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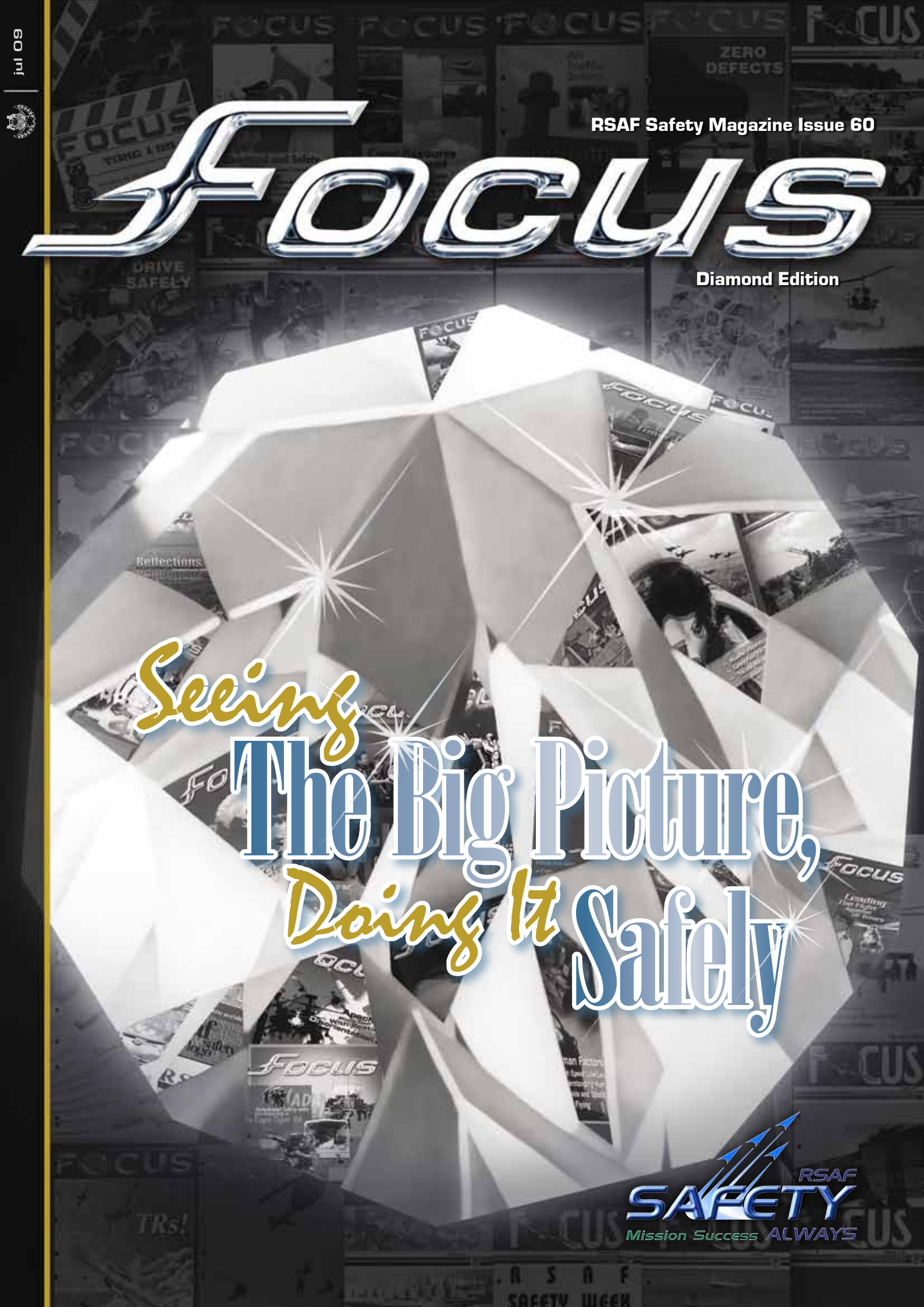
FOCUS

Diamond Edition



Seeing The Big Picture, Doing It Safely

RSAF SAFETY
Mission Success ALWAYS

foreword

The RSAF has made tremendous progress with respect to safety over the last 40 years. Good safety records do not occur by chance. They are brought about by a well-structured safety system, founded on the zero accident philosophy we have in place today. One important avenue to promote safety awareness and accident prevention is the FOCUS magazine.

In April 1977, two officers were appointed to two newly created posts of Accident Prevention Project Officers under the office of the Director of Air Staff then. Alongside Accident Prevention efforts, the idea of a RSAF safety newsletter was mooted and the first "FOCUS" was published in 1978. As the Accident Prevention Office transformed over the years to become today's Air Force Inspectorate, FOCUS has also evolved from an ad hoc newsletter to a regular publication. From the humble beginnings of publishing foreign safety articles, FOCUS presently boasts a wide range of indigenous articles that are featured in a professionally designed magazine.

Today, FOCUS is well-circulated among local and overseas units and is distributed to other Air Forces. An online version of FOCUS was introduced to widen our readership and share our safety lessons with professionals within the wider global aviation community. The quarterly safety magazine now features regular write-ups from the areas of Flying, C2, Air Defence, Logistics and Ground Safety to cater to a broader readership.

As the RSAF continues to transform itself, we must focus on strengthening a safety system that is rooted in the RSAF core values. By administering the right training to the right people, safety is firmly founded on competency both at the individual and system levels. Above all, the Air Force needs the active participation and utmost commitment of each and every servicemen and women in order to sustain safety while enhancing our operational capabilities.

This issue marks the 60th publication of the RSAF FOCUS magazine. I would like to convey my appreciation to the magazine's editorial board for their continual efforts in advocating safety to all. The prompt and effective sharing of safety lessons and ideas is an important element in achieving the goal of zero accident. However, persuading people to write on their mistakes and faults can be challenging. In the same vein, I thank the writers who have bravely contributed articles detailing their errors and oversights. Their commitment of open-reporting and sharing may well have helped to save a life. I urge more servicemen and women to come forward with their opinions and experiences. This way, we are able to learn from the mistakes of others and introduce measures to prevent similar accidents from occurring. To this end, I am sure that FOCUS will achieve many more milestones and continue to be a focal source of safety information in the years to come.

Ng Chee Khern

By **MG Ng Chee Khern**
Chief Of Air Force

preface

The RSAF has in place a very robust safety framework which has worked well through the years. Working alongside Cardinal, the RSAF has made significant progress against safety infractions. Nevertheless, it is important that individuals recognise that regardless of the safety nets in place, they will always be the last line of defence against safety lapses and violations. In recent months, the RSAF has recorded some HF lapses that were completely preventable. In this respect, complacency and distraction are two known HF factors that we need to guard against.

While we publish the 60th edition of the FOCUS magazine and celebrate our 44th national day this Aug, let us take time to reflect on the duties and responsibilities that we, as an Air Force is called upon to shoulder. As guardians of Singapore's airspace, each mistake made is one too many. Much like Singapore's birthday, the FOCUS magazine is a rallying point for unity and vision. Through the years, experience collected from open reporting and admission of mistakes made have allowed the RSAF to progress safety in a way that's balanced against our operational tempo. Together, we must execute each mission professionally and at the same time continue our journey towards ZERO accident.

By **COL Ng Chee Keong**
Head Air Force Inspectorate

This cover celebrates the 60th milestone issue of the magazine. Featuring the previous magazine covers, one gets a good overview of the different graphic styles throughout the years and how far FOCUS have come.

COVER CREDITS
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contents

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SAFETY in CONTEXT

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CONTEXT PROVIDES SENSE

Contrary to popular belief, an engine failure in a multi-engine aircraft is still a critical emergency which requires deliberate measures, like landing as soon as possible. Such an emergency would normally render the mission value of the flight a lower priority because safety of flight comes into play. In Jun 2002, a RSAF C130 on its way to an overseas destination, experienced a malfunction which led to an engine shut-down. The normal procedure would either be a diversion to a suitable airfield or to return to base, depending on standard considerations like location, weather, airfield suitability, etc. However, in this case, the mission continued to its destination, with full knowledge that there was no rectification capability there. After offloading its cargo, the aircraft eventually took off with three engines to a more suitable airfield. Three engine takeoffs are only permitted "when absolutely necessary (and) when higher authority has granted approval and accepted the risks involved..."[1] To many who have grown accustomed to the usual way such emergencies are handled, the decision to continue and subsequently takeoff with three engines was unimaginable. But yet, this unprecedented decision was made. Why? Because a unique context was presented. This particular mission was important enough that decision makers at all levels warranted giving mission continuation a higher priority. Since then, no other missions came close to outweighing such emergencies and the episode remains a 'war-story' account. What makes the decision different in this case was not the aircraft, crew nor management. The difference was the context of an important, time sensitive cargo in a geopolitical situation of that specific time. Such is the importance and power of context that it can turn the unthinkable to palatable, turn mavericks to heroes, and at times turn the wrong to right. And vice versa of course. However, context is so 'omnipresent' and ubiquitous that we do not realise that it is the hidden framework in which most decisions are made, until we have to dissect an occurrence, like in a safety investigation.

The established RSAF belief, that "zero accident" and a good safety record are measures and indicators of operational readiness, is also made in context of operations in peacetime. It is the best proxy we have, and fortunately so, because nobody wants a history of victories in wars and battles to prove operational readiness and prowess.

1. C130 Flight Manual Chap 3

However, the true measure of operational readiness, one can argue, is the ***demonstration*** of operational success. Interestingly, since September 2001, the advent of 'troubled peace' which is the precursor of 'full spectrum operations', including Operations Other Than War (OOTW), provided the RSAF with a canvas to demonstrate our capability, not by proxy, but in terms of real operational success. In the domain of 24/7 island defence, we have had success in intercepting suspect aircraft which intruded into our airspace.

Context sometimes makes the intuitive perceptually right deci

In terms of Peace Support Operations (PSO) and Humanitarian Aid and Disaster Relief (HADR), we have contributed in the global fight against terrorism by offloading millions of pounds of aviation fuel to our coalition partners in non-benign environments, and expeditiously airlifting tons of relief supplies to needy areas, even to unprecedented destinations. Therefore, our belief in operational readiness, traditionally anchored almost exclusively on our peacetime safety record, is being reinforced by direct indicators of real operations successes. And this trend of demonstration through real operations is set to increase as the scope of RSAF operations increases globally. That is another topic by itself. Now back to context.

BRINGING OUT THE CONTEXT

When we approach safety and safety management, we need to put everything into context before assessing, judging and most importantly learning from it. The essence of why and how a decision is made is lost when one does not carefully consider the context because decisions are never made in a vacuum. Our belief in learning from earlier mistakes and errors, best practices and knowledge management is only comprehensive when we fully realise that every occurrence and decision has a set of unique context. If one does not understand the context of a previous occurrence, he will blindly apply the same action plan to the next seemingly similar scenario, oblivious to the context which may be different. An example to illustrate this is the occurrence of an aircraft taxying without clearance in a flying training unit. In the ensuing discussions following the FAIR, one of the retrospective comments was that the Squadron Executive Officer (SXO) would have perhaps cancel the training sortie, should he be informed about the error immediately after it occurred. If a junior SXO in another unit were to read across this action plan (ie. to cancel the sortie) without examining the context, he may apply it inappropriately. An ops mission where there are implications at the task, operational or campaign level definitely requires different considerations before a sortie is canceled. In the reported case, the unit being a training squadron, can rightly cancel a sortie because their considerations are mainly type-oriented because they deal mainly with ab-initio and basic flying skills training. However, an ops unit would need to consider the task or higher level considerations which may out-weigh canceling a sortie, say for example, because of a minor Air Traffic Control (ATC) violation during aircraft launch. Conversely, an ops unit conducting OCU training may very well follow this training unit's intent of canceling.

Context sometimes makes the intuitively wrong action become right, and the perceptually right decision potentially wrong. An example of the former is a unique immediate action for a landing-gear related problem in the C130. After the gears are selected down, if there is a corresponding excessive hydraulic pressure decrease, the immediate action is for the co-pilot to re-select the gears up, even if the gears are transiting to the down and locked position. This is counter-intuitive against the mainstream rational that getting the landing gears down and locked is always a priority. Because there are several ways of lowering the gears in the C130, stopping the loss of hydraulic fluid for other critical systems is deemed more important than expeditiously getting the gears down. The action of immediately re-selecting gear up ensures that the hydraulic system maintains some integrity for the fluid to be refilled in flight and re-used by other critical systems. The landing gear can then be lowered alternatively without the need for hydraulic assistance.

ATC elements are susceptible to the latter phenomenon of making seemingly right decisions which can be potentially wrong. This is because

the ATC makes decisions in a time pressured environment. There is a need to make decisions fast. Every single piece of the puzzle in the jigsaw of the area of responsibility and control must be identified and more importantly, understood. Missing out any element may deem any well thought out plan to be potentially wrong. In this sense, the context in which ATC makes their decision is always changing and therefore requires constant updating and refinement. An example occurred in 2008 where there were simultaneous departing and arriving fighter formations, with an aircraft conducting circuit training. With the context constantly changing as their relative positions to each other changed, the controller was unable to cope with the rate of change and was fixated on an earlier decision that was unable to address the newly formed situation. Fortunately, the duty Tower Executive Officer (TXO) understood all the pieces of the puzzle and issued timely instructions to all affected elements to avoid a possible conflict.

ly wrong action become right, and the
sion potentially wrong.

COPING WITH CHANGING CONTEXT

Mindset and context are opposing forces. Mindset allows you to do things efficiently by going into 'automatic' or 'routine' mode. Mindset is important for standardisation and predicting behaviours. The mindset in an exclusively training unit compared to that of an operational unit can be fundamentally different, commensurating with the different contexts as mentioned in the earlier paragraphs. A challenge presents itself when an operational unit conducts training, or a training unit undertakes operational tasking. The mindset change when switching roles must be quick and drastic enough to suit the context. Fighter squadrons face this need for immediate mindset swing everyday. While most of their day to day flying is training oriented, they need to make drastic changes to this mindset every time they are put on alert standby duties outside of their training schedules. The crews must be cognizant that a natural action-reaction cycle in the training context may not apply during real operations. There must be steps to remind crews to make this mindset change, for example, through briefings, checklist and procedures. Occurrences of actual activation though rare, do happen. There is little history or pool of knowledge or references to use when issues surface during actual ops. Crews must spend enough time and effort to analyse and think through training incidences, and 'play out' the same incidence with real ops consideration. The differences in the course of action should then be shared and documented, specifically highlighting that there are ops and training differences, thus ultimately helping the crews change mindset expeditiously.

Take the case[2] of an F16's engine parameters fluctuating after a suspected bird-strike. One such occurrence led to the pilot doing a night landing at Pulau Sudong. Despite the initial fluctuations, the engine continued to operate normally throughout the recovery of the aircraft to Sudong. This flow of events is one that is widely accepted in the RSAF and even expected – in other words, take the conservative approach and land the aircraft the safest manner available. Now change the scenario to one that the fighter is activated to investigate an inbound civilian liner with suspicious intent. The pilot faces a dilemma. He faces a possible engine failure although the engine is working well presently. He faces a possible civilian liner with intrusive intent. Both are not certain, both are only possibilities. But the answer becomes clearer when one extrapolates and play out the possible outcomes. The worst-case scenario of the suspect airliner, if not intercepted or intervened, is a possible 9/11 type catastrophe. By understanding the context, decision makers can then apply the best option amongst many. The job of the crew on the seat is not an easy one. He believes, preaches and teaches one thing during training missions. Then on the same day, when he is sitting on alert, he must be ready to do another set of actions based on real world considerations.

TEACHING CONTEXT

Teaching context is much more difficult than teaching the skill set. Context is that unique set of conditions, that specific point in history and that

2. *And You Thought It Could Never Happen To You, FOCUS Issue 59 by LTA Max Ng*

particular socio-political state, that the decision must be made in. It takes time to gain experience to recognise different contexts, and more difficult to be taught context through rhetoric or documentation. But it is essential to know context so that decisions make sense. One way of learning to appreciate context is more emphasis on the 'why' than 'what'. When a choice is made, the decision itself is relatively easy to transmit because it usually involves a final set of instruction or intent. Why the decision is made, among all the possible options, is more complex to impart, but it is necessary in order for others to learn. Usually when executives or duty personnel makes decisions during emergencies, incidences or occurrences, one concentrates on the 'what' because that is the foremost requirement to address the situation. After the occurrence, we do not usually dwell on why the decision was made, unless the situation was handled unsatisfactorily and an investigation ensues. Therefore, the 'whys' of most good decisions usually go unstudied and un-imparted. It is important for crews to revisit all incidences and spend some time to understand why the decision was made. The decision makers should share the thought processes with junior or learning crews. Another way of learning to consider context is conducting 'table top' exercises. Table top exercises are usually conducted by initially using familiar or common occurrences, then different contexts are presented, resulting in different courses of actions. It is a quick and effective way to appreciate how decisions are different when contexts are different.

The need to consider context must not undermine proven problem solving methods like bold-face and matrix. These quick reference actions and guide will continue to anchor our good safety record because aviation abhors the luxury of time. Most aviation and military-related incidences require quick initial reactions to stabilise the situation before subsequent actions are executed. While providing initial guides and actions, such tools cannot be expected to guide thought processes throughout the whole progress of the incidences, because as the occurrence progresses, more and more options and considerations are created. Ultimately, it will still be the crew, backed up by technical knowledge, experience and layers of ground or duty executives, to make the final decision. Most matrix and technical manuals always caveat the publications with the lines in the essence of 'crew discretion must be exercised and crew decision is final', exactly because matrix cannot possibly accommodate all contexts. The crew is therefore really the last line of defence to exact the appropriate actions according to the context.

In most cases, contexts in our present environment will add weight, in different amounts, to the safety side of the scale, thereby invariably lending safety the over-riding factor over accomplishing routine missions or training. This is demonstrated by the vast majority of reported incidences aborting missions or training to allow for successful handling of abnormalities and emergencies. However, in some cases, certain contexts do tip the scales towards mission accomplishment. The key word is 'tip', meaning that while the mission continues, a large component of the thought process and decision making is still directed at safety. During such instances, the emphasis on safety manifests in trying to maximise mitigating factors and minimise further risks. In all cases, safety exists to support ops imperatives.

CONCLUSION

Context is increasingly important in the 3rd Generation RSAF. We are getting less autonomous and more integrated, be it as ONE SAF with the other services, or as part of a coalition in the global fight against terrorism. With new expanded roles, operating in new areas of operations, utilising new platforms in an intricately connected world, our policies and actions have far reaching implications, inwardly to Singaporeans and outwardly, to the rest of the world. Today, there are far more components that form the context in which we operate in. In order to make the 3rd Generation people in the RSAF more 'context' savvy, we will have to be armed with deeper knowledge – firstly through increased awareness of issues at the task level and above, for example, commander's intent, HQ RSAF policies, SAF and national interests, geopolitical situation, etc. Secondly, deeper knowledge at the type level, gained through deeper analysis and sharing of abnormal occurrences, questioning on the 'why's, and simulations, like through table top exercises. Armed with a better understanding of context, coupled and anchored with competency, professionalism, sound doctrines and our safety culture, we can be certain that the decisions we make are the most relevant, appropriate and robust.

DEALING with TRANSITIONS

The story of a Dog, A Tiger and a Bear.

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The cool, breezy day started with a jog. Jogging along my regular path, I approached the first junction. For a change, I decided to take a new route – one that would take me along the canal. As I jogged along this less familiar path, I wondered where this route would take me and how long it would take. Thinking for a short while, I decided not to worry about the inconsequential details and instead enjoy the new sights around me. My mind soon drifted to the changes that have taken place in our organisation, I thought to myself how far we have come and how much longer the journey will take. It was then that I heard a low growling noise. I turned slowly and to my dismay observed a brown, angry looking mongrel approaching me. Maybe the change of route was not such a good idea after all...

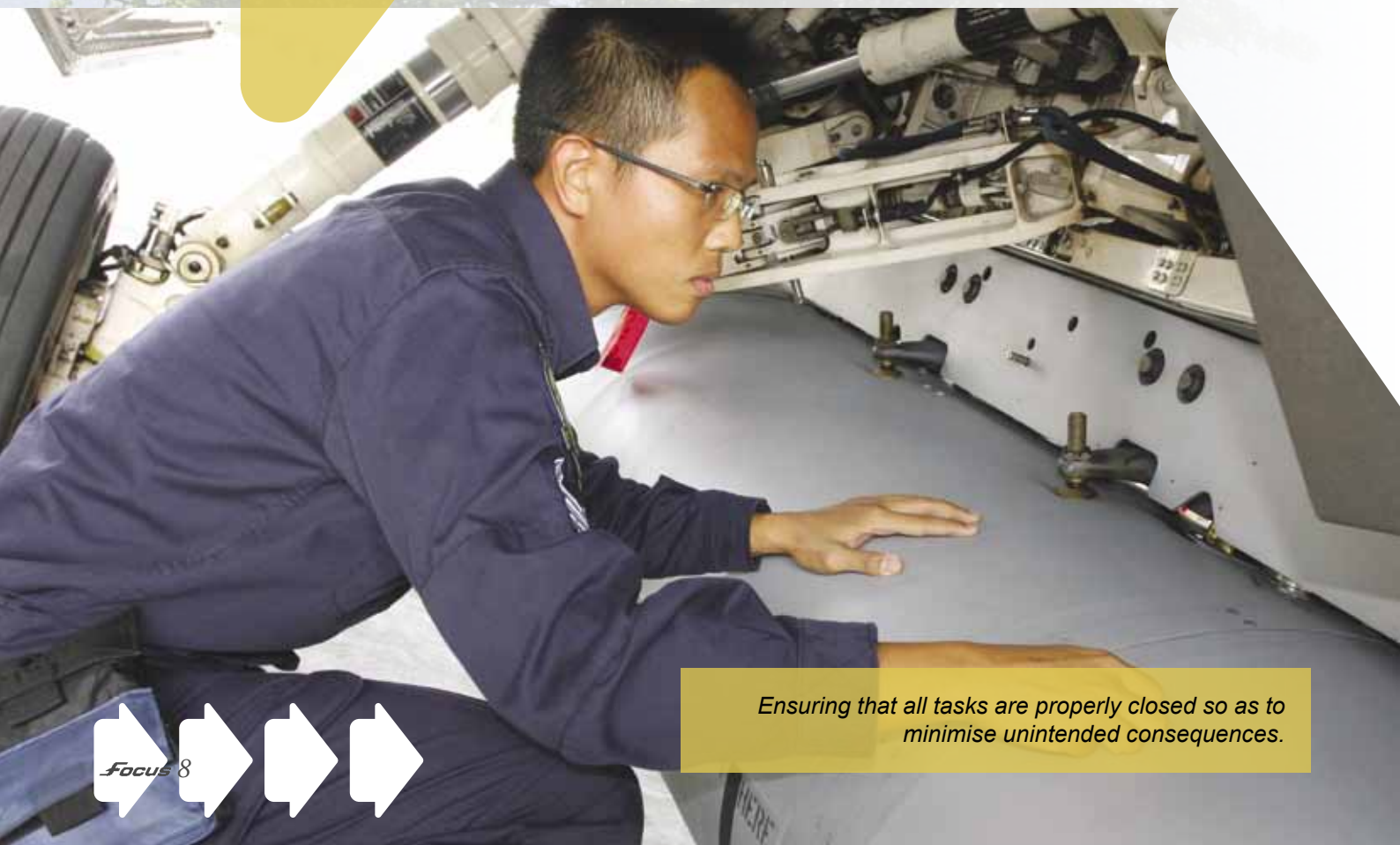
ABOUT TRANSITIONS

Transitions. We face them every day in various forms and degrees. The more obvious ones involve the significant stages or events in our lives. They include the progression from adolescence to adulthood, from singlehood to matrimony, or even the graceful process of ageing. We also face similar transitions at work. For example, there is a transition when we restructure the organisation. At the individual level, a Senior Technician can undergo a transition when he switches from maintaining an F-5 aircraft to an F-15, or moves from a predominantly Intermediate Level workshop environment to the flight line. These transitions are typically planned well in advance and are deliberately executed. They may also dictate a change in management plans to ensure that all parties involved in the transition are clear about their new roles.

There are less significant transitions that occur far more frequently. When we wake up in the morning, we slip from a state of sleep to a state of wakefulness. At breakfast, we veer from hunger to satiation (and for some, another transition from satiety to emptiness takes place shortly after that). While driving to work, some shift from a composed inclination to an angry disposition depending on the traffic condition. These transitions are so common that we have become accustomed to them and therefore, place no special emphasis on dealing with them. This does not constitute a problem as most of these small transitions carry little or no significant impact on the general quality of life. However, periods of transition are prone to high levels of errors. A study conducted in the US reported that medication errors were most likely to occur when patients were transferring between outpatient and inpatient care[1]. Another factor that accounted for a large portion of medication errors was the period when house staff were changing duties. It would thus make sense for us to see how we can reduce the likelihood of errors occurring during periods of transition. This will be the focus of the rest of my article.

As I was researching this topic, I found that little has been written on reducing errors during transitions. This is especially true in the domain of aviation safety. Hence, I decided to take the cue from the famous French philosopher René Descartes, once wrote "It is only by comparison that we know the truth"[2]. In line with his quote, I will use examples found in nature, sports and economics to illustrate how we can effectively deal with transitions.

1. *LaPointe NM, Jollis JG [2003]. "Medication Errors in Hospitalized Cardiovascular Patients". Arch Intern Med, 163:1461.*
2. *Descartes, René (2000). Philosophical Essays and Correspondance. Indianapolis: Hackett Publishing Company, 26.*



Ensuring that all tasks are properly closed so as to minimise unintended consequences.

LESSONS FROM NATURE

Nature is in a constant state of transition. An analysis of the coping mechanisms employed by the natural world will prove to be instructive. For example, nature has developed a wide range of responses to the ever-changing seasons. These responses provide a rich source of knowledge that can guide the management of transitions. A study has found that worker ants increase significantly in numbers, up to 25-fold, during the Spring to Fall months, to ensure the population as a whole can withstand the harsh winter months when a large number of both queens and workers die[3]. For them to carry out this complex task, the ants must be able to discern the patterns of nature and subsequently perform the necessary adjustments to their population to afford themselves with the best chance of survival. Similarly, we need to be able to recognise the many transitions we face daily and be more aware of the times when we may be more susceptible to making errors.

To illustrate my point, consider the act of photocopying a stack of documents (without the aid of a document feeder) – to make a copy of the next sheet, we have to remove the preceding page from the machine. Since there are no pages to copy after the last sheet, there is no practical implication if we do not remove it. Hence, the emergence of the last copied page sends a strong but erroneous completion signal and people often forget to remove the last page of the original document. In fact, studies have shown that leaving the last page of the original in the machine is the most common omission error in photocopying[4]. This is because, false sense of completion prompts the person performing the job to switch his attention from the mundane task to the next task at hand. To combat such behaviour, we first need to identify tasks that are frequently carried out and analyse the steps that are prone to errors. Procedures should then be introduced to reduce the likelihood of omission errors. Returning to the example of the photocopier, one method to reduce the tendency of forgetting about the last page of the original document is to place a reminder on a stapler that is located next to the machine.

LESSONS FROM SPORTS

Events and actions in sports are perpetually in transition and the single act of swinging a golf club exemplifies this. A golf swing takes less than 2 seconds to complete; in fact, the time taken from the top of the backswing to the point of impact is only about 0.3 seconds[5]. But in that time, the club head (of a driver) would have travelled about 4 metres and accelerated to a speed of 200 km/h (only for Tiger Woods, of course). From a standstill, the ball would have been propelled to a speed of around 320 km/h. Now that is what I call a quick transition.

What lessons can we draw from the golf swing? For a start, trying to swing like Tiger Woods is probably unsafe and can potentially result in an unplanned trip to the hospital for the unskilled player. Also, despite the fact that the club-head travels about 8 metres from address to impact, the physiological-head moves by only 5 – 10 centimetres. In other words, a core, or point of focus, remains relatively still amidst all the movement. Therefore, the second lesson we can take away from golf is that while undergoing transition, we must remain focussed on the task at hand and not be distracted from it. In this way, we will be able to reduce a significant number of transition errors. However, staying focused is easier said than done. Certain human traits like forgetfulness cannot be entirely eliminated. Likewise, situations and people often cannot be controlled completely. This is where golf offers yet another lesson on managing situations.

Consider a scenario where you are teeing off on a hole and there is a pond on the right side of the fairway (my apologies to non-golfers, you really do not know what you are missing out on). Logically, you should position the ball on the right edge of the tee-box to allow you to aim away from the water hazard as much as possible. This is because we do not swing like Tiger does and we want to minimise the chances of hitting the ball into the pond. Applying the same logic to daily events, we should adopt safe practices to mitigate the risks involved in our

3. *Laskis KO, Tschinkel WR (2008). "The Seasonal Natural History of the Ant in Northen Florida". Journal of Insect Science; 9:2:17.*
4. *Reason JR (2002). "Combatting omission errors through task analysis and good reminders". Quality and Safety in Health Care; 11:40-44.*
5. *Chong WS et. al. (2004) "A Quantitative Evaluation of the Golf Swing". The 30th Annual Conference of the IEEE Industrial Electronics Society, 2054*

activities. Safe practices can lower risk levels even after errors have been committed. A safe practice that can be adopted is to avoid putting items above the roof of a car, even if only for a while. This act can be tempting especially when our hands are full. However, if we make a commitment not to do it, we will never encounter a situation in which we drive off with the item still on the roof[6]. Relating to an aircraft maintenance setting, we should not place tools or consumables within aircraft compartments as there is a possibility that we forget to retrieve them.

A specialist once made such a mistake during the installation of an aircraft formation light. Part of the job required the use of a rubber sleeve, which functions to connect two wires together. As another sleeve did not work well on a previous occasion, the specialist bought an extra sleeve onto the aircraft in case one was faulty. He put the unused sleeve on the aircraft deck and proceeded to install the other. When the job was accomplished, he moved on to the next task of performing the operational check and completely forgot about the sleeve on the deck. The extra sleeve was only discovered during pre-flight checks some days later. This incident could have been entirely avoided had the specialist adopted the safe practice of not placing consumables on surfaces within the aircraft. He could have instead kept the sleeve in the pocket of his coveralls, or better yet, in his toolbox.

LESSONS FROM THE ECONOMY

We shall now examine the lessons that the economy has to provide on the topic of making safer transitions. In the current context, we probably cannot talk about the economy without reference to the big Bear – that is, the global financial meltdown that was exacerbated by the sub-prime crisis. A little more than a year ago, the Straits Times Index (STI) was at an all time high. This serves

Staying "Tiger' focused

6. *http://www.snopes.com/autos/mishaps/babyroof.asp (last accessed on 11 Mar 09) details at least 3 instances in which parents drove off with child seats (occupied ones!) left on the roof of the car.*

on the task at hand.

as a stark contrast to the current situation in the market. Evidently, the rapid transition from peak to trough has affected the lives of many around the world and we hear incessant reports of how people are struggling to cope in these dire times. Counter-intuitively, experts say that the financial crisis is also spurring on an obesity crisis[7]. When people had less income in the past, they simply ate less food. However, with the availability of low cost food in the developed world today, poor people are switching from healthier foods to cheaper, high-calorie alternatives. Analysts are also unearthing other surprising consequences of the financial crisis, such as the increase in online advertising and the lowering of hemlines[8].

The lesson that we can extract here is that we need to be mindful of the unintentional impacts that are created by the deliberate transitions that we choose to undertake. We only need to refer to the case of the Exxon Valdez oil spill in 1989 to see how the lesson works. The infamous incident resulted in the enactment of new laws in many coastal states that placed full responsibility of oil transport operations on tanker operations. The change in policy was intended to increase safety of such operations; but in reality, the outcomes were less than desirable. Shell group began sub-contracting the delivery of oil instead of using its own forty-six-tanker fleet. Gradually, other suppliers began following suit to avoid accepting the daunting responsibility of answering for another oil spill. This mandated the field with operate-night tanker operators that had leaky ships and questionable insurance. As a result, the new laws led to an increase in the risk of spills and a decrease in the likelihood of recovering damages through insurance[9]. We should therefore be as thorough as possible when we plan a transition so as to minimise the number of unexpected consequences. If this is done well, we minimise the risk of experiencing unintended consequence that may potentially derail the transition.

For transitions that are less deliberate, planning is not possible and the problem becomes more

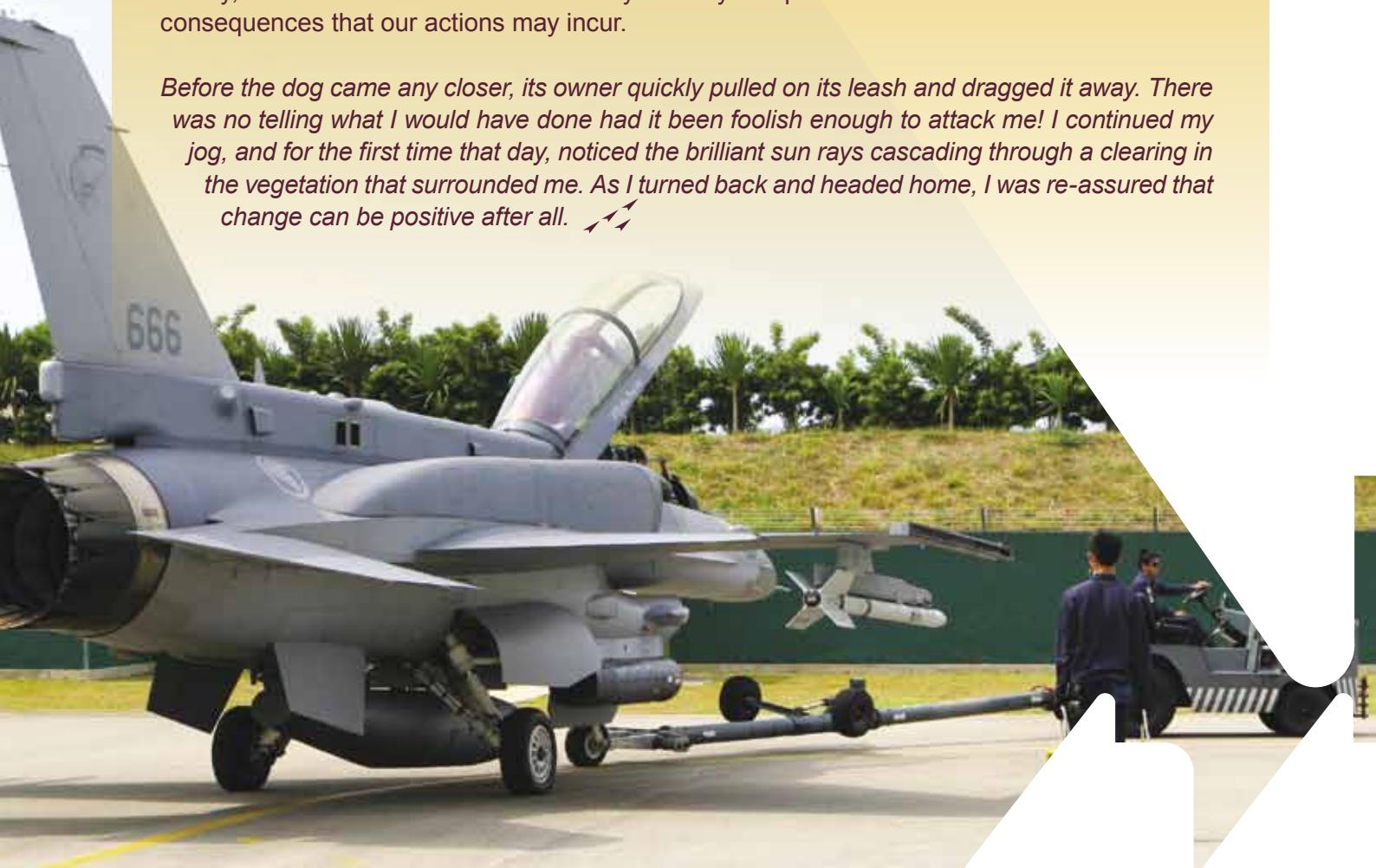
7. *Roan S. "Economic Crisis, Meet Obesity Crisis". Los Angeles Times, 3 Feb 2009.*
8. *Drezner DW (Mar/Apr 2009). "The Long Legs of the Crash: 13 Unexpected Consequences of the Financial Crisis". Foreign Policy.*
9. *Norton R (2007). "Unintended Consequences". The Concise Encyclopedia of Economics. Indianapolis: Liberty Fund Inc.*

intractable. One way of tackling this issue is to ensure that all tasks are properly concluded so as to minimise unintended consequences. Let me illustrate what I mean. Several years ago, a technician partially installed a display (item was seated but not fastened) on an aircraft so that he could do a functional test to confirm that the component was working well. After the test was done, the technician forgot to return to fasten the display. You can imagine the shock on the part of the pilot when the display slid out while the aircraft was on its take-off roll. This incident could have been prevented if the first task of installing the display, had been duly completed before the technician proceeded with the next job of performing the functional test.

CONCLUSION

John Kotter concludes his seminal book on change with an emphasis on lifelong learning. He writes, "In an ever-changing world, you never learn it all, even if you keep growing into your 90s."[10]. One way of learning is through observing and analysing the world around us. The three analogies that I have used also reflect how the three phases of how transitions should be managed. Prior to the transition, we should learn from the ants and be attuned to the transitions we go through each day. Staying attuned will help us identify and hopefully mitigate periods when we are more susceptible to making mistakes. During the transition itself, we need to stay "Tiger" focused on the task at hand so as to avoid being distracted. We should also adopt safe practices so that the impact of mistakes can be minimised. Finally, we need to take heed from the economic situation and be watchful for unintended and unexpected consequences. Finally, we should track our tasks until they are fully completed so as to minimise the undesired consequences that our actions may incur.

Before the dog came any closer, its owner quickly pulled on its leash and dragged it away. There was no telling what I would have done had it been foolish enough to attack me! I continued my jog, and for the first time that day, noticed the brilliant sun rays cascading through a clearing in the vegetation that surrounded me. As I turned back and headed home, I was re-assured that change can be positive after all.



10. Kotter J (1996). Leading Change. Boston: Harvard Business School Press: 175

HARE TODAY, GONE TOMORROW.

Amongst my favourite fables is that relating the race between the hare and the tortoise. I am sure everyone is familiar with the phrase “the slow and steady, win the race”. Parents often use this story to encourage their children to persevere and excel whatever challenges they are undertaking. I would, however, like to offer an alternate perspective to interpret the story. And if I have my way, I would re-title this fable as “Hare Today, Gone Tomorrow”.

I have some questions for you to consider. Why did the Hare choose to race against the tortoise when there were so many other animals in the woods? Why did it not pick a race with a faster animal? Why did it not benchmark against higher standards? In essence, you begin to adopt inferior practices and standards when you opt to level down. A dangerous norm forms when we make a habit of leveling down; it encourages complacency and lethargy in life.

As the world continues to globalise, it presents a level playing field that calls for better, faster and more cost-effective methods of accomplishing tasks. Business gurus label this ongoing process of upgrading as “benchmarking” or “continuous improvement”. Evidently, these terms were not in the Hare’s vocabulary as it chose to benchmark downwards. Some people might disagree with my assessment of the hare's decision. They argue that nobody wants his or her child to receive grades that are lower than others' or to aim for second or third place in life. Furthermore, no one will deliberately downgrade the quality of his life by benchmarking downwards. But if this is really the case, why do we still find quality discrepancies and non-compliance? Why is it that people still take shortcuts and compromise their work processes?

Do we see the Hare creeping into our daily choices and attitudes? Do we realise the Hare gaining the upper hand when we choose to benchmark against lower standards? What happens when we allow that Hare to grow (no pun intended for the shiny heads amongst us)? Like how the fable ends, we wind up lagging, losing, and being left behind. If it is quality that we compromise, a system may subsequently fail. If it is a safety practice or process that we compromise, we expose ourselves and others to grave danger.

Beware if you decide to be the Hare that levels down! You may be HARE today, but GONE tomorrow. The moral of the hare and tortoise story is to level up to a higher standard and never compromise on any processes. Remember, we are a first class Air Force, made up of world class people, and it is imperative for us to live up to our vision.

It is a choice to aim higher, daily.

Author
LTC (NS) Rendell Tan

LTC (NS) Rendell Tan retired from the RSAF on 1 Jan 2009. During his active duty, LTC (NS) Tan held various positions including Senior National Representative, Joint Strike Fighter (F-35) Program Office (United States), Branch Head, ALD, Section Head, ALD and OC Log Flight 144 Squadron. He holds a Bachelor of Engineering (1st Class Honours) from NTU and a Master of Science in Aeronautical Engineering from the United States Naval Postgraduate School. LTC (NS) Tan was an active advocate of the concept of Human Factors (HF), and mandated HF training for all senior technicians in Air Logistics. He has also served in AFI, on the Focus magazine editorial board, from 1996 to 1998.

Teaching Blokes To Fly ... Safely!

Author
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Lieutenant-Colonel (Ret) Koh Chai Hong is an experienced transport pilot with more than 7500 flying hours, of which nearly 5000 hours were spent on instructional flying in Flying Training School (FTS) on the Marchetti SF260 and S211. In addition to some transport flying experience on the Skyvan and C-130 Hercules, she has also served several staff tours in HQ RSAF. LTC (Ret) Koh was the first SAF(W) officer to attend the Singapore Command and Staff Course in 1997 before her appointment as Commanding Officer of Standards Squadron in July 1998. She served as Wing Commander of the Aviation Wing in Air Force School before retiring in Jul 2005; but remained in service until Jan 2008 as a contract DXO QFI in Air Grading Centre based in Tamworth, Australia to fulfill her passion to teach flying.

When it comes to safety, it is natural to focus on the potential safety hazards associated with multi-task and mission-oriented operations. Already we are seeing more FAIRs generated by squadrons in the SIS with regards to their local and overseas operations. Yet, the more complex a mission or sortie is, the more "safe" it probably will be as it is likely to be subjected to layers of supervisory scrutiny, mission briefings and risk management prior to the flight. Perhaps it is in the mundane and routine sorties that flight safety is more likely to be infringed. These sorties are repetitive and are conducted daily regardless of weather conditions. Unfortunately, training flights that are flown in the Flying Training School are not without its own safety risks.

In this article, I would like to share my views on the various factors and considerations that bear safety implications for our Flying Training School (FTS).

Editor's note: This article was originally published in FOCUS 28. While the author makes several references to the Marchetti S211, the experiences and lessons learnt then are still very relevant in today's training context. The editor has made minimum amendments to the article to preserve the style and essence as intended by the author.

MEDIUM

The five training squadrons in FTS account for a significant portion of the total flying hours clocked by the RSAF, out of which about 84% are flown overseas in 'foreign' medium. Not surprisingly, the overseas FTS units are a major contributor of FAIRs. Many of these FAIRs are Air Traffic Control (ATC)-related and close proximity FAIRs that occurred predominantly in the initial years just after the overseas detachments had been set up. Some of the problems associated with training in an overseas environment are listed below.

Airspace - ATC Requirement

The lack of airspace in Singapore has led us to source for training opportunities elsewhere. However, the RSAF pilots may not be accustomed to the different set of ATC rules that comes with flying in foreign airspace. For example, our pilots are more attuned to a rigid but efficient ATC system locally that affords radar monitoring even when operating in Visual Meteorological Conditions (VMC). In contrast, Visual Flight Rules (VFR) practised overseas are less strict and leave the onus on the pilot to identify and maintain separation with other aircraft. Should a pilot require ATC assistance for radar vector or traffic separation, he has to request for it by switching to Instrument Flight Rules (IFR). The dependence on ATC is further tested during Mandatory Broadcasting Zone (MBZ) operations when ATC service is not available. Pilots will have to keep their eyes and ears open for `see and be seen' operations that are assisted by timely broadcast of positions and intentions. Therefore, new pilots who arrive at overseas bases tend to form the erroneous perception that ATC will constantly monitor and challenge them just like in Singapore.

Airspace - Local Procedures

In Pearce, the proximity of Perth International Airport (17 nm south) might potentially result in safety infringement and ATC violation. Over in Cazaux, the Calamar Air-to-Ground Range, which is only half a nautical mile south of the airfield, creates a range of safety concerns for pilots and aircraft. R/T procedures and read backs have to be followed strictly in accordance to the local format. This can prove to be a challenging re-learning process for our pilots - instead of straightforward transmitting, we now have to deliberate before transmitting our intentions.

Overseas bases have their own local procedures and tolerances for aircraft of different speeds. In Pearce, for example, ATC rules limit the number of aircraft that are allowed to fly in continuous circuits to six planes. However, up to ten aircraft, inclusive of departing, joining, Practice Forced Landing (PFL) and go around traffic, may be accommodated within the Aerodome Traffic Zone (ATZ) at the same time. This calls for very high Situational Awareness (SA) to remain on top of the situation, especially so for solo students. Also, the airfield layout is more complex, with two runways and a parallel lane for circuit operations that offer six approaches to the airfield and simultaneous runway operations. Pilots can opt for a different runway from that in use, depending on their own considerations of strong crosswinds, runway length and availability of instrument approaches. Thus, it is not unusual for Pearce ATC to line up a S-211 on R/W 05, clear a Hawk to take-off on R/W 36R whilst a PC 9 is on long finals for Instrument Landing System R/W 18L. Such situations demand a high level of alertness from the students and instructors.

Language

The ability to understand and communicate effectively in the language medium used by pilots, aircrew and air traffic controllers will directly affect safe flying operations. This is especially so for those pilots based in Cazaux, France due to the impact of the French accent on communications. During my staff visit to the squadron in late 1999, I listened to an AVTR tape in order to enhance my understanding of this problem. I discovered that the French accent was so significant that the only words I managed to make out were QNH 1012!! Although this problem is less evident in Australia, some students still have difficulty understanding the Aussie accent of some ATC controllers and their peculiar R/T phraseology. The transition to a foreign environment is made more difficult if a different first language is spoken. Although normal R/T transmissions in Cazaux are made in English, French pilots and ATC controllers tend to converse in French during emergency situations. Such an

occurrence will degrade the SA of an RSAF pilot and may compromise on his awareness of the emergency situation.

Weather

Few factors affect a pilot as much as weather. As such, weather cannot be taken lightly. Neither aircraft nor pilots perform well in extreme weather conditions encountered during the peak of summer and winter. Summer temperatures in Pearce are known to hit 42 degrees C, causing serious degradation in engine thrust and human tolerance. In winter, flying operations in Cazaux are affected by unexpected low clouds, icing and hailing that can `blacken' the runway for more than an hour. Recoveries can be further hampered by the lack of Ground Control Approach (GCA) services. In Pearce, waves of squall line weather and gusty winds are common in winter and pilots have to be very vigilant. Ironically, crosswinds measuring up to 40 kts are common even in good VMC with clear blue skies. Squadron Executives often face the difficult task of making sound decisions to launch, hold or recall the aircraft. These decisions are especially daunting when updates on weather forecasts are limited and instrument recovery cannot be guaranteed.

Because of the large weather variation in temperate countries, it is not necessarily beneficial to always train in clear VMC. Students may encounter adverse weather conditions during the transition of seasons when they proceed to subsequent training modules. Likewise, they may have gotten accustomed to operating from a particular runway for most of their training; but seasonal variation in wind direction might dictate different runways to be used for departing and recovering traffic. During such periods, it is inevitable that students may have to be `ghosted'[1] during their solo sorties until they are certified competent to operate in these conditions. In Pearce, strong crosswinds

Good pilots will not n poor pilots will definit

may drift an aircraft from the main runway to the lane-runway and vice versa, which can result in close proximity hazards if the pilots are not vigilant.

MISSION

Flying training sorties follow a structured syllabus and are generally routine in nature. However, our Qualified Flying Instructors (QFIs) and Qualified Helicopter Instructors (QHIs), including very experienced instructors, need to guard against complacency when the sorties become mundane. It is important to recognise that the student is always the variable. Students exhibit a myriad of personalities and their actions can sometimes surprise even the most experienced instructors. An example was a S211 pilot trainee who shut down a perfectly good engine when he was given a simulated emergency! As such, instructors have to remain vigilant at all times and be ready to take corrective measures should the trainee make a grave mistake.

Rotary Wing Conversion

The routine mission is itself a challenge for RWC students switching from the fixed wing to rotary

1. *Ghosted solo sorties refer to a pilot trainee flying as though it were a solo sortie while the instructor observes the flight in the back seat of the aircraft.*

wing trainers, at least initially. It has been said that helicopters are not meant to fly and indeed, manoeuvring a helicopter requires different psychomotor skills from those used for conventional flying. This is where one needs to guard against the negative cross transfer of platforms. Helicopter pilots posted to the Flying Instructor Course (FIC) to become QFIs at Pearce also encounter the challenge of having to adapt their skills to control fixed wing aircraft. It would thus be beneficial for cross platform pilots to identify and be familiar with the differences between helicopters and fixed wing flying characteristics.

Flight Simulators and Cockpit Procedural Trainers are effectively used in FTS to supplement real flying. They better prepare students for routine exercises, as well as hone flying skills and develop airmanship considerations to deal with potential contingencies. However, one also has to exercise caution when transferring the lessons learnt from simulator training to real flying.

MAN

Human Factors comprise of many aspects, including physical, mental, and environmental factors. These can significantly influence flying training safety, to either prevent or contribute to human error incidents and accidents.

The Instructor

Good pilots will not necessarily make good instructors but poor pilots will definitely not make good instructors. How can weak pilots find the spare capacity to monitor and teach non-pilots if they themselves are struggling to cope with their own flying and situation awareness? The `teeth' of our airforce will always be the fighter units and the best pilots will be channeled there to meet the operational requirements. However, I believe that training and operations are closely intertwined and will directly affect each other. The type of pilots you select to be flying instructors will undoubtedly affect the quality of pilots produced for the operational squadrons downstream. It is thus logical and sensible to ensure that at least average pilots, and preferably above-average pilots, are sent for FIC/HIC during the selection process. Inexperience can be overcomed with time, but not incompetence; not

ecessarily make good instructors but ely not make good instructors.

when you are the one responsible for imparting flying skills to future generations of pilots. QFIs/QHIs are role models for their students and should be exemplary in every aspect in terms of flying skills, leadership and bearing, and inculcating the correct core values.

Besides the importance of competence and experience, I believe a good QFI/QHI should have two other positive traits - discipline and good communications skills. And they need to guard against two emotions that may obstruct good instruction and safety - ego and anger. In flying, almost all pilots possess an intrinsic tendency to want to flaunt their flying skills. They may be tempted to take risks to impress their juniors, peers or even seniors and in the process boost their self-confidence. However, a pilot who engages in such behaviour fails to realise that the manner in which he flies is testament to all about his character, discipline and attitude towards safety. Without discipline, potential talent is wasted. I find that the greatest challenge about being a QFI/QHI is the constant need to set a good example for students and to do things the way we preach, even when we may be tempted to take short cuts. It is of little relevance how many hundred times an instructor tells a student to fly a standard profile. All it takes to trigger a student imitation of a more 'exciting' flying profile is a SINGLE sighting of his instructor executing it. Such is the eccentricity of the human nature.

A flying instructor's misplaced ego can be dangerous, especially if the anger or frustration with his students impairs his judgment. Good emotional control and problem-solving skills need to be exercised. Some less experienced QFIs may feel peer pressure to prove their abilities, but it is worthwhile to note that our structured QFI/QHI category system houses instructors with various levels of experience. Thus,

an experienced Cat A QFI is more likely to recognize and correct potentially dangerous situations, and hence be paired with the more junior or weaker pilot trainees. There is no room for complacency on the part of the QFIs and plenty of lessons can be learnt from past incidents resulting from late take-over of controls by QFIs, especially in the landing phase of basic flying training.

Communications

Good communications, or rather the lack of it, between ATC and pilot, QFI and student, or elements within a formation, can affect safe operations. This is evident from the number of ATC-related FAIRs involving misinterpreted read back and hear back transmissions. Miscommunication is especially common in units based overseas due to the presence of a language barrier. In my conduct of the Fixed wing Instructor Course (FIC), I was very particular about imparting the importance of proper handing and taking over of controls between QFI and student. This was a result of my experience as a pilot trainee undergoing the advanced wings phase training on the Strikemaster aircraft.....

".....the Squadron had participated in a low level ADEX mission. I was very excited to be allowed on board the flight with the QFI, especially since I was given the controls to fly low-level tactical formation through a valley. As our formation approached a checkpoint that required a large change in heading, the QFI took over the controls to show me how to execute the turn while remaining in a tactical formation with the leader. The next impression my mind registered was that the aircraft was dangerously banking towards the mountain slope in a steep descent. I was wondering why the QFI was flying in such a manner, when he loudly asked what was I doing and ordered to pitch up. I replied that I did not have control of the aircraft, after which he let out an expletive and quickly recovered the aircraft to level flight. The QFI later apologised as he had forgotten to say 'You Have Control' when he had intended to hand the controls over to me in the midst of executing the low-level crossover. I never forgot this lesson learnt on the importance of proper handing/taking over of controls.

Many of our pilot trainees are reticent when it comes to speaking out. Sometimes, they do not speak up enough to communicate effectively with their instructors, even when there is something wrong with the aircraft. An example was a FAIR submitted in 2000 when a S211 student felt some control restriction on the ailerons and had trouble maintaining wings level; but did not sound out to his QFI. By the time the QFI learnt that something was wrong, the aircraft was heading into a steep bank and the QFI promptly took over the controls. By then, he had lost almost all aileron control inputs in one direction, and had to rely on his superior skills and cross control with rudders to land the S211 safely. Following this incident, students were briefed to let their QFIs know should they experience anything unusual in the aircraft especially for flight controls. Even so, during a subsequent sortie when a trainee experienced a stab-trim failure, he flew a large part of the recovery route holding large pitch forces, yet did not communicate to his QFI of his control difficulty throughout. Students are truly amazing, thus the need for instructors to be always vigilant!!

CONCLUSION

How we train in peace will determine how we fight in war. We cannot afford to have a poor safety record whilst we train as it erodes public and international confidence in our airforce and our operational capability, the skills of our pilots and the reliability of our aircraft maintenance. Although training flights are predictable and routine, we should never take safety for granted. Within the mundane exercise profiles, there are many variables that are pivotal - the inexperienced and unpredictable student; the experience and competence level of the flying instructor and the air traffic controller, the environment and weather; ageing aircraft; unreliable navigation systems and the quality of maintenance. Safety should not be a concern at only the management level; it is everyone's responsibility and we need to apply common sense in what we do - both on the ground and in the air. Rules and regulations serve no purpose if they are not adhered to. Drink-driving in the wee hours of the morning without a seat-belt proves nothing, except extreme foolhardiness and the lack of common sense. If you can see the weather conditions deteriorating, don't wait for the SXO to recall aircraft as he has limited information on the ground; give a PIREP and initiate your own recovery.

Barring all the potential safety hazards in a training flight, the flying instructor remains the most important link in the prevention of incidents/ accidents. As such, I would like to close this article with a quote by Charles Lindbergh on his definition of `The Instructor'.

The Instructor

A pilot doesn't understand the real limitations of his aircraft until he is instructed in it. Try as he may, he can never duplicate intentionally the plights that a student gets him into by accident. When you are flying yourself, you know in advance whether you are going to pull the stick back, push it forward, or cut the throttle. You think of a manoeuvre before you attempt it. But you're never sure what a student is going to do. He's likely to haul the nose up and cut the gun at the very moment when more speed is needed. If you check his errors too quickly, he loses confidence in his ability to fly. If you let them go too long, he'll crash you. You must learn the exact limits of your plane, and always keep him far enough within them so the wrong movement of a control will still leave you with the situation well in hand. You must learn not how high the tail should go in takeoff, but how high it can go without disaster, not how to avoid a wind drift when you are landing, but how much drift there can be when the wheels touch without a ground loop or blown tire resulting. And after you've learned how to keep a student out of trouble, you find that you've become a better pilot yourself. As you instruct your student in the primary art of flying, he instructs you in its advanced phases. In a gust of wind or if the engine fails, or in any emergency, you handle your plane more skilfully than you ever did before.

Safety in Transformation :

A Personal Perspective

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INTRODUCTION

The metamorphosis of a caterpillar is an amazing process. The transition begins when the caterpillar selects a spot to weave its cocoon and ends on the day it breaks out of its cocoon, transformed into a butterfly. Understanding safety hazards associated with transitions is akin to the decision made by the caterpillar in selecting the best spot to build its cocoon. For the caterpillar, the location selected has to be sheltered from inclement weather and most importantly, safe from predators. Relating to the transformation efforts in the RSAF, all hazards during a transition have to be identified early, and relevant risk factors mitigated with the most appropriate control measures. Failing to adequately address such safety hazards and issues could jeopardize the entire transformation process.

TRANSITIONAL STAGES

The continuous advance in defence technology has seen a corresponding evolution in security challenges in recent years. The RSAF has also transformed itself to meet these challenges and changes. At the system level, the RSAF experiences transitions when new platforms are being acquired (Inter-platform transition), or when current equipment/systems undergo a mid-life upgrade (Intra-platform transition). Broadly defined, these transitions would involve the stages of Exploration, Consolidation and Realisation. I will explain further on this.

STAGES OF TRANSITION

Exploration Stage

- Learning Mode
- Lack of Knowledge
- Prone to Accident

Consolidation Stage

- Develop Competency
- Build Confidence
- Complacency may set in

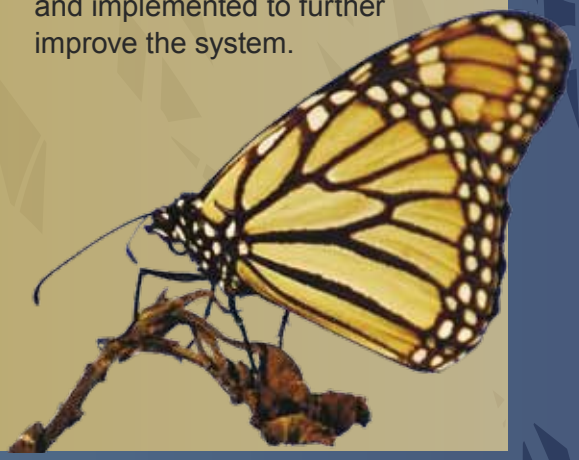
Realisation Stage

- Able to look at issue at greater depth
- Able to provide solution
- Able to improve SOP and standards

Exploration Stage – This stage begins when we are first introduced to a new environment. When faced with unfamiliarity and a lack of knowledge, we will instinctively adapt ourselves into the environment by transiting into a learning mode. Boundaries and limits at this stage are often being tested due to the lack of knowledge, and we are also more prone to making assumptions. Therefore, we are often advised to take exceptional precautions when unsure or faced with uncertainties, e.g. Calling safety 'time-out' when the need arises.

Consolidation – After being immersed in the operating environment for a period of time (typically 6–12 months after induction to a new platform), we become more knowledgeable of our systems / equipment and gain confidence with better competency. Consolidation allows for rapid progression in the areas of skill, knowledge and experience in the new system and we gradually develop deeper proficiency in the new system. With deeper proficiency, we risk complacency to set in.

Realisation – As we gain experience and achieve higher levels of confidence and competence in the new system, we are able to look at issues in greater depth and derive better solutions more readily. This stage also allows new standards and procedures to be set, or regularly reviewed and implemented to further improve the system.



Understanding these stages will provide greater awareness and allows better management of the safety hazards in times of change.

Relating to the stages mentioned above, I would like to share some personal views on safety, as well as lessons learned from my experience working on a weapon system upgrade program. Comprising of two parts, the transformation involved firstly the upgrading of the existing equipment, and secondly the development of a new Platform-to-platform transition.

EXPLORATION STAGE

We often draw on our past experiences to provide some reference or guidance in order to resolve a problem. Hence, a lack of knowledge on the new or changing environment usually brings about uncertainties. Subsequently, we are inclined to accept relevant information without questioning its reliability or factuality. This is especially true when the information is obtained from a credible source. For example, the Original Equipment Manufacturers (OMEs) were the experts on the upgraded system, and the ground crew working on the upgrade programme seldom questioned the OME's opinions. However, as the following example demonstrates the OMEs were not always right.

In late 2003, I was involved in a routine training exercise using the upgraded equipment. During the final phase of the exercise, a intermittent failure was observed on one of the equipment. The OEM attributed the failure to a non-upgraded portion of the equipment. The exercise crew proceeded with regression testing on the non-upgraded portion which unfortunately led to further technical complications on the equipment. It was only after 3 years of detailed investigation on the equipment that the root cause of the problem was eventually established. Contrary to the OEM's judgement, the defect was the result of a design deficiency in a newly-introduced component. The deficiency caused the component to overload, which in turn led to the equipment losing one of the critical signals required to successfully complete its operation. Although the manufacturer finally acknowledged the design deficiency of the upgraded system, it was a lesson that came rather late.

We have to be wary of as there is a tendency comfort zone and sta should work when

We often venture into uncharted waters in the process of a transition, and thus, the lack of in-depth knowledge on the subject matter is expected. Nevertheless, this does not give us an excuse to accept all information at face value. We need to adopt a question-laden and factual approach in our pursuit for knowledge, even when information comes from a credible source (in this case, the system manufacturer). Years of training and a wealth of experience, as well as clear and timely feedback, are key ingredients to a safe and successful transition.

CONSOLIDATION STAGE

An increasing familiarity with the new environment and system, together with the constant consolidation of our combined knowledge and varied experiences, leads to the acquisition of experience and knowledge necessary to become more confident and proficient in the new system. Equipped with these confidence, we are in a position to further explore the performance boundaries of the system. However, there is a likelihood for complacency to set in during this period. This is exemplified in a personal encounter during another routine training exercise in 2005.

complacency at all times, for us to settle within our rt assuming how things we are complacent.

We encountered some failures on one of the equipment, the crew carried out regression tests to determine the cause and discovered several simultaneous component failures. Learning from the experience in 2003, the reasons for component failure was not assumed this time around. Instead, a more rational trouble-shooting approach was adopted: we observed for anomalies on related signals when the equipment is in operation. One of the indicators was in the 'ON' state during the tests, and we thought it to be normal based on previous experience and the technical manual. Our over-confidence caused us to overlook the fact that the indicator should be 'OFF' for the successful operation of the equipment. It was only much later that this realisation dawned on us. Indeed, we found a system design problem and a failed component only after turning our attention to the indicator that we previously thought was 'Normal'. Evidently, being complacent and accepting the status quo hindered the fault-rectifying process.

We have to be wary of complacency at all times, as there is a tendency for us to settle within our comfort zone and start assuming how things should work when we are complacent. In order to be safe and successful in this stage of the transition, we have to be on a constant look out for faults and problems while ensuring the validity and factuality of every observation.

REALISATION STAGE

After a period of continual consolidation of new knowledge and experiences, we are able to overcome the difficult issues with more in-depth analysis. To achieve greater operational effectiveness and system efficiency, we also review and improve the way we operate and how the new system is maintained.

While changes are inevitable during the different stages of transition, ensuring individual and system safety is of paramount importance. As such, one of the key factors in the management of change during any transition is risk management. Proper risk management ensures all hazards are identified early and their corresponding risk factors are assessed. Subsequently, control measures are developed and implemented to remove or mitigate the risks identified. However, control measures should be periodically reviewed or re-validated to ensure their effectiveness. Risk management is a continuous improvement process that requires compliance by each and every individual as part of a holistic accident prevention effort.

In 2006, I had the opportunity to lead a team of engineers overseas to participate in system testing for the system upgrade programme. This is

one of the critical milestone before the upgraded system can be safely put into full operations. During the test, however, a major software glitch was observed on one of the equipment. It failed a critical function test whenever the time interval between subsequent operations of the equipment is too wide. After a comprehensive test, the defect was narrowed down to a software bug that required some time to rectify.

Based on the project timeline, this software glitch would have adverse implications on the planned operationalisation of the upgraded system. The project team conducted a thorough risk assessment to explore the feasibility of inaugurating the upgraded system according to plan while concurrently rectifying the software error. All hazards relating to the defect were identified and all corresponding risks were assessed. Operational procedures were then updated and system hardware work-around solutions were implemented to mitigate the risks associated with the hazards. Through a detailed assessment of risks and the implementation of control measures, the upgraded system was eventually put into operation on schedule.

CONCLUSION

As we venture into uncharted waters, we must acknowledge that the lack of knowledge will be a challenge to transforming safely. However, we should not use the lack of knowledge as an excuse when faced with problems or possible failure. Instead, we should use it as a driving force in our pursuit of knowledge. As we continue to improve and strengthen our competencies through the stages of transition, we must ensure that safety is not compromised. We have to focus on managing changes, challenging norms and looking out for defects. By keeping our senses close to the ground for even the slightest ripples, every person plays a part in ensuring a safe and successful transition.

Safety is one of the nine core values of the RSAF, and it provides the foundation upon which the RSAF will transform into a formidable 3rd generation fighting force.

UNVEILING THE 5M4L AND HUMAN FACTORS ANALYSIS MODEL (HFAM)

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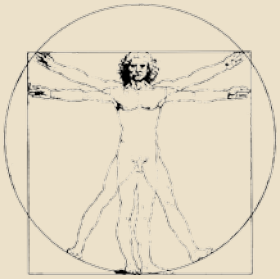


At this year's Annual Safety Conference, HAFI announced upcoming changes that will be made to the analysis portion of the FAIR reporting system and our current Human Factors Analysis and Classification System (HFACS). He spoke of a new Human Factors Analysis Model (HFAM) and 5M4L model. This article outlines the impetus for adopting HFAM and 5M4L, and the principles behind the new analysis system.

A Little Bit Of History

In 2008, an analysis conducted on RSAF's HFACS data yielded 3 key findings. Firstly, there was a tendency for units to suspend their analysis of human errors at the individual level, instead of exploring more fundamental causes. This was partly due to the current design of the FAIR reporting system and HFACS module. Senior commanders often pursue the crux of the issue, which proliferates debate and analyses over the email system. While such an open discussion culture is encouraged, the lessons learnt and points brought up in these email exchanges are not captured in the original analysis nor the SIS II database. Secondly, it was

observed that many of the 250 factors in HFACS were not used. The system's many levels, vague, overlapping and massive list of items also made analysis and classification tedious. Users often selected the first applicable option, without looking further for more suitable ones. However, as we all know, there probably is more than one causal and contributory factor in any incident. Our incident analyses can therefore be made more straightforward yet thorough. Lastly, some of the nomenclature used in our HFACS are non-intuitive. For example, the term "skill-based errors" is defined as errors occurring in the execution of highly practised skills that are performed without conscious thought. These errors tend to be memory lapses or attention failures. However, when a layperson reads the phrase "skill-based error", he would intuitively think that it refers to errors due to the operator having insufficient skill in the task.

In addition, a closer look at how HFACS has been operationalised exposes a significant flaw. The HFACS analysis is only required should man or management be chosen as the causal factor of an incident. When this happens, the HFACS analysis is filled in and analysed as a separate supplementary report. However, mission, machine and medium factors rarely cause incidents on their own. More often than not, man is involved in an accident because he sanctions the mission, services the machine or chooses to fly in a particular medium. Thus, the use of HFACS as a separate analysis from the main 5M framework resulted in repetition and gaps in reporting.

Re-designing the analysis portion of FAIR/GAIR Reports

The re-designing of the analysis portion of a FAIR/GAIR report bears 3 goals and one basic pre-condition. This pre-condition is that the 5M classifications should remain, as these classifications are fundamental to how the RSAF understands the causes of incidents and accidents. Building on this pre-condition, the first goal is to make the HFACS model more parsimonious to address the issue of having excessive, vague and duplicate items. Furthermore, each factor should articulate an independent concept that does not overlap with that of another factor. The second goal in reviewing the analysis portion of the FAIR reporting system is to reflect the inter-relationships between each factor of the 5Ms, and also between the 5Ms and HFACS. Thirdly, the new analysis system aims to guide the user through a simple but thorough incident-reporting process. In line with Reason's model, this analysis process should cover all levels of the organisation and encompass both individual errors and latent factors.

Pre-condition: Building on the fundamentals of the 5M framework

The 5M framework is a widely-used model in the RSAF. Regardless of whether one is a technician, a Commanding Officer, or a safety investigator sitting in AFI, the 5M model is usually the first tool that is employed to aid an incident investigation. The model's simplicity impels its usefulness - as long as one covers all the 5 factors in the model, it would provide a comprehensive coverage of the possible causal factors of an incident. The 5M model therefore affords the breadth for factors to be considered in an incident investigation.

Figure 1: Current 5M Model

Goal 1: The replacement of HFACS with HFAM

The original HFACS model, as designed by Wiegmann and Shappell, was intended to be used as an analysis and classification tool for any Human Factors incident. It therefore covered a wide range of factors, including weather and

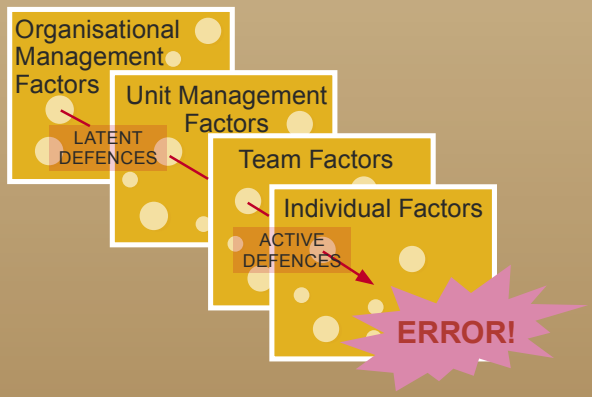


Figure 2: HFAM Model
(Based on Reason's Swiss Cheese Model)

mission. While it is a good operationalisation of Reason's Swiss Cheese Model, the HFACS is clumsy and tedious to understand.

The HFACS model was reviewed and modified, and is now called the Human Factors Analysis Model (HFAM). This is RSAF's version of the HFACS, and is also based on Reason's Swiss Cheese Model. It covers 4 levels of the organisation, ranging from the individual to RSAF's management (refer to Fig. 2).

At the level closest to the incident, cognitive, physiological, emotional, attitudinal and personal readiness factors can potentially cause or contribute to an individual's error. The second level looks into team factors such as inadequate team skills or inadequate mission management. The third level examines the error factors that can be attributed to a unit's management, including climate, process and resource management and planning. Lastly, the RSAF level inquires into climate, process, and resource management and planning issues that are governed at the organisation level (refer to Fig 3). These 4 levels provide the depth for analysis of the myriad of man and management issues that surround the error.

Goal 2: The integration of 5M and HFAM, resulting in the 5M4L Model

As previously mentioned, it is uncommon for medium or mission to be the sole cause of an incident. More often than not, man is involved in the incident in one way or another. The errors made by man can be compounded with issues pertaining to machine, mission, medium or management. Also,

INDIVIDUAL FACTORS

Physiological	Cognitive	Attitudes and Emotional State	Personal Readiness
¤ Fatigue	¤ Poor attention management	¤ Overconfidence	¤ Inadequate planning/ preparation
¤ Effects of spatial disorientation / Illusions	¤ Information overload	¤ Ill-discipline	¤ Inadequate rest, meals or hydration.
¤ Effects of G-forces	¤ Distraction	¤ Missionitis	¤ Consumption of medication or alcohol
¤ Hypoxia	¤ Expectancy	¤ Rush factor	¤ Inadequate level of physical fitness
¤ Hyperventilation	¤ Exceeded operators' mental limit	¤ Emotional state	¤ Failure to adhere to mission requirement
¤ Circadian Rhythm Desynchrony			¤ Physical injury
¤ Motion sickness			
¤ Effects of pressure changes			
¤ Visual adaptation			

TEAM FACTORS

Inadequate Team Skills	Inadequate Mission Management
¤ Miscommunication	¤ Poor mission planning
¤ Absence of communication	¤ Failure in mission leadership
¤ Lack of cross monitoring or team self correction	¤ Failure to cultivate proper crew climate
¤ Poor coordination	
¤ Lack of assertiveness	

UNIT MANAGEMENT FACTORS

Resource Management & Planning	Unit Climate	Unit Processes
¤ Poor supervisory oversight	¤ Unit culture	¤ Operations
¤ Failed to provide adequate time for task	¤ Unit structure	¤ Procedures
¤ Failed to manage workload / tasking	¤ Failed to enforce rules and regulatons	¤ Oversight
¤ Failed to track qualifications	¤ Poor vertical communication	¤ Training
¤ Poor crew pairing		
¤ Failed to manage limited experience or proficiency		
¤ Authorised unnecessary hazard		
¤ Staffing		

ORGANISATIONAL MANAGEMENT FACTORS

Resource Management & Planning	Organisational Climate	Organisational Processes
¤ Staffing	¤ Organisational culture	¤ Operations
¤ Budget	¤ Organisational structure	¤ Procedures
¤ Equipment	¤ Poor vertical communication	¤ Oversight
		¤ Training

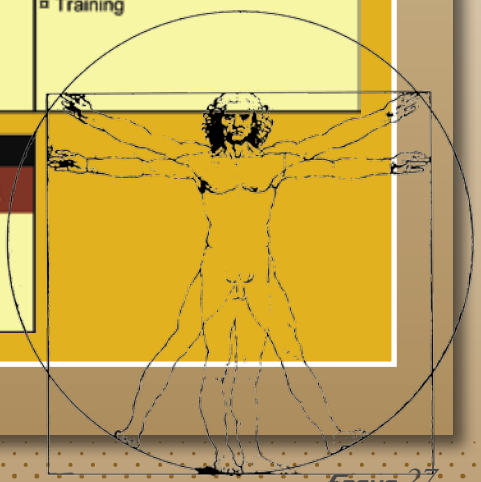


Figure 3

the man who services the machine or the management that plans the mission is just as likely to commit an error. The relationships between the factors are captured in the new analysis portion of the HFAM, such that the user considers the contribution of each of the 5Ms towards

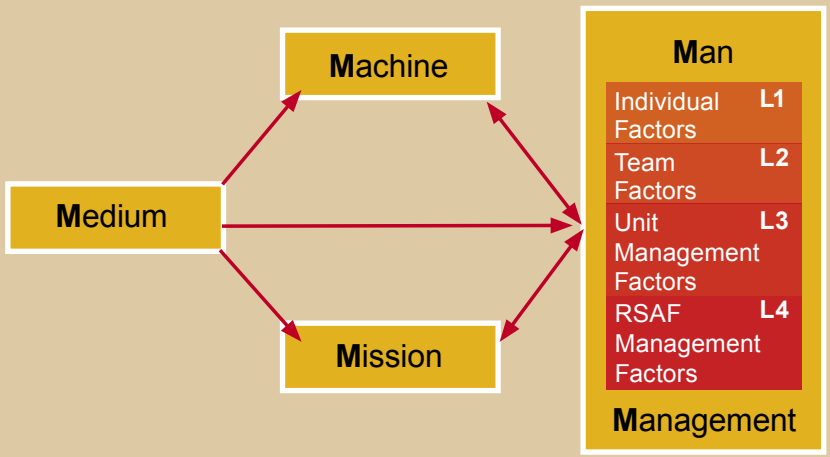


Figure 4: 5M4L Model Showing Inter-relationships Between the 5Ms and HFAM.

the error. This ensures that the breadth of factors (using 5M) and depth of factors (using HFAM) are covered in the improved analysis and classification model. The new 5M4L Model effectively integrates the 4 HFAM levels of the organisation with the 5M structure, such that only one analysis is done on an incident.

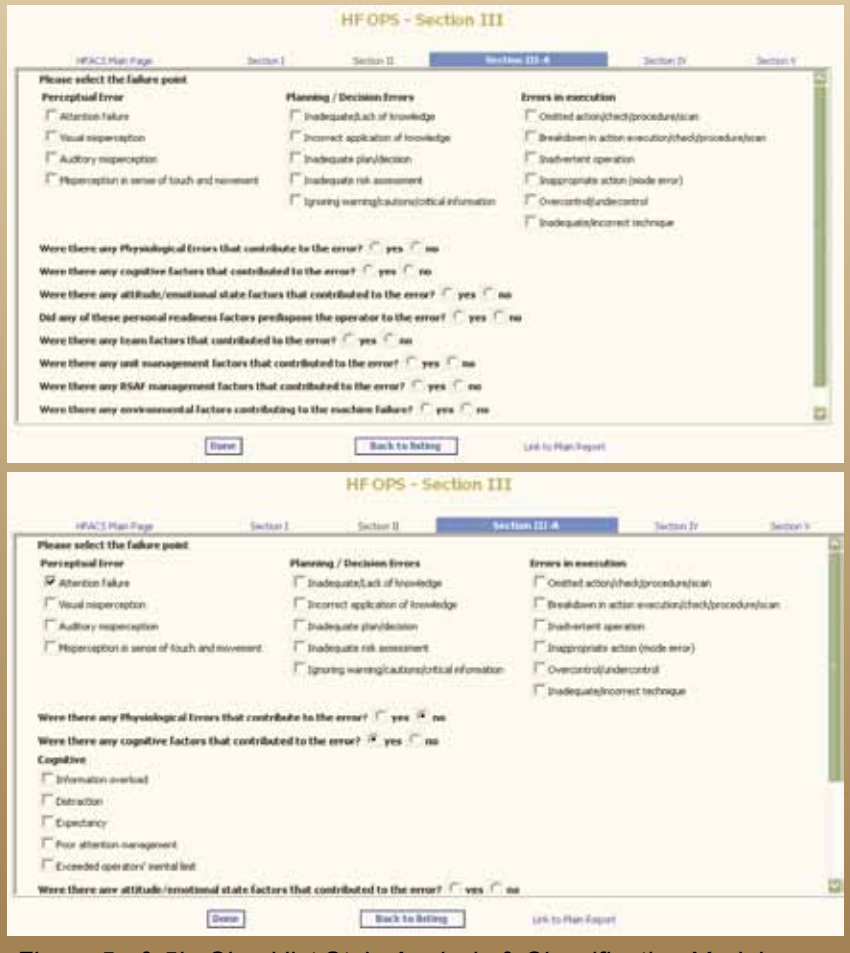


Figure 5a & 5b: Checklist Style Analysis & Classification Module

Goal 3: Guiding users through an "intelligent" analysis process

Users of the HFACS are currently required to fill in an occurrence summary when reporting an incident. To facilitate this process, new analysis model guides the user through a series of questions. The user reports the sequence of events, root cause of the error, issues contributing to the error and the consequences of the error. These ensure that there is sufficient detail for the reader to gain a good grasp of the actual situation. This simple analysis process also helps the user analyse the incident better.

The new system aims to be "intelligent". Depending on the primary causal factor that is chosen from the 5Ms, a series of checklist questions will be presented. The questions ensure a logical and systematic navigation through the 5M4L model, as seen in Figures 5a and 5b. The analysis is easy to complete, and emphasises the areas that are relevant to the incident.

Conclusion

The RSAF will soon implement a Human Factors Analysis Model that is firmly rooted to our very own Human Factors principles. It is designed to be user-friendly to facilitate a deeper and more thorough incident analysis process. Ideally, we will be able to learn better from past incidents and prevent similar ones from happening in future.

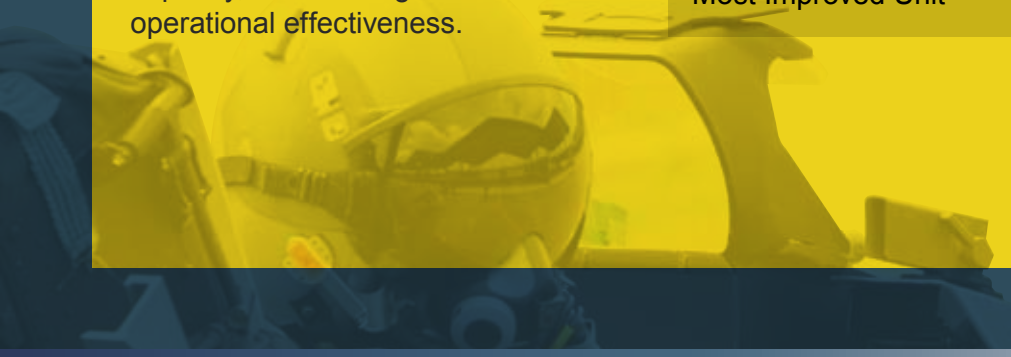
HAVING "PRIDE" IN SAFETY

"Simple Ideas, Big Difference" was the theme for this year's MINDEF PRIDE (Productivity & Innovation In Daily Effort) Day. One might query the connection between PRIDE and Safety. How does PRIDE complement Safety?

Drawing an example from this year's Minister for Defence Award (MDA) winner, ALG FW 1, APGC, the design of a tool strap has helped enhanced safety. This simple device attaches the tool to the wrist of the maintenance crew, preventing tools from falling into otherwise hard to reach spaces (I.e. Bottom of a tank, aircraft flight deck, etc) without the need to spend time retrieving the fallen tool and risk injury from cuts and risks. The tool saves time and provides a safer work environment, allowing the unit to increase productivity and build capacity, enhancing the RSAF's operational effectiveness.

AFI congratulates all recipients of the 2009 Minister for Defence Award (MDA)!

MDA 09 Award	Unit
Minister for Defence Award - Winner	- ALG Fixed Wing 1, APGC, RSAF
Minister for Defence Award - Special Commendation	- Changi Maintenance Base (CMB), NALCOM, RSN
Minister for Defence Award - Commendation	- 1st Army Maintenance Base, Army - ALG Rotary Wing, APGC, RSAF
Minister for Defence Award - Commendation (Combat)	- HQ 9 Div/Infantry, Army - 128 SQN, UC, RSAF - CDG, NDU, RSN
Minister for Defence Award - Most Improved Unit	- 1st Army Maintenance Base, Army



FOCUS QUIZ

1. What was the theme for this year's MINDEF PRIDE Day?
2. We face transitions everyday in various forms and degrees. True / False
3. The Human Factors Analysis Model (HFAM) is designed to facilitate a deeper and more thorough incident analysis. True / False
4. The Accident Prevention Office was first formed in 1977. True / False

Email your answers with your Rank / Name, NRIC, Unit and contact details to 2WO Steven Goh before **1st October 09.**

The first 3 correct entries will receive a $30 BORDERS voucher each.

The contest is open to all except personnel from AFI and the FOCUS editorial board.

(Answers can be found in this issue of FOCUS)

Winners of FOCUS 59 Quiz:

CPT Lim Sing Hui

3SG Neo Yi Qing

LCP Vijayrajan

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