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International Fighter
Conference 2018:
Perspectives and
Comments



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Berlin, Germany and the International Fighter Conference 2018: A Look Back

11/22/2018

By Robbin Laird

I spent a good deal of the 1980s traveling within and dealing with German security issues.

A key challenge in the early part of the decade was the Euromissile challenge and working common positions among European partners and with the United States to deal with Soviet intrusions and policies towards Western Europe.

I lectured on these issues and wrote several books on the subject as well.

It was a tough political environment, for President Reagan certainly was winning no popularity contests in Western Europe at the time.

At the Fighter Conference, we heard that we unexpectedly won the Cold War and were unprepared for the consequences.

I get the point but in 1985 I formed a working group at the Institute for Defense Analysis with both government and non-governmental experts to look at the prospects and possibilities for German unification and how we might deal with the Soviets to achieve this outcome.

Several future members of the Clinton Administration were in that group and we discussed quite often what role might a unified Germany play in Europe and would it act like a “normal” state after unification.

Several of us cautioned the more optimistic members that dealing with East Germany would take time for West Germany to pay for and culturally integrate.

Others were more optimistic and expected the pace of change to be rapid and the emergence of the new Germany to be a significant player in the rebuild of Europe more generally.

When the moment came, we could provide inputs to the process and again I wrote several pieces, including a couple of books on the subject as well.

So when I returned to Berlin for the international fighter conference this month, naturally thoughts of the 1980s and then the 1990s came flooding back into my mind, notably as I was not too far from Checkpoint Charlie, which is a museum for the current generation, but a fact of life for mine.

What then ensued in the 1990s would set the stage for where we are now.

Germany along with most European states in the wake of the collapse of the Wall and the emergence of collapsed Soviet Union, celebrated their good luck with a defense holiday.

And with this defense holiday, direct defense became a museum piece along with Checkpoint Charlie.

After the Crimean takeover by the Russians in 2014, the beginning of a new phase was emerging, one where direct defense had to now be considered as a realistic challenge for Europe, NATO and the United States.

But the Cold War required one type of political-military structure but now is required a quite different one.

How to build a relevant direct defense structure for Europe is not consensual and some states are more advanced in dealing with the challenges than others.

Notably, Northern Europe is accelerating their concern with direct defense.

This leaves a fundamental question with regard to Germany.

What is the direct defense strategy of Germany today?

Notably with European disaggregation and conflict with the US President, how is German to shape a realistic and resourced defense strategy?

What is the relationship of Germany to Poland in central front defense?

What is the relationship of Germany to the newly refocused Nordics on Northern European defense?

What kind of force structure does Germany need to build as a non-nuclear power facing a resurgent Russia, and one which clearly emphasizes the central role of nuclear weapons?

At the International Fighter Conference 2018, a representative from the German Ministry of Defence provided a perspective on how Germany is resetting its defense posture.

He argued that the current security environment was increasingly complex, increasingly volatile, increasingly dynamic and increasingly difficult to predict.

All of this is true, but how will Germany defend itself against resurgent Russia?

He noted that the last 25 years have seen a steady downward trend in defense resources and personnel.

He underscored that the German government is now focused on reversing three trends.

First, they are reversing the personnel trend with growth in the number of personnel and abolishing the upper limits constraint.

Second, they are reversing the decline of investment in materiel, with a new procurement push. He noted that maintenance funds have been boosted from 2.6 billion Euros in 2013 to 3.2 billion Euros in 2017.

Third, he noted a reversal of the funding trend.

But although there is an increased defense budget, there is no real increase in the defense spending as a share of GDP.

It is anticipated that such growth will occur so that there would be a 29% increase from 2013 to 2021 by about 10 billion euros.

He argued that the strategic direction was to “become more European, but to stay transatlantic.”

In the brief, there was an emphasis on the various out of area missions in which Germany has participated under UN approval.

Clearly, a major trend has been to take the residual force which was the result of the drawdown through 2013 and make it more capable of operating in areas of counter-insurgency operations.

But with the return of direct defense, nuclear deterrence and how Germany can contribute more effectively to Central European, Northern European and Southern Europe defense has returned as a key question.

And this will require a strategy which can guide where resources can transform the Bundeswehr into a force much more capable of contributing to the direct defense of Europe.

It is not about leading the various committees within NATO and the European Union on how to think about the future in abstract terms.

It is about building relevant force structure with some sense of urgency.

This is the challenge facing Germany and as it does so, it can then build out future capabilities which can leverage the transformation of its forces in the short to mid-term.

A recent German Ministry of Defense study provided some texture to what might be the way ahead for Germany as well.

According to a Canadian military officer who has studied the classified study which has now been de-classified, the German MOD has a very realistic sense of the challenges it faces.

According to [J. Paul de B. Taillon](#):

In response to the ongoing political, financial and economic uncertainty and instability, strategists at Germany's Ministry of Defence developed six possible scenarios and the potential cascading political consequences.

The resulting "Strategic Forecast 2040" was published in February 2017 and sent a very distinct message that the "structure of Western Europe since World War II, and of all of Europe since 1991, is no more.

And Germany intends to look out for itself....."

After decades of peace, the EU and NATO may be experiencing a slow and painful breakup "under the weight of an increasingly divergent set of interests among their members.

So, Germany must make its own plans and it must plan for the worst."

Given the dire scenarios propounded by the German study, other EU nations would be prudent to create contingency plans for the possible demise of an EU dream, as well as considering the necessity for rearmament programs to address future defence and security requirements.

Germany, Fighters and the Future of Air Combat: Perspectives from the International Fighter Conference, 2018

11/24/2018

By Robbin Laird

This year's International Fighter Conference held in Berlin provided a chance for the participants and the attendees to focus on the role of fighters in what we have been calling the [strategic shift](#), namely, the shift from the land wars to operating in higher intensity operations against peer competitors.

It is clear that combat capabilities and operations are being recrafted across the board with fighters at the center of that shift, and their evolution, of course, being affected as well as roles and operational contexts change.

The baseline assumption for the conference can be simply put: air superiority can no longer be assumed in operations but needs to be created in contested environments.

It is clear that competitors like China and Russia have put and are putting significant effort into shaping concepts of operations and force structure modernizations which will allow them to contest the ability of the liberal democracies to establish air superiority and to dominate future crises.

There was a clear consensus on this point, but, of course, working the specifics of how one would defeat such an adversary in an air campaign gets at broader and more specific force design and concepts of operations.

The conference worked from the common assumption rather than focusing on specific options.

But the way ahead was as contested in the presentations and discussions as any considerations for operations in contested airspace.

The assumption that the air forces of the liberal democracies faced a common threat of operating in contested airspace was not contested; but the preferred approaches or the approaches being followed were.

There are clearly different approaches being taken to this challenge and each approach deserves to be examined.

The clear force for change is the coming of the F-35 global enterprise.

As a senior RAF officer put it, "[The future is now.](#)"

He included in his presentation a slide outlining what from his point of view constituted the F-35 global enterprise and how the [UK](#) would both contribute to and benefit from that enterprise.

This slide laid out how he saw interactions among F-35 partners in shaping common and distinctive approaches to air power modernization driven by the introduction of the F-35.

The former Chief of Staff of the RAAF, [Geoff Brown](#), who is also the Chairman of the Williams Foundation, provided an overview of how the selection of the F-35 and its introduction in the force was part of a significant shift in the ADF to what the Aussies call a fifth-generation force.

Chatham House rules are followed by the Conference and are respected throughout this article.

A senior USAF officer involved with F-35 integration highlighted the work of the USAF in the area of operating the aircraft and working integration both on the level of the MADL-enabled F-35 force and that force with the legacy force.

His baseline point was that the F-35 is operating globally now and that the USAF is working with its service and global partners on both the ability of the F-35 as a unique fleet to operate together as well as through its link capabilities, notably generated by the software designed and enabled [CNI system](#) to work with other assets as well.

This officer argued that it was clearly a work in progress and the “sensor fusion” of the force was in its infancy, in terms of its being informed by and driven by the F-35 as a combat aircraft.

Or to put it in his words: “The aircraft works well in terms of sensor fusion; what we are focused on in this journey to mature its effects as an air system on the overall force.”

An experienced USAF test pilot, a combat proven F-16 pilot who shifted to the F-35, provided a presentation with regard to what sensor fusion means with regard to the combat pilot.

He addressed the core question: What does the situational awareness of the F-35 pilot look like and what does it mean for his combat prowess?

But in simple terms, the 4th generation pilot fuses the data from his systems on-board to operate up against a specific combat task.

The F-35 pilot has SA provided to him from the sensor fusion machines on-board and he focuses on shaping tasks crucial to missions in the combat space.

What is also clear is that the [evolution of legacy fighters](#) which most would refer to as fourth generation fighters is part of the evolution of the response to operating in contested airspace.

This is a major focus of attention for any of the air forces introducing the F-35 and is clearly of concern for a legacy force like the French Air Force which does not intend to buy an F-35.

There is an interesting question: How will the different legacy fleets adapt to the F-35 and what will be their tactical and strategic contributions as they adapt to the evolving strategic environment?

This question will be the focus of attention for some of our work next year, and we will publish various pieces on this issue as well as a report next year.

There is also a key dynamic of change for what are referred to as the [“big wing” aircraft](#) such as AWACS, and the various ISR aircraft.

More generally, there is a major shift in how C2 will be done as fighters and their connected brethren work together to deliver the desired effects in the 21st century contested battlespace.

Several questions need to be addressed.

Where is sensor fusion done?

Where will decisions be taken with regard to determining the requisite effects and who will deliver them?

How will different air forces connect the force in distributed operations in contested airspace and with what systems and means?

And as multi-domain operations come to dominate, meaning the ability to deliver effects throughout the entire combat force with fighters playing various roles, C2, ISR, strike, how will platforms be designed going forward to enhance capabilities of the overall combat force?

The evolution of the fighters will include the F-22 as well so you have a case of a fifth-generation aircraft evolving with the introduction of the F-35 as well as the USAF’s F-16s and F-15s or the US Navy’s Super Hornets.

These adaptations will not be exactly the same and are clearly a focus of attention and discussion going forward.

Put in other terms, [how will legacy aircraft evolve](#), as the challenge of dealing with contested airspace but also contributing to multi-domain operations becomes a primary driver of change for the air combat force?

European speakers highlighted the evolution of three legacy aircraft, the Gripen, the Rafale and the Eurofighter.

The presentations built around Gripen provided insights concerning how the fighter really has become a flying computer and how the modern fighter is evolving as part of the reconnaissance strike enterprise.

One presenter argued that the evolution of fighters more on the model of computer dynamics meant that the meaning of aircraft generations was put in question.

A senior French General highlighted the upcoming changes in the core French fighter, [the Rafale](#), which would make it more capable, in terms of processing power and in terms of upgradeability.¹

He also raised concern that the coming of the F-35 to Europe and to NATO posed a significant problem of interoperability for the Rafale and he argued that this challenge needed to be met.

And this is a significant concern but also a focus of core attention at places like the [European Air Group](#) where I have engaged for many years exactly on this challenge.

The Eurofighter presenters highlighted as well the modernization of their aircraft and its expanded capabilities.

I have visited several Eurofighter bases and have discussed [modernization](#) of the aircraft with several persons involved in the process and produced a [report](#) on this effort in 2015.

I have also visited [RAF Tornado](#) squadrons as well to discuss the impact of the termination of their operations on the RAF as well.

The British evolution of their Eurofighters is called [Project Centurion](#) and encompasses changes associated with the retirement of their Tornados.

But it is also about evolving the aircraft to fly with F-35 which more generally subsume a broader range of Tornado and Harrier missions while adding some new mission capabilities as well.

There is an accompanying effort as well in the sustainment approach for the UK Eurofighters called [TyTan](#) and a visit to a key RAF airbase earlier this year provided an opportunity to discuss this approach with the architects and initial implementors of the evolving sustainment approach to the Typhoon fleet.

French and German presenters highlighted proposed modifications of the Rafale and the Eurofighter as part of a broader transformation which they refer to as the [Future Combat Air System](#).

This program has been launched last year by the French and German governments with the Spanish as probable partners perhaps later this year or next year.

The program is designed to replace Rafale and Eurofighter by 2040, although the question of the Tornado replacement for Germany remains a question mark and a clear focus of attention and contention as well.

Does FCAS incorporate the Tornado replacement by expanding the Eurofighter fleet and waiting for the new 2040 plus fighter or not?

This is an actively debated question, which came up as well at the discussions at the conference.

The FCAS approach can be looked at two very different ways.

One way is to look at the end state as a target towards which modernization is focused.

Here the notion is that the system or the networks will be designed to provide multi-platform and multi-node capabilities to deliver the combat effects required to operate in contested airspace and to prevail in the combat areas of interest.

The focus is less on what organically can be delivered by a proposed new fighter than its ability to trigger, interact with or work with other platforms to deliver the desired combat effect.

Here the discussion encompasses as well discussions I have in Australia with regard to what is the [changing relationship between platforms and systems](#) as well as the question of how to develop new platforms in light of the evolving approach to force package integration and distributed C2 approaches and capabilities.

A second but correlated way to look at it is to shape a building process whereby key elements are identified, designed and built through the next 20 years and operationally introduced into the relevant European combat force in anticipation of the fighter to be designed through an open-ended process with the design closure affected by that learning curve.

A case in point was provided by a senior Airbus official involved in FCAS who provided a case study of what Airbus has in mind.

The broad point was that the manned fighter would be working in the future with remote combat systems in the combat air space and the core competence which needs to be created would be a teaming capability.

This requires developing and evolving sophisticated software and teaming concepts of operations to work with extant fighters and any future fighter.

Airbus recently did a demonstration of such a complex teaming effort over the Baltic Sea. In this experiment, the drones or remotes were given combat tasks by a combat aircraft and the drones then executed their tasks using their own autonomous systems.

What this approach might mean for Airbus is that they would generate a core software driven house working to then shape relevant (in this case) platforms which would operate with remotes in the battlespace.

In other words, the relationship between software development teams and platform designers is in the throes of an historical shift, and the focus of the FCAS project in many ways underscores recognition of this shift.

Such software driven teaming capability could be understood as a building block or a stakeholder in the FCAS fighter some years down the road.

Of course, it could be part of the overall transition being driven as the F-35 has entered and expands its presence in the European combat force as well.

In other words, the adaptations of the legacy combat fighter fleet plus the development of blocks of FCAS capability can be seen as harbingers of FCAS and as adaptations to work as the NATO fleet changes as other new capabilities come into the force.

In short, significant innovation will characterize the way ahead as peer competitors confront each other and adjust to each other's capabilities and performance in combat.

And the [decade of innovation](#) ahead will clearly lay the foundation for the next.

The elephant in the room clearly was what would Germany do with regard to their Tornado replacement aircraft?

This replacement challenge also includes a subsumed issue with regard to any nuclear mission within which the German Air Force might participate in the period ahead.

The Germans face three choices with regard to Tornado replacement.

First, they could buy a squadron or two of F-35s which would link them as well to what the Nordics, the UK and Italy are also doing.

If they wish to continue the nuclear mission, the evolution of the F-35, [Block IV](#) of the software which is being readied now would be available to integrate nuclear weapons within the F-35.

Several German companies already are involved with the F-35 in terms of the manufacturing base for F-35 within the context of [Industry 4.0](#).

Second, the Luftwaffe could replace Tornado with an upgraded Eurofighter, similar in some ways to what the [UK](#) has done with Project Centurion.

There are key questions of the UK working relationship with the German part of Eurofighter as there are IP and investment issues which the [UK has made](#) but the other Eurofighter partners have not.

And with Brexit looming over the [Eurofighter future](#), ways need to be navigated to shape the way ahead.

But Eurofighter has not been certified to carry [nuclear weapons](#), and it is not clear that the US will do this, less for reasons of pique than for reasons of suitability as well.

But this is a work in progress or not.

Third, the FCAS project clearly is a long range goal for the French and German governments, but the path ahead needs to be shaped in part to find ways of convergence between the Rafale and German Eurofighter upgrades and software commonality.

Can this be done in time for the Tornado replacement?

It the goal is to replace Rafale and Eurofighter in the future with a common fighter aircraft in the 2040 time frame there is little doubt that by dovetailing efforts this can be achieved.

This requires convergence at the governmental level with regard to procurement, with convergence with regard to the two Air Forces and cultural integration among the key companies which will develop, test and build the new fighter aircraft.

As a long term goal, the key focus in the near to mid term needs to focus on the building blocks to get to the kind of integrated air combat picture highlighted by the FCAS approach.

For example, a new Airbus [A320neo](#) could be built in such a way that it is modular and FCAS enabled so to speak.

But the Luftwaffe is facing the question posed by the RAF F-35 leader: the future is now?

How does Germany address this question?

The French answer on display throughout the conference was fairly straightforward — continue the upgrade process of the Rafale which would fly in the words of on French General until 2060.

And concurrent with that upgrade and modernization process, launch the process of convergence in French and German thinking to get to an FCAS end point.

The question of the Tornado replacement either is a question which deserves an answer in and of itself, or it is mutated into Eurofighter evolution which neither the RAF nor the Italian Air Force are doing outside of the context of F-35 integration.

It is a debate and work in progress and perhaps by the next Fighter Conference there will be more clarity on these issues.

The International Fighter Conference is held by IQPC and next year's conference will be also held in Berlin from [November 12-14 2019](#) and if this year's conference is anything to go by, it is highly recommended that persons interested in the evolution of the air combat force attend.

Although the focus is upon fighters, given the evolution combat, the scope is rapidly expanding to a discussion of operations in the integrated battlespace.

I will conclude by highlighting a graphic which I crafted during my time over the past five years engaged with The Williams Foundation looking at the evolution of the integrated combat force, in ways necessary to deal with the evolving battlespace.

Operating and Prevailing in the Extended Battlespace

The Offensive-Defensive Enterprise Operating As a Kill Web



FOOTNOTES

1. A report on the Rafale was published by our partner Operationnels and can be found here <https://operationnels.com/produit/operationnels-slds-21-hors-serie-automne-2014/>

The French Air Force and FCAS: Perspectives from the International Fighter Conference 2018

11/25/2018



By Robbin Laird

The French Air Force (FAF) is one of the most active Air Forces in the Western World.

They have had significant demand on the force and have been stressed through a continual flow of operations.

They are a nuclear-armed Air Force and their focus on Quick Reaction Alerts revolves around the nuclear mission.

Our partner <http://Operationnels.com> provides the most comprehensive coverage of the FAF of any non-governmental source and the editor has been on several missions with the FAF over the years, in Africa and the Middle East.

We have a lot of respect for the FAF and its challenges.

A good sense of how the FAF operates was provided in the editor of Operationnel in her piece on the Syrian strikes and the QRA focus of the FAF.

In this piece published by [Breaking Defense](#), where she is a regular contributor, Murielle Delaprote highlighted the years of cooperation and collaboration between the FAF and Allied Air Forces in being able to do the Syrian strike:

Building the trust necessary so that a French mission commander based in the Mediterranean could direct part of the strikes in an autonomous manner did not just happen overnight.

This is the result of years and years of flying and sailing together and operating together whether in Afghanistan or over Libya or in Niger.

It is also the result of the joint planning done in 2013, albeit in a very, very different threat environment.

So when the French Air Force Generals spoke at the International Fighter Conference 2018 about Future Combat Air Systems, they spoke from the perspective of operational realities, and real world focus on modernization of airpower and within their experience as a coalition air force as well.

The two FAF Generals who spoke highlighted the importance of modernization and upgrades as the force evolved over time to the point whereby a new fighter could be fielded by the 2040s.

The new fighter would then become a key piece in the overall evolving air combat integrated force.

One of the two generals specifically discussed that with the F-35 coming in significant numbers to Europe, this meant that working integration of the FAF with the F-35 was an important task as the FAF and German Air Forces (and the Spanish) as the FCAS approach was being shaped and worked.

A similar perspective was highlighted during my interactions over the past few years with the European Air Group, of which the FAF is a key member.

The EAG refers to this as 4th and 5th generation integration and during my visit to the EAG earlier this year during my visit, [Air Commodore Adang](#) highlighted how he saw the challenge:

If I look at European air forces, current plans, when you total the projected number of F-35s in about ten years' time, say 2028, and you compare it to the number of 4th gen fighters that will be used at that time still, then you're looking at about 20% fifth gen systems and 80% 4th gen systems, not including any F-35 or F-22 US forces.

"And the total number that makes up that 20% of F-35s is too small to create the total effects that you need in a major combined air operation.

"You need the missile carrying capabilities and other attributes of the 4th gen fighters to ultimately be successful. So it's only through a combination of 4th and 5th gen that we can be successful in future air operations.

“And this is the trick.”

Working such integration is a key task facing the FAF along with any participants in FCAS and will undoubtedly be part of the roll out of the connectivity technologies shaped for FCAS.

New Generation Weapons System Within a Future Combat Air System

The first presentation was entitled “New Generation Weapons System Within a Future Combat Air System” and focused upon the environment in which the evolving capabilities would need to operate and to prevail.

The FCAS was launched by the German and French declaration in July 2017 and will see the first contracts generated early next year.

The goal of the effort is to be able to “guarantee” air and space superiority and the FCAS is envisaged as delivering this capability.

As a ‘system of systems’ approach, the notion is that the system will deliver the goal of air superiority; not any specific platform.

As a result, the focus will be upon the build of new platforms in terms of **how they connect and work together**.

The focus is upon the platform team to be built to augment existing legacy assets which will be undergoing continuous modernization, like the Rafale fighter which will go through significant upgrades through its service life beyond the projected introduction of the FCAS fighter in the 2040s.

This means the challenge of connecting the force becomes a crucial choke point to or focus of attention for effective implementation of the FCAS approach.

In the first presentation, this was clearly recognized.

Connectivity from the perspective of the FCAS approach was seen to encompass: the network, data storage and management (**the combat cloud**), interoperability for combined and joint ops; and interactions between the FCAS and legacy systems.

To achieve this is challenging on several levels.

Standing up the system requires working a number of issues: standardization in waveforms, communication systems, data infrastructure (cloud architecture, aircraft avionic architecture, and digital services (SAAS – Software as a Service).

Also important are the challenges of security, data protection and cyber intrusions as well as working the relationship between autonomy and collaboration among the platforms in the FCAS ‘system of systems’.

Even though the FCAS is being launched as a German-French program, the first speaker noted that the French would like the fighter to be carrier capable, something which is not necessary for the Germans.

And finally, the first speaker underscored the requirement to be able to shape new processes to adapt swiftly to the changing environment.

And he illustrated this challenge by highlighting the need to have effective and rapid interaction between the customers and operational capabilities, on the one hand, and industry and the development of technologies, on the other hand.

The graphic illustrated a major opportunity and challenge within the FCAS approach: how to get the procurement agencies to work more effectively with the combat force and in turn how to get better cultural integration across industry to support the transformation of governmental processes?

This is no easy set of tasks.

Building a Global Combat Air Systems (GCAS), Path to the FCAS

The second speaker entitled his presentation “Building a Global Combat Air Systems (GCAS), Path to the FCAS.”

In his presentation, this speaker provided an overview of the objectives, but spent most of his time focused on the key tasks necessary to get to the FCAS end point.

A number of air operational requirements were identified in the presentation as the launch point for the FCAS discussion.

- Air superiority in a contested environment;
- Height, speed, reach, payload and responsiveness of the system and the platforms to achieve air superiority;
- More persistence
- More weapons and larger range of effects
- Better survivability (which could be collectively achieved rather than focusing on a particular platform)
- Right mix of autonomous (i.e. onboard) versus collective capabilities
- Connected and able to collect and share data
- Data processing depending on needs and position in the system
- European sovereignty
- National caveats (national clouds and specific capabilities if needed)
- Affordability versus numbers.

In his presentation he provided an overview of how he saw the FAF combat fleet evolution in light of the FCAS objective.

The first phase was from 2020-2030 where the focus was upon Rafale and Mirage modernization.

The fleet would be stabilized at 225 fighter aircraft for the FAF and the Navy.

Rafale upgrades would be provided to enhance connectivity, survivability, and new sensors and weapons.

The second phase from 2030-2040 would see the retirement of the Mirages and the FAF would have a Rafale fleet only.

In this period, modernization would continue with regard to new sensors, weapons and networking capabilities.

The Rafale would evolve (F-5.MLU) to continue its nuclear delivery role as well.

The third phase would be from 2040-2050 with the fielding of a new generation system.

FCAS/NGF initial deliveries would be made to start the Rafale replacement process.

Rafales would continue in service until 2060-ish.

The rest of the presentation focused on the air connectivity challenges and the need to deal with legacy approaches and to expand the envelope of working digital integration.

And at the heart of the FCAS is clearly what [Generals Hostage and Deptula](#) identified several years ago as the combat cloud. Information superiority is to be enabled through the combat cloud.

This means that much focus of research, development and combat improvement in the FAF over the next decade and beyond must be in this area, and the challenge identified in the first briefing or in the EAG's work becomes a key one – working F-35 integration with the legacy fleet.

And such efforts, by definition become part of the FCAS as well.

The second speaker highlighted how he saw the GCAS network evolving and laying the foundation for FCAS: "Given the complexity and program cycles, we need to have an incremental approach."

And here he provided what he identified as a connectivity roadmap.

From 2018 through 2025, he envisaged the creation of the network which is connected but limited in its full impact.

From 2025-through 2030 he saw a catch up imperative where a digitally ready FCAS system was being shaped.

From 2030 through 2040, a system architecture by design would be crafted and put in place as the laydown for the new fighter in the 2040s.

Put in other words, modernization of the legacy air combat fleet and the shaping of an evolving incremental network would be subsumed in a new architecture and a new fighter by the 2040s.

He concluded his presentation by identifying what he saw as the risks and opportunities of the FCAS approach with GCAS as the development and implementation path.

The key risks identified were as follows: an interoperability gap (4th and 5th gen); not being able to define international norms; lose a strong and capable aeronautical European industry; and to lose time.

The opportunities were identified as follows: operational gains; share/promote the connectivity concept at the joint force, industrial and allied levels and to develop cooperation.

In other words, for the FAF, it is about evolving the current fleet and modernizing the Rafale to remain a centerpiece of FAF airpower, but to do so in a way that provides building blocks to the FCAS and the Rafale replacement fighter.

And to do so, in the context of evolving airpower modernization in Europe and beyond by non-FCAS airpower players, including adversaries for that matter.

The graphic at the beginning of the article shows an Naval Group / Dassault Aviation image showing the NGF (next generation fighter) and a UCAS being launched from a conceptual aircraft carrier.

Crafting a Fifth Generation Combat Force: The Perspective of Air Marshal (Retired) Geoff Brown

11/24/2018



By Robbin Laird

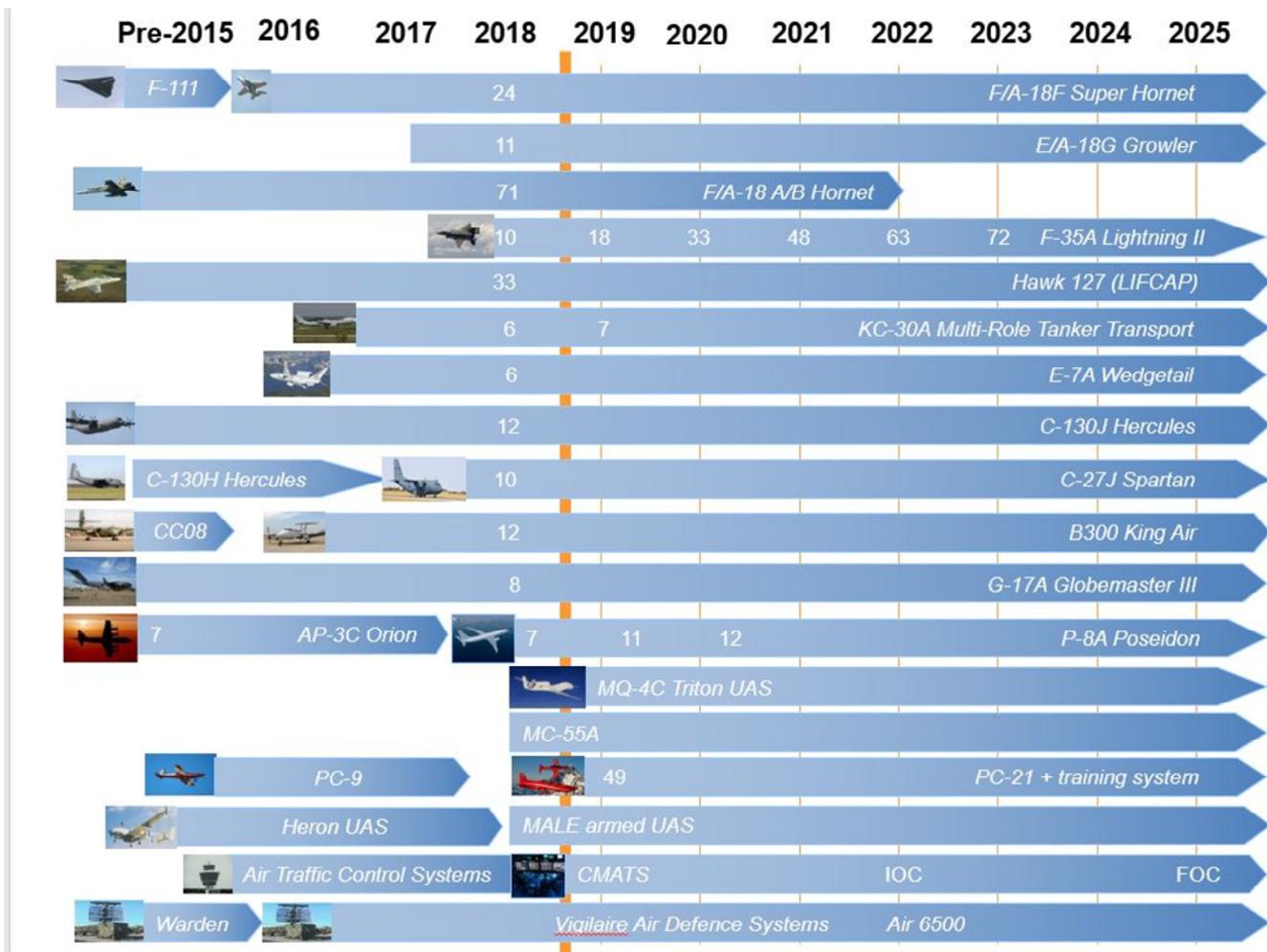
At the International Fighter Conference 2018, Air Marshal (Retired) Geoff Brown provided an overview of how the RAAF has shaped a way ahead along with the Australian Defence Force to craft what they refer to as a fifth-generation combat force.

In the case of the Royal Australian Air Force (RAAF) and the Australian Defence Force (ADF), the acquisition of the F-35 has been seen as not providing a replacement aircraft but a trigger to broader force transformation, with a future is now mentality.

Brown provided an overview of how the ADF is looking at the crafting of a fifth gen force or a fifth generation enabled force and some of the highlights from his presentation underscore how the Aussies are looking at this dynamic of change.

For the last 5 – 10 years in Australia we have been determining the characteristics of combat operations in the post 2025 era.

The RAAF we have been very fortunate to have been well supported and funded by government.



In the RAAF it's been nice to say that most pieces of the future combat fleet are in place or that the funding has been secured. It will be a F-35's supplemented by Super Hornets and they will well be supported by systems like Wedgetail, Growler, KC-30s, and air defence systems like Vigilaire and over-the-horizon radar, and I even think the Maritime Patrol Fleets, P-8s and Tritons, will all contribute to the air combat system.....

We have concluded in Australia, that air operations will be characterized by the capability to connect air, ground and maritime forces.

In the ADF we have actually called that 5th Generation enabled CONOPs. The ultimate goal is that the combat and strike power of a single aircraft is not defined by what it carries itself but by its ability to direct and rely upon its network partners. Even to the point of using other platforms weapons. We have been in the process of developing 5th Gen CONOPs across the ADF informed by the forcing function of 5th Gen aircraft and the associated air, maritime and land systems.

In a 5th Gen force, C2 systems will be enabled by flying ISR and C2 system, the combination of sensors and Stealth will enable aircraft like the JSF to operate in an Adversaries airspace and allow aircraft to serve as nodes in a dispersed and distributed air battle management system....

One of the things that the critics of the F-35 don't get is, in all the studies of air combat, the amazing statistic is that 5% of the pilots have taken 95% of the kills. Now, when you do the analysis of those 95% of the kills and what makes the difference with those 5% of pilots, it was their superior situational awareness in all the situations that they faced that made the difference. And the F-35 gives you a massive leap in situational awareness, and that's the key factor in 5th generation capability. It's the integrated fused picture.

It's worth briefly working through the value chain of the F-35. I'll start in operations and I'll work my way towards fundamental inputs to capability, and we'll just have a bit of a look at some areas that we have been working on.

Over the last 10 years I almost get a hoarse voice trying to explain to people why 5th generation capabilities are important in the F-35 and why speed and maneuverability don't necessarily have the same impact that they previously had.

What is 5th generation?

It's low observability, it's a low infrared signature, it's low electronic emissions, it's an AESA radar, it's the data links associated with that, but the most important thing in my mind that the JSF brings is the fused picture – that situational awareness that it actually brings to the operator.

And your level of situational awareness is a combination of all those things. If you look at the difference between an F-35 and a legacy platform, you don't have to manipulate the sensors. You've got a fused picture on the display, you don't have to have as much communications between the flights; the pilots fundamentally got a lot more brain space to actually look at the tactical situation and go forward.

Now what are the implications for Air Battle Management?

We're already implemented some of this with the rest of the ADF.

We're successfully fusing the picture between Wedgetail and the Navy Destroyers and Frigates. One of the great decisions we made with Wedgetail was that on each one of the crews there's a Navy Air Intercept Controller. We've had Mission Commander who's are Navy Lieutenant Commanders – and our recent experience on exercises and in Iraq and Syria with the Super Hornet and Wedgetail have really shown the power of that integration.

When you look at the F-35 be able to find, fix, track, target, engage and assess. That's the cycle. The JSF can do that all by itself, but it is far more powerful if you look at the find and fix and you use a lot of the systems we've got from Vigilare to JORN to Space Based Systems, to maybe even the Triton and P-8.

They're all part of that find and fix. And if I was to look at track – Wedgetail, AWD, Growler are all parts of that. The engage – well, that's the job of Super Hornet, JSF and Growler, and what we aspire to is to have, some integrated fire control with the Royal Australian Navy. That's all well within the realms of possibilities.

The more nodes you've got, the better off it is for the entire system. And what we see is the advantage of the F-35, it does increase the capability of the entire system....

After his presentation, I had a chance to sit down and discuss his presentation and the way ahead for the ADF leveraging the F-35 as a trigger point for change.

In the discussion after his presentation, Air Marshal (Retired) Brown highlighted a number of key points which he believes are central to thinking about the future of airpower.

First, he argued that buying an advanced plane and getting on with it was crucial.

“70% of your cost is about maintaining, supporting and modernizing your airplane. Why would you want to do that with a legacy jet when you can buy a fifth gen jet?”

Second, by getting the F-35 into service, the ADF could then look to add what is missing to that jet or to the air system and then look to shed legacy assets.

A case in point is support to the Australian Navy.

“When we have an effective maritime strike weapon onboard the F-35, we will look to retire our Super Hornets, with the exception of the Growler. Flying the Super Hornet has prepared us for F-35 in some key ways, notably in terms of the security requirements necessary to manage data generated by the aircraft.”

Third, the 5th gen approach as characterized by Brown is a shift to working the interconnected force in a different way.

He provided an example with regard to CEC and the Air Warfare destroyer.

“Our Navy has just started deploying our air warfare destroyers but we have already demonstrated CEC interoperability with the US Navy.

“We will put CEC on our Wedgetails to be able to provide weapons quality tracks to our ships, hence enhancing significantly the range for the strike capability of our fleet.

“And as we go forward we will find ways to directly link our F-35s with the fleet as well.

“Our Navy and Army are now focused on fifth generation communications with their platforms as well, which is why having the F-35 in the force can drive change in the strategic direction in which you want to go.

“You fly a legacy asset you cannot drive the kind of change the ADF needs in the near to mid-term.

“It is not an abstract, long-range aspiration or goal.

“As the head of the RAF Lightning force, noted, the future is now.”

Fourth, the change in the overall structure of the ADF and the architecture to guide its development is being driven by a fifth-generation mentality and approach as well.

“Our architecture is not up to speed with what the F-35 can provide.

“We have a great airplane with enormous capability which will continue to evolve but a lot of the supporting infrastructure we’ve got is not designed to get the best out of that airplane.

“And I think that our focus needs to be on getting the rest of the system up to speed.”

Finally, fifth generation warfare training requires a paradigm shift.

“If you want an integrated system, you’ve got to train with an integrated system.

“You can exploit a lot of the capabilities that the F-35 brings to the fight in the live environment but the only place you can do it as a force is in the simulated environment.

“We need to develop fifth gen warfare networked simulation capabilities.

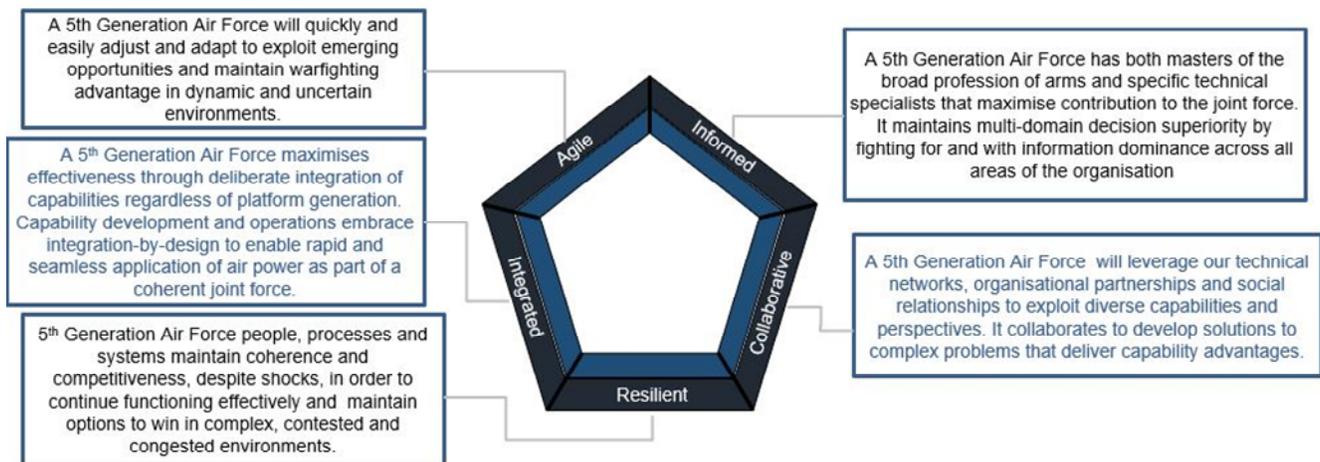
“And you just can’t afford for the simulated environment to be behind the airplane.

“It’s got to be updated at the same rate that the aero plane is being updated.

RAAF – The 5th Generation Air Force

The Royal Australian Air Force will become the world’s first 5th Generation Air Force driven by our need to fully exploit the potential of 5th generation technology in increasingly volatile, complex and uncertain environments.

The attributes below describe a 5th Generation Air Force. To become a 5th Generation Air Force, RAAF must develop these attributes across all areas of our organisation including, but not limited to workforce, infrastructure, training and education, logistics, capability management / development, engagement and operations.



A 5th Generation Air Force is a bold ambition and our transformation will require bold leadership. We will know we are being bold when we: innovate beyond the plan, think ahead of current paradigms and build an air force that can contribute to win, whatever the situation.

The featured photo shows F-35 Aircraft AF-4 Australian KC-30 Tanker Test.

The Royal Australian Air Force (RAAF) completed the first fuel transfer with the air refuelling boom from a RAAF KC-30A Multi-Role Tanker Transport (MRTT) to a US Air Force (USAF) F-35A Joint Strike Fighter at Edwards Air Force Base in California.

A total of 59 contacts were conducted of which five contacts transferred 43,200 pounds of fuel during the four hour sortie.

September 2015.

The F-35 and Data Fusion: A Perspective from the International Fighter Conference 2018

11/26/2018

By Robbin Laird

At the International Fighter Conference 2018, one of the key themes was the standup of the F-35 in several air combat forces, and the impact of this effort on the way ahead for air combat forces.

One of the presenters at the conference was an experienced F-16 pilot who had transitioned to the F-35 in 2010 and has spent several years as a USAF test pilot at Edwards Air Force base and more recently has joined Lockheed Martin in 2016 in a test pilot capacity at Edwards AFB.

I had a chance to sit down and talk with Scott "Shark" McLaren about his experience with sensor fusion on the F-35 and his perception of the combat advantages which this provides the F-35 pilot.

The baseline point is that the designers of the [F-35 cockpit](#) based on their experiences with the F-16 and the F-22 worked to provide for a visual and work system that significantly reduced the pilot load.

Then with the integrated sensor system built into the F-35 the role of data fusion is to provide situational awareness as a service to the pilot and the MADL linked combat force.

This is in contrast to a legacy fighter where the pilot is fusing the data up against a core task such as air superiority or ground attack.

In contrast, the fusion system "engine" leaves the F-35 pilot with more flexibility to perform tasks as well as operate in the words of the USAF speaker in the first morning of the conference to provide for strategic inputs as well.

"Shark" described his experience as an F-16 pilot as fusing the data from the various screens within the aircraft.

“The radar will be on one display; the targeting data on another.

“Perhaps a picture generated from the Link-16 network on another.

“You are now focused on a particular mission and putting together that data up against the core mission for which your aircraft and the formation is dedicated to executing.

“The human brain is where the information on those separate displays are being fused and translated so that pilot is able to execute the mission. And he might also be working his radio to coordinate the mission as well.

“And this is being done in a high-speed combat jet where if there is a pop-up threat you might need to refocus and deal with that as your focus of situational awareness.”

The training cycle for our proficient F-16 pilot according to Shark is around 24 months to go from basic flight skills to formation flying, to learning the different mission sets and getting comfortable with delivering weapons or an effect in the different mission set environments.

And over time, as the experienced pilot flies more missions he can shape the mental mission profiles in his brain to guide the various combat missions with other combat aircraft.

“Over time, those years that I’m talking about, he’ll be able to build that mental picture, that mental model, and do most tasks, take on more responsibilities so that he can lead a two-ship, a four-ship, an eight-ship- whatever the case may be- and have enough of a mental model, based on the information coming in, to execute the mission.”

Shark added that the role of the radio is important in working the execution of missions onboard the F-16 as well which is also part of the demand side on the pilot’s attention and thinking process.

“A lot of what’s done in side a fourth-generation aircraft is done over the radio.

“That’s why I have other players maybe command and control, other tactical players that are sending me information over the radio.

“Audible communication.

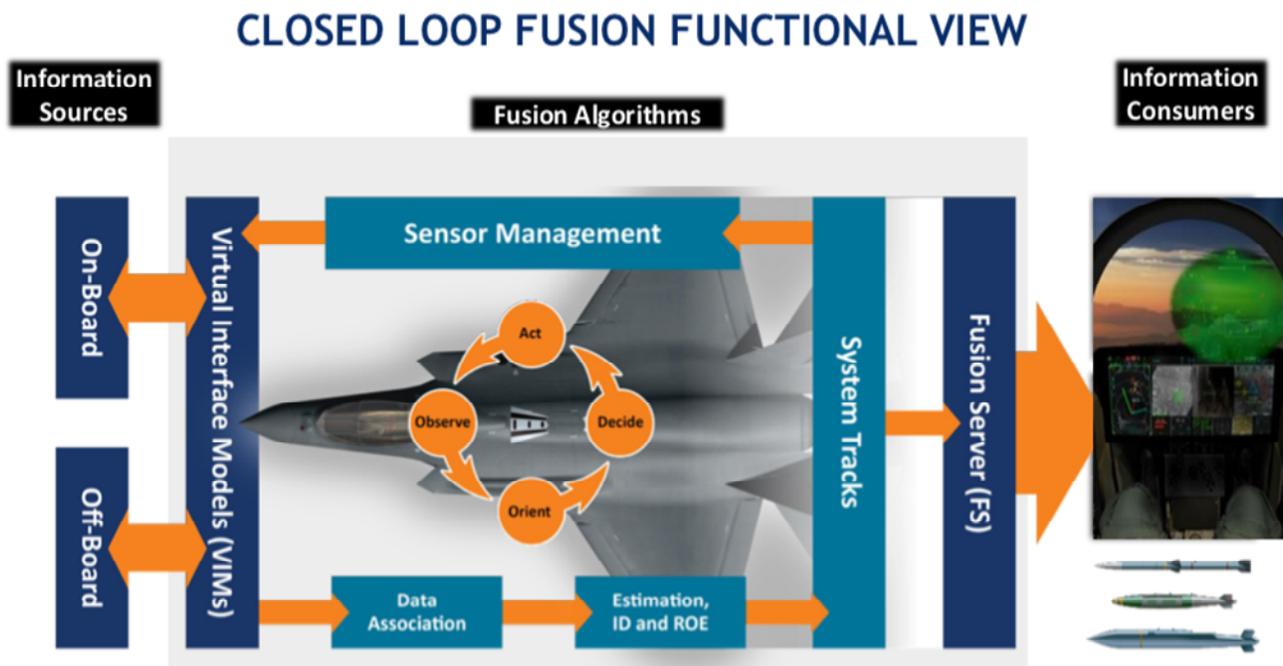
“There’s no hand gestures that I can use for seeing body language, nothing. It’s just the communications that’s said over the radio, or heard over the radio.

“And now you take more time, you ask questions. And all the time that you’re doing that, that mental picture that you were supposed to be building? Your mental picture is getting disrupted.

“So when you come back to it, where is that mental picture?”

“You’re probably going to drop out some of it, some of that mental picture. Some of the best pilots could keep track of it. And keep track of it pretty well.

“But even then, some of the information has dropped out.”



With this as the notional baseline, “Shark” then described the significant difference which the F-35 systems and sensor fusion can provide the pilot and the combat group.

“With the F-35, this is where the operational capability changes.

“With the F-35 you have automation via fusion going on.

“That process that is taking the F-16 pilot years to get good at, and almost all of a notional ten-minute engagement time to build a good picture, is being done automatically for the pilot in F-35 fusion.

“That picture is being built. In that same ten-minute scenario, it’s taking less than a minute for all of that information to be presented to him.

“He knows the picture.

“And that’s without any communication having to go across the formation.

“Your mental processing power which in the F-16 is focused on creating the operational mental picture or SA is now focused on combat tasks and missions.

“Your training focus also changes.

“Rather than focusing significant training time on how to shape your SA picture, you can now focus on tasks in the battlespace and distributed operations.

“The Commander and the F-35 force can focus on the effects they want to deliver in the battlespace, not just with themselves, but by empowering other combat assets as well by sharing the SA through targeting tasking.

“We have the capacity to third party target and to distribute the effects desired in the battlespace.

“That becomes our focus of training and of attention; not a primary focus on generating the SA for my organic asset to survive and to deliver a combat effect itself.

Using Shark’s 10-minute operating paradigm where the F-16 pilot is spending 8 minutes of that time period on SA and mission preparation, the F-35 pilot can spend 9 minutes of his time on mission preparation and distributed operations if so tasked.

Shark concluded: “For the F-35 pilot, training will now need to include how you go out and influence the battle area the best for the commander?”

“And that’s going translate up to what the commander needs to give in direction, but also back down to what the pilot needs to know.

“And that training is part of a larger joint exercise, a larger concept of operations for the joint force which gets at the strategic impact of the F-35, which the USAF BG discussed in the conference.”

The International Fighter Conference 2018 was held from November 12-14 2018 and was organized by IQPC Germany.

Next year’s conference will be held from [November 12-14 2019](#).

Extending Combat Air Capabilities With Unmanned Systems: An Airbus Defence and Space Perspective from the International Fighter Conference 2018

11/27/2018



By Robbin Laird

At the 2018 International Fighter Conference held in Berlin from November 13-15 2018, one of the topics for presentation and discussion is the European concept and approach to what is being called the Future Combat Air System.

Here the target is to shape a new combat system by 2040, which will drive change in both European industry and force structure.

The presentation by Bruno Ficheteux, Head of the FCAS Programme in Airbus Defence and Space, focused on a key building block in the FCAS trajectory, namely working manned-unmanned teaming.

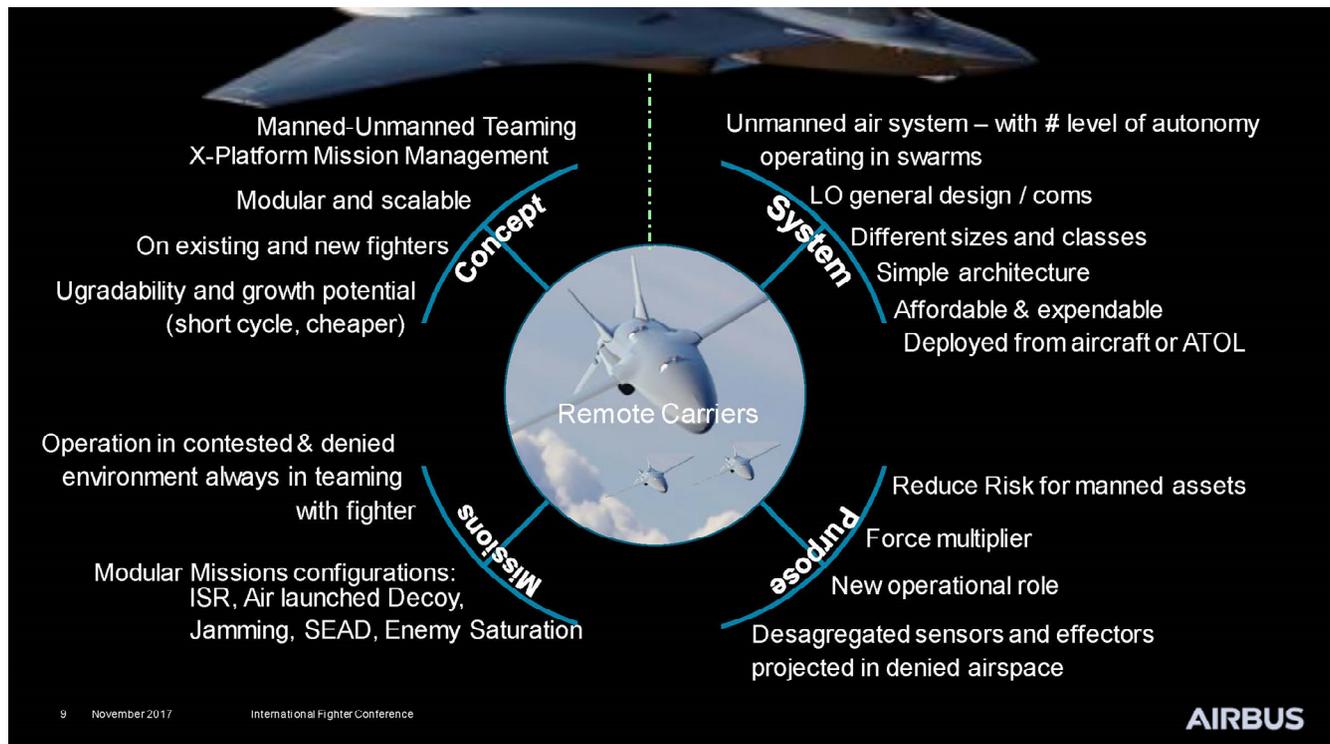
As Airbus Defence and Space already builds and supports two key non-fighter elements for a 21st century combat force, namely the A330MRTT and the A400M and is working through 2 “big wing” potential contributors to the integrated battlespace, namely: The EuroMALE Unmanned Air Systems and the A320neo multi-mission aircraft, it is clear that a core opportunity for Airbus Defence and Space rests on shaping FCAS as a business approach for legacy as well as newly introduced combat systems.

The manned-unmanned teaming research and approach clearly can do both, namely, build towards a new combat fighter capability in the 2040s and support the evolution of air combat fleets, whether operating legacy or fifth generation assets.

In his presentation, Fichfeux argued that manned-unmanned teaming would be increasingly part of the combat air space and function as remote carriers. The manned and unmanned assets would collaborate in the battlespace and be connected through a combat cloud ecosystem.

At the heart of the ability to shape such a future, software needs to be developed which allows for manned-unmanned teaming and as that software evolves, the capability to manage swarming and its effects would become part of the combat force.

The graphic below captures how he has conceptualized the approach and the effort.



He underscored that although the vision is futuristic, the needs are not.

And he mentioned in his brief that Airbus Defence and Space had recently demonstrated the manned-unmanned teaming approach in a dynamic display to a wider audience in order to visualize the obvious benefits it has for air warfare already today.

After his presentation, I had a chance to sit down with Bruno Fichfeux to discuss the experiment and how that experiment laid down a building block for the future. He explained that Airbus Defence and Space put a core software development team together to work the integration necessary for a manned aircraft to work a team of remotes to execute a variety of missions.

The focus was upon the pilot in the cockpit setting the tasks and passing that task off to the swarm of remote carriers, which then would distribute among themselves and execute the task or mission autonomously.

The team worked for a year preparing for the experiment, which was conducted in the North of Germany over the Baltic Sea and the experiment was conducted a month ago. The team used off the shelf drones and equipment; the focus was on the software development.

Five drones were flown in formation flight with a C2 manned aircraft, which provided real time mission tasking.

“The pilot is not piloting the drones; he is just giving the swarm a High-level command which then sort out their mission allocation among themselves. You give the machines the task; and then it executes the task.”

As the tasking requires only a minimum of attention from the pilot the teaming has far more benefits than costs.

Customers were invited to the experiment and invited to set unplanned tasks during the course of the experiment underscoring the flexibility of the software rather than having a scripted pre-programmed event.

The capability demonstrated by Airbus Defence and Space is a core one for them going forward.

Rather than being considered primarily a platform company, with the FCAS transformation process, software development, integration and evolution of a team of combat assets becomes a core focus of attention.

While the tangible part of Remote Carriers is expected to be relatively simple in architecture and as such affordable and potentially attritable, the Remote Carrier’s brain and behavior will be the valuable game changer on the battlefield.

And given the company’s significant capabilities in a variety of lift, tanking, ISR and C2 platforms already, clearly these platforms and their evolution and the formulation of a new platform approach will be informed by this core software development and integration capability.

Teaming capability in the connected battlespace is a core competence being worked by Airbus Defence and Space, and they will work as well to inform Eurofighter evolution as well with these new and evolving capabilities.

In the past, Airbus Defence and Space had worked the Barracuda program, performing the first “European made” Unmanned Air System mission on air which was designed to provide Eurofighter with an unmanned partner.

This experiment built on that effort to extend it to the swarming environment.

Fichefeux underscored the importance of working non-stove piped software approaches so that cross-domain interoperability would be enhanced.

“By developing common cross-domain mission systems software for manned and remote air platforms, we can get the kind of interoperability we need and is a core goal of the FCAS program.

“The platform is much less relevant than the teaming capability and intelligence you put into it; and the way you allocate the performance among the manned-remote capabilities as a system.”

He added a key point:

“Following this rationale, many existing airframes can be transformed into Remote Carriers and taken into real missions where they reduce the risk for the legacy manned assets already tomorrow.”

The International Fighter Conference is held by IQPC and next year’s conference will be also held in Berlin from [November 12-14 2019](#) and if this year’s conference is anything to go by, it is highly recommended that persons interested in the evolution of the air combat force attend.

Although the focus is upon fighters, given the evolution combat, the scope is rapidly expanding to a discussion of operations in the integrated battlespace.

The following article looks at a key theme at the conference and provides additional insight with regard to the French view with regard to the FCAS project.

The Future Combat Air System: The View From Paris

11/26/2018

By Pierre Tran

Paris, November 26, 2018

The French government and industry are in negotiations for a budget to upgrade the Rafale fighter jet to an F4 standard of higher capability, and also funding for architecture and concept studies for a next-generation fighter, a source close to the talks said.

The planned Rafale F4 encountered “a major difference in the negotiations,” said the source, who declined to be identified.

A contract is due to be signed in December.

A benchmark for the F4 budget could be Britain’s £2 billion (\$2.6 billion, €2.3 billion) funding for development of its Tempest future fighter.

France Leads FCAS Effort

France and Germany plan to sign early in the new year a contract for architecture and concept studies for a next-generation fighter jet to replace Rafale and Eurofighter Typhoon, the defense ministries of the two nations said Nov. 21 in a joint statement.

Dassault Aviation is prime contractor on the Rafale and will also lead on the successor fighter, which carries a project name of Next Generation Fighter.

Spain, which will join that fighter project, expects to see a share of industrial work, the source said.

Germany has agreed France will lead the fighter program.

That future fighter is effectively an attempt to maintain a European industrial capability in response to the arrival in Europe of the Lockheed Martin F-35.

“If we don’t do something, we’ll be toast,” said the source.

“It is a matter of timing.

“We need to define requirements, we need to launch the research contract to have a plane by 2040.”

The budget for the architecture and concept studies for the future fighter is estimated to be worth some tens of millions of euros.

Dassault and the French procurement office, Direction Générale de l’Armement (DGA), declined comment on the budgets.

The F-4 Upgrade

Meanwhile, the planned Rafale F4 version will be equipped with a Multi-Function Array, combining radar, electronic warfare and communications.

Thales worked on the MFA in a feasibility study for the Future Combat Air System-Development Program.

Other F4 features include satellite communications, internet connectivity and armed with the MBDA Meteor very long-range, air-to-air missile and a midlife upgrade of the Mica air-to-air weapon.

There have been studies for the F4, with “several ideas on the table,” the source said.

The Rafale F4, along with a mid-life upgrade of 55 Mirage 2000D, will form the “legacy” fighter fleet for the French Air Force in an initial phase spanning 2020-2030.

In the 2030-40 period, a key feature will be the planned airborne nuclear-tipped missile dubbed Composant Nucléaire Aéroportée, successor to the ASMPA weapon.

For 2040 and thereafter, there will be a Next Generation Fighter (NGF) and legacy Rafale, with those aircraft flying in a system of systems, dubbed Future Combat Air System.

The Next Generation Fighter

France has signed a partnership agreement with Germany on the FCAS project.

Dassault displayed a reduced scale model of the NGF at the Euronaval trade show, held October 23-26.

The fact the model, which is not a definitive and final version, was shown at Euronaval signaled that the French version of the future fighter will fly from an aircraft carrier which will one day replace the Charles de Gaulle capital ship.

France and Germany signed April 26 at the ILA Berlin Airshow a cooperative agreement setting out high-level common requirements for a new fighter jet.

That pact paved the way for French and German officers to work on a government-to-government contract due to be signed in January, the source said, adding that Spain has taken part in the talks.

A task force, formed Jan. 1 and comprising the French Air Force and DGA, submitted its report to the office of President Emmanuel Macron in September, setting out the issues, technology and industrial road map.

Urgency is seen as the F-35 is arriving among European allies.

France is leading on the FCAS project, having agreed to German leadership on a future tank, dubbed Main Ground Combat System, and a planned European medium-altitude, long-endurance drone.

Since the summer, French and German officials have held talks to reach a detailed agreement on requirements and a common road map.

The plan is to launch the Franco-German fighter program in 2020.

France is keen to enlarge as much as possible its cooperation with Germany, beyond building a common fighter, and to agree to a broad concept of a Next Generation Weapon System.

The French Air Force, DGA, Dassault, MBDA, Safran and Thales are working together to study concept of operations, and research and technology.

Concept studies have been drawn up, drawing on DGA technology studies, lessons learnt on the Neuron demonstrator for an unmanned combat aerial vehicle, and work on the Future Combat Air System-Development Program conducted with the UK.

Those studies focus on missions and threats, pitching systems against systems rather than fighter against fighter.

A Team Approach to Air Combat Superiority

The concept is that the aircraft will work together, connected and exchanging information over an internet grid.

There will be manned, unmanned aircraft and “objects” flying in the skies, all hooked up on a network.

This focus on an overall system of system is seen as a different approach to the U.S. focus on an aircraft, the F-35, which is hooked up to other units through the network.

A key element of the French concept is a fleet of small drones, dubbed mules, flying ahead to detect and jam the enemy, and clear the way for the manned fighter.

The fighter jet will link up with satellites, AWACs spy aircraft, aircraft carrier, ground troops and command centers.

The planning is based on two conceptual circles, with the first circle comprising Rafale and next-generation fighter, future cruise missiles and future anti-ship missile, unmanned aerial vehicles, unmanned combat aerial vehicles, and “remote carriers,” which will be manned aircraft working with drones.

The second circle will include electronic warfare aircraft, AWACs and its successor, satellites, aircraft carrier task force, ground troops, and command and control centers both airborne and on the ground.

Hooking all these up will require a successor to the Link 16 communications network and the French Air Force is working on how to evolve the existing system to the next-generation FCAS, the source said.

The concept is to share tasks among the mix of aircraft so the fighter does not need to master every mission, the source said.

There will be high degree of stealth.

A British Role?

Meanwhile, the UK has announced its Tempest project for a future fighter, reflecting its air superiority requirement.

Tempest is intended to maintain British industry, said the source, adding that the announced £2 billion budget for development out to 2025 will not be enough.

Britain is expected eventually to be a partner on the Franco-German FCAS project.

“The door is never closed,” the source said.

Companies and FCAS

Airbus and Thales are reported to be competing to be system architect for FCAS, a key role in shaping the overall program.

France has invested a great deal in Thales, seen as a champion in connectivity and aeronautics, the source said. A formula will be found that satisfies the competing claims. "Each has its capability," the source added. "Airbus will not lose out."

Under French leadership, French and German companies have worked together with much effectiveness in the FCAS project, and presented to the authorities of the two nations their ambitions for FCAS, the French and German ministries said in the Nov. 21 joint statement.

The ministries have agreed that Airbus and Dassault will share leadership on a joint concept and architecture study for FCAS, with internet connectivity part of of the latter study, the ministries said. The two countries will sign that contract in early in 2019.

Contracts for studies for research and development, and demonstrators will be signed at the 2019 Paris Air Show, the ministries said.

French engine builder Safran will take the lead in developing the engines, with German MTU Aero Engines as subcontractor, business website La Tribune reported.

F-4 Technology as FCAS Building Block

Meanwhile, the DGA qualified Oct. 31 an F3-R standard for the Rafale, allowing the fighter to be armed with the Meteor very long-range, air-to-air missile, and carry the Thales Talios laser targeting pod, the procurement office said in a Nov. 8 statement.

The Meteor weapon will be hooked up with the active electronically scanned array RBE2 radar. The Talios pod aims to boost detection, recognition and identification of targets in day and night, seeking to deliver highly accurate air-to-ground strikes.

A laser-guided version of the Safran AASM powered smart bomb will also arm the F3-R, Dassault said in a statement.

Upgrades of the 144-strong Rafale fleet to F3-R began in October, with a first batch of 10 F3-R aircraft to go to the Air Force and Navy for operational trials, the DGA said.

Four of those units will be delivered by the end of this year.

French export sales of the Rafale to Egypt, Qatar and India are based on the F3-R standard.

Work on the F3-R standard drew on operational experience, particularly for fitting the AASM, the DGA said.

Interoperability and regulatory requirements were also factored in. Dassault, Thales, MBDA and Safran signed in 2014 the contract for F3-R, on a budget of some €1 billion.

“The Rafale continuous improvement approach is now looking to the F4 standard, development of which should begin soon, after completion of the ongoing feasibility studies,” Dassault said.

“This future standard will notably improve the connectivity of the Rafale and its ability to operate as part of a network.”

Technology in the F4 is seen as a building brick for the FCAS project.

The UK suspended the bilateral FCAS-DP project with France due to uncertainty over Brexit, Britain’s departure from the European Union on March 29, 2019.

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