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## OVERVIEW OF PRECISION STRIKE CAPABILITY FOR CP-140 AND C-130J

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## **OVERVIEW OF PRECISION STRIKE CAPABILITY FOR CP-140 OR CC-130J**

### **AIM**

1. The aim of this service paper is to provide an overview of possible options for the addition of a precision strike capability to either the RCAF CP-140 Aurora or CC-130J Hercules airframe. This paper will discuss the operating environment that such a strike capability could be employed in; the capabilities that should be considered for a project; the potential of the CP-140 and/or CC-130J as growth platforms; the new roles and missions these platforms could perform; and the possible barriers that could disrupt the implementation of such a capability. Future areas of investigation should include the study of technical feasibility and engineering impact of installing a PGM capability on these aircraft.

### **INTRODUCTION**

2. This service paper was written in response to the Commander RCAF's list of research topics for 2016, specifically the study of options to place Precision Guided Munitions (PGM) onboard long-range, high-endurance Intelligence, Surveillance, Reconnaissance (ISR) airframes. The use of PGMs in conventional, asymmetric and hybrid warfare has seen a significant rise since Op DESERT STORM in 1991. PGM use is expected to continue to rise in the coming years with focus on airstrikes as the primary delivery method.<sup>1</sup> By leveraging existing technology for targeting and weapons systems and applying lessons learned from our allies, the RCAF has the opportunity to build upon its existing strike capability that is currently resident only within the CF-18 Hornet fleet.

### **DISCUSSION**

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<sup>1</sup> IHS Jane's Aerospace Defence and Security, *Precision Strike – Current Weapons and Future Requirements* (London: IHS Inc, 2016).

## Theory/Assumptions

3. It should be acknowledged immediately that the implementation of an ISR precision strike capability should be expected to take a minimum of 5 years, with a likely 5-10 year window to see delivery or installation. RCAF Shape doctrine states that armed ISR platforms provide advantage and flexibility. “A platform that is both capable of collecting information and acting upon it blurs the lines between intelligence collection (Sense) and operations (Shape), emphasizing the flexibility, versatility, and responsiveness of aerospace power.”<sup>2</sup> The expected use of this platform would be in a permissive or semi-permissive environment only. The assumed survivability of these aircraft in a non-permissive environment, where air superiority or supremacy is not guaranteed, and area defense weapons are present, is assumed to be low.<sup>3</sup> Equipping another fleet with precision strike capability will build upon the RCAF doctrinal tenets of flexibility and versatility.

“Flexibility and versatility are key to the effective employment of aerospace power. Inherently flexible and uniquely versatile, aerospace resources can be quickly and decisively shifted from one objective to another across a broad spectrum at the strategic, operational, or tactical levels of conflict.”<sup>4</sup>

The platform and associated PGM capability should be oriented towards being useful in a near-peer hostile force engagement. To avoid the pit fall of ‘fighting the last war,’ any future capability should be employable in such a campaign. If prepared for a near-peer engagement, a transition to counterinsurgency (COIN), asymmetric or hybrid warfare conflicts would be more easily accomplished than the reverse. The lessons learned in Afghanistan, those of a COIN campaign with a permissive air environment, could be falsely-positive in this respect, where air

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<sup>2</sup> Canada Department of National Defence, *B-GA-403/FP-001 Canadian Forces Aerospace Shape Doctrine* (Trenton, Ont.: Canadian Forces Aerospace Warfare Centre, [2014]).

<sup>3</sup> Dr. Carlo Kopp, Air Power Australia, “UAVs versus manned LRMP platforms,” accessed 01 Feb 2016 <http://www.ausairpower.net/SP/DT-LRMP-vs-RPV-Dec-2010.pdf>

<sup>4</sup> Canada Department of National Defence, *B-GA-400-000/FP-000 Canadian Forces Aerospace Doctrine* (Trenton, ON: Canadian Forces Aerospace Warfare Center, [2010]).

power was able to be concentrated and operate at will without a credible threat from opposition forces.<sup>5</sup>

## **Platforms**

4. The CP-140 Aurora is the only dedicated ISR aircraft in the RCAF. It has grown from being an Anti-Submarine Warfare-centric (ASW) asset into a multi-role ISR platform, operating over land, in the littorals and in open ocean areas. The fleet continues to develop proficiency in the overland role, conducting littoral and overland ISR as well as Strike Coordination and Reconnaissance Coordination (SCAR-C) during Op MOBILE, and is involved in overland operations in Op IMPACT in Iraq. It is in the midst of a mid-life refit which will result in a total fleet of 14 aircraft, each receiving wing and empennage structural upgrades, and avionics upgrades delivered in several blocks. Block 3 is scheduled to be FOC in mid-2019, with Block 4 reaching IOC around the same time period. The aircraft has a 14 hour endurance, enabling long on station periods and a bomb bay that is capable of carrying eight Mk-46 ASW torpedoes. Physically, the bomb bay has the space to carry a similar number of PGMs of similar size, up to approximately 500lbs each, using Mk-46 specifications. Internally stored sonobuoys are only marginally smaller and lighter than some PGM, and are deployed in a similar manner. The aircraft is capable of being fitted with 10 external hard points, but the recent wing upgrade does not currently have hard points installed and the supporting ordnance wiring is unconfirmed to still be in place. The MX-20 Electro-Optic/Infrared (EO/IR) turret is able to image targets from overt and covert profiles, day or night. No laser devices are mounted in the turret. Current statements of life cycle place the CP-140 in service until 2030.

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<sup>5</sup> Paul Doyle, "Canada's Air Force Kinetic Capability for the 21st Century: What is Needed?" (Masters of Defense Studies, Canadian Forces Aerospace Warfare Center), 163.

5. The C-130J Hercules is a new fleet to the RCAF; the last C-130J was delivered in 2012 for a total of 17 airframes. It is currently employed as a transport aircraft with an endurance of 12 hours, and is able to deliver troops and cargo to austere landing strips. Its cargo area represents a configurable area for roll-on/roll-off (RORO) mission equipment that could see it used in a variety of roles; for example, ISR and Aerial Fire Support. The RCAF C-130J does not possess integral weapons storage or any type of imaging or targeting sensor, but the flexibility of the configurable cargo area allows fitment of the required mission equipment. The CANSOFCOM-sponsored SABIR project to equip C-130J with a RORO EO/IR turret and crew console has been shelved at present.

## **CAPABILITIES FOR CONSIDERATION**

### **USMC Harvest HAWK**

6. The US Marine Corps (USMC) has modified several KC-130J tankers as dual-purpose refuelers with ISR/gunship capability by installing the RORO Hercules Airborne Weapons Kit (HAWK). The Harvest HAWK is specifically designed around the C-130J airframe with installation taking approximately 6 months for the wiring fitment, and approximately 8 hours for the roll-on installation.<sup>6</sup> Rough costing via open source defence websites places HAWK purchase cost at approximately USD \$6.2M each, but this value is unconfirmed and any level of service support is unclear.<sup>7</sup> The kit delivers precision strike to a high-endurance platform and provides precision targeting, video downlink, Blue Force Tracker and multiple PGM options. In a USMC report, it cited the long loiter time and pinpoint accuracy of the KC-130J as a key

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<sup>6</sup> Global Security, "Harvest HAWK: Hercules Airborne Weapons Kit," accessed 02 Feb 2016, <http://www.globalsecurity.org/military/systems/aircraft/systems/harvest-hawk.htm>

<sup>7</sup> Flight Global, "US Marines order additional KC-130J Harvest Hawk kits," last modified 17 May 2012, <https://www.flightglobal.com/news/articles/us-marines-order-additional-kc-130j-harvest-hawk-kit-372024/>

enabler in providing effective close air support (CAS) to land operations in Afghanistan.<sup>8</sup> The HAWK kit allows internally stored PGMs to be deployed through a “Derringer Door” in place of a paratroop door, similar to internal sonobuoy launches aboard the CP-140. This allows the aircraft to remain pressurized during weapon drops, decreasing response time to calls for fire support while allowing it to stay higher, increasing effective weapons ranges and allowing greater standoff from targets. Currently the kit replaces a refueling pod with 4 x AGM-114 Hellfire missiles, and internally carries a mix of up to 10 AGM-176A Griffin glide bombs or GBU-44 Viper Strike glide bombs that are manually loaded into the Derringer Door. A 30mm canon is scheduled to be integrated in future updates. The two person crew console is palletized and rolls on for installation allowing quick reconfiguration. The EO/IR targeting sensor turret includes EO/IR sensors, plus laser designation and range finding. This kit represents a proven, ‘plug and play’ hardware solution to the option of arming a C-130J.

### **Choice of Weapons**

7. The selection of available PGMs is broad. To maintain agility across a variety of mission sets, a munition, or set of munitions, should be selected to be multi-purpose, sustainable and interoperable. The purpose of this analysis is not to propose a specific solution, but to identify the characteristics of existing PGM that could satisfy the Comd’s request. The required effects must be determined for the weapons; should it be able to precisely strike and destroy a building, or strike an apartment in that building without destroying the building? It should be capable of day/night operation, and of striking fixed and moving targets. The Griffin and Viper Strike PGMs used in Harvest HAWK are proven to engage fixed and moving targets by employing GPS/INS guidance plus terminal laser guidance. Laser guidance is critical to engaging moving

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<sup>8</sup> United States Marine Corps, "KC-130J Harvest Hawk Operations in Afghanistan," United States Marine Corps Center for Lessons Learned Newsletter 8, no. 11 (2012), 3-4.

targets using existing PGM technology. This capability would permit the prosecution of time sensitive targets (TST) that could be in motion. Laser guidance should be able to be self-designated, 'buddy-designated' by other aircraft, or designated by ground forces. Multiple warhead options could be a desired attribute, allowing different target sets to be serviced by one munition using different warheads. Interoperability should also be considered as new fleets and capabilities are procured. Procuring a PGM that is used across fleets, for example the CP-140, C-130J, JUSTAS and Next Generation Fighter would considerably enhance the Sustain function in the provision of munitions to a deployed Air Task Force (ATF) by reducing the variety of munitions required. At a higher level, interoperability with allies, using the US for example, could gain purchasing, development and upgrade advantages with the defense industry. However, the counterargument to that advantage is that US forces could likely have priority in the delivery of munitions ahead of foreign military sales to Canada. Interoperability of munitions with coalition partners could allow leveraging of their supply lines and have the desired effect of reducing the dependence on provision of supplies directly from Canada, a key lesson identified during Op MOBILE and Op IMPACT.<sup>9</sup> Multiple types of PGM should be considered for high endurance ISR platforms in order to allow flexibility in the delivery of the desired kinetic effect from a single platform. With an appropriately armed CP-140, it could transition between multiple roles; Anti-Submarine Warfare (ASW) attack using Mk-46 torpedoes; Anti-Surface Warfare (ASuW) attack using a Harpoon or similar PGM; Land Attack against hardened structures using a munition similar to GBU-39/53 Small Diameter Bomb (SDB), and finally, engage a mobile TST in a crowded environment using something similar to GBU-44 Viper Strike with a precise, low collateral damage warhead.

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<sup>9</sup> Col. Chuck Mathe, "The Operational Level Sustain Function," (lecture, Canadian Forces College, Toronto, ON, 28 January 2016).



## CP-140 Aurora and C-130J Hercules – Common Requirements

8. Both platforms would greatly benefit from a Signals Intelligence (SIGINT) capability. The inclusion of this capability would enable greater fidelity of information by providing definition and context to the visual image that is presented on EO/IR sensor displays. CANSOFCOM operations would be enhanced by the provision of SIGINT aboard long-range, high-endurance ISR platforms providing more utility and greater integration. Options of fitting aircraft 'for, but not with' would provide supported commanders with greater flexibility depending on mission sets that involve dynamic targeting, as "Accurate and timely intelligence is critical to maximizing the inherent offensive advantages of aerospace power."<sup>10</sup> Furthermore, "During the Finish phase of a Find-Fix-Finish [SOF] direct action mission, manned ISR assets are considered critical to success."<sup>11</sup> RCAF Sense doctrine states, "Surveillance and reconnaissance activities are normally conducted by units that have significant self-protection or stand-off capabilities. They are often assigned to support other combat tasks by providing combat information."<sup>12</sup> Enhanced counter measures would be mandatory if these platforms were to be employed as part of a package in a non-permissive environment that includes hostile air forces or area defense systems like radar-guided surface to air missiles (SAM). The provision of a variety of options of kinetic and non-kinetic aerospace effects to supported commanders is critical.

## EXPANSION OF ROLES

9. If furnished with a PGM strike capability, the CP-140 or C-130J or their manned/unmanned replacements, would be capable of employing kinetic effects across a greater

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<sup>10</sup> Canada, *B-GA 402/FP-001 Shape Doctrine...* 12.

<sup>11</sup> *Ibid.* 97.

<sup>12</sup> CANADA. DEPARTMENT OF NATIONAL DEFENCE, 2012. *B-GA-402/FP-001 Canadian Forces Aerospace Sense Doctrine*. Trenton, Ont.: Canadian Forces Aerospace Warfare Centre.

spectrum of missions. Doctrinally, these would include: support to Special Operations Forces (SOF) by Aerial Fire Support and Armed Overwatch; support to counter-land missions by Air Interdiction, Aerial Fire Support, Close Air Support, Tactical Security, and Direction and Control of Fires.<sup>13</sup> This represents a significant growth from the predominantly overland/overwater ISR role that the CP-140 fills and the tactical transport role that C-130J fills. This growth would also reduce pressure on the CF-18 fleet to provide strike effects, and provide commanders at the joint, air and land component levels with further options for both ISR and kinetic effects.

## **BARRIERS TO DEVELOPMENT**

### **Personnel**

10. Significant frictions from both communities will likely delay the development and implementation of a precision strike capability to either the CP-140 or C-130J. The author contends that a capability is a combination of correctly trained personnel and appropriate hardware. Both fleets would need to source additional personnel trained as FAC or JTAC to either crew the aircraft or establish an appropriate training program to qualify aircrew to employ the weapons system. In this environment of Person Year (PY) 'neutral' establishment changes, availability of correctly trained personnel and positions will be a barrier to establishing IOC of the PGM capability, regardless of fleet.

### **CP-140 Aurora**

11. The CP-140 is in the midst of a phased upgrade that is not set to reach IOC of its final phase, Block 4, until 2019.<sup>14</sup> Inserting a weapons requirement into this process will not be possible until IOC is declared as it will delay the upgrade program at great cost and delay to the

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<sup>13</sup> Canada, *B-GA 402/FP-001 Shape Doctrine...* 54-65.

<sup>14</sup> LCol Fil Bohac, "Aurora Incremental Modernization Project: Block IV," Project Management Office Aurora, Ottawa, 2016.

overall Aurora modernization (AIMP) program.<sup>15</sup> From an airframe standpoint, given enough time, funding and priority, anything is possible; the bomb bay could be configured for PGMs; hard points could be installed and wired; internal drop chutes like the Derringer Door installed; and capabilities like a counter measures , laser designator and SIGINT capability could be added, if the requirement is supported and funding available. Significant flight testing would be required for the external carriage of munitions.<sup>16</sup> The limiting factors (LIMFAC) in this case are PY levels, capital project funding; amount of aircraft engineering required; and political will to develop an armed ISR capability in an aircraft that is slated to be removed from service in 2030. The lifespan of the Aurora may require that the RCAF take the long-term view to integrating a PGM strike capability into the CP-140 replacement. Spending the time, money and engineering to install a weapons suite on the CP-140 may only yield 6-8 years of service life. Conversely, developing this capability now may firmly establish PGM strike capability in the fleet, making its transition to the CP-140 replacement straightforward.

### **C-130J Hercules**

12. The Hercules fleet is new and is not slated for retirement in the near future as the CP-140 is. The major LIMFAC is that Lockheed Martin (LM) is the prime contractor for interim service support (ISS) contract, meaning that any design change or engineering test must be run by LM at cost to the Government of Canada (GOC). "...this is ensure proper transition to their in-service management roll [sic]..."<sup>17</sup> Normally, integral RCAF engineering units like the Aerospace Engineering Test Establishment (AETE) performs such roles for other fleets, but this has been outsourced for the time being to LM, meaning any engineering tests or fitment changes must be

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<sup>15</sup> LCol Fil Bohac, Project Management Office Aurora, email conversation with author, 02 February 2016.

<sup>16</sup> *Ibid.* 1.

<sup>17</sup> Maj Mike Tourond, Aircraft Engineering Officer – C-130J, email conversation with author, 04 February 2016.

coordinated, tested and implemented with LM, at additional cost to GOC. Training of personnel will require significant effort to convert aircrews from a transport-oriented community into crew proficient in ISR, targeting and weapons employment, a skill set that the CP-140 community already has, and is continuing to develop.

## **CONCLUSION**

13. The future operating environment will continue to be dynamic, and the RCAF should be prepared to provide additional kinetic and non-kinetic effects to supported commanders in upcoming campaigns. Development and selection of precision strike capability on high-endurance platforms will provide such agility. PGM should be selected to be interoperable, sustainable and effective across RCAF fleets and potentially within allied fleets. Leveraging the results of existing engineering testing and development – such as the USMC Harvest HAWK – could enable a more rapid technical and operational approval process with RCAF fleets. The establishment of a strike capability within either the CP-140 and/or C-130J fleet will require significant effort to overcome multiple barriers to implementation, including personnel, funding, and the development of political will. However, establishing this capability in the near future will enable an easier transition from precision strike to future airframes within the RCAF; it will also bring depth of kinetic options for future operations, be they against a near-peer adversary or in a hybrid context.

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