This document is intended to provide additional information related to questions posed by members of the Standing Committee on Government Operations and Estimates during the appearance of Guillaume Valois, Public Relations and Research Manager for the International Association of Machinists and Aerospace Workers, at the May 17, 2022, meeting on air defence procurement projects.

Table of Contents

COVID-19 AND THE AEROSPACE INDUSTRY

While the aerospace industry's main concern at the start of 2020 was how to meet the increased demand for aircraft, that all changed dramatically in March of that year.

The COVID-19 pandemic brought air traffic to a massive and abrupt halt. The situation soon became catastrophic, leading to the largest economic contraction in commercial aerospace history. The near-total disruption of air traffic forced most carriers to postpone, reduce or cancel aircraft orders. This trend has put enormous pressure on prime contractors. As a result, most governments were forced to respond with contingency plans in addition to, or to modify, their respective aerospace policies.

For large original equipment manufacturers, inventory growth reached record highs between March and June 2020. Within the global supply chain, leading suppliers, such as General Electric, Rolls-Royce, Safran and MTU, had to reduce their production capacity by roughly 30% during the first few months of the pandemic.

As part of larger and more diversified organizations, major industrial groups have a better chance of a sustainable recovery from the crisis. The same cannot be said for the network of thousands of small aerospace-only suppliers. Unable to survive without a steady influx of new orders, many of them have been forced to cease operations or have ended up in a tight financial situation.

Overview of the impacts of the crisis on the industry's operations (2020–2021)

- Airbus and Boeing had to reduce their production forecasts by approximately 50%.
- Maintenance and repair operations (MRO) were minimized outside of regular maintenance activities.
- Suppliers, whose financial situation has become precarious, are running out of funds and losing staff and valuable resources, all in the context of a skilled labour shortage and high inflation. This represents an additional obstacle to the continuation of their operations.
- Demand has increased for cargo aircraft as a result of reduced shipping capacity in passenger aircraft.
- The new reality of commercial aviation may increase demand for new-generation single-aisle aircraft or New Midsize Aircraft (NMA).

OVERVIEW OF THE IMPACTS OF THE PANDEMIC ON AEROSPACE JOBS IN QUEBEC

The pandemic has led to significant job losses in the Canadian aerospace industry. In Quebec alone, 4,500 direct jobs were lost out of a total of 43,400. Nearly 40% of aerospace workers reportedly experienced a temporary layoff at some point in 2021. This

trend is beginning to reverse, which is bringing the problem of the skilled labour shortage to the forefront.

RESPONSES FROM INTERNATIONAL GOVERNMENTS

To limit the impacts of the crisis, a number of governments responded proactively by rapidly implementing emergency aid measures and rapidly increasing the number of procurement contracts, particularly in the defence sector.

On June 12, 2020, France presented its aerospace support plan for a green and competitive industry. The €15-billion plan proposes a series of investments in guarantees, loans and various aid programs. In January 2021, the French government said it was considering the possibility of extending government support to Airbus SE and other aerospace companies until 2024, should the new strains of the coronavirus significantly delay the resumption of commercial flights.

The goal of France's strategy is to domestically produce next-generation clean planes and helicopters in order to remain a global aerospace leader.

France's plan is based on the following three axes:

1. Respond to the emergency by supporting companies that are struggling and protecting their employees.

2. Invest in SMEs and intermediate-sized enterprises (ETIs) to support the industry's transformation.

3. Invest in the design and production of next-generation aircraft in France.

The United States Senate approved a $2-trillion stimulus package to support the U.S. economy in March 2020. The package included a budget of $17 billion for federal loans to businesses deemed "critical to maintaining national security." The provisions do not mention Boeing by name, but several sources indicated that it was largely intended to help the company.

Lastly, Brazil, China, Germany, Japan and Morocco also deployed strategic plans to safeguard their aerospace industry.

The establishment of a partnership with all industry stakeholders within a pan-Canadian aerospace policy

Objectives

- Make aerospace a strategic industry for Canada.
- Provide a clear, long-term vision for our aerospace ecosystem.
- Boost our national economy through the efficient and responsible development of a high-value-added industry.

- Mobilize stakeholders in the aerospace industry and increase their level of cooperation.
- Protect and create good jobs.
- Increase Canada's attractiveness to key companies in the industry.
- Expand and enhance existing provincial supports.
- Stimulate and coordinate innovation projects in an effective way.
- Promote the transformation of our productive capacities.
- Enhance coherence and synergy between our national investment policies and our public policies.
- Acquire the tools to anticipate and adapt to changes.
- Encourage the direct involvement of governments and unions in decisions concerning the aerospace industry.

The government is responsible for developing a transparent process and requiring a certain number of commitments from the stakeholders involved when earmarking resources and investing public funds in a project. Otherwise, it is difficult to guarantee results and long-term benefits. We therefore believe that sector-specific aid to an economic pillar like the aerospace industry must include clear rules in terms of economic, technological, social and industrial benefits.

By requiring guarantees of benefits from aerospace companies and establishing win-win conditions, the government will ensure the recovery of our economy while supporting our aerospace ecosystem. This must be achieved in a manner that respects our collective interests and has the public's support.

By setting a clear framework for companies, this policy will also improve the quality of interactions within the industry, making it more effective.

Recommendation

Structure the pan-Canadian aerospace policy with a charter on best practices for relations among the various stakeholders in the Canadian aerospace ecosystem. This charter would serve as a foundation for the policy by incorporating the vision, goals and commitments that will be put forward. By signing and committing to the charter, companies will be able to take advantage of the benefits of the Canadian aerospace ecosystem and contribute to its growth.

OBJECTIVES

- Define the industry's commitments to Canada's economic development.
- Build trusting relationships among stakeholders.
- Bolster the industry's cohesion, resilience and efficiency.
- Respect Canada's economic interests and priorities.

Examples of commitments that can be included in the charter:

- Accelerating the transition to 4.0.
- Prioritizing collaboration and diversification in the supply chain.
- Enhancing collaboration in research and development.
- Prioritizing additional support for the Canadian aerospace industry during restructuring and/or consolidation.
- Ensuring transparent, fair and respectful contractual relationships.
- Increasing mobilization and co-operation for projects related to the green transition.
- Fostering cross-sectoral synergies among Canadian industries.

STABILIZING THE SUPPLY CHAIN

A major breakdown in the supply chain could lead to the shutdown of all or a significant portion of the production activities of prime contractors and leading suppliers. This poses a serious risk to the jobs of tens of thousands of workers and to the financial stability of many companies.

We have been building this industry in Canada for over 100 years. While Canadians recognize Bombardier, Airbus and Boeing, they are not aware that the presence and activities of these prime contractors are supported by a network of 391 companies (2019), a quarter of which have fewer than 100 employees. The Canadian aerospace supply chain represents 10% of the global aerospace supply chain and relies on core companies in Quebec, Ontario, Manitoba, British Columbia, Prince Edward Island and Nova Scotia.

Recommendation

To strengthen and protect the Canadian supply chain, particularly SMEs, we must increase co-operation, agility and versatility in the aerospace ecosystem supply chain.

Objectives

- Ensure access to an efficient supply chain by promoting the repatriation of operations to Canada.
- Increase the footprint of prime contractors.
- Build the sector's resilience, capacity and skills.
- Prevent consolidation, merger and acquisition activities from resulting in operations and jobs going oversees.

The government's role

- Work with industry to identify sectors that could be repatriated.

- Establish a financial aid program to support initiatives to increase the level of supply chain activity in the Canadian aerospace ecosystem.
- Obtain long-term commitments from companies that wish to benefit from the program.

MOVING TOWARD THE FACTORY OF THE FUTURE

Even before being confronted with the challenges of the COVID-19 pandemic, the aerospace industry was facing those of the fourth industrial revolution.

To sum it up in one sentence: the fourth industrial revolution is related to the artificial intelligence. Machines can now communicate with each other and workers in order to spur production and reduce production costs.

In its report entitled "Post Covid-19 Aerospace Industry: An opportunity to embrace the 4.0 Era?" Deloitte identifies four aspects required for a satisfactory implementation of new technologies in aircraft production.

1. Increase the profitability of operations by implementing sensor-equipped processes.

2. Optimize production quality by implementing automated controls.

3. Reduce operating and maintenance costs through the development of robotics and automated operations control centres.

4. Improve EHS (environment, health and safety) practices by digitizing operations.

SME TRANSITION TO 4.0

Helping our industries make the shift to the factory of the future is a way to secure jobs, boost our aerospace ecosystem and revitalize our economy in an effective manner.

Companies that implemented 4.0 technologies before 2020 saw additional gains of 40% to 60% by reducing maintenance time, lowering occupational health and safety costs and accelerating product development.

According to Aéro Montréal's study on 4.0, SMEs are lagging behind the most in the implementation of new technologies. It should also be noted that SMEs that began their 4.0 shift before the COVID-19 pandemic must now deal with the significant drop in revenue caused by the pandemic while having to resume their operations in a difficult context (labour shortage, inflation, supply chain issues), in addition to having to repay the loans that financed the modernization of their operations.

SMEs play an important role in the industry's supply chain, so it would be wise to safeguard their operations in order to prevent their challenges from destabilizing the entire sector.

Recommendation

Incorporate an approach to support SMEs in implementing 4.0 into a pan-Canadian aerospace policy.

This approach can be deployed as follows:

1. Identify and evaluate the potential of SMEs and at-risk activities.

2. For SMEs whose survival depends on the implementation of 4.0 technologies, provide support through targeted programs developed as part of a pan-Canadian aerospace policy.

3. For SMEs that need to repay a loan incurred to finance their 4.0 shift, provide emergency assistance, such as extending the co-lending program and the Business Credit Availability Program, Export Development Canada (EDC), beyond June 2021.

4. Provide a space for dialogue in order to identify and initiate co-operation projects for the 4.0 shift between SMEs and other aerospace industry stakeholders.

5. For SMEs whose operations and expertise are essential for supply chains to run properly, but whose viability cannot be ensured by points 2 and 3, steps may be taken for a merger or acquisition within the Quebec aerospace ecosystem.

This approach could be financed through public and private funds, and a group of industry stakeholders would be created to identify needs and implement actions.

Objectives

- Secure the supply chain.
- Increase the efficiency and productivity of SMEs.
- Ensure that, in the event of corporate mergers or acquisitions, the relevant operations will remain in Canada.
- Support SMEs in evaluating their needs.
- Facilitate the implementation of 4.0 technology within a company without interfering with its operations.

The government's role

- Coordinate the various steps of the action plan.
- Finance a portion of the approach.
- Participate in the establishment and management of the investment fund.
- Contribute to canvassing activities during corporate mergers or acquisitions.
- Ensure that operations and jobs stay in Canada.

AEROSPACE EDUCATION, TRAINING AND WORKFORCE RENEWAL

The academic community has an important role to play in maintaining the vitality and level of excellence of the aerospace ecosystem. Ensuring the development of skills and talent of current workers and properly training the next generation promotes the industry's growth and resilience and the creation of good jobs.

Canada has a strong network of educational institutions dedicated to aerospace. Several of our universities offer advanced programs in mechanical, electrical, computer, aerospace, industrial and metallurgical engineering. Institutions such as the École des métiers de l'aérospatiale de Montréal (ÉMAM) in Quebec, Centennial College in Ontario and the British Columbia Institute of Technology (BCIT) are recognized for the quality of the training they offer. This network allows us to train some of the best skilled aerospace workers, technicians, engineers and researchers in the world.

As Alain Dubuc pointed out in his analysis of the strategic importance of the industry, aerospace, because of the specialization of its workforce, places a significant demand on the education system. Whether for scientific, technical or production jobs, the industry needs highly skilled workers to improve its productivity, continue its transition to 4.0 and renew its workforce.

PREPARING TOMORROW'S WORKERS

According to the main analyses on the implementation of new technologies in next-generation factories, workers will continue to be an important resource. Reducing production costs and manual tasks will not necessarily mean reducing the number of workers in factories. However, it will profoundly change their roles.

Beyond simply executing a task, workers will be asked to participate directly in creating added value in the company and contribute to improving production. This new reality will require them to take initiative and will demand a greater fusion of their manual and intellectual abilities. To prepare future workers for this new reality, they will need to be trained on these new requirements.

Thus, aerospace workers will need to increase their level of knowledge, skills and versatility significantly. The achievement of these objectives depends largely on our aerospace educational institutions. To put our schools in the best possible position to train the next generation of workers, we need to replicate the reality of modern factories in our classrooms.

Aerospace schools in Canada have an important role to play in the development of this industry. However, this requires a review and an accelerated modernization of infrastructure, equipment and learning methods. We need to take advantage of the fact

that the industry is experiencing a downturn to adapt our schools to the reality of a 4.0 factory and what the aerospace industry will look like in the aftermath of the pandemic.

Recommendation

Add a component to the pan-Canadian aerospace policy dedicated to the modernization of infrastructure, equipment and learning methods to ensure the quality, versatility and recognition of aerospace training programs across Canada.

Objectives

- Increase workers' level of versatility and skills.
- Promote high-quality and accessible training that is open to new technologies.
- Increase the level of co-operation among schools and research centres (innovation hubs, updates to training).
- Upgrade infrastructure and equipment.

Role of the Canadian government

- Work with representatives of provincial educational institutions to identify needs and provide financial support for projects to modernize infrastructure and equipment and update training programs.

AEROSPACE WORKFORCE RENEWAL

Currently, the main concern of the vast majority of aerospace companies in Canada is the skilled labour shortage.

The case of Quebec

With an estimated loss of approximately 8,500 workers in 2020, a turnover rate of over 20%, and more than 1,500 job vacancies in early 2021 despite the downturn, it will be a difficult task for human resources to ensure a labour pool that can meet the needs of an ongoing and sustainable recovery.

Managing the issue of the availability of skilled labour needs to be prioritized to maintain a healthy aerospace industry. First, there is the demographic context. The aging of the population is a reality that has direct impacts on the labour market. The aerospace industry is no exception. According to a March 2018 study by the Canadian Council for Aviation and Aerospace (CCAA), employees in the industry are generally older than the average Canadian worker and have half as many workers under the age of 25 as other industries. As a result, one third of the Canadian aerospace workforce will be retired in approximately five years.

A decline in 2020

In Quebec, aerospace companies reportedly to have permanently lost roughly 10% of their workforce in 2020. The gap between hires and permanent departures is largely negative. The labour pool is shrinking particularly among manufacturers, with a net loss of about 14% of the pre-pandemic labour pool, representing 4,000 workers. Manufacturers are also more pessimistic than other employers about their company's short-term prospects. Note that these figures do not include all of the temporary layoffs that occurred during the year, as they are not considered permanent departures. In this regard, we have seen that the COVID-19 pandemic persuaded many of our union members working in the aerospace industry to retire earlier.

Second, there are discrepancies between the profiles of job seekers and those sought by aerospace employers. According to data collected by CAMAQ, the shortage of aerospace workers is explained in 38% of cases by a lack of candidates, in 30% of cases by a lack of experience and in 10% of cases by a lack of training. Aerospace jobs require a minimum of a few months to a few years of professional or in-house training. Technical or university courses last from two to four years. In short, connecting job seekers with aerospace jobs presents both time and skills development constraints.

Third, the cohorts of aerospace school graduates have not been on target for a number of years. For example, the École nationale d'aérotechnique de Longueuil has had an occupancy rate of about 50% since 2018. This lack of interest in aerospace occupations among the next generation of workers appears to be the result of a negative perception of the industry and a lack of awareness of its career opportunities.

The top ten occupations in the aerospace manufacturing industry account for 44% of the workforce. Aircraft assemblers alone account for nearly 10% of jobs. Eight of the top ten occupations require at least college training.

In the next two years, the shortage will be most acute for positions requiring high school or vocational training. Shortages are expected for positions such as machinists, polishers and CNC operators or preparers, which require high school or occupation-specific training.

For the recovery of the aerospace industry to be sustainable, we must ensure that the labour pool corresponds with the industry's needs. For the reasons described above, measures must be put in place quickly to address the skilled labour shortage.

This reality leads us to recommend that the various levels of government work on creating an aerospace trades enhancement program that will take into account the industry's needs, retirement and the duration and level of training required for in-demand trades. This program will need to encourage a renewed and diverse pool of workers in the industry and be able to collect and process the information needed to ensure that the program is effective.

AEROSPACE, GREEN TRANSITION, AIRCRAFT RECYCLING AND CLEAN ENERGY DEVELOPMENT

AIRCRAFT STORAGE AND RECOVERY

The effects of the COVID-19 pandemic on airlines have required them to temporarily store or remove a number of aircraft from their fleets. According to the forecasts of the specialized firm Cirium quoted by Reuters, the number of dismantled aircraft worldwide could double by 2023, from 400 to 500 per year to 1,000 as a result of the pandemic.

Airlines have announced the permanent retirement of 1,200 aircraft since 2020. Of these, nearly 25% are regional aircraft (145 E-Jets, 144 CRJs and 22 ERJs). This trend could accelerate in the fall if U.S. companies are forced to cut regional routes.

Airbus recently announced that it plans to increase the level of aircraft recycling by developing partnerships in different parts of the world. The fact that one of the largest aircraft manufacturers is moving in this direction is a signal that storage and recycling activities present attractive environmental, economic, industrial and technological advantages.

North America has the largest aircraft “graveyard” in the world, meaning that the North American market is currently the biggest and is under-exploited. If a company of Airbus’ calibre can be convinced to partner with companies like Aerocycle and Dynajet Aviation Solutions, the only companies specializing in aircraft recycling in Canada, we could lay the groundwork for a North American aircraft recycling hub.

In addition to its obvious environmental benefits, aircraft recycling would help strengthen our aerospace ecosystem and retain the industry’s workforce; provide new opportunities for training, research and innovation; and increase the level of cooperation in our industrial sector. In order to create the right conditions for achieving this major project, we recommend bringing economic, political and union stakeholders together around the same table.

Aircraft recycling has many environmental and economic benefits. For example, recycled materials can be reused in the interior finishing of aircraft or in the manufacturing of automotive components. In addition, the demand for recycled aluminum is steadily increasing, providing an excellent opportunity for aluminum salvage activities and the dismantling of the thousands of aircraft that are retired or in the process of being retired.

Economically, the residual value of the components and materials contained in these aircraft can be very high with the right dismantling and disassembly technologies. Aircraft are made of high-quality alloys and parts with considerable market value, such as engines and landing gear. However, the number of end-of-life aircrafts does not compare to that of electronics or vehicles. That is why methods must be adapted to the realities of the aerospace and air transport sectors. Research projects on this subject have already been carried out in Quebec. For example, in 2016, as part of the "Aerospace of Tomorrow: Towards a 100% Recyclable Aircraft!" competition organized by Aéro Montréal, a team of four students from the École Polytechnique presented the Cyclair project. The goal of the project was to create a Quebec hub for dismantling end-of-life aircraft that would make it possible to recycle or reuse 100% of the parts of the aircraft.

Aircraft storage serves as a gateway to recycling activities. Storage activities make it possible to build relationships with the airlines and provide a complement to recycling activities. Storage expands service offerings, solidifies customer relationships and diversifies revenue streams. In terms of aircraft recycling, the SMEs Aerocycle and Dynajet put Quebec in an excellent position. As the only Canadian companies accredited for aircraft dismantling and recycling, they represent a significant asset for developing this niche. By further integrating and leveraging their activities within our aerospace ecosystem, Canada has every opportunity to carve out a place for itself in aircraft storage and recycling.

List of key benefits of commercial aircraft storage and recycling activities:

Storage

- As a result of the pandemic, aircraft storage is up sharply and is not expected to stabilize until air travel returns to pre-COVID-19 levels.

- There is a possibility of offering a service to convert former passenger aircraft into cargo aircraft.

- Storage is an opportunity to create maintenance, repair and overhaul (MRO) jobs and/or temporarily reassign workers who have lost their jobs. Stored aircraft must be maintained by airlines, and it is not uncommon for carriers to recover parts from their stored aircraft for reuse on their aircraft in service.

Recycling

- Recycling activities have high potential in a context where airlines have chosen to retire some of the aircraft from their fleets earlier than anticipated.

- Even an end-of-life aircraft has excellent recovery potential.

- The aluminum alloys used in the frame are of very high quality and expensive.

- The most important spare parts can be restored to flight condition (engines, landing gear and avionics in particular) or resold, sometimes for several million dollars.
- The financial situation of airlines will increase the demand for used aircraft and parts. There are therefore attractive market opportunities.
- The recovery of these parts also requires special care and a strict framework to avoid encouraging the black market for spare parts, which exposes the aviation sector to major safety risks. This is an incentive for aircraft manufacturers, air carriers and other types of businesses to get involved in aircraft dismantling.

- Recycling also presents an opportunity to temporarily reassign aircraft manufacturing workers who have lost their jobs.

Other benefits

- New training opportunities.

- Opportunity to become an R&D hub.

- May encourage air carriers to develop their activities in this area.

- Creation of companies specialized in recovering recycled materials.

- Improved waste sorting and recycling methods.

Recommendation
Support initiatives for the storage and recycling of aircraft and their components.

Objectives

- Maintain and create jobs in MRO and manufacturing.
- Increase the level of air carrier activity in Canada.
- Stimulate R&D and innovation (e.g., green aircraft, material lifespans, MRO techniques).
- Promote cooperation among industry stakeholders.
- Increase the number of training and internship opportunities.
- Create cross-sectoral partnerships.

The government's role

- Support initiatives related to aircraft storage and recycling.
- Contribute to research projects on the improvement of aircraft recycling activities and the recovery of recycled materials.
- Support aircraft recycling companies in their efforts to obtain certification and comply with standards concerning the resale of refurbished parts.

CLEAN ENERGY DEVELOPMENT

Recently, a number of countries have made the green transition of the aerospace industry a central consideration of their industrial policy. There is currently a clear desire to reduce the pollution linked to the activities of the aerospace and air transport sectors.

In the fight against climate change, many voices are being raised to demand the decarbonization of air transport. As a result of this movement, a growing number of airlines are looking to reduce their CO2 emissions substantially. Faced with the need to develop energy-efficient aircraft, several aerospace companies are seeking to develop the first "zero-emission" aircraft.

On September 21, 2021, Airbus unveiled three concepts for hydrogen-powered hybrid aircraft. The three aircraft, grouped under the "ZEROe" program, will be available in different configurations. Airbus expects to be able to fly a first demonstrator between 2026 and 2028 and to put its aircraft into service in 2035.

Also regarding hydrogen, on September 24, 2020, ZeroAvia completed the world's first hydrogen fuel cell-powered passenger aircraft flight in Cranfield, United Kingdom. Based in the U.K. and California, ZeroAvia focuses its research activities on hydrogen-electric aircraft propulsion. It is part of the U.K. government's Jet Zero Council and receives financial support from the U.K. Aerospace Technology Institute and Innovate UK.

Significant advances have been made in Quebec in the 100% electric aircraft sector, and we could soon see electric aircraft carrying passengers over short and medium distances. David Rancourt, a professor at the University of Sherbrooke's Faculty of Engineering, recently stated that the commercial potential in the near term, meaning about three to five years, is for two- to four-seat aircraft, with or without a pilot, for passenger transport over distances of up to 150 kilometres. Professor Rancourt is in charge of the design of the Hybrid Extended Range Aircraft (HERA), the first hybrid aircraft in Quebec. Managed by 20 students specializing in mechanical or electrical engineering, the project consists of replacing the engine of a two-seater aircraft with a hybrid fuel-electric engine and a generator to recharge the electric batteries during flight.

RECOMMENDATION

Promote the involvement of CanmetENERGY, their provincial counterparts and university research centres in international R&D groups for the development of clean energy for sustainable aviation.

Objectives

- Stimulate R&D activities in clean energy innovation.
- Build new partnerships on an international scale.

- Generate economic, industrial and technological benefits.
- Accelerate the transition to a green economy.

Role of the Government of Canada

- Coordinate and support R&D initiatives in the development of clean energy for sustainable aviation.
- Involve Canada in international groups working to develop aviation decarbonization technologies.
- Act as an ambassador for the aerospace ecosystem within these groups.

GREEN INDUSTRY AND PRODUCTIVITY

Large aerospace companies generate a significant portion of their revenues during the useful life of the product, which explains the emphasis placed on developing manufacturing processes and increasing useful life. However, not enough attention is being paid to managing an aircraft's lifecycle, even though it has been demonstrated that companies would benefit from implementing innovative processes and strategies that focus on the recovery of all materials and parts, from manufacturing to the end of life of an aircraft.

Increasing the percentage of materials and components that can be reused depends directly on how manufacturers design and manufacture their aircraft. In this regard, aircraft manufacturers will need to incorporate a sustainable development approach by taking into account the refurbishment and reuse potential of components, as well as the recycling of the various materials used in their aircraft.

The Integrated End-of-Life in Conceptual Aircraft Design (IEOLCAD) proposes a framework that combines the integration of environmental variables and end-of-life management of aircraft in the administration of each stage of production. The development sequence suggests that the stages of material selection, design, production methods, supply chain, transportation, flight operations, and end-of-life management be coordinated and planned to produce the least amount of pollution possible.

Aircraft manufacturing, repair and maintenance operations are the stages considered to have the greatest environmental impact. This means that reducing the amount of energy and raw materials needed for these operations would significantly reduce the ecological footprint of the aerospace industry. According to IEOLCAD, economies of scale could be optimized by changing this way of doing business and promoting the exchange and sharing of information among various industry stakeholders. Although research in the field has demonstrated the environmental and economic potential of such an approach since the early 2000s, the lifecycle management of aircraft is still a weak point.

In a context where every measure that can reduce production costs and improve the industry's efficiency is important, maximizing the use of materials, from the manufacturing of an aircraft to the end of its useful life, is essential. It is therefore urgent to foster greater collaboration among stakeholders and to carry out and improve current initiatives in order to maximize the industry's efficiency. Moreover, if only for environmental considerations, improving the lifecycle management of aerospace products will inevitably have to be a part of this reality.

RECOMMENDATION

Support projects aimed at efficient and sustainable management of aircraft production and life cycle.

Objectives

- Improve planning, beginning from the design stage of a new aircraft, of how to optimize the resources used for each phase of the aircraft lifecycle.
- Reduce production costs through the environmentally responsible use of resources in aircraft manufacturing.
- Develop machinery to facilitate the recovery of materials.
- Reclaim raw materials in a manner that is economically and environmentally beneficial.
- Minimize the loss of raw materials used in aircraft manufacturing.
- Facilitate the recovery of end-of-life aircraft.

Role of the Government of Canada

- Coordinate and support projects to improve the efficiency and cost-effectiveness of aircraft production and lifecycle planning activities.
- Foster cross-sectoral partnerships.
- Promote companies that demonstrate innovative practices in this area.