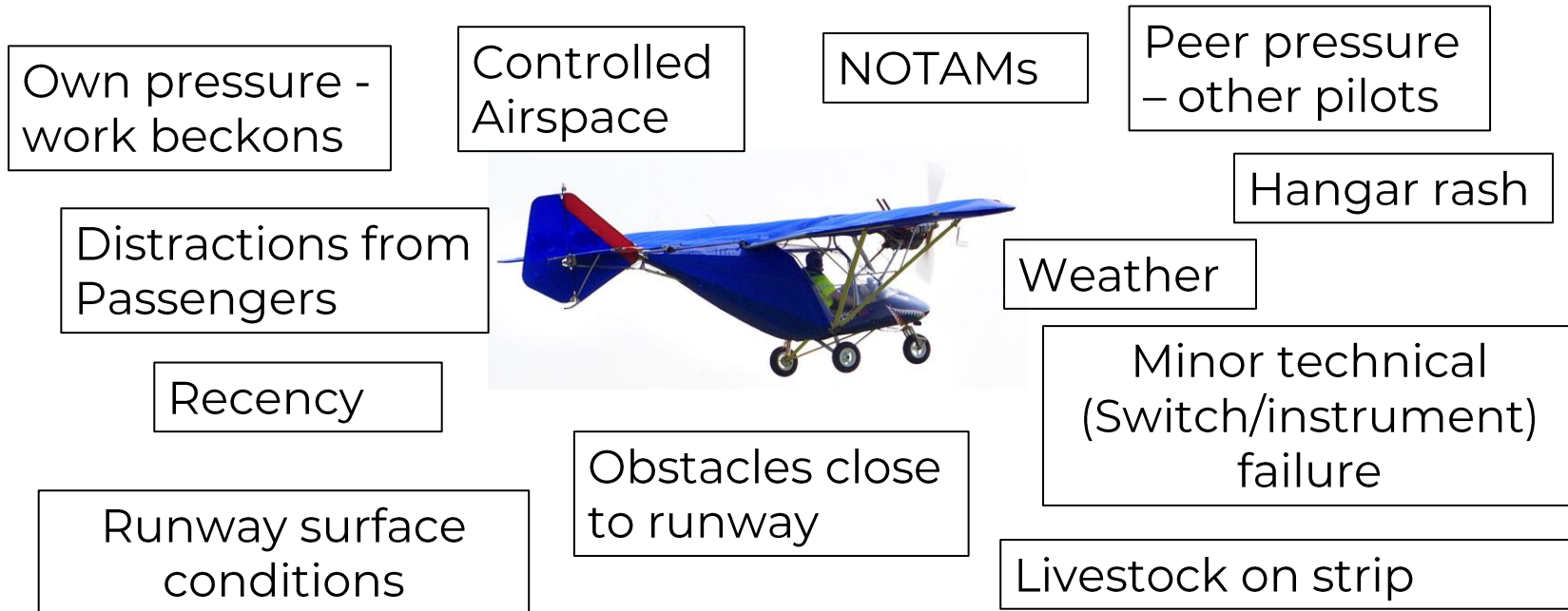
- ➡ Identify **threats**
- ➡ Assess degree of **risk**, and
- ➡ Identify best course of **action**

Where a **Threat** is any potential source of harm, object or circumstance that could lead to or contribute to an unplanned or undesired event

And **Risk** is the *likelihood* that a threat will have an adverse effect if it isn't controlled/eliminated

In aviation ***“if you are looking for perfect safety you will do well to sit on a fence and watch the birds”*** (Wilbur Wright)

Typical Microlight Threats



- Some threats can be **anticipated** eg NOTAMs, while others cannot eg airprox
- Key is to identify and manage those that can be anticipated and..
- Allow capacity to manage those that cannot

Risk - It's All About You (1)



- ✈ Risk - highly **individual**, we all see things differently
- ✈ Flying is a **risk** others will not take but we do, yet...
- ✈ Our levels of **expertise & experience** are different & they alter our perception of risk
- ✈ **Personal minimums** - challenging but manageable
X wind velocity (w/v) to one is outside someone else's personal limits
- ✈ Accept **no unnecessary risk** e.g. 1st flight in new aircraft in iffy weather?
- ✈ Make risk decisions at **appropriate level**



Risk - It's All About You (2)



- ✈ Your passenger (pax), an experienced pilot, suggests it's OK to continue fly-out in iffy weather? **It's YOUR decision**
- ✈ Accept risk when benefits outweigh dangers
 - ✈ e.g. Landing on short runway vs landing on long runway with strong crosswind
- ✈ Integrate risk management into every aspect of flight
- ✈ Start risk management before 'work' starts



Managing Threats & Errors



- ✈ Management of threats & errors starts long before you reach the airfield, because...
- ✈ The more you assess and manage threats the less likely you are to make errors, and we should constantly assess threats...
- ✈ Pre-flight, In-flight, & Post-flight, because...
- ✈ A mismanaged **threat** can lead to **error** which can lead to Undesired Aircraft State (UAS) which can lead to...



Your Threat Assessment Skills?

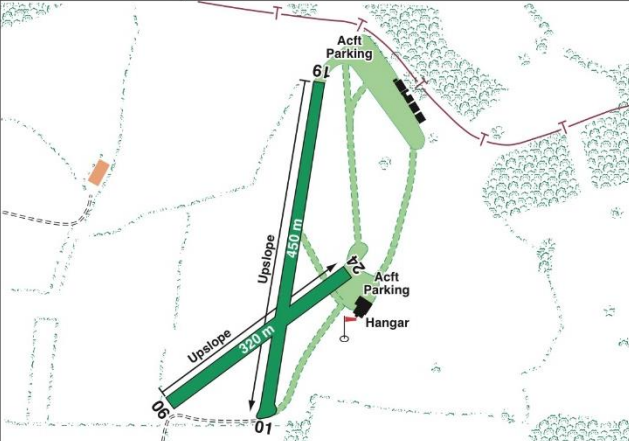


- ✈ In the following 'fun' exercise we present a fictitious airfield along with its associated weather and NOTAM information.
- ✈ It will give you an opportunity to take a quantitative look at your own skills of threat assessment.
- ✈ Try to approach the task as if you were planning to visit the airfield but because you are considering many options, try to limit yourself to **three minutes of study time**.

Scenario: It's 22nd October 2021, you are about to depart for TEMfield. Lincolnshire with an estimated landing time of 17:30.

The info ...



| N52 15.20 W001 22.45 | | | TEMFIELD | | 12ft AMSL | |
|---|--------|---------|------------|--|-----------|--|
| 1.5 nm SW of RAF Doomland Moor. | | | | | | |
| SAFETYCOM 135-480 | | | | | | |
|  | | | | | | |
| Rwy | Dim(m) | Surface | TORA(m) | LDA(m) | Lighting | |
| 01/19 | 450x6 | Grass | Unlicensed | | Nil | |
| 06/24 | 320x5 | Grass | Unlicensed | | Nil | |
| Op hrs: SR-SS. Strictly PPR. | | | | | | |
| Landing Fee: Nil. | | | | Customs: Nil. | | |
| Hangarage: Nil. | | | | Maintenance: Nil. | | |
| Remarks: Operated by Temfield Ltd., 123 Notrew Place, Doomland, Lincs. L22 4QX. PPR Mandatory due to local weather effects and circuit procedures. Airfield situated within Doomland Moor MATZ (Tel: Cpl Mike Fish 01998 747200) Airfield on sloping ground and only recommended for microlights and STOL aircraft. Landings Rwy 06 or 19. Caution tall crops adjacent to Rwy edges May-Sept. Powerline 30ft crosses threshold Rwy 19 and runs east of airfield boundary. Initial overflight of landing Rwy (not below 500ft agl) recommended due to grazing livestock. Despite upslopes both approach ends liable to waterlogging Oct-Mar. No landing fees but donations to Lincs Air Ambulance appreciated. Tea/Coffee available from hangar near windsock. Accommodation available 1.5 miles SE at the "Aviators Arms" Severe turbulence encountered with southerly wind in excess of 12 knots. | | | | | | |
| Fuel: MOGAS on request. | | | | Tel: 01998 747436 Mob: 07899 123456 Website: www.riskaware.co.uk | | |

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2022

R.A.F. DOOMLAND MOOR (EGVF)

Briefing 22 October 2021

METAR: EGVF 221420Z 31007KT CAVOK 08/07 Q1034

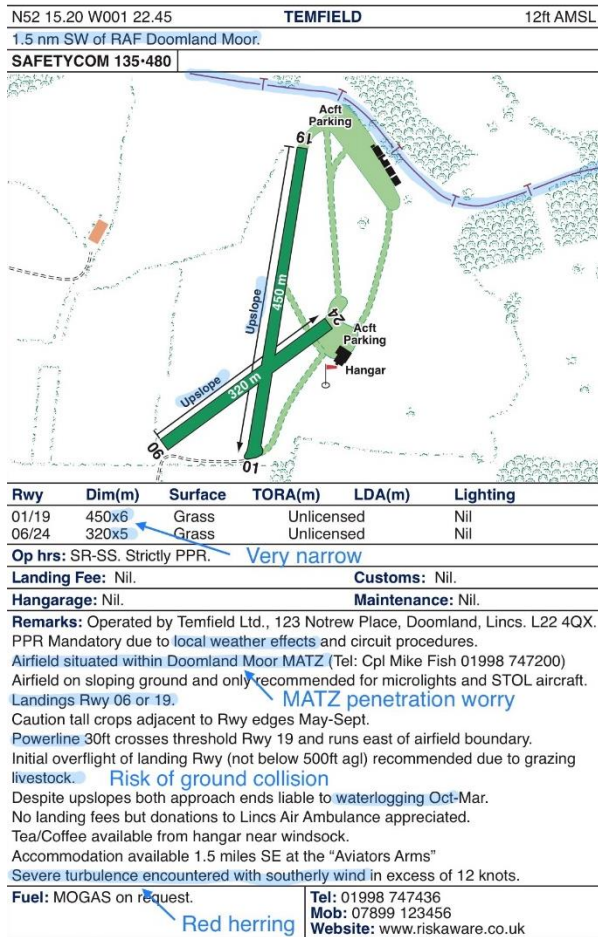
TAF: EGVF 221220z 2215/2315 VRB03KT 9999 FEW012
 BECMG 2216/2310 4000 BR SCT008 PROB30
 TEMPO 2216/2309 1200 MIFG FM231000 32009KT
 9999 SCT018

NOTAM: *EGVF* Oct 220645z-Oct 251900z
 A/G Facility temporarily U/S
 Doomland RADAR VHF 122.175 on maintenance

EGVF Oct 220830z-221700z
 Rotary wing circuit activated
 Doomland intense military helicopter
 activity within 3nm radius SFC-1000ft agl

EGVF Sep 090000z-TFN
 A/F Lighting U/S
 Doomland RWY 22 PAPI u/s

How did you get on?



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325

Please be aware that there are no exact right or wrong answers because we all have a different view of threat due to our experience. But here is what you might have noticed:

TEMfield

- ✖ V close to RAF base – MATZ penetration
- ✖ Fixed Wing circuits downwind 1nm from runway (heavies can be even further out)
- ✖ Very narrow strip
- ✖ Local weather effects – mandatory PPR
- ✖ Runway slope and landings in 2 directions only on 4 runways
- ✖ Poss livestock on runway
- ✖ Turbulence in Southerly wind? Not issue today!

How did you get on?



R.A.F. DOOMLAND MOOR (EGVF)

Autumnal weather

Briefing 22 October 2021

Looks lovely but tailwind on both ends! Temp approaching dewpoint = FOG

METAR: EGVF 221420Z 31007KT CAVOK 08/07 Q1034

TAF: EGVF 221220z 2215/2315 VRB03KT 9999 FEW012
BECMG 2216/2310 4000 BR SCT008 **PROB30**
TEMPO 2216/2309 1200 MIFG FM231000 32009KT
9999 SCT018

Never trust a
"PROB30"

NOTAM: EGVF Oct 220645z-Oct 251900z
A/G Facility temporarily U/S
Doomland RADAR VHF 122.175 on maintenance
An R/T worry for the under confident

EGVF Oct 220830z-221700z
Rotary wing circuit activated
Doomland intense military helicopter
activity within 3nm radius SFC-1000ft agl

TEMFIELD is only 1.5nm from Doomland so think airprox & lingering rotorwash

EGVF Sep 090000z-TFN
A/F Lighting U/S
Doomland RWY 22 PAPI u/s
No significance just a time waster

RAF Doomland






- ✪ It's Autumn & temp (8) only 1 deg above dewpoint (7) – Fog?
- ✪ Landing r'ways and wind – tailwind on 06 and 19
- ✪ Mist & low cloud expected fm 1600hrs, reducing daylight & viz
- ✪ Prob 30 Temp fog – that is NOT a low probability. Fog can be very localised and the TAF applies 1.5nm from landing field
- ✪ Radar frequency out of action! No LARS
- ✪ Helo activity within 3nm of RAF base – airprox and rotor wash/wake
- ✪ RAF base airfield lighting of no consequence to us

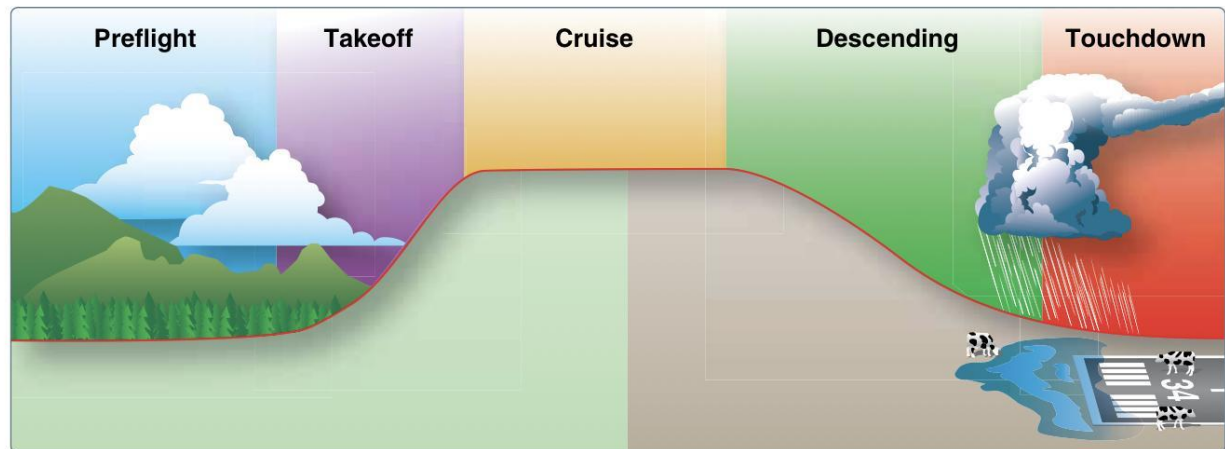
The '5 Ps'



Widely accepted as most usable of tools for effective SRM techniques, '5 Ps' provides pilot with a **scheduled** framework to analyse the info gathered and consider the threats **before and during flight** and then to make solid decisions (ADM)

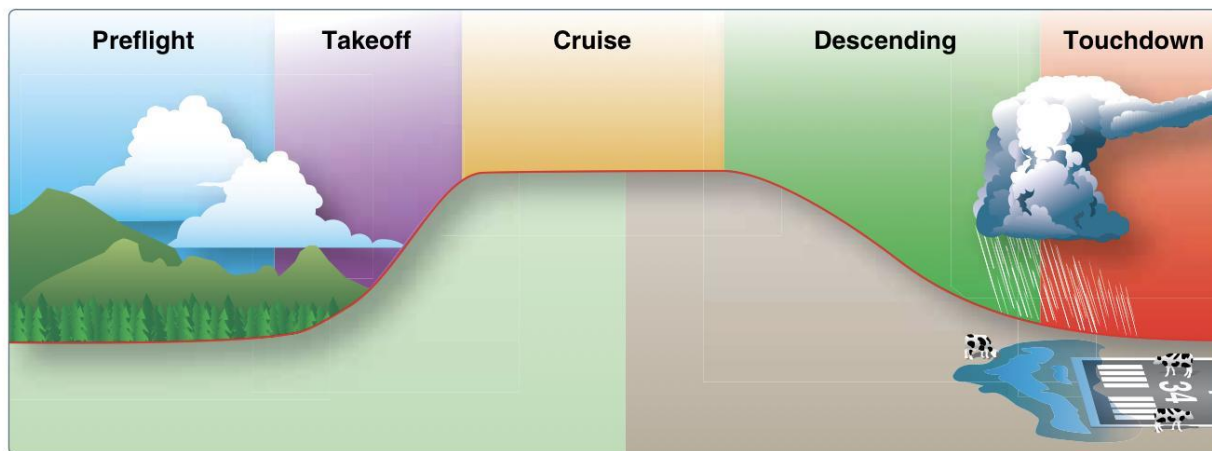
The '5 Ps' comprise:

-  Plan
-  Plane
-  Pilot
-  Passengers
-  Programming



The '5 Ps'






For maximum effectiveness it is recommended that the '5 Ps' be considered at least once prior to each of the 5 flight periods.



Each period poses a set of challenges and opportunities that every pilot encounters

The '5 Ps'- In Whatever Order You Want



-  **Plan** - planning, weather, NOTAMS, route, fuel, publications, ATC crossing/re-routes, airspace awareness inc 'Take 2'
-  **Plane** - mechanical status, airworthiness validity, fuel & oil quantity and quality
-  **Pilot** - *IMSAFE* - illness, medication, stress, alcohol, fatigue, eating (covered further in Human Factors Section)
-  **Passengers** - pilot or non-pilot, experienced or inexperienced, nervous or calm, etc
-  **Programming & Automation** - GPS, EC, autopilot, possible re-routes requiring GPS reprogramming

The '5 Ps'



- 🔄 Our first tool to help identify existing and future threats which will in turn...
- 🔄 Reduce our workload ...
- 🔄 Increase our safety, and ...
- 🔄 Help protect our spare capacity should the unthinkable happen

It's down to you to adopt and apply but it's simple, it's usable
before and during flight, in fact anytime, AND...

It doesn't even matter in which order you use it!

Heart of Threat Management



- ✈️ Recognise threats exist or might exist
- ✈️ Devise way to deal with each threat so that...
- ✈️ It does not reduce safety margins and/or...
- ✈️ It does not contribute to an error
- ✈️ How - anticipate...
 - ✈️ Assess pre-flight
 - ✈️ Monitor, evaluate & anticipate in flight
 - ✈️ Honest debrief post-flight

Heart of Threat Management



- 🔄 Situational Awareness (SA) is key, in air and on ground
 - 🔄 Ideally **Avoid** threats, but...
 - 🔄 In flight **Trap** unanticipated ones, so they no longer concern you
 - 🔄 Then **Mitigate** any that remain

TEM - Anticipation



- ✈ **Unease** reinforces necessary vigilance, NOT
 - ✈ 'Thumb in bum, mind in neutral'
- ✈ **Vigilance** is key to recognising adverse events & error
- ✈ **Recognition** leads to recovery, but
- ✈ Sometimes **recovery** MUST precede analysis of causes
 - ✈ eg approach to wrong runway at airfield, and a/c is now in UAS,
- ✈ SO **correct** it and then **analyse** why

TEM - Anticipation



You cannot consider everything,
so try to pick out a
max of 3 or 4 main threats
that you will “***watch out for***”
above all else

TEM Tools, Techniques & Countermeasures



- ✈ Very common in aviation and other high risk activities - operating theatres
 - ✈ - procedures inc ANO, POH, Checklists, etc
- ✈ Last line of defence is pilot
 - ✈ - checklists, etc only work if used properly
- ✈ 3 stage philosophy
 - Anticipation
 - Recognition
 - Recovery

TEM Tools, Techniques & Countermeasures



3 stage philosophy

Anticipate

- 🔄 Planning, preparation, briefing (inc pax), contingency management (what if)
- 🔄 Think about it on drive to airfield - rehearse in mind

Recognise

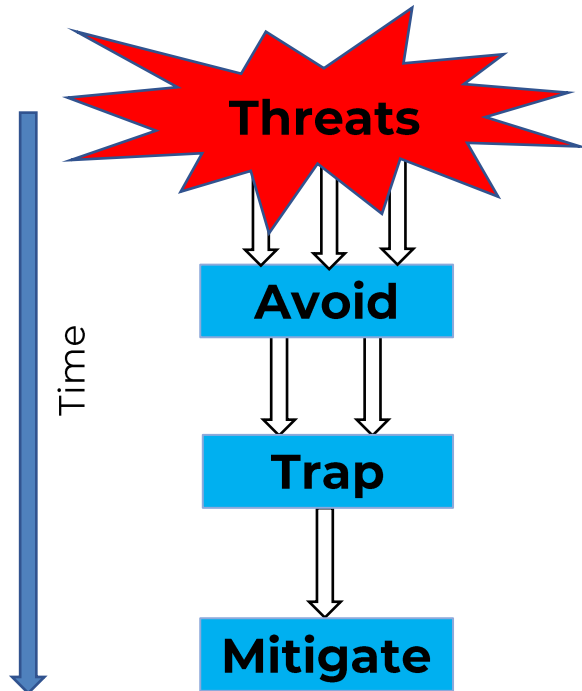
- 🔄 double check, workload, programming/automation (GPS, EC) are essential for error detection and response

Recovery/Review/Modify

- 🔄 evaluate plan, debrief flight (on drive home?), review & maybe modify your 'mental shortcuts' (see ADM Section 3 later).

Avoid - Trap - Mitigate

(Univ of Texas model)



- Identify potential threats & **Avoid** them
- Identify current threats as they develop and correct (**Trap**) them
- Identify errors that have occurred and **Mitigate** them

Imagine what could be, confront what can be, and contain what is now

Pilot capacity



How the level of a pilot's **situational awareness** relates to their **ability to cope** with **threats and errors** they encounter in flight

| Level of Situational Awareness (SA) | Workload | Spare Capacity | State of Threat & Error Management (TEM) |
|-------------------------------------|----------|----------------|--|
| Think Ahead | Lowest | Highest | Avoid |
| Understand | | | Trap |
| Notice | Highest | Lowest | Mitigate |

Reading across the table

| Think Ahead | Lowest | Highest | Avoid |
|--------------------------------------|--|---|---|
| A pilot who routinely "THINKS AHEAD" | Will experience the lowest mental workload | Will have the highest spare thinking capacity (our 'capacity bucket' - covered shortly) | And will have the best possible chance to be able to AVOID threats and errors |

Managing Threats (& Errors) - Avoid & Trap



- ✈ Most effective management is to identify threats, to anticipate them and then to **AVOID** them
 - ✈ '5 Ps' pre-flight
 - ✈ Good training, recent experience, SOPs, etc
 - ✈ This also help prepare against errors
- ✈ Those threats that cannot be predicted need to be identified as they develop and then **TRAP** them, in that..
- ✈ Errors are identified & corrected **before** they become consequential
 - ✈ '5 Ps'
 - ✈ Good SA inc GPS (MM = Moving Map)
 - ✈ Regular methodical checks, SOPs, etc
 - ✈ Other Pilot, Pax, ATC?

MITIGATE



| State of error management | Workload | Spare capacity | Level of (SA) |
|---------------------------|----------------|----------------|---------------|
| AVOID | LOWEST | HIGHEST | HIGH |
| TRAP | | | MEDIUM |
| MITIGATE | HIGHEST | LOWEST | LOW |

As can be seen from the chart, MITIGATE indicates that a pilot is operating at the lowest level of SA.

"So that must be bad, right?"

ABSOLUTELY NOT!

MITIGATION is NOT Failure
NOT MITIGATING is Failure

NOT Mitigating is Failure - Go Around?



"After almost an hour of flying I returned to the airfield,... completed my turn onto final approach and everything was fine, I was all set up with flaps and trim, good angle and speed.

As I came over the last few trees I entered a thermal, which made the plane pitch up and drop the left wing, after quickly gaining control from these attitudes seconds later the same occurrence happened again, presumably exiting the other side of the thermal.

*Although **now higher than normal**, having negotiated this I set the plane down on the grass runway.*

*Realising I had now **landed long** and it was too late to go around I applied the brakes.*

At this point I was still travelling too fast with the wire fence approaching, the brakes were locked on solid and I slid into the fence. Having turned off the mags, ignition and fuel tap I got out to see the damage. As the front wheel had collapsed the prop was stuck into the ground."

SOPs, Checklists, POH, (1)





These are there as mitigation

- ➡ They help your mental capacity
 - help empty your *Capacity Bucket*
- ➡ SOPs/Checklists/POH establish consistent and safe baseline...
- ➡ Allows Pilot to concentrate on things that aren't in SOPs, Checklists, POH, etc
- ➡ Personal minima - checklist
- ➡ Using lists helps make identifying deviations from SOPs, Checklists, POH, etc that much easier
 - ***'I don't usually miss things like that'***

SOPs, Checklist, POH, etc as Mitigation



Met brief

-  214 & 215, Met Office local, phone call, nearby METAR/TAF, etc
-  Assess route for areas of 'unusual' weather - mountain waves, thermal turbulence, etc

NOTAMs

-  Narrow route to minimise info you need to absorb

Think 3D for NOTAMs & Controlled Airspace (CAS)

-  Remember 'Take 2'

New airfield

-  RunwayHD, SkyDemon, etc, Pooleys (& other) plates, Phone them

Route, Kneeboard & PLOG

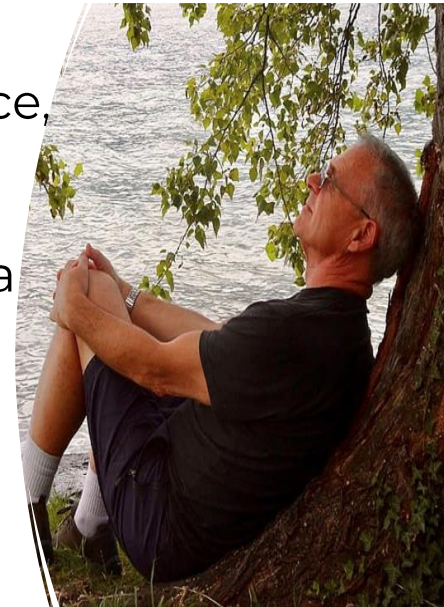
-  Frequencies, Heights, SSR Frequency Monitoring Code (FMC), etc

Good TEM & High SA Is the Goal, NOT Mental Overload



Start **planning and threat assessments** as early as you can, be focused and disciplined in your approach and *if possible* do so **on the ground**.
Why?

- ✈ Because we are **free from distractions** of flight (and other things?)
- ✈ Generally our **workload is low**
- ✈ **High workload** (overload) associated with increased errors, fatigue, task degradation and poor performance, and can lead to...
- ✈ **Mental overload** - one of the most dangerous states a pilot can find themselves in because it...
 - ✈ Is extraordinarily difficult to recognise in ourselves
 - ✈ Clouds our judgment, leading to irrational decision making
 - ✈ Physiologically it degrades our hearing first



Know Thine Enemy - Capacity Bucket



We all have a **Capacity Bucket** and it gives us a useful metaphorical reference to approaching ***MENTAL OVERLOAD, which is the absolute enemy of effective TEM***

The items we as pilots 'fill' it with are common to all i.e. we all use the same mental processing to physically fly the aircraft, use the radio & navigate, etc.

HOWEVER, critically it is of ***variable size depending on our experience*** (thus a novice pilot will operate with their bucket close to capacity just flying around the circuit)

Know Thine Enemy - Capacity Bucket



🔄 At **NORMAL** we are airborne and all is right with the world

🔄 At **WORKING HARD** our training and experience is kicking in, we are still coping

But ...



🔄 We are beginning to encroach on our **SPARE CAPACITY**

What if?

- Your engine begins to run rough?
- You see your route is blocked by lowering cloud or rising ground?
- Your navigation tablet warns that you have infringed controlled airspace?

DANGER

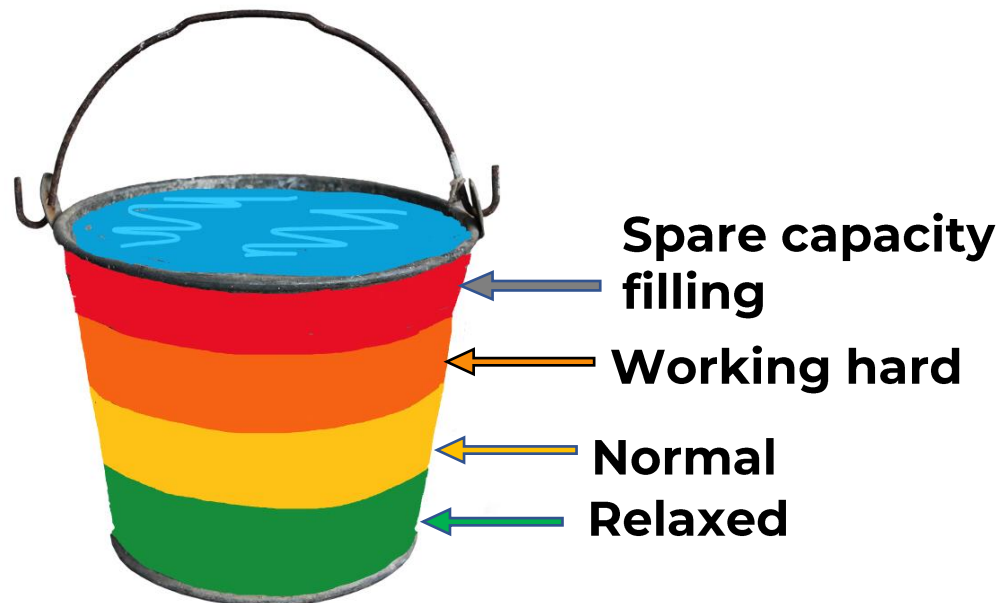
Your spare capacity can quickly be exceeded

With enough experience
you may cope, if not you
become

OVERLOADED

Leading to potential...

- ✖ Task saturation
- ✖ Inability to think clearly
- ✖ Loss of SA
- ✖ Incident/accident



Protect Your Spare Capacity



Bucket's contents can be reduced by
'pre-empt(y)ing' stressful situations (think before
you transmit, verbally brief - inc self-brief of engine
failure after take-off, etc)



- 🔄 If you know your planned route has a particular point about which you are nervous, eg a pinch point such as a MATZ crossing
- 🔄 Try to protect your spare capacity by spending more time pre-flight mentally rehearsing what you might say to ATC - on the ground
- 🔄 Maybe write it down as a pro forma on your kneeboard or even telephone the unit concerned beforehand to ask what you can expect?

Regain Your Capacity - Empty Your Bucket



It's not always easy, but try to **remove the threat** and **gain thinking time** by falling back on the **basics**:

A-N-C

Aviate

- above all else fly the plane don't panic, don't stall

Navigate

- if possible turn away from the threat (180 degrees if necessary)

Communicate

- absolutely, if you've infringed controlled airspace speak up and get help

***A-N-C is the ultimate form of MITIGATION, and
it will keep you safe***

To Err is Human



*'Errors are **action/inaction** that leads to **unsafe deviation** from plan, potentially leading to **adverse event** or undesired aircraft state'*

- ✈ Slip or lapse by pilot so is unintentional, or
- ✈ Intentional non-compliance, so is deliberate eg shortcuts which violate SOPs/POH/SB
- ✈ Handling errors are most common Microlight errors, and can have most serious consequence

We are all human, we all make mistakes.

Key is recognising mistake and correcting it in time so it becomes inconsequential.

That is, the mistake doesn't lead to (further) error(s) or undesired aircraft state

Microlight Error Mismanagement



- ✈ In a professional, complex airline cockpit errors are considered 'normal', but are still recorded and reported so...
- ✈ By the nature of our flying and our airfields microlight 'errors' believed to under-reported
- ✈ GA generally operate from licensed airfields with ATCOs/FISOs
- ✈ 2017 GA & Microlights:
 - 213 reported accidents/incidents
 - 23 (10%) microlights
 - 13 microlights were Abnormal Runway Contact - on take-off and landing
 - 56% - matches US figures for GA (55% in 2016)

***NB. On & v close to ground accounts for only 15% of 'flight' time
So, half of accidents/incidents in 1/6th of 'flight' time***

Error Management - When?



- ✈ You cannot avoid **threats** & you will always make **errors**
- ✈ Thinking **ahead** from before you get to the aircraft is key
 - anticipating & managing threats & workload to give you time
 - ***always work to empty your capacity bucket***
- ✈ Consider pre-flight, because mismanaged threat is linked to or causes error

Error Management - When?



- ✈ An error that is detected & managed effectively has **no overall adverse impact** on a flight. It is..
 - Largely inconsequential
 - A good learning /debrief point

- ✈ **Mismanaged** error reduces safety margins, leads to Undesired Aircraft State (UAS), and this may lead to accident

- ✈ For all types of aircraft including Microlights
 - Descent, approach & landing account for majority of mismanaged errors

Learning from Errors



✈️ Errors can become an issue when *mismanaged*, & do lead to

- **Undesired Aircraft States, Accidents, & Fatalities**

“Pilot considered that in his haste to depart, due to a significant workload and jobs he had planned for the rest of the day, he omitted to set the trim lever to neutral for takeoff, leaving it in the nose up position from the previous landing” Aircraft stall & crash

✈️ Errors can be avoided

- We must admit this to ourselves, and others if we really want to improve our own performance
- We realise that the best flight safety systems are not about blame, but about helping everyone to be better

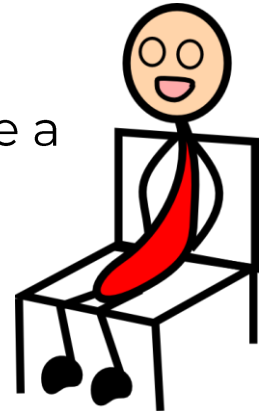
Remember:

***Flying is too expensive & dangerous to learn everything ourselves,
we must learn from others***

Do Nothing



- ✈️ As pilots we tend to want to be in control and be ready to act at all times, however sometimes **doing nothing** can be a valid option
- ✈️ Rather than potentially **exacerbate** problem
- ✈️ **Live with it**, and
- ✈️ Worry about it on ground when our capacity bucket is not filling - **when we have time and capacity**



Example

You are 'fighting' turbulent heavy showers under low cloud and have infringed CAS.

You want to talk to ATC but would have to change the frequency, now is NOT the time to add to your workload

Remember A-N-C, and for this error do nothing

TEM - Does It Work?



- ✈️ Pilots who develop **contingency plans** & proactively **anticipate** threats have fewer mismanaged threats
- ✈️ Pilots who plan, **double check** and **monitor** commit fewer errors & have fewer mismanaged errors
- ✈️ Pilots who exhibit **strong leadership, enquiry** (what went right and what went wrong, etc) and **workload management** have..
 - Fewer mismanaged errors, and
 - Fewer UAS (Undesired Aircraft State) - wrong speed, wrong configuration, etc

TEM - Does It Work?



“the instructor was informed by personnel on the ground that the left main landing gear structure appeared to have failed. ...the instructor declared a PAN and diverted to RAF Woodvale, where a successful landing was carried out.”

BMAA Comment

‘Given the situation the pilot handled the problem in a very sensible manner, deciding to divert to an airfield with a long runway and emergency services on site.’

TEM Summary



- ⚡ Threats: sources of harm outside your control BUT can be **assessed & reduced**
- ⚡ Errors while normal are more dangerous BUT we can **be ahead of game** and minimise errors, keeping ...
- ⚡ **Empty** capacity bucket which allows us to ...
- ⚡ **Avoid - Trap - Mitigate** threats & errors
- ⚡ **NOT mitigating is failure, not other way round**

TEM Summary



- ⌚ Remember ultimate mitigation **Aviate - Navigate – Communicate**
- ⌚ Failure to **Avoid - Trap - Mitigate**, quickly leads to...
- ⌚ Undesired Aircraft State (UAS) = lost SA, eroded safety and looming incident/accident
- ⌚ **Be honest**, and learn from yourself & others

It all starts pre-flight
“Time spent in preparation is seldom wasted”



Section 3.

Aeronautical Decision Making

“A systematic approach to the mental process used by all in aviation to consistently determine the best course of action for a given set of circumstances” (US FAA)

Aka **‘good pilot judgement’**, and

IT CAN BE TAUGHT!



ADM & Situational Awareness (SA)



- ✈ ADM usually safety critical (unlike many Conventional decisions)
- ✈ Carried out in dynamic and complex environments
- ✈ Difficult to perceive, evaluate, understand and act on all aspects of environment
- ✈ Aim is almost always **a safe and satisfactory result**, not an optimal one
- ✈ ADM strongly dependent on Situational Awareness (SA) and the alternatives available to a pilot
- ✈ Pilot's level of SA determines solutions to be considered and helps guide the choice of a response
- ✈ Results of selected actions can enhance perception and understanding of the situation, serving as feedback to alter and improve subsequent decisions
- ✈ SA & ADM are thoroughly intertwined

Start At the Beginning



- ✈ From the moment you start to think about a flight until you walk away from the airfield after the flight you have a never-ending series of decisions to make
- ✈ The process begins long before you put the 'Master Switch' 'on'
- ✈ It is a continuous flow of information in and actions out, and ADM is an effective way to manage this
- ✈ Key reason for thinking before you get to airfield/aeroplane is **you have TIME - your Capacity Bucket is empty**

It's All About You - Steps for Good Decision Making



- ➡ Identify personal attitudes that are hazardous to flight
- ➡ Learn how you recognise and cope with your stress (not covered in this module)
- ➡ Develop risk assessment skills – TEM
- ➡ Use all resources available – SRM
- ➡ Evaluate effectiveness of your ADM skills - Self-debrief

6 Hazardous Attitudes - Which Are You?



- Your attitude affects the quality of the decisions you will make, so...
- Affects the safety of your flight

| Attitude | Example |
|--|---|
| Anti-authority - don't tell me, I know. They resent rules. | SB not applied correctly. Structural failure, crash & fatality |
| Impulsive - do something, anything but quickly. Do 1st thing they think of & it's rarely right | Wet field, rush to get airborne. Crash on t/o - write off |
| Invulnerable - it won't happen to me so more likely to take risks | Cross Channel, round world - poor weather, crash into sea. Crash & fatality |
| Macho - I can do this. Want to prove themselves & impress others so take risks | Microlight wingovers & whipstalls. Structural failure, crash & fatality |
| Resignation - what's the use, tend to believe in luck. So leave action to others and accept unreasonable/risky requests | Pilot had several opportunities to change plan, abort flight, overnight, precautionary landing, etc - did none. 'Forced' to PL after dusk, crash & injury |
| Complacency – it'll be fine, why worry? Reduced awareness of danger | Airframe 'in extremely poor condition', engine accessories 'non-standard and badly installed'. Pilot injured, a/c write-off |

Human Senses



- 🕒 5 senses are ONLY means by which **external info** gets to brain, but..
 - Sight is dominant
 - Hearing is 1st sense to degrade/disappear
- 🕒 Technically we **cannot detect everything**
 - eg sight at night, speed, etc
- 🕒 The senses/brain do **mix up/block** some of the info from being processed
- 🕒 Usually we can see or 'attend to' only image/conversation 1 at a time

Human Senses



- 🔄 Info perceived & 'noticed' by brain if it is stimulating to subconscious - then brain **'brings it to our attention'**
- 🔄 So need time to **compare** info perceived to long-term memory - the brain's very quick 'best guess' based on previous similar stimuli
- 🔄 But long-term memory is an **unconscious/automatic** activity whereas
 - 🔄 **Attention** is a conscious one, so there are 'gaps'
 - 🔄 When info is **incomplete** brain 'fills in' the gaps especially visually
 - 🔄 So need **training & experience** to help fill any gaps

Inadequate Info = Incorrect Process



- ✈ Knowledge from **training & experience** help fill any gaps
- ✈ Especially **when time is short** - as in air
- ✈ Motivation, attitude, emotion, distraction all help to **block accurate gap filling**, so...
- ✈ May NOT fill-in correctly
- ✈ Likely to be unaware because gap-filling is smooth and **automatic**

Inadequate Info = Incorrect Process



AAIB Microlight Fatal Crash

“The majority of this flying had been from (airfield X), a large field with good clearance from hedges and trees’.

‘The pilot joined a syndicate of pilots operating from (airfield Y). Landing or departing aircraft from this strip are presented with more obstacles than at (airfield X). Approximately.. abeam the upwind end of Runway 13, the outer part of the aircraft's left wing struck the only tree in a elevated hedgerow 30 feet agl”

In dealing with ‘problem’ at low level on new field was pilot inattentive & ‘missed’ seeing tree?

Decision Making Continuum (CAP737)



Rational decisions
- long & effortful

Quicker decisions –
assisted by shortcuts

Intuitive decisions –
quick & effortless

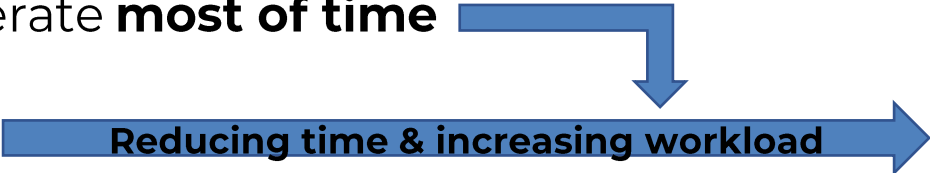
Decreasing time & increasing workload

A large blue arrow pointing to the right, representing the continuum of decision-making from rational to intuitive. Below the arrow, a box with two upward-pointing arrows indicates the typical operating range for microlight pilots.

Once in the cockpit this is
where microlight pilots
operate most of time

Quicker DM & Shortcuts



- ✈ Where microlight pilots operate **most of time** 
- ✈ Brain uses **shortcuts** all time to construct *partial* understanding
- ✈ **Decision** comprises
- Assessment of info
 - Processing of info, inc action to take
- ✈ Recency or 'Up-to-Date' bias - brain is **heavily influenced** by info perceived most recently or comes to mind easily
- ✈ May lead to **important info being ignored** because it wasn't recently considered
- ✈ Most times we don't seek optimal solution, just **satisfactory one**

Shortcuts & Anchoring



Anchoring and adjustment

Reducing time & increasing workload 

- brain still influenced by things it 'knows'

Quicker decisions – assisted by shortcuts

Start with initial idea/information and adjust our beliefs based on this

- eg 'First pilot continues through iffy weather and either says it's fine or says nothing at all. Then lands at destination'
- Subsequent pilots now have anchor that weather is fine

Good training is the most solid anchor we can have

For real.. "There was nothing in the weather forecast to cause concern but his experience on the outbound flight was an indication that navigation might be difficult on the return flight. The pilot had the option to change his plans and postpone the return flight but decided to continue"



Shortcuts

- Confirmation Bias



- ✈️ Mental models - **shortcuts** - reduce our need to attend to every input, but can lead to...
- ✈️ Tendency to seek out/trust or notice info that **confirms** what we already think/ believe/ want to believe, & **avoid/discount** information that goes against it
- ✈️ Once we've made a decision - to take off for example – we give more weight to evidence that supports the decision

***Simply put,
we tend not to ask a question
if we think we might not like the answer***

Shortcuts

- Confirmation Bias

Example

- ✈️ **Instrument discrepancy** “The pilot attributed the accident to the Skyview (EFIS) system indicating an incorrect, high, airspeed”
 - ✈️ Decision to t/o and not to investigate on ground & not to cross-check steam vs SkyView (EFIS) ‘confirmed’ by W/V “*straight down the runway at about 6 kt*”
 - ✈️ Stall after t/o and crash



Shortcuts

- Checklists & Mnemonics



- ✈ Shortcuts save **time/effort** & can be reliable provided based on knowledge/experience
- ✈ Shortcuts useful & prevalent as **workload increases**, and
- ✈ When decision not critical and helps **prioritise** attention/resources elsewhere
- ✈ **Checklists** are simplest form of shortcut
- ✈ **Mnemonics**
 - - eg IMSAFE
 - Aviate - Navigate – Communicate
 - '5Ps'
 - STAIP, CHIFTWAP, etc

Reducing time & increasing workload

Quicker decisions – assisted by shortcuts

Fast Decision Making



- ⌚ An answer to a problem '**comes to mind**' - but 'can't put a finger on why'

Reducing time & increasing workload

Quickest decisions - Intuitive

- ⌚ No conscious scrutiny, but we are **confident**
- ⌚ Process primed by deeply-learned, '**implicitly learned**' expertise
- ⌚ 'Typical' situations recognised from **previous experience**, so
- ⌚ **Practice & learning** (= experience) is essential - EFATO, PFL, etc
- ⌚ **But** better options may not be considered
- ⌚ Are today's circumstances **typical**?
- ⌚ However, keys are **speed & workload** not optimisation
- ⌚ Then **review/evaluate**, especially after flight

Decision Errors



Framing the alternatives - ask the Q another way

- “I know weather is marginal at destination but that’s where the fly out is going to” **OR**
- “If I can’t land at X because of the weather where can I divert to?”

Mental Shortcuts

- Mental shortcut - brain influenced by what ‘it knows’, training & recency are key
- Beware of jumping to conclusions

Bias

- Look for info to confirm decision made, & way info is presented can ‘assist’ this
- eg In METAR/TAF we ‘see’ ‘*Visibility 10 km or more*’ but take less notice of the ‘*Probability 30% : Temporary from 26 at 09 UTC to 26 at 12 UTC Visibility: 3000 m*’ shown further down

Decision Errors



- ✈ **Expertise, training & experience**
 - we see world in terms of our experience & training
 - our mental models

***Common pattern is pilots continuing
with original plan
when conditions suggest otherwise***

***‘Press-on-Itis’
(see later in Human Factors)***

Personal Minimums



- ✈ One of best SRM tools - **'Personal Minimums Checklist'**
(printout at end of module)
- ✈ Compiled well **away from flight** in a stress-free environment
- ✈ **Assess** abilities and capabilities
 - **Ability** - what you have demonstrated you CAN do
 - **Capability** - what you believe or have been told (FI?) you have the POTENTIAL to do
 - eg. You have **demonstrated** an ability to cope safely with a 15kt X wind, but...
 - You have been told your technique will allow you **cope** with 20kt X wind
 - Is **today** the day to try that out?
- ✈ PM checklist should be clear and concise reference point for **go/no go decisions**
- ✈ Made when capacity bucket is almost **empty** - ON GROUND

Post-flight Evaluation - The Debrief



- ✈ Invaluable - but often overlooked, except by airlines & military
- ✈ Review and analyse whole flight - especially key parts - objectively
- ✈ Be self-critical & honest
- ✈ Mistakes and errors of judgement are inevitable, key is to...
 - Recognise, analyse and learn lessons
 - In slow time evaluate every aeronautical decision
- ✈ Honest re-assessments helps
 - 'Reset' Rule of Thumb - efficient mental shortcut that allows us to make a decision, etc
 - Adds to our expertise, training & experience

Summary



- 🕒 Note that a change has (or hasn't) occurred
 - keep your Situational Awareness (SA)
- 🕒 Be honest with yourself and your ability
 - identify your own biases
- 🕒 Set and adhere to personal minimums

Summary



- 🕒 Quicker Decision Making (DM)
 - mental shortcuts, for **satisfactory solution** not optimal one
 - **Recency & Knowledge** are key, avoid important info being ignored
 - Beware of 'confirming' decision with bias 'evidence'

- 🕒 Fast Decision making (DM)
 - deeply learned, based on experience - 'feel'
 - Speed & workload are key
 - Scrutinise why option 'feels' better, or why it doesn't
 - Assess atypical features
 - Continuously evaluate outcomes

Remember
a chance that you can make it
MEANS a chance you CANNOT



Section 5.

Situational Awareness (SA)

A pilot who thinks ahead of the aircraft with a high level of SA will operate with a consistently higher margin for error and will therefore be safer.



Situational Awareness (SA)

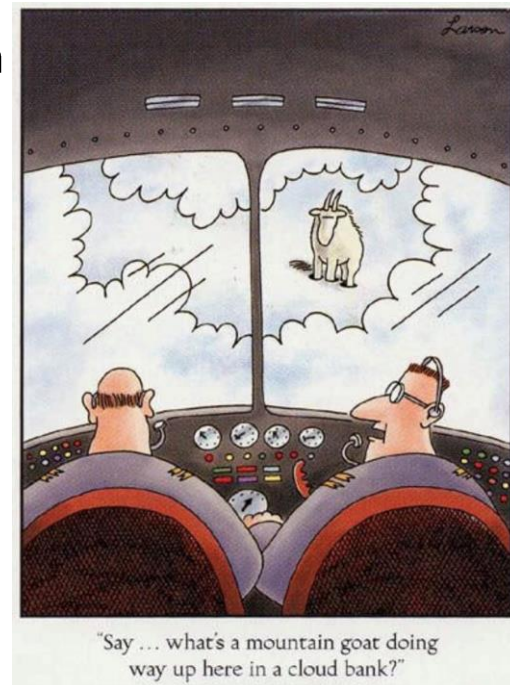


Inextricably linked with TEM, SA is an all encompassing term for knowing ***where we are, where we are going and what is happening to us at any particular point in time or space.***

A pilot who **thinks ahead** of the aircraft with a high level of SA will operate with a consistently higher margin for error and will therefore be safer.

However high SA can only be achieved by pre-empting threats and potential errors at times of low workload when our brains have the capability to take them in.

HIGH WORKLOAD = LOW SPARE CAPACITY



Good SA



- ✈️ Good SA starts with good TEM
- ✈️ Pre-determine pilot task priorities for high-workload phases of flight
- ✈️ Solicit input from others, inc Group members, ATC, etc
- ✈️ Rotate attention from plane to path to people (Aviate-Navigate-Communicate)
- ✈️ Monitor and evaluate current status relative to your plan
- ✈️ Project ahead and consider contingencies
- ✈️ Focus on the details and scan the big picture
- ✈️ Create visual and/or aural reminders of interrupted tasks
- ✈️ Watch for clues of degraded SA

Poor/Low SA



- ✈️ Pilot probably unaware they have poor SA
- ✈️ Requires clear signal that SA is lost (near miss?), although...
- ✈️ Maybe regained without pilot ever knowing it was lost
- ✈️ Some indications of Microlight pilot's poor/lost SA
 - Ambiguity of information, 2 or more sources don't agree
 - Confusion about a situation (with anxiety/psychological discomfort?)
 - Not prioritising the flying task - a focus on non-flying activities
 - Skipping or not complying with SOPs/POH/Checklist/Limits/Regulations/etc
- ✈️ Contributors to poor SA inc
 - ✈️ Poor or no information (lack of attention, failure to gather info, etc), Lack of experience, Poor training, Lack of knowledge, Stress & high workload, Pilot's hazardous attitude

Consequences of Poor/Low SA



- ➡ SA means having mental picture of the existing inter-relationship of
 - Location
 - Flight conditions
 - Configuration
 - Energy state of your aircraft
- ➡ Plus any other factors that could be about to affect its safety...
 - Nearby terrain, Obstructions, Controlled Airspace & Weather
- ➡ Potential consequences of inadequate SA inc...
 - CFIT, loss of control, airspace infringement, wake turbulence, unexpected strong head wind, & more



'When the microlight was about 30 feet above the runway it rolled "violently" to the right in the wake of the twin that had just landed, and hit the ground in a nose-down attitude

Are You a NUTA?



✈️ U.S. Air Force proposed 3 levels of Situational Awareness, but that seemed a bit complicated, so..

✈️ British Airways revised names of 3 levels to..

NUTA

- Notice
- Understand
- Think Ahead

✈️ Using 'NUTA' as a tool to assess "Where/how is my SA now?" can give the single pilot *vital* feedback potentially before SA is reduced or lost

✈️ Ask yourself: "Have I been or am I making mistakes?" "Am I making the most of the information and cues that I am receiving?" "Am I picking up on and prepared for change?"

3 Levels of SA



- ✈ Level 1 - **Notice**. Extract information from the environment
- ✈ Level 2 - **Understand**. Integrating this info with relevant previous knowledge to create a coherent mental picture of the current situation, and then...
 - Use this picture to direct further perceptual exploration in a continual cycle, so you..
- ✈ Level 3 - **Think Ahead**. Anticipate future events
- ✈ **Remember**, in addition to being a critical component of safe aircraft operation SA is fundamental to TEM.
Pilots cannot assess or mitigate Threats or Errors without a clear understanding of their current situation
- ✈ Good SA takes some effort & resources

NUTA

- Levels of SA Example



Whilst flying on a summer's day in good weather, smoke from a factory chimney can be seen being blown by a steady wind.

- PILOT A – **NOTICES** how dramatic it looks but sits back and enjoys the view
By having information available but doing nothing about it PILOT A will have a LOW level of SA. Any issues that arise will probably have to be **mitigated**
- PILOT B – on seeing the smoke **UNDERSTANDS** that it is a useful marker to surface wind direction should his engine fail
Although not using all of information, by making mental note PILOT B has taken significant step towards **trapping** errors and is operating at a MEDIUM level of SA

NUTA

- Levels of SA Example



Whilst flying on a summer's day in good weather, smoke from a factory chimney can be seen being blown by a steady wind.

- PILOT C – realises that the smoke direction is contrary to his expectation generated by his preflight planning and **THINKS AHEAD** to his destination airfield where he will expect a different circuit direction to a different runway
By not only considering his present situation but the potential effect on the future PILOT C will **avoid** errors and is operating at the highest level of SA

Regaining & Improving SA



- ✈️ **Identify reason we lost it in first place...**
 - Distraction, fatigue and inattention are likely causes &...
 - Each has obvious remedies
- ✈️ **Empty your Capacity Bucket** so you can think ahead to IMPROVE your SA; focus on the things we *don't know* about the flight but *should know*...
 - What fuel do we have remaining, ETA, destination weather, etc?
 - If I had to land *right now*, where would it be?
 - Go back to TEM to identify threats and your response to them
 - Reinstate scheduled '5 Ps' assessments
- ✈️ These are always important things to know & form a foundation of good SA in the cockpit
- ✈️ Focusing on these questions & answers is a good place to start regaining SA

Summary



- 🔄 Be a **NUTA** - **N**otice, **U**nderstand, **T**hink **A**head
- 🔄 Means you are better prepared to...
- 🔄 Pre-empt threats at times of low workload when capacity bucket is NOT filling or full = anticipate future threats
- 🔄 Starts with good TEM, so know when periods of high and low workload are
- 🔄 Poor SA difficult to recognise in self - are you confused, ambiguous about decisions or info?
- 🔄 Caused by distraction, fatigue, etc
- 🔄 Focus on what you DON'T know about the flight to start to regain SA
- 🔄 Go back to using TEM & '5 Ps'



Section 6.

Human Factors

“The disease or disorder called “human error” causes half of the preventable deaths in both civil and military flying personnel”



Human Factors



Despite all the changes in technology to improve flight safety, one factor remains the same - the human factor - which leads to errors

“The disease or disorder called “human error” causes half of the preventable deaths in both civil and military flying personnel”

Human Factors knowledge and application covers the full range of **individual** (and team) human characteristics in aviation for the purpose of improving performance and reducing errors

Remember

2 of the ‘5 Ps’

Plan, Plane, Pilot, Pax & Programming

are about PEOPLE

SRM Human Factors



- ✈ Fitness to fly depends more than on just
 - Physical condition, &
 - Currency

- ✈ Your **attitude** is absolutely key, because it affects
 - Affects the quality of your **decisions**
 - Your predisposition to **respond** to people, situations & events

- ✈ There are 6 hazardous attitudes that affect ability to make sound decisions & exercise authority effectively
 - **ALL** contribute to poor pilot judgement

IMSAFE - Never Leave Home Without This



- 🔄 No point in assessing threats, planning, etc if you are not **FIT to FLY**
- 🔄 So check using IMSAFE for **you and pax BEFORE** you leave home:
 - **Illness:** Do I have any symptoms?
 - **Medication:** Have I been taking prescription or over-the-counter drugs?
 - **Stress:** Am I under psychological pressure – job, financial matters, health problems, family issues or peers?
 - **Alcohol:** Have I been drinking within 8 hours?
 - **Fatigue:** Am I tired and not adequately rested?
 - **Emotion:** Am I emotionally upset?

Pilot Passengers Are Only Human Too



Flying with qualified pilot/co-owner can be a good thing and a huge benefit. They should ...

- Know when to assist (thus reducing workload)
- Know when to keep quiet (avoiding distraction or overload)
- Can be allocated specific tasks pre-flight (reducing workload) and
- Can be a great sounding board for options when things aren't going to plan
- But remember according to the Air Navigation Order - the Pilot In Command (PIC) is..

“a person who for the time being is in charge of the piloting of an aircraft without being under the direction of any other pilot in the aircraft”

SO...

there can be only one pilot in command.

“I offered him the sector but he weaselled his way out of it”



The Pilot Passenger (Pax) - A MayDay Story

(28 May 2021)



"...both occupants (pilot and pax, a FI & Examiner) boarded the aircraft...backtracking the runway." "...so the takeoff was commenced without delay. The pilot had missed the final power check..to confirm that the propeller was in fine pitch. The pilot described the a/c as sluggish...he checked the airbrakes were stowed and the rpm was in normal limits as he was expecting to get airborne by this point.

Seeing the yellow winch caravan approaching, the pilot called out his intentions to abort the takeoff and stop. The passenger in the right seat (FI & Examiner) then called out that he had control and the pilot let go of the controls. Shortly afterwards the aircraft became airborne although it was immediately clear that it was not climbing away as expected.

The a/c reached approx. 100ft agl before descending. The pilot called to the passenger, who was not flying the a/c, that there was a suitable field to their left. The a/c banked left but struck a tree with the right wing as it descended."

All For The Want of A Brief

| Errors | Cause | Solution | Section |
|-------------------------------|---|-------------------|--------------|
| No pax brief | 2 x qualified pilots? | Pax brief | TEM & ADM |
| No pre-takeoff checks | Rushing? | Checklist | TEM & ADM |
| Unaware of glider on finals | Listening to R/T? Distraction? Not insisting on quiet cockpit at busy times? | '5 Ps' | TEM, SA |
| No take-off emergencies brief | Complacency - it won't happen to us? | Checklist | TEM, ADM |
| Abort aborted! | Lack of defined control | '5 Ps', Checklist | TEM, ADM |
| Pax takes control | No briefing. <i>'Not unless I'm incapacitated'?</i> | '5 Ps' - Plan | ADM |
| Field choice | Pax felt sufficiently capable to take control but 'left' choice of field to pilot | A-N-C? | TEM, ADM, SA |

Did pilot have 'flight' response of 'fight or flight', psychologically fleeing from threat by leaving it to pax? What - if anything - went wrong?

Pilot 'Passengers'



Flying '1 sector each' is no problem but if the lines of authority become blurred then beware that one of 3 undesirable options might occur

- ✈️ **Potential for complacency** with another qualified pilot onboard
- ✈️ **No one is in charge** - can lead to ambiguity and a lack of drive to complete the task with associated low SA
- ✈️ **"Risky-Shift" or "Groupthink"** - where two or more equally qualified pilots don't want to "upset the apple cart" or show signs of weakness by admitting to the other they are feeling uneasy. This can lead to unintentionally taking on a level of risk
 - eg going on a fly out in poor weather or
 - 2 pilots in the cockpit deciding to continue
 - when none would be prepared to accept the same risk individually



Passenger Brief



Every 2nd seat occupant should be briefed before strapping in

Know rules, regulations and limits inc your own, and DO NOT breach them, so that you can meet the aim of the brief which is...

To instil confidence in the passenger so that they relax and enjoy the flight. The more relaxed (less anxious?) they are the better and easier it will be for P1.

🔄 The objectives of the brief will be to...

- Project a safe and enjoyable flight
- Achieve minimum distractions for P1
- Brief tasks for pax, if any
- Brief about emergencies
- Ensure clarity about who has control and when

A suggested passenger brief is included as part of the printout/handout

Unexpected Threat

- Fight or Flight?

- Humans have well-developed ability to assess risk vs reward in its most basic form, for example, we sprint out of the way of rapidly approaching car

It's the *fight or flight* response

This can lead to..

- **panic**
- **freezing**, or
- **rushing** into a bad decision



Unexpected Threat

- Fight or Flight?



- 🕒 The processes used by the brain and the chemical and psychological effects are complex but be aware that..
- 🕒 For **mild to moderate** threat your brain allows you to fall back on emotions, experiences and judgement to **consciously** respond
- 🕒 However, in the case of **high** threat your brain will **unconsciously override** the rational part of the brain and trigger the fight-or-flight response
- 🕒 So, your TEM, your Situational Awareness (SA), your training, your experience and your recency will help you **avoid high threats**, and..
- 🕒 Allow you to judge more clearly and **respond consciously** and safely

'Press-on-Itis' - A Bad Decision



- ✈ 'Press-on-Itis'- continuing with original plan when conditions suggest otherwise; a dangerous mental state that can affect us all
- ✈ Start/continue flight despite a lack of readiness of the airplane or pilot and the availability of reasonable lower-risk alternatives
- ✈ Cause or suspected cause of many accidents
- ✈ Four factors contribute to this...
 - **Poor SA**
 - Pilots typically **under-assess risk** associated with situation - 'Press-on-Itis'
 - **Goal Conflicts** - willing to accept safety risk because of peer pressure & loss-of-face by turning back
 - **Workload & Stress** - overload the Capacity Bucket, degrade mental processes, tunnel attention, etc. Making correct decision becomes difficult

Summary



- ⌚ Human error still largest premature killer of Microlight pilots
- ⌚ Human Factors pervade EVERY aspect of what we do and of SRM
- ⌚ 2 of 5 risk areas, the '5 Ps', are 'human' - Pilot & Passenger
- ⌚ IMSAFE focuses solely on YOU, so use it right at the start
- ⌚ Brief yourself - TEM - and brief your pax
- ⌚ Another Pilot is 'just' a more-qualified pax
- ⌚ Use open Q's eg 'what did you hear ATC say?' and avoid Groupthink
- ⌚ Use TEM to avoid being startled, so no 'Fight or Flight'
- ⌚ Self-control to avoid Press-on-Itis &/or Showing Off
- ⌚ Properly weight Risk vs Benefit
- ⌚ Remember, being Human we 'break' easily



Section 7.

Programming & Automation

Electronic systems & displays inc GPS/Moving Map (MM),
EC (Electronic Conspicuity),
Electronic Flight Instrument System (EFIS) &
Autopilot
(Introduction only)



Aids to Your SA



- ⚡ Electronic systems/displays can reduce pilot workload and aid increased SA - they do NOT replace it
- ⚡ Even the humble radio can help eg pre-load on the ground (when your capacity bucket is low) a frequency for a new airfield
- ⚡ Programming/operating them can create serious distraction from other tasks
- ⚡ Mitigate risk by having a thorough understanding of the kit long before take-off
- ⚡ All electronic systems have limitations
- ⚡ Mount systems where they offer most benefit
- ⚡ And where they can be part of but not detract from your normal scan & lookout
- ⚡ Is this best place for a display?



NB. For this Module, only GPS/MM will be introduced

GPS/MM

(CAA Safety Sense Nov 21)



- 🌀 MMs “Provide significant enhancement to your SA”
 - Position, Controlled Airspace (CAS), Aerial activities, NOTAMs
- 🌀 Aid flight planning, taking account of airspace - Take 2, FMCs
 - Route simulation can aid threat evaluation/mitigation, NOTAM & weather update/evaluation
- 🌀 Need to understand device capabilities/functions to get best from it
 - Gain familiarity with it on ground, then on simple flights
- 🌀 Practice accessing different menus/layers of information available from the device when your Capacity Bucket is empty
 - Consider the reality of operating in flight, under pressure
 - can you identify relevant information quickly and accurately while flying the aircraft and not compromising your lookout?
- 🌀 Chart information may be in layers eg max glider winch cable altitude or R/T frequencies - know how to access info quickly

MM - Proficiency Is Ability To..



- ✈ Update software and aeronautical database
- ✈ Manage downloadable data - weather, NOTAMs, etc
- ✈ Plan route and identify features and hazards, inc in hidden layers
- ✈ Mount it securely so it is visible & accessible, but doesn't obstruct controls or lookout
- ✈ Configure and use in most effective manner eg setting appropriate altitude layers, airspace warnings, etc
- ✈ Work seamlessly thro' device inc altering key parameters eg zoom, change map scale, etc
- ✈ Use it effectively in abnormal situation eg diversion, route re-plan in air, etc



MM Considerations

- Ground & Air



✈️ Primary task is to fly a/c - **remember A-N-C & your lookout**

✈️ **MM proficiency really helps**

- Do as much as poss on ground pre-flight - remember your Capacity Bucket
- Screen visible in all light conditions?
- Does device overheat, especially in direct sunlight?
- Battery life in constant use, inflight charging options
- Long tasks eg re-route - break down into small, discrete 'steps' or use pax?
- Audio airspace alerts with appropriate settings

✈️ **Continue TEM & remember A-N-C**

✈️ **Paper map**

- As back-up, &..
- To maintain map & stopwatch skills

Infringements 2019

(Last full & 'normal' year)



- ✈ Not all GA or microlight, but
- ✈ 1272 reports inc 64 microlights
- ✈ 403 investigated inc 305 PPL/NPPL
- ✈ Conclusions (as % of 403)
 - Correct use of a moving map would help avoid 72% infringements
 - 65% could avoided by correct use of SSR Frequency Monitoring Code (FMC) - microlights with SSR?
 - 65% (260) could avoided by recognising and dealing with distraction/overload - EMPTY THE CAPACITY BUCKET
 - Distraction (as % of 260) by weather (24%), mechanical failure (19%), pax (10%), change of plan (26%), unfamiliarity with a/c (7%)

"It could be said that nearly all infringements have distraction as a causal factor"

Take 2



**It's not my problem I always get a basic service from a radar unit or use a listening squawk...
... just like 65.5% of airspace infringers in 2019!**

Take 2



But.. biggest airspace infringers ***by far***:

Plan route too close to controlled airspace

- it doesn't take much of a distraction or change of wind strength & direction to push you off course.

Deviate from original plan

- can be *deliberate* eg to avoid weather, traffic or show your passenger an interesting place,
- or *unintentional* eg typically poor height keeping due to distraction.

***Don't let all of your hard work pre-flight
be wasted by becoming **distracted** or
wholly **dependent** on your GPS and
remember "Take 2".***

Summary



- ✈ **Electronic systems** are designed to make our aviating lives easier and safer
 - To achieve that we should know how to use them
 - And we should 'tell them what to do' on the ground
- ✈ **GPS/MM** in particular can help with one element of the key mitigation **A-N-C**
- ✈ **GPS/MM** aid planning and when coupled with Take 2 will have a hugely beneficial impact on infringement
- ✈ **EC devices** convert us from '*see and avoid*' to '*see, be seen and avoid*', but
 - They don't detect & display everything, and they remain
 - Only an aid to lookout & SA
- ✈ **EFIS displays** in wide use but transition from 'glass' to steam' isn't straightforward
- ✈ **Autopilot systems** as they come in for Microlights will need monitoring

SRM Summary



- 🕒 Remember the Swiss Cheese slices & the holes aligning to compromise safety?
- 🕒 The encouragement to consider threats and plan for them, and...
- 🕒 To consider nice and early, well before you get in the cockpit
- 🕒 When unexpected threats do arise, to use your knowledge, training, and recency to make the right decision
- 🕒 How having good SA helps you cope with unexpected threats
- 🕒 Well, read on...

The Holes Align

- A Sad and True Story



- ✈️ C150 - performance roughly as microlight at 100hp, but heavier
- ✈️ Pilot A 70hrs total, 3 in last 28 days, 3 in last 90 days
- ✈️ Pilot A + pax flew airfields X - Y - Z, with Z as a challenging field in hills
- ✈️ PPR required at Y & Z, but NOT obtained
- ✈️ Take-offs at X & Y both overweight
- ✈️ Route Y - Z preceded by friend - Pilot B - in another a/c
- ✈️ Pilot B landed at Z on r/w 36 which was *"sludgy"*
- ✈️ B tried to call A on mobile to warn him but couldn't *"positively remember"* the call
- ✈️ B met by airfield Z owner who was then informed of incoming C150 and was *"very cross"* as it was *"not appropriate for one (a C150) to land here in the conditions"*
- ✈️ Tried to R/T C150 with no luck
- ✈️ C150 landed uneventfully
- ✈️ Pilot A shown where to park but parked elsewhere, in boggy ground
- ✈️ Pilot A flight Y to Z *"very stressful"* with *"radio being intermittent because of the terrain".."climb and descend to avoid clouds and trying to keep up (with preceding a/c)"*.

The Holes Align, Not the Stars - Airfield Z



- ✈️ Pilot B suggests he take pax back, Pilot A *"No no, we'll get out easily"*
- ✈️ Airfield owner not happy, Pilot A claims he thought someone had got PPR for him
- ✈️ Owner instructed C150 to return to base (rtb) solo &..
- ✈️ Using full length of r/w 36, which involved backtrack - pilot A agreed to both
- ✈️ Owner reiterated instructions to pilot B then had to leave field
- ✈️ A & B walked r/w 36 but NOT threshold
- ✈️ Pilot A said to B he would backtrack part way towards threshold and B accepted this
- ✈️ After start C150 had to be assisted out of boggy ground
- ✈️ Taxi onto r/w 36 but NO backtrack and straight into t/o roll - no power checks
- ✈️ At 50ft agl a/c stalled and dived vertically into waterlogged ground
- ✈️ Pilot died

So Many Warning Signs - But Only One Tragic Outcome



"Cocaine had been used (by Pilot A) within one or 2 days before the accident".. "the behaviour of the pilot would not have been directly affected by cocaine on the day of the accident"....

But was pilot's attitude affected day before accident, during his preparation/thinking?

"The flights after the pilot passed his licence skills test and which led up to the accident flight were characterised by incomplete preparation and an apparent disregard of advice from those notably more experienced than him"... "it appears that chastisement and subsequent discussion with one of his instructors about what type of flying was appropriate for a newly-qualified pilot, and the unsuitability of the C150 for some airstrips, was not heeded."..

So Many Warning Signs - But Only One Tragic Outcome



"Opportunities were missed to prevent the accident...pilot did not heed advice not to operate into grass, performance-limiting airfields,".. "did not obtain PPR".. "probably was not on the correct radio frequency".. Pre-flight Pilot B told A "call (to airfield Z) probably good but not essential".. "However, the airfield's plates clearly state 'Strictly PPR'".

"During the take-off from Z - an airfield on the limits of the aircraft's performance capabilities - the pilot rushed; he did not use the full length of the runway; ..used a nose-up elevator trim setting appropriate to landing, having not completed his pre-takeoff checks;" "the pilot did not have his shoulder harness secured".. "against the advice of his instructor "...the accident became unsurvivable."

"..the pilot's conduct during the flights leading up to, and including the accident is explained by an apparent willingness to trust his own judgement over the advice of others."

What Went Wrong?



| Error | Cause | Solution | Section |
|--------------------------------|--|--|------------|
| Poor preparation | Hazardous attitude Cocaine use | Honest self-assessment IMSAFE | ADM HF |
| Incorrect r/t frequency | No use of plates? No PPR | '5 Ps' - Plan | TEM |
| Arrival at unsuitable airfield | No PPR | '5 Ps' - Plan | TEM |
| Stressed after inbound flight? | Did he prepare fully - weather? | Checks - weather | TEM |
| Fail to use full r/w length | Hazardous attitude? Peer 'agreement' | Honest self-assessment YOU are P1 | ADM HF |
| Yaw after takeoff | Binding brake | '5 Ps' - Plane | TEM |
| High nose attitude | Landing trim setting, no pre-takeoff checks | Pre-takeoff checks | TEM |
| Head/chest impact frame | No shoulder harness - against advice Hazardous attitude | '5 Ps' - Pilot Honest self-assessment | TEM ADM |

SRM Module Summary



 Do we have a problem that needs solving?

| | 2018 | 2019 | 2020 (a Covid-truncated Year) | 2021 |
|--------------------------|------|------|-------------------------------|----------------|
| Fatalities | 40 | 14 | 6 | |
| Airprox | 319 | 328 | 280 | 269 (to 1 Dec) |
| Microlight Infringements | | 63 | 33 | 40 (to 31 Oct) |
| Unknown infringements | | | | 72 (to 31 Oct) |

'It (human error) is the largest single cause of premature mortality in this (the aviation) population'

 Yes we do have a problem, but...

"We cannot solve our problems with the same level of thinking that created them."

(Albert Einstein)

THE END

