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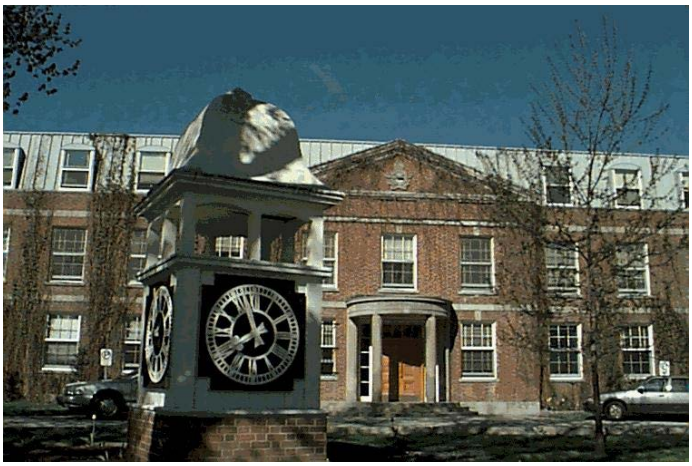

FIXED-WING SAR: SEARCHING FOR A SOLUTION

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JCSP 40

Exercise *Solo Flight*

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INTRODUCTION

A recent Canadian newspaper story outlined the plight of a Calgary woman trapped on an ice floe off Baffin Island. A media brouhaha ensued over the cost of the rescue considering the woman was a wealthy eco-tourist.[1] However, the story also highlighted the classical response of Canada's fixed-wing search and rescue (SAR) assets. The woman was located, resupplied and monitored throughout the rescue by a CC-130H Hercules.[2] Controversy over costs aside, the role and need of a fixed-wing asset to Canadian SAR is meaningful.

The Department of National Defence (DND) assumed responsibility for aeronautical Search and Rescue (SAR) in 1947. It has since become a core component of the Royal Canadian Air Force (RCAF). The idea of responsibility for SAR is pervasive through the RCAF community but also explained in documents such as Canada's First Defence Strategy (CFDS). The CFDS includes SAR as one of the three core roles of the Canadian Armed Forces, Defence of Canada. This translates into no-fail mission for the RCAF. The solution to the task of SAR includes, among other resources, fixed-wing assets that can quickly respond to an aeronautical or humanitarian incident inside the "critical time period"[3] in which lives can be saved.

However, there is currently a problem with SAR in that some of the aircraft used to conduct the vital SAR missions described above are approaching their end of life. For example,

[1] Tristan Hopper, "Calgary woman part of expedition rescued off ice floe for $2.7M now planning snorkel relay through Northwest Passage," *National Post*, 15 April 2014.

[2] Susan Eaton, "How survivors were rescued from an ice floe adrift in the Canadian High arctic," *Calgary Herald*, 11 April 2014.

[3] Department of National Defense, "FWSAR Backgrounder," last accessed 3 May 2014. http://www.tpsgc-pwgsc.gc.ca/app-acq/stamgp-lamsmp/svtvn-rscfw-eng html.

two fixed-wing aircraft used for RCAF SAR are the aforementioned CC-130H Hercules and the CC-115 Buffalo. Respectively, these aircraft fleets are now comprised of thirteen Hercules aircraft ranging in age from thirty to forty-seven years old, and six Buffaloes that are forty-seven as well.[4] The end of life estimate for the Buffaloes is 2015[5] and for the Hercules fleet is 2020. In order to continue conducting SAR, a project to procure a new aircraft began in 2004 to replace the ageing fleets. This is known as the fixed-wing search and rescue (FWSAR) replacement project.

Unfortunately, since 2004, the FWSAR project has, "remained more or less stillborn amidst Government confusion concerning the project's scope, (and) which procurement plan to take…"[6] This has been in part due to the original statement of requirements (SOR) for FWSAR. The SOR was a platform-based document that narrowed airframe possibilities down. It was also never made public thereby negating any possibility of public scrutiny or "testing of the government's analysis and accounting."[7] Due to the constraints put on the project by the SOR and the political environment, FWSAR seemed to be a "wicked" problem. This caused the project to become stalled introducing risk to SAR. The current fleets are becoming less reliable with respect to serviceability and the procurement plan is still in preliminary stages.

This paper will argue that the FWSAR project began as a "wicked" problem but due to changes within the external environment it has a straightforward solution. This is the CC-130J or J-Model Hercules, an airframe already in the RCAF inventory. This thesis will be proved in three parts. First, the way in which the FWSAR project was a seemingly wicked problem will be

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[4] House of Commons. *House of Commons Debates*, 27 May 2010, 1930.

[5] Michael Byers and Stewart Webb, "Search and Replace: The Case for a Made-in-Canada Fixed-Wing Search and Rescue Fleet," *Canadian Centre for Policy Alternatives*, (June 2012): 5.

[6] Jim Dorschner, "FWSAR Plus: A Way Forward," *Canadian Military Journal*, Vol.12, No.4 (Autumn 2012): 58.

[7] Michael Byers and Stewart Webb, "Search and Replace: The Case for a Made-in-Canada Fixed-Wing Search and Rescue Fleet," *Canadian Centre for Policy Alternatives*, (June 2012): 6.

explained. This is based on the constraints of basing, requirements and a misdirected SAR response mandate. Next, the proper method (capability-based) of solution selection will be discussed in the context of procurement. Finally, using the criteria from the SOR in a capability-based manner, the solution of the J-Model will be presented.

WICKED PROBLEM

"Wicked" is a term used to describe a problem that is, "highly resistant to resolution."[8] There is no malevolence implied merely the presence of complexity, differences between stakeholders and, "high levels of disagreement about the nature of a problem and the best way to handle it."[9] The criteria upon which a problem is defined as "wicked" was originated by the mathematician, Horst Rittel. Some attributes of "wicked" problems are: there is no definite formulation of the problem, there are no stopping rules, there are no criteria for correctness, no immediate test of the quality of the solution, there are no well-defined solutions, the problem solver had no right to be wrong and there are no criteria for correctness.[10] As well, solutions to "wicked problems" are not absolute. They are not described as true or false, but good or bad.[11] Rather the appraisal of a solution is described in terms of, "better or worse", "satisfying" or "good enough."[12] With respect to the problem of FWSAR, this describes some of Rittel's further explanations of "wicked" problems. Specifically that a "wicked" problem can be a symptom of another problem, the existence of discrepancies can be explained in numerous ways, "wicked" problems do not have an enumerable (or an exhaustively describable) set of potential solutions,

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[8] Sam Bateman, "Solving the "Wicked Problems" of Maritime Security: Are Regional Forums up to the Task?," *Contemporary Southeast Asia*, Vol. 33, No. 1 (2011): 2.

[9] *Ibid*.

[10] Andrejs Skaburskis, "The Origin of "Wicked Problems"," *Planning Theory & Practice*, Vol. 9, No. 2 (June 2008): 278.

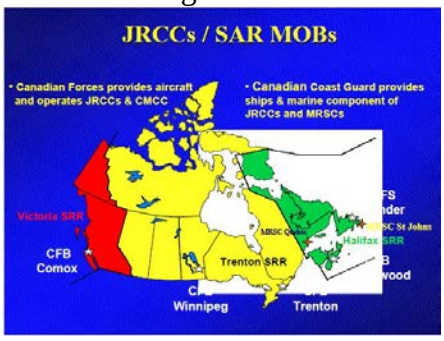
[11] Horst Rittel and Melvin Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences*, Vol. 4 (1973): 162.

[12] *Ibid*., 163.

nor is there a well-described set of permissible operations that may be incorporated into the plan."[13] These attributes will be explained in the context of basing of SAR assets, requirements of the FWSAR replacement aircraft and a SAR mandate that is focused on response vice arrival to a search area.

First, the primary iterations of the SOR kept SAR assets in the four main air bases of SAR operations. These bases are located in the Southern part of Canada namely: Comox, BC, Winnipeg, MB, Trenton, ON and Greenwood, NS. The prescribed SAR region (SRR) for each base is described in the National SAR Manual (NSM): Victoria SRR for Comox, Trenton SRR for Winnipeg and Trenton, and the Halifax SRR for Greenwood. Figure 1 pictorially describes the areas of responsibility for each base. Keeping status quo basing was a constraint introduced into the FWSAR project.

Figure 1.[14]



The SOR described this constraint. For example, as one if its assumptions it stated that the, "current four FWSAR MOBs (main operating base) will continue operation."[15] The reasoning was that the precursor to the CFDS, Defence Plan 2003, used SAR statistics based on

[13] Horst Rittel and Melvin Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences*, Vol. 4 (1973): 164.

[14] Department of National Defence, *Evaluation of the CF/DND Component of the National Search and Rescue Program* (Ottawa: Chief of Review Services, 2008), 7/15.

[15] Department of National Defence, *Statement of Operational Requirement Version 4.1*(Ottawa: VCDS, 2006), A-11.

historical SAR incident data. Since the data supported keeping bases in situ, there was no reason to consider otherwise. The SOR explains the current number of operating bases is sufficient due to, "their relative proximity to the majority of SAR incidents according to the stated level of service and based on statistical analysis." In addition, it argues in the context of loiter time, "Given the current location of FWSAR main operating bases, and using historical SAR activity as a basis, sufficient time on-station would be available for the majority of SAR cases."[16] This basing constraint satisfies one of the attributes of "wicked" problems.

The constraint illustrates a "symptom of another problem."[17] For example, the National Research Council (NRC) was commissioned to examine the FWSAR SOR and found the analysis lacking with respect to SAR basing. The NRC report explained that the reason for not considering other SAR asset locations was using an outdated document, namely the Defence Plan 2003. As alluded to before, this document was superseded by the CFDS. The problem is that in the time between release of the SOR and consideration of procurement, the government's focus changed.

In the CFDS, operations in the North are a priority. The section that explains SAR is part of "Defending Canada – Delivering Excellence."[18] This portion explains how the Arctic is an area of focus and that the Canadian Forces needs to have the ability to respond, "quickly and effectively."[19] The NRC report uses this new direction in its analysis of the SOR. It explains that, "there are virtually no forecasts based on changing trends such as increased trans-polar

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[16] Department of National Defence, *Statement of Operational Requirement Version 4.1*(Ottawa: VCDS, 2006), A-21.

[17] Horst Rittel and Melvin Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences*, Vol. 4 (1973): 164.

[18] Department of National Defence, *Canada First Defence Strategy* (Ottawa: MND, 2008), 7.

[19] *Ibid.*

airline traffic, arctic shipping, northern mining activity, or generally increased human presence in the north."[20] Therefore, the SOR did not take into account the problem of changing government focus. The SAR basing symptom revealed a problem that changing government priorities over time made initial analyses incorrect.

The requirements of the FWSAR also attributed to the "wicked" problem. The SOR determined a number of aircraft required to continue SAR. However, there are discrepancies amongst governmental documents that can be explained in various ways. To begin, the SOR contends that 15 FWSAR aircraft are required. This is based on providing, "24/7 primary SAR response at each of the basing locations,"[21] serviceability rates, number of airplanes required to generate new aircrews and requirements for third-line maintenance. Specifically, the number of twelve airplanes is derived from the necessity of three aircraft per operating base established by, "years of operational SAR experience in the Canadian Forces, and through an analysis of other users maintaining a 24/7 unit commitment."[22] Two more aircraft are necessary to, "provide the force generation requirements of the FWSAR operational units."[23] Finally, to sum the total to 15, one more aircraft is mandatory to augment any operating base that loses an airplane due to third-line maintenance.[24]

An indirect governmental response to the SOR came in the form of the CFDS. Amongst the directions in that 2008 document is the affirmation to procure the FWSAR aircraft. The

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[20] National Research Council Canada, *Review of the Statement of Operational Requirement for the Fixed Wing Search and Rescue Aircraft – Final Report* (Ottawa: NRC, 2010), 11.

[21] Department of National Defence, *Statement of Operational Requirement Version 4.1*(Ottawa: VCDS, 2006), B-3.

[22] *Ibid*., B-4.

[23] *Ibid.*

[24] *Ibid*., B-5.

CFDS explains that the government will acquire, "17 fixed-wing search and rescue aircraft"[25] in order to, "Maintain search and rescue response capabilities that are able to reach those in distress anywhere in Canada on a 24/7 basis."[26] However, the document gives no real reason for the difference from the 15 airframes depicted in the SOR.

In addition, a 2009 audit of the FWSAR program by Chief Review Services Canada (CRS) advised a different fleet size as well but gave reasons. The CRS audit posits that the number of aircraft needed to enact third line maintenance while continuing operations is greater than the SOR dictates. The reasoning is based on a comparison of four other CF fleets (CC-17, CC-130J, CP-140, CC-115). The observation is that, "the percentage of aircraft in repair and overhaul (R&O) (is) low relative to the other fleets."[27] Specifically, the SOR requested one aircraft for R&O, this was found to be, "5 to 10 percent lower than the number of aircraft in R&O from the four other fleets."[28] This report does not suggest a better number for FWSAR fleet size; it merely contends the SOR's projection is too small.

Fleet size is discussed as well in the fore mentioned NRC report. Its determination is that there is confusion with respect to the number of aircraft required. It cites both the SOR and CFDS numbers but also brings in values from an Air Force Readiness analysis. This study concluded, "that a minimum of 19 aircraft are required to maintain crew proficiency without exceeding the planned yearly flying rate (YFR) per aircraft while maintaining the status quo standby posture."[29] The NRC report goes on to recommend that fleet size should be determined

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[25] Department of National Defence, *Canada First Defence Strategy* (Ottawa: MND, 2008), 4.
[26] Department of National Defence, *Canada First Defence Strategy* (Ottawa: MND, 2008), 7.
[27] Department of National Defence, *Audit of the Fixed Wing Search and Rescue (FWSAR) Project* (Ottawa: Chief of Review Services, 2009), 7/13.
[28] *Ibid.*
[29] National Research Council Canada, *Review of the Statement of Operational Requirement for the Fixed Wing Search and Rescue Aircraft – Final Report* (Ottawa: NRC, 2010), 37.

using a, "statistically valid method"[30] and that this number be incorporated into future versions of the SOR but the, "specified minimum number of aircraft (fifteen) is not adequately supported."[31]

Overall, the number of aircraft for the FWSAR fleet determined by operational, governmental and third-party reports shows a difference in the total. Whether the number is 15, 17 or 19, the discrepancies were all explained in various manners. Maintenance, R&O and YFR were described in the various reports to arrive at the different totals. This discrepancy explained in numerous ways is another factor leading FWSAR into a "wicked" problem.

The SAR mandate is another element that contributed to the confusion of the FWSAR project. As described in the evaluation of the Canadian SAR system, there is no operational level doctrine for SAR in Canada. The NSM is the interim document giving RCAF crews direction on response. The only requirement stipulated in the NSM is, "efficient operation of the aeronautical …components of the SAR system,"[32] and, "the normal state of readiness for a ramp or strip alert will be one dedicated SAR aircraft and crew capable of becoming airborne within 30 minutes."[33] Both the SOR and NRC make mention of a Chief of the Air Staff letter to the National SAR Secretariat. This letter is an affirmation that a SAR asset will be at a point ready to commence searching, "for any aeronautical or maritime SAR incident occurring in a Canadian Search and Rescue Region within 4.0 hours of being tasked for 90% of SAR incidents and within 11 hours of being tasked for 100% of SAR incidents."[34] However, this level of service

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[30] *Ibid.*

[31] National Research Council Canada, *Review of the Statement of Operational Requirement for the Fixed Wing Search and Rescue Aircraft – Final Report* (Ottawa: NRC, 2010), 2.

[32] Department of National Defence, B-GA-209-001/FP-001, *National Search and Rescue Manual* (Ottawa, ON: Department of National Defence, 2000), Ch 1 pg 7.

[33] *Ibid*., Ch 4 pg 17

[34] Department of National Defence, Canadian Forces Search and Rescue Level of Service and Roles and

commitment has not been formalized. The way in which this affected FWSAR was that there was no accepted standard to which a capability could be aligned. In "wicked" problems terms, there was no well described set of permissible operations. For example, the SOR makes the aforementioned references to cruise speed and range. This is based on the level of service commitment. However, the only hard requirement is the direction from the NSM in that an aircraft and crew must be airborne in 30 minutes. The NRC report criticizes the SOR based on these speeds and range calculations determining that, "performance requirements of range and response time in the SOR are not supported by the analysis used to derive them."[35] The proper or acceptable procedures used to determine these criteria were not given to the SOR authors in the beginning but the ones they used were not permissible.

The final factor in this discussion of FWSAR as a "wicked" problem is the way in which the proposed solution was merely, "good enough."[36] The NRC report accentuates the factors well. First, one of the assumptions of the SOR is that the chosen FWSAR aircraft will, "be at least equivalent to the current capability."[37] However, in some of the SOR's descriptive scenarios used to draw out requirements, the proposed solution is not, in fact, commensurate. For example, one scenario describes the need to reach the furthest area of the SAR region, the North Pole. This would be a task given to the CC-130H. The speed suggested as a requirement, 273 knots[38], is approximately 30 knots slower than the CC-130H can accomplish[39]. In addition,

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Responsibilities, letter from Chief of Air Staff to the National Search and Rescue Secretariat (Ottawa: CAS, 2002).

[35] National Research Council Canada, *Review of the Statement of Operational Requirement for the Fixed Wing Search and Rescue Aircraft – Final Report* (Ottawa: NRC, 2010), 2.

[36] Horst Rittel and Melvin Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences*, Vol. 4 (1973), 163.

[37] Department of National Defence, *Statement of Operational Requirement Version 4.1*(Ottawa: VCDS, 2006), A-9.

[38] *Ibid*., A-26.

[39] http://www rcaf-arc.forces.gc.ca/en/aircraft-current/cc-130.page, last accessed 3 May 2014.

the SOR's scenarios discuss unrefueled range. The range proposed by the SOR (1699nm)[40] is less than the CC-130 again. Overall, "the un-refuelled range and speed capabilities of the CC-130 are far in excess of that proposed under the new FWSAR SOR.[41] Next, the current CC-130H aircraft can work in icing conditions. This capacity is demarcated in the SOR as merely a tier one requirement vice a mandatory one. This means that a solution proposed could exclude this ability. Therefore, the solution proposed by the SOR could be an aircraft that is not as capable as the current fleet conducting SAR. It would be a result that does not solve the problem ideally but does a "good enough"[42] job of equivalency.

The culmination of all these factors (SAR bases highlighting other problems, discrepancies in FWSAR fleet size, no clear set of permissible ways in which to determine FWSAR response) turned the FWSAR project into a seemingly "wicked" problem. The manifestations of which took many forms. First, after the SOR was released there were recommendations made by the RCAF to sole-source purchase a particular airframe, the C-27J Spartan. This is a two-engine aircraft that fit the requirements of the SOR. The push to purchase the C-27J caused other governmental departments, industry and the public to believe that the SOR could produce only one option. Some argue that, "the Air Force had so favored the purchase of C-27J Spartans that the SOR was specifically written to exclude all but that

[40] Department of National Defence, *Statement of Operational Requirement Version 4.1*(Ottawa: VCDS, 2006), E-1.

[41] National Research Council Canada, *Review of the Statement of Operational Requirement for the Fixed Wing Search and Rescue Aircraft – Final Report* (Ottawa: NRC, 2010), 17.

[42] Horst Rittel and Melvin Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences*, Vol. 4 (1973), 163.

aircraft."[43] With the ensuing political fall-out in 2006, "the FWSAR Project was officially put on hold and the Project Office was dissolved."[44]

The 2008 CFDS' commitment to purchasing FWSAR platforms brought the project back but there were subsequent changes. The scrutiny given to the first drafts of the SOR generated the need for an assessment of the way the SOR was written. This took the form of the aforementioned NRC report of 2010. The effect of this report was that the requirements for the FWSAR aircraft became broader. This allowed more contenders to vie for the possibility to fulfill the contract. However, with these broad criteria, the wicked problem is exacerbated. There is still no clear direction on FWSAR basing, size of fleet or response. The result is that industry, instead of SAR operators, can suggest where bases should be, if alternative service delivery is an option or even if mixed fleets will suffice.[45] In summary, the answer to FWSAR seems a "wicked" problem because the myriad criteria used can determine a solution that will be only, "good enough."[46]

PROCUREMENT

The question then follows as to the proper course ahead. The solution lies with putting forth the proper set of capabilities for consideration rather than working towards a particular platform. The full results of the NRC report were incorporated into DND and the Canadian Armed Forces (CAF) in light of a different procurement strategy. DND's response was that, "the

[43] Peter Pigott, "The Sorry Saga of FWSAR," *Frontline Defence*, Vol.2 (2013), 1.
[44] *Ibid*., 3.
[45] Murray Brewster, "Replacement for 50-year-old air force search planes postponed another year," *The Canadian Press*, 8 March 2012.
[46] Horst Rittel and Melvin Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences*, Vol. 4 (1973), 163.

Air Force is revising the SOR in support of the procurement of a new FWSAR aircraft."[47] Capability-based planning manifested from a desire to make defence acquisitions less, "reactive."[48] It strives to be a, "more proactive… rational forward-looking decision-making process."[49] It begins with a force development process that takes "government strategic guidance as its input and as its output generates employable force elements for the CF operational commands."[50] This force development process includes capability based planning in its linear progression.

Capability-based planning is divided into two subsections. First, a "future security analysis"[51] creates an evaluation upon which force planning occurs. This planning takes the form of scenarios that determine the capabilities required. These scenarios are then utilized in the second step, "capability planning, management and integration."[52] Capability planning provides structure to the force scenarios. It evaluates capability elements in order to find, "measures of capability."[53] These measures of capability "quantify and qualify the role of the element within the scenario."[54] Capability management then determines how the CAF will fulfill these scenarios with its capabilities. What results is a, "high-level view of the potential of

[47] Department of National Defense, "The Department of National Defence's response to the National Research Council Report: "Review of the Statement of Operational Requirements for FWSAR Aircraft"," last accessed 3 May 2014. http://www.forces.gc.ca/en/about-reports-pubs/response-fwsar-report-2010.page.

[48] Department of National Defense, *An Overview of the Canadian Forces'Second Generation Capability-Based Planning Analytical Process* (Ottawa: Defence R&D Canada, 2010), i.

[49] *Ibid*.

[50] Department of National Defense, *An Overview of the Canadian Forces'Second Generation Capability-Based Planning Analytical Process* (Ottawa: Defence R&D Canada, 2010), 4.

[51] *Ibid*.

[52] *Ibid*., 5.

[53] *Ibid*.

[54] *Ibid*.

the existing and programmed operational force elements to achieve individual scenario capability framework element requirements over time.[55]

Force elements are determined or identified as shortfalls through the next step, capability integration. It is here that they fit into one of the key outputs of the force development process, the investment plan. It is through integration that alternatives to address any insufficiencies are determined. This is an analysis that understands deficiencies and finds the ways to address them. The investment plan is one alternative. If investment is to be the course of action, a capability-based SOR will be generated to start procurement. This SOR will then be given to stakeholders such as the Department of Public Works and Government Services Canada (PWGSC) and Industry Canada in order to ensure transparency and have a defendable position.

FWSAR took a platform-based approach and the results were, "claims (that) the Department of National Defense (DND) was limiting competition and the potential for Canadian industrial participation."[56] A capability-based SOR ensures that economic benefit to Canada is properly analyzed. Whether PWGSC awards the contract to a Canadian company or Industry Canada determines Canadian industrial participation, a competitive and open process is assured.[57]

SOLUTION

The discourse so far has shown that the FWSAR project has the attributes of a "wicked" problem in that the criteria for choosing the airframe have discrepancy. The result has been that, "the procurement of Fixed Wing Search and Rescue (FWSAR) aircraft has waxed and waned for

[55] *Ibid.*
[56] http://aviationweek.com/awin/canada-tries-again-fixed-wing-sar-aircraft, last accessed 3 May 2014
[57] J.C. Stone, "A Separate Defence Procurement Agency: Will It Actually Make a Difference," *Strategic Studies Working Group Papers, Canadian Defence and Foreign Affairs Institute*, (2012): 9.

over a decade."[58] Part of the reason for this lengthy process has been the original SOR and its platform-based nature and the contested RCAF choice of the C-27J Spartan. The discussion then offered the new method of capability-based planning and involvement of stakeholders to ensure equitable competition and economic benefit for Canada.

Many solutions have been proposed. For example, a mixed fleet consisting of a smaller aircraft to take the current role of the Buffalo combined with a larger aircraft to replace the CC-130's role. Most of the solutions look to mirror the current paradigm of "low and slow"[59] for a Buffalo replacement (an airframe capable of working in the Rocky Mountains) and "range and speed"[60] for the CC-130 (an airframe capable of reaching the furthest areas of Canada's SRR quickly and being able to stay on-station to search). A re-examination of this construct is necessary.

In revisiting capability management, the idea of examining *existing* force elements is found. Currently the RCAF has in its inventory for SAR an array of airframes. Two of these can aid in the discussion of FWSAR. One is the CH-149 Cormorant. The capability required for a FWSAR aircraft in the "low and slow" context should be addressed from the point of view of its role in an actual search. The Buffalo was introduced in a time where rotary-wing aircraft were not as capable as they are today, certainly not as capable as the Cormorant. The Buffalo was used for searching in the "low and slow" missions. Now, since the CH-149 can transit at 150 knots, has a range of 550 nautical miles, and can fly in known icing conditions[61], this rotary-wing asset can take on "low and slow" capability. Helicopters are preferred for searching in the

[58] Peter Pigott, "The Sorry Saga of FWSAR," *Frontline Defence*, Vol.2 (2013), 1.
[59] Michael Byers and Stewart Webb, "Search and Replace: The Case for a Made-in-Canada Fixed-Wing Search and Rescue Fleet," *Canadian Centre for Policy Alternatives*, (June 2012): 5.
[60] Michael Byers and Stewart Webb, "Search and Replace: The Case for a Made-in-Canada Fixed-Wing Search and Rescue Fleet," *Canadian Centre for Policy Alternatives*, (June 2012): 5.
[61] http://www rcaf-arc.forces.gc.ca/en/aircraft-current/ch-149.page, last accessed 3 May 2014.

mountains due to the ability of slower search speeds and maneuverability.[62] The capability required of a FWSAR asset is in the initial stages of a search where a "co-operating target"[63] (search target with ability to signal) is sought. This searching is generally done at 1500 feet.[64] Current CC-130H fleets are already capable of this type of search.[65] Therefore, the capability for "low and slow" is an existing capability found in the CH-149 and not required for FWSAR.

The question then remains, "what are the capabilities required of FWSAR"? Utilizing the newest SOR, the capabilities required are: capability to respond to SAR incidents anywhere within the Canadian SAR area of responsibility; provide assistance through aerial delivery; conduct electronic and visual searches incorporating multi-spectral sensors; carry, load and unload palletized SAR equipment; operate in all weather conditions, day or night; and meet mission-ready requirements and force generate crews in existing SAR main operating bases.[66]

An *existing* force element in the RCAF fulfills these roles. The CC-130J is a transport aircraft utilized primarily for tactical airlift. Seventeen of these aircraft are currently in the RCAF inventory. Its primary purpose was fulfilling the tactical airlift needs in expeditionary theatres of operation like Afghanistan. However, as, "Canada's military mission in Afghanistan winds down and the country faces several years of fiscal austerity,[67] the tactical aircraft can provide a capability to the SAR community. Therefore, much like the older CC-130H, it is an answer to the FWSAR problem. First, the CC-130J has the capability to respond to SAR

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[62] Department of National Defense, *Searchmaster Handbook* (Ottawa: 1 Canadian Air Division, 2002), 87.

[63] Department of National Defence, B-GA-209-001/FP-001, *National Search and Rescue Manual* (Ottawa, ON: Department of National Defence, 2000), 6-14.

[64] Department of National Defence, SMM 60-2605-CC130 (SAR), *Standard Manoeuvre Manual CC130(E/H) Search and Rescue Operations* (Ottawa, ON: 1 Canadian Air Division, 2010), 5-2.

[65] *Ibid*., 6-1-1

[66] Department of National Defence, *Statement of Operational Requirement Version 6.0* (Ottawa: VCDS, 2010), 4.

[67] Peter Jones and Phillipe Lagasse, "Rhetoric vs. Reality: Canadian Defence Planning in a Time of Austerity," *Defence and Security Analysis*, Vol. 28, No. 2, (June 2012): 140.

incidents anywhere in the SAR region. Much like the CC-130H, it has extended range even when laden with SAR equipment. Its cruise speed is over 300 knots, has longer range than H models, and it can carry the palletized SAR equipment.[68]

The J-Model also is capable of flying in all-weather conditions, day or night evinced by its work in its primary tactical role.[69] It is also has the same characteristics of the H-Model in that it can be mission ready within SAR parameters. The J-Model also is able to provide assistance with aerial delivery. Again, like the H-Model, this aircraft has a ramp from which to dispatch either SAR equipment or SAR technicians. In addition, it also has an established force generation model in place for aircrew. This force generation capability exists at 8 Wing Trenton with the requisite number of aircraft to ensure all SAR bases have the required number of aircraft.

The only capability lacking in the J-Model is incorporating multiple sensors into its array. Already the J-Model adheres to the old SOR principle of providing an equivalent capability. The aspect of potential electro-optical (EO) sensors is a definite improvement demanded of the new SOR. However, this does not have to be a setback. In looking at other problems of this nature, an RCAF solution already exists. The MX-15 is an EO sensor that was affixed to the CH146 Griffon in Afghanistan. This equipment was an aftermarket add-on that was an, "ISR configuration consist(ing) of cabin-mounted sensor controls, map and imagery displays, a cockpit-mounted multifunctional digital moving map display and a data link."[70] It also

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[68] http://www rcaf-arc.forces.gc.ca/en/aircraft-current/ch-149.page, last accessed 3 May 2014.
[69] http://www.lockheedmartin.com/us/products/c130.html, last accessed 3 May 2014.
[70] Proquest Military Collection, "Canada to outfit helos for ISR, escort missions," last accessed 3 May 2014. http://search.proquest.com/docview/220576994?accountid=9867

"included a "high-powered camera and full-motion video downlink capability."[71] The sensors were, "configured for easy installation and removal, and the modification of existing Griffon avionics (was) not required."[72] The system was in all accounts a great success and proved to be a "game changer"[73] in the Griffon's mission in Afghanistan. This type of capability could be applied to domestic missions as well as, "an extra monitoring platform for border incursions or as an aid to civil powers, SAR, or police forces."[74] PWGSC has the precedent in this strap-on EO platform from the Griffon. A similar type of project would easily allow the J-Model to perform the EO function for SAR.

Some would argue that offering the CC-130J as a solution to FWSAR is an oversimplification and that the CC-130J is a capability that should be, "devoted to the most demanding international operations.[75] Many issues such as operating cost, single fleet maintenance savings, airworthiness, force generation, aircrew preferred manning levels, effects to existing contracts, reduction in tactical airlift capabilities, etc. are beyond the scope of this paper yet are important to the overall decision. However, "truly complex issues need a different approach, described as emergent practice."[76] This emergent practice would need to translate into an emergent strategy. Emergent strategy is one that arises, "despite, or in the absence of,

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[71] Department of National Defence, *Project Laminar Strike- Canada's Air Force: Post OP ATHENA* (Ottawa: CFAWC, 2011), 18.

[72] Proquest Military Collection, "Canada to outfit helos for ISR, escort missions," last accessed 3 May 2014. http://search.proquest.com/docview/220576994?accountid=9867

[73] Department of National Defence, *Project Laminar Strike- Canada's Air Force: Post OP ATHENA* (Ottawa: CFAWC, 2011), 18.

[74] *Ibid*.

[75] Peter Jones and Phillipe Lagasse, "Rhetoric vs. Reality: Canadian Defence Planning in a Time of Austerity," *Defence and Security Analysis*, Vol. 28, No. 2, (June 2012): 141.

[76] Julie McLeod and Sue Childs, "A Strategic Approach to Making Sense of the "Wicked" Problem of ERM," *Records Management Journal*, Vol. 23, No. 2, (2013): 106.

intentions."[77] Henry Mintzberg, a management academic, describes one environment in which emergent strategy is necessary. This is a situation where, "environment dictates patterns in actions either through direct imposition or through implicitly pre-empting or bounding organizational choice."[78] The FWSAR issue has these attributes. The RCAF would maximize capability yet the Government will put controls in place to further political goals.[79] Therefore, utilizing capability based planning with an emergent theme, leaders need to, "expect the unexpected and …imagine a future very different from the current state."[80] This different future requires emergent strategy: finding solutions outside of the current construct. This would include making, "difficult choices as to which expeditionary capabilities to maintain…"[81] Perhaps finding ways of keeping the tactical role in SAR squadrons is the emergent strategy required. Further study on possible emergent strategy is conceded.

CONCLUSION

Much like the news story covering the rescue of the Calgary eco-tourist, the FWSAR issue has its share of controversy. The ways in which the project has evolved, or not evolved, is a subject of scrutiny by both military and civilian organizations alike. The preceding discourse was centered on this very topic. Scrutiny of the project could lead one to postulate that the problem is too complex and a solution is difficult. This is the basis of a "wicked" problem.

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[77] Henry Mintzberg and James Walters, "Of Strategies, Deliberate and Emergent: Summary," *Strategic Management Journal (pre-1986)*, Vol.6, No.3, (July-September 1985): 257.

[78] *Ibid*.

[79] J.C. Stone, "A Separate Defence Procurement Agency: Will It Actually Make a Difference," *Strategic Studies Working Group Papers, Canadian Defence and Foreign Affairs Institute*, (2012): 9.

[80] Natalie Webb, Anke Richter and Donald Bonsper, "Linking Defense Planning and Resource Decisions: A Return to Systems Thinking," *Defence & Security Analysis*, Vol.26, No.4, (December 2010): 387.

[81] Peter Jones and Phillipe Lagasse, "Rhetoric vs. Reality: Canadian Defence Planning in a Time of Austerity," *Defence and Security Analysis*, Vol. 28, No. 2, (June 2012): 141.

The FWSAR project indeed has many of the attributes of a “wicked” problem. The discussion showed how the project showed symptoms of another problem, had discrepancies that were explained in myriad ways, and had no set of approved operations for its planning. This was illustrated through the areas of SAR asset bases, requirements of the FWSAR aircraft and the overall SAR mandate. Overall, the project was leading into a realm in which the solution was to be only “good enough” since any option did not seem to entirely meet the SOR or the SOR is so broad that some third order effects that may come with industry suggestions have not been fully considered.

The discourse then described elements of procurement to explain how a particular course of action could be realized. Specifically, this is the capability-based planning of the CAF force development process. This is a method by which answers to procurement problems are found through analysis of capabilities rather than platforms. This process ensures transparency amongst all governmental players in the procurement cycle. This practice also relies on identifying existing capabilities. This was the crux of the final section.

An existing capability within the RCAF is the CC-130J. With the drawdown from Afghanistan, these 17 airframes can be diverted from their primary tactical airlift role. They fulfill the SOR from both the platform-based and capability-based aspects. The dialogue first explained how the “low and slow” paradigm currently filled by the Buffalo is now accomplished by helicopter and should not be attributed to FWSAR. Next, an explanation of the abilities of the CC-130J showed how it can fulfill the role demanded of a FWSAR platform. In summary, the essay showed how the FWSAR seemed a “wicked” problem, provided the proper course of action and described a solution that is not merely “good enough”.

Cuts to the CAF budget has been postulated to result in delays to procurement.[82] Over the coming years there could be significant tension as to what procurement project gets priority. By utilizing an existing capability in the CC-130J, the RCAF can have continue to perform the no-fail mission of SAR while leveraging its abilities in capability-based planning in other procurement processes. This will ensure that a reliable aircraft is available to aid in the search and rescue of not only the eco-tourists of today but of the potential burgeoning Northern populations of tomorrow.

[82] http://www.cbc.ca/news/politics/budget-2014-military-wings-clipped-again-1.2532827, last accessed 3 May 2014.

Bibliography

Aviation Week. “Canada Tries Fixed Wing SAR Again” Last accessed 3 May 2014. http://aviationweek.com/awin/canada-tries-again-fixed-wing-sar-aircraft.

Bateman, Sam. “Solving the “Wicked Problems” of Maritime Security: Are Regional Forums up to the Task?,” *Contemporary Southeast Asia* Vol.33, No.1 (2011): 1-28.

Brewster, Murray. “Replacement for 50-year-old air force search planes postponed another year.” *The Canadian Press*, 8 March 2012.

Byers, Michael, and Stewart Webb. “Search and Replace: The Case for a Made-in-Canada Fixed-Wing Search and Rescue Fleet,” *Canadian Centre for Policy Alternatives* (June 2012): 1-39.

Canada. Department of National Defence. *An Overview of the Canadian Forces’Second Generation Capability-Based Planning Analytical Process.* Ottawa: Defence R&D Canada, 2010.

Canada. Department of National Defence. *Audit of the Fixed Wing Search and Rescue (FWSAR) Project.* Ottawa: Chief of Review Services, 2009.

Canada. Department of National Defence. *Canada First Defence Strategy*. Ottawa: MND, 2008.

Canada. Department of National Defence. *Canadian Forces Search and Rescue Level of Service and Roles and Responsibilities, letter from Chief of Air Staff to the National Search and Rescue Secretariat.* Ottawa: Chief of the Air Staff, 2002.

Canada. Department of National Defence. *Evaluation of the CF/DND Component of the National Search and Rescue Program.* Ottawa: Chief of Review Services, 2008.

Canada. Department of National Defense, “FWSAR Backgrounder,” last accessed 3 May 2014. http://www.tpsgc-pwgsc.gc.ca/app-acq/stamgp-lamsmp/svtvn-rscfw-eng.html.

Canada. Department of National Defence. *Project Laminar Strike- Canada’s Air Force: Post OP ATHENA.* Ottawa, ON: CFAWC, 2011.

Canada. Department of National Defence. B-GA-209-001/FP-001, *National Search and Rescue Manual.* Ottawa, ON: Department of National Defence, 2000.

Canada. Department of National Defence. “RCAF Aircraft” Last accessed 3 May 2014. http://www.rcaf-arc.forces.gc.ca/en/aircraft-current/cc-130.page.

Canada. Department of National Defence. *Searchmaster Handbook.* Ottawa, ON: 1 Canadian Air Division, 2002.

Canada. Department of National Defence. SMM 60-2605-CC130 (SAR), *Standard Manoeuvre Manual CC130(E/H) Search and Rescue Operations.* Ottawa, ON: 1 Canadian Air Division, 2010.

Canada. Department of National Defence. *Statement of Operational Requirement Version 4.1*. Ottawa: VCDS, 2006.

Canada. Department of National Defence. *Statement of Operational Requirement Version 6.0.* Ottawa: VCDS, 2006.

Canada. Department of National Defence. “The Department of National Defence's response to the National Research Council Report: “Review of the Statement of Operational Requirements for FWSAR Aircraft” Last accessed 3 May 2014. http://www.forces.gc.ca/en/about-reports-pubs/response-fwsar-report-2010.page.

Canada. House of Commons. *House of Commons Debates*, 27 May 2010, 1930.

Canada. National Research Council Canada. *Review of the Statement of Operational Requirement for the Fixed Wing Search and Rescue Aircraft – Final Report.* Ottawa: NRC, 2010.

CBC News. “Budget 2014, Military Wings Clipped Again” Last accessed 3 May 2014. http://www.cbc.ca/news/politics/budget-2014-military-wings-clipped-again-1.2532827.

Dorschner, Jim. “FWSAR Plus: A Way Forward,” *Canadian Military Journal* Vol.12, No.4 (Autumn 2012): 58-64.

Eaton, Susan. “How survivors were rescued from an ice floe adrift in the Canadian High arctic.” *Calgary Herald*, 11 April 2014.

Hopper, Tristan. “Calgary woman part of expedition rescued off ice floe for $2.7M now planning snorkel relay through Northwest Passage.” *National Post*, 15 April 2014.

Jones, Peter, and Phillipe Lagasse. “Rhetoric vs. Reality: Canadian Defence Planning in a Time of Austerity,” *Defence and Security Analysis* Vol. 28, No. 2, (June 2012): 140-151.

Lockheed Martin. “J-Model Hercules” Last accessed 3 May 2014. http://www.lockheedmartin.com/us/products/c130.html.

McLeod, Julie and Sue Childs. "A Strategic Approach to Making Sense of the "Wicked" Problem of ERM," *Records Management Journal* Vol. 23, No. 2, (2013): 104-135.

Mintzberg, Henry and James Walters. "Of Strategies, Deliberate and Emergent: Summary," *Strategic Management Journal (pre-1986)* Vol.6, No.3, (July-September 1985): 257-272.

Pigott, Peter. "The Sorry Saga of FWSAR," *Frontline Defence* Vol.2, (2013): 1-3.

Proquest Military Collection. "Canada to outfit helos for ISR, escort missions" Last accessed 3 May 2014. http://search.proquest.com/docview/220576994?accountid=9867.

Rittel, Horst and Melvin Webber. "Dilemmas in a General Theory of Planning," *Policy Sciences* Vol.4, (1973): 155-169.

Skaburskis, Andrejs. "The Origin of "Wicked Problems," *Planning Theory & Practice* Vol.9, No.2 (June 2008): 277-280.

Stone, J.C. "A Separate Defence Procurement Agency: Will It Actually Make a Difference," *Strategic Studies Working Group Papers, Canadian Defence and Foreign Affairs Institute* (2012): 1-16.

Webb, Natalie, Anke Richter and Donald Bonsper. "Linking Defense Planning and Resource Decisions: A Return to Systems Thinking," *Defence & Security Analysis* Vol.26, No.4, (December 2010): 387-400.