



LIFToff



Key upgrades to the Hawk will ensure it is better able to train the fifth-gen fighter pilots of the future

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WGCDR CARLOS ALMENARA

Four decades ago as the Air Force was on the cusp of transitioning its frontline fighter force into the 21st century as it looked to replace the Mirage with a new-generation fighter, the very first issue of *Australian Aviation* also looked ahead to see what advanced trainers the next generation of RAAF fighter pilots would learn their trade on.

Jim Thorn's 'Macchi, Hawk or CASA?' feature felt that the Italian-built Aermacchi MB-339 and the British Hawker Siddeley Hawk were the serious options as future jet trainers to replace the RAAF's Macchi MB-326Hs, while Spain's CASA 101 was something of an outsider.

As it would transpire it would be another 20 years before the RAAF ordered a jet trainer to replace the Macchi, with the Hawk getting the eventual nod. In the meantime the RAAF elected to replace the Macchi in the advanced trainer role with the Pilatus PC-9/A, and from 1991 on the Macchi would be used solely as an advanced lead-in fighter trainer for aircrew selected for fast jets.

It was for this role that 33 BAE Systems Hawk 127 Lead-in fighters were ordered in June 1997, with 21 aircraft assembled locally at BAE Systems Australia's facility at Newcastle Airport, north of Sydney.

The more powerful and agile 'digital' Hawk 127 virtually simulated the cockpit and systems of the Hornet – a quantum leap in training capability for both students and instructors over the decidedly 'analogue' Macchi – with a heads-up display (HUD) in the front cockpit, hands-on-throttle-and-stick (HOTAS) controls and three multi-function display (MFD) screens, advanced mission computers and a simulated radar capability.

Since 2001 the Hawk has ably shouldered the lead-in fighter trainer role, operated by 79 Squadron from RAAF Base Pearce, WA and 76 Squadron from RAAF Base Williamtown, NSW. During the two-part introductory fighter course students undertake a 14-week conversion onto the jet with 79SQN before moving across to 76SQN where they learn to 'fight' the aircraft during a 20-week air-to-air and air-to-ground weapons training phase.

From there graduates either progress to 20CU to convert to the classic Hornet, or head to the US for conversion training on the Super Hornet or Growler with the US Navy. ➔



LIFCAP

As was the case 40 years ago, generational change is looming in the RAAF air combat force, with today's classic Hornets about to be replaced by the F-35A Lightning. And so to keep pace with the changing needs for lead-in fighter training, an upgrade program is now underway to better prepare the Hawk for training pilots bound for the F-35A.

That work is well advanced thanks to the Project AIR 5438 Phase 1A Lead-In Fighter Capability Assurance Program, or LIFCAP, which achieved initial operating capability (IOC) in July, upgrading the aircraft with many of the capabilities of the Royal Air Force's Hawk 128 (or Hawk T.2).

"The initial scoping [to upgrade the Hawks] was done back in 2007-2008 when Air Force was first engaging with BAE Systems on their Hawk 128 software and what could be done in terms of software upgrades to our aircraft," Wing Commander Carlos Almenara, acting officer commanding 78 Wing, under which the Hawk's 79 and 76SQNs sit, tells *Australian Aviation*.

"At that point we were already looking forward to what we would need in terms of capability upgrades to bridge the future training needs."

Those capability upgrades are coming to fruition under LIFCAP, which introduces a major avionics upgrade to the jets as well as acquiring three advanced full mission simulators (FMS) and operational support systems.

LIFCAP is being delivered by BAE Systems teams in both Australia and the UK, as well as CAE and Cubic Global Defense, with upgrade work slated for completion in early 2019.

"The Australian Government had to go back to the OEM (original equipment manufacturer) to have such a large upgrade done," said Steve Drury, BAE Systems Australia's director of aerospace.

"The contract asked BAE Systems to do an upgrade to the RAAF's Hawk Mk 127s to be pretty much like the Hawk 128. Reading across from a current design was the most efficient way to get a good upgrade for their aircraft and when they looked at the ability of the 128 they realised it pretty well matched what their requirements were for the future."

New MFDs, new mission computers, more realistic weapons simulation, datalink features, an



🕒 In 25 years of contributing to *Australian Aviation*, Paul Sadler's 'pax ride' in the back seat of 76 Squadron Hawk A27-30 in September 2006 was one of his many highlights.

PAUL SADLER

improved simulated radar, a radar warning receiver, the ability to program simulated surface-to-air threats and digital mapping have greatly improved the training outcomes the Hawk can deliver.

"The weapons simulation is higher fidelity," said WgCDR Almenara. "We've always had the heat-seeking missile capability on the Hawk, but we now have robust algorithms in there for short-range and medium-range weapon options as well as for simulating radar missiles, which before we could do but only really using rules of thumb. Now the software is there, in a training sense, we can basically simulate more advanced tactics without going to that effort of the mental mathematics."

The Hawk's safety systems have been improved as well, thanks to the fitment of ground proximity warning and traffic alert and collision avoidance systems.

To accommodate the new avionics and systems the Hawk's nose required major structural changes.

"It is a significant amount of work to upgrade the aircraft, which takes 85 days to complete each jet," said Drury. "This includes 6,000 tasks to be completed with 700 wiring changes. There is wiring that goes through the whole aircraft that needs to be changed out."

While the radar simulation in the original Hawk 127 emulated the classic Hornet's radar to a reasonable level, WgCDR Almenara said the upgraded radar simulation is much more realistic and powerful.

"The radar simulation fidelity is really getting into the more modern displays that you are seeing in 4.5 and 5th generation fighters," said WgCDR Almenara. "The upgraded Hawks are allowing us to simulate a lot more of the high technology capability of frontline aircraft. We can now build

so much more comprehensive tactical scenarios around the training package."

Another element of LIFCAP is the addition of Cubic's P5 combat training system (CTS/TCTS) and GPS-enabled air combat manoeuvring instrumentation (ACMI) pods. They allow pilots and instructors to electronically review an air combat training mission during the post-flight debrief with a degree of fidelity not previously offered by the Hawk.

"The P5CTS and ACMI offer fantastic capabilities for the Hawk and provides us with the ability to maximise our mission outcomes and minimise our need for re-training," said WgCDR Almenara.

"Squadron mission supervisors also have the ability to observe aircraft during flight using the live monitor functionality, plus manage the mission and flight environment to improve training performance."

Cubic has previously provided the P5 system and ACMI pods for the RAAF's Hornet, Super Hornet and Growler fast jets.

During the upgrade, all of the Hawk's six multi-function displays (MFD) were replaced with new full-colour LCD screens which feature significantly improved resolution and symbology. This is a marked improvement as the basic Hawk 127 lacked the computing power to cope with the substantial increase in information that needs to be displayed.

"Everything about the F-35 is about what's on the screen and the information provided," said Drury. "The screen size for LIFCAP is unchanged but they're packed with more information. It's about making the symbology of what is displayed on the screens replicate what they will see and experience on the F-35."

Another significant upgrade on the original spec Hawk is much improved mission recording and playback functionality.

"We had old little video tapes that we would record the HUD view and cockpit audio on during a sortie," said WgCDR Almenara. "These are obsolete now and its now captured on a solid state memory card unit that fits into the aircraft. The HUD camera records a lot more of what is happening for mission playback during a debrief."

"The debrief system now has a lot more fidelity and is a lot more robust. With that you can link it up to replay a whole formation of Hawks in synchronisation together. It was

🕒 Acting officer commanding 78Wing, WgCDR Carlos Almenara speaks at the Hawk LIFCAP IOC ceremony. DEFENCE





very ‘mandraulic’ to do that with the old technology that we had.”

LIFCAP upgrade work began in 2014 with the first modified jets, A27-06 and A27-27, rolling out of BAE’s Newcastle facility at the end of that year, allowing flight trials by a joint test team of BAE Systems and RAAF test pilots to begin.

Forty-four test flights were undertaken between February 23 and May 8 2015, while a second phase of test flying in 2016 saw 23 flights completed between June 22 and August 10.

LIFCAP design and development clearance was subsequently granted by the RAAF’s Airworthiness Board in April this year.

Downloading to the sim

The upgraded aircraft are being complemented by three new full mission simulators, two at 76SQN and one at 79SQN, which replace two existing simulators.

“The change in technology compared to when we got our original simulators 17 years ago is a whole new generation in capability,” said WGCdr Almenara.

“This one piece of equipment will probably make the biggest difference to our training system out of everything. The fidelity of the sim means there are elements of the previous airborne-



only training that we will be able to download to the simulator.”

Designed by BAE Systems UK and built by CAE, the Pearce-based FMS is fully up and running with one of the two simulators at Williamtown currently operational. The second FMS is expected to be online in September.

Looking forward to what is going to be required for the transition of fast jet training for the F-35, WGCdr Almenara said the syllabus is very much going to be centred around a ‘sim to solo’ as there is no two-seat trainer variant of the JSF.

“That is something we need to be thinking about in our Hawk training of how we transition our junior aircrew from a training system where you have an instructor in the back seat to clear them solo, to a point where they can successfully go from sim to solo in a safe manner,” he said.

“There will be the traditional

⦿ LIFCAP means the Hawk is better able to prepare trainee fighter pilots for the classic and Super Hornets (top) and Lightning II (above). DEFENCE & PAUL SADLER

elements in there of dual flying, but there will be parts of our new syllabus which transitions them into that sim to solo mentality by the time they get to the JSF.”

First course

At the time of writing 13 aircraft had now been upgraded, with eight of those at 79SQN supporting the first fast jet pilot course – Introductory Fighter Course (IFC) 58 – to begin using the upgraded aircraft, which commenced on June 12. The remaining upgraded Hawks are at 76SQN to assist with designing the new course ahead of Course IFC 58/59 students arriving there in January.

“We’ll build up with more [aircraft] numbers between now and December and BAE Systems, again, is helping us out a lot there with a bit of a surge to ensure that we’ll have enough to then split them between the two squadrons.” ⦿

said WGC DR Almenara.

From January 2018, all fast jet courses will use the upgraded jet with students currently training at 76SQN the last to learn on the 'classic' Hawk.

"LIFCAP has been a challenge – it was always going to be a challenge," said WGC DR Almenara. "We do have limited aircraft numbers and throughput of our trainees has been pretty critical through all of the JSF transition period at Air Combat Group. The [LIFCAP] plan has very much taken that into account and the schedule and the balancing between the two Hawk squadrons on how we were going to manage the transition has been carefully thought through."

Both 76 and 79 Squadrons at times have worked hard to overcome the reduction in aircraft numbers. But 78 Wing has managed to get through to IOC of the upgraded Hawk at a time when it has been graduating more fighter aircrew than ever before.

"I stepped into this role in January so the LIFCAP was already in motion and I have been very impressed with the collegiate approach between industry and Defence in terms of making things work," said WGC DR Almenara.

Out the door

At any one time four Hawks are being upgraded under a rolling process, with upgrades staggered two to three weeks apart so the technicians are not using the same equipment all at the same time.

The Hawk's wings remain attached to the fuselage during the upgrade with other smaller servicing being carried out on the jets if it is efficient to do.

"The focus is on getting as many modified fast jets out of the hangar as possible," said Drury.

"Since we can't upgrade all the aircraft at once, there is some really complex project management and scheduling going on right now to make sure Air Force doesn't skip a beat through all of this. That is quite unique as you can normally upgrade aircraft and the aircrew can fly either variant, but in this case, there is a definite progression of students moving onto the new aircraft and not being able to use the old variant."

To achieve IOC for LIFCAP, a minimum number of jets was needed to have completed the upgrade program and be cleared to fly. Additionally, at least two of the three simulators had to be operational at Pearce and Williamtown.



At any one time up to four Hawks are being upgraded under a rolling process. DARREN MOTTTRAM/BAE SYSTEMS

It is anticipated final operational capability (FOC) for the LIFCAP program will follow the last aircraft delivery.

"We are committing to an early 2019 completion date and we are doing our best to make it quicker than that," said Drury. "But as it gets to a later stage [in the program] the final few aircraft in the hangar getting modified will also be undergoing lengthy scheduled servicing and would already have been in the hangar anyway. So, by the end of 2018, all of the Hawks out in the squadrons being flown will have been modified."

Hawk begins to Sprint

Separate to LIFCAP, the Hawk is also leading the way with the lead project under the 'Acquisition Sprint' methodology of rapidly introducing into service future capabilities.

A Plan Jericho initiative, BAE Systems is working with Air Force to demonstrate the Acquisition Sprint process with the installation of a 1090MHz extended squitter ADS-B (Automatic Dependant Surveillance Broadcast) transponder onto the Hawk fleet.

Adding ADS-B will improve the Hawk's situational awareness of civilian air traffic, complementing its existing military Identification Friend or Foe (IFF) capability.

"With this [ADS-B] project we are guiding the way properly for other projects that will be wanting to use Acquisition Sprint for this type of

upgrade," said Drury. "We have been involved at an earlier stage assisting in the down selection and choice of the best way of adding ADS-B to the aircraft. It is progressing well with a lot of good collaboration between us and Defence."

Drury said an important part of this project is trialling a new process and recognising which is essential red tape and which red tape is over-governance and probably could be avoided.

"We'd like to bring things in faster without red tape as efficiently and cost-effectively as possible," said Drury. "That's quite a tricky thing because what we might label 'red tape' quite quickly, may actually be best-practice built up from decades of knowledge of what can go wrong and lessons learnt, so you can't ignore it."

"We have actually learnt some pretty good lessons out of this so far about how best to initiate these types of projects and get them through as quickly as possible."

After Hawk?

Somewhat lost in the February 2016 Defence White Paper's accompanying Integrated Investment Program document, which outlines new defence capability acquisitions, was a new \$5 billion project to replace the Hawk.

The Integrated Investment Program "includes a substantial provision for a new lead-in fighter training system to support those students who go on to complete the ADF's fast jet pilot training," the document read.



Little other detail was provided other than a line in a “summary of key investment decisions” table that shows the ‘Lead-In Fighter Training System’ program has a timeframe of 2022-2033 and an “approximate investment value” budget range of \$4-5 billion.

“We don’t have a dedicated project stood up for replacing the Hawk yet but we obviously have one eye on that,” said WGCDR Almenara. “At the moment, LIFCAP gets us through to the late 2020s timeframe in terms of capability assurance. Whilst it hasn’t been decided, we are potentially looking to extend the Hawk out into that timeframe at the moment. So beyond that, then, yes, we’ll be looking at all options in terms of what is going to be required for our future training needs.”

One of those options would likely seem the outcome of the US Air Force’s T-X program to replace its ageing Northrop T-38C Talon. Under T-X, the USAF intends to buy 350 aircraft and 46 ground based training systems worth an estimated US\$16.2 billion (A\$20.5 billion).

From an initial field of five, remaining T-X bidders are Leonardo (the successor to Aermacchi) with the T-100, a development of M-346 which is in Singapore air force service, Boeing’s all-new T-X design, developed in partnership with Saab and Lockheed Martin’s T-50A, which is based on the Korean Aerospace T-50. The selection process is underway and is scheduled to end with a contract award in December.

Another Hawk replacement option could be the Hawk itself.

BAE Systems’ Advanced Hawk demonstrator made its first flight from the company’s Warton facility on June 7.

The Advanced Hawk concept aircraft features an upgraded cockpit equipped with a single large area touchscreen display that will introduce new students to an F-35-like training experience. It also features BAE Systems’ LiteHUD, a low-profile head-up display and a redesigned wing equipped with active slats and combat flaps improving turn rates and angles of attack.

Other features include a 3,000kg weapons payload and new defensive aids including a radar warning receiver and countermeasure dispensing system.

The new Hawk will now undergo a series of flights to collect test data on the new key capability enhancements. BAE says features of the Advanced Hawk, including the advanced display and new wing, could be fitted to

RAAF Hawks (two pictured here at Darwin) passed the 100,000 flight hours milestone in May 2016. DEFENCE

Graduates from a recent introductory fighter course. All future courses will exclusively fly the LIFCAP-upgraded Hawk. DEFENCE



existing Hawks under an upgrade program.

Making the grade

For now though, any further upgrade of the Hawk or its replacement remains in the future. Today the focus is on the continued generation of sufficient numbers of highly-skilled and trained aircrew essential to the Air Force maintaining its air combat capability edge. A long-term shortage of fighter pilots and weapon system operators has been identified as one of the top five risks in Air Force’s Air Combat Capability Transition Plan, and so the improved student pass rates at operational conversion units is essential.

“The lead-in fighter training system must be able to adequately prepare aircrew to sustain pass rates, both in terms of quality and quantity, and to continue to do this out to the planned withdrawal date for Hawk,” said WGCDR Almenara.

“In order to sustain these pass rates it is important that the capability gap between the LIF aircraft and the operational platforms is minimised. This is clearly demonstrated when you consider the increase in pass rates that occurred when the Hawk originally replaced the Macchi back in 2001. They jumped from an historic 75 per cent overall pass rate to a 90 per cent overall pass.

“The capabilities inherent in the LIFCAP upgrade will allow us to continue to minimise this capability gap throughout our transition to more advanced fighter platforms.” **A**