TOP KNIFE: AVIATION MEDICINE IN ACTION

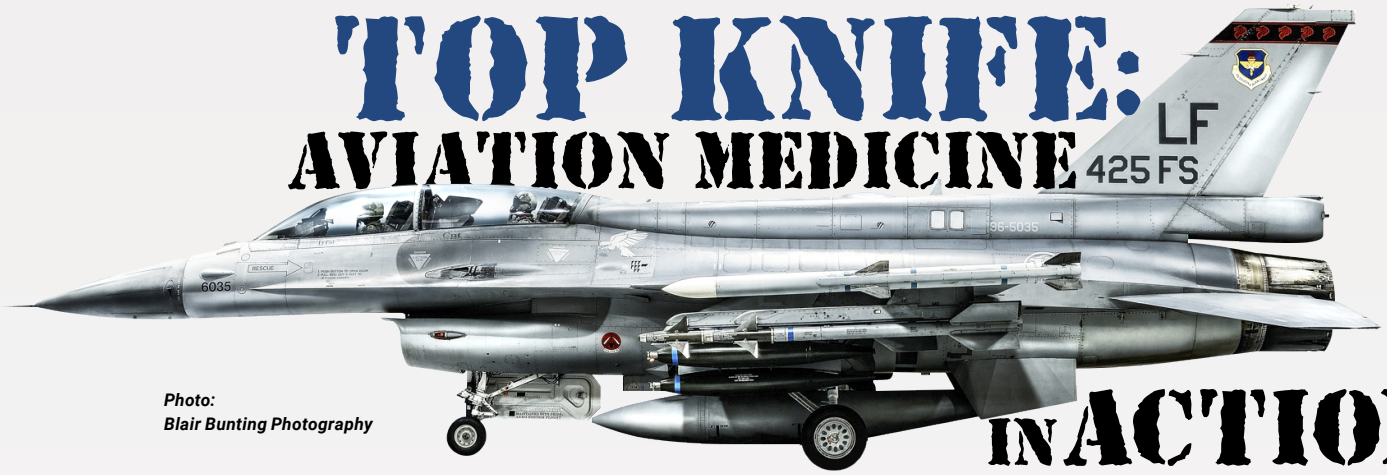
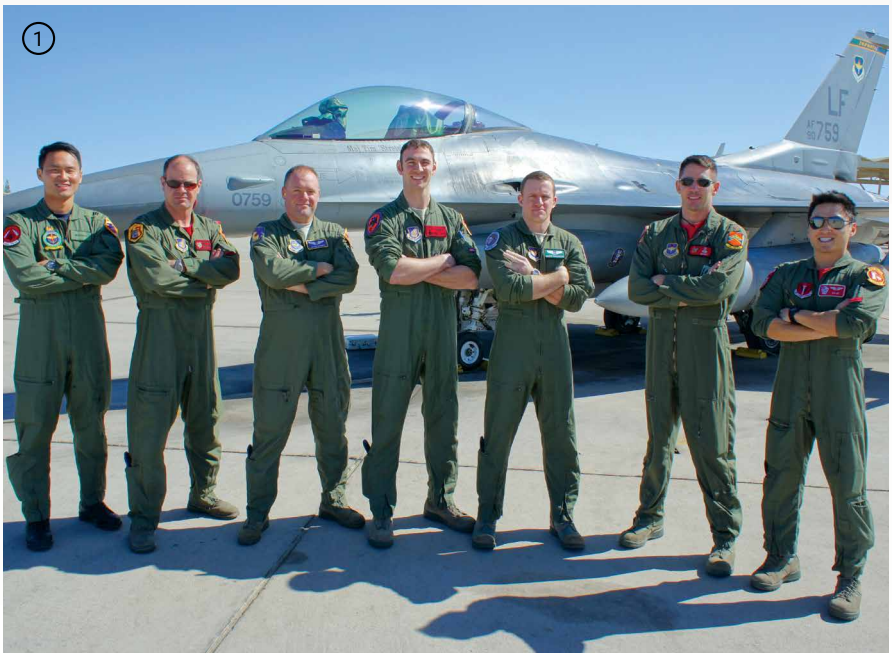


Photo:
Blair Bunting Photography

Another hill top zips by outside the canopy, its peak towering above us. Here we are, travelling at 500 knots (that's roughly about 926 km/h, more than twice as fast as the fastest car in the world) and at 500 feet above the Arizona desert. The roar of the engines change slightly as the F-16 pitches into a 25 degree climb; the G-suit, seemingly having a mind of its own, was starting to do its thing again and squeezing the lower body uncomfortably like a sausage. This is the *pop*.

A hundred things happen all at once as the aircraft levels off, giving the uplifting feeling of the negative-G for a split second, followed by a right bank to see the ground. I hear the pilot state with remarkable sangfroid, "*tally* the target…" and the aircraft begins to dive. An alien yet paradoxically visceral female voice sounds out over the intercom in quick succession, "altitude, altitude" — that's the aircraft's altitude low warning. The bombs are dropped with punctilious precision, and the aircraft proceeds to pull up at 5Gs, with the G-suit doing its squeeze again. A customary bank is initiated to catch a glimpse of the bombs landing on target, followed by an almost instantaneous jolt back to wings-level position.

A 4G turn to the left ensues, followed by the release of chaff and flares, with the all too familiar female voice prompting, "chaff, flares", in case we don't realise they have been released. After an interminably long time *jink-ing* around avoiding enemy fire, the aircraft rolls back to wings-level position at 5,000 feet for us to catch a breather before setting up for the next attack run…



In flying operations, there is no room for errors in communication. To avoid any confusion, words used by pilots are succinct and precise. Here are some of the commonly used operational brevity words, also commonly known as pilot lingo:

Bandit — An aircraft identified as an enemy based on theatre identification criteria.

Bogey — A radar or visual air contact whose identity is unknown.

Friendly — A positively identified friendly contact.

Tally — Sighting (of a target, bandit, bogey or enemy position).

No Joy — No visual contact (with the target, bandit or landmark).

Furball — A turning fight involving multiple aircrafts with known bandits and friendlies mixed.

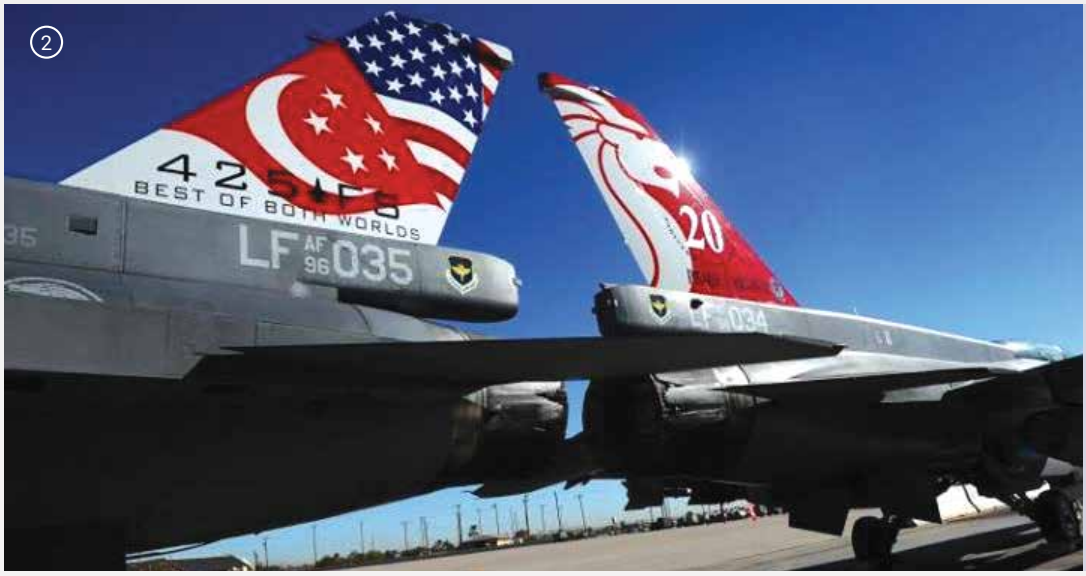
Pop — Starting climb of an air to surface attack.

Jink — Directive call to perform an unpredictable manoeuvre to negate a gun tracking solution.

Bingo — Fuel state needed for recovery.

Scramble — Take off as quickly as possible.

Knock it off — Directive call to cease air combat manoeuvres, attacks or activities.



Legend

1. Top Knife II course students.
2. Peace Carvin II, the RSAF detachment in Luke Air Force Base, celebrated its 20th anniversary on 11 Dec 2013.

Photos by Dr Benjamin Tan

IT AIN'T ALL GLAMOUR

In all honesty, there really isn't much about a fighter cockpit that's even remotely close to being pleasant. The Plexiglas® bubble canopy acts like a great big glasshouse and the cockpit heats up very quickly in the Arizona desert. The flying gear is chunky and uncomfortable and the helmet hot and heavy. You cannot see below nose-level because of the oxygen mask, so you need to move your head a lot more to see things in that new blind spot. Your throat is perpetually dry from the unceasing supply of dry air from the mask. Add to that the incommodious cabin, the rock-hard seat and the smell of jet exhaust and aircraft oil. And there's the ongoing din of the jet engine in the background, even if you only hear the sound of your laboured breathing.

To the seasoned fighter pilots, all the unpleasantness is part and parcel of their daily routine. "It's just not the most comfortable workplace," some say. Despite that, they have to stay focused on the task of the day; this could be pulling 9Gs to get their aircraft into position to shoot down the *bandit* while avoiding a mid-air collision at 700 knots, or flying perilously close to the ground in a surface attack mission to drop bombs on an enemy target. Every manoeuvre a potential catastrophe, every second potentially the last. There is only room for perfection in precision. Such is the stressful "office" of the fighter pilot.

As part of our training to be aviation medical physicians, or flight surgeons as they are called in the United States Air Force (USAF), we are all taught during residency training the basic physiology of flight and how the human body is never really meant for the empyrean. We know fighter pilots are subjected to numerous physiological stressors such as acceleration force (G), spatial disorientation, pressure changes and visual illusions. These problems are further compounded by the high workload in their stressful "offices". Knowing the theory is one thing, but there is nothing like putting yourself in the cockpit to experience the full impact of the fighter pilot's job. Since 1991, the USAF's Air Education and Training Command has put together a course for flight surgeons to do just that — be a fighter pilot for two weeks!

Physiological stressors encountered when flying a fighter aircraft

Negative G
Hypogravity due to the G-force acting in the opposite direction. Pilots get a rush of blood toward the head and may experience "red out" vision.

Spatial disorientation
This often occurs due to erroneous sensory inputs produced by the vestibular system, especially with degraded visual cues or the absence of it.

The G
The centrifugal force felt by pilots when making a turn, described as a multiple of gravitational force. In a 9G turn, the pilots feel the weight of their body multiplied by nine times and blood is aggressively pooled to the lower limbs. The inflation of the G-suit (compressing the lower body) and the anti-G straining manoeuvre are methods to prevent pilots from losing consciousness while battling in the air.

Hypoxia
As fighter aircraft cabins are not completely pressurised, hypoxia can occur due to a reduction in barometric pressure and partial pressure of oxygen. It also explains why fighter pilots need to fly with an oxygen mask.

Pressure changes
Due to air volume expansion on ascent and contraction on descent, pain may be experienced in the sinuses, abdomen and other air-filled organs subjected to these pressure changes.

Other physiological stressors
Motion sickness, aircraft vibration, noise, night flying visual illusions and many more.

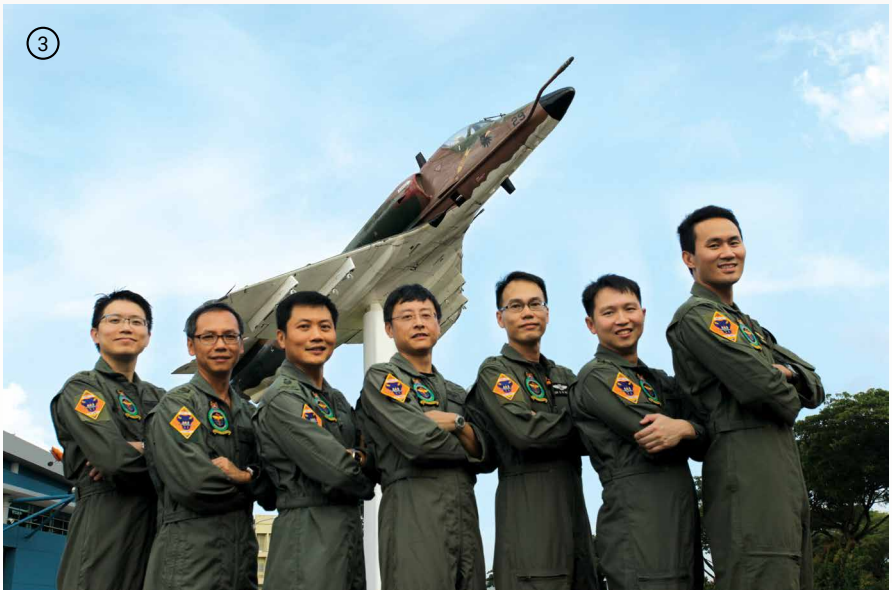
DOCTORS LEARNING TO BE FIGHTER PILOTS

Conducted at Luke Air Force Base, the premier F-16 training base in the USAF, the Top Knife II course purports to teach flight surgeons the essentials of flying and operating the F-16 Fighting Falcon. Besides revising the "medical stuff" of fighter flying such as the Gs, spatial disorientation and flying with night vision goggles, a large portion of the academics involve teaching the flight surgeons how to operate the flight controls and radars. Using computer aided instruction and flight simulators, course students are given the chance to fly, operate and fight the F-16. The apogee of the course comes in the second week, when students are strapped into the back seat of a F-16 to fly with the operational pilots, and perform what they had rigorously studied and practised the week prior. Graduates from this course will officially be called the Viper Docs.

Without exception, the experience is a massive adrenaline rush for all Top Knife II graduates. But fun aside, the exposure is invaluable because the experience of operating the F-16 aircraft (with its attendant physiological stressors in full force) can never be fully taught nor appreciated through didactic learning. Workload takes on a whole new meaning as you are trying to fly the aircraft, work the appropriate modes of the radar to find the target, avoid being shot down by hostile enemy and yet still maintain your wits about you to manoeuvre your aircraft in three-dimensional space. Snap decisions must be made in time frames which are alien to most doctors, while keeping a tight watch over fundamental (yet still critically important) parameters such as fuel state, aircraft attitude and altitude, air speed, etc. The ability to think at the speed of light, maintain composure under duress and to plan three to four steps ahead of time are distinct qualities which have become synonymous with the best fighter pilots. "I am humbled by how you guys train to get here and how you do this with such consistency every single day," I said in admiration to the pilot who flew with me on my last sortie. "It's easy when you practise it every day," he replied.

THE PRACTICE OF AVIATION MEDICINE

Indeed, fighter pilots are a rare breed. It takes several years and a few million dollars to train a fighter pilot — possibly the only profession which eclipses that of a doctor's. It is not surprising that it is harder to train or find a good fighter pilot than a good surgeon; for one, fighter pilots are expected to be at their prime at a much younger age due to the physical demands of the profession. In our practice of aviation medicine, we attempt to put every trained pilot back to flying whenever they are afflicted by medical conditions. Great care is taken to ensure that their full recovery and optimum physical conditioning is achieved. However, that may not be always possible; medical conditions which are degenerative or chronic in nature may persist. This is when difficult decisions about their flying disposition have to be carefully considered and made after having understood the exact requirements and demands of their job. The risks and responsibilities associated with such Daedalian decisions is the quintessence of aviation medicine.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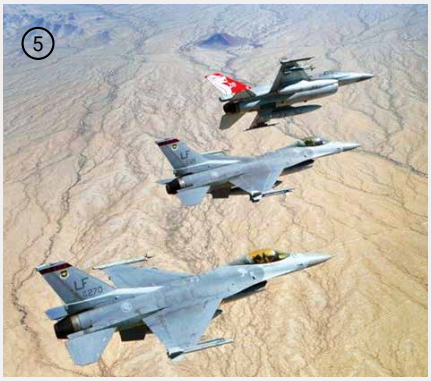
With seemingly erudite and industrious allies in the form of flight surgeons, one might expect an alacritous show of warmth and gratitude in return. "Truth be told, we don't like doctors." This came curtly from a very senior and illustrious USAF fighter pilot we met on the course. "We cannot believe that there is anyone, other than God and ourselves, who can decide our destiny. We fighter pilots live to fly and no one should be able to take that away from us." You see, fighter pilots are a very confident, highly motivated and passionate group of professionals, who leave nothing to chance. And because interactions with the doctor may yield surprises with regard to their fitness to fly, they very seldom seek medical attention. Therefore, unlike most doctors, aviation medicine physicians usually face "patients" who significantly downplay their symptoms or deny them outright. Over the years, aviation medicine physicians have learned to hone that special ability to pick up hints during casual conversations, or detect subtle behavioural changes in pilots to identify those who may need medical help. However, identifying a pilot in need is one thing, convincing them to seek medical attention is another.

An important part of our job as aviation medicine physicians, therefore, is to cultivate trust from our clients — the pilots. Only with trust can we convince the pilots that we are there for their best interest, and that we will go out of our way to put them back in the air should they suffer from

any medical condition. Attending the Top Knife II course is one of many steps toward fostering this trust. By experiencing exactly what the pilots go through in the air and learning to understand some of their lingo during the two weeks, the course enhances their confidence in us — that we can make better decisions when it comes to treating their ailments and deciding on their flying disposition. The analogy in the medical aspect would be to reverse the doctor-patient roles with our patients for two weeks, to experience their daily grind amid their struggle with medical disease, just so that we can gain their trust. Surely, that is an interesting proposition and it might just change current mindsets about finishing a busy clinic on time regardless of the patient's consultation experience or to arrange follow-up appointments with no consideration of the patient's family background and social support systems.

BACK IN THE CLINIC

Back in a busy clinic in the hospital, I had strangely encountered, for the third time in a day, a patient thanking me for being a "different doctor" — presumably in a positive way and something which eluded me the last 13 years of my medical practice.



Maybe it was pure luck or that I was still feeling high from all that flying, but somehow I remember spending more time asking my patients the simple questions that mattered to them, such as, "How long was your waiting time?", "Who looks after you at home?" and "How did you get to the hospital — by train, bus or taxi?". It dawned on me that maybe I have started learning to be a more patient and caring doctor — one who now makes an effort to strengthen communication, understands their needs and builds the ever-important trust with my patients. The roar of jet engines and glamour of flying F-16s aside, I suddenly realise that the most important lesson imparted to me through the Top Knife II course was simply how to be a better doctor. ◆

PROFILE

TEXT BY

LTC (DR) BENJAMIN TAN

LTC (Dr) Benjamin Tan is a consultant in aviation medicine with the Republic of Singapore Air Force and is currently pursuing his second clinical specialty in ophthalmology.

Legend

3. Top Knife Alumni, L to R: LTC (Dr) Wilfred Lim, SLTC (Dr) Dale Lim, COL (NS)(Dr) Chong Chun Hon, COL (NS) (Dr) Robin Low, SLTC (Dr) Wong Sheau Hwa, LTC (Dr) Benjamin Tan and MAJ (Dr) Hong DeHan.

4. Viper Doc in the backseat of a F-16 aircraft.

5. The RSAF detachment, Peace Carvin II flies with the "Black Widows" — RSAF's F-16s from the 425th Fighter Squadron over the Arizona Desert.

ACKNOWLEDGEMENT

This article was written with permission to include excerpts from unpublished writings of COL (NS)(Dr) Robin Low (the first Top Knife II graduate and Viper Doc from Singapore). Like some of the world's greatest ideas, the origins of this article can be traced back to a few pints of beer and a progressively "coherent" exchange of ideas among Viper Docs as the night went on.