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Future Fighter Mission - Power to the Edge

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Service Paper

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FUTURE FIGHTER MISSION - POWER TO THE EDGE

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FUTURE FIGHTER MISSION-POWER TO THE EDGE

AIM

1. The aim of this service paper is to present new concepts of Air Combat Warfare (ACW) centred on the Future Fighter expected capabilities. By 2026 the Future Fighter should achieve initial operating conditions¹ and with this initial operational debut, there will be changes with respect to the roles of Command and Control (C2). This paper will demonstrate three main considerations: the reallocation of Airborne Warning and Control System (AWACS) and Control and Reporting Element (CRE); the creation of Air Battle Management (ABM) teams; and the delegation of Tactical Control (TACON)² and Tactical Command (TACOM)³ to the Future Fighter formation.

INTRODUCTION

2. If the next Air War migrates to a full-spectrum contested battlespace, the core capability Control of the Air⁴ will be challenged by Anti-Access Area-Denial (A2AD) systems. In the Air Domain, A2AD systems will be a combination of networked Surface-to-Air Missiles (SAM) and networked fighter aircraft. With the implementation of the Future Fighter, traditional airborne C2 has the opportunity to change to meet the dynamic aspects of this contested airspace. By using advanced data-links and concepts of “Power

¹ Canada, *Strong Secure Engaged*, (Defence Capabilities Blueprint: May 2018), Future Fighter Capability Project Overview, <https://www.canada.ca/content/dam/dnd-mdn/documents/quad-charts/ffcp-quad-chart-en.pdf>

² Department of National Defence, B-GA-402-001/FP-001, *Royal Canadian Air Force Doctrine Command and Control*, (Canadian Force Aerospace Warfare Center: 2nd Edition July 2018), 6.

³Ibid, 6.

⁴ Department of National Defence, B-GA-400-000/FP, *Royal Canadian Air Force Doctrine*, (Canadian Force Aerospace Warfare Center: 3rd Edition November 2016), 32.

to the Edge”⁵, the Future Fighter will execute their missions differently from today’s fighters, such as the classic CF-18AM/BM Hornet.

3. A traditional C2 structure comprised of AWACS or a CRE, which is ground-based, uses an Air Surveillance Radar (ASR) as the primary sensing system to direct fighters towards airborne targets. This method will not be required when conducting Air Operations with the Future Fighter. The Future Fighter with its advances in sensor technology will have the ability to fuse, integrate and share data with other battlefield assets⁶. It is expected that the Future Fighter would operate in a large spread formation to extend its sensor coverage and provide a combined Air and Surface picture or Command Operation Picture (COP). This improved sensing capability would then replace the AWACS or CRE with the COP being transmitted back to an ABM site via Satellite Data-Link.

4. The formation of Future Fighters will act together in a team mindset with a set of rehearsed gameplans under the leadership role of single Future Fighter pilot that would be trained to operate as the quarterback.⁷ The Wingman would be given additional freedom to act in ACW. This will be explained as the “Power to the Edge⁸” concept.

DISCUSSION

5. In order to understand the potential capabilities of the Future Fighter there must be a mindset change from previous concepts of Fighter Tactical Operations. Leaving the

⁵ Alberts, David S., and Richard E. Hayes. “Power to the Edge: Command and Control in the Information Age.” *Command and Control Research Publication Series (2005)*, 6.

⁶ Newdick, Thomas, “Lightning in The Sandbox,” *Air Forces Monthly*, 375, (June 2019), 15.

⁷ Ibid, 15.

⁸ Alberts, David S., and Richard E. Hayes. “Power to the Edge: Command and Control in the Information Age.” *Command and Control Research Publication Series (2005)*, 6.

previous mindset of traditional fighter control behind in the past, presented are three new concepts that will change the operational conduct of the RCAF's Future Fighter.

a. First, each Future Fighter Aircraft will act as a Data Network Contributor Distributer (DNCD) and act as a node in the formation to which is capable of relaying fused sensor information to an ABM site.

b. Second, is the concept that some Future Fighter Pilots will become the Multi-Mission Airborne Coordinators (MMAC) or quarterbacks assuming TACON and TACOM of the formation, replacing the role that was traditionally executed by AWACS or CRE.

c. Third, is the concept that every Wingman within a Future Fighter formation will make their own airborne decisions using the "Power to the Edge" methodology⁹, with self-identification, self-targeting, and self-engagement capabilities.

6. As seen in Figure 1: Concept of Future Air Combat Warfare, a formation of Future Fighters will have the ability to execute multiple different tasks at the same time. The formation of Future Fighters will share sensor information between aircraft instantaneously and they will execute gameplans using a team mentality. The team mentality would result in a formation of three to nine Future Fighters. With one Future Fighter as the MMAC and the remainder as Wingman. These formations would be

⁹ Alberts, David S., and Richard E. Hayes. "Power to the Edge: Command and Control in the Information Age." *Command and Control Research Publication Series (2005)*, 6.

capable of executing what would normally require 30-50 multi-role fighters and supporting combat aircraft to execute the same number of tasks.

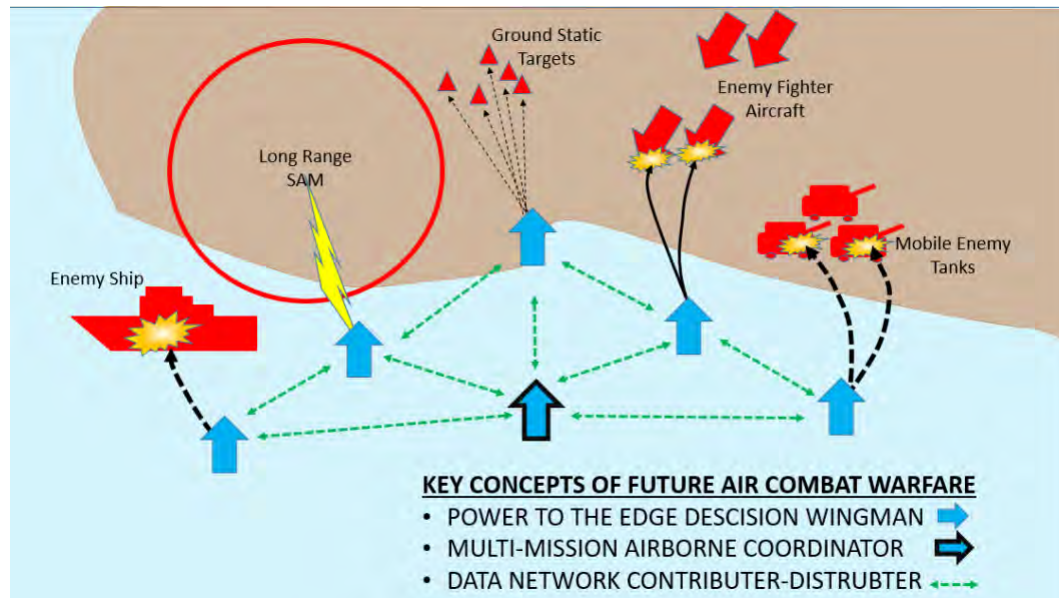


Figure 1: Concept of Future Air Combat Warfare

Assumptions

7. The backbone of the concepts is assumed from two main technological advances that the RCAF does not process. The first assumption is that the Future Fighter will have technology with be the ability to share multitude of different sensor information over a secure network with high precision and accuracy at a high data rate¹⁰ via satellite to a ground station. This means that there would be a requirement to use either the Mobile User Objective System (MUOS), a narrowband military communication satellite or another satellite system to relay the information from the Future Fighters to a ground based ABM for over the horizon operations.

¹⁰ "Mobile User Objective System," *Wikipedia The Free Encyclopedia*, https://en.wikipedia.org/wiki/Mobile_User_Objective_System (last update: 7 June 2019)

8. The second assumption is the technology required in Advanced Air Weapons. This includes missiles and bombs. These Advanced Air Weapons must be capable of engaging multiple different targets, including air and surface targets, with the same weapon. The advanced weapons will need to be capable of engaging targets at longer ranges and higher speeds. They will need to be networked in order to be dynamically re-targeted in-flight. The Future Fighter would have to be able to employ these Advanced Air Weapons and have the capability to control other platforms' Air Weapons.

Air Battle Management

9. One of the operational changes that could occur with the introduction of the Future Fighter is the relocation of AWACS and CRE. The AWACS or CRE would not be required in the same Area of Operations (AO) as Future Fighter. Instead the Future Fighter's sensor information will be sent to an ABM site that could potentially be ground based. The ABM becomes more command orientated vice control orientated. Here is where difference in Air Operation occurs. For instance, TACON with traditional AWACS or CRE controllers is done by directing fighter aircraft through vectors and engagement authorities, as in Figure 2. TACON would be transferred to the Future Fighter. The ABM team would receive the same fused near-real time information from the Future Fighter. A bubble of Air and Surface information would be used to monitor the global or regional picture, as in Figure 3. It would eliminate the need for AWACS aircraft and CRE radar sites due to advances in technology and the mentioned mindset changes.

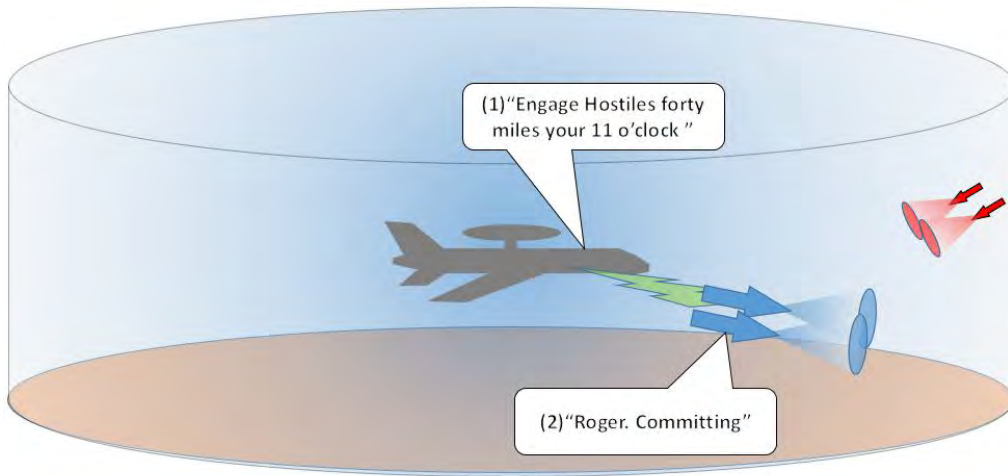


Figure 2: Typical Airborne Control

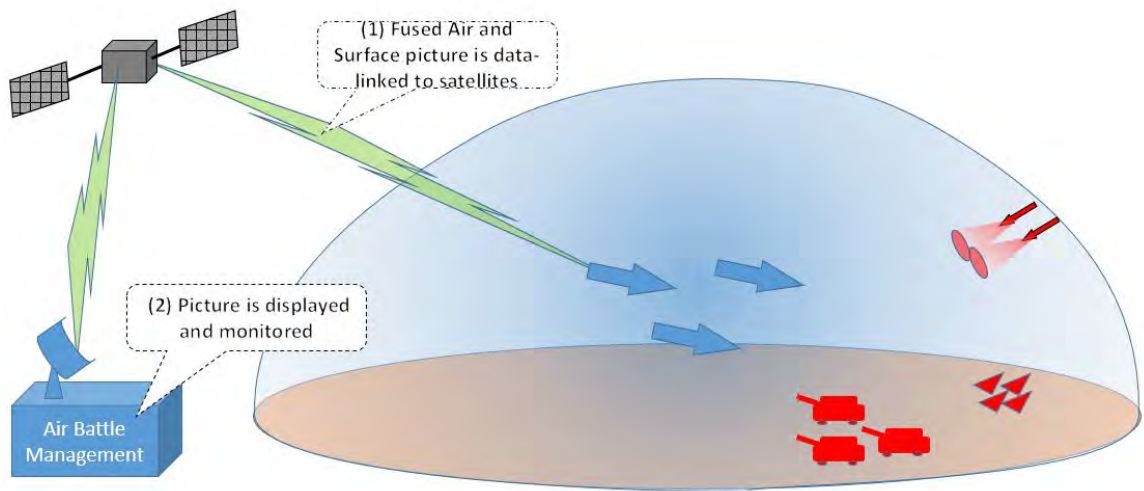


Figure 3: Future Fighter and Air Battle Management

10. It's understandable that with the reallocation of AWACS aircraft there is lack of persistence. The fuel normally used by the AWACS can be translated to additional fighter aircraft and/or other Air-Air Refueling (AAR) aircraft. Not only can AAR aircraft extend the range and persistence of the Future Fighters, but they can be used as a relay platform and for "offloading data collection".¹¹ "Getting intelligence and surveillance data for

¹¹ Everstine, Brian W, "The F-22 and the F-35 Are Struggling to Talk to Each Other ... And to the Rest of USAF" *Air Force Magazine*, (March 2018), 38.

analysis”¹² back to the ABM team is key and the future AAR aircraft could be reconfigured to conduct this transfer. This would be an advantage where there is a contested satellite area of operations.

11. The other significant change would be to the current CRE’s controller’s display. This is because the Future Fighter will be capable of providing both Air and Surface targets. The Future Fighter is expected have sensor technology that includes Electro-Optical and Infrared Targeting System, Ultraviolet Sensing Systems and Active Electronic Scanned Array (AESA) Radar. This allows it to sense targets in most of the electro-magnetic spectrum. The sensor information fused from the Future Fighter will therefore need to be displayed to reflect what is within the bubble as per Figure 3. This means the current CRE scope would require some changes with respect to data processing in order to display an Air and Surface Operating Picture. This quite different from the traditional Recognized Air Picture (RAP). The difference will be that an overlay of ground features will be important to the display because what is sensed by the Future Fighter will be relevant to the Air Battle. That also means that ABM teams would focus on Air and Surface threats.

12. This concept of converting to an ABM team and potential removing the AWACS and CRE is not only discussion from this author, but it is also being discussed in the United States Air Force as they look at the contested environment and how they are going to fight.

¹² Everstine, Brian W, “The F-22 and the F-35 Are Struggling to Talk to Each Other ... And to the Rest of USAF” *Air Force Magazine*, (March 2018), 38.

*The Air Force's Air Superiority 2030 Flight Plan, outlined current and future threats...is conducting an Advanced Battle Management System analysis...include the next generation of networks and radios....adaptable networks for operation in highly contested environments.*¹³

Future Fighter “How to Fight”

13. The major concept change can be solidified with the Future Fighter and its expected high throughput data-link acting as a DNCD. The internal sharing of fused sensor information within the formation will lead to enhanced Situational Awareness (SA) by all members of formation. This Enhanced SA provides enough information for one member of Future Fighter formation to assume TACOM. As mentioned, a member within the formation of the Future Fighter would act as the MMAC. The MMAC would act like a football quarterback who sometimes runs the ball, or throws the ball, or hands off the ball, yet he/she still calls the play on the field. In fighter operations, this would mean the MMAC has TACOM capable of dropping a bomb, shooting a missile, targeting a threat for another fighter, and at the same time directing tasks or gameplans for the formation.

14. The last concept is the change in expectations and capabilities of the Wingman within a Future Fighter formation. The Wingman would be expected to execute the directed gameplans from the MMAC and be capable of self-targeting and employing weapons without further direction.

¹³ Everstine, Brian W, “The F-22 and the F-35 Are Struggling to Talk to Each Other ... And to the Rest of USAF” *Air Force Magazine*, (March 2018), 38.

15. The basis of the Wingman expectations is from the Alberts-Hayes model. This model demonstrates how in a networked command situation one could distribute the decision-making process down and out to the lower echelons of a group. In this case, the Wingman within the Future Fighter formation are the lower echelons. This distribution of decision-making is what Alberts-Hayes called “Power to the Edge”¹⁴. The three dimensions of the model that is based on allocation of decisions rights, patterns of interactions, and distribution of information¹⁵. This means even more tactical decisions could be delegated from higher command to the Future Fighter formation. While executing in a group mentality, the Future Fighter will be more agile and flexible. This group mentality can only occur because of the information sharing data-link within the formation. “Power to the Edge” requires the Airborne command relationship to change to a fully networked environment.

16. Assuming TACOM for the MMAC means additional training. This additional training would focus on airborne decisions, gameplan execution and rules of engagement (ROE). The training would be in the form of working with the newly created ABM team (ie: the off field coach in our analogy) and networked Wingman. Training would have to include going through a series of gameplans against various scenarios (just like a football team running through the different set plays).

¹⁴ Alberts, David S., and Richard E. Hayes. “Power to the Edge: Command and Control in the Information Age.” *Command and Control Research Publication Series (2005)*, 6.

¹⁵ Ibid. 6.

17. The concepts discussed will have significant offsets that will require additional analysis. In order to remain relevant to the reader, and not completing a large multi-dimensional analysis, instead a summarization of the changes to be analysed is addressed:

a. Multi-Mission Airborne Control: There will be four sections that additional analysis would have to examine in order to conduct MMAC:

(1) Rehearsal Training: Larger formation training with 8-10 Future Fighter simulators must be able to linked to ABM team simulators to execute Rehearsal Training at the same time. It is this where MMAC and ABM will be qualified and the consolation of tactics will be confirmed.

(2) Gameplan Development: New development of tactical gameplans against various scenarios would have to developed. In this case, the tactical gameplan would be distributed among the formation and shared with the ABM team.

(3) Mission Command Training: Additional command training for two pilots per formation. It would include insuring orders, rules of war and ROE are formalized in the training. A certification may be required in order to allow the MMAC to have the authorities needed for TACOM.

(4) Mixed Force Training: There will be a need for training that will also allow the concepts of the integration of different generations of aircraft.

b. Power to the Edge Wingman: In order to execute “Power to the Edge Wingman”. there are three sections that would require additional analysis:

(1) Wingman Weapon Employment Training: Additional weapons training in relationship to the specific kinetic effects each weapon could have on the various target sets. This is something that is not currently expected of 1st tour pilots.

(2) Formation Gameplan Training: There would be additional training in the multi aircraft formation using linked simulators. In order to practice live fly training missions, the use of Live Virtual Constructive concepts may be needed to provide significant challenges.

(3) Additional ROE Training: The consequences of given power to the edge is the responsibility of what each wingman actions could inflict on the enemy. There would be need to be addition ROE training to insure the legal responsibilities are understood for each wingman. This would be above and beyond current training.

CONCLUSION

18. The Future Fighter will change the TACON and TACOM of ACW. Traditional AWACS and CRE operations will be replaced by a formation of Future Fighters that will push the COP from its sensors to an ABM team. Future Fighters will assume TACON of their formation and formation leads will require additional training to assume TACOM roles. Wingman will have more executive capabilities based on the “Power to the Edge” concept. The emphasis for ABM teams will include the surface picture, and the

importance of data-link for individual Future Fighters will be paramount. Redundancy through nodes in the network will address the contested environments with potential AAR aircraft providing data offload and relay capabilities when needed. The Future Fighter will improve ACW through technology and changes away from current C2 concepts.

RECOMMENDATION

19. The RCAF should conduct further studies into requirements for Future Fighter data-link and satellite communications capacity. The RCAF should look at the TACON and TACOM considerations that would be delegated from the CRE. The replacement project for the AAR aircraft should consider capabilities to data offload Future Fighter information. Last, the FFCP should evaluate the requirement to have linked simulators between Future Fighter and ABM teams to rehearse Airborne Gameplans.

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