DAIO Defense AI Observatory

Exploring the Benefits of a New Force Enabler

Defense AI in Italy

Andrea Gilli, Mauro Gilli, and Ivan Zaccagnini

DAIO Study 22|05

Ein Projekt im Rahmen von
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Zentrum für Digitalisierungs- und Technologieforschung der Bundeswehr

About the Defense AI Observatory

The Defense AI Observatory (DAIO) at the Helmut Schmidt University in Hamburg monitors and analyzes the use of artificial intelligence by armed forces. DAIO comprises three interrelated work streams:

- Culture, concept development, and organizational transformation in the context of military innovation
- Current and future conflict pictures, conflict dynamics, and operational experience, especially related to the use of emerging technologies
- Defense industrial dynamics with a particular focus on the impact of emerging technologies on the nature and character of techno-industrial ecosystems

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Content

1 Summary

As a latecomer to defense artificial intelligence (AI), Italy is trying to catch up, with its commitment to defense AI being part of its broader digitalization plans for the Armed Forces. The Italian government views AI technologies as both potential threat as well as an asset that can enhance its own capabilities. The former has played a critical role in the government's commitment to keep human involvement in decision making (human in the loop) while modernizing. Italy warns about AI application with other emerging and disruptive technologies such as unmanned and autonomous vehicles (Swarming and Robotics). At the same time, Italy considers Defense AI as a force enabler, something that could strengthen Italian Armed Forces' capabilities on the battlefield through advanced sensors and automation, data fusion and support for decision-making process.

Since 2007 an ambitious procurement and digitalization process has been ongoing through the so-called Force NEC (Network Enabled Capabilities) program. It aims to modernize, digitize, and integrate Italian Armed Forces, putting old and new military assets "into network" to enhance the computational, information exchange, communication, and situation awareness capabilities by 2031. Moreover, in 2021 the Italian Ministry of Defense allocated €190M for a program dedicated to AI development and enhancement in the period 2021-2035. Even though this is probably the only project exclusively dedicated to defense AI, many programs (national and multinational) financed by Italy for the same period include the design, development and application of defense AI elements and components. The Future Combat Air System, the Naval Future Combat System, the Safe Soldier System, and the Robotics and Autonomous Systems Experimentation Campaign, are good examples.

Worthy of note is the fact that the Italian Armed Forces are developing their main projects synergically with its whole AI ecosystem – which includes universities, military, and civil research centers, as well as private and public high-tech companies. For example, Leonardo has been largely involved in all the phases of the Force NEC program acting as prime contractor, system integrator and systems authority for the architectural requirements.

Finally, most Italian defense AI development projects are designed with the goal of optimizing resources and ensuring integrability and interoperability both among the branches of the Italian Armed Forces as well as among NATO allies and platforms – also true for AI and simulations geared towards training. The Italian Armed Forces has set some specific goals that it intends to meet by 2035, but it still needs to be seen whether they will be able to meet them by this deadline.

2 Thinking about Defense AI

Artificial Intelligence (AI) is a critical technology for both the commercial and the military domains. Commercial companies such as Google, NVIDIA, Alphabet, Amazon, META, or IBM are market leaders in AI technologies applied to projects such as guidance systems for autonomous vehicles, processing software, algorithms for e-commerce searches, social networks, targeted advertising, virtual reality, visual tracking systems and many others. At the same time, according to many experts and practitioners the defense industry and military organizations appear to be late (at least in some sectors) but they are catching up quickly. Today most of the medium and great powers of the world have understood that defense AI will be a key strategic technology in future conflicts as well as in global competition general.

Italy has officially recognized the importance of applying AI to defense. Even though it is considered a "latecomer", both the Italian government and its Armed Forces (Esercito Italiano, Marina Militare and Aeuronautica Militare)[1] have listed AI in their official documents as one of the key technologies in which the country must invest in the present and in the future. Accordingly, Italy has planned a development and funding program which comprises AI and other related technologies.[2]

In 2021, the former Minister of Defense Lorenzo Guerini published the Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023 (Pluriannual Planning Document of the Defense for the Three years 2021-2023). This document detailed and put in perspective the Italian efforts to invest in emerging and disruptive technologies such as AI, augmented reality, robotics, big data, quantum computing and direct energy systems.[3] It also explained that these technologies represent urgent and priority investments and highlighted the need to exploit and investigate the possible applications of these new technologies in order to efficiently operate in the cyber-domain.

The Italian Army General Planning Department in 2019 published the document "Future Operating Environment post 2035 – Implications for Land Forces," which was part of the "conceptual work conducted by the Army" with the goal of "identifying the principal actors and the nature of the future environment in which land forces may be called upon to operate." The document thus aimed to "describe hypothetical scenarios and the main challenges which the Army will confront" and to "find possible solutions that will be able to drive the process of capability development in support of Defence."[4]

1 Italian Armed Forces encompass Esercito Italiano, Marina Militare, Aeronautica Militare and Arma dei Carabinieri. However, we decided to exclude the latter from this analysis because the Carabinieri are at the same time part of the Italian Armed Forces and one of the law enforcement agencies of the country.
2 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023.
3 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 37.
4 Future Operating Environment post 2035 – Implications for Land Forces, p. 2.

Moreover, the document gives a brief summary of the current scenarios and challenges that Italian land units are likely to face in modern battlefield.[5] The Italian Army thinks about AI as both a technology to be exploited and a potential source of danger in the future. Specifically, Italian land units might have to face new threats like swarms of drones and robots equipped with AI.[6] At the same time, the document also lists AI in the category of the "new and potentially revolutionary technologies" or "game changers" that Italian Army must develop and exploit in the future to enhance its capabilities.

The other branches of the Italian Armed Forces share these views: both the Italian Air Force (Aeronautica Militare) and the Italian Navy (Marina Militare) are committed to develop a new approach for Intelligence, Surveillance and Reconnaissance (ISR) missions through the integration of manned and unmanned systems that requires the application of AI technology. Specifically, they foresee the application of AI for the employment of autonomous surveillance, automatic target recognition and teams of autonomous vehicles.[7] The example of the Italian participation in the UK Future Combat Air System (FCAS) program is telling.[8] The Italian Armed Forces as well as defense companies such as Leonardo are involved in numerous programs that require the application of AI in order to develop and integrate modern sensors and different platforms both manned and unmanned. Prominent additional examples include the Eurodrone MALE RPAS (Medium Altitude Long Endurance remotely piloted aircraft system) or the Future Combat Naval System.[9]

To sum up, Italy recognizes the need to promote digitalization within its military, and to apply defense AI in order to meet some critical requirements for cooperation with its allies, such as interoperability and integrability. In this context, industrial and military interests seem to overlap. Because of the collaboration between military and industrial sectors, since 2007, Italy has been going through an ambitious procurement and digitalization process. The so-called "Forza NEC" program integrates the roles of "system integrator" and "prime contractor" in a single actor – Finmeccanica-SES – and involves a wide number of national companies such as MBDA Italia, Oto Melara, AugustaWestland, Elettronica, Iveco DV, Engineering, CIO – Consorzio Iveco-Oto Melara, Leonardo-Finmeccanica, Beretta, Sistemi Compositi, and Aerosekur.[10]

5 Future Operating Environment post 2035 – Implications for Land Forces, pp. 11-12.
6 Future Operating Environment post 2035 – Implications for Land Forces, p. 13.
7 "Artificial Intelligence (AI) Autonomous Surveillance, Automatic Target Recognition & Teams of Autonomous Vehicles" (Seminar).
8 "A Bordo del Tempest"; See also, "£30-million injection for UK's first uncrewed fighter aircraft."
9 "Team Tempest"; "Military Capabilities"; "European Medium Altitude Long Endurance Remotely Piloted Aircraft Systems" and "Il Future Combat Naval System 2035 nelle operazioni multi-dominio."
10 "Italy and the Forza NEC Program," p. 120; See also Leonardo, "Forza NEC Program."

2.1 Defining AI

Not humans against AI, but humans working with AI[11]

In 2021, the Italian Defense General Staff (Stato Maggiore Difesa) recognized emerging and disruptive technologies, including AI, quantum computing, robotics and autonomous systems, bio and nanotechnologies, smart materials, and hypersonic technology, as a set of technologies that "are modifying and influencing society, the economy, politics and the military world."[12] Even though the Defense General Staff did not provide an explicit definition of AI, we can infer it by analyzing the documents of the Italian Armed Forces. In accordance with some common definitions in the field, Italian Armed Forces consider AI as the set of hardware and software capable of providing computers with capabilities and performance commonly believed to be the exclusive domain of human intelligence.

Moreover, AI is considered to be a supportive technology, a sort of force and capacity multiplier that supports the work of soldiers and officers. Despite understanding the importance of emerging technologies and in particular of AI application, the Italian Armed Forces are committed to keeping the human operator in the center of the loop in military operations.[13] For this very reason, today the Italian Armed Forces do not consider AI as a technology that aims to replace human beings, rather as an enabler that will improve their performance and their ability to make decisions (Human in the loop). At the same time, the Italian Defense General Staff takes into account the possibility that in the near future some tasks will be carried out autonomously by AI under the supervision of the human being (Human on the loop) and, they do not exclude a priori the possibility that in a more distant future, AI could even operate without human action in the management process (Human out of the loop).[14]

The Italian Navy displays more concern than the other forces in opening up completely to automation. Because of the core principle of multiple redundancies within the Navy, removing human control from some key processes and activities currently appears unfeasible to them. In this regard, the Navy believes that the specific challenges of the maritime domain, in comparison to others, make human control imperative. However, the Italian Navy is gradually introducing drones, adapting existing naval units for the employment of remotely piloted aerial vehicles, and developing new units with these technologies in mind.

11 "Concetto Scenari Futuri," p. 41.
12 "Concetto Scenari Futuri," p. 74.
13 Future Operating Environment post 2035 – Implications for Land Forces, pp. 8-9.
14 "Concetto Scenari Futuri," pp. 41-42.

Finally, the Italian Armed Forces consider the use of AI as necessary in many related fields and technologies such as robotics, quantum computer, unmanned and autonomous vehicles, ISR systems (sensors and data fusion) and so on. Consequently, the progressive "technological addiction" is expected to lead to a "new era" where the synergy and the balance between human being and machine will be crucial to military forces development and operations.[15]

2.2 The Role of AI in Italy

The Italian AI ecosystem consists of a wide number of Research Technology Organizations (RTO), defense and non-defense companies.[16] The complex and varied set of actors also includes universities and research centers, governmental organizations, state-owned as well as private-owned companies, and startups. The Agency for Digital Italy (Agenzia per l'Italia Digitale) in collaboration with the Italian Association for Artificial Intelligence (Associazione Italiana per l'Intelligenza Artificiale) registered in the period between 2017 and 2020 the following data: twenty Universities, nineteen Research Centers, ninety two Companies, six Public Administration entities and fifty one startups.[17] In addition, Leonardo, one of the largest multinational Italian companies, invested in research hubs dedicated to R&D for AI and related technologies and processes such as: advanced logistic 4.0, applied artificial intelligence, future aircraft technologies, future electronic & sensing, future rotorcraft technologies, future security & safety technologies, high performance computing (HPC)/cloud/big data technologies, intelligent autonomous systems, quantum technologies and space technologies.[18] In the fields of AI R&D Leonardo is particularly focused on "system autonomy through Swarm Intelligence techniques; algorithms for unmanned systems; command and control systems; cognitive sensors and resilience systems; cyber security systems; signal processing in radars through to war-gaming and simulation systems; industrial process optimization; and predictive maintenance."[19]

In 2021, the Italian government published its "Strategic Program on Artificial Intelligence 2022-2024" which discussed the strengths and weaknesses of its AI ecosystem and set its objectives in the field for the following years.[20] The document identifies four strengths and weaknesses. Regarding the latter the main problems are represented by the parceled growth of research labs, a poor talent

15 "Concetto Scenari Futuri," pp. 42-42.
16 See also: https://ia.italia.it/ia-in-italia/ (last accessed 10 October 2022).
17 "Ecosistema Intelligenza Artificiale" and see also "Ricerca AI in Italia."
18 "Leonardo Labs for Innovation Technologies."
19 "Artificial Intelligence - Leonardo"
20 In addition, the Strategic Program indicates 3 main areas of intervention and 24 respective policy initiatives. See "Strategic Program on Artificial Intelligence 2022-2024", p. 2.

attraction capacity, a significant gender gap among its members, and finally by a limited number of patents.[21] The strengths of the AI ecosystem include research, education and training, assets, and communities:

- First, Italian researchers are very active, and they work mainly in research labs of universities and public research centers such as the National Research Council (CNR) or in research foundation like the Fondazione Bruno Kessler or the Italian Institute of technology. In addition, they cover a wide area of AI technologies, namely "Machine/Deep Learning, Computer Vision, Natural Language Processing (NLP), Data Mining, Big Data analytics, Embedded AI, Human aspects in AI, Knowledge Representation and Symbolic Learning, Decision Support Systems, Agent-based systems, and Trustworthy AI."[22]
- Second, the document reports that Italy is assertively investing in education and training. At the moment, there are more than 200 AI curricula spread over fifty universities of the country. In addition, the Italian government recently launched its National "Artificial Intelligence" PhD Program to boost the training of researchers, innovators, and professionals in the field of Artificial Intelligence. The Strategic Program indicates that the initiative "has issued 200 PhD scholarships with a budget of € 16M."[23]
- Third, Italy can rely on top-tier research infrastructure and assets such as the CINECA-INFN Infrastructure for HPC, CNR-High Performance Artificial Intelligence Center HP-AI, and finally, on the new IIT HPC infrastructures that are part of the 2020-2023 Strategic asset in AI and Machine Learning.[24]
- Finally, Italy presents a dynamic AI research community, where its experts are involved in all the main international AI research networks such as CLAIRE, ELLIS, HumanE-AI-Net, TAILOR, AI4ME- DIA, ELISE, and VISION. Moreover, Italy is among the founding members of the Global Partnership on AI (GPAI).[25]

Focusing on defense AI, the Italian Armed Forces fully recognized the need to develop AI-driven and AI-supported military technologies and to operate them in modern conflict.[26] Today the battlefield is more complex than ever and soldiers, thanks to the integration of modern sensors and technologies, receive a huge load of information which must be aggregated, fused, filtered, processed, and understood in real-time. To accomplish this goal and to identify and interpret data that are even larger by volume, faster and more complex than in the past, they need the support of AI and Machine Learning in every step of the process. The computational capacity of AI will facilitate and support the work of soldiers in

21 "Strategic Program on Artificial Intelligence 2022-2024," p. 6.
22 "Strategic Program on Artificial Intelligence 2022-2024," p. 5.
23 "Strategic Program on Artificial Intelligence 2022-2024," p. 5.
24 "Strategic Program on Artificial Intelligence 2022-2024," p. 5.
25 "Strategic Program on Artificial Intelligence 2022-2024," p. 5.
26 "Concetto Scenari Futuri," and Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023.

military operations, and through simulations and probabilistic calculations it will also assist officers in the decision-making process. For instance, Leonardo established a research group with the aim to "study artificial intelligence applied to new technologies and solutions to develop systems that support forecasting and decision-making processes."[27] In sum, the Italian Armed Forces see AI as a supportive technology that must support and improve the performance of the human operator without replacing him.

The Ministry of Defense recognizes that cooperating with non-defense companies and organizations is inevitable to facilitate transfer of know-how and technology, given that it is commercial companies that are driving technological innovation. For this reason, as we will discuss more extensively in the following chapters, the Ministry of Defense, among others, plans the creation of research centers in AI, so as to promote synergies with civilian and commercial companies.[28]

2.3 Concerns and Opportunities

Italian Armed Forces have recognized the opportunities offered by AI and have tried to identify the best way to take advantage of them. The Italian Defense General Staff and the Italian Army Headquarters General Plans Department Plans Office have drafted two cornerstone documents in this regard.

The former has identified several opportunities to employ AI. It has acknowledged that even though AI has become a critical technology for armed forces and defense companies, it is still not possible to completely identify the trajectory of this technology. Yet, the Defense General Staff has detected some possible trends. For example, it argues, AI will ease demanding maintenance and complex logistics, thus enhancing readiness and agility, will increase computational capabilities, and thus armed forces will be able to more quickly and more effectively analyze adversaries' decisions, and identify the most appropriate and effective responses; it will improve the management of remotely piloted vehicles, thus allowing for autonomous and coordinated operations, including the integration of a network of sensors with IoT (Internet of Things) and with IoBT (Internet of Battlefield Things).[29]

Italian Defense General Staff has also acknowledged some concerns that AI raises related to how it would make part of the workforce redundant, thus requiring effort to help them reintegrate into the job market.[30] A document drafted by the

27 "Applied Artificial Intelligence Laboratory."
28 "Savio (Leonardo): Innovazione militare e civile, 2 metà della stessa mela."
29 "Concetto Scenari Futuri," pp. 41-42.
30 "Concetto Scenari Futuri," p. 26.

Italian Army Headquarters General Plans Department Plans Office, has shed light on other concerns. Specifically, military personnel will have to learn to coexist with and manage the process of technological innovation and the introduction of disruptive technologies (such as robots equipped with artificial intelligence, swarms of drones, nanotechnology, alternative energy, psychological operations).[31]

31 Future Operating Environment post 2035 – Implications for Land Forces, p. 13.

3 Developing Defense AI

In this section, we discuss how the Italian Armed Forces plan to develop defense AI technologies, and hence the systems and networks required for AI technologies to fulfill specific tasks for the defense. Italy is currently lagging behind in AI, and the Ministry of Defense aims at delivering to its Armed Forces digital platforms, integrated with robotic systems, that are capable of receiving and processing information at the tactical, operative and strategic level, in a fast and effective way. The Ministry of Defense, and in particular the General Secretariat of the Defense and the National Directorate for Armaments, oversees the development of military AI as well as of others military technologies. The Ministry of Defense tries to concentrate the needs of the different Armed Forces and ensure that the technologies meet the requirements of interoperability, interchangeability, and integration. Among others, the priorities for the Ministry of Defense are autonomous systems, cyber capabilities, space, command and control as well as multi-domain situation awareness technologies.

Moreover, since the 2002 Prague Summit, NATO members have pursued the digitization of their armed forces, through the so-called Network Enabled Capabilities (NEC). With this acronym, "NATO expressed the idea of 'enabling the capability' of combining heterogeneous elements – doctrinal, procedural, technological, organizational and human – into a single network, in order to achieve, through the interaction of these elements, strategic superiority in military operations."[32]

Table 1: Program Forza NEC Phases*

Forza NEC Program Phases	Year
Feasibility Study	2007
Project Definition	2007-2010
CD&E (Concept Development & Experimentation)	2010-2013
First Phase of Implementation	2018
Second Phase of Implementation	2026
Third Phase of Implementation	2031

*The table shows the Forza NEC program phases as they were planned in 2007. Today the program is still ongoing and is in the first implementation phase.

32 "Italy and the Forza NEC Program," p. 115.

Consequently, in 2007 Italian Ministry of Defense started a procurement and digitalization inter-force program to meet this requirement and to modernize its armed forces. The "Forza NEC" program, is to be completed by 2031 with an expected cost of €22bn (Table 1).[33]

3.1 Current Defense AI

Italy is a "latecomer" in defense AI technology, which is a result of multiple causes, including economic and technological factors.[34] As acknowledged in the Pluriannual Planning Document 2021-23 of the Ministry of Defense, there is "an evident gap" between Italian national capabilities and those of comparable countries, such as in AI, quantum computing, cyber defense, and microprocessors. For this reason, the Ministry of Defense and the Ministry of Homeland Security are committed to promote Italian technological development so that it can catch up with state-of-the-art AI. In 2013, the Center for Advanced Studies in Defense reported that Italy was investing relatively little in R&D for defense in comparison to other countries.[35] The same report also highlighted that the Government had promoted projects aimed at incentivizing technological innovation and exchanges of ideas and information among different sectors, such as research centers, ministries, armed forces, universities, as well as private and public companies.[36]

Since at least 2019, according to official documents, the Italian government has committed to invest in AI in order to catch up to allies and competitors. Already in 2013, some research centers of the Italian Armed Forces (such as the Center for Advanced Defense Studies) had drafted documents on emerging and disruptive technologies and on the evolution of military technologies, emphasizing the necessity of allocating investments for technological innovation. Yet, the most significant incentives have emerged only in recent years, since 2019. In this regard, it has not helped that government expenditure for the military declined between 2008 and 2015 – even though the percentage of government expenditure spent on research and development has increased, from 0.95% to 1.53%.[37]

33 "La trasformazione delle Forze Armate: il programma Forza NEC," p. 12.
34 For data about Italian military expenditure see https://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS?locations=IT (last accessed 10 October 2022).
35 "Tecnologie Emergenti e possibili impieghi futuri in campo militare"
36 See among others, "la matrice delle tecnologie abilitanti."
37 For data about Italian Research and development expenditure see: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=IT (last accessed 10 October 2022).

3.2 Defense AI Structure and Organization

The Italian Ministry of Defense manages, plans, and coordinates military-related research and development. Specifically, the General Secretary for the Defense is in charge of facilitating and promoting cooperation between the government and companies, whether military or commercial, national or from allied countries. The goal of the 5th Directorate of the General Secretariat of the Defense and the National Director for Armaments (SDG/DNA) is to promote the growth of the knowledge base of the Ministry of Defense in high-tech sectors, so that future defense programs – whether national or international – are within the reach of Italy.

With regard to R&D in defense, the General Secretariat of Defense and the National Director for Armaments SGD/DNA carries out assessment and planning, which entails gathering and coordinating ideas and proposals from universities, research centers, and private companies, as well as from the Ministry of Defense itself. The SGD/DNA then integrates these ideas and proposals with the National Plan for Military Research. At the same time, the SGD/DNA aims at strengthening and expanding international cooperation, in line with efficiency within the EU and NATO.

Within the Stato Maggiore Difesa, another important organization is the Center for Innovation in Defense, whose task is to ensure and promote the conceptual and doctrinal development and upgrading, so as to enable the transformation of the military.[38] Specifically, this center is responsible for the development of innovating strategic thinking, to identify goals, directions and priorities for technological development.

3.3 Main Defense Projects that Rely on AI

Before looking at the main defense AI projects of the Italian Armed Forces it is important to note that Italy, as part of NATO and European Union, has taken part to many multinational projects, and that some of the most ambitious and innovative programs are in cooperation with other countries. The case of the European Permanent Structured Cooperation (PESCO) in defense is telling: Italy is coordinator of eight projects and a member of twenty six projects, which concern the development of shared and enabling capabilities, the cyber sector and the Command, Control, Communication, Computer, Intelligence, Surveillance and Reconnaissance

38 "Tecnologie Emergenti e possibili impieghi futuri in campo militare," p. 108.

(C4ISR) sector. Additionally, Italy participates in projects dedicated to unmanned vehicles, aircraft, naval units, and space systems. In one way or another, all these projects require the support, application, and development of AI tools.[39] Because of the participation in so many multinational projects, Italy will have to meet the interoperability requirements established by both NATO and EU.[40]

Joint

One of the most ambitious projects of the Italian Armed Forces is the multi-year funding program for Artificial Intelligence 2021-2035. This joint initiative aims to create a network that connects the research and experimentation centers of different Italian military services. In addition, the project aims to promote and support the cooperation between the network and civil research companies specialized in the sector of Artificial Intelligence. Specifically, part of the resources allocated for this program will be dedicated to create/modernize physical spaces, tools acquisition and to support cooperation agreements between the Ministry of Defense and civil research institutes such as Universities and specialized centers.[41]

Army

The Italian Army is pursuing several projects centered around the applications of AI with the Future Soldier Program, now called Safe Soldier System, and the Robotics and Autonomous Systems (RAS) Experimentation Campaign at the heart of the Army's initiatives.

The Safe Soldier System aims to develop new capabilities for infantry units and to modernize their weapons and equipment also through the implementation of both new hardware and software. For instance, in 2020 the Army bought 20,000 electronic systems for individual control and situational awareness on the battlefield in order to enhance its soldier's capacity to gather, process and share real-time information.[42] The Safe Soldier System program aims to improve infantry protection, survival skills, C2 integration, nocturnal mobility and lethality, giving them advanced situational awareness capabilities. The Safe Soldier System webpage

39 Taking into account the example of the Tempest jetfighter, it is clearly difficult to define the platform as defense AI project, but Italian non-classified documents underline that the application of AI is crucial for the development of the Future Combat Air System program (among others) and that the Italian participation in this project will also contribute to improving national knowledge and know-how in the whole AI innovation sector. For this reason, in the text we consider both defense AI technologies and platforms that rely on AI elements/components.

40 NATO 2020 and 2021 Highlights Science and Technology Organization – Empowering the Alliance's Technological Edge; https://www.pesco.europa.eu/ (last accessed 10 October 2022); "Europe's Training Pitch for Enhanced Interoperability."

41 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 66.

42 "L'Esercito si modernizza con nuovi sistemi d'arma – Il Programma 'Soldato Futuro' è diventato 'Soldato Sicuro'."

states that "the system allows, through digitized C2 devices, the joint use of the platform, ensuring maximum operation in all scenarios, from combat to population support, always remaining 'connected' to the net-centric architecture."[43]

The second main project is the Robotics and Autonomous Systems experimentation campaign, which aims to improve human-machine interaction and manned-unmanned teaming. Through this cooperation and the synergistic employment of new advanced sensors, the project aims to improve the situational awareness capabilities of ground units, in particular during operations in urban areas. The program is led by the Army Innovation Office. This office is not involved in R&D but is in charge of understanding the most effective way to employ the technology that is developed by specialized centers in order to enhance military capabilities. The Army Innovation Office represents a kind of bridge between technological development and operational activity. Specifically, the RAS campaign aims to understand how to improve the human-machine teaming, identifying how robotic and autonomous systems can generate operational advantages in the core tasks of the ground forces.[44] The experimentation campaign is structured as follows: definition of conceptual framework, organizational framework (2020), technological call branching (2020), capability spotlight (2020), contracting phase (2021), 1st trial and final experiment (2022). In December 2021, the Italian Army finalized a contract with the foreign company Milrem Robotics (Estonian) that joined the program as technological partner. In March 2022 and in May of the same year, two training activities have been carried out employing the digital models of the platforms provided by the Milrem Robotics. In addition, two more training activities are scheduled for the months of September and October.[45]

Air Force

Italy has taken part to the development processes of two important platforms that will be employed by its Air Force: The Future Combat Air System (FCAS, also called Tempest Program) and the MALE RPAS PESCO project also called Eurodrone.

The first main project, FCAS, is led by the United Kingdom with the collaboration of Italy and Sweden, and it aims at developing a sixth-generation jet fighter (the first tier aerospace companies involved are BAE Systems, Rolls-Royce, Leonardo

43 "Sistema Soldato Futuro."
44 Lieutenant Colonel Vito Marra, Head of Concept Development Section - Army Innovation Office - 3rd Army Staff Department, Centro Studi Militari Aeronautici (CESMA) Seminar, "Artificial Intelligence (AI) Autonomous Surveillance, Automatic Target Recognition & Teams of Autonomous Vehicles", Rome, 7 June 2022.
45 Lieutenant Colonel Vito Marra, Head of Concept Development Section - Army Innovation Office - 3rd Army Staff Department, Centro Studi Militari Aeronautici (CESMA) Seminar, "Artificial Intelligence (AI) Autonomous Surveillance, Automatic Target Recognition & Teams of Autonomous Vehicles", Rome, 7 June 2022.

UK and MBDA UK).[46] The Tempest aims to be a high-tech jet fighter fully integrated with new technologies such as deep learning, swarming drones, direct-energy weapons and so on.[47] Some claims that in the light of its specifications and alleged capabilities, the Tempest would become "the most cutting-edge aircraft in the world."[48] Specifically, the cockpit will be revolutionized, and the conventional controls will be replaced by "augmented and virtual reality displays inside the visor of the helmet, which would be fully customizable."[49] In addition the human-machine teaming will improve pilots' performance, assisting them making instantaneous decision, and carrying out critical flight maneuvers. Finally, the Tempest will embody the so-called cooperative engagement capability, that is, "the ability to cooperate on the battlefield, sharing sensor data and messages to coordinate attack or defense" with both manned and unmanned systems.[50]

The second main program, MALE RPAS PESCO, aims to develop a next-generation medium-range long-endurance drone with ISTAR capabilities. The application of new sensors and AI technologies will provide the Eurodrone with advanced ISR and data processing capabilities. The first-tier defense companies involved in the project are Airbus (EU), Dassault (FR), and Leonardo (ITA), with other Italian companies such as Avio and Elettronica Group also taking part. The Eurodrone will be fully integrated with other platforms and aims to enhance EU Joint ISR capabilities, and to carry out homeland security operations, international conflict prevention and crisis management, thanks to high-tech sensors and communication systems.[51]

Navy

The main defense AI projects pursued by the Italian Navy are focused on technologies like unmanned systems and maritime surveillance. The Navy is trying to reduce the gap with other countries in unmanned and autonomous technologies, as only a few Italian ships have been modernized to host and operate drones, which the Navy aims to address.

46 See: "Team Tempest." Furthermore, Japan is considered very likely to sign a cooperation agreement with UK on the joint development of engine and radar and even to merge their next-generation fighter jet programs. See: "EXCLUSIVE Britain and Japan aim to merge Tempest and F-X fighter programmes-sources."
47 "UK unveils new Tempest fighter jet to replace Typhoon."
48 "Team Tempest: Cutting-Edge AI and Cockpit Technologies Trialled."
49 "Team Tempest: Cutting-Edge AI and Cockpit Technologies Trialled."
50 "U.K. Introduces New Fighter Jet: The Tempest."
51 "MALE RPAS - Medium Altitude Long Endurance Remotely Piloted Aircraft System," and "European Medium Altitude Long Endurance Remotely Piloted Aircraft System (MALE RPAS) - development until Preliminary Design Review (PDR)."

This Navy aims to pursue this goal by developing new platforms that already possess these capabilities and by modernizing the so-called legacy platforms.[52] The Navy acknowledges that Italy is a latecomer in this field, and stresses the need to catch-up technologically in order to protect national interests on both territorial and international waters.[53] Specifically, by integrating, storing and analyzing a large volume of different types of data (data fusion), the Navy believes that the unmanned surface, underwater, and aerial vehicles will improve its intelligence, surveillance, and reconnaissance capabilities guaranteeing an all-domain all-weather coverage over its operational areas.

The Naval Future Combat System 2035 policy paper describes the main threats that Italian Navy will have to face in the next years and "summarizes the vision of the Armed Force on the Maritime Instrument of the future."[54] This document lists the sectors where Italy will have to focus its efforts on the next years: AI, big data, quantum, robotics, unmanned systems, innovative materials, hypersonic and direct energy weapons, and biotechnologies.[55]

Among other projects worthy of attention, we find the new European Patrol Corvette (EPC), the Harbour And Maritime Surveillance & Protection (HARMSPRO) PESCO, the new offshore vessels, the and the new destroyers.[56] Italy is coordinator of the HARMSPRO, which aims to provide member states with the capabilities to surveil and protect specified maritime areas such as harbors, littoral waters and sea lines of communication fielding "an integrated system of maritime sensors, software and platforms (surface, underwater and aerial vehicles), which fuse and process data, to aid the detection and identification of a range of potential maritime threats."[57] With regard to the new destroyer, it aims at the development and deployment in the coming years of a comprehensive anti-ballistic and anti-hypersonic missile capability to defend national territory and population.[58]

52 Ship-of-the-line captain Andrea Quondamatteo, Head of the General Planning Office of the Maritime Instrument, Ship-of-the-line captain Enrico VIGNOLA, Head of the Space and Technological Innovation Office - Navy Staff - 3rd Department of the Military Aeronautical Studies Center, (CESMA) Seminar, "Artificial Intelligence (AI) Autonomous Surveillance, Automatic Target Recognition & Teams of Autonomous Vehicles", Rome, 7 June 2022.

53 Ship-of-the-line captain Andrea Quondamatteo, Head of the General Planning Office of the Maritime Instrument, Ship-of-the-line captain Enrico VIGNOLA, Head of the Space and Technological Innovation Office - Navy Staff - 3rd Department of the Military Aeronautical Studies Center, (CESMA) Seminar, "Artificial Intelligence (AI) Autonomous Surveillance, Automatic Target Recognition & Teams of Autonomous Vehicles", Rome, 7 June 2022.

54 "Il Future Combat Naval System 2035 nelle operazioni multi-dominio," p. 1.

55 "Il Future Combat Naval System 2035 nelle operazioni multi-dominio."

56 Italy is coordinator of the European Patrol Corvette (EPC) PESCO project which aims to design and develop a new naval unit that foresee the embarkation of unmanned vehicles, hence the implementation of new communication and guidance systems, new antennas, new wiring, and ground control stations. The project involves some of the most important shipyard companies in the world such as Fincantieri (ITA), Naval Group (FR) and Navantia (ESP), coordinated by NAVIRIS joint venture. See https://www.pesco.europa.eu/project/european-patrol-corvette-epc/ (last accessed 10 October 2022).

57 «Harbour & Maritime Surveillance and Protection (HARMSPRO) PESCO Project.»

58 "Il Future Combat Naval System Secondo la Marina Militare."

4 Organizing Defense AI

In the previous section, we have summarized programs that represent the backbone of Italian development in Defense AI technologies. The ongoing and future projects are organized both jointly and individually by Italian Armed Forces in accordance with the tasks they need to accomplish. On the one hand, the main AI programs are coordinated by the Secretariat General of Defense and National Armaments Directorate and are developed and operated jointly by the Armed Forces. Thus, they serve the Army, the Navy, and the Air Force at the same time. On the other hand, other projects designed for specific requirements are developed and organized individually. The cases of the Robotics and Autonomous Systems Experimentation Campaign (RAS) of the Army, and the Advanced Recognition and Exploitation System (ARES) of the Air Force, are good examples. While the main task of the Secretariat General of Defense is to coordinate and centralize the efforts in research and development, all the platforms and systems must meet the requirements of integration, interoperability, and interchangeability. These requisites are mandatory to allow the Italian Armed Forces to combine the organizational efforts to operate jointly with each other and with their allies.

To improve its innovation and organizational capabilities, Italy has actively looked at the lessons learned by and best practices of its traditional partners, such as United States, United Kingdom, France, and Germany. Accordingly, Italy is planning to create a network that connects all the national actors involved in the development of AI and other technologies considered to be of "strategic value". The ultimate goal is to give positive impetus to the innovation process creating "potential technological discontinuity – an objective aggressively pursued overseas by the famous Defense Advanced Research Program Agency (DARPA)."[59]

59 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 138.

5 Funding Defense AI

In this section, we list the main defense projects of the Italian Armed Forces that rely on AI, and their relative budgets and funding programs for the period 2021-2035. The national Defense plan, coordinated by the office for the General Joint Planning (Pianificazione Generale Interforze) "aims to create and support an efficient, ready and effective military instrument, sustainable in terms of human and financial resources, perfectly balanced and integrated, with significantly interoperable features in its various components and in a multinational and inter-agency context, functional to a credible deterrence and to express concrete operational capabilities with multi-domain effects."[60] This type of long-term investment and planning is regulated by the Italian Leggi di Bilancio (budget laws).[61]

Italy plans to field most of these investment programs by 2026-2028. For 2021, the budget law has refinanced the "Fund relating to the implementation of multi-year investment programs for the needs of National Defense" with a budget of €12.35bn and which runs between 2021-2035. The Italian government claims that these measures will bring an "epochal turning point," providing the Italian Armed Forces with the instruments to support long-term national efforts in defense needs, country digitalization and technological development. Italian main programs include the following projects, among others:

- **Joint:** Joint Maritime Multimission System (J3MS), AI Development and Enhancement Programs, Acquisition of Defense Cloud capacity, Multi Data Link Modernization (MDL), European Cooperation Programs, A/R and air and missile defense enhancement and maintenance of the operational capacity of the defense satellites.
- **Army:** Infantry Fighting Vehicle (IFV), Leopard Tank Modernization and logistic support, Robotics and Autonomous Systems (RAS), SHORAD GRIFO renovation on CAMM-ER.
- **Air Force:** EUROPEAN MALE RPAS, TEMPEST (6th gen. "Combat Air System"), C-27J (Jedi and Praetorian).
- **Navy:** Embarked Unmanned Aerial Systems (UAS), New Destroyers (DDX), New amphibius Units (LXD), European Patrol Corvette (EPC) and the new Offshore Patrol Vessels (OPV).

60 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 54.
61 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, pp. 54–56. See Bilancio 2020 - Legge 27 dicembre 2019, n. 160 (G.U. n. 304 - 30/12/2019, S.O. n. 45) and Bilancio 2021 - Legge 30 dicembre 2020, n. 178 (G.U. n. 322 - 30/12/2020, S.O. n. 46).

5.1 Joint Programs

The main goal of the joint programs planned in the Documento Programmatico Pluriennale della Difesa 2021-2023 is to develop, modernize and renew a set of military assets and technologies considered of absolute strategic value by all the Italian Armed Forces. The document underlines the importance of the development and application of artificial intelligence to Defense platforms and architectures.

Specifically, for AI development and enhancement Italy has allocated a budget of €190M for 2021-2035. This multi-year program aims to create a network of innovation centers "that enable the most qualified actors of the technical-operational area of Defense (i.e. the Experimental Centers or in any case the similar realities) to interact synergistically with the world of civilian research specialized in the sector of Artificial Intelligence and, in general, of emerging digital technologies."[62]

Table 2: Joint Programs Involving Defense-Relevant AI Applications

Joint Programs	Amount (in €M)
Emerging Disruptive Tech R&S	60
Data Collection	55
Capacity Acquisition for Data Sharing Based on Defense Cloud Concept	90.7
Upgrade Subsystem Multi Data Link Processor (MDLP)	26.29
Joint Maritime Multimission System (J3MS)	470
Acquisition of Defense Cloud capacity	90
Multi Data Link Modernization (MDL)	312
European Cooperation Programs	90
A/R and air and missile defense enhancement	358
Maintenance of the operational capacity of the defense satellites	100
Loitering Ammunition	3.88

62 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 66.

In sum, these allocated resources are going to enable the creation of physical spaces, the acquisition of tools and the signing of collaboration agreements with major research centers that, among other things, will permit to work synergistically with civil researchers.[63]

In addition, Italy has earmarked funds for other joint programs relevant to develop defense AI applications. Table 2 provides an overview of these programs and the allocated resources.

5.2 Army

The Italian Army aims to integrate AI technologies and new platforms with its legacy assets. Specifically, through the modernization and renovation of older vehicles and systems. In addition, the Army plan to enhance its infantry soldiers' capabilities equipping them with new sensors, and connecting them to the network, namely giving them the capacity to receive, share and process information quickly and more efficiently. Furthermore, through the Robotics and Autonomous Systems Experimentation Campaign (RAS) they are improving the human-machine interaction, through the synergically employment of small tactical unmanned aerial and ground vehicles and infantry units.

Table 3 highlights the Army programs that include defense AI applications and the respective allocated resources.

Table 3: Army Programs Involving Defense-Relevant AI Applications

Army Programs	Amount (in €M)
Remotely-piloted aircraft Mini and Micro	89
Infantry Fighting Vehicle (IFV)	1,022
Leopard Tank Modernization and Logistic Support	192
Robotics and Autonomous Systems	unknown
Short-Range Air Defense (SHORAD) GRIFO renovation on CAMM-ER	235
Light tactical multirole vehicle (LMV) "Lince 2"	272

63 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 66.

5.3 Air Force

The Italian Air Force is involved in two main ambitious (and most expensive) projects that involve AI, namely the development of the EUROPEAN MALE remotely piloted aircraft system, and the Tempest 6th generation "Combat Air System" program.[64] On one hand, Italy has allocated €1.8bn for the development, acquisition, and logistic support of the so called "Eurodrone" within the framework of the PESCO project. On the other hand, for the concept, design, development, and acquisition of 6th generation combat air systems Italy has allocated €2bn. These two programs alone represent about the 31% of the total budget of the "Fund relating to the implementation of multi-year investment programs for the needs of National Defense" planned for the 2021-2035.[65] Table 4 highlights additional Air Force programs and allocated funds.

Table 4: Air Force Programs Involving Defense-Relevant AI Applications

Air Force Programs	Amount (in €M)
Smart Wing/Anti-intrusion	20
Air Defense Radar Digitalization	68
Network Info/Infrastructure (TLC e T-B-T)	29
Interoperability Force Elements C6ISTAR-EW* – LND Study	71.40
C27J EW-JEDI** and Mission System	27
Ballistic Missile Defense System (BMD+)	408
Implementation of the System for the Generation and Processing of Meteorological Data	22.49
Short Range Air Defense (SHORAD) capabilities	127
C4ISTAR***	28

* C6ISTAR-EW: Command, Control, Computers, Communication, Cyber, Cyber Defense, Combat Systems, Intelligence, Surveillance, Target Acquisition, Reconnaissance, and Electronic Warfare.

** EW-JEDI; Electronic Warfare - Jamming and Electronic Defense Instrumentation.

*** C4ISTAR: Command Control, Computers, Communication, Intelligence, Surveillance, Target Acquisition, Reconnaissance.

64 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, pp. 61 and 95.
65 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 56.

5.4 Navy

The Italian Navy's main projects aim to build new generation naval units and to modernize older systems so that they can operate with new platforms and in particular with unmanned systems. One of the most important projects regards the development of the new offshore vessels with a budget provision of €1.5bn in the period 2023-2035.[66] In addition, Italy is coordinator and project member of the European Patrol Corvette (EPC) PESCO Project. Finally, Italy has allocated €2.3bn for the development and acquisition of new Destroyers (the final estimated cost is €2.7bn). These state-of-the-art naval units will benefit from the latest generation of sensors, hardware, and software. Furthermore, they will be able to send, receive and process a large amount of data in real time.

In addition, the Italian Navy has also allocated €3M for the Embarked Remotely Piloted Aircraft study and €26M on the Coastal Radar Network.

66 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 90.

6 Fielding and Operating Defense AI

The Italian Armed Forces are currently engaged in forty-three operations around the world, with about 16.400 military personnel deployed. About half of these operations are aimed at enhancing international security and stability. Italy is one of the main contributors to NATO and EU missions, as well as the first contributor, among Western countries, to UN missions.[67] Specifically, Italy is committed to crisis management operations and deterrence activities. Its main areas of interest are represented by the Euro-Mediterranean region and contiguous areas such as Balkans, Maghreb, and Middle East. In addition, Italian Armed Forces are called to secure national interests from external threats also in Sahel, West Africa, Horn of Africa, and Arabic Peninsula aiming at contrasting international terrorism, stabilizing the regions, protecting trade routes, and strengthening the Euro-Atlantic cohesion.[68]

Despite Italy lagging in defense AI technology, its armed forces are already fielding some platforms that rely on AI applications. For instance, they are already operating unmanned vehicles for ISR operations and recently, the Secretariat General of Defense and National Armaments Directorate planned to invest some resources for the design and development of a deep learning model used for the analysis of aerial images acquired by drones.[69] Moreover, even though the employment of Defense AI in technologies such as drones, mixed reality, robotics, big data or data fusions, is still at an early stage, many important programs are ongoing. These projects are in line with the Italian plan to develop "an agile and projectable force, technologically advanced and capable to work with its allies in the context of international missions."[70]

6.1 Army

The Italian Army is strengthening its human-machine teaming capabilities with the development of the RAS project thanks to which unmanned vehicles are increasingly integrated with ground forces. Whereas some of the technologies have been deployed the whole concept and the main architecture are still under development. However, the Army infantry units already employ a wide number of mini and micro drones such as the Sixton, Asio, Spyball, Crex-B and Raven.[71] In addition, AI-supported software is employed in command and communications tasks and in virtual and mixed-reality training activities.

67 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 10.
68 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 14.
69 PNRM proposal N. a2021.126, «DRAGONS» – Drone Aerial Images Segmentation System.
70 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 10.
71 "Droni: Dossier sugli APR militari italiani," p. 3.

6.2 Air Force

In the early 2000s, the Italian Air Force started to acquire large, unmanned aerial vehicles from the United States. Specifically, Italy bought and then operated state-of-the-art platforms such as the Predator, the Reaper and finally, the Global Hawk (NATO).[72] Recently the Ministry of Defense considered investing in the Italian-made P2HH, to replace the Predator and Reaper in the future. Additionally, the Italian Air Force is developing the Advanced Recognition and Exploitation System (ARES) which aims to create and employ an open-source neural network based on data acquired by Predator platforms. The project provides the use of deep neural network algorithms for real-time object detection. Training the algorithms on an unclassified dataset, they tested and demonstrated the potential application of AI for the automatic recognition of multiple targets in a theater of operations. In fact, the system was able to recognize multiple objects at the same time, following and classifying them. The next step of the project aims to develop forecasting capabilities giving the system the capacity to make predictions based on the data it has gathered and classified.[73]

6.3 Navy

Even though the Navy already employs some unmanned vehicles, such as the Camcopter S-100 used for patrol missions, also in this case their integration with the armed force is still in an early stage when compared with the capabilities of other countries. The main goal of the Italian Navy is to develop the capability to employ drones in three domains: on sea, under the sea and on land with the amphibious units. Specifically, the Navy relies on a trident of capabilities that are carrier strike group, the amphibious task group and underwater units and special forces. Thus, the main goal is to integrate unmanned vehicles with the trident in order to improve the capabilities of the naval force in the three domains.

72 "Droni: Dossier sugli APR militari italiani," p. 4.
73 Colonel Roberto Del Vecchio and Lieutenant Colonel Roberto Diana, Air Force Staff, Centro Studi Militari Aeronautici (CESMA) Seminar, "Artificial Intelligence (AI) Autonomous Surveillance, Automatic Target Recognition & Teams of Autonomous Vehicles", Rome, 7 June, 2022.

7 Training for Defense AI

Future requirements of Italian Armed Forces foresee the capability to operate synergically with machines, exploiting new emerging technologies and enhancing military personnel performances. Moreover, armed forces will benefit from this human-machine interaction also in their training activities. Specifically, Italy relies on a set of simulation environments and technologies to train its military personnel in different ways: live, virtual, and constructive:

- The "live" simulation category foresees the interaction between physical objects and personnel with other physical assets in a physical environment, but the effects of their interactions on the battlefield are simulated.
- The "virtual" simulation foresees the employment of real people which operate with simulated assets in virtual spaces. The outcomes of their interactions are then reproduced in a synthetic environment.
- Finally, the "constructive" simulation foresees the interaction between simulated people and virtual AI-controlled assets in a synthetic environment, in the same way it happens in flight simulators.[74] In this context, Italy planned to build one new Center for constructive simulations and five new Centers for live simulations, to further enhance its simulated training capabilities.[75] In addition, also Virtual Reality Systems (VRS) will be improved to enhance Italian pilots training activities.[76]

From the Italian point of view, simulated training activities allow, and will allow more and more in the future, the armed forces to improve the preparation of their personnel using digital platforms and cutting-edge software. In addition, Italy supports joint activities among its services, to optimize resources management and their environmental impact. With regard to that, a good example is represented by the Rotary Wing Mission Training Center (RWMTC) initiative which aims to strengthen Italian pilots joint training activities in order to create a unique and shared virtual and constructive simulated environment.

Taking into account Italian infrastructure dedicated to simulated activities, the armed forces can rely on both joint and single-service training areas and centers such as the Salto di Quirra Joint Training Area, the Army's Simulation and Validation Center in Civitavecchia, the Navy's Training Center in Taranto, or the Air Force's Multi-Crew Training Center in Pomezia (Pratica di Mare). In 2021 Italy launched the Operational Training Infrastructure (OTI) program to be completed by 2033 with an expected cost of €79.2M. Specifically, OTI project aims to strengthen simulated training capabilities through "the development of an open, modular, persistent, resilient and safe geo-federated architecture aimed at

74 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 43.
75 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 117.
76 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 117.

connecting flight simulators, simulation systems and C2 systems to make them interoperable within a single and common synthetic simulation scenario that reproduces operational real, complex, uncertain and highly variable environments."[77] In particular, the program also aims to improve and modernize the infrastructures of the Salto di Quirra Joint Training Area.

77 Documento Programmatico Pluriennale della Difesa per il Triennio 2021-2023, p. 130.

8 Conclusion

Italy lags behind its peers when it comes to defense AI projects. This relative backwardness is the product of several factors, including a relatively narrow digital base in AI in general, lack of large AI companies operating within its borders, and relatively limited funds. Yet over the past few years and in light of its position, Italy has increased its effort with the goal of catching up with state-of-the-art technology, through cooperation with EU and NATO partners, the national digitalization program, investment plans in academic research and development. In this regard, the Italian approach has both strengths and weaknesses. Regarding strengths, for instance, Italy possesses private and public research centers with established traditions in high-technology, existing synergies between governmental, commercial and defense companies, as well as a couple of leading educational institutions in Europe. On the weakness side, Italy's public finances allow for only limited funds, and hence it is up to question whether participating in the development of military technologies that rely on AI (such as Tempest, Eurodrone) will allow the country to develop experience and know-how necessary to fill existing gaps with other countries.

The two main capability goals for the future are the digitalization of the Italian Armed Forces (through the Force NEC program) and the development and modernization of the conventional assets (through the Documento Programmatico Pluriennale 2021-23). Force NEC aims at making different units "networked", so that they can share real-time data, transmit and receive large amount of data, and benefit from advance computational capabilities. The Documento Programmatico Pluriennale 2021-23 encompasses several investment plans in technologies that rely on AI applications and in modernization of legacy assets.

Italy's wide participation in multinational defense projects is pivotal to its goal of catching up in AI. On the one hand, such wide participation stems from Italy's budgetary and technological exigencies - namely, the complexity of state-of-the-art technologies. On the other hand, Italy's dependence on multinational projects might influence the type of experience and know-how Italy will gain, hence the defense AI technologies that Italy will be able to develop in the future, and also the trajectories that such technologies might have to follow.

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