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National Occupational Standards and Certification System

Soaring to New Human Resources Heights in the Aviation Maintenance Sector

This case study looks at the impact and benefits that the Canadian Aviation Maintenance Council's (CAMC's) National Occupational Standards and Certification system is having on the aviation maintenance and aerospace industry in Canada. It explores how national standards and certification affects the capacity of individuals and organizations to perform. It also considers the Keys to Success of the CAMC standards and certification system as a model for other sector councils and organizations to adapt or replicate.

The Canadian aviation maintenance and aerospace manufacturing sector is the fourth largest of its kind in the world, employing over 140,000 workers in 1,200 original equipment manufacturers and suppliers (OEMs), third-party independent maintenance repair and overhaul facilities (MROs), and approved maintenance organizations (AMOs).[1] Rolls-Royce Canada Ltd., Air Canada, Air Canada Technical Services (ACTS), Standard Aero Ltd., Bombardier Inc., and Bristol Aerospace Ltd. are just a few of the organizations that fill the skies and hangars within Canada's aviation maintenance and manufacturing sector.

With sales of over CDN$24 billion, Canada produces over five per cent of the world's aviation output, making this sector one of the most important economic engines for the country. Canada's regional jet, gas turbine engine and helicopter subsectors are some of the largest in the world.

THE AVIATION MAINTENANCE INDUSTRY

The aviation maintenance industry subsector includes general aviation, commercial carriers, rotorcraft operations, military activities, and the suppliers and maintenance repair and overhaul companies. This

industry employs approximately 30,000 people in over 1,000 organizations, and generates almost CDN$4 billion in sales by servicing, repairing, overhauling, retrofitting and remanufacturing all types of aircraft and aircraft components for both the domestic and international markets.[2] Today, only a few airlines with large fleets, such as Air Canada, keep their maintenance activities in-house. Most airlines outsource this work, which is typically irregular in scheduling and requires considerable labour and specialized equipment. The maintenance organizations of a few large airlines, for example Air Canada Technical Services (ACTS), also offer third-party maintenance services to other airlines.[3]

THE AEROSPACE MANUFACTURING INDUSTRY

The aerospace manufacturing industry includes original equipment manufacturers, space products manufacturers, and manufacturing companies that service and repair their own products, including the machining and manufacturing of complete systems, sub-systems and parts.[4] This subsector employs approximately 60,000 people in 200 companies and generates over CDN$15 billion in annual sales.[5]

HUMAN RESOURCE CHALLENGES FACING THE SECTOR

The main human resources challenges facing the aviation maintenance and aerospace manufacturing sector include:

- an aging workforce and a resulting skills shortage;
- attracting youth to careers in the aviation maintenance industry; and
- upgrading skills to keep up with new technologies.

Today, only a few airlines with large fleets keep their maintenance activities in-house.

This case study examines the impact that CAMC's occupational standards and certification program is having on businesses and individuals within the aviation maintenance and aerospace manufacturing sector, and the role that it plays in enhancing workplace performance, productivity and safety. The study has two objectives:

1. Identify the economic impacts that the CAMC standards and certification program is having on aviation maintenance technicians and companies in Canada.
2. Identify the Keys to Success of the CAMC standards and certification system and offer insights as to how this model might be replicated or adapted by other sector councils.

A clear indication of the sector's support for CAMC is its corporate membership list.

Qualitative and quantitative data used in this study were gathered using a number of research techniques, including a review of Sector Council, government, and aviation maintenance and aerospace literature, and a series of in-depth interviews and conversations with 13 employers, employees, labour representatives and CAMC staff.[6]

CANADIAN AVIATION MAINTENANCE COUNCIL

Established in 1991, the Canadian Aviation Maintenance Council is a not-for-profit organization responsible for the human resources strategy for aviation maintenance and aerospace manufacturing in Canada.[7] CAMC's primary objective is to build the overall strength and economic well-being of the industry through the development of its human resource capacity. Its programs include: the development of national occupational standards for skilled trades; a professional certification and national registration system; the development of curricula; the accreditation of training programs; youth orientation programs; and the implementation of recruitment and retention strategies.[8]

A clear indication of the sector's support for CAMC is its corporate membership list, which includes over 180 aviation maintenance, aerospace manufacturing, and aviation training corporate members.[9]

A GROWING NEED FOR SKILLED AND CERTIFIED EMPLOYEES

A 2002 CAMC study found that annual employment growth rates of 3 to 5 per cent over the coming years, combined with significant attrition rates, over the long-term, mean that a large number of new skilled entrants will need to be recruited.[10] By 2016, for example, it is expected that only 40 per cent of the current manufacturing workforce, and less than one-third of the current aviation mechanical engineers, will still be on the job—due mostly to retirement.[11]

Coupled with these anticipated human resources challenges are the tremendous advances in the sophistication and effectiveness of repair, replacement and manufacturing technologies, which are driving changes in the knowledge and skill sets required within aviation maintenance and aerospace trades and occupations.

Canadian Aviation Maintenance Council

CAMC links business, labour and educational institutions as it responds to the human resources needs of the aviation and aerospace industry. Key CAMC products, programs and services include:[1]

National Occupational Standards and Curricula—CAMC, along with industry, has developed standards that define the skills, knowledge and competencies required to perform the duties of 19 occupations.

Certification—CAMC is the only nationally recognized trade-certifying body representing the aviation maintenance and aerospace industry.

Human Factors & Safety Management System Programs (HF & SMS)—These CAMC programs address the human dimensions of quality maintenance and safety in the industry.

Labour Market Information System (LMIS)—LMI helps define the current and future state of the industry, aids job-seekers to determine where to look for work and what fields they should pursue, and helps the education community adjust its training.

Career Focus Program (CFP)—This program offers employers one-third of a new employee's wage for the first year of employment.

Youth Internship Program (YIP)—This is a two-year aviation maintenance program that begins in high school and allows graduates to either proceed into a college technician diploma program or enter the industry workforce with generic skills.

Prior Learning Assessment and Recognition (PLAR)—This program expedites the process of recruiting skilled technicians from other sectors within Canada and from other parts of the world.

1 For a complete review of all that CAMC offers, go to: www.camc.ca.

A HIGHLY REGULATED INDUSTRY

The aviation industry is one of the most highly regulated in the world, as new regulations are being issued constantly by national authorities, such as Transport Canada, the Federal Aviation Administration (FAA), and the European Joint Aviation Authorities (EJAA).[12] New regulations often have immediate and potentially short-term negative impacts on the productivity and efficiency of individual aviation maintenance workers, as training and production cycles need to be adjusted and refined, and individual employees must adapt and get up-to-speed on them.

It is little wonder that the Canadian aviation maintenance industry supports CAMC's national occupational standards and certification program—as it provides documented evidence that individuals who are either pursuing a career in the industry, or who are currently working in it have, or are working towards obtaining, the skills, knowledge and abilities needed to perform specific tasks and sub-tasks.

Overhauling, repairing and maintaining an aircraft—including all of its mechanical, electrical and structural components—is a complex, detailed and intricate process. It requires the attention and diligence of a number of highly specialized and trained people, including mechanics, technicians, engineers, machinists, welders and painters. An aircraft is made up of tens of thousands of parts, each one serving a role in the aircraft's overall airworthiness—from the paint to the smallest of rivets. It is important that the organization servicing the aircraft is confident in the skills, knowledge and abilities of its employees. Gas Turbine Engine Repair Technicians, for example, need to know how to disassemble and label engine parts, keep detailed records, overhaul engines and turbine assemblies, conduct emergency repairs and perform routine maintenance tasks—all on a tight schedule. An AMO with competent and certified Gas Turbine Technicians know that the work they complete will be done professionally, on-time, on-budget and to an accepted industry standard.

An AMO's and MRO's credibility depends on it being able to offer its customers the highest quality and standard of service, craftsmanship and workmanship in the most economical way. A training and development

manager at a leading aviation maintenance organization in Canada summed it up nicely when he asked: "If you had a choice between a CAMC–certified technician and an uncertified technician working on your engine, who would you choose?" To him and many others the choice is simple: CAMC's system of national occupational standards and certification goes a long way towards ensuring that Canada's—and the world's—skies are supplied with a full complement of well-crafted and well-maintained aircraft.

CAMC NATIONAL OCCUPATIONAL STANDARDS AND CERTIFICATION

Having CAMC develop a suite of national occupational standards and certifications contributes to proficiencies in work quality coming out of many of Canada's AMOs and OEMs; it also helps aviation maintenance companies like Standard Aero Ltd. and ACTS remain competitive and achieve productivity gains by establishing benchmarks for personnel to complete tasks on time, on budget, and to a recognized standard and level of professionalism.

In consultation with key stakeholders from industry, labour, government, and educational institutions, CAMC has developed 19 national occupational standards and certifications—thirteen of which are recognized by Transport Canada (TC), and three for which CAMC is in the process of obtaining TC recognition.[13] These 19 occupational standards cover the primary licensed and unlicensed trade occupations within the industry. Based on industry input and guidance, CAMC is now in the process of introducing five more occupations to its platform of national occupational standards and certification.[14]

LICENSED AND UNLICENSED TRADES

The aviation maintenance and aerospace industry is made up of two types of technicians: licensed and unlicensed. Licensed technicians are recognized professionals within the industry and are given the authority to sign-off on finished work and ultimately release a part or an aircraft. Transport Canada issues Aircraft Maintenance Engineer (AME) certificates to all licensed technicians under one of three designations: maintenance, electronics and structures. The Transport Canada licence ensures that all AMEs perform their tasks and duties to stringent standards and specifications. In the aviation industry there is no room for interpretation. Unlicensed technicians, on the other hand, have had very little in the way of formal recognition, or in the development of standards of practice, other than what an individual organization might have implemented. This can lead to discrepancies in the level of service offered.

Transport Canada (TC) Licensing[1]

Transport Canada issues three licences under the Aircraft Maintenance Engineer (AME) designation, each with its own level of maintenance release privileges. They are:

1. AME-Maintenance (M1): non-turbojet aircraft built to certain standards (includes all airframe, engines, propellers, components, structures and systems).[2]
   AME-(M2): all other aircraft not included in M1, excluding balloons.
2. AME-Electronics (E): aircraft electronic systems (includes pulse, communications, navigation, auto flight, flight path computation, instruments and electrical elements of other aircraft systems, and structural work directly associated with the maintenance of those systems).
3. AME-Structures (S): aircraft structures (includes all airframe structures).

All AMOs are required to have a number of AMEs on staff (M.E.- and S-designations) in order to release aircraft once a technician, machinist, painter or specialist completes and signs-off on a repair or overhaul.[3]

1 For more information on Transport Canada's AME Licensing, see: www.tc.gc.ca/civilaviation/maintenance/aarpb/General/General.htm.
* Denotes a licensed occupation, in which a technician can pursue Transport Canada Aircraft Maintenance Engineer (AME) (M/S) designation license if he/she so chooses.

2 Includes non-turbojet aircraft built to CAR 522, 523, 523-VLA, 527, 549 and equivalent standards.

3 Of interest, there are three CAMC Certifications that can lead to Transport Canada licenses (AME-designation). They include: the Aircraft Structures Technician, the Aircraft Maintenance Technician and the Avionics Maintenance Technician.

CAMC established its standards and certification system partly as a means to formally and systematically recognize the baseline skills of those individuals not covered under Transport Canada's AME designations. Standards and certification have a number of advantages, including:

- Clearly defined levels of performance expectations for all job tasks and sub-tasks, resulting in consistent, high-quality and accurate workmanship.
- Potential cost savings and increased revenue for organizations through improved efficiencies and reductions in errors; improved production cycle times; improved revenues per employee; improved

product and service quality; and improved health and safety records.
- Potentially significant benefits for employees, including: improved self-confidence— employees know what is expected of them and what they are capable of doing; improved attitudes towards work—everyone knows they are working to the same level of standards and expectations; and improved communications and teamwork skills—employees share best practices when completing tasks.

COMPETENCY-BASED STANDARDS DEVELOPMENT

CAMC's national occupational standards and certification system serves the interests of individuals in two ways. First, it offers current industry workers the opportunity to upgrade, maintain and formally recognize their competencies and become certified trades practitioners. Second, it offers individuals interested in pursuing a career in the industry to gain the skills, knowledge and competencies needed to succeed through CAMC-accredited training program deliverers.

THE CAMC CERTIFICATION PROCESS

CAMC is the only nationally recognized trade-certifying body representing the aviation and aerospace industry. To become a nationally recognized Certified Technician in a specialized field requires a number of steps:

1. Acquire CAMC Associate Membership

To become CAMC-certified, individuals must first become a CAMC Associate Member.[15] To initially apply for associate membership individuals must:
- be enrolled in, studying at, or training in an accredited aviation maintenance program;[16]
- be working in the aviation industry; or
- have aviation maintenance experience.[17]

An individual who is a CAMC Associate Member is then eligible to apply for certification in a particular occupation, provided he/she works in a CAMC-approved aviation maintenance trade and that he/she satisfies the minimum requirements of an occupation (which includes a minimum number of years of experience, as well as being able to complete unsupervised tasks to a minimum level of competency).

The CAMC Associate Membership provides individuals with: a CAMC logbook, recognized by Transport Canada; access to the AvAero CareerLink—CAMC's members-only online employment resource site; subscription to AviNation magazine; and the opportunity to meet other industry members and associates at CAMC events.[18]

2. Complete CAMC Logbooks

As Associate Members, individuals are given a CAMC logbook representing their chosen trade or occupation. These logbooks—designed and developed by CAMC and aviation maintenance industry stakeholders—are used to document work experience, formal training and hands-on experience. They attest to an individual's ability to perform competently and without supervision the tasks and sub-tasks that form part of a national occupational standard.[19] Individuals can complete the logbook at their own pace throughout their careers. Once the minimum requirements of a logbook are satisfied, an employee is eligible for certification—the industry's seal of approval, providing them with a permanent, verified and registered record of their abilities.

CAMC logbooks attest to an individual's ability to perform competently and without supervision the tasks and sub-tasks that form part of a national occupational standard.

For example, the requirements to become an Aviation Mechanical Component Technician are: completion of secondary school; completion of an aviation mechanical component technician program or a maintenance technician program, and the equivalent of 36 months' experience in the trade. An Aviation Painter, on the other hand, must have a minimum of 5,000 hours or three years' experience in the trade to qualify for certification. The logbook is used to document the months of on-the-job experience and to verify that certain tasks are completed to an acceptable standard.

3. Complete Specialty Training, Where Required

A number of CAMC–certified occupations require additional specialty training. For example, Aircraft Gas Turbine Engine Repair and Overhaul Technicians need

to complete a 10 to 12-month training program in gas turbine repair and overhaul, either at a college or through a company-sponsored training program, as part of their three-year trade experience qualification.[20]

4. Obtain Approval and Get Registered

Each task identified in a logbook must be signed-off by a CAMC-certified and delegated authority upon completion. Once the logbook is filled out completely, and all other requirements have been met, the logbook is submitted to CAMC—along with any additional documentation one wishes to submit for consideration—for approval and certification. A successful review is registered in the CAMC database and an individual's status is upgraded to that of certified practitioner in a chosen occupation.[21]

The practical expertise gained through the certification process provides individuals with the kind of know-how that gets recognized—on the job, among peers and by employers.

VALUE OF NATIONAL OCCUPATIONAL STANDARDS AND CERTIFICATION

CAMC's national standards and certification system helps ensure that current and future employees perform job tasks to a certain code and level of conduct. CAMC standards describe in detail tested procedures, courses of action and techniques, and provide the blueprint from which decisions are made.[22] If followed, they help reduce human-factor variances in the workplace. By using CAMC standards, the aviation industry is more satisfied with the level of quality and workmanship coming out of its shops, hangars and garages.[23] Through the CAMC standards and certification system, organizations have also been able to realize significant cost savings and productivity improvements.

1. IMPROVED HIRING AND TRAINING PRACTICES

Organizations that use the CAMC standards and certification system gain access to a pool of potential new hires who are trained to national standards. The importance of having access to highly qualified new hires when required can be attested to by Standard Aero Ltd., a maintenance, repair and overhaul (MRO) organization that provides services on a wide range of gas turbine engines.[24]

In 1996–1997, the company needed to hire more than 300 unlicensed trades' technicians. However, outside of a handful of ex-military personnel, the machinists and welders who came to their doors did not have the necessary level of technical skills needed to function in the high-precision world of aviation maintenance and aerospace manufacturing. Standard Aero discovered that there were no standards for unlicensed trades in the aerospace industry.[25] To overcome this labour shortfall, Standard Aero recruited machinists and welders from many other industries and trained them to the standard that it (and Transport Canada) required. This in-house training was a costly and significant investment for the company, as they had to design their own training programs, hire instructors, train mentors, and oversee the administration and upkeep of the program on a yearly basis.

Standard Aero approached CAMC about developing standards for unlicensed trades, and soon a program of occupational standards and certification was up and running at Red River College and other institutions. Standard Aero was quick to embrace the system, and soon realized significant advantages, including access to skilled workers and significant savings in time and money for hiring and training.

Organizations that use the CAMC standards and certification system gain access to potential new hires trained to national standards.

Using CAMC's standards and certification system also saves time for organizations when their human resources training programs are being audited by Transport Canada. Because many of the standards and certifications are recognized by the regulatory body, it is more a matter of administration and checking the logbooks rather than examining and assessing the intricacies of individual training programs.

2. ACCESS TO A STREAM OF WELL-TRAINED AND COMPETENT NEW HIRES

CAMC's standards and certification system offers organizations access to a stream of credible candidates with strong technical skills and competencies in non-licensed and licensed trades.

At Standard Aero, for example, when potential new hires from a CAMC-accredited learning program are being interviewed the human resources team knows that these individuals come well-equipped in terms of their technical knowledge and skills (an associate membership status is meaningful to many AMOs and MROs). As such, they are inclined to spend less time on a candidate's occupational-specific skills and competencies and focus more attention on interpersonal skills, like their ability to work with others and communicate effectively, and their attitudes toward work and authority. These are the skills that ultimately keep workers in organizations, and that keep organizations functioning effectively and efficiently. By freeing up Standard Aero Ltd.'s time to focus on employability and essential skills, the organization has over the years built a much more dynamic and cohesive working environment.

3. REDUCTION IN THE TIME IT TAKES TO HIRE NEW EMPLOYEES

The CAMC standards and certification system also greatly reduces the time that it takes companies to locate, interview and hire staff, saving them both money and time. Qualified and competent workers are often hard to come by, so when an individual can show that they have some CAMC-accredited learning under their belts organizations are typically able to expedite the hiring process. Both ACTS and Standard Aero, for example, noted that the biggest value that the CAMC system offers them during the hiring stage comes from speeding up the process to prove competencies. One individual interviewed for the case study noted that CAMC's standards and certification system allows ACTS to hire the right people the first time round.

CAMC's AvAero CareerLink is an online job search site that caters to the needs of the aviation and aerospace industry and helps companies speed up their hiring processes. Only qualified candidates (all of whom are CAMC Associate or Certified Members) can post resumés and apply for jobs on the CareerLink site; and only CAMC Corporate Members can post job opportunities. Qualified job-seekers are easily matched to the needs of an organization, and time typically spent on sifting through the résumés of under-qualified, inexperienced and inappropriate candidates is saved for other purposes.

4. ENHANCED PRODUCTIVITY AND BENCH-STRENGTH OF NEW HIRES

The immediate and long-term value of tapping into a pool of skilled and competent individuals with industry-specific training is immeasurable to the aviation industry. The new hires that come to aviation maintenance and aerospace organizations with CAMC–accredited training require far less up-front training than those without. Not only have they been trained on industry-specific parts and to industry-recognized standards, they are also familiar with all of the forms and papers that need to be completed as part of one's job. One Standard Aero manager interviewed for this case study estimated that individuals coming through a CAMC-accredited training program require, on average, approximately 50 to 100 fewer hours of on-the-job training. This translates into significant cost savings and productivity gains for a company.

When an individual can show that they have some CAMC-accredited learning under their belt, organizations are typically able to expedite the hiring process.

Not only is the time of the new hire freed up to add to the productivity quotient of the organization, the co-workers who would otherwise be mentoring these individuals can also focus more of their time and attention on billable, core job responsibilities. Standard Aero estimates that graduates from CAMC-accredited programs are able to attain standard productivity rates 50 per cent faster than graduates from non-accredited programs.

5. SIGNIFICANT TRAINING COST SAVINGS

By using the CAMC standards and certification system, many companies have saved significantly in training costs over the years. Standard Aero Ltd., for example, estimates that it has saved well over CDN$1 million in training and training-related expenses (e.g., lost productivity) over the past five years by using CAMC's occupational standards and certification system.[26]

Companies also save substantial time in training their employees using CAMC's system. Rolls-Royce Canada, for example, estimates that it saves between six months to two years in training time per employee

(depending on the occupation) by using CAMC standards and certification training, as opposed to other available training programs. The initial instructor-led training and teaching is kept to a minimum, but there is a significant amount of on-the-job mentoring and experiential learning and practice recorded in logbooks. In contrast, other training programs might take an employee off the shop floor for up to a month of off-site training—significantly reducing his/her productivity.

6. INCREASED EFFICIENCIES AND SIGNIFICANT REDUCTIONS IN NON–CONFORMANCES

Before CAMC introduced its standards and certification system there was little industry conformity in the way skilled-trades practitioners went about completing their work. Certainly everyone worked to code and work was done to meet industry standards, in order to get sign-off and release of a part or a plane. However, individuals may not have been using the most effective or efficient techniques possible, resulting in lost productivity, non compliances, and increased production costs.

It makes good business sense to have all workers performing to an established standard, as opposed to being dependent on a few "best guys" to get jobs done right.

For example, aviation painters work with very expensive paints (fusion paints cost anywhere from CDN$600–700 per gallon), so when they mix a 50-litre batch of paint it is in the interests of the organization that it be done right the first time. A simple mixing mistake with a 50-litre batch of paint can cost a company like Rolls-Royce Canada more than CDN$35,000. By utilizing CAMC's aviation painter occupational standard, which sets out the steps needed to mix different types of paints a certain way, and then apply it in the most efficient manner, an organization can reduce or eliminate the chances of mistakes. Companies like Rolls-Royce Canada see the costs of certifying painters through CAMC's program as an investment that will pay dividends in quality work, efficiencies and productivity gains.[27] According to the manager of technical training at Rolls-Royce Canada, "We wouldn't be where we are today without CAMC's certification program."

7. A MEANS TO ASSESS QUALITY OF WORK, BUILD EFFECTIVE TRAINING PROGRAMS, AND ENHANCE PROFITABILITY

Having meaningful standards and levels of certification enables organizations like Standard Aero, Rolls-Royce Canada and Air Canada to assess work quality, identify good work practices, and build effective training programs around any identified gaps or weaknesses.

In the long term, if an organization is able to enhance the quality of work of all its employees by adhering to standards in which everyone is expected to perform to a minimum level, then productivity improves. A manager at Rolls-Royce Canada pointed out that it makes good business sense to have all workers performing to an established standard, as opposed to being dependent on a few "best guys" to get jobs done right. If more employees can complete a job to an accepted standard the first time round, then a company will save on costs as fewer jobs will have to be redone. This, in turn, leads to increased profitability, since more employees can do more work to recognized standards at a more efficient rate.

According to the manager of technical training at Air Canada, one of the biggest performance and productivity benefits of CAMC standards is that the skills of individuals performing maintenance are known, and therefore the right individual can be assigned to the task the first time.

8. IMPROVED CONFIDENCE AND TEAMWORK SKILLS, LEADING TO HIGHER QUALITY OF WORK

Noticeable changes take place in the confidence and work ethic of employees who work to CAMC standards. Most aviation maintenance and aerospace work is shift work, and often it takes multiple shifts to complete a task or job. In the past, over a period of four shifts, there would be four different people doing the same tasks four different ways based on four different personal standards. CAMC eliminates this by establishing a common standard for all workers in a given occupation.

A painter at Rolls-Royce Canada noted that the CAMC occupational standard for his trade shows employees the best way to do things. It is not meant to put employees down, he emphasized, but to help them work better and more effectively, and ultimately to help the company as errors and mistakes are eliminated. He went on to say that with more and more workers following CAMC standards, there is much more respect between co-workers, and that working conditions are better, as the level of trust in workmanship has also improved. In his own words: "Before we all did our own jobs, according to our own ways . . . and that was that. Now we work together and we solve things together. There is much more collaboration. Because we are working to the same level and standard and using the same techniques found in the logbooks, no one is afraid to ask questions about a procedure or a painting method found within the CAMC standard." One of the most striking changes to the work ethic and culture of the painters is that before sending a job to be formally inspected, the painters themselves now take ownership in their work and collectively conduct their own informal inspections to ensure that the quality and standards have been met to their own level of satisfaction.

VALUE TO EMPLOYEES

Embraced by organizations and industry professionals across Canada, CAMC certification remains one of the most effective ways for employees to reach long-term career goals, and is a reliable way for companies to develop skilled and dependable employees.

Working for an organization that adheres to national standards means that an employee's knowledge, skills and abilities need to remain up-to-date. It also means that employees are building a highly valued work ethic, and a recognized and portable portfolio of skills and knowledge that will serve them well throughout their aviation careers. CAMC certification brings credibility to a technician's, painter's or machinist's portfolio—especially for those trades that are unlicensed, as the CAMC certificate is one of the only portable forms of skills recognition for these occupations.

Licensed trades workers in the industry are less inclined to acquire CAMC certification, because it is not a job requirement, and they are therefore reluctant to invest the required time and money to achieve certification. As one individual interviewed for the study noted, "Licensed aircraft maintenance engineers don't need the CAMC certification to do their jobs, so they either don't pursue it, or let it slide."[28]

CAMC's standards and certification system, according to those interviewed for this case study, is most meaningful to younger workers and recent hires keen on having their skills and competencies recognized. National recognition means that an individual's skills are portable across all regions and most organizations.[29] On the other hand, the industry's older workers (those nearing retirement or who have been in the trade for twenty-plus years) are less inclined to fully embrace and pursue CAMC certification, as they are not looking to advance and are often set in their ways. However, through promotional campaigns within organizations, the support of human resources management teams, and co-workers, and the influence of company policies, more and more workers—regardless of seniority—are embracing the need for and value of CAMC's standards and certification system.

CAMC certification remains one of the most effective ways for employees to reach long-term career goals.

Making CAMC certification a mandatory Transport Canada requirement for all licensed as well as unlicensed trades would be one way to ensure the system was universally adopted. However, all of the managers, supervisors and directors interviewed for this study noted that although this would be a good thing for the industry, it would be extremely difficult to achieve and is not something that will likely happen soon.

KEYS TO SUCCESS

1. OBTAINING INDUSTRY SUPPORT FOR CERTIFICATION

CAMC's national occupation standards and certification system is respected and supported by the aviation maintenance and aerospace industry. Industry support for CAMC's system is not something that was gained overnight, and is based on a long record of trust, integrity, performance and meaningful impact on business operations.

A key component in building this support has been CAMC's efforts to engage industry in meaningful collaboration. CAMC knows that to be relevant and meaningful, its occupational standards must evolve to address new regulations, technologies, and products. The best way to keep on top of industry needs is to involve industry itself in the design and development of the national occupational standards.

National Standing Trade Advisory Committees

CAMC has established 11 National Standing Trade Advisory Committees (NSTACs)—made up of industry practitioners and subject matter experts—to provide technical knowledge and advice on the use and validity of the national occupational standards, curricula and logbooks. The committees meet on a regular basis, typically once a year, to review the standards, discuss current competencies, and ensure that they serve industry needs, and remain relevant and applicable.

The box, National Standing Trade Advisory Committees, lists the areas of expertise for which CAMC has established its NSTACs and the organizations that make up these committees.

Large airlines—one of the aviation maintenance industry's most important clients—also value CAMC's standards and certification system because it is a program that is validated and administered by an external source. AMOs and MROs are constantly being audited by their key clients—predominately the major airlines—to make certain that the people working on their planes are qualified and competent, and that they are receiving the best possible training. Being able to show customers that employees are working to national industry standards developed by a third-party organization, and recognized by Transport Canada, is a real plus for organizations like Rolls-Royce Canada and ACTS.

2. INTEGRATING CAMC'S STANDARDS AND CERTIFICATION SYSTEM INTO EDUCATION AND LEARNING SYSTEMS

CAMC has been able to effectively integrate its national occupational standards and certification system into the public and private learning and training systems, including high schools, colleges, universities, independent training bodies and aviation maintenance workplaces.[30] CAMC has built curricula for 13 of its national occupational standards, through which accredited training programs can offer courses.[31]

National Standing Trade Advisory Committees

1. **Aircraft Maintenance Technician**

   British Columbia Institute of Technology (BCIT), Avipro Helicopters, International Association of Machinists & Aerospace Workers (IAM & AW), Air Canada, Fireweed Helicopters, Canadore College of Applied Arts & Technology (CCAAT), Field Aviation, Transport Canada

2. **Avionics Maintenance Technician**

   Northern Alberta Institute of Technology (NAIT), First Air, CCAAT, IAM & AW, BCIT

3. **Aircraft Gas Turbine Engine Repair & Overhaul Technician**

   Stevenson Aviation & Aerospace Training Centre, BCIT, Rolls-Royce Canada, Standard Aero Ltd., Holland College, Department of National Defence (DND), École nationale d'aérotechnique (ÉNA), MTU Maintenance Canada, Essential Turbines

4. **Aviation Machinist**

   Cormer Group Industries Inc., IAM & AW, Rolls-Royce Canada, Standard Aero Ltd., BCIT

5. **Aviation Mechanical Component Technician**

   DND, Standard Aero Ltd., IAM&AW, Air Canada, Transport Canada, BCIT

6. **Nondestructive Inspection Technician**

   Air Canada, Standard Aero Ltd., Kelowna Flightcraft, First Air, DND, NDT Certifying Agency, Canadian Institute for NDE

7. **Aircraft Painter**

   Fleet Industries, IAM & AW, Air Canada, Kelowna Flightcraft, Rolls-Royce Canada, CAE

8. **Aircraft Structures Technician**

   BCIT, Kelowna Flightcraft, IAM & AW, Air Canada

9. **Aviation Welding Technician**

   Standard Aero Ltd., Red River College, Lincoln Electric

10. **Accreditation Board**

    BCIT, First Air, Standard Aero Ltd., ÉNA, DND, Bombardier Aerospace Training Centre, IAM & AW, New Brunswick Community College, Eurocopter Canada, Air Canada

11. **Registration and Certification Board**

    WestJet, DND, First Air, Air Canada, Rolls-Royce Canada

The benefit to the aviation and aerospace industry of having CAMC-accredited programs delivered in colleges and training institutions has been immeasurable, as potential new hires come to organizations with the technical skills and understanding needed to function effectively.

One challenge that colleges and universities face when offering CAMC curricula is to keep up-to-date with the latest industry components. For example, it is an expensive undertaking to train on the newest Airbus fuel control component, as the mechanism costs in the neighbourhood of CDN$500,000, and is not something

that colleges can readily acquire on their own. However, working in partnership with industry, government and independent organizations, educational institutions can find solutions when the need is great enough.

3. MAINTAINING THE INTEGRITY OF CAMC ACCREDITATION

Maintaining the integrity of CAMC's standards and certification system is essential to its long-term success. All Canadian training organizations are eligible to apply for accreditation of their aviation and aerospace programs. The purpose of the CAMC accreditation process is to ensure that aviation and aerospace programs delivered by training organizations across Canada are of high quality, meet the needs of industry, and offer standardized training delivery—which ultimately supports the transferability of credits across institutions and employee mobility across provinces.[32]

There are 16 learning and training institutions, located in eight provinces across Canada, that offer CAMC-accredited training programs.[33] The box, Insitutions Delivering CAMC-Accredited Training Programs, lists these institutions, which include 12 colleges and four training organizations.

Institutions Delivering CAMC-Accredited Training Programs

ACRO Aerospace

British Columbia Institute of Technology

Canadore College of Applied Arts & Technology

Centennial College

Collège Édouard-Montpetit

College of the North Atlantic

Department of National Defence (DND)-Canadian Forces School of Aerospace Technology and Engineering

École des métiers de l'aérospatiale de Montréal

Gander Aerospace Training Centre

Holland College

Kelowna Flightcraft

Northern Alberta Institute of Technology

Nova Scotia Community College

Renaissance Aeronautics Associates

Southern Alberta Institute of Technology

Stevenson Aviation and Aerospace Training Centre/Red River College

CAMC has an Accreditation Board to ensure that all of the institutions delivering CAMC-accredited training programs meet the highest quality standards and represent the interests and skills needs of the aviation maintenance industry. Accreditation Board members include: British Columbia Institute of Technology, First Air, Standard Aero, École nationale d'aérotechnique, Department of National Defence, Bombardier Aerospace Training Centre, the International Association of Machinists and Aerospace Workers, New Brunswick Community College, Eurocopter Canada, and Air Canada.

Occupational analysis forms the basis of all of CAMC's occupational standards.

4. ENSURING COMPLIANCE WITH INDUSTRY STANDARDS

CAMC develops its occupational standards through a process called occupational analysis. CAMC directs an occupational analysis with the assistance of high-performing employees and subject matter experts, who work together to document the tasks and sub-tasks executed by employees in the performance of their duties. The analysis also itemizes the knowledge requirements to perform each task and sub-task, including what equipment and tools need to be used to accomplish the tasks. This information forms the basis of all of CAMC's occupational standards.

The aviation maintenance industry is often in a state of flux, and as technologies, products and maintenance processes change, so too must the occupational standards that go with them. CAMC's standards and certification system responds to these changes, in part, because of its occupational analysis process and because of the direct involvement of industry in the decision-making process (including through the work of the NSTAC Certification Board). In comparison, the Red Seal program—a program that encourages standardization of provincial and territorial apprenticeship training and certification programs—is not as quick to respond to changing industry needs.[34] A representative of one company interviewed for this study noted that when the company seeks changes to a Red Seal standard (e.g., the Red Seal Welder trade standard)

it takes a significant amount of work and time; whereas when it seeks changes to CAMC's Aviation welding technician occupational standard, the standard is upgraded much more easily and quickly.

5. MAKING THE CAMC LOGBOOK A KEY COMPONENT OF THE CERTIFICATION PROCESS

CAMC's logbook is the common touch-point for all of CAMC's national occupational standards and certifications, and for all stakeholders, including new hires, current workers, labour, organizations, companies, government, training bodies and the education system. They provide everyone with a common language, a common goal, a common set of objectives and targets. The logbooks clearly lay out the steps needed to meet industry-established standards and to achieve certification. They ensure that there is no room for creative interpretation as to what makes up a standard. The integrity of the CAMC logbooks has been, and will continue to be, the backbone of CAMC's national occupational standards and certification programs.

Including CAMC certification in a collective agreement demonstrates a shared level of commitment from all interested stakeholders in the strategic importance of targeted training and skills development programs.

6. CUSTOMIZING THE CERTIFICATION PROCESS TO MEET SPECIFIC INDUSTRY NEEDS

Although CAMC logbooks provide verification that a worker has the skills and competencies necessary to complete a comprehensive set of tasks for a given occupation, they do not provide an appropriate level of detail on specific components for which many organizations are responsible. Nor do the logbooks provide the necessary details about what is required for a technician to be qualified as a specialist. For example, at Rolls-Royce Canada's Montreal facility, employees repair and overhaul a wide range of engines—such as the AE 3007, the BR715 and the Tay 611-8—for airlines as well as corporate and government operators. These engines require a level of detail not found in the occupation-specific CAMC logbooks.

To address this challenge, CAMC has been working closely with Rolls-Royce Canada to implement a customized-certification program for the organization and just recently signed an agreement with Rolls-Royce Canada to certify company employees on its unique engines and components. A key part of this agreement includes customizing the logbooks to meet Rolls-Royce Canada's unique needs, and the development of a specialized endorsement system for Rolls-Royce Canada employees. For example, an employee could become CAMC-certified as a Gas Turbine Engine Repair and Overhaul technician, and be further certified to work on the BR710 engines.[35]

Steve Dick, Chief Executive Officer of CAMC, sums up the growing need for product-specific endorsement: "Since industry has already created proven national standards for its key industry occupations, it only follows that the next step is to develop standards for specialization within occupations."[36]

Customization takes the CAMC certification program to the next level of detail and value by addressing the specific skill and competency needs of original equipment manufacturers and suppliers. Rolls-Royce Canada is not alone, as other companies have expressed interest in the idea of company-specific endorsements based on the CAMC system.

7. MAKING CAMC CERTIFICATION PART OF COLLECTIVE AGREEMENTS BETWEEN WORKERS AND ORGANIZATIONS

Including CAMC certification in a collective agreement between employees and aviation maintenance and aerospace organizations, as has been done at Rolls-Royce Canada, illustrates the value and importance of relevant, focused and nationally recognized skills development and training programs. It also demonstrates a shared level of commitment from all interested stakeholders—including employees, managers and the industry as a whole—in the strategic importance of targeted training and skills development programs. Rolls-Royce covers the costs of specific CAMC training because it makes good business sense. From the employees' perspective, CAMC training helps them enhance their own personal skills portfolios while also acquiring recognized and portable skills credentials.[37]

CONCLUSION

Having a common set of national occupational standards and certifications is something that the aviation maintenance and aerospace industry always envisioned, but was only able to achieve in collaboration with CAMC. Today, CAMC's system of standards and certification serves both licensed and unlicensed trades workers across Canada, and is having a significant impact on the way that organizations develop the skills, knowledge and competencies of their employees in order to succeed in a competitive marketplace.

CAMC's standards and certification system is a good example of how a Sector Council can work with key industry stakeholders to address and overcome pressing human resources issues in a timely, professional and collaborative manner. Today, there is a growing demand for certified workers throughout the country in many industries and occupations. The CAMC model is leading the way in the aviation maintenance and aerospace industry and is in a position to share its expertise and knowledge with other sectors and industries of the economy.

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1 The aviation maintenance and aerospace manufacturing industry is made up of maintenance organizations, manufacturers, suppliers, associations, training institutions, regulators, military, government agencies, employers, employees and educators. For more on the industry, visit CAMC's website at: www.camc.ca/en/index.php?sv=&category=About%20The%20Industry&title=167.

2 The family of Air Canada companies, for example, has multiple AMOs, and the two largest—one of which is Air Canada Technical Services (ACTS)—have a combined workforce of about 8,000 employees. Less than half of the 1,000-plus AMOs certified by Transport Canada employ more than five people. This information is taken in part from: the Government of Canada's *Sector Council Fact Sheet: Canadian Aviation Maintenance Council;* the CAMC 2002 Sector Study*;* and the CAMC website: www.camc.ca.

3 In the spring of 2005 ACTS, for example, picked up a five-year, multi-million dollar agreement to maintain part of Delta Air Lines' fleet, including the maintenance, repair and overhaul of Delta's Boeing 757-200, 767-300m and 767-300ER aircraft. See: www.aircanada.com/acts/en/media032905.html.

4 The aviation manufacturing sector can be divided into four tiers—Tier 1: aircraft/platform manufacturers involved in the design, development, manufacture and marketing of complete aircraft and propulsion systems; Tier 2: systems integrator companies that design, develop, manufacture and market major aircraft systems like landing gear; Tier 3: proprietary product companies that design, develop, manufacture and market proprietary engineered products and sub-systems such as sensors; and Tier 4: parts and services subcontractors that manufacture and supply goods and services such as machined components to companies in Tiers 1–3 and other Tier 4 companies. CAMC 2002 Sector Study*,* (November 2002), p. 4.

5 See: www.camc.ca. The remainder of the workforce—approximately 50,000 employees—consists of individuals engaged in a variety of occupations, including: engineering, management, scientific research and development, training, flight operations, navigation, airport services and operations, pilots and cabin crews.

6 Information for this case study was also gathered from presentations, discussions, and interviews at the CSC National Owners meeting, held in Toronto, Ontario, April 7, 2005.

7 CAMC is served by a board of directors that is made up of business and labour groups representing the aviation and aerospace industry, and includes: Air Transport Association of Canada (ATAC); Aerospace Industry Association of Canada (AIAC); Canadian Business Aviation Association (CBAA); International Association of Machinists and Aerospace Workers (IAM & AW); Department of National Defence (DND); National Training Association (NTA); Association of Canadian Community Colleges (ACCC); and Ontario AME Association (OAMEA).

8 For more information on CAMC, go to: www.camc.ca.

9 Corporate membership demonstrates an organization's support for CAMC and its programs. For the full list of CAMC Corporate Members, go to: www.camc.ca/index.php?sv=&category=Membership&title=Corporate.

10 The aviation industry is very cyclical in nature; however, it is expected that global air passenger traffic will increase annually by 4–5 per cent, and cargo traffic will increase annually by over 6 per cent, for the next 20 years. To accommodate this growth (and to replace aging aircraft), the world's aircraft fleet is expected to more than double, to over 32,000 aircraft by 2022. Many skilled employees will be needed to manufacture and service these aircraft. Somewhat troubling is the forecast that the current capacity of relevant aviation programs at Canadian educational institutions is insufficient to meet new entry requirements of the aviation industry. For an in-depth overview of the industry, see CAMC's 2002 Sector Study: *A Human Resources Study of the Canadian Aviation Manufacturing and Maintenance Industry,* available online at: www.camc.ca/index.php?sv=&category=Resource%20Library~Industry%20Studies&title=2002%20Sector%20Study%20.

11 CAMC 2002 Sector Study, (Exec. Sum.), p. 7.

12 Regulations are based on the International Civil Aviation Organization (ICAO) standards, which are modified to meet the laws, policies, and regulations of individual countries. Transport Canada, the FAA and the JAA are the leaders in regulatory developments and greatly influence the regulations of other countries. Ibid. (2002 Sector Study—Full Report), p. 24.

13 Transport Canada recognition—(Ref: Airworthiness Notice AN-C009). Having Transport Canada recognize CAMC's national occupational standards and certifications helps AMOs fulfill their training and skills designation requirements, and is a good example of how a nationally recognized standard can help independent businesses meet their regulatory requirements. Without the CAMC standards and certification system, organizations find it a much more arduous task to get Transport Canada approval.

14 CAMC's 13 occupational standards and certifications recognized by Transport Canada include: *Aircraft:* Gas Turbine Engine Repair and Overhaul Technician; Interior Technician; Propeller Systems Technician; Reciprocating Engine Technician; and Structures Technician. *Aviation:* Electrical/Electronics/Instrument Component Technician; Machinist; Painter; Mechanical Component Technician; Special Processes Technician; Nondestructive Inspection Technician; and Welding Technician. *Aerospace:* Materials Specialist. The three standards and certifications for which CAMC is in the process of obtaining Transport Canada recognition include: *Aircraft:* Maintenance Technician. *Aviation:* Maintenance Inspector. *Avionics:* Maintenance Technician. Three other standards and certifications for which CAMC is currently not seeking Transport Canada recognition include: *Aircraft:* Simulator Technician; and Refueller. *Aviation:* Ground Services

Attendant. The five occupations being added to CAMC's suite of standards and certification include: Composite Fabricator; Structures Assembler; Aircraft Mechanical Assembler; Electrical/Electronic Assembler; and Maintenance Manager.

15 The cost for an initial Associate Membership application is CDN$84.50, and includes the cost of a logbook (needed to become a Certified Member) and two years' membership. Associate Members seeking renewal are offered a minimum two-year renewal term at a cost of CDN$59.50, and Certified Members are offered a minimum three-year renewal at a cost of CDN$89.49.

16 Currently, CAMC-accredited training programs are delivered in 16 learning and training institutions across Canada. See Table 2 for details.

17 To be working in the aviation maintenance industry or to have acquired experience in the industry one typically must have some previous education background—including for example, a high school diploma, a college certificate or a university degree (typically with a focus in math, physics, communication skills or computers).

18 From: CAMC, *Careers in Aviation & Aerospace, 2004 Edition,* (online) at: www.camc.ca/en/data/files/download/CAMC%20Resource%20Library/CareerGuideweb2004.pdf.

19 CAMC has developed a personal logbook for all 19 of its national occupational standards trades and will have logbooks for another five shortly. It has also established a Registration and Certification Board to ensure quality and relevance of its programs. The Board is made up of key aviation stakeholders including: WestJet, DND, Air Canada and Rolls-Royce Canada, as part of CAMC's National Standing Trade Advisory Committee initiative.

20 Completion of a required training program is often, but not always, recognized as part of the minimum on-the-job experiential requirement. Depending upon the occupation, credit is given ranging from an equal month-for-month basis, reduced by one month for each 100 hours of approved basic training, up to a maximum of 50 per cent of the total experience required; or sometimes not at all. See: *Careers in Aviation & Aerospace, 2004 Edition,* for details.

21 CAMC, *AviNation,* (Winter/Spring, 2005), p. 4. Transport Canada also recognizes the CAMC logbooks, as they relate to maintenance task experience needed to fulfill the requirements towards obtaining an AME license (Ref: AN-C0013).

22 The demands on aviation maintenance professionals in today's competitive market are extreme. Materials, technology, procedures and components are constantly changing, and systems are more complex than ever before—in an engine overhaul there are more than 15,000 possible steps to take. Compound this with shift changeovers, deadlines and other workplace pressures, and it is little wonder that working to a set of established standards is necessary. See: CAMC's Human Factors and Safety Management Program at: www.camc.ca/en/index.php?sv=&category=Human%20Factors&title=HF%20Modules.

23 One manager interviewed for this case study noted that the aviation maintenance industry is 80 per cent reactive and 20 per cent proactive when it comes to adjusting its practices and human factors capabilities. Certification, he noted, helps move the industry forward by being proactive through constant upgrades and adjustments to the standards in acknowledgement of changing technologies, products and processes.

24 With over 2,500 employees in six different countries Standard Aero is a leading supplier of services to the global aerospace, defence and energy industries. For more information, go to: www.standardaero.com/default.asp.

25 It could be argued that the Red Seal Program covers the need for welders and machinists; however, the differences between a general machinist and welder compared to those who work in the aviation and aerospace industry are significant. A Red Seal graduate is, without question, a highly skilled and competent machinist, but may have very little, if any, experience working with the sophisticated tools and high tolerance equipment found within the aviation and aerospace industry. When hired, these machinists require a substantive amount of in-house and specialized training to get them up-to-speed on the intricacies and peculiarities found within the world of aviation.

26 This figure is based on net savings, and includes all overhead training costs, instructor costs, production and administration costs, and lost-productivity costs, over a 5–7 year timeframe (since the deployment and adaptation of CAMC's standards and certification system).

27 It takes a significant amount of training and time to obtain CAMC's aviation painter certification. As well, it costs approximately CDN$9,000 per painter to become certified (for the cost of training programs only). Rolls-Royce Canada is committed to ensuring that the policies and procedures defined by the CMAC registration and certification board are adhered to, and when certifying its members in selected trades, the company is prepared to invest the required funds necessary to ensure the successful certification of its employees.

28 Interestingly, there has been a recent and significant upswing in the number of AMEs pursuing their CAMC certification—perhaps indicating a significant shift in the recognized value of the certification among the licensed trades within the industry.

29 Many of the industry's unions support CAMC's certification system as it brings with it good training, knowledgeable workers, set standards, established rules and portable certifications. At the same time, however, it does put pressure on older workers who are less happy with the movement to standards and certification. A challenge for CAMC and the industry is to get all unions to support the initiative—sooner rather than later.

30 The CAMC Youth Internship Program (YIP) offers high school students an academic orientation and work-based experience in aviation maintenance and technology. YIP is a bridge program for students interested in careers within aviation by establishing pathways for transition from school to the working world of the aviation and aerospace industry. Approximately 450 students from grades 10–12 are participating in the YIP program. For details, see: www.camc.ca/en/index.php?sv=&category=CAMC%20Projects&title=Youth%20Internship%20Program.

31 The occupations that have CAMC-designed curricula include: *Aircraft:* structures technician; nondestructive inspection technician; gas turbine engine repair and overhaul technician; propeller systems technician; maintenance technician; reciprocating engine technician; interior technician. *Aviation:* machinist; mechanical component shop technician; welding technician; painter; electrical/electronic/instrument component technician. *Avionics:* maintenance technician.

32 Training organizations that apply to CAMC for accreditation enter into an agreement that allows them to be inspected any time, and audited by CAMC at least every three years. Organizations are required to demonstrate that their programs meet all of the requirements of the CAMC training standard. Organizations applying for accreditation of an existing program must produce a table of conformance that demonstrates that their lesson plans meet the CAMC curriculum in all respects.

33 This figure includes those institutions that offer CAMC-accredited programs as well as those programs with pending accreditation (e.g., Centennial College, École des métiers de l'aérospatiale de Montréal and DND–CFSATE). In addition to these 16 institutions, there are 13 colleges offering non-CAMC-accredited aviation programs; 11 universities offering aerospace engineering programs; and 24 universities offering professional engineering programs—all of which serve the aviation maintenance and aerospace industry. For details, see: www.camc.ca/en/index.php?sv=&category=Resource%20Library&title=Career%20Guide.

34 For information on the Red Seal program go to: www.red-seal.ca/.

35 CAMC, *AviNation,* (Winter/Spring 2005), p. 7.

36 Ibid.

37 From the employees' point of view, including CAMC certification within the collective agreement at Rolls-Royce Canada speaks volumes about the value they place on the certification system, as it means that they prioritized this learning over other issues that they could have negotiated in the contract, like higher wages.

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by *Douglas Watt*

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