Assertiveness A good team member will not agree with a plan of action just to 'keep the peace' if he/she is feeling uneasy about it. On the other hand, once an appropriate plan of action has been decided upon, a good team member will fully support it if he/she might personally prefer a different plan. The degree of assertiveness displayed by a particular team member is controlled to a very great extent by that person's personality, however if you are convinced that a particular course of action is incorrect or dangerous, it is vital that you put your opinion forward for consideration. Many of the worlds worst aviation disasters may have been avoided if the first officer or other crew member had strongly voiced their objections to a bad decision. If you were in a ship and the captain insisted on maintaining a course which headed straight for an iceberg, you could choose to do nothing and start planning the best route to the lifeboats. If you are part of the crew of an aircraft, you do not have that option!

THREAT AND ERROR MANAGEMENT [TEM].

Basic principles.

Firstly it must be said that TEM is nothing new. It has been part of human behaviour since we first evolved. When my mother told me not to climb the mango tree in our back yard she identified two threats: Firstly I could fall and secondly there was a big bee hive in the branches. I then made the error of ignoring those threats and suffered the consequences of both. First the bees and then the fall!

In the context of aviation TEM is simply an extension of the concept of airmanship and airmanship has often been described as the application of common sense. Sadly, experience shows that so-called common sense is not all that common. On many occasions common sense becomes obvious only *after* the event and it certainly can't be relied on as a means of preventing undesirable outcomes.

In the past, human error in aviation was considered a weakness and the person involved was 'guilty' of making the error. The fact is that our propensity for error is simply the price we must pay for being human and the best we can do is find ways to identify errors and resolve them when they occur.

TEM is an attempt to develop a mind-set which enhances the identification of threats, minimizes the opportunities for error, and resolves those errors when they do occur. The TEM model has three basic components:

- **Threats**
- **Errors, and**
- **Undesired aircraft states**

If threats, errors and undesired aircraft states are not recognised and managed in time, an accident or incident may result. In the TEM model this final event is called an **outcome.**

Let's consider each of these in turn.
Threats. To put it simply, threats originate in the environment outside the aircraft or in the cockpit and are not directly attributable to something the crew did or did not do. They include things such as poor weather, wind shear, high pilot workload in very busy airspace and interruptions or distractions during an approach to land.

Errors. Again to put it simply, errors originate from pilot actions or inactions that have the potential to adversely affect the safety of the flight.

Undesired aircraft states. This peculiar phrase refers to any flight condition or attitude which was not intended by the operating crew. Undesired aircraft states would include such things as inappropriate flap selection on take-off or landing, flight above or below the desired altitude, airspeed too high or too low during climb or descent or *[careful of this one]* unintentional stalls or spins. Note that an undesired aircraft state can result from either a threat such as turbulence or wind shear, or an error such as inappropriate use of controls.

Let's examine threats in more detail.
In the CASA material a threat is defined as:

- *A situation or event that has the potential to impact negatively on the safety of a flight or*
- *Any influence that promotes the opportunity for pilot error or*
- *Anything that causes a variation to a 'perfect' flight.*

Threats can be classified as *external* and *internal* and *latent*.
External threats originate from the environment in which the aircraft is operating and can lead to pilot error. They include such things as:

- Distractions caused by passengers or cabin crew
- Unexpected requests or enquiries from ATC
- Weather problems
- Maintenance issues
- Heavy traffic situations and/or unfamiliar aerodromes
- Missed approach
- Pressure to meet time schedules
- In-flight diversion
- System failures

External threats can be further sub-divided into **anticipated, unexpected or latent.**

Anticipated, or expected, external threats would include such things as weather and heavy traffic or unfamiliar aerodromes.
Unexpected external threats would include such things as distractions from passengers, in-flight diversions and missed approaches.
Latent external threats are not directly obvious to the pilot but are lurking in the background waiting for a particular set of circumstances. They include such things as a 'user unfriendly' work environment such as poor cockpit design or instrument layout, aircraft design characteristics and company policies that do not adequately address proper maintenance issues or pilot fatigue and optical illusions such as sloping runways or 'black hole' approaches.

Internal threats originate from the environment on board the aircraft and in the cockpit. They cannot in themselves be called errors but they increase the likelihood of errors.
They include such things as:

- Pilot fatigue
- Team familiarity in multi-crew aircraft
- Language and cultural issues
- Health and fitness
- Pilot experience and personality [See 'Personality and decision making' - Page 8.4]
- Pilot recency and proficiency

Threats can be further classified as environmental threats and organisational threats.

Environmental threats exist because of the environment in which the aircraft is operating. They include:

- Weather such as thunderstorms, icing, crosswind/tailwind/downwind wind shear and turbulence
- Airspace communication problems such as may occur in CTA or in a CTAF area
- Ground environments at airports including signage, the presence of birds or obstructions
- Terrain about and below the aircraft
- Operational pressures such as late arrivals or unserviceabilities

Organisational threats originate from deficiencies in the infrastructure and organisation in which the aircraft is operating. They include such things as:

- Documentation errors [incorrect data entry or misinterpretation of manuals]
- Tour of duty problems

Management of threats.
Threat management refers to tools or procedures that allow pilots to anticipate and/or respond to threats. A managed threat is one which is recognised and responded to before it can adversely affect the safety of the flight.

Example: *A pilot reads and interprets an aerodrome forecast which imposes an alternate requirement. The pilot chooses an alternate aerodrome and ensures that sufficient fuel is carried to proceed to that aerodrome should it become necessary. The threat has been managed.*

A mismanaged threat is one that is linked to or induces an error which adversely affects the safety of the flight.

Example: *A passenger in an aircraft approaching an unfamiliar aerodrome asks the pilot questions about the availability of a public telephone after landing. The pilot checks the ERSA and fails to make the ten mile inbound call resulting in a near collision with a departing aircraft.*

Tools and techniques used to manage threats.

- Detailed study of weather enroute and at the destination
- Ensuring compliance with operational requirements pertaining to the flight
- Checking ERSA for arrival at unfamiliar aerodromes for special procedures
- Thorough and careful pre-flight inspection
- Self-assessment of fitness, recency and experience required
- Familiarity with aircraft type and emergency procedures
- Application of standard operating procedures [SOP].

Now let's examine errors in more detail.
In the CASA material an error is defined as flight crew actions or inactions that lead to a deviation from crew or organisational intentions; reduces safety margins; and increases the probability of adverse operational events on the ground and during flight.

Errors can be classified as *handling errors, procedural errors* and *communication errors*.

Handling errors are errors in the actual manipulation of the aircraft controls. Not surprisingly handling errors most often occur when the pilot has limited total aeronautical experience or limited experience on the particular aircraft type. Handling errors are much less likely as experience increases, although it must be said that too much reliance on modern automated systems can reduce a pilot's level of skill in 'hands on' flying. This often shows up in instrument rating renewals when the pilot has spent the last year flying almost every approach with the auto pilot coupled to the navigation system. Handling errors include such things as:

- Rounding out too high or too late in a landing
- Failure to maintain tracking and descent profile tolerances during an approach
- Failure to accurately maintain height when flying manually
- Over/undershooting the intercept of a desired track
- Unnecessary excess speed during taxi or unnecessary harsh braking
- Inappropriate use of power during approach
- Poor technique during cross-wind landings

Procedural errors. Although inexperienced pilots are more likely to make handling errors, procedural errors may occur across the whole spectrum of pilot experience. They often occur as a consequence of an external or internal threat such as time constraints, poor communication, distraction or poor quality aerodrome markings or signage. They include such things as:

- Failure to use a written checklist for take-off or landing
- Failure to fly a right-hand circuit when required by ERSA
- Failure to stop at a holding point
- Failure to conform to the tracking and height limitations during an instrument approach
- Incorrect calculation in flight planning or weight and balance management

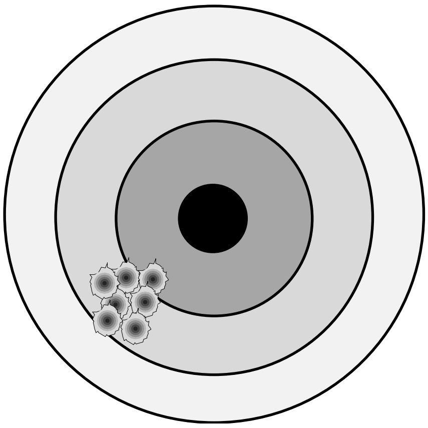
Communication errors are the result of ambiguous or misinterpreted communication [usually speech]. They often result from:

- Use of non-standard phraseology in the case of radio communication
- Poor quality radio reception
- Over-transmission of radio messages by a third party
- Unfamiliar foreign accents or rapid speech

Any of the above types of pilot error may occur as a result of external threats that may divert the pilot's attention or internal threats such as memory lapses or preoccupation with personal issues.

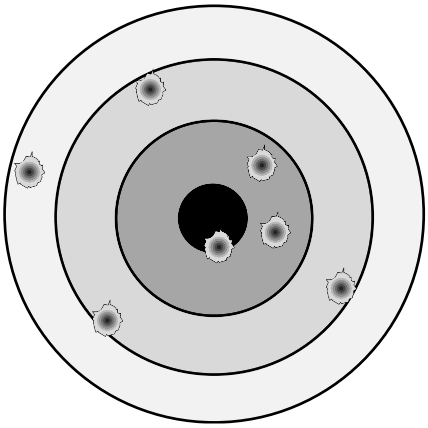
Further methods of classifying handling errors.

The human errors that are associated with any one individual performing a given task can be classified according to their frequency and nature. Examining the pattern of these errors can sometimes be useful in recognising the type of remedial training required or in some cases identifying a fault in the procedure being applied. It must be accepted that human error can never be entirely eliminated and to conceal errors is to encourage their repetition. Pilot errors can be a source of embarrassment and the temptation can be to cover-up or deny them. The *error-cause-removal* approach to safety encourages pilots to *identify* and *report* potential sources of error and act to prevent such errors occuring in the future. Three of the most common error classifications are discussed below.



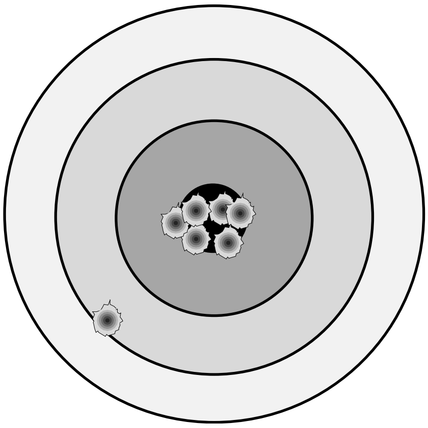
Systematic Error. In this case the error occurs with a definite pattern. All other elements of the task are error free, but an error occurs regularly in one particular element. Once identified, systematic errors can usually be easily remedied because there is likely to be one particular fault in the process.

Example: All elements of the circuits flown by a pre-solo student pilot are of a consistently good standard except that every round-out and hold-off is too high. Once it is recognised that the same error is occurring consistently, the instructor begins to look for a single cause. He discovers that the student is looking in the wrong place at this point. The student changes the system accordingly and the error vanishes.



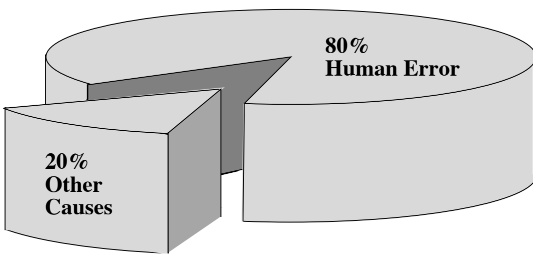
Random error. Random errors occur without any specific pattern. Each time the task is performed an error occurs at a different stage and may or may not be repeated on the next try. Random errors are usually an indication that either the system is too complex causing an overload of mental capacity, or the person performing the task has not grasped the basic fundamentals and needs retraining - expecially in the basics.

Example: A pre-solo student pilot makes inconsistent errors during circuit flying. The approach is too slow on one occasion and too fast on another. The round-out is too high on one landing and too late on another. On one take-off he forgets to retract the flaps; on another he forgets the fuel pump; one circuit is too wide while the next is too close. [sound familiar]? More dual on this sequence!



Sporadic error. This is by far the most difficult error to remedy. All elements of the task are performed satisfactorily almost all of the time. But occasionally a serious error is made in one element that has been performed correctly a number of times previously.

Example: This time the pre-solo student pilot has just flown a really good session of circuits to the point where the instructor is about to get out and send him on his first solo. The instructor decides to do just one more circuit and on this occasion the student loses all interest in airspeed on late final to the point where the instructor has to take over and apply power to save the situation. Errors of this nature can sometimes have an emotional cause. The student is preoccupied with personal problems or simply nervous about going solo.

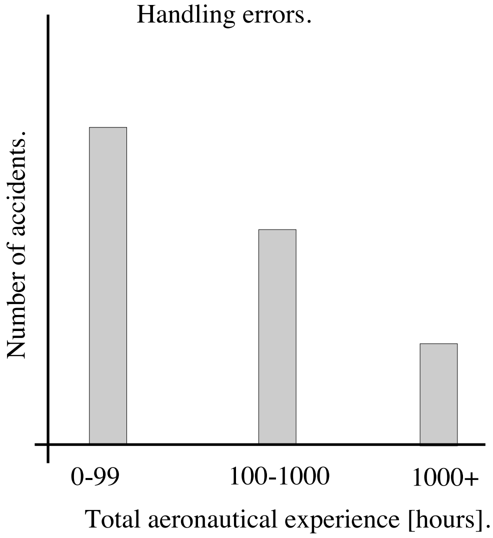


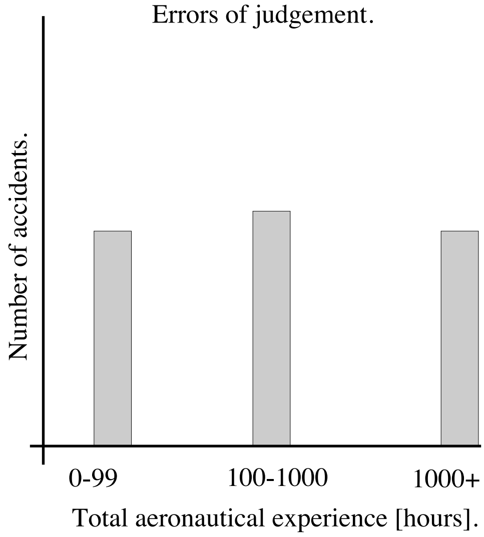
The sad reality is that recent statistical analysis of world-wide aircraft accidents has shown that in at least 80% of cases the cause is human error rather than a failure of a system or an external environmental factor such as weather or volcanic eruptions etc.

Accidents versus Experience. Aircraft accidents have been investigated from every aspect you can imagine. One interesting breakdown of the statistics is types of errors against pilot experience. Accidents have been grouped according to whether the cause was lack of manipulative skill [usually called handling errors], or errors resulting from poor operational decisions [errors of judgement].

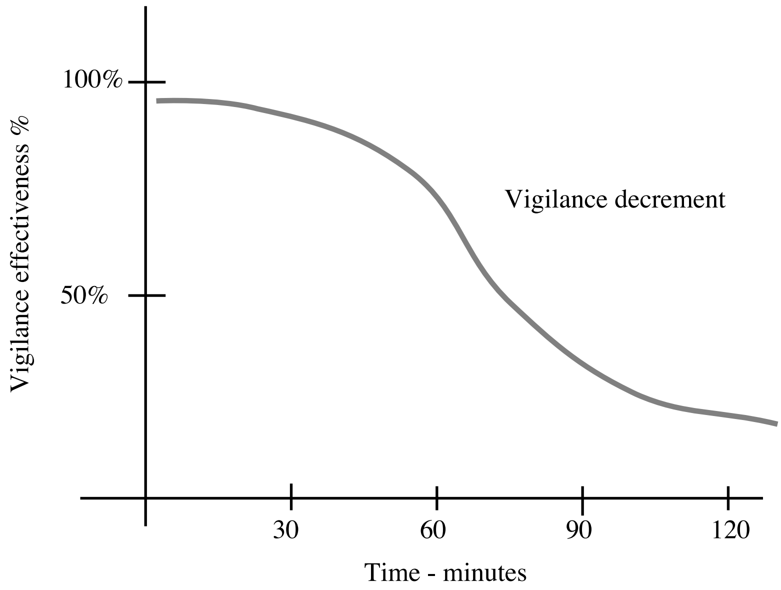
Not surprisingly, the handling errors are more common amongst low-time pilots and they tend to become less frequent as pilot experience increases. These accidents include such things as heavy landings, stalls during low level turns and cross-wind landing or take-off accidents. What may be more surprising though is the revelation that errors of judgement do not become less frequent with experience and an experienced pilot is just as likely to make a poor operational decision as a novice. These accidents include such things as continuation of VFR flight into deteriorating weather conditions, accidents associated with visual circling to land after an instrument approach at night or in marginal weather and fuel exhaustion. So you see, no matter how many hours you have in your log book. or what type of aircraft you fly, there's no guarantee that your next operational decision will be a good one!

Vigilance Decrement. Experiments have shown that the human capacity to maintain vigilance when monitoring a





system's performance tends to decrease markedly after about 30 minutes. A pilot monitoring the instruments while flying on autopilot is much more likely to miss deviations or system malfunctions after the first 30 minutes. Also pilots who are forced to fly manually on instruments while in cloud or in darkness take much longer to recognise deviations and to implement corrective action after that time.

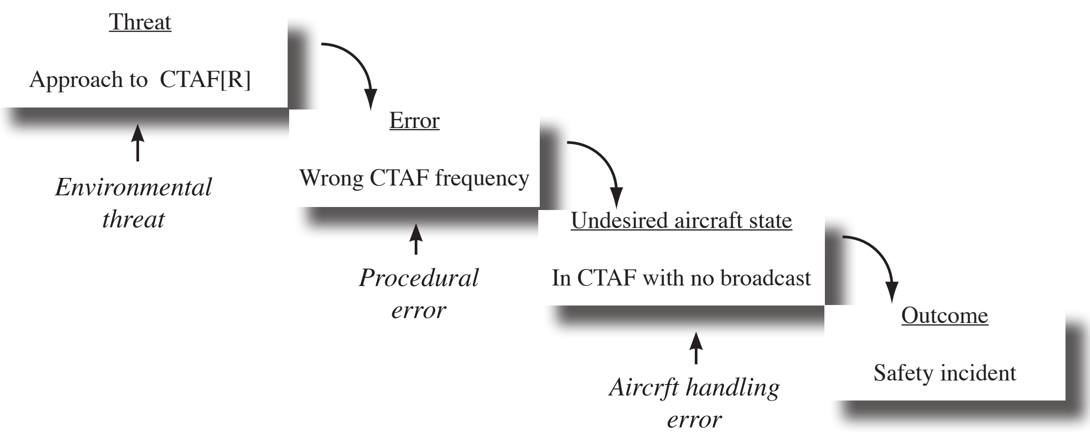


This is one reason why the autopilot is such a useful aid in instrument flight. If the pilot is forced to fly the entire flight on instruments in IMC, it is very likely that by the time he arrives over the destination aid, his vigilance will be at a low ebb just at the time when the highest work load is imposed.

An **undesired aircraft state [UAS]** is simply any flight condition, aircraft attitude or aircraft configuration which was not intended by the pilot or appropriate to the particular phase of flight. Typically a threat which is mismanaged leads to an error which is unrecognised or unresolved which in turn leads to an undesired aircraft state. The undesired aircraft state is really the pilot's last chance to remedy the situation. Even at this late stage, if appropriate action is taken to manage the UAS the outcome may still be avoided. In the TEM model, the outcome is simply an incident or accident that results from the mismanagement of threats, errors or undesired aircraft states.

Example:
An aircraft is approaching an aerodrome at which CTAF[R] procedures apply. The pilot is unaware that the frequency has recently been changed. Since he has landed at that aerodrome several times in the past he assumes that the frequency is the same as it was on previous occasions. He makes his call on the old frequency and hears no reply so assumes that there is no traffic. As he turns from base onto final, he has a near miss with an RPT aircraft making a straight-in approach.

In the example above, the threat could have been managed by careful attention to the current ERSA in which case the error would not have occurred. Even after the error had occurred, it could have been resolved by cross-checking the selected frequency with the current ERSA or by noting the absence of the AFRU response.



Undesired aircraft states can be categorised as:

Aircraft handling states which include such things as:

- aircraft control [deviations in pitch, roll and yaw]
- altitude, track or speed deviations [deviations in flight path]
- placing the aircraft in a hazardous situation [weather or violation of CTA or CTAF procedures]
- exceeding structural load factor or speed limitations and
- poor technique in flying the approach or landing

Ground navigation states such as:

- attempting to use the wrong taxiway or runway
- taxiing too fast

Aircraft configuration states such as:

- inappropriate flap or speed-brake selection
- incorrect autopilot mode
- incorrect programing of GPS or other navigation aid
- incorrect fuel distribution
- incorrect distribution of weight

Setting priorities

While an identified error can be corrected and resolved so that the undesired aircraft state is avoided, it is important to accept that there may be occasions where continuing to recognise and rectify an error may allow the undesired aircraft state to go from bad to worse! That is the pilot may need to switch his/her attention from managing the error or threat to managing the aircraft state.

Example

The pilot of an agricultural aircraft was returning to base at about 300 feet AGL after a job. The headset microphone was unserviceable so he was using a hand-held microphone. After making a call to circuit traffic he dropped the microphone. He immediately lent forward with his head in the cockpit trying to retrieve the microphone by pulling on its cord. The aircraft entered a spiral dive and crashed. The pilot was killed.

Remember the age old adage: "Aviate, Navigate, Communicate - in that order."

Not all threats justify the time and attention of the pilot. In considering the risk involved in a particular threat we must first consider the probability that the threat will be realised along with the possible consequences. There is a probability the earth will be struck by an asteroid tonight and although the consequences are dire, the probability is very low. Also there is a high probability that I will be delayed in traffic on the way home, but the consequences are acceptable. Neither of those threats justify the time and effort involved in trying to avoid them.

The response to a threat should be in proportion to the associated risk. It makes no sense to invest a great deal of time and effort in countermeasures to threats that have very little risk associated. A perfect example of this is the absurd response we see to the perceived threat to national security at regional airports. It is possible that an eighty year old woman in a wheel chair could have a bomb concealed in each of her slippers, but the risk is extremely low.

The effective management of the threats that do justify the pilot's attention depends mainly on early detection and the time available to consider the options and take appropriate action. Of course the most proactive option would be to anticipate the threat in time to avoid any impact in might have had on the flight.

Example:

A pilot approaching a non-towered aerodrome realises that landing on an into-wind runway in the late afternoon will involve an approach into the setting sun. He also notes that his dirty windscreen is likely to create serious visibility problems on late final. The pilot anticipates this situation and joins the circuit for a crosswind approach that will be away from the sun. The threat has been anticipated and avoided.

The effectiveness and thoroughness of threat management depends ultimately on the pilot's attitude and motivation. A pilot who fails to anticipate environmental threats is faced with the situation of having to deal with them *after* they have impacted on the safety of the flight. Another wise old adage:

Prevention is better than cure!

The University of Texas human factors research project's line operations safety audit [LOSA] has compiled an extensive data base of over 4500 observed cases of threat and error situations in actual airline operations. Some of the most interesting results of this audit are sumarised below.

- ☆ 45% of observed errors that occur in airline operations are not detected.
- ☆ On average 4 to 6 threats are encountered on each airline flight.
- ☆ The phase of flight during which most threats occur is taxi and take-off.
- ☆ The most frequent threats encountered are ATC related [challenging clearances etc].
- ☆ 85% to 95% of threats encountered are successfully managed by the crew.
- ☆ Of the threats that do occur, the highest percentage that are mismanaged are ATC related.
- ☆ 80% of flights feature some form of observable crew error.
- ☆ Most crew errors are made during the descent/approach/landing phase of flight.
- ☆ Also most *mismanaged* crew errors are made during the descent/approach/landing phase of flight.*
- ☆ The most common type of crew error observed are procedural errors [check lists and cross checks].
- ☆ The most common type of *mismanaged* crew errors are handling errors.*
- ☆ 20% to 30% of crew errors lead to additional errors or undesired aircraft states.

☆ 35% of airline flights feature an undesired aircraft state.
☆ 5% of airline flights feature an unstable approach and 5% of those result in a missed approach.
☆ 30% of undesired aircraft states can be linked back either directly or via an error to an initial threat.

* Note: A mismanaged error is defined as one that leads on to a further error or to an undesired aircraft state.

Processes to identify and manage threats, errors and undesired aircraft states.

Standard operating procedures [SOPs]. It is the use of standard operating procedures [SOPs] that have given aviation the level of safety it enjoys to-day. SOPs impose rule-based behaviour on the crew so that almost every possible event that can be anticipated is reduced to a sequence of preordained actions that have been carefully thought out beforehand to ensure maximum safety. When an IFR pilot arrives in the vicinity of the destination aerodrome in IMC, he/she follows a set procedure of tracking and descent limitations which has been surveyed and published on the approach plate and is relieved of the task of working the whole thing out from 'scratch'. Also a set procedure for coping with an engine failure at a critical time such as just after take-off is subject to a standard operating procedure. Rule-based behaviours such as these are not motor programs but are stored as a set of rules in the long term memory. They are actioned as a deliberate conscious set of actions and monitored by the short term [working] memory which 'ticks off' each item as it is carried out.

Some students during muli-engine training fall for the trap of learning the procedures to the point where it becomes a motor program which is often run without proper attention during the stress of an engine failure situation at take-off. When the instructor fails the engine the student 'rattles off' the procedure, "*mixture up - pitch up - power up - gear up - flaps up - identify - confirm - feather,*" like a poem - all in record time and smiles a satisfied smile. However the whole procedure is of little value unless the items are carefully monitored and, if necessary modified. Was it a complete or partial loss of power? Is there enough runway left to allow a landing straight ahead?

Simulators and synthetic trainers are very useful tools in achieving rule-based behaviour, mainly because many situations that must be dealt with would be dangerous if performed in flight. In the case of larger aircraft, many SOPs are too long and involved to be reliably committed to the error-prone long term memory and so are written as a check list that can be followed by a 'challenge and response' technique as each item of the procedure is dealt with. Because the use of SOPs greatly reduces the risk of errors occurring in the actual implementation of the procedure, they have proved to be very effective as a means of dealing with a myriad of both routine and emergency situations in flight. In fact experience has shown that when SOP related errors do occur, it is most likely because the original problem was misidentified by the crew and the incorrect SOP was initiated.

Knowledge-based behaviour. This can be thought of simply as thinking and reasoning. The pilot makes decisions based on a knowledge of all of the facts and these decisions are not in any way related to previously existing rules. The most important element in knowledge-based behaviour is the quality of the knowledge in the first place. The pilot must be careful to examine all of the facts in an unhurried way remembering that even in flight instant action is rarely necessary.

Example: *An instructor and an experienced pilot took off from a controlled aerodrome in a light twin with the fuel caps off. The tower noticed a white stream coming off the right wing and informed the pilot that 'something' appeared to be trailing from the wing. The pilot immediately assumed that it was smoke and that the engine was on fire and, in a series of panic actions, closed the throttle on a perfectly good engine and without attempting to feather it, turned back towards the runway with the undercarriage still down. The aircraft crashed killing both pilots. All of the facts were available to confirm that the engine was functioning normally, but apparently none of these were considered in an unhurried way - there was no knowledge-based behaviour.*

Situational awareness may be defined as knowing what is going on around you, being able to predict what could happen and taking the appropriate action in a timely manner. Situational awareness may be considered as three separate levels.

<u>Level one is perception.</u> The sights, sounds and other sensations that come to the attention of the pilot.
This includes such things as sighting other aircraft, observing signs of threatening weather, unusual engine vibration, instrument indications, warning lights, runway condition and crosswind or downwind conditions.

Level two is comprehension. This refers to the interpretation of the elements that have been perceived. The sights, sounds and sensations perceived are used to create an accurate picture of the current situation considering both the aircraft state and the outside environment.
Ensure that you do not interpret the world according to how you would like it to be, but in terms of how it is.

Level three is projection. The pilot now applies past experience and training to predict the likely outcome of the current situation and make decisions about the most appropriate action to take.

By now you have probably realised that TEM is really just an attempt to confront problems that have been with us in aviation since the famous brothers first flew at Kitty Hawk. A lot of new [and in some cases, quaint], terminology is used to describe some very familiar and simple concepts. The scenario below contains elements which can be used to illustrate the TEM model.

The pilot of a single-engine Beechcraft departed a Queensland country airstrip on a solo flight. The latch on the cabin door had passed its 'use by' date and didn't always engage securely with the locking mechanism. The pilot used a written check list before take-off which included the item 'hatches and harnesses secure'. Just after take-off the door latch released resulting in a sudden alarming increase in cockpit noise and a change in aircraft performance. The pilot attempted to close and lock the door but was unsuccessful. He made a second and third attempt to close the door but to no avail. While the pilot was struggling with the door, the aircraft, in a left turn and losing height, struck rising terrain. The aircraft was destroyed and the pilot was seriously injured.

The condition of the door latch was a maintenance issue which was not always obvious except on occasions when it failed to engage.	→	a latent external threat
The cockpit check list contained the item 'hatches and harnesses secure' but the pilot failed to adequately check that item.	→	a procedural error
The door popped open after take-off.	→	an undesired aircraft state
The pilot fixated on closing the door and lost control of the aircraft.	→	loss of situational awareness failure to manage undesired aircraft state
Aircraft impacts with the ground - pilot injured.	→	outcome
The most direct cause of the accident was the pilot's failure to realise that the door could wait.	→	failure to switch from error management to undesired aircraft state management. failure to prioritise

Countermeasures.

We have examined the need for the management of threats, errors and undesired aircraft states. The tools and techniques used to manage these are called countermeasures. A countermeasure is any action or system which is directed to avoiding or reducing the impact of a threat, error or undesired aircraft state. Some countermeasures are systemic based [built into the system]. They may be mechanical or electronic devices such as:

- stall warning devices
- systems failure warnings such as enunciator panels
- airborne collision avoidance system [ACAS] and
- ground proximity warning systems [GPWS]

Or they may be aimed at ensuring appropriate pilot actions in given situations such as:

- standard operating procedures [SOPs]
- written checklists
- briefing and
- training

Other less formal countermeasures reside in the individual pilots themselves. These include such things as skill, experience, knowledge, attitude and airmanship.

TEM QUESTIONS.

Question No 1
Select the item which best describes an external threat
[a] a noisy intoxicated passenger
[b] a pilot suffering from the effects of a hangover
[c] another aircraft entering the runway while you are on late final
[d] difficulty in understanding the transmission of a foreign pilot

Question No 2
Select the item which best describes an undesired aircraft state
[a] arrival over the threshold too high and too fast on a landing approach
[b] failing to notice a damaged tyre during a daily inspection
[c] failure to realise that a destination aerodrome requires an alternate
[d] aircraft overdue for its annual inspection

Question No 3
An example of an expected threat is
[a] thunderstorms forecast on the TAF
[b] engine failure in flight
[c] becoming lost in flight
[d] being diverted in flight by ATC

Question No 4
For the flight crew, the three basic components in the TEM model are
[a] threats, errors and undesired aircraft states
[b] threats, errors and anticipated aircraft states
[c] threats, flight crew human resources and aircraft states
[d] errors, flight crew human resources and undesired aircraft states

Question No 5
Which of the following would be classified as an external threat
[a] pressure to meet timetables
[b] pilot fatigue
[c] health and fitness
[d] lack of familiarity with other crew members

Question No 6
An example of a latent threat is
[a] undercarriage will not retract in flight
[b] wind gusts exceeding the aircraft's cross wind limitations for landing
[c] poor aircraft equipment design
[d] unexpected high traffic volume in the terminal area

Question No 7
Entering the incorrect way-point data while operating in a stressful cockpit environment is an example of
[a] environmental threat
[b] organisational threat
[c] expected threat
[d] unexpected threat

Question No 8
The three primary categories of error in the TEM model are
[a] loss of heading control, loss of attitude control and loss of airspeed control
[b] navigational error, radio frequency error and navigation aid error
[c] crew resource error, airtraffic control error and ground handling error
[d] aircraft handling errors, procedural errors and communication errors

Question No 9
Undesired aircraft states are categorised by the TEM model as
[a] aircraft handling, ground handling and incorrect aircraft configuration
[b] aircraft ground handling, vertical navigation and incorrect inflight configuration
[c] vertical navigation, ground handling and inflight navigation
[d] aircraft configuration, ground handling and inflight aircraft handling

Question No 10
Track and speed deviation are examples of
[a] ground navigation state
[b] aircraft handling state
[c] horizontal navigation state
[d] aircraft configuration state

Question No 11
Unauthorised penetration of controlled airspace is an example of an undesired
[a] ground navigation state
[b] aircraft handling state
[c] air navigation state
[d] navigation configuration state

Question No 12
Being positioned at the incorrect holding point prior to take-off is an example of an undesired
[a] aircraft handling state
[b] aircraft ground configuration state
[c] situational awareness state
[d] ground navigation state

Question No 13
Incorrect navigation aid setting is an example of
[a] ground navigation state
[b] aircraft configuration state
[c] horizontal navigation state
[d] situational awareness state

Question No 14
With regard to TEM, the use of a checklist prior to take-off is an example of
[a] a desirable aircraft state
[b] a safety state
[c] a countermeasure
[d] a safety tactic

Question No 15
When considering the risk any threat imposes you should consider
[a] the probability of encountering the threat irrespective of the consequences
[b] the seriousness of the consequences irrespective of the probability of encountering the threat
[c] the probability of encountering the threat and the seriousness of the consequences
[d] the probability of encountering the threat an any stage during the flight

Question No 16
When an undesired aircraft state is identified the primary task should be
[a] identify the error which led to the undesired aircraft state
[b] identify and correct the error which led to the undesired aircraft state
[c] deal with the undesired aircraft state and return to controlled stabilised flight
[d] advise ATC of the undesired aircraft state

Question No 17
One measure of the effectiveness of actions taken by a crew to manage threats is
[a] the accuracy of the crew's recall of events during de-briefing
[b] the speed with which the crew acted to manage the threat
[c] whether the threat was detected in time for the crew to respond appropriately
[d] whether an undesired aircraft state was avoided

Question No 18
The most proactive option in threat management is to
[a] anticipate the recovery action required if the threat occurs
[b] anticipate and avoid the threat altogether
[c] take corrective action once the threat has occurred
[d] concentrate on management of any undesired aircraft state that may result

Question No 19
Mismanaged threats usually lead to
[a] errors which are then linked to undesired aircraft states
[b] undesired aircraft states which are then linked to errors
[c] aircraft handling errors which then lead to environmental errors
[d] diversion from standard operating procedures

Question No 20
With regard to TEM, a cockpit systems failure warning light is an example of
[a] a proactive decision making process
[b] a systemic-based countermeasure
[c] an undesired aircraft state management device
[d] a handling error countermeasure

Answers to TEM Questions

No 1 [c]	No 2 [a]	No 3 [a]	No 4 [a]	No 5 [a]	No 6 [c]	No 7 [b]
No 8 [d]	No 9 [d]	No 10 [b]	No 11 [b]	No 12 [d]	No 13 [b]	No 14 [c]
No 15 [c]	No 16 [c]	No 17 [c]	No 18 [b]	No 19 [a]	No 20 [b]	