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PILOTLESS AIRFORCE

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JCSP 43 DL

Exercise Solo Flight

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EXERCISE *SOLO FLIGHT* – EXERCICE *SOLO FLIGHT*

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Pilotless Airforce

There is often no single factor that drives CF personnel to leave, but a confluence of factors, a “death of a thousand paper cuts”

- Maj Mark N. Popov

Introduction

There is a critical shortage of pilots to fill the global demand. People are always going to need to travel and unmanned passenger airlines remain a long way from reality thus qualified pilots are going to be continuously required by airlines well into the future. The CAF and other Militaries are ripe for the picking as they produce and employ quality pilots capable of good decision making and have proven their flying skills. The military is challenged to compete with the private sector for financial compensation, thus military pilots will surely be tempted to leave in favour of the promise of a higher paycheque. The job security is a factor that favours the military when weighed against the unpredictability of a private sector employer, but the dollar speaks loudly. Most policies implemented to address pilot shortages focus on these aspects of retention and continue to fail, leaving military aircraft without bums in the seats.

There can be no debating whether retention is a problem that needs to be addressed; it is a key factor contributing to the shortage of pilots in the military, however it is not the only factor. This paper argues that the CAF’s pilot retention problem is a wicked problem however; it is simply one factor in the greater challenge of pilot manning. The paper will provide a short refresher on Wicked Problems followed by a brief description of the lifecycle of a pilot, from how they are recruited, trained and employed. This will be followed by a discussion of some of the programmes instituted by armed forces around the world to right size their pilot cadre. This

paper will conclude with the identification of an opportunity to influence policy makers to fully consider all the issues surrounding our pilot manning problems.

Wicked Problems

A wicked problem is “a social or cultural problem that is difficult or impossible to solve for as many as four reasons: incomplete or contradictory knowledge, the number of people and opinions involved, the large economic burden, and the interconnected nature of these problems with other problems.”¹ Wicked problems are extremely complex and require dedicated thought and cooperation of the many stakeholders who may view the same problem very differently. The Five Blind Men and an Elephant story provides an excellent example of how different perspectives can blind people to the truth about the overarching issues and can lead to them each down the wrong path. “And as the elephant moved on, they [the five blind men] stumbled along down the road, arguing more vehemently as they went, each sure that he, and he alone, was right and all the others were wrong.”²

Pilot Lifecycle

RCAF Pilots start out like any other officer recruit in that they are recruited and receive basic officer training, second language training and a university education (if they have not joined pre-packaged with a degree). For the sake of this essay I’ll assume the average pilot spends five years from the day he is recruited to this point where he is ready to commence primary flying training. From here an average of two years will get the pilot through primary,

¹ “Wicked Problems: Problems Worth Solving,” Wicked Problems, www.wickedproblems.com, accessed 13 May, 2018. https://www.wickedproblems.com/1_wicked_problems.php

² *Author unknown* “Five Blind Men and an Elephant – A Story About Perspective” Animal Stories and Principles, Inspirational Stories, Betterlifecoachingblog.com, 23 July 2010. <https://betterlifecoachingblog.com/2010/07/23/five-blind-men-and-an-elephant-a-story-about-perspective/>

basic and advanced flying training and onto their first operational training unit for conversion on the platform they will be flying for their first posting. The average pilot will spend seven and a half years of training before they conduct their first operational flight and normally another two years of on-the-job training before the pilot is ‘fully qualified’ on their aircraft type. After nearly a decade of training, these new mission commanders are ready to take their aircraft and crew into harm’s way. The typical progress for aircrew is two flying tours and potentially one staff or instructor tour as a Captain while also completing the myriad professional development courses of the Canadian Armed Forces Joint Officer Development (CAFJOD) and Airforce Officer Development (AFOD) Programmes. This will usually be rewarded by promotion to Major and a flying supervisor tour and operational or strategic staff tour with the Joint Command and Staff Program in the mix. Those pilots successfully getting through the mill to this point may be further rewarded with a promotion to Lieutenant-Colonel and very limited opportunities for ever sitting in a cockpit again.

The Problem

The RCAF Pilot Career Manager annual briefing showed that as of 30 Sept 2016 the pilot occupation was 89.2 percent manned with 1,441 bodies filling 1,615 positions. This delta has shrunk only minimally since the early ‘90s. In 2008 Lieutenant General Angus Watt, then Commander of the RCAF told the Senate defence committee that “We are 13 per cent below the manning level for pilots... We have been that way for almost a decade. It has been a long term persistent problem in the air force, and part of that went back to the 1990s when we experienced a rapid decrease in the number of people in the air force.”³ It should be noted that during this

³ David Pugliese, “Air Force Short 250 Pilots but Getting a Handle on Retention,” *Ottawa Citizen*, 13 June 2008. <http://ottawacitizen.com/news/national/defence-watch/air-force-short-250-pilots-but-getting-a-handle-on->

time of reduction, pilots and other CF occupations were given financial incentives to retire early. The RCAF is still trying to recover from the FRP. From the early 1990s until today we have improved from 250 pilots short to about 175 short, I would that in nearly 30 years, we have hardly gotten a handle on the problem.

Bad to Worse

New regulations surrounding pilot fatigue are being implemented in Canada ““On the physical side, we know that to be alert and fully functioning, pilots need to be well-rested," Garneau told 200 members of the aviation industry.” So we set limits to the amount of time a crew member can be on the job.”⁴ Shortening the number of hours a pilot can work in a day will necessitate airlines to cut routes or hire more pilots to fly the same volume. “The country is already dealing with a pilot shortage, said John McKenna, president of the Air Transport Association of Canada. He estimates the proposed regulations could increase the demand for pilots by up to 30 per cent, meaning less experienced pilots could be hired to meet the demand.”⁵ I would suggest that rather than hiring less experienced pilots, the RCAF will be further targeted. In the US, changes in the experience required to hold an air transportation rating are similarly going to require a hiring spree that will target the kind of experienced pilot that the military offers. “Add to that a recent change in requirements that new commercial airline pilots have 1,500 flight hours under their belts, and suddenly military-trained pilots become even more attractive than usual.”⁶ The USAF suggests that this policy change will mean on the order of

retention

⁴ Ashley Burke, “Pilot fatigue rules set to move forward despite safety concerns,” *CBCnews*, 7 Jun, 2018. <http://www.cbc.ca/news/canada/ottawa/canada-new-pilot-fatigue-rules-marc-garneau-1.4148201>

⁵ *Ibid*

⁶ Deborah Lee James and Gen. Dave Goldfein “The US Air Force Is Short 700 Fighter Pilots. Here’s Our Plan to Fix That.” *Defenseone*, 14 July, 2016. <https://www.defenseone.com/ideas/2016/07/us-air-force-short-700-fighter-pilots-our-plan/129907/>

5000 pilots per year will be consumed by American commercial airlines.⁷ Clearly the Airline requirement for more pilots will drain talent and critical experience from the military in significant numbers, but it is not solely responsible for the deficiency.

While there can be no doubt that pilot retention is a critical factor in ensuring the right number of pilots are available to permit the CAF to continue operations, it would be foolish to lay all the blame at the feet of the airlines. Mike Benitez likens those blaming the current pilot shortage on retention issues to those who solely blame the iceberg for the Titanic sinking, “The tragic fate of the Titanic was sealed not by the iceberg, but by the ship’s design combined with operating missteps.”⁸ He further proposes that Pilot manning requires proper consideration of seven elements: The requirement, how many pilots do we need; accessions, hire already qualified pilots; Production, train new pilots; Sortie production, integration of trained pilots on front line units (learn how to fight as a team); Retention, getting a return on the investment; and Industry, working with the airlines.⁹ The following paragraphs will be limited to discussing three of these elements and how they impact the pilot manning problem.

Requirement

The Strategic Intake Plan (SIP) looks at anticipated attrition rates out a number of years and backcasts how many recruits in a particular occupation need to be recruited today to meet the required Trained and Effective Strength (TES) at the Preferred Manning level (PML) down the road. Looking at the Pilot occupation, the near-decade of training means the SIP is looking a horizon into the future to ‘guess’ the future preferred manning level for pilots. With Chief of

⁷ Mike Benitez, “Air Force in Crisis, Part I: Why Pilot Retention Matters Right Now,” *War On the Rocks*, 28 February, 2018. <https://warontherocks.com/2018/02/air-force-crisis-part-pilot-retention-matters-right-now/>

⁸ *Ibid.*

⁹ *Ibid.*

Force Development's Capability based planning tools looking out well beyond ten years the SIP team has a daunting task to perform with respect to recommending pilot intake.

Production

In order for the SIP to have any hope of success the training system that creates pilots from raw recruits needs to be well understood, it needs to be consistent and it needs to be flexible. A 2012 chief of review services report found that "Training program performance is guided by appropriate direction, and for the most part is producing the quantity and quality of trained personnel to meet the needs.... An exception to this is Pilot training, which consistently fails to achieve production target levels."¹⁰ This is clearly a problem for the pilot occupation, and is all the more concerning considering the cost associated with production of this single occupation, "Annual direct program spending [on all 26 RCAF occupations combined] is approximately \$350 million. Pilot training represents 89 percent of the total program cost."¹¹ In other words the RCAF is spending over \$310 million on pilot training and consistently fails to meet the SIP number of pilots.

LCol Kyle Solomon conducted an analysis of CAF recruiting through to the Operational Functional Point (OFP) using a system model. His analysis suggests that getting the right number of people from the street to being operationally employable is a complex problem that will require both an institutional culture change as well as immediate action to come up with innovative solutions "Otherwise the CAF will only undertake the analysis in response to a crisis,

¹⁰ Department of National Defence, "Evaluation of Air Force Training and Readiness Part 1 – Air Force Initial Occupational Training" Chief of Review Services, Nov 2012, pg iv.
http://www.forces.gc.ca/assets/FORCES_Internet/docs/en/about-reports-pubs-audit-eval/p0940-eng.pdf

¹¹ Ibid pg v

which is the worst time to undertake this type of change.”¹² Clearly, optimising the system that takes a recruit from the street to the cockpit is a Wicked Problem. Unless something changes the training system will never catch up to attrition.

Retention

Statistics Canada lists the average age of a new father in 2011 was 28.3 yrs¹³ and 29.9 yrs for first-time mothers in 2013.¹⁴ Assuming RCAF pilots start their careers at 18 years old, and follow the normal pilot lifecycle previously described, their upgrade to top category aligns perfectly for the average age for becoming a first-time parent. This emotional event is certainly a factor worth consideration when attempting to determine why pilots are looking outside the military for financial and personal safety stable jobs. These young women and men now have bigger and longer term responsibilities that they will need to consider. There have been very few initiatives that have successfully reduced the time from recruiting to fully qualified and ready to share their Pilot expertise with the next generation. The single largest time killer in the Pilot’s training period is the five year average to get their undergraduate degree. Postponing, or eliminating this requirement would allow those same five years as a third and/or fourth flying tour before they hit parenthood. It is in these later tours where the RCAF will truly see the return on investment.¹⁵ Losing experienced pilots prior to achieving the return on investment is doubly

¹² Kyle Solomon, “A Systems Approach to Recruiting and Training CAF Members: Designing an Optimized Model,” Royal Military College St. Jean, Blue Knight, 25 Jan, 2018. <http://www.cmrsj-rmcscj.forces.gc.ca/cb-bk/art-art/2018/art-art-2018-5-eng.asp#fn1>

¹³ “Father’s Day... By the Numbers,” Statistics Canada, accessed 20 May, 2018. http://www.statcan.gc.ca/eng/dai/smr08/2017/smr08_218_2017#a3

¹⁴ “Mother’s Day... By the Numbers,” Statistics Canada, accessed 20 May, 2018. http://www.statcan.gc.ca/eng/dai/smr08/2017/smr08_216_2017#a9

¹⁵ Koskie, LCol Brad, Canadian Armed Forces, “Surly Bonds? An Examination of Pilot Retention Issues and Strategies and their Application to the Canadian Forces.” Ottawa: National Defence, 2010. <https://www.cfc.forces.gc.ca/259/290/295/287/koskie.pdf>
<https://www.cfc.forces.gc.ca/259/290/295/287/koskie.pdf>

painful. Not only does that position become empty, but as LCol Richard Kohli comments in *skies* magazine, it impacts the on-the-job training of those pilots trying to upgrade.

“Unfortunately, even if it were possible, significantly increasing the quantity of trainees will not solve the problem in Canada without affecting operations, Kohli noted. For one, the RCAF lacks that large pool of experienced instructors...”¹⁶ Kohli goes on to discuss the mechanisms used to tempt pilots to stay in the military. “Kohli noted the RCAF commander has “limited levers” and focuses on job satisfaction and ensuring people have the tools to do the job well within the RCAF, while working with the Military Personnel Command on things like retention bonuses or other benefits packages.”¹⁷

LCol Kevin Kozak explains *Queep* as “the United States Air Force [USAF] term roughly translated as the additional duties and requirements often levied by higher headquarters that offer little value to the mission,”¹⁸ and the RCAF is rife with *Queep*. C.W. Lemoine writes that “Non-flying jobs are the reason most military pilots work 50-65+ hour weeks, and a major reason for the problems the military faces with retaining aviators.”¹⁹ *Queep* is a major dissatisfier for pilots who joined the military to fly.

Policies

A complication with trying to implement general policies to retain experience is that the target audience is not a homogenous group. In his Masters of Defence Studies paper Major Mark Popov suggests “that motivators for brand-new captains who recently earned pilot’s wings are

¹⁶ Chris Thatcher, “Managed Shortfall,” *Skies Magazine*, 2 March 2018. <https://www.skiesmag.com/features/managed-shortfall/>

¹⁷ Chris Thatcher, “Managed Shortfall,” *Skies Magazine*, 2 March 2018. <https://www.skiesmag.com/features/managed-shortfall/>

¹⁸ LCol K. Kozak, “Air Mobility Releases: the RCAF’s Canary in a Coal Mine,” *RCAF Journal*, Vol 6 no 3. Summer 2017, pg 93. http://publications.gc.ca/collections/collection_2017/mdn-dnd/D12-16-6-3-eng.pdf

¹⁹ C.W. Lemoine, “The Non-Flying Side of Being a Military Pilot,” *FighterSweep.com*, accessed 14 May 2018. <https://fightersweep.com/5352/non-flying-side-military-pilot/>

very different from motivators for 40-year-old majors who may have seen their last flying jobs.”²⁰ I would continue that line of thought and propose that a policy tailored to motivate the newly winged graduate, could push out the old desk bound major.

Over the years and in many different militaries the use of bonus pay has been widely used to incentivise pilots to accept additional obligatory service. The USAF Aviator Bonus Program offers a wide array of contract lengths to permit pilots flexibility. “But now, airmen can choose to sign on for one, two, five, nine, or up to 13 years of service and get annual payments of up to \$35,000 per year.”²¹ A pilot signing a 13 year contract at the top rate would receive a bonus of \$455,000. However, a RAND study from 2016 recommended that the max bonus at that time (\$25,000 per year) needed to be raised to \$48,000 in order to account for anticipated airline hiring increases.²² Even the USAF appears to have a financial threshold they are not willing to exceed.

An innovative solution to keeping pilots longer has been proposed to the USAF in which USAF and Airlines agree that provided the pilot remains with the USAF for 15 years they will be eligible for a \$100,000 bonus upon separation from the USAF and will receive an airline transport rating and preferential treatment from the airline.²³ It should be noted that while \$100,000 might not seem that much of an enticement today, this innovative solution was proposed in 1997 close to the same time the CAF was ending the Forces Reduction Plan early

²⁰ Major Mark N. Popov, “A Confluence of Factors: Canadian Forces Retention and the Future Force,” *The Curtis Papers, Canadian Aerospace and Joint Studies*, Vol2, 2010, p 168. <http://w08-ttn-vmweb01/CFAWC/en/elibrary/pubs/the-curtis-papers-vol2.pdf>

²¹ Stephen Losey, “Air Force rolls out 13-year, \$455,000 bonuses for fighter pilots,” *AirForce Times*, 5 June 2017. <https://www.airforcetimes.com/news/your-air-force/2017/06/05/air-force-rolls-out-13-year-455000-bonuses-for-fighter-pilots/>

²² Michael G. Mattock, James Hosek, Beth J. Asch, Rita Karam, “Retaining U.S. Air Force Pilots When the Civilian Demand for Pilots Is Growing,” Santa Monica, CA: RAND Corporation, 2016. https://www.rand.org/pubs/research_reports/RR1455.html.

²³ Mike Benitez, “Air Force in Crisis, Part I: Why Pilot Retention Matters Right Now,” *War On the Rocks*, 28 February, 2018. <https://warontherocks.com/2018/02/air-force-crisis-part-pilot-retention-matters-right-now/>

retirement 'Golden Handshake' in which a similar amount was being offered to pilots to leave the military. Interesting how north of the border the CF is offering cash bonuses for pilots to retire while south of the border bonuses are being considered for pilots to stay.

The RAF offers two streams for pilots, spec aircrew which offers better pension by including the aircrew allowance in the basic pay, but limits promotion to the equivalent of Major. This stream keeps experience in the cockpit and minimizes the queep that a career stream pilot interested in progressing up the ranks will still be subjected to. In the Canadian career progression model it is assumed that everyone aspires to become the CDS and thus everyone is subject to queep. The RAF specialist aircrew model certainly has benefits of keeping pilot experience in the cockpit and passing on the benefits of the investment the CAF made in them.

Opportunity Knocks

The 2018 RCAF Spring Air Board record of discussion (ROD) indicates that a discourse regarding restricted releases for distressed occupations resulted in a number of proposals, the details of which were not included. "Comparing figures such as Percentage Trained Effective Strength, relative cost of training and relative demand in industry, DG Air Rdns proposed specific restricted release policies for the following occupations: Pilot, Aerospace Control Systems Officer, and Aerospace Controller."²⁴ While the ROD indicates that none of the proposals were approved (likely due to the Commander's imminent retirement four days later) it is promising that he directed a Tiger Team be assembled to study restricted release.

²⁴ 1150-20 (COS AS) "Record of Decisions – 2018 Spring Air Board Held at RCAF Officer's Mess, 28 March 2018," Signed 1 May 2018 by LGen M.J. Hood, Comd RCAF.

Conclusion

As the demand from the Airlines for quality pilots is expected to soar in the upcoming years it should be no surprise when Airline recruiting campaigns ramp up their targeting of military pilots, further increasing the pilot position vacancy rate. Unless the RCAF can plan, recruit, train and retain the right number of qualified and experienced pilots to fill operational, staff and support positions, the CAF's ability to deliver air power will be in significant jeopardy. All the SSE initiatives that promise to provide new, state of the art aircraft are completely useless without pilots to fly them.

This paper showed that the CAF's pilot retention problem is a wicked problem due to the economic power of commercial airlines and quality of life for military pilots who are not interested in military duties unrelated to piloting. This paper also showed that determining the number of pilots required and then producing that number of pilots are also wicked problems. The combination of these three factors and others not discussed together show the overarching wicked problem that the CAF should be working to address. Policies that fail to address all the factors that lead to pilot manning problems will fail to resolve pilot manning problems. Examples from Canadian, British and US policies have shown that despite aggressive changes in one dimension, the problem remains.

Right sizing the cadre of pilots in the RCAF has been shown to be a wicked problem with a number of underlying wicked problems. There may be a narrow window of opportunity to expand the Commander RCAF's Tiger Team's focus to ensure all the elements contributing to Pilot Manning are considered.

BIBLIOGRAPHY

“Wicked Problems: Problems Worth Solving.” Wicked Problems. www.wickedproblems.com. accessed 13 May, 2018. https://www.wickedproblems.com/1_wicked_problems.php

Author unknown “Five Blind Men and an Elephant – A Story About Perspective.” *Animal Stories and Principles, Inspirational Stories*. [Betterlifecoachingblog.com](http://betterlifecoachingblog.com). 23 July 2010. <https://betterlifecoachingblog.com/2010/07/23/five-blind-men-and-an-elephant-a-story-about-perspective/>

Pugliese, David. “Air Force Short 250 Pilots but Getting a Handle on Retention” *Ottawa Citizen*. 13 June 2008. <http://ottawacitizen.com/news/national/defence-watch/air-force-short-250-pilots-but-getting-a-handle-on-retention>

Burke, Ashley. “Pilot fatigue rules set to move forward despite safety concerns.” *CBCnews*, 7 Jun, 2018. <http://www.cbc.ca/news/canada/ottawa/canada-new-pilot-fatigue-rules-marc-garneau-1.4148201>

James, Deborah Lee and Gen. Dave Goldfein. “The US Air Force Is Short 700 Fighter Pilots. Here’s Our Plan to Fix That.” *Defenseone*. 14 July, 2016. <https://www.defenseone.com/ideas/2016/07/us-air-force-short-700-fighter-pilots-our-plan/129907/>

Benitez, Mike. “Air Force in Crisis, Part I: Why Pilot Retention Matters Right Now.” *War On the Rocks*, 28 February, 2018. <https://warontherocks.com/2018/02/air-force-crisis-part-pilot-retention-matters-right-now/>

Department of National Defence. “Evaluation of Air Force Training and Readiness Part 1 – Air Force Initial Occupational Training.” Chief of Review Services, Nov 2012, pg iv. http://www.forces.gc.ca/assets/FORCES_Internet/docs/en/about-reports-pubs-audit-eval/p0940-eng.pdf

Solomon, Kyle. “A Systems Approach to Recruiting and Training CAF Members: Designing an Optimized Model.” Royal Military College St. Jean. Blue knight. 25 Jan 2018 <http://www.cmrsj-rmcjsj.forces.gc.ca/cb-bk/art-art/2018/art-art-2018-5-eng.asp#fn1>

“Father’s Day... By the Numbers.” Statistics Canada. Accessed 20 May, 2018. http://www.statcan.gc.ca/eng/dai/smr08/2017/smr08_218_2017#a3

“Mother’s Day... By the Numbers.” Statistics Canada. Accessed 20 May, 2018. http://www.statcan.gc.ca/eng/dai/smr08/2017/smr08_216_2017#a9

- Koskie, LCol Brad. Canadian Armed Forces. "Surly Bonds? An Examination of Pilot Retention Issues and Strategies and their Application to the Canadian Forces." Ottawa: National Defence, 2010. <https://www.cfc.forces.gc.ca/259/290/295/287/koskie.pdf>
- Thatcher, Chris. "Managed Shortfall." *Skies Magazine*. 2 March 2018. <https://www.skiesmag.com/features/managed-shortfall/>
- Kozak, LCol K. "Air Mobility Releases: the RCAF's Canary in a Coal Mine." RCAF Journal. Vol 6 no 3. Summer 2017. pg 93. http://publications.gc.ca/collections/collection_2017/mdn-dnd/D12-16-6-3-eng.pdf
- Lemoine, C.W. "The Non-Flying Side of Being a Military Pilot." *FighterSweep.com*. Accessed 14 May 2018. <https://fightersweep.com/5352/non-flying-side-military-pilot/>
- Major Mark N. Popov, "A Confluence of Factors: Canadian Forces Retention and the Future Force," *The Curtis Papers, Canadian Aerospace and Joint Studies*, Vol2, 2010, p 168 <http://w08-ttn-vmweb01/CFAWC/en/elibrary/pubs/the-curtis-papers-vol2.pdf>
- Losey, Stephen. "Air Force rolls out 13-year, \$455,000 bonuses for fighter pilots." *AirForce Times*, 5 June 2017. <https://www.airforcetimes.com/news/your-air-force/2017/06/05/air-force-rolls-out-13-year-455000-bonuses-for-fighter-pilots/>
- Mattock, Michael G. James Hosek, Beth J. Asch, and Rita Karam, "Retaining U.S. Air Force Pilots When the Civilian Demand for Pilots Is Growing." Santa Monica, CA: RAND Corporation, 2016. https://www.rand.org/pubs/research_reports/RR1455.html.
- 1150-20 (COS AS) "Record of Decisions – 2018 Spring Air Board Held at RCAF Officer's Mess, 28 March 2018. Signed 1 May 2018 by LGen M.J. Hood, Comd RCAF.