Education in Military Logistics and its Contributions to Aerospace Power: A Brazilian Assessment of Educational Institutions Abroad

Lt Col Abel de Castro Laudares, Brazilian Air Force
Brig Gen (Ret.) Luiz Tirre Freire, Brazilian Air Force

Introduction

Education in the Brazilian Armed Forces aims to equip active-duty military and reserve personnel, as well as civilian personnel, with the necessary competencies to perform their duties effectively and prepare them for the tasks outlined in the Ministry of Defense's organizational framework. The constant pace of technological change, the growing instability between the great powers, and the constant political pressure to reduce military budgets require today's leaders to have intellectual agility that allows them to always act innovatively.

Military training requires a pedagogical approach that includes administrative and operational issues well beyond the barracks' walls. The educational system must be geared toward constant and incremental development throughout military members' careers to address new challenges and conflicts. For example, the Brazilian Air Force (FAB) acquisition of new technology and equipment for the KC-390 Millennium and F-39 Gripen aircraft required the implementation of a curriculum update for the training of both those involved in their operation and those involved in their logistical support.

Due to its multidisciplinary nature, military logistics requires highly qualified and diverse staff capable of performing a wide range of logistics support activities. If there are no efforts to promote educational programs focused on logistics, this profession will stagnate in a very short time.[1] Thus, human resources emerges as one of the most crucial logistical components and a fundamental prerequisite for the effective execution of all activities.

Meanwhile, the FAB is constantly faced with evolving logistical needs due to the dynamic nature and heterogeneity of military capabilities. This requires life cycles that account for a continuous process of transformation and updates to maintain the Armed Forces' ability to operate in a highly complex operational environment.[2]

The primary objective of an armed force's logistics capability is to identify and provide supplies and services to personnel in the appropriate quality, quantity, and opportunity to prepare and execute the mission. The FAB's organizational restructuring framework, regulated by DCA 11-45, "Air Force Strategic Design 100" (2016), describes logistics support capacity as essential to conduct air force actions in any contingency situation, involving activities that enable the air force and military to work.[3]

The "Air Force Strategic Design 100" outlined six fundamental prerequisites to ensure that logistics support capacity can meet Air Force requirements while considering strategic factors and regional contingencies. To meet these requirements, it is imperative for logistics education to aid in the fulfillment of these requirements by acquiring modern management concepts applicable to the entire supply chain. This education should encompass current topics in various domains, such as decision support systems, simulation and modeling, artificial intelligence, and other related topics.

In general, nations plan and implement their military education programs to meet current and future demands for the use of their war equipment, considering their specific challenges. In turn, armed forces invest in education and specialized training of its troops to ensure high logistics performance levels. However, how well do these programs specifically support the FAB education system in the long term?

This article evaluates whether leading educational institutions abroad (EIA) with whom FAB has an ongoing exchange program have contributed to developing Brazilian aerospace power's long-term sustainability, considering current issues related to military expenditures and advances in global military logistics education.

This article is organized into five complementary sections and uses qualitative descriptive research, including methodology, bibliography, and field research to meet the proposed objective. The first section presents the background, purpose, contribution, and relevance of the present study and the structure of this article. In the second section, we will provide a literature review of the main concepts and works related to this research. The third section will address the research methodology used.

The fourth section discusses EIAs and compares their education programs in logistics. The fifth section examines the outcome of more effective use of some EIAs regarding teaching topics related to the FAB's logistics sustainability. The sixth section concludes the article with a summary of the highlights.

Development

Literature Review

This section provides the theoretical foundation for the discussion. Considering the study's objective, three fundamental areas must be understood: logistics theory, capabilities, and requirements for logistics support, and finally, the relationship between military logistics education and Brazil's Aerospace industry.

Logistics Theory

Military leaders have used logistics since biblical times. Logistics were especially necessary for the long duration and distances involved during the conflicts at the time, which required large and constant displacements of resources. Military troops, weaponry, and heavy war machinery needed to be transported to combat sites, and these activities required the development of strategic routes, necessary for access to nearby drinking water, transportation, storage, and distribution of equipment and supplies.

In the first half of the nineteenth century, French general Baron de Jomini defined logistics as the art of moving armies. For him, logistics included not only transportation but also support, administrative preparation, reconnaissance, and intelligence in the movement and support of military forces. Logistics is all or almost all of the field of military activities except combat, according to Gen Jomini.

Over time, logistics has changed from a strict concept about the movement and physical distribution of goods and services to a more general concept about the supply chain as a whole. The Council of Supply Chain Management Professionals defines logistics as the process of planning, executing, and overseeing the flow and cost-effective storage of raw materials, inventory of in-process items and finished goods, and related data from the point of origin to the point of consumption to meet customers' requirements. The North Atlantic Treaty Organization defines logistics as the science of planning and executing the movement and maintenance of forces. Although the term "logistics" may have several meanings, in essence, it is related to having the right thing at the right place and time. Logistics also serves as the bridge between deployed forces and the industrial base, providing the materiel and weapons the deployed troops need to accomplish their mission, critical for any military operation. Without it, operations cannot continue and succeed.

The FAB uses the Aeronautics Logistics Doctrine (DCA 2-1/2003) to define the range of activities related to forecasting and provisioning of all types of resources to meet adequate quantity, time, and location requirements.[4] At the same time, it defines the fundamental logistics roles used in aerospace as human

resources, health, supply, maintenance, engineering, and transport. These logistics roles consist of grouping activities and tasks related to or of the exact nature to meet the needs of the air force.

Logistics Sustainability Capabilities and Requirements

The purpose of logistics for the Department of Defense is obvious: to support military operations and the troops participating in them.[5] Despite the apparent simplicity of this statement, the ability to support an armed force is tied to a wide range of uncertainties and issues. Long and distant conflicts demand planning, organization, and the ability to perform military support activities.[6]

From a systematic perspective, we can say that defense logistics is a science that involves planning and executing procedures that meet the needs of the armed forces with the aim of achieving and maintaining the operational readiness required for military operations. Based on this premise, it can be inferred that logistics is the foundation for the success of military operations, from initial education to the provisioning and maintenance of gear and equipment at the war front.

Military deployment support capability requires the coordinated participation of key personnel. The Brazilian Defense Strategy states that the logistics capability required for national defense is based on military logistics and its systemic actions, involving the direct and indirect interactions of various national sectors trained in seven logistical roles: engineering, maintenance, human resources, rescue, health, supplies, and transport.[7]

The FAB meets these roles under its "Air Force Strategic Design 100," which identifies six essential requirements to meet the logistical capabilities needed to forecast, provide, and maintain the resources and services necessary.[8]

- Effective logistics and administrative procedures.
- Facilities and equipment for limited duration deployments in the national territory, to ensure the operation of aircraft and space platforms.
- Engineered modular squadrons to serve locations without established infrastructure.
- Ability to pre-deploy resources and services to support pre-planned activities and rapidly replenish provisions to meet contingencies.
- Interagency and armed forces interoperable logistical support capability.
- Integration with the national defense industrial base to ensure optimal FAB performance.

Achieving these capabilities means constantly planning and preparing equipment and facilities and especially providing support to logistics staff. Therefore,

training military logistics personnel requires regular updating and modernization in the early stages of the training, correctly defining curricula, and theoretical and practical study plans corresponding to the different levels of training and activities to be developed.

From a professional training perspective, "Air Force Strategic Design 100" sets out requirements for each one of the knowledge-based areas identified as relevant to meet the objectives. The FAB has taken the initiative to invest in developing and enhancing its military personnel's education in such topics, both in person and distance, to meet these requirements and consequently enhance the FAB's logistical capacity.

Military Logistics Education and Brazilian Aerospace

Brazilian aerospace developed swiftly in the nineteenth and twentieth centuries, driven chiefly by broad conflicts of humanity during this period. This constant change requires the military to be prepared for situations with varying degrees of complexity and solutions presenting high levels of uncertainty.

In this context, the success of any military deployment depends on a plan that allows for the preparation and support of all actions to be carried out on time. It is based on reliable and updated data that is flexible and complete for dealing with the change in facts and elements that go beyond the limits of the purely military field.[9]

FAB logistics personnel are continuously trained throughout their careers. That includes training courses in schools and military institutions starting at basic levels of training and continuing to higher and specialized graduate courses. The syllabus covers fundamental topics like transportation and inventory management, as well as future trends, which will allow for the addition of new administrative and operational capabilities to the FAB to meet the demands of a nation with a broad international reach.

The strategic context where the Brazilian aerospace industry has been active is getting more unstable, complicated, and uncertain. Current conflicts, both state and nonstate, have been characterized by a variety of different players, blurring the lines between war and peace. Moreover, because of the speed of information dissemination, the conventional physical, maritime, and land combat areas have joined the cyber domain, becoming a highly destructive, silent, and irreversible threat.

Thus, the FAB has sought to establish cooperation agreements in different areas of research and education as well as contracts aimed at increasing exchanges and partnerships between researchers in universities, international research institutes, and other educational institutions.

Methodology

The author chose the taxonomy presented by Sylvia Vergara and John Creswell to achieve the objectives of this study.[10] Therefore, this study undertakes descriptive research to reveal the characteristics of a phenomenon related to a specific population.

Regarding research methods, this study was focused on two main areas: bibliography and field studies. The bibliographic analysis is based on sources open to the public, such as books, articles, and target research educational institutions' websites. The field study was carried out at the Institute of Logistics of the Aeronautics (ILA) through unstructured interviews with military personnel.

This study is a qualitative investigation. Creswell highlights that the primary objective of qualitative investigation is to understand the context in which a phenomenon is inserted based on the connection that this phenomenon forges with the subject and is interpreted by it. Similarly, Creswell argues that qualitative research should be used when a phenomenon needs to be investigated and this investigation involves groups or populations.[11]

Research Results

In this section, the study seeks to present and assess the results from this survey, covering several EIAs and a comparison between their logistics education programs.

The armed forces' mission and tasks require the military to be highly committed to the proper execution of the mission. This commitment is tied to the nature of the mission nature and dependent on being provided military experience and training relevant to assigned mission roles. The more significant the difference between the mission and the professional capability to perform it, the less likely the mission will be accomplished efficiently and effectively.[12]

The Defense Department's technology development program has created a high demand for trained and updated military personnel, who must be able to manage innovative and highly systematic logistics operations due to the adoption new technologies and state-of-the-art military equipment. They must be able to pull together diverse processes, while implementing cost reduction measures, and an efficient flow of information.

Military logistics is taught not only in military academies but also in universities and educational institutions. Thus, knowledge and skills acquisition in military logistics is merged with other logistics areas through courses organized and implemented by companies and educational institutions. In most military institutions, training in military logistics begins early at training schools and is augmented through sensu lato and sensu stricto specializations.

We assessed the leading foreign EIAs with which the FAB has academic cooperation agreements, especially in master's and doctorate programs, by using their respective websites on the internet. Usually, FAB institutions, such as the Instituto Tecnológico de Aeronáutica (ITA) and the Instituto de Logística da Aeronáutica (ILA), promote the exchange of their students between these educational institutions through their postgraduate courses with the purpose of exchanging experiences, joint research activities, publications, and technical training. The six EIAs listed here, labeled A through F, promote excellence in education and research in their countries' armed forces, with which the FAB maintains academic cooperation.

EIA A: Air Force Institute of Technology (AFIT)

AFIT is the main US Air Force institute, located at the Wright-Patterson Air Force Base in Dayton, Ohio. It serves as a postgraduate institution focused on defense and related research that is operationally relevant to sustaining the technological supremacy of US Air Force aerospace and cyber operations.

Dayton's aviation-oriented heritage and industrial base, along with its proximity to the Air Force Research Laboratory and the National Center for Air and Space Intelligence, favors students in many areas of scientific research. AFIT is divided into four main schools: the School of Engineering and Management, the School of Systems and Logistics, the Civil Engineer School, and the School of Strategic Force Studies.

As such, the effects of AFIT's educational programs permeate the US Air Force and the US Department of Defense. AFIT is committed to providing cutting-edge, defense-focused education through research, continuing professional education, consulting, space, and cyberspace to support the technological evolution and supremacy of America's air, space, and cyber forces.

EIA B: Naval Postgraduate School (NPS)

NPS offers defense-focused postgraduate courses, including interdisciplinary research involving defense-sensitive topics to promote operational effectiveness, technological leadership, and combat advantage to naval power.

Located in Monterey, California, NPS' campus covers 627 acres of land and since 1951, has provided state-of-the-art laboratories, academic buildings, a library, government housing, and recreational facilities.

The student body consists of officers from all US military forces, civilian officials from federal, state, and local government, and officials and civilians from 55 foreign countries. Among the main courses, NPS offers master of arts, master of business administration, master of science, and doctor of engineering degrees.

NPS emphasizes study and research programs relevant to the interests of the Navy and those of other sectors of the US Department of Defense. Programs are planned to accommodate the unique requirements of the military, Department of Defense, and other federal agencies, including requirements for defense acquisition certification.

NPS has three schools, several research departments, research institutes, and research groups. Among these schools and departments, the following stand out: the Graduate School of Engineering and Applied Sciences; the Graduate School of International and Defense Studies; and the Graduate School of Operational and Information Sciences.

According to NPS, the institution's goal is to provide students with an advanced education oriented toward critical thinking and the comprehensive technical skills needed to fight and win future conflicts. In this context, many of the NPS's research and academic programs relate to the operational level of warfare.

EIA C: Cranfield University

Founded in 1946, Cranfield is a public university in England focusing on graduate and research programs in science, engineering, technology, and management. The university works closely with businesses, industry, and governments worldwide, developing applied research projects and executive education programs. In this context, it develops specialized topics in aerospace, defense and security, energy, environment and agri-food, manufacturing, transportation systems, and water.

The military aerospace and airworthiness program offered by Cranfield University is designed to meet the needs of employees of the UK Ministry of Defense (MoD), the armed forces, and the international defense industry. Despite being a public civilian university, Cranfield offers master's degrees explicitly focused on military context, with classes taught by staff from Cranfield Defense and Security and the School of Aerospace, Transport and Manufacturing.

In 2005, through a contract with the MoD, Cranfield University took over the responsibility for qualifying around 4,000 military students per year, offering 80 courses, ranging from short courses to doctorates in areas such as defense technology, information management, strategic leadership, procurement management, and security studies. In 2021, Cranfield University and the Royal Air Force signed an agreement including research, innovation, and education in related areas between the two institutions. Because of this partnership, the two institutions have been working on research involving military personnel training in space and artificial intelligence.

The University of Cranfield has two campuses, one near the Vale of Cranfield and the other in Shrivenham. At the Cranfield campus, there are several short and

long-term courses in areas such as aerospace defense and security, environment and agri-food, manufacturing, transportation, and water systems. At the Shrivenham campus, there are several courses related to security and defense, such as defense and security engineering (design, manufacturing, mobility, impact, armor, propulsion, aerodynamics, robotics, autonomy), defense chemistry, weapons, digital warfare, and cybersecurity, combating terrorism, among others.

EIA D: Luleå University of Technology

Luleå is in northern Sweden. Its main facilities are in Luleå, in the province of Norrbotten, and it has branches in Skellefteå, Piteå, and Kiruna. The school averages 15,500 students, of which 579 are doctoral candidates.

It collaborates in research projects with companies such as Ericsson, Scania, LKAB, Airbus, Bosch, SKF, Boliden, Vattenfall, Trafikverket, Volvo, and Metso. It has cooperation agreements with universities such as Monash, Research Institute on Mines and Environment, Stanford, and ITA. Since 2010, the University of Luleå has partnered with the Swedish Armed Forces through a master's program in information security.

Among the various courses offered, it offers a master's in maintenance engineering. According to the University of Luleå, the program is designed to maintain a high academic level while dealing with real industrial problems. Courses such as "Condition Monitoring and Condition Based Maintenance" or "Degree Project in Maintenance Engineering" use actual examples and cutting-edge methods for their students' education.

Due to the acquisition of the F-39 Gripen fighters, the Brazilian government has established compensation agreements with the Swedish government in research areas. Among the various agreed proposals, the University of Luleå participates in research areas such as aircraft design and operations; aerodynamics, aeroacoustics and Computational Fluid Dynamics; structures and materials; product development and manufacturing; propulsion systems; and embedded systems and security.

In addition, the University of Luleå, in partnership with ITA, will jointly develop some projects, such as: laboratory of logistics and maintenance engineering, maintenance planning methodologies for military aircraft, systems safety and reliability for the conceptual design phase, the 3D fabric of composite material for reinforcement of mechanical joints, and other stress concentrations.

EIA E: University of Twente

Founded in 1961, the University of Twente is in Enschede, Netherlands and has a variety of bachelor's programs, master's, and doctorate. They also offer 31 bachelor's and master's degree programs offered in English, all focused on technological medicine, robotics, information technology, business and public policy, chemistry and engineering sciences, earth observation, and natural and social sciences.

Among its many courses, the University of Twente has master's courses in applied artificial intelligence, maintenance engineering, space science, and technology. The University of Twente recently established a cooperation agreement with the Brazilian Ministry of Defense and the Royal Dutch Army for education and research in innovation in maintenance, engineering, and laboratories for research in master's courses.

In 2021, Brazil's Instituto Tecnológico de Aeronáutica signed the renewal, for another five years, for a double master's degree agreement in the areas of mechanical and aeronautical engineering, which will allow the exchange of students by receiving Dutch students and sending FAB military personnel to the University of Twente.

EIA F: Institut Supérieur de l'Aéronautique et de l'Espace (ISAE-SUPAERO)

Founded in 1909, the ISAE-SUPAERO is a public university in aeronautical engineering and is located in Toulouse, France. The French Ministry of Defense has an agreement with ISAE-SUPAERO for the academic training of engineers and researchers and the initial military training of aviation officers.

ISAE-SUPAERO comprises a consortium of schools specializing in aeronautical and space engineering, providing diverse advanced programs devoted to Engineering, which are internationally renowned.

There are six schools with approximately 60 training programs with unique scientific and technical backgrounds, and about 2,000 of their graduates per year enter the industries and institutions in the aerospace sector.

The Department of Design and Operation of Aeronautical and Space Vehicles at ISAE-SUPAERO develops methods, simulation tools, and experimental platforms for designing and operating aeronautical and space vehicles. They also develop training and research activities focused on air transport and future space systems, integrating environmental and socioeconomic dimensions in their studies.

Comparison of Educational Programs in Logistics

Exchange programs promote the consolidation, expansion, and internationalization of science and technical-scientific innovation.[13] These programs have numerous advantages, including training highly qualified personnel in skills and abilities necessary for their future technological advancement.

From this perspective, experiences of this type are highly relevant as they add value to professional and personal growth. However, this research for new skills and capabilities must be aligned with organizational demands. Additionally, the structure of logistics training programs should be planned and developed to meet market needs.[14]

Considering the prerequisites for a suitable logistics support capacity for aerospace power as stipulated by the "Air Force Strategic Design 100," the author conducted a comparative analysis to determine whether these educational programs address these issues in their courses.

As for the topics related to the requirements, considering that the greater focus on exchanges demanded by the FAB concerns master's and doctoral courses, disciplines with themes and nomenclature similar to those shown in the table below were considered relevant.

As for the definition of topics related to the requirements, the author opted for unstructured interviews with military personnel from the ILA, who are ITA's former students and had participated in exchange programs like those targeted in the research. In this interview, we tried to capture approximately four themes related to the questions' requirements, as shown in the following table.

In addition, as a criterion for choosing the EIAs, the author opted for a convenience sample of six EIAs which are a reference in education and research for the armed forces in their countries and have an academic cooperation agreement with FAB institutions, such as the ILA and ITA through postgraduate exchanges in master's and doctorate courses.

Requirements	**Topics assigned to requirements**	**Presence (+) or absence (-) of topics of interest in courses**					
		EIA A	**EIA B**	**EIA C**	**EIA D**	**EIA E**	**EIA F**
I	Planning, programming, and logistical controls	+	+	+	-	+	-
	Process management	+	+	+	+	+	
	Information technology management	+	+	+	+	+	-
	Organizational management	+	+	+	+	+	-

Requirements	Topics assigned to requirements	Presence (+) or absence (-) of topics of interest in courses.					
		EIA A	EIA B	EIA C	EIA D	EIA E	EIA F
II	Distribution and transportation operations	+	+	+	–	+	–
	Supply chain management	+	+	+	–	+	–
	Maintenance, repair, and overhaul management	+	+	+	+	+	–
	Procurement management	+	+	+	–	+	–
III	Project management	+	+	+	+	+	+
	Construction and paving technologies	+	–	–	–	+	–
	Operations research and decision analysis techniques	+	+	+	+	+	–
	Defense modeling and simulation	+	+	+	–	–	–
IV	Decision support systems	+	+	+	+	+	–
	Artificial intelligence and machine learning	+	+	+	+	+	+
	Digital twins	+	+	+	+	+	–
	Transportation systems and strategic mobility	+	–	+	–	+	–
V	Electronic countermeasures techniques	+	+	+	+	–	–
	Attack and defense of computer networks	+	+	+	+	+	–
	Joint military operations	+	+	–	–	–	–
	Planning and conducting interagency operations	+	+	–	–	–	–
VI	Maintenance, logistics, and supply chain	+	+	+	+	+	-
	Development and prototyping of warfare systems	+	+	+	-	-	-
	Systems engineering for logistics support	+	+	+	+	-	-
	Logistics contract management	+	+	+	-	-	-

Table: Comparative analysis of educational programs in logistics

Source: Author

Analysis and Discussion

Internationalization of higher education provides frequent and valuable exchange of knowledge that contributes to doctrinal improvement and increased interoperability between the forces. From the FAB's perspective, the advantage of these cooperation agreements is that students can undertake internships as part of their courses overseas, which also provides a network for the exchange of researchers and professors in addition to carrying out joint research and project development opportunities in leading education institutions worldwide.

Despite the various advantages, by comparing some thematic areas offered by postgraduate courses in these EIAs, it was observed that from an educational standpoint, some EIAs, such as A, B, and C, meet almost all topics related to the requirements proposed by the strategic design plan, while institutions C, D, and E have some specific advantages. However, EIA E contributes little to the education topics related to logistics requirements, albeit filling some specific knowledge gaps, such as promoting joint research projects in areas of mutual interest, exchange of academic publications, exchange of experiences in education methods, course structuring, organization of symposia, workshops, and joint conferences.

Regarding topics related to the requirements focused on defense and the use of military power, military institutions such as EIA A and B, as well as institutions with more significant partnerships with the armed forces of their countries, such as EIA C, give more emphasis to these topics in their postgraduate courses.

Conclusion

This article aimed to discuss and verify whether a portion of the main EIAs FAB partners with student exchange programs, offer programmatic content that contributes to the logistical support capacity of the FAB.

The motivation for this effort arose from the constant evolution of new vectors and aeronautical equipment that are equipping FAB and, consequently, demanding constant improvement of logistics military personnel skills with a view to proper logistics support management.

Faced with this challenge, the author decided to investigate what future expectations for the FAB might be. The main document that guides the future of the FAB until 2041, the DCA 11-45 (2016 version), "Air Force Strategic Design 100," was studied to identify the logistical support capabilities described as essential to conducting force actions, to enable the deployment of air force and military power.

Considering that DCA 11-45/2016 highlights six fundamental prerequisites for the logistical support capacity to meet the air force's operations, this article

sought to verify whether the programs offered by EIAs adhere to the themes suggested by the ILA's military personnel interviewed and the programs offered by these EIAs.

From this proposal, the authors generated a comparative table to measure and present its findings. Based on the information provided by the websites of the researched EIAs and topics considered essential for the requirements proposed in DCA 11-45/2016, the authors noted that the EIAs with greater adherence to military matters have educational programs that contribute more to the training of military logistics, with regards to the topics listed and requirements defined in the strategic design plan.

Other EIAs, like EIA F, were removed from the sample, as they were military institutions without theoretical or practical disciplines in their portfolio of courses focused on military matters or related to the topics listed in table.

The primary contribution of this study is to indicate which EIAs exhibit a stronger correlation with the essential requirements for ensuring logistical support capacity compared to those with a lesser correlation. With this knowledge, establishing priorities during the selection and choice of EIAs will undoubtedly enhance the training of military logistics personnel, thus contributing to the optimum logistical support needed for the new vectors of the FAB.

The authors suggest continuing this study to increase the scope of the table by adding additional EIAs, as well as adding new areas related to the requirements proposed in DCA 11-45/2016. Finally, it is worth mentioning that all the institutions mentioned in this work and the others that maintain academic cooperation agreements contribute in some way to education and research programs at the FAB. Nonetheless, in conclusion, it has been observed that some EIAs contribute more directly to the logistical activities necessary to attain the FAB's core mission. ❑

Notes

1. David Streett, "What Does the Future Hold for Young Logisticians?" *Air Force Journal of Logistics,* Vol 9, No. 3, (1995) , 4, https://apps.dtic.mil/sti/pdfs/ADA302519.pdf.

2. Brasil, *Livro Branco de Defesa Nacional* (National Defense White Book) (Brasília: Ministério da Defesa, 2020), 195, https://www.gov.br/defesa/pt- br/assuntos/copy_of_estado- e- defesa /livro_branco_congresso_nacional.pdf.

3. Ten Brig Ar Nivaldo Luiz Rossato, *Concepção Estratégica Força Aérea 100* (Air Force Strategic Design 100) (Brasil: Ministério Da Defesa, 2018), https://www.fab.mil.br/Download/arquivos /DCA%2011-45_Concepcao_Estrategica_Forca_Aerea_100.pdf.

4. Comando da Aeronáutica, "Portaria (Ordinance) n° 912/GC3," (Brasília: Boletim do Comando da Aeronáutica, 25 September 2003), N° 190.

5. Moshe Kress, *Operational Logistics: The Art and Science of Sustaining Military Operations* (London: Springer, 2016).

6. Rodrigo Diedrich, *Logística empresarial* (Business Logistics) (Rio Grande do Sul: Ediouro, 2007).

7. Brasil, *Estratégia Nacional de Defesa* (National Defense Strategy) (Brasília: Ministério da Defesa, 2020), https://www.defesa.gov.br/estado-e-defesa/estrategia-nacional-de-defesa.

8. Comando da Aeronáutica, "Portaria (Ordinance) n° 189/GC3," (Brasília: *Boletim do Comando da Aeronáutica*, 30 de janeiro de 2017).

9. Bruno Américo Pereira & Flavio Neri Hadmann Jasper, *Instrumentalização do Poder Aeroespacial: o caso do KC-390* (Instrumentalization of Aerospace Power: the case of the KC-390) (Brasil: Editora Dialética, 2021).

10. Sylvia Constant Vergara, *Projetos e Relatórios de Pesquisa em Administração* (Projects and research reports in administration), 9th ed., (São Paulo: Atlas, 2007); John W. Creswell, *Projeto de pesquisa: métodos qualitativo, quantitativo e misto*, 2nd ed., (Porto Alegre: Artmed, 2007).

11. John W. Creswell, *Projeto de pesquisa: métodos qualitativo, quantitativo e misto* (Research design: qualitative, quantitative and mixed methods), (2007).

12. David Pion-Berlin, "Cumprimento de missões militares na América Latina," (Fulfillment of military missions in Latin America), Vol. 28, N° 48, *Sci Elo 25*, (2012), 627-643, https://doi.org/10.1590/S0104-87752012000200008.

13. Indiara Sartori Dalmolin et al., "Intercâmbio acadêmico cultural internacional: uma experiência de crescimento pessoal e científico," (International cultural academic exchange: an expe-rience of personal and scientific growth), (*Revista Brasileira de Enfermagem*, Vol. 66, N° 3, (2013), 442-447.

14. Yen-Chun Jim Wu, "Contemporary logistics education: an international perspective," In*ternational Journal of Physical Distribution & Logistics Management*, (2007).

Lt Col Abel de Castro Laudares, Brazilian Air Force

Lt Col Abel de Castro Laudares is currently chief of the teaching division at the Brazilian Air Force Logistics Institute. He holds a bachelor's degree in production engineering (2016) and accounting sciences (2020), master's in aerospace sciences (2019) and is a PhD student at the Brazilian Air Force University's Aerospace Sciences Postgraduate Program. He graduated as a military aviator from the Brazilian Air Force Academy in 2001 and his previous operational assignments include command of the C-115 Buffalo and C-105 Amazonas aircraft at Manaus Air Force Base. He's served as an instructor pilot and chief of the Aircraft Maintenance Squadron as well.

Brig Gen (Ret.) Luiz Tirre Freire, Brazilian Air Force

Brig Gen Freire, PhD, is a professor at the Brazilian Air Force University Postgraduate Program, the Brazilian Air Force Command and Staff College, the School of Army Command and Staff College, the Superior School of War, and the School of Socio-Educational Management. Freire also authored "Impact on the Defense Budget" and commanded the Logistics Command in the Ágata VI operations area.