SRM:
Single Pilot Resource Management

A BMAA Wings Course
In flying I have learned that carelessness and overconfidence are usually far more dangerous than deliberately accepted risks.

Wilbur Wright, 1900.
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

Section 1: Introduction

Section 2: Single Pilot Resource Management (SRM) Concept

Section 3: Threat and Error Management (TEM)

Section 4: Aeronautical Decision Making (ADM)

Section 5: Situational Awareness (SA)

Section 6: Human Factors

Section 7: Programming & Automation

Section 8: Summary

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

There But For the Grace of God Go I?

 exemptions used in this material are real

Over 200 Microlight accidents/incidents analysed (and photos) from AAIB & certainly many more are not reported

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
**Crash, 1 injury** ‘The pilot had the option to change his plans and postpone the return flight but decided to continue. The accident occurred because the pilot departed too late in the day and was delayed by navigational difficulty until it was dark. He decided to perform an emergency landing, but it was too dark to see and avoid power lines on the approach to his chosen field’

**Precautionary Landing** ‘The pilot acknowledged that the most likely cause of the accident was that he had run out of fuel…The fuel tank is in the wing root and it is not easy to see the fuel level’

*Obviously no en-route fuel checks*
Yes! It Does Happen to Microlights?

**Crash, 2 Injuries** ‘In the pilot’s assessment, contributory factors to the accident were the reduced climb performance due to the high ambient temperature and the possibility of a down draft or rotor effect from the buildings and trees located near the eastern end of the strip’

Temperature and wind velocity ‘missed’

**Crash, 2 Deaths** ‘Some time previously the microlight’s uprights upper fittings had been modified to comply with Service Bulletin 116 requiring the fitting of additional rivets. The additional rivets were not only fitted incorrectly, and without reference to the Service Bulletin, but two of them did not match the specification of those rivets supplied by the manufacturer in the modification kit. Additionally, no duplicate independent inspection was carried out on the correct embodiment of the modification’

Mod kit ‘incorrect’, parts fitted incorrectly, no 2nd inspection
Swiss Cheese Slices & Safety

- Model for avoiding the ‘if only’ in microlight accidents/incidents

- Developed 1990's by Prof James Reason (University of Manchester) – to replace ‘weakest link in the chain’ model

- Widely used in many professions where harm can be caused, e.g. aviation & medical profession
Swiss cheese model by James Reason published in 2000 (5)
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

Decision making

Reliable maintenance & paperwork

Human failures, training, currency, communication, etc

Unsafe acts, lack of training, experience, etc

Pressures – personal & other

ACCIDENT

Source: Maged Saeed Al-Hadabi, 23 Jun 2021, Human Factors
Swiss Cheese Model contends that microlight aviation is generally well-protected by **layers** of defences (‘slices of Swiss Cheese’)
  • e.g. Permit to Fly (PtF), POH, training, etc

Accidents involve **successive** breaches of layers
  • holes in cheese slices align

Triggered by many **enabling** factors
  • eg equipment failures, operational errors, etc

Single-point failure is **rarely** consequential
Breaches in safety defences can be a delayed consequence of decisions made at the other levels of the organisation (group member?), which may remain dormant:
- eg previous heavy landing

Until their effects/damaging potential is activated by certain operating conditions

Under such specific circumstances, human failures by pilot breach the final layers of safety defence
Does it Apply to Microlights?

- Microlight a/c - self maintenance permitted, but NO maintenance schedule
- PtF passed but with compression check by ‘feel’
- Rough running/lack of power for several months
- Fuel flow issue ‘diagnosed’ as mechanical fuel pump
- Elec fuel pump fitted - no mod application, no inspector involvement, no tech help sought
- Partial power loss after take-off
- Turn-back attempted

Crash resulted

- Post-crash investigation showed
  - Crack in seal giving lean mixture & low compression on 2 cylinders
Yes: These Holes Align!

**Hole 1:** Self-maintenance, permitted but 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 tech help sought  
no mod application, no inspection

**Partial power loss after take-off**

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

**OUTCOME:** Crash resulted
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 better

“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
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
At the turn of the twentieth century, during the pioneering years of aviation accidents were commonplace.

Common aeronautical principles were yet to be established, materials and engines lacked the capability to fly long distances in all weathers.

Sixty years later man walked on the moon & returned safely.
But despite this incredible rate of technological advancement, that same year 1969 saw the worst aviation disaster up to that point when a Venezuelan DC-9 crashed on take-off killing all 84 on board and a further 71 on the ground.

By that year's end 1039 people had lost their lives in commercial aviation accidents.
What became apparent during accident investigations in those dark years was the realisation that in general, experienced and technically competent pilots were failing to recognise their mistakes and crashing fully serviceable aircraft.

Term "pilot error" became the norm.

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

It is the largest single cause of premature mortality in this population.

This disorder needs to be attacked as aggressively and effectively as we have attacked the physiological and medical disorders responsible for the remainder of preventable deaths”
1978 US Military Inspector General determined that ‘poor crew interactions were a major factor in aircraft accidents’

1979 NASA conduct the first formalised research into ‘Resource Management on the flight deck’ concluding that ‘60-80% of aircraft accidents are the result of human error’

1981 United Airlines add Cockpit Resource Management (CRM) to training syllabus, NASA bring CRM to the Shuttle program

1990 “Threat and error Management” introduced to airline CRM modules

2011 Federal Aviation Administration (FAA) mandates that CRM training is required for all crewmembers conducting either dual or single-pilot operations
Cockpit (or Crew) resource management may outwardly appear to be the exclusive domain of multi-crew operations where a Captain and co-pilot work together to ensure the safe outcome of a commercial flight.

However the facts speak for themselves. 1987 FAA study discovered that “an operator flying about 400,000 hours annually demonstrated a 54 percent reduction in accident rate” when using a formalised approach to threat assessment, risk management and appropriate decision making.

If we as solo pilots could routinely approach our flying with the same structured approach there is NO reason to believe that our own safety record couldn’t improve by a similar percentage.

Hence the emergence of Single Pilot Resource Management - SRM.
This is where we need to be careful because

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

Are you really as good as you think you are?

Be brutally honest.
Back in 1996 when the UK airlines first formally introduced CRM to its crews it was not uncommon to hear:

Q. “What does CRM stand for?”
A. “Captain’s Right Mate!”

But who was it heard from?

Typically the time-served senior crews who felt that CRM would undermine authority & erode their position on the flight deck.

The very same senior crews who by attitude alone (ego?) had the most to learn!
Section 2.
Single Pilot Resource Management (SRM)

An ART and a SCIENCE ...

to ensure the successful outcome of the fight is never in doubt
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 better prepared...

“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
# CRM vs SRM

When compared to CRM, SRM may seem much the same but differs for the following reasons

<table>
<thead>
<tr>
<th>CRM</th>
<th>SRM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relies on a crew combining their knowledge, experience and skills to share the tasks of assessing risk and avoiding errors.</td>
<td>Relies on you, the individual to process all of the information, assess threats and risks, make decisions and act on them at all times in flight.</td>
</tr>
<tr>
<td>Provides mutual support and option of 2nd opinion.</td>
<td>Tends to lead to higher cockpit workload.</td>
</tr>
<tr>
<td>Can help to recognise overload in the individual and allow tasks and workload to be shared.</td>
<td>Does not provide a safety net</td>
</tr>
<tr>
<td>Generally used in commercial ops where autopilots take over most of the physical flying tasks thus freeing up capacity to think.</td>
<td>With a few exceptions microlight flying is a manual task thus adding to pilot's workload &amp; reducing the ability to think</td>
</tr>
</tbody>
</table>

Therefore (with the single exception of the number of lives at stake) it should be appreciated that SRM skills are arguably **even more important** than those techniques of CRM used by professional pilots.
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
For reasons that will be explained later, be wary of the human factors issues which can arise when flying with another qualified pilot.

As you will undoubtedly remember the CAA Air Navigation Order (Section 1 part 33) states that a ‘Pilot in Command’ 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’

Or more simply:

SOMEONE MUST AT ALL TIMES BE IN CHARGE
Fitness to fly depends more than on just
• Physical condition &
• Currency

Your **attitude** is absolutely key, because it
• Affects **quality** of decisions
• 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
Your attitude affects the quality of the decisions you will make, so...

Affects the safety of your flight

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Antidote</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anti-authority</strong> - don’t tell me, I know. They resent rules.</td>
<td>Follow the rules – they’re usually right</td>
</tr>
<tr>
<td><strong>Impulsive</strong> - do something, anything but quickly. Do <strong>first</strong> thing they think of &amp; it’s rarely right</td>
<td>Not so fast – think first</td>
</tr>
<tr>
<td><strong>Invulnerable</strong> - it won’t happen to me so more likely to take risks</td>
<td>It certainly could, what makes you so different?</td>
</tr>
<tr>
<td><strong>Macho</strong> - I can do this. Want to prove themselves &amp; impress others so take risks</td>
<td>Taking chances is foolish.</td>
</tr>
<tr>
<td><strong>Resignation</strong> - what’s the use, tend to believe in luck. So leave action to others and accept unreasonable/risky requests</td>
<td>I can make a difference.</td>
</tr>
<tr>
<td><strong>Complacency</strong> – it’ll be fine, why worry? Reduced awareness of danger</td>
<td>Whatever your confidence and contentment it CAN happen to you.</td>
</tr>
</tbody>
</table>
### 6 Hazardous Attitudes - Microlights

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

That some of the tablet based navigation systems allow you to set up a timed repeating reminder for inflight use?

Why not consider setting one up to remind yourself to update your Situational Awareness?

NB: shown here purely for illustration with a 1 minute reoccurrence (10 minutes would be better in flight)
SRM is NOT a physical flying skill, it is ...

- A series of human factors which combine to pro-actively maximise flight safety

In essence ‘Thinking ahead to be better prepared’

Remember - there can be **Only One P1/PIC**

'5 Ps' = scheduled framework to assess threats before & during flight

- Plan, Plane, Pilot, Pax, Programming

Use at any time/any order, but ideally before each of 5 key stages of flight

- Pre-flight, Take-off, Cruise, Descent, Touchdown

Reminders can be programmed into some GPS tools
Section 3.
Threat & Error Management (TEM)

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

‘Thinking ahead to be better prepared’
What is TEM?

Tem is

• NOT new, we do it every day in normal lives
• NOT about teaching you to fly

Application to aviation developed in late ‘90s.

Since then it has been 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
So, Threats are Risks

**Threats** are ...

- **Events** that occur outside your control which require your attention to maintain safety

- **Events** that have potential to impact negatively on the safety of a flight, or any influence that promotes the opportunity for pilot error(s)

**Threats** increase the complexity of flying, require attention, and detract from the fun of flying

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

- 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** – e.g. challenging but manageable crosswind velocity (w/v) to one is outside someone else’s personal limits

01-Mar-22 (V1.0) ©BMAA
Threats vs. Errors

As pilots we are constantly bombarded by BOTH, but what’s the difference?

- **THREATS** come **at** the pilot
- **ERRORS** are made **by** pilot

They are related because...

a mismanaged **threat** is linked to or induces **error**

This Section will look at the various categories of both
Management of threats & errors starts long before you reach the airfield, because...

The more you assess & 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...
Typical Microlight Threats

- Controlled Airspace
- NOTAMs
- Hangar rash
- Weather
- Minor technical (Switch/instrument) failure
- Runway surface conditions
- Distractions from Passengers
- Recency
- Livestock on strip
- Obstacles close to runway
Threats from Environment and/or Organisation

Environment - weather, terrain, airspace, etc

Organisation - only airlines? No, Microlights too..
  - Pressures - usually self-induced
e.g. you’ve taken day off to fly
  - But not always,
you are part of Club fly-out - peer pressure
  - Late agreement to take pax
  - Technical/Maintenance
Group member did last service, do you trust them?
Group member not owning up to issues

We’ve all been there, seen it, done it
Threat Management Principles

In flight as in life …

🚫 Accept **no unnecessary risk**
  e.g. 1st flight in new aircraft in iffy weather?

🚫 Make risk decisions at **appropriate level**
  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
Remember 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
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- 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.
Visualise & Manage Threats
(1) Self

‘5 Ps’

Self-brief & visualise flight, especially key/riskiest parts
• Top athletes do it as it helps them, why not us?
• Helps stay ahead of a/c

What if?
• What could go wrong?
• What will you do about it?

Talk to peers, FIs, etc

Whilst driving to airfield?
Visualise & Manage Threats
(2) Checks

**Met** brief
- 214 & 215, Met Office local, phone call, nearby METAR/TAF, etc
- Any and every source for as full a picture as possible
- 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**)

**CAS** & Take 2

**New** airfield
- RunwayHD, SkyDemon, etc
- Pooleys (& other) plates
- Phone them
- 50K/Google maps

**Personal minima** - checklist

**Route**
- Kneeboard & PLOG - on Map?
- Frequencies, Heights, SSR Frequency Monitoring Code (FMC), etc
Visualise & Manage Threats
(3) Electronics

GPS/MM (Moving Map), but you need ...
- Up-to-date software
- Up-to-date charts
- Airspace alerts on
- Batteries, power supply

Electronic Conspicuity (EC)
- On
- Narrow range
- Audio warnings only?
  Beware hearing is first sense to degrade when stress is on, use visual display as well if possible
So as pilots when we consider our approach to and use of TEM what are we actually trying to achieve?

- A capability to assess & avoid **THREATS** before they impact on us
- An ability to create and maintain the capacity to **trap** **ERRORS**
- Which allows the pilot to **mitigate** an **UNDESIR ED AIRCRAFT STATE (UAS)**, accident or incident

However we routinely operate in an environment which is **dynamic** (airspeed), liable to **constant change** (weather) and contains **invisible hazards** (controlled airspace, windshear, ATC) all of which can conspire to **overload** our ability to think
Types of Threat

**Anticipated** - from planning/preparation eg weather, airspace, etc
- Depend on pilot experience & knowledge, etc
- Requires reasonable pre-plan & self-briefing, and...
- ‘What if’ - changes/differences to plan if threat appears
- Can be fascinating. Define variation in the airfields we visit. A sea level, single concrete runway in Norfolk with an R/T frequency is more of a known entity (and a lesser threat) than a non-R/T, short grass strip, in a steep wooded valley in Scotland where local knowledge is required to operate safely

**Unanticipated** - late seen conflicting a/c, instrument failure, etc
- More difficult to pre-empt/quantify as they can change eg weather at destination or other a/c encountered in flight
- Also depends on pilot’s experience & knowledge
- Relies on broad skill and knowledge base
- Development of transferrable skills
Watch Out!

As part of our SRM process of using all sources of information to plan ahead, the potential of all threats should be assessed with equal weight to best of our ability.

However be aware that we can’t remember everything.

So try to pick out a max of 3 or 4 main threats that you will “watch out for” above all else.
Your Threat Assessment Skills?

In the following ‘fun’ exercise we present a fictitious airfield along with it’s 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 ...

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

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EGVF Oct 220830z-221700z

Rotary wing circuit activated

Doomland intense military helicopter activity within 3nm radius SFC-1000ft agl

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EGVF Sep 090000z-TFN

A/F Lighting U/S

Doomland RWY 22 PAPI u/s
How did you get on?

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?

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 from 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
- Helicopter activity within 3nm of RAF base – risk of airprox and rotor wash/wake
- RAF base airfield lighting of no consequence to us
Heart of Threat Management (1)

- **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
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**

- **Accept** something is likely to go wrong, just can’t know where or when
- **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 and a/c is now in UAS, so
  - Correct it and then analyse why
TEM Tools & Techniques

- 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 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 Section 4: ADM)
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*
# SA vs Threats & Errors

<table>
<thead>
<tr>
<th>State of error Management (TEM)</th>
<th>Workload</th>
<th>Spare capacity</th>
<th>Level of situational awareness (SA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVOID</td>
<td>LOWEST</td>
<td>HIGHEST</td>
<td>THINK AHEAD</td>
</tr>
<tr>
<td>TRAP</td>
<td></td>
<td></td>
<td>UNDERSTAND</td>
</tr>
<tr>
<td>MITIGATE</td>
<td>HIGHEST</td>
<td>LOWEST</td>
<td>NOTICE</td>
</tr>
</tbody>
</table>

AVOID: Understand how to avoid errors and threats in the current task.

LOWEST: Maintain a low workload to keep the task manageable.

HIGHEST: Use the highest level of spare capacity to handle unexpected situations.

THINK AHEAD: Always think ahead to anticipate potential threats.

UNDERSTAND: Understand the current situation and make informed decisions.

MITIGATE: Use the lowest level of spare capacity to mitigate risks.

LOWEST: Maintain a low level of workload to focus on the task.

NOTICE: Always be aware of the environment to notice potential issues.

©BMAA
A pilot who routinely ‘THINKS AHEAD’ will experience the **LOWEST** mental workload. Will have the **HIGHEST** spare thinking capacity - the most empty ‘bucket’. 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?
As can be seen from the chart, MITIGATE indicates that a pilot is operating at the lowest level of Situational Awareness.

“So that must be bad, right?”

ABSOLUTELY NOT!

MITIGATION is NOT Failure
NOT MITIGATING is Failure
“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.”
Don’t be too Hard on Yourself!

• Operating at mitigation level may appear to be the lowest acceptable level of your TEM skill by relying on falling back on the last line of defence

• However we should remember that pilots are routinely exposed to complex and varied threats where perfection will be rarely achieved

WE ARE ONLY HUMAN

• At least the pilot who mitigates will still get home safe to their loved ones, having avoided flying into terrain, controlled airspace or the wrath of the authorities!
SOPs, Checklists, POH

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’
Good TEM & High SA

Good TEM combined with high SA is the GOAL

But not one that you should approach only when you’re strapped into the aircraft!

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 on the Ground?

- Because we are **free from distractions** of flight (and other things?)
- Generally our **workload is low**
Times of Low Workload

The following 2 aide memoirs from the briefing section of a UK airline’s checklist both start with:

1. **Threats**/MEL-CDL/AIS/Weather/Take-off Alternate/Taxi Route/RWY/Terrain awareness/Flap/Fixed De-rate/Perf NOTAMs & Restrictions/SSA/MSA/Transition Altitude/SID/AFDS/Radio AIDS/Emergencies/Review


**QUESTION:** which briefings do they represent and why?

1. The Pre-takeoff briefing
2. The Approach briefing

**Why?** Specifically because they are both used at *times of low workload* for the pilots allowing the threats to be *carefully* considered *before* the engines are started and *before* the top of descent point in the cruise.
Workload

The workload we experience can be directly attributed to 4 main factors…

- Difficulty of the task
- Number of tasks running concurrently
- Number of tasks in a series (switching from task to task)
- The time available for the task (speed of task)

And **high workload** (overload?) is associated with **increased errors**, fatigue, task degradation and poor performance and can lead to..

- **Loss** of Situational Awareness (SA)
- **Poor** prioritisation and decision making
- Focusing on one element to the **detriment** of all others
Mental overload by its very nature generates one of the most dangerous states a pilot can find themselves in because it:

- Is extraordinarily difficult to recognise in ourselves (if we don’t think it’s happening we won’t do anything to fix it)
- Clouds our judgment, possibly leading to irrational decision making
- Physiologically it degrades our hearing first thus (in the case of single pilot operation) can remove our ability to comprehend instruction, guidance or help from an outside source such as ATC
Dangers of excessive workload and focus on one element are amply illustrated in fatal gyro plane accident in 1998.

The accident led to CAA banning of the use of PVC fuel pipes in aircraft.

“Evidence indicated that at some stage during the accident flight the fuel tank contents transparent PVC sight-tube had become disconnected from the lower fuel tank outlet pipe, which would have allowed fuel to have been lost from the fuel tank... , it was considered possible that during the final hover manoeuvre the pilot, whilst looking down from the left-hand side of the gyroplane for a possible ground reference, had noticed the leaking fuel and the disconnected sight-tube, which may have been 'flailing' in the airflow... The close proximity of any fuel leakage to the hot exhaust may have concerned and distracted the pilot and he may have inadvertently allowed the gyroplane to adopt a nose high attitude before it started to slide backwards; a manoeuvre from which he did not recover.”
Know Thine Enemy

Be aware that mental overload is...

*the absolute enemy of effective TEM*

It’s here we introduce the concept of the pilot’s ...

CAPACITY BUCKET
We all have a **Capacity Bucket** and it gives us a useful metaphorical reference to approaching **MENTAL OVERLOAD**

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

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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:

Aviate -> Navigate -> Communicate

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
- if you’ve infringed controlled airspace speak up and get help

Aviate -> Navigate -> Communicate is the ultimate form of MITIGATION, and it will keep you safe
Managing Workload

So now we know *why* it’s vital to try to raise our SA and protect our capacity by pre-briefing while we are in a position to take it all in.

Now we will go on to identify *what* we’re looking for.
To Err is Human

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

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.
Errors

Could be either

- **Unintentional** – a slip or lapse by pilot or
- **Intentional** - deliberate, non-compliance e.g. shortcuts which violate SOPs/POH/SB

Both types are

- **Knowledge-based** – you should know, or
- **Skill-based** – you do one thing when you should do another

Handling errors are most common Microlight errors, and can have most serious consequence
Professional Pilots  
– are they error free?

- 60% flights have 1 error or more
- Average has 1.5 errors
- Of those, 25% are mismanaged leading to:
  - Further error, or
  - Undesired aircraft state
- 60% of total errors go undetected by the crew

And yet aviation remains statistically the safest method of long distance transport.
Microlight Pilots – are they error free?

⚠️ In a professional, complex airline cockpit errors are considered ‘normal’, so..

⚠️ Is Microlight cockpit likely to be any different?

⚠️ Absence of proper confidential data collection system makes accuracy impossible in Microlighting, but..

⚠️ Analysis of available data suggests we are NOT so different, and..

⚠️ Reinforced by flying club/crewroom chat/tales!
Microlight Error Mismanagement

By the nature of the airfields from which they operate microlight ‘errors’ are believed to be 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 & very close to ground accounts for only 15% of flight time.

So, half of accidents/incidents occur in 1/6th of flight time.
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’ 

\[ \text{A/C stalled & crashed} \]

‘The aircraft adopted a steep nose-high attitude immediately after lift-off. The pilot closed the throttle and applied forward pitch control in an attempt to land back on the runway, but the aircraft stalled, dropped a wing and struck the ground. The pilot considered it likely that the trim lever had been left in the nose-up setting used for the previous landing’. 

\[ \text{Pilot - serious injury} \]
Learning from Errors
- mine & yours!

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**

If not we run the risk that our ego takes over leaving us ripe for a fall

Remember:
*Flying is too expensive & dangerous to learn everything ourselves, we must learn from others*
Threat & Error Management is about how pilot anticipates or responds to threats & errors.

**Remember..**
- You cannot avoid **threats** & you will always make **errors**
- Thinking ahead from before you get to the aircraft is key - managing threats & workload to give you time
- Pre-flight ...
  - Consider **threats**, because mismanaged threat is linked to or causes **error**
- An error that is NOT detected CANNOT be managed, yet...
  - Mismanaged error reduces safety margins
  - by linking to or inducing additional error, or
  - leads to Undesired Aircraft State (UAS) and
  - this may lead to Accident
An error that is **detected & managed** effectively has no overall adverse impact on a flight. It is

• Largely inconsequential
• A good learning /debrief point

A **mismanaged** error reduces safety margins

For both airlines and Microlights

• Descent, approach & landing account for majority of mismanaged errors
• Errors on ground are not as difficult to manage as errors when approaching ground
• On ground our **capacity bucket** isn’t (yet) full
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**
Threats vs Errors

Which is the most dangerous?

- **THREATS** are always present but on their own won’t kill you
- **ERRORS** can be more serious but we all make them and will quite often go initially unnoticed

Which leaves **UNDESIRED AIRCRAFT STATE**

*If you find yourself here you have already LOST your SITUATIONAL AWARENESS (SA) and eroded your safety margins and could be heading towards an accident*
Undesired Aircraft State

It **MIGHT** mean crash or smash & refers to unintentional ...

- Position, speed, altitude or
- a/c configuration resulting from pilot error, action or inaction
- It clearly reduces safety margins, and...

**Results from**
- *Ineffective* error management, OR
- Capacity *overload*
  i.e. Capacity Bucket is full+

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Undesired Aircraft State

Airline's measure UAS to improve safety - and it works!

Although UAS are still prevalent, with:
  • Vertical and/or lateral deviations
  • Speed/attitude control errors, etc

Very doubtful we Microlight pilots are very different

So, many Microlight UAS will be the same, and

Many start with mismanaged threat or pilot error
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.
“Whilst carrying out a training flight in the Ince Blundell airfield circuit, the instructor was informed by personnel on the ground that the left main landing gear structure appeared to have failed. After completing a low pass, the ground personnel confirmed the failure so the instructor declared a PAN and diverted to RAF Woodvale, where a successful landing was carried out. Examination of the aircraft confirmed that the left main landing gear axle had failed due to a previously unidentified crack, which had propagated into fatigue. The aircraft was used primarily for training from grass runways which the owner believed, contributed to the crack formation and growth”

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.”
How do Microlight pilots develop good TEM?

If we mismanage our approach to, and use of TEM, we won’t actually achieve key aims.

We need to develop

1. A capability to assess **THREATS** before they impact on us
2. An ability to create **and maintain** the **capacity** to trap **ERRORS**
3. Which allows the pilot to mitigate an **UNDESIRED AIRCRAFT STATE, accident or incident**
Preparation is Key

_for pilots – professional or Microlight_

“Time spent in preparation is seldom wasted”

- TEM is **thinking ahead** to be better prepared
- By spending time **on the ground** thinking what might go wrong, you will be better prepared **in the air**
**TEM Summary**

**Threats**: sources of harm or risks that are outside your control
- They can cause **harm**, impact safety and reduce the fun of flying!
- But they can be **assessed & reduced** to minimise the risk to acceptable levels

**Errors** can be dangerous BUT
- They are **normal**: we all make them
- By being be **ahead** of the game we can minimise & spot them

**Manage** by getting ahead of the game
- Keeping the capacity bucket **below** maximum
- **Start** pre-flight
TEM Summary

The empty capacity bucket allows us to

Avoid – Trap – Mitigate threats & errors

NOT mitigating is failure, not the other way round

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
Section 4.
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 – It Can Be Taught

- US FAA mandates ADM as part of pilot flying training

- Independent studies show pilots who receive such training make fewer in-flight errors

- 10-50% fewer errors!

PROOF THAT IT CAN BE TAUGHT!
Conventional DM

- Everyday, every minute activity
- Triggered by..
  - Something that **changes** - engine note, heavy steering or..
  - Something **hasn't changed** that should have done - engine note on gear change,
  - The situation you were experiencing has changed - cars each side of you at traffic lights start to move
- Not noticing it can lead to a mishap
- **Change requires appropriate response/action** to modify ‘new’ situation & bring about desired outcome
- Situation Awareness (SA) - knowing what’s going on – is key to successful and safe DM
- In an ideal world we would **evaluate** the full range of possible outcomes before deciding so we get the best possible outcome
Aeronautical DM

- Builds on foundations of conventional/everyday decision-making
- Enhances it to decrease probability of pilot error
- Provides structured, systematic approach to analyse changes in a flight and how these might affect safety of flight

We will cover

- All aspects of decision-making in cockpit, and
- Steps involved in good ADM

In all decision making

- Need to evaluate full range of possible responses
- To get best possible outcome
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**
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** (only briefly covered in this module)

- Develop risk assessment skills – **TEM**

- Use all resources available – **SRM**

- Evaluate effectiveness of your ADM skills - **Self-debrief**
Remember the 6 Hazardous Attitudes?

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

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Antidote</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anti-authority</strong> -</td>
<td>don’t tell me, I know. Follow the rules – they’re usually right</td>
</tr>
<tr>
<td>They resent rules.</td>
<td></td>
</tr>
<tr>
<td><strong>Impulsive</strong> -</td>
<td>do something, anything but quickly. Do first thing they think of &amp; it’s rarely right</td>
</tr>
<tr>
<td>They resent rules.</td>
<td></td>
</tr>
<tr>
<td><strong>Invulnerable</strong> -</td>
<td>it won’t happen to me so more likely to take risks</td>
</tr>
<tr>
<td>They resent rules.</td>
<td></td>
</tr>
<tr>
<td><strong>Macho</strong> -</td>
<td>I can do this. Want to prove themselves &amp; impress others so take risks</td>
</tr>
<tr>
<td>They resent rules.</td>
<td></td>
</tr>
<tr>
<td><strong>Resignation</strong> -</td>
<td>what’s the use, tend to believe in luck. So leave action to others and accept unreasonable/risky requests</td>
</tr>
<tr>
<td>They resent rules.</td>
<td></td>
</tr>
<tr>
<td><strong>Complacency</strong> -</td>
<td>it’ll be fine, why worry? Reduced awareness of danger</td>
</tr>
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<td>They resent rules.</td>
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</tbody>
</table>

Complacency – it’ll be fine, why worry? Reduced awareness of danger

Whatever your confidence and contentment it CAN happen to you.
5 senses are ONLY means by which external info gets to brain.

BUT

Technically we cannot detect everything:
- high frequencies, sight at night, speed, etc

The sense/brain mixes/misinterprets signals:
- e.g. slip of tongue or operating wrong switch

The senses/brain also block some of the info from being processed:
- e.g. there’s too much info
- expectation/anticipation of what info we expect, this can be over-riding so we
  - Don’t always ‘hear’ to what is said to us - missed ATC radio calls
  - Don’t always see what ‘info’ comes into our eyes - the late seen a/c
  - Don’t always see what we think we see..
Human Senses (2)

- Sight is dominant, but..
  - We ALL have (at least) a blind spot where optic nerve enters eye

- If stressed or overloaded
  - our hearing 1st sense to degrade/’disappear’

- Usually we can see or ‘attend to’ only image/conversation 1 at a time
Seeing is Believing?

- Faces or a Vase?

- Whichever it is, you can see or ‘attend to’ only 1 at a time

- i.e. You can only make 1 decision at a time

- Multiple, coincident decisions are ONE decision being made plus motor (automatic) responses
Because of processing and memory **limitations** of the brain some things are missed and/or mis-interpreted.

Need attention as brain cannot ‘**attend**’ to every piece of info it receives.

Info **perceived** & ‘noticed’ by brain if it is stimulating
- The stimulus is **remembered** by a special ‘sensory memory’, just long enough for...
- An **unconscious** interpretation or ‘perception’ is then assessed to determine whether the info is important enough to draw the person’s attention to it.
Processing Information

- Info perceived & ‘noticed’ by brain ONLY if it is stimulating to subconscious - then brain ‘brings it to our attention’

- Then we 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 true **when time is short** - as in air

- Motivation, attitude, emotion, distraction all help to **block**
  **accurate gap filling**

- That means the **brain may NOT fill-in correctly** in some circumstances

- Likely to be unaware because gap-filling is smooth and **automatic**
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

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

- Normal process of decision making
  - Written scoring system
  - Pros & cons/good & bad

Doesn't work in the cockpit

- Requires mental effort
  - to consider ALL permutations
  - to arrive at optimal solution

Effective in limited situations as it requires complex analysis, so it's usually **incomplete**
Rational Decision Making

- Predictable issues
  - usually trained for

- most in-flight decisions
  - usually rule-based

- Novel or complex situations, like diversion, may require rational DM
- Combination of circumstances/options - maybe with emergency – can be different every time
- New & unpractised (?), unanticipated & undesirable, so IF WE CAN
  - Consider & discuss carefully rather than act intuitively
  - Consult other pilot/other aircraft, ATC, 121.5, etc
- Complex & novel situations are not conducive to clear thought so use ‘DECIDE’
Structured process – it DOES NOT make the decision for you!

Improve SA & Risk Management

- **Define** decision to be made - Bad weather ahead
- **Explore** options - go L, R or back
- **Consider** consequences of each option
  - e.g. Controlled Airspace (CAS), high terrain, shortest distance, over water, etc
- **Identify** what’s important - have I got enough fuel
- **Decide & implement**
- **Evaluate** effects/results as you go
  - If not working out divert, land, refuel and wait for weather to clear

This approach requires time
Rational DM requires **time**, especially in air

First thing to consider is **whether time is available**: T-DECIDE

Briefly consider time available - ‘time spent in preparation’, etc

**EFATO not time to take time!**

4000ft agl, running out of fuel, lots of available fields - maybe time to DECIDE

Rational DM process does NOT replace good training and expertise, it augments it - so practise
Remember 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.
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

- Info that comes to mind easily more likely to influence hypothesis
  - Flying is safest form of transport, but air accidents have high media profile so most recently available info for most people is of an accident, so people are unreasonably afraid of flying
Shortcuts & Anchoring

Reducing time & increasing workload

Most times we don’t seek an optimal solution, just a satisfactory one.

Anchoring and adjustment
- Brain still influenced by things it ‘knows’

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.
Shortcuts & Anchoring

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”
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 e.g. hot day & heavy aircraft are ‘**ignored**’ in favour of the **evidence** that it will be ‘all right’ because the wind is right down the runway.

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

“The pilot expected that the return journey would take approximately 30 minutes, the same amount of time as the outbound flight”. Inbound wind was 5-10kts on tail.
Example: **Instrument discrepancy** *digital vs ‘steam-powered’*

⚠️ “The pilot attributed the accident to the Skyview (EFIS) system indicating an incorrect, high, airspeed”

**Decision** to take-off 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”

⚠️ **Outcome:** Stall after take-off 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
Shortcuts - Knowledge

- Shortcut useful & prevalent as **workload increases**
- When decision not critical this **helps prioritise** attention/resources elsewhere
- BUT can lead to **incorrect** diagnosis
- Decision review - ‘Evaluation’ – essential

**Example: 727 vs C172**

- Capt. unsure of 172 position, asks crew “are we clear of that Cessna?”,
- No-one knew for sure, “probably behind us now” i.e. he is ‘supposed to be behind us’
- No-one actually sure, Cessna cannot be seen SHOULD have been cause for concern
- But the fact they cannot see it becomes evidence for supporting idea that it is behind them
- 727 collided with C172

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

Process primed by deeply-learned, ‘**implicitly learned**’ expertise

- ‘Typical’ situations recognised from **previous experience**, so
- **Practice & learning** (= experience) is essential - EFATO, PFL, etc
- **Simulate 1st option that comes to mind as long as satisfactory**
- If 1st option NOT satisfactory then move on to another – serial processing of options
- But better options may not be considered
- However, keys are speed and workload – not optimisation
Fast Decision Making

May not be open to **conscious** scrutiny at time

We feel **confident** in a choice without knowing why - ‘can’t put a finger on it’

But don’t always opt for option that ‘feels’ **better**

We should at least **scrutinise** why

Intuitive decisions based on **typical** circumstances, so in today’s circumstances? Are today’s circumstances **atypical**?

**Scrutinise** atypical features

Always Review decision - **Evaluate**

Quickest decisions - Intuitive

Reducing time & increasing workload
Evaluate

- Relative success or failure of flight may hinge on how well you did **DECIDE**

- So essential to evaluate the outcome of **EVERY** decision, then...

- Start **DECIDE** again

- ADM stops **ONLY** when the flight is ‘put to bed’ - physically and mentally
Decision Errors

 sebuah alternatif - tanya pertanyaan tersebut dalam cara lain
- “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 that helps us make decision quickly, often (usually?) without considering all available (and relevant) info
- We jump to conclusions

Bias
- Look for info to confirm a decision already made
- The 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
  - In taxi clearance a newly-based pilot will have no experience of how to get to R/W28 which will lead to different model of how to taxi than pilot based there long-term

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

  *‘Press-on-Itis’*
Factors Contributing to Decision Errors

Four factors contribute to decision errors

- **Situations not recognised** as requiring a change of action, due to:
  - Ambiguity of cues
  - Poor SA

- **Erroneous Risk Perception/Management** - pilots typically under-assess risk associated with situation - ‘Press-on-itis’

- **Goal Conflicts** - Willing to accept safety risk to arrive at long-planned fly-out. Peer pressure & loss-of-face by turning back

- **Workload & Stress** - overload Capacity Bucket, degrade mental processes, tunnel attention, etc. Making correct decision becomes difficult
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
  - e.g. 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

- What went well, went as expected?
- What was unexpected, how was it managed?
- What could have been done better, and how?
- Recommendations/lessons learned for future flights and Group members

Be self-critical & honest

Mistakes and errors of judgement are inevitable, key is to...

- Recognise, analyse and learn lessons
- Use T-DECIDE and evaluate every aeronautical decision
Post-flight Evaluation  
- The Debrief

**Rule of Thumb** is efficient mental shortcut that allows us to make a decision, pass judgment, solve a problem quickly and with minimal mental effort.

**Reduce burden** of decision-making and free-up limited cognitive resources

- help empty the capacity bucket a bit, BUT...

They can be costly when they lead us to miss critical information or act on unjust biases, so we need to evaluate after the flight.

We MUST be honest

Honest debrief helps to reduce bias

- Because we now have info that won’t necessarily confirm decision we made or would otherwise have made

**Add** to our expertise, training & experience

- Helps us see world slightly different because of the new experience
ADM 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

- Rational DM - perfect but needs TIME & requires mental ability (not always ‘available’ in air?)
  - Augments good training and expertise
ADM 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**
Three Levels of SA

**Level 1:** Extract information from the environment

**Level 2:** 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

**Level 3:** Anticipating 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.
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
  • Exceeding Limits, minimums, regulations etc
Contributions to Poor Mental Picture

- Poor or no information, inc.:
  - Lack of attention
  - Failure to gather info
  - Anomalous info
- 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
High situational awareness should be a **conscious goal** but as **single pilots** workload has a habit of creating a **vicious circle** where the **busier** we are, the **less capability** we have to **asses** our own **declining** SA

“Without reflecting upon how we think and act (especially under stress)... (we are)... more vulnerable”

It would therefore be useful for the **single pilot** to have the capability of **assessing their own** current state of SA without needing to rely the second opinion utilised in a multi crew environment.
**Incident**

‘The instructor announced on the RTF Air/Ground frequency of 123.5 MHz the cross-country student’s duration of flight and ETA. He then transmitted that his aircraft was ready for take-off, and this was acknowledged by the aerodrome manager who was monitoring the radio’.

‘neither of the 2 occupants of the (microlight) saw the (other a/c), and cannot recollect any RTF calls from this aircraft in the circuit’

‘(microlight) took off’.

‘(other a/c) was seen to carry out its third touch and go landing…and also climb away’

‘(other a/c) caught up with (microlight) and collided with it from behind’

**Result:** 1 x fatal injury, 2 x injured
As Chief Scientist of the U.S. Air Force, Dr Mica Endsley proposed that the three levels of Situational Awareness are:

- **Perception** of elements of the surrounding environment
- **Comprehension** of the current situation
- **Projection** into the future state

**Three long words all ending in the sound “shun”, simple to recall for a pilot under stress?**

**Or just another complication?**
First introduced by British Airways to remember the concept without the complication of remembering
• Perception
• Comprehension
• Projection

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?”
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
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
Improving SA

- Think ahead
- Identify threats
- Consider your response to them
- Remember to empty your Capacity Bucket - minimise overload
- Reinstate scheduled ‘5 Ps’ assessments
Summary

Be a NUTA - Notice, Understand, Think Ahead

Means you are better prepared 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?

Poor SA can be caused by distraction, fatigue, etc

Focus on what you DON'T know about the flight that you SHOULD know 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”
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 the ‘5 Ps’

The **scheduled** framework to analyse the info gathered and consider the threats **before and during flight**

The ‘5 Ps’ comprise:

- Plan
- Plane
- Pilot
- Passengers
- Programming

For maximum effectiveness it is recommended that the ‘5 Ps’ be considered at least once prior to each of the 5 flight periods – including **pre-flight**
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?
By now you should be aware of the vulnerabilities of operating as a single pilot but that is only half the story because so far we have not mentioned the potential issues of flying with another pilot or passenger.

As microlight pilots we tend to want to share our enthusiasm for flight with as many takers as we can find, leading us to fly with a broad cross-section of personality types - some experienced, some keen, many nervous, etc, and the conscientious pilot will adapt the flight to suit the passenger.

Passengers will want to enjoy the experience and an unfit passenger almost certainly won’t enjoy it, and nor will the pilot.

Why not IMSAFE your passenger too?
All passengers also need to be adequately briefed - especially non-pilot passengers.

When appropriately briefed, passengers can be an asset to flight safety (i.e. spotting other aircraft) but they can also take up valuable capacity by way of distraction, and in some cases, do their best to catch you out!

As the unfortunate pilot of this C42 was to find out:
“the pilot started the engine and ran it at idle to allow it to warm up. His passenger was strapped in and the doors were closed but the passenger complained that she could not find her mobile telephone and suddenly, against the advice of the pilot, opened the door, stepped out of the aircraft and into the path of the rotating propeller.

She suffered a suspected dislocated shoulder and two of the three composite propeller blades were damaged.”
Pilot Passengers are Also Human

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.
“...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

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

Did pilot have ‘flight’ response of ‘fight or flight’, psychologically fleeing from threat by leaving it to pax? What - if anything - went wrong?
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 - e.g. 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
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 handout.
Stress: a Brief Introduction

- **Stress** - nervous tension or mental strain - is very personal. One person’s stress may just be a fillip to another: flying is a good example.

- Recognise it exists in us ALL & recognise your OWN signs use IMSAFE checklist honestly

- A person may experience stress on one occasion but not the next, partly because *successful completion of stressful task will mean less stress next time in similar situation* - good experience

- Stress comes from the **demands** we perceive to be placed upon us, and our ability we perceive we have to **cope** with the actual demand.
There is **feedback** mechanism so once we have successfully completed the task we reduce perceived demand of us and we increase our perceived ability.

**Demands** we place on ourselves which exceed our capacity to cope with them - our Capacity Bucket is full/overflowing - make us overstressed.

Stress is **cumulative** - domestic stress taken into cockpit (C/P) increases our flying stress levels.
Cockpit stress
- lack of experience, noise, vibration, weather, pax

With little or no stress our vigilance is low
- low Situational Awareness (SA), so performance is low

Stress gets us ‘keyed up’ to act & promotes performance
- until the overload point

High/overload stress levels
- Narrowing of attention, errors made, and important data missed or incorrectly interpreted by brain
- Funnels attention onto tasks we perceive as important and others (maybe truly more important) are ignored. We may reject vital info purely because we are overloaded
- Unable to time physical movements accurately
- A key effect for us is ‘confirmation bias’
- Hearing goes first

We lose SA
The ‘fight or flight’ response (covered shortly)
Coping with Stress

How do we cope
- adjust to perceived demand or change the situation causing it

Increase your stress tolerance - adjust by..
- Training - take course/module, so reflex responses are performed under stress
- Experience - 2 yearly check on things you find stressful, additional training or FI advice
- SRM & TEM - think ahead to avoid or mitigate threats causing stress and increase SA

Remove/reduce issue causing stress
- e.g. weather - delay take-off or maybe re-route.
- Use TEM & SA
Coping with Stress

- No simple cures for excess stress
- Requires positive effort to achieve confident state of mind for flying.
- Learn and acquire knowledge & experience to develop automatic responses which cost little in energy and strongly resist stress
  - Learn from your and others’ experience, especially in handling emergencies
  - Thorough pre-flight briefing and preparation to anticipate threats - threats cause stress
Unexpected Threat
- Fight or Flight?

Since before man walked upright, we developed the ability to assess risk vs reward in its most basic form, **the fight or flight response**

*Note that in this context flight means to flee or run away and has nothing to do with aviation!*

It is the flight or flight response that makes us sprint out of the way when surprised by a rapidly approaching car or jump when watching a horror film.

This can lead to:
- **panic**
- **freezing**, or
- **rushing** into a bad decision
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.
The Danger of Fight or Flight

Unless equipped with an ejection seat, we as pilots rarely have the option to run away from an issue arising in flight.

We are usually compelled to ‘fight’

However the effect of the brain during this process can be so powerful as to override our ability to think clearly and act rationally which could lead to poor decision making.

Let’s look at some examples where perhaps taking a little more time to override the flight or flight response might have had a more positive outcome.
“As the aircraft approached the town... at an altitude of about 1000ft, a large section of canopy detached, following which the pilot decided to make a forced landing in a nearby grass field. The nose gear collapsed during landing and the right wing, propeller and engine support were damaged. The pilot was uninjured.”

“The pilot reported that he had placed himself under pressure to land expeditiously due to his passenger becoming nervous. The aircraft rolled onto its right side, bending the right wing leading edge and the king post, and damaging the right wheel spat. The pilot and passenger were uninjured. He considered that with hindsight, and given the calm wind conditions at the time, he should have gone around and landed on the longer 300m runway...”
“ Whilst flying at approximately cliff-top height over a deserted beach, the aircraft suddenly rolled to the right and it required full movement of the control bar to return the aircraft to a wings level attitude. The pilot was concerned by this sudden and unexpected departure from level flight and elected to make a precautionary landing to check that there was no fault with his aircraft. He identified an area on… the beach. When the aircraft landed, the nosewheel dug into the soft sand and the aircraft flipped over before stopping… both the aircraft’s occupants were uninjured and they vacated the aircraft. The pilot later considered that the most likely reason for the unexplained roll to the right was air turbulence.”
Beware that ‘flight’ in this context does NOT always mean that some action will occur.

‘Flight’ is a psychological state that can result in ‘freezing’ - the ‘the rabbit in the headlights’

This could be particularly relevant in the cockpit with any sort of passenger.
With any kind of passenger …

‘on final approach the aircraft sank in turbulence, and this alarmed the passenger who then, inadvertently, restricted the control stick from being moved rearwards. …the pilot could not prevent the aircraft from descending rapidly, and the left main landing gear detached in the ensuing ground contact…’

‘At around 100 ft the microlight began to drift to the right of the centreline and the instructor said ‘I have control’. The student pulled the control bar fully back and froze. The instructor immediately applied full power and attempted to push the bar forward. Despite repeated vocal commands the student did not release the control bar and the microlight struck the ground at around 80 mph’.
Even with a qualified pilot...

“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.”
‘Press-on-Itis’

Press-on-Itis’ is a dangerous mental state that can affect even the best and most experienced pilots.

It is a psychological phenomenon as a result of a decision making error that involves starting a flight or continuing toward a destination despite a lack of readiness of the aircraft or pilot and the availability of reasonable lower-risk alternatives.

It often occurs when the pilot feels time pressures or a compulsion to continue to land despite warnings of bad weather from ATC or other crew members.
‘Press-on-Itis’

Example:

You carry out your magneto check and feel the engine isn’t happy but you’ve only got 15 miles to get back to base and dinner booked for 7:30...

Many accidents are caused or suspected to be caused or contributed to by **Press-on-Itis**.

This is any unreasonable pressure to get to the destination, whether self-generated or externally-imposed (perhaps by a promise to take a friend flying on a certain day) and can cause a pilot to decide to continue to their planned destination despite conditions being unsuitable to do so.
We all love what we do, but have you ever been tempted to show off?

In 2017 a French study by the BEA (Bureau of Enquiry and Analysis for Civil Aviation Safety) concluded:

"since 2004,... **more than 120 accidents** had occurred during manoeuvres not required for normal flight, indicating that pilots were clearly taking risks caused by emulation.

Of these, at least **70 fatal accidents** had resulted in the death of **nearly 120 people**, representing **13.5% of fatalities** in general aviation accidents since 2004’
In more than half of these 120 accidents ... suggested that the pilot may have been seeking to do some form of demonstration to third parties on the ground.

In more than 20 cases, the presence on the ground of spectators, particularly people close to the pilot, was confirmed.

This form of demonstration could also be carried out to impress passengers.

In two thirds of recorded cases, the pilot was accompanied by at least one passenger.
“The accident occurred at the start of the return flight after participation in a vintage aircraft rally for which no demonstration flight was planned. After flying over the runway centreline, a half-roll to the left was performed, followed by a descending half-loop. This manoeuvre was not carried out at the altitudes required for aerobatics… (and) did not provide a sufficient safety margin to avoid collision with the ground at the end of the manoeuvre.

The investigation did not find any technical failures… The pilot’s recent experience… meant that he lacked sufficient points of reference for performing aerobatic figures… During the manoeuvre, the aircraft flew over parking areas and collided with the ground about 40m away from numerous spectators. The number of casualties could therefore have been much higher. As the rally did not meet the definition of an air show, no safety study had been carried out regarding the immediate proximity of a large number of people”
Risk Normalisation
(Normalisation of Deviation)

As humans and pilots we are regularly exposed to risk. However it is critical to understand that if a pilot takes a risk beyond their normal level of skill and experience and yet survives this can lead to a skewed perception of risk in the future.

The pilot will most likely approach the risk next time with ‘been there, seen it, done it’, attributing their previous success to skill not luck.

This failure to recognise the ‘lucky escape’ may lead a pilot to accept higher risk than their experience should allow and dramatically increase their chances of an accident in future.

As Jester said to Maverick in Top Gun
“That was some of the best flying I’ve seen to date. Right up to the part where you got killed”
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 e.g. ‘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)
Programming & Automation

Electronic systems/displays like GPS (Moving Map (MM)), Electronic Conspicuity (EC), Electronic Flight Instrument Systems (EFIS) & Autopilot can reduce pilot workload and aid increased Situational Awareness.

Even the humble radio can help e.g. pre-load a frequency for a new airfield on the ground (when your capacity bucket is low)

Programming/operating them can create serious distraction from other tasks

The way to mitigate this risk is by

- risk by having a thorough understanding of the equipment long before take-off
- Planning in advance when & where any airborne programming changes should be carried out as well as times when changes should NOT be attempted
Aids to your SA

- All electronic systems have **limitations**, none are perfect.
- Key is to **know** what they can and cannot do.
- Settings for one pilot not necessarily settings for another, so..
- In Flying Group allow time to check/re-set electronics **BEFORE** flight.
- Position 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 screen?
- Whether GPS, EC, EFIS or Autopilot these systems ONLY aid your SA **They do NOT replace it**
The availability of GPS-based navigation software has never been better, what was once the preserve of the business jet pilot at enormous cost can now be purchased cheaply and used by anyone with a mobile phone or tablet.

Their positive impact on planning capability, airspace avoidance and enhanced Situational Awareness shouldn’t be underestimated particularly when coupled with one of the traffic collision avoidance systems, which not only display but physically warn of approaching aircraft.
Specific GPS systems’ capabilities will not be explored here but most will be familiar with the ease with which our navigation tasks can be planned.

Combined with instantly downloadable weather and NOTAM information ensures that not only will our route be accurate but also (unlike a paper VFR chart) always up-to-date.

Our navigation “Plog” containing our speed/distance/time/heading/fuel burn calculations that once took hours with a protractor and “Whiz-wheel” can now be prepared and printed in minutes without the risk of human error.

*Perfect ... where do I sign?*
And yet a study in 2019 by the U.K. Airspace Infringement Working Group discovered that in a study of 403 infringement reports, 71.7% “had an appropriate moving map”
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:
Abillity 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
Primary task is to fly a/c
- remember A-N-C
- remember your lookout

MM proficiency really helps
- Do as much as poss on ground pre-flight - remember your Capacity Bucket – e.g. data update, NOTAMS etc.
- Screen visible in all light conditions?
- Does device overheat, especially in direct sunlight?
- Battery life in constant use, inflight charging options?
- Consistency of GPS/GNSS signal reception
- When first airborne – do a course error check – does it look like it’s working OK?
Primary task is STILL to fly a/c
- remember A-N-C
- remember your lookout

MM proficiency really helps
• When first airborne do coarse check - does it look like it’s working OK
• Any course adjustments - make then fly heading, avoid track crawl
• Long tasks e.g. re-route - break down into small, discrete ‘steps’
• Ask pax to programme re-route?
• Audio airspace alerts with appropriate settings
• Continue TEM & remember A-N-C
• Carry a 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 aircraft (7%)

“It could be said that nearly all infringements have distraction as a causal factor”
Built in Warnings?

Indeed they can, but is yours **equipped** to do so?
Or have you **changed** the settings?

As previously stated, when overloaded one of the first physiological effects is that we lose is our ability to hear, **so do we comprehend the warnings?**

Or maybe we routinely fly so close to controlled airspace (e.g. the Manchester corridor or London TMA) that we simply become “**alarm fatigued**” where we simply cancel a warning without considering what it’s telling us.
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!
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”.*
Electronic Conspicuity (EC)

зн ‘See and Avoid’ becomes … ‘See, Be Seen and Avoid’ - to help mitigate mid-air collision risk

Allows more awareness of other users in same airspace

Works without SSR/Transponder

Used for flight in Class G, and maybe other airspace Classes

Units are small, inexpensive & portable, and signals YOUR presence to others

There are still some issues of interoperability: the devices can’t all ‘talk to each other’ yet!

Not mandatory, not SSR, but … very useful for helping improve SA

Does NOT replace good visual lookout
Typical EC Systems

- FLARM, SkyEcho & Pilot Aware (and others) all offer great benefit
- Either stand-alone, or integrated in Electronic Flight Bag (EFB)/Tablet
- Technologies differ slightly, so capability and accuracy also differs
- Cannot show everything
Does NOT replace core flying skills, especially lookout
- it is an aid to SA

But it can help cover blind spots in lookout
  e.g. Converging traffic from behind

Need to understand what it can and cannot do: systems
  • Can be complex, and..
  • All currently have limitations & compatibility issues

EC measures own speed, height & position and compares to others
  • But standards differ – e.g. 1013 hPa vs GPS height
  • Accuracy especially of GPS is always an issue, &..
  • Vectors for climb/descent & heading may be instant or average

Text/symbology
  - need to know what it means and be large enough to see/read

So not good enough on its own for avoidance manoeuvres
Visual &/or audio alerts, may need ‘extra’ screen

Planned use
- what will you do IF you encounter a situation requiring traffic avoidance?
- What will you do if it fails in flight?

Make sure it:
- Is well-placed & secure
- Doesn’t block lookout/scan
- Has good batteries/power

If possible, check signal pattern as aerial positioning can make significant difference to detection and propagation, and therefore to performance/detection

Stay up-to-date with SkyWise, Software, etc

Record any undue ‘events’ and/or failures - help all learn lessons
Automation

With change of microlight weight category to 600kg we can expect the introduction of even more exciting and complex a/c types with an ever-longer options list for installed equipment.

It is therefore worth considering the potential impact on SRM of **autopilot** systems.

When *programmed and utilised correctly* an autopilot will:

- Increase flying accuracy
- Reduce pilot workload
- Allow safe multi-tasking thus increasing Situational Awareness
- Provide a smoother flight for passengers
However, the autopilot systems available at a microlight and G/A level can be expected to be more basic in function than their airliner cousins.

Therefore it is critical to understand that a microlight autopilot will not prevent you from ...

- Flying into the ground or another aircraft
- Infringing controlled airspace
- Stalling or overspeed
- Becoming overloaded and losing your SA

*Remember, an autopilot is a tool, and like all tools its performance is dependent on its operator*
An autopilot is a complex system consisting of a main computer taking external inputs from ...

- Environment (airspeed, barometric pressure, temperature and magnetic heading)
- Navigation data from GPS, ground based radio (ILS, VOR) and tablet based sources
- The pilot via the autopilot mode control panel

Which are combined to send signals to the..

- Flight control servo motors which control the aircraft
- Flight director on the Electronic Flight Information System (EFIS) display
- EFIS, autopilot mode display
EFIS display replaces conventional gauges normally found in light aircraft and presents a comprehensive amount of flight information.

When coupled with autopilot it will also display autopilot modes, active (in green) and armed (in white) adding to the complexity.

These modes are critical to understanding what autopilot is doing (or about to do) and must be monitored by the pilot.

**Failure to maintain mode awareness and autopilot status is probably biggest threat to single pilot who could be easily lulled into a false sense of security thinking that autopilot would keep them safe.**
It is recommended that you should monitor automatic flight with the same degree of vigilance and caution as if you had handed control to a *non-pilot passenger*

It will do exactly as it is told but that might not always be a good thing!

The next slide illustrates just one of the fundamental traps that an autopilot can set for you.
Using an Autopilot

The aircraft is climbing through 4260 ft to a target of 6500 ft.

The autopilot modes show: **AP HDG VS ALTS** (in white)

The pilot has selected a vertical speed of +2000 ft per minute which the autopilot is obeying,

**BUT**

The selected rate of climb is in excess of the aircraft’s capability!

The words “MIN SPEED” should be a clue here, but if not corrected, **this aircraft will stall.**

You could only imagine how the pilot would react at that point.
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
"We cannot solve our problems with the same level of thinking that created them."

(Albert Einstein)
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 True Story

- Pilot hadn’t flown for while

- Wanted to see various points of interest that would be useful on another flying training course in near future

- Wanted to take friend, who...
  - Had never been in Light Aircraft before
  - Had history of motion sickness in other forms of transport

- Set off for a map/stopwatch navigation exercise
“Lining up on the runway the pilot failed to correct a 5° DI (Direction Indicator) error.

The route planned started from overhead and quickly passed 1nm from CTA (base 1500ft).

After departure the pilot followed the LH circuit and climbed on the downwind leg.

Shortly after turning downwind, the aircraft ahead in reported that they were returning to land so the pilot of the subject aircraft decided the safest course of action was to continue climbing on the downwind leg and delay the turn overhead onto the planned heading.

This resulted in the turn occurring approximately 1NM further northeast than planned, a gentle turn with 10° AoB.

The result of the 2 actions, lead to a track error of 0.6nm, with the actual track offset to the NE, towards CTA. ... (cont) ...
At the top of the climb (1800+ft), the pilot completed the after-take-off checks. These included a gross-error check of the route and heading, and the pilot noted the ground features as expected.

During the checks the pilot became concerned about the silent passenger’s wellbeing and questioned how they were feeling, to assess if an immediate return would be required.

This led the pilot failing to note and correct the track error, caused by the late turn, and failing to correct the DI. The pilot also recalls the wind appeared stronger than forecast, leading to a further 10° track error. The pilot inadvertently entered CTA one minute after the top of climb.

After checking if the passenger was ok, the pilot noticed that the picture, particularly the aircraft’s position relative to a nearby airfield, didn’t look correct. They referred to their VFR Moving Map which was under their PLOG and noticed that they had infringed the CTA. The pilot expedited the exit of controlled airspace.”
Planned too many of points of interest
• Took airsick-likely passenger, who had never before flown in light aircraft
• Direction Indicator (DI) noted as 5 deg out on runway (r/w) but not corrected
• Delayed turn out (due another a/c in circuit) on take-off (t/o) meant setting course already 0.6nm cross-track error, towards Controlled Airspace (CAS)
• Actual track offset to NE, towards CAS
• Inaccurate track check at top of climb, undue focus on quiet passenger
• Then track error noted
• Referred to GPS only now, but GPS was UNDER printed PLOG

Consequence

Aircraft was ALREADY inside CAS
## What went wrong?

<table>
<thead>
<tr>
<th>Error</th>
<th>Cause</th>
<th>Solution</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of recency</td>
<td>Covid - nothing can be done about this</td>
<td>‘5 Ps’ - Pilot &amp; Personal Mins Checklist</td>
<td>TEM &amp; ADM</td>
</tr>
<tr>
<td>Too much planned</td>
<td>Tried to mix aims – Dead Reckoning navex, prep for next flying course &amp; pax</td>
<td>‘5 Ps’ - Plan</td>
<td>TEM</td>
</tr>
<tr>
<td>Built-in distraction in cockpit</td>
<td>Pax - not Light Aircraft experienced and prone to airsickness</td>
<td>‘5 Ps’ - Passenger</td>
<td>TEM, HF, ADM, SA?</td>
</tr>
<tr>
<td>Distraction outside - other aircraft</td>
<td>Circuit traffic</td>
<td>Take 2</td>
<td>TEM, ADM &amp; SA</td>
</tr>
</tbody>
</table>
## What went else wrong?

<table>
<thead>
<tr>
<th>Error</th>
<th>Cause</th>
<th>Solution</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unaware of Take 2</td>
<td>Lack of knowledge</td>
<td>Take 2</td>
<td>SA</td>
</tr>
<tr>
<td>Tight plan</td>
<td>Mixed aims inc pax</td>
<td>‘5 Ps’ - Plan</td>
<td>TEM</td>
</tr>
<tr>
<td>GPS not readily available</td>
<td>Under PLOG</td>
<td>‘5 Ps’ - Programming</td>
<td>TEM, SA</td>
</tr>
<tr>
<td>Slow to use GPS</td>
<td>Didn’t realise they could be off-track</td>
<td>‘5 Ps’ - Plan</td>
<td>SA</td>
</tr>
</tbody>
</table>
Lessons Learned?

- Honest pilot to be applauded
- We can all learn from this
- Was Pilot really ready for a map/stopwatch navex after Covid layoff?
- Was Pilot really ready to take this or any other passenger?
- Was passenger briefed?
- Plan was tight from start
- Noted error (DI) was not corrected
- Distraction was built in from start (pax), then..
- More was added in circuit
- Capacity bucket was filling (full?) from the off
Do we have a problem that needs solving?

<table>
<thead>
<tr>
<th></th>
<th>2018</th>
<th>2019</th>
<th>2020 (Covid-truncated Year)</th>
<th>2021</th>
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</thead>
<tbody>
<tr>
<td>Fatalities</td>
<td>40</td>
<td>14</td>
<td>6</td>
<td></td>
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<tr>
<td>Airprox</td>
<td>319</td>
<td>328</td>
<td>280</td>
<td>269 (to 1 Dec)</td>
</tr>
<tr>
<td>Microlight Infringements</td>
<td>63</td>
<td>33</td>
<td>40 (to 31 Oct)</td>
<td></td>
</tr>
<tr>
<td>Unknown infringements</td>
<td></td>
<td></td>
<td></td>
<td>72 (to 31 Oct)</td>
</tr>
</tbody>
</table>
Do we have a problem that needs solving?

‘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)
In flying I have learned that carelessness and overconfidence are usually far more dangerous than deliberately accepted risks.

Wilbur Wright, 1900.