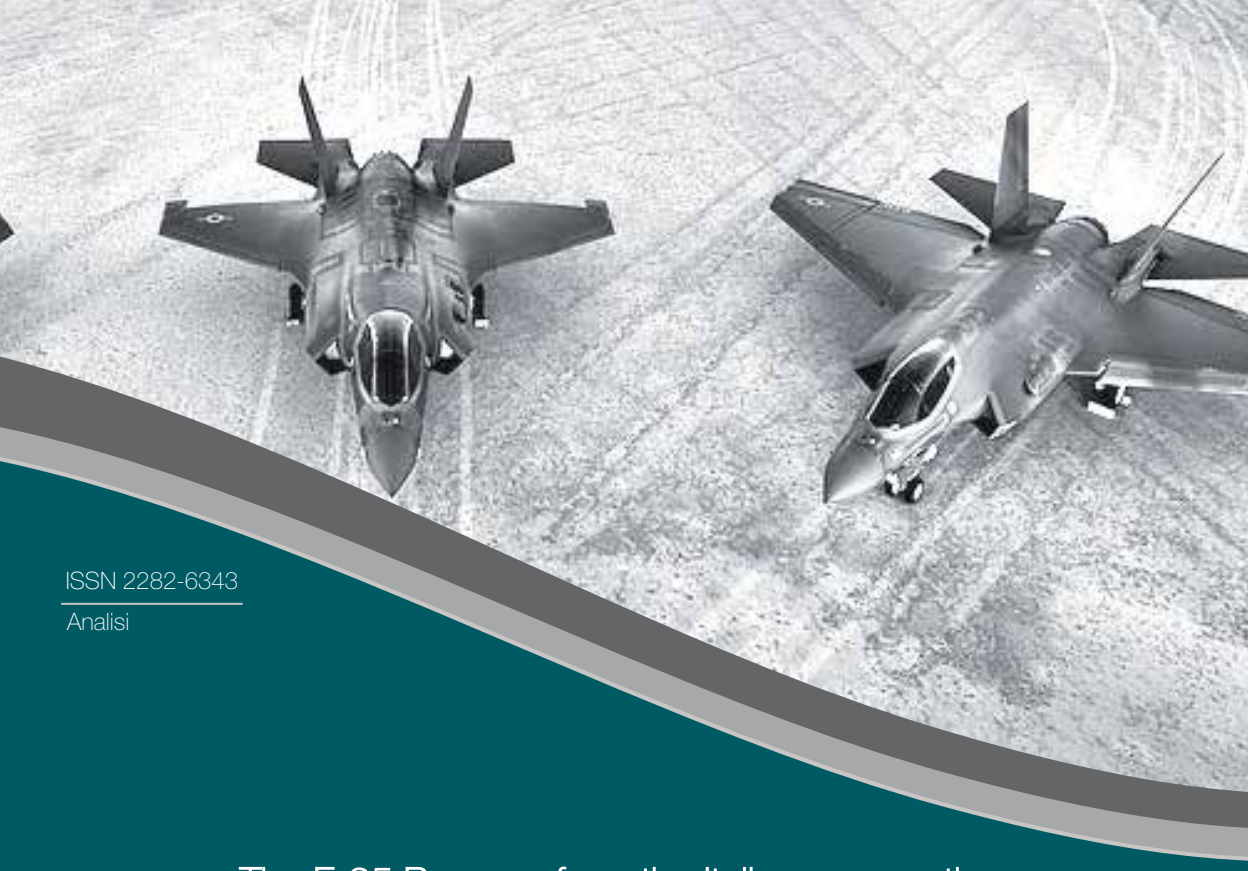

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Analisi

The F-35 Program from the Italian perspective

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Note on methodology

The present work intends to set the current state of the F-35 Joint Strike Fighter Program within a national perspective in order to assess both the strong and the critical points of Italian involvement, not only on the basis of the data and information available, but also through direct experience. From January 20 to January 24 2014, the Delegation from Ce.S.I. – Centro Studi Internazionali, led by Prof. Margelletti with the Director of Analysts Gabriele Iacovino and the Director of the Military Affairs Desk Francesco Tosato, visited the United States for the purpose of a "hands-on" inspection of the aircraft and to view the productive and training infrastructures.
On January 21 the delegation visited the Lockheed Martin plant in Fort Worth where the F-35 is produced. Thereafter the delegation moved to the Eglin air base in Florida where the main training centre for the future F-35 pilots and technicians is situated and where daily flights are made by 40 aircraft in all three versions. On that occasion the Ce.S.I. met Colonel Todd Canterbury of the 33° Fighter Wing of the United States Air Force (USAF) and Lieutenant Colonel David Berke of the Marine Fighter Attack Training Squadron 501 (VMFAT-501). Furthermore, the delegation was able to be present at flight activity and visit the installations for the training of pilots and technical personnel.
The information thus obtained has been reprocessed and is presented in a systematic framework that includes the history of the program, the commercial prospects and the present and potential industrial involvement of Italy.

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I. Background: the start-up of the JSF program and Italian involvement[1]

The F-35 Lightning II is a multirole fifth generation single-seat fighter-bomber developed to carry out missions of close-range air support, ground attack, reconnaissance and, in part, air superiority.

The aircraft is classified as fifth generation thanks to its intrinsic stealth design, i.e. barely detectable by the adversary's radar systems. Another fundamental feature of the F-35 is the new approach to avionic systems resulting from the impact of modern communications and data-processing technologies. The aircraft is in fact capable of integrating and merging the data gathered by the various on-board sensors in order to combine all mission information and increase the pilot's awareness of the surrounding situation. This ability is called "Sensor Fusion". Lastly, the F-35 possesses the most advanced communications technologies currently available, making it able to send rapidly all information collected not only to other command and control nodes but also to all support and maintenance logistic supply chains. Projected by a consortium with Lockheed Martin as group leader with the participation of Northrop Grumman (also USA) and the British BAE Systems, the F-35 Lightning II comes in three versions:

- the F-35A, with conventional take-off and landing;
- the F-35B, short take-off and vertical landing, therefore particularly suitable for use on aircraft carriers such as the Cavour without a flight deck long enough for the take-off of traditional planes;
- the F-35C, for use on conventional aircraft carriers with catapult systems.

This triad was generated by the very concept from which the JSF (Joint Strike Fighter) program started. Back in 1996 it was firstly conceived to prepare a multi-variant system to satisfy integrally the flight lines of both aviations and navies. Secondly, the logic featured by this program was the fact that it was open right from the start to the participation of other nations in its development, and in particular at the following three levels, determined on the basis of total investments:

1°- United Kingdom;

2°- Italy and Netherlands;

3°- Canada, Turkey, Australia, Norway and Denmark.

The different levels of investment of the partner countries involved has made possible a proportional access to the most sensitive technologies and to the industrial benefits for the national aerospace sectors. It should be noted Israel, Korea and Japan are additional countries who have committed to the F-35 and participate in the program via the Foreign Military Sales (FMS) process of the United States, as will other future F-35 customers.

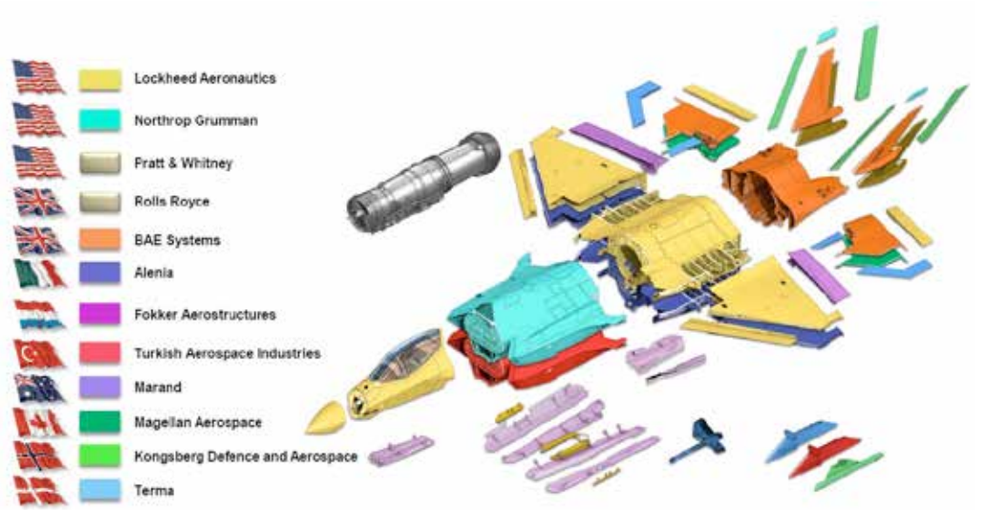

Figure 1. Subdivision of work quotas per structural component among the F-35 program partners.

As far as Italy's original involvement is concerned, in 1998 our country signed an agreement for the conceptual-demonstration phase[2] of the machine, and in 2002, after approval by the Defense Commissions of the Chamber and the Senate, the Government confirmed participation in the development stage. The aim of this decision was the need to replace:

- the last 52 Air Force Tornados still operating until 2020-2025 (out of a total of 100 delivered as of 1981) and intended for strike missions, interdiction, suppression of enemy air defense and reconnaissance. For this purpose, the F-35A aircraft with conventional take-off and landing were selected;

- the Air Force's 60 AMX still in operation until 2020 (out of a total of 132 aircraft acquired from 1988 on) and the 18 AV-8 Harriers II Plus of the Navy also in use until 2020 (acquired as of 1991) for close-range air support missions, tactical redeployment in distant theatres, on-board aviation, etc. For this purpose the short take-off and vertical landing F-35Bs were chosen.

It should be recalled here that the Tornado line has always been one of the country's strategic assets and has been incessantly in use in combat operations from 1991 (the Desert Storm Operation over Iraq) up until the recent 2011 operation in Libya. The AMX flight component,

1 Lorenzo Striuli, one of the Institute's external collaborators, assisted in drafting this chapter.

2 Conceptual demonstration stage: preliminary stage for the definition of the aircraft's project features.

slightly more recent, has also taken part in real operations from 1995 on (the Deliberate Force Operation in Bosnia) and is still used in the Afghan theatre for the protection of our contingent.
In 2009, therefore, aware that within a decade the Tornado and AMX lines would end their operative careers after forty years, the Defense Commissions of the two branches of Parliament expressed a favorable opinion on the program outline presented by the Government, which included the purchase of 131 F-35s at the cost of 12.9 billion euros. We know, however, during the term of Defense Minister Giampaolo Di Paola a reduction was announced in the number of aircraft originally forecasted, 131 (69 F-35As and 62 F-35Bs) to only 90 (60 F-35As and 30 F-35Bs, the latter to be fairly divided between Air Force and Navy), and this was soon approved in successive parliamentary sessions. So far, according to data contained in the long-term defense program for the three years 2013-2015 (Documento Programmatico Pluriennale per la Difesa per il Triennio 2013-2015), Italy's participation costs in the F-35 program can be summarized as follows:

- for the Systems Development and Demonstration stage (SDD), approximately 1 billion dollars;

- for the Production, Sustainment and Follow-on Development stage (PSFD), approximately 900 million dollars spread over a period ending in 2047;

- for preparatory activities in the national sphere, approximately 465 million euros;

- for setting up the Final Assembly and Check Out line (FACO) at Cameri, the probable future centre of reference for maintenance, repairs and up-dating of the F-35s operating the in Euro-Mediterranean area, overall costs of 795.6 million euros (estimated completion in 2014);

- for setting up the purchase and logistic support, total estimated expenditure approximately 10 billion euros to be completed by 2027.
In detail for the current three-year period, financing for the purchase of the F-35s comes to 500.3 million euros for 2013 with expected expenditure of 535.4 million for 2014 and 657.2 for 2015.

II. Participation of national industry

In the context of participation in the F-35 program, since 2005 our country has negotiated with Lockheed Martin and the American Government for the realization of a FACO (Final Assembly and Check Out line) on national territory for the construction of aircraft not only for the Air Force and Navy but also for any further potential purchasers. In 2009, following parliament's authorization for the purchase of the F-35s, the construction of the FACO was also approved and has been built within the Air Force base of Cameri, Piedmont, due to the obvious need for security and secrecy featured in the new Fifth Generation fighter project. The plant, costing 795.6 million euros, was actually built between 2011 and 2013 on an area of 40.87 hectares and consists of 22 buildings housing 11 assembly stations and 5 maintenance, repair, overhaul and upgrade (MRO&U) stations, and is run by the AleniaAermacchi Company, part of the Finmeccanica Group. Originally, the Cameri FACO was to construct 131 aircraft for the Italian Armed Forces and 85 for the Dutch Royal Air Force. As a consequence, the plant was built with spaces and structures suitable for the assembly of 2 aircraft per month, a total annual productive capability of 24 fighters. The structure started production in July 2013 with construction operations of the first national aircraft and it is expected to be at full output by 2016 with about one thousand workers. The reduction of the Italian order to 90 aircraft and the Dutch order to 37, however, means that new collaboration agreements will have to be stipulated with the program partners in order to retrieve the level of aircraft assembled to values near those originally foreseen (216 units[3]).

In addition, as a further major program in the Italian industrial participation plan for the F-35 program, Lockheed Martin chose AleniaAermacchi as the second source for the production of the aircraft's wings and wing carry-through section. According to the initial agreements (which envisaged the purchase by Italy of 131 aircraft) the American company pledged to purchase 1,215 sets of wings. The total was then reduced to 835 after the reduction of the national order to 90 aircraft because Industrial participation in the F-35 program is proportional and commensurate to the total number of aircraft bought. The wing production plant is also housed in the Cameri FACO and foresees a full production rate of 66 wings per year with the possibility of reaching 72. The wings produced by AleniaAermacchi will be used not only for making the Italian and American aircraft but also for all countries that buy the F-35. The innovative productive solutions used in constructing the F-35 have entailed a passage of new technologies from Lockheed Martin to AleniaAermacchi in order to ensure total quality homogeneousness between the parts produced in Italy and those manufactured in the USA. This transfer of know-how has concerned:

- high-precision work of composite parts;

- manufacture by robot of complex parts with the use of materials at high temperature;

3 216 units, that is 131 aircraft for Italy and 85 for Holland.

• high-speed work of complex parts forged in aluminum;

• the training of personnel for cold-working;

• the design of cutting instruments;

• the design of assembly equipment in order to reduce variations in the aircraft parts produced;

• new non-destructive inspection methods for the composite parts.

The participation of national industry involves not only AleniaAermacchi but also other important national industries with establishments throughout the peninsula (especially in Lombardy, Piedmont, Liguria, Tuscany, Lazio, Campania and Puglia).

Figure 2. National productive sites involved in the F-35 program. Elaborated by Ce.S.I..

Italy is particularly active in the production of parts and the logistic support of the F-35 engine, i.e. the F-135 turbofan produced by the U.S. company Pratt & Whitney. Three large national undertakings are involved in this activity at present: Avio, Piaggio Aero and Forgital and 2 small or medium companies (PMI), Aerea and T.C.S. Group.

Other leading national industries are working on the supply of further component parts for the aircraft, among which we recall in particular Selex ES (back up radio, ejector seat system, and the component parts for the EOTS[4], the electronic war apparatus and the assisted landing system), Vitrociset (power carts), Sirio Panel (interior cockpit lighting) and Oto Melara (cannon). Overall, there are about thirty Italian undertakings[5] involved in the F-35 program which have so far stipulated more than 90 contracts for an amount of approximately 667 million dollars. This amount, according to Lockheed Martin's estimate, should reach 9.8 billion dollars in relation to the production currently planned and may well rise by a further 2 billion dollars through opportunities made available to Italian companies on a competitive basis. The question of the program's future industrial returns will however be dealt with in further detail in the chapter entitled "A national perspective for the F-35 program".

4 Electro-Optical Targeting System.
5 See Annex 1 for the list of undertakings involved

III. The technological development of the F-35 program

The F-35 Lightning II is at present the most advanced fighter constructed in the west and is going to be the first aircraft of the Fifth Generation exported outside the United States. This project is a complete break with the past, and was created after the end of the Cold War envisioning possible operative scenarios for the 2020s; the aircraft therefore incorporates technological solutions so innovative as to take it beyond any comparison with the fighters now in production, all conceived in the 1970s and 1980s.

In order to observe the aircraft construction personally, the Ce.S.I. delegation visited the Fort Worth plant in Texas where the F-35 are produced. The new assembly line was set up (and is being enlarged year by year) in premises previously used for the production of the F-16. The outside observer is immediately struck by the extremely high technological level of the production and the great degree of automation and digital technologies.

The production chain is a very silent, sterile environment, organized in assembly stations where highly-specialized technicians work with the aid of the most modern technologies on processing composite materials. As the people responsible for the Lockheed Martin production confirmed, the productive segment of the wings has been "copied" practically in the same way in the Italian Cameri plant as well, in order to ensure the same very high productive standard also in our country. This circumstance is of primary importance, seeing that the wings produced in Italy will equip F-35 aircraft exported throughout the world and there can be no discrepancies of any type.

In fact the F-35 uses state-of-the-art stealth technologies both for the techniques of the aircraft architecture design itself (where the size of each angle has been studied to reduce radar reflexivity to a minimum) and for the special radar-absorbing paints used (the painting process takes 22 days of which 3 with the help of particular robots that apply the most delicate layer).

This level of quality finish is immediately apparent not only to the sight but also to the touch, since the delegation was able to verify personally that the aircraft surface is completely smooth with no riveting. Furthermore, the aircraft has very few service panels for maintenance, and they are situated in hidden positions. Both these precautions target those features of low detectability which are the raison d'être of the F-35.

Photo 1. The F-35 assembly line, Lockheed Martin plant in Fort Worth (Texas).

From the sensory point of view as well, the performance of the Lightning II suite is in all ways incomparably beyond anything else currently available. In this regard, we must remember that all the aircraft's electronics have been realized in line with the concept of "sensor fusion" which makes available a single "reasoned" element of information from the system directly to the pilot's helmet. The result of information optimization, this comes simultaneously from the cutting-edge AN/APG-81 electronically scannned array radar, from the electro-optical targeting system installed on the aircraft's nose (EOTS system) and from the 6 passive surveillance sensors positioned to cover the aircraft at 360° (DAS system[6]). Through its six TV cameras the DAS also allows the pilot to observe what is happening around him (even under the aircraft itself) by simply rotating his head towards the area of interest, as if he were physically outside the plane. Having had the opportunity to try the F-35's "sensor fusion" simulator at the Fort Worth production plant, we can state that the experience of using the helmet-mounted display system is totally different to that of anything else so far available. Once the system is activated, the physical structure of the plane in no way hinders the pilot's vision since he is directly connected to the TV cameras surrounding the aircraft and therefore enjoys a panoramic 360° view no matter what the ambient light conditions may be.

Again, to guarantee best performance in low detectability, the electronic and acoustic components also received particular attention. Emission control systems were installed to make the aircraft extremely discreet also with regard to electromagnetic tracking, while the high power of the engine makes take-off possible without afterburning, thus reducing fuel consumption and sound emissions.

Lastly, being the first plane developed in the digital age, the F-35 has fully benefited from the

6 DAS - Distributed Aperture System: a 360° control system that identifies potential threats to the aircraft.

networkcentric revolution[7]. The aircraft is equipped with superabundant communications systems able to transform it into a data transmission node in real time, and it is also the first fighter-bomber to be ready-designed with electronic attack capability. The idea at the root of the project, therefore, is not to construct just a 'simple' fighter-bomber, but to construct a multi-purpose weapon system able to penetrate undetected into highly-defended air spaces to carry out missions whether of attack, reconnaissance, or intelligence.

In view of such ambitious operative requisites, one comment should be made immediately. The technical, economic, and financial planning originally estimated by Lockheed Martin and by the U.S. Government has proved excessively optimistic.
In the original plans, in fact, the program should have concluded the stage called "Systems Development and Demonstration" (started in 2002) by 2012, but already at the end of 2009 the American Air Force, the Defense Department and the Government Accountability Office – GAO (an American federal body comparable to the Italian Corte dei Conti) had found that not only would it be impossible to terminate all the necessary tests by that date, but also that the economic resources allocated were not sufficient to guarantee the complete development of the F-35 weapon system in all its component parts.

The new approach taken in the aircraft's development was to use a few planes as prototypes before proceeding rapidly to the serial production of jets to be up-dated as work progressed in order to save time and hasten the arrival of the F-35s in the wings. This specific approach proved the source of substantial delays and cost increases. The aircraft in the first construction batches were not in possession of sufficiently advanced software or dependable sensors.

As a further negative effect, the trend of "spiral" capability enhancement earned the aircraft a notably bad public image, since planes considered to be "production" in fact underwent all the limitations typical of prototypes (vulnerability to lightning, structural faults, software instability, low quality images received by the helmet display system, and the need to avoid cloud formations whilst waiting the completion of tests). As a consequence, in March 2010 the Defense Department officially communicated to the United States Congress that the average cost of each F-35 would be 50% higher than that initially estimated in 2002 (and that is 50.2 million dollars with the values of that year) and that the application of the Nunn – McCurdy act was necessary. This act requires a review of weapon programs for the United States Armed Forces should their cost be over 25% above the cost estimated at the project stage. The re-examination of the programs had to take into account three specific parameters, i.e.: the importance of the new weapon system for United States national security, the lack of credible alternatives and the evidence that the issues leading to the cost increase be under control.

On the basis of the Nunn – McCurdy norm, during 2010 a strict revision process started of the whole F-35 program, known as the Technical Baseline Review (TBR), involving more than 120 technicians supported by U.S. Air Force and U.S. Navy staff. In January 2011, the then Defense Secretary Robert Gates was thus enabled to restructure the Systems Development and Demonstration stage according to the new principles specified:
• separation of tests on the F-35B (the technically more complex version) from that on the other models (to avoid slowing down the whole project), and the "trial testing" of this version for 2 years;

• increase of U.S. funding for the Systems Development and Demonstration stage by a further 4.6 billion dollars, (bringing the total to a little under 51 billion dollars) and the extension of the same until the first months of 2016);

• recalibrating the entry into service of the F-35 in its various versions with the American Navy, Air Force and Marines on the basis of the new development stage schedule;

• postponement until 2013 of increases in the production of aircraft for the United States to allow the aircraft to achieve greater technical maturity.

In particular, the focus of activities in the Systems Development and Demonstration stage was recalibrated taking into account above all the need to prepare a list of requisites for the mission software development of the F-35 that was to be more in line with the real complexity of the task. With more than 8.6 million lines of code (compared to one million or little more for the most modern aircraft currently offered on the market) this component is by far the most onerous and risky to perfect.

7 Networkcentric: the term refers to the technological revolution in the world of data transmission through rapid communications networks; it has enabled military platforms also to begin to communicate and share information in real time thus generating the new doctrine of Network Centric Warfare.

IV. The F-35 program today

Following the re-configuration of the SDD, the F-35 program is back on the rails of sustainable development and, thanks to the growing fleet of aircraft available for testing and for the basic training of the first operative pilots, it is going forward speedily and conforming in the main with the new timeline.
Back in 2012 the then Defense Secretary Leon Panetta removed the F-35B short take-off/vertical landing variant from "probation" while the other two models of the aircraft, the F-35A (conventional) and F-35C (U.S. Navy variant) benefited from an aggressive campaign of additional tests to correct the earlier defects previously found.
In May 2012 training on the F-35 started for operational pilots and technicians from the American Armed Forces in order to start effective transition to the new aircraft. This process intensified throughout last year, thanks to the effects of increased aircraft production; as a result, the fleet of aircraft currently delivered to the United States Defense Department and to some foreign partners (Great Britain and the Netherlands) has reached 93 units (as of July 2014, this is 107). In December 2013 the one hundredth F-35 was produced in the Fort Worth plant.
At the end of January 2014 the situation of the completed F-35s is the following:

- 40 aircraft are deployed in the Eglin Air Force Base in Florida where they are used for training pilots and technicians. In detail, the fleet is made up of 14 F-35Bs (three of them British), 23 F-35As (two of them Dutch) and 3 F-35Cs of the U.S. Navy;

- 10 aircraft (5 F-35Bs and 5 F-35Cs) are at the Patuxent River Naval Air Station in Maryland where they carry out development and demonstration activities (SDD);

- 4 F-35As are deployed in the Nellis Air Force Base in Nevada;

- 15 aircraft are stationed at the Edwards Air Force Base in California. Of these, 9 F-35s (A, B and C) are used in development and demonstration activities (SDD) while 6 others, version A only, are used for tests and operative evaluation;

- 16 aircraft, all B version, are stationed at the Marines' base in Yuma, Arizona; this is to become the first operative infrastructure on the new plane for the Marines;

- 6 "static" aircraft and the AA-1 prototype are used in testing activity in support of development and demonstration (SDD). 2 more newly-built F-35s are at the Fort Worth Lockheed Martin plant in Texas awaiting transfer to their assigned bases.

In the opinion of the Ce.S.I., the most important work currently under way is that at the Eglin base where respectively the USAF 33° Fighter Wing, the Marine Fighter Attack Training Squadron 501 and the U.S. Navy Strike Fighter Squadron 101 have started to "produce" combat pilots for the F-35 line. One of the F-35's salient features is that there is no two-seater training version available (the source of further costs); the pilot training process is based on the use of the simulator until they are able to pilot the aircraft safely and independently. This is why the Eglin base possesses 5 ultra-modern simulators (to be increased to 8) to allow up to 94 pilots to be trained per year. As we saw personally, the F-35 is the first weapon system equipped with specific "desk-top" teaching simulators in the classroom to enable the pilots to become familiar with the aircraft management software also through practice on actual throttle and sticks, along with tablets in the use of the cockpit touch screen as if they were in the cockpit. The classroom sessions are integrated with sessions in the Full Mission Simulator. This innovative solution reduces training costs (since actual flying time is cut) and allows the pilots to train their so-called "muscular memory" in the use of the commands. In fact, a close-up observation of the F-35 cockpit immediately shows that the old "analogical" instrumentation made up of levers and switches is practically non-existent. In its place is a large main touch screen (which the pilot can configure as he wishes) for the immediate, simple use of all the command and control functions (fuel level, weapon set-up, state of the engines, digital route map, objectives, etc. etc.). Operational functions are then performed via manipulating switches on the throttle and the stick, along with using voice commands.

The same philosophy of digital training is also used in training Armed Forces technicians whose job it is to maintain the aircraft through the highly sophisticated self-diagnostic and logistical support software (Autonomic Logistics Information System - ALIS) designed to support the maintenance of the F-35 throughout the aircraft's life cycle. The technicians can also get to know the ALIS not only through the specific simulators installed at Eglin, but through specific tablet applications as well. To simplify, during our trial of the ALIS we saw that it functions in the same way as the "guidelines" of the main I.T. programs of home PCs. By self-diagnosis, the aircraft signals any dysfunction or a maintenance service deadline and the ALIS sets in motion a guided problem-solving procedure. Through his own service tablet, the technician in charge is guided step by step from the stage of selection and preparation of the necessary tools, to a view of the digital map showing the component to be replaced, up to the correct procedure to carry out the task. Furthermore, the ALIS is programmed to impose certain check points in the maintenance procedures on the technical personnel in order to ensure compliance with security rules and to avoid any potential mistakes.
As well as practicing on the simulators, the technical personnel is trained in loading and unloading weapons on life-size reproductions of the aircraft. The specific nature of these systems is that, with a view to cost-saving, every one is able to simulate the wing and the weapon bay of each different F-35 version (A, B or C). The pilots also have a full-size training cockpit for practicing the emergency egress of the aircraft and the failure simulation.

The training structures of the F-35 line are at present being constantly up-graded. With regard to the Eglin base, as of 2015 they will have a training capability of up to 200 pilots and 2000 technicians per year. Furthermore, in 2014 the second training base for the USAF will become operative on the F-35A model at the Luke Air Force Base in Arizona. With specific regard to the F-35B short take-off/vertical landing version, a new training location is also planned to open at the Marines Air Station of Beaufort in South Carolina as the time approaches for operations to start on this model with the Marines.

Currently, the aircraft used for training new pilots on the F-35 line at the Eglin base use the 2A version software which essentially enables them to become familiar with the flight features of the F-35 and to make the acquaintance of the aircraft's avionic system. This release software does not yet possess all the "sensor fusion" functions under development for the F-35; these will gradually become available for the 2B and then the 3F versions. The installation of 2A software, however, made it possible to partially overcome the critical situation emerging in February 2013 (when the aircraft were still equipped with the previous Block 1A version) as reported in "Readiness for Training Operational Utility Evaluation" prepared by J. Michael Gilmore, Director of the Office for Operational Test and Evaluation (DOT&E) on weapon systems. This document referred to evaluations carried out from September to November 2012 and was widely publicized in our country. It stressed that pilot training activities were limited by a series of precautionary restrictions that impeded night flights, flights in instrumental conditions, and flights in bad weather, and also excluded simulated combat activities.

Up to the present day, therefore, the standard Block 2A aircraft, as well as the basic activities mentioned above, give pilots initial familiarity with the innovative integrated electro-optical and infrared EOTS system and with the use of the six sensors that are part of the DAS. Furthermore, the avionic system can simulate the presence of air-to-air missiles (AIM-120 Amraam) and air-to-ground weapons (GBU-12 /GBU 31) and make it possible to carry out training for basic combat. It is extremely important to underline that, although in conditions that are not yet ideal, the pilots themselves report that the performance of the electro-optical targeting system (EOTS) and that of the APG-81 radar (in terrain mapping mode), have proved greatly superior to those of the best comparable systems in use on the F-15, F-16 and F-18 fighters in service with the American Armed Forces.

Passing on to analyze the situation of the development of the F-35, since 2012 with the production of batch n° 6 (LRIP 6), the structure of the airframe has been freezed and the 2013 tests have confirmed the value of the project. Consequently, as mentioned above, the efforts of Lockheed Martin and of the Joint Program Office of the F-35 program are now oriented toward completing the software development. Currently, the test program under way targets achieving the first fundamental objective, the Initial Operational Capability – IOC for the first Squadron of F-35Bs for the Marines, planned for the period from July to December 2015. These aircraft are to be equipped with 2B software that has real combat capability centered on the potential to face air threats with 2 long-range air-to-air AIM-120 C Amraam missiles and to engage ground targets using two 2,000lb. GBU-31 JDAM bombs or two 550lb GBU-12 Paveway II bombs. Thereafter, between August and December 2016 the IOC of the first Wing of the USAF on F-35As is planned; and lastly, the IOC of the first Squadron of F-35Cs of the U.S. Navy is planned between August 2018 and February 2019. In order to clarify further the impact of the continuing development of software on the F-35's performance, it is sufficient to analyze the following figure showing the "sensor fusion" capability enhancement of the aircraft following the release of the continually up-dated software versions:

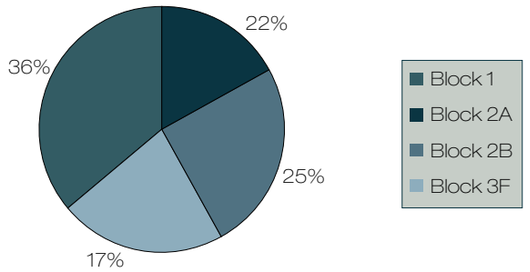

Figure 3. Percentage of sensor function development per Block. Elaborated by Ce.S.I., GAO data

The diagram shows clearly that the aircraft so far used in training (Block 2A) can make use of 58% of all the sensors planned. However, the Block 2B aircraft now being tested with delivery starting in April-June 2015 will raise this percentage to 83%. Lastly, with the release of the 3F (full combat) software, the aircraft will reach 100% operative capability as of July-September 2017.

In order to stay on schedule in achieving initial operative capability (IOC) as agreed with the American Defense Department, Lockheed Martin is now working on an in-depth test program involving all three versions of the F-35 aircraft, a program including contemporary 2B software development, integration of AIM-120C Amraam air-to-air missiles and GBU-12 Paveway II and GBU-31/32 JDAM bombs, exploration of flight behavior at high angles of attack, while tests have been completed on the aperture and closure of the doors of the internal weapon bays with the aircraft at supersonic speed.

Photo 2. Qualification test on a laser-guided Paveway II (GBU-12) bomb by an F-35.

At the end of 2013 49% of the System Development and Demonstration stage was reached with the use of a fleet of aircraft comprising 18 F-35s in various versions which carried out all 1,153 test flights planned and completed 9,000 check points. This result is practically in line with that outlined in January 2011 by the Technical Baseline Review[8] in spite of the fact that the Sequestration[9] of the American budget entailed the loss of several working days due to the closure of the U.S. state firing ranges.

The closure of these structures in fact delayed the tests since the aircraft were grounded until federal personnel were called back to work. Regarding specifically the Block 2B F-35s, the tests made it possible to explore 86% of the flight features, effect 70% of the tests on the aircraft's behavior at high angles of attack (AOA), and complete 74% of the trials for the separation of the weapons from the aircraft (AIM-120, GBU-12 e GBU-31/32).

As to the weapon system qualification, on October 29 last year an F-35B dropped a laser-guided GBU-12 Paveway II bomb on a fixed targe (representing a tank) complying with the precision aims prescribed. The next day for the first time, an F-35A launched an air-to-air AIM-120C Amraam missile proving its ability to acquire, track and bring down an air target. Finally on December 6 2013, another F-35B dropped a GBU-32 JDAM bomb again onto a fixed target representing a tank, demonstrating the precision capability required.

8 Technical Baseline Review: this term indicates the complete revision of the F-35 program made in 2011 which led to the extension of the System Development and Demonstration stage to 2016 and the new schedule for achieving the aircraft's initial operative capability.

9 Sequestration: this term indicates all the automatic cuts to the American federal budget as of March 1 2013 resulting from the failure of Congress to agree to the increase the federal debt cap.

2014 will see the completion of the tests on the F-35 2B configuration and the continuation of those on the final 3F configuration. Futhermore, the fire system of the On Board Inert Gas Generation System (OBIGGS) will be evaluated as will the certification of lightning protection as required by the Defense Department in previous years.

The results illustrated above were confirmed both by the Joint Program Office F-35 and by Director J. Michael Gilmore's[10] annual report. Eagerly awaited because it was issued by an independent authority, the annual DOT&E report also certifies completion of the F-35's engine tests (Pratt & Whitney F-135) and its capability to tolerate excessive fuel ingestion and mechanical damage caused by ballistic damage received in combat.

However, the DOT&E report also pointed out what it considers the major challenges to be faced by the F-35 program in the near future, and presented a series of recommendations that we include in Annex 2.

The DOT&E report in particular certifies the progress in the F-35 weapon system; however, it considers the availability of machines so far delivered to be still insufficient, and the schedule of July-December 2015 for the initial operative capability of the Marines' aircraft to be over-optimistic.

In the opinion of DOT&E, the rate of progress of the F-35 evaluated historically predicts that the 2B software may be installed serially on aircraft from July 2016 (therefore with 9-12 months' delay with respect to the current plan). Lockheed Martin and the Joint Program Office F-35 replied that the DOT&E's historic evaluation of software progress does not take into account the modifications to the organizational structure involved in such development, modifications which will make it possible to respect the schedule originally set.

As we have repeatedly stressed, even in the light of such different opinions, the F-35 software development remains the most onerous, technically complex component, that which requires the greatest effort between now and August 2015.
In any case, there is no further mention, even at the DOT&E, of any possible failure of the program; discussion regards only, and exclusively, the increase in operative capability of the machines and the enhancement of their sustainability in view of their use by operative units of the American Armed Forces.

10 Director of the Office for Operational Test and Evaluation (DOT&E).

V. Commercial prospects and price dynamics

From the outset the F-35 program strongly targeted export, well represented by the presence from the start of 8 partner nations of the United States for the development of the system. Up to the present, Lockheed Martin's forecasts evaluate a potential market for the aircraft of 3,922. These aircraft will be purchased by the American Armed Forces (2,443 in all), by partner nations (a further 660 aircraft) and by other future purchasers through the Foreign Military Sales channels – FMS[11] (819 more planes).

The F-35's current productive situation shows a total of 211 jets, at different stages of confirmed orders, aircraft under construction and planes already delivered. The gradual but constant increase in the construction rate of the F-35s is generating economies of scale and production efficienciesthat influence the aircraft's final price, which has started a decreasing trend. Up to the present, we can be exact regarding the aircraft's price trend, although without the engine which is contracted for separately. In 2011 an F-35A of the fifth batch of low-rate annual production (LRIP 5) cost 118 million dollars. The year after, LRIP 6 aircraft of the same version were quoted at 103 million and, lastly, LRIP 7 aircraft in 2013 for the first time showed a price below 100 million, set at 98 million dollars.

The same descending trend was shown by the more complex and more costly F-35Bs which went from a price of 156 million dollars in 2011, to 109 in 2012, down to 104 million dollars in 2013. It should be noted that these prices were lower by approximately 10/15% than those estimated by the United States Defense Department.

Regarding the F-35's engines, at present only official data are available relative to contracted prices for one of the very first batches (LRIP3) with the F-35A's jet engine costing approximately 16 million dollars and that of the F-35B (which can land vertically) costing 38 million dollars. However, with the increased production rate the engine prices too should have started a downward trend, although there are no official data in this regard.

Currently the construction of the first aircraft of the eighth batch has also started, a total of 43 planes to be financed by the United States with funds from the 2014 fiscal year. Furthermore, negotiations are under way among Lockheed Martin, the American Defense Department and the partner countries regarding annual production batch number 9 (LRIP 9) for 2015 which should see the completion of about 65-70 aircraft. This will be an increase of approximately 55% over the previous year, and 38-40 planes will be constructed for the United States Armed Forces while the rest of the F-35s will be distributed among Italy, Holland, Japan, Israel, Great Britain and probably Turkey as well.

11 FMS: the American Government's program to facilitate the sale abroad of United States weapon systems
12 http://www.aviationweek.com/Article.aspx?id=/article-xml/awx_07_30_2013_p0-602401.xml

On the basis of current industrial plans, the forecast is that annual production will reach 170 planes in 2018 with the price (engine excluded) stabilizing at around 85 million dollars for the F-35A and 94 million for the F-35B.

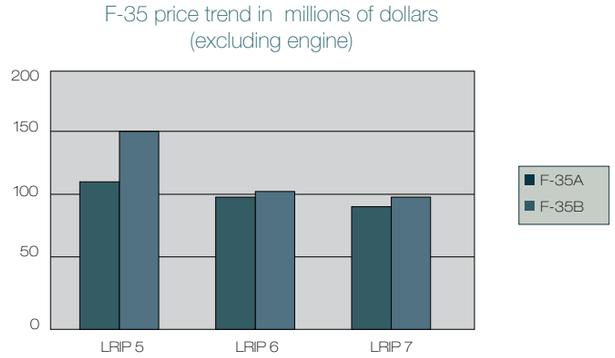

Figure 4. American Defense Department Data. Elaborated by Ce.S.I.

th regard to an evaluation of the situation of the individual partner countries (apart from Italy which will be dealt with in the next chapter), the following information is currently available:

• Great Britain: the country is committed to purchasing 48 F-35Bs. So far it has received the first 3 aircraft and Royal Air Force personnel is being trained at the Eglin Base infrastructures. By next March an order for a further 14 aircraft is expected backed up by a substantial packet of logistic, infrastructural and training support for an estimated value of approximately 5 billion dollars.

• The Netherlands: on November 7 last year the local Parliament gave the all clear for the purchase of 37 F-35As for a total of 4.5 billion euros. According to the agreements in force between Amsterdam and Rome, the Dutch aircraft are to be assembled at the Cameri FACO.

• Denmark: ithe country's requirement is for about 25-30 aircraft. Although taking part in the F-35 program as a founding member, the Danish Government always indicated it would execute a a competitive tendering procedure for their F-16 replacement aircraft, a procedure which should be completed by mid-2015. The main requirement for assignment of the order is to be the upturn in jobs for the country. Participants in the competition, besides the F-35, are the Eurofighter Typhoon, the Saab JAS-39 Gripen NG and the Boeing F/A-18E/F Super Hornet.

• Norway: the Norwegian Government is one of the staunchest supporters of the F-35 program. The country's requirements are for 52 aircraft, of which the first 16 are ordered and are to be delivered as of 2017 (LRIP 7).

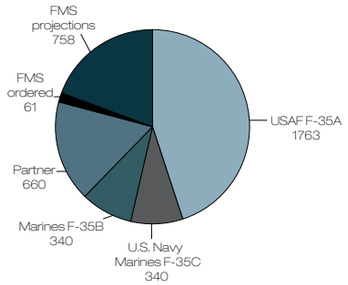

Figure 5. F-35 global market projections. Lockheed Martin data, elaborated by Ce.S.I.

• Turkey: The country's requirement is for 100 aircraft. So far Ankara's approach to the purchase of the first F-35s has been extremely prudent, fruit of the amibiton of local industry to realize their own stealth aircraft. However, rumors increasingly have it that the order for the first two F-35s is likely to come within 2014, in part for the purpose of safeguarding the industrial participation of national industry in the program.

• Canada: Ottawa has been a partner in the F-35 program since its origin and envisaged the direct purchase of 65 F-35As. In 2012 a report of the local "Corte dei Conti" strongly criticized the purchase procedure undertaken by the country for having had recourse to a selection process with one single supplier. As a result, Canada has set in motion a new procedure of competitive analysis that sees the F-35 competing with the Eurofighter Typhoon, the Dassault Rafale and the Boeing F/A-18 E/F Super Hornet.

• Australia: The country is planning a fleet of about 100 F-35As. The first two aircraft, currently at an advanced stage of construction, will be delivered in the course of 2014. Twelve more F-35s have already been ordered and will be delivered at a later date.
Over the last few years, the F-35 program has attracted further countries besides the original project partners. These nations are treated as "foreign customers" and they purchase the aircraft through the specific American Government channel for transactions regarding weapon systems for Foreign Military Sales (FMS).

The purchase of the F-35 by these other nations generates royalties that are then shared among the nine original partner countries on the basis of their respective participation quotas. As a consequence, the greater the F-35's global distribution, the greater the return on our country's investment.

So far, the F-35 has been chosen by Israel for the needs of its own Military Air Force, in the region of 75 machines, and the first 19 conventional-version aircraft have been ordered.
Another country which has already opted for A-version F-35s for its Air Force is Japan. Tokyo is currently planning a fleet of 42 A-version aircraft to deploy within 2021. However,

Japan wishes to assemble its own aircraft locally, following the Italian example, and therefore it is likely to purchase only 4 aircraft directly from the United States. Then in future, as the country prepares to equip itself with two large "helicoptercarrier" units capable of being rapidly adapted to the role of aircraftcarriers for short-take-off/vertical landing aircraft (STOVL), a further order for F-35Bs cannot be excluded.

Photo 3. Vertical landing test of an F-35B on the USS WASP

In conclusion, it is advisable to mention the "current" market prospects that may materialize during 2014. In this regard, one country that has already formally announced its decision to acquire the F-35A is South Korea. The authorities in Seuol are negotiating with Lockheed Martin and the American Government for a first order of 40 aircraft with the possibility of opting for a further 20 planes. A second potential buyer may be Singapore which is considering the possibility of acquiring 20/30 F-35B models to renew its own Air Force's line of combat aircraft.

Photo 4. A USAF F-35A in flight above California

VI. A national perspective for the F-35 program

As already stated in the first chapter, Italy has been a partner country of the F-35 program since the project's initial stages. So far the acquisition of the F-35s has already cost more than 2 billion dollars between financial contributions to the aircraft's development and the construction of the FACO at Cameri for the assembly in Italy not only of planes for our Armed Forces, but also of those for the Royal Dutch Air Force.
During 2013, furthermore, our country presented a firm order for 6 F-35As (3 in the LRIP6 and 3 in the LRIP7) and for the purchase of the first materials for 4 more aircraft to be built in pairs in the successive LRIP8 and LRIP9 (two-year period 2014-2015).

IThe intial Italian F-35s are to be delivered according to the following time schedule:

- First aircraft (named AL-1) in the fourth quarter of 2015. It will be based in the USA for training activity. AL-2 through AL-5 will follow and also be based in the US
- AL-6 will be delivered in the in the fourth quarter of 2016. It will be the first F-35A based in our country and be the first F-35 based outside the United States.
- The first F-35B will be delivered in the fourth quarter of 2017.

The delivery dates of the aircraft are also very important in determining the degree of maturity of the F-35s made for our country. As you see, the first Italian plane will be delivered during the Initial Operational Capability (IOC) evaluation for the Marines (July-December 2015) and the second during the IOC for the USAF (August-December 2016). This means that the Italian F-35s will possess software 31 (definition indicating the 2B software but installed on the new, more powerful processors for the next definitive standard 3F).

As a consequence, our first aircraft will not have to undergo any up-dating relative to the frame or hardware systems, but – like modern computers – they will have to undergo only the software upgrade to standard 3F that is currently planned for the end of 2017.
In any case, considering the reduced number of orders so far made by our country, it is likely that the Italian Air Force will obtain initial operational capability on the first F-35As in about 2018 and complete capability in 2020. This means at least 3 years after the term now foreseen by the American Defense Department for the delivery of the F-35s at the final standard of the project. This time interval also enables any delays that may occur in finalizing the 3F software to be easily absorbed[13].

From this aspect, it must be stressed that it is in the national interest to make the investment at Cameri profitable. This can be done by operating on three levels:

- increasing the number of aircraft and wings constructed by our production line to reduce production costs;
- acting to ensure the plant has the role of the future Center for Maintenance, Repairs, Overhaul and Upgrades (MRO&U) for the European and Mediterranean area, nipping any possible Turkish competition in the bud;
- increasing the number of national undertakings, included Small and Medium Enterprises (PMI), that are in a position to access the F-35 program.

In relation to the first point, it must be remembered that the Cameri installation was designed for an original requirement of 131 aircraft for our country plus another 85 planes for the Netherlands (216 F-35s in all). However, so far the two orders (90 Italian + 37 Dutch aircraft) total only 127 units. It is therefore important that Italy insists with Lockheed Martin that part of the new commissions under purchase be given to the FACO of Cameri (above all those coming from the European and Mediterranean area). The first country with which it would be possible to open negotiations in this regard is Turkey, which (as mentioned above) needs 100 aircraft and should start to order the first models within this year. Rome and Ankara already have solid industrial relations in the Defense field and there could well be opportunity for collaboration on the F-35 project. Another country on which to focus in future is Spain. By 2020 Spain will need to replace at least the McDonnel Douglas AV-8B Harrier II short take-off/vertical landing aircraft (for the same reasons as our Navy), and will be able to purchase nothing but the B version of the F-35 for use on its amphibious assault ship (Landing Helicopter Dock - LHD) Juan Carlos I. In view of Madrid's economic difficulties, we could be talking about another dozen aircraft which our country should try to have assembled at Cameri. The increase in the number of orders for the Cameri FACO is fundamental to widen the economies of scale and to bring Italian production costs as close as possible to the American ones. Up to the present, with regard to the cost of the F-35s assembled in Italy, we must bear in mind that on top of the sums estimated for the aircraft produced in

13 https://www.f35.com/news/detail/department-of-defense-announces-f-35-ioc-dates-for-all-services

the United States, at least another 10%[14] must be added for the costs of shipping the parts to our country and of producing the wings and assembling the fighter-bombers in loco. Simply as an example, therefore, with reference to the first 3 F-35A aircraft of LRIP 6, with a per-piece cost of 103 million dollars for the planes produced in Texas, the Italian equivalent should cost at least 111 million dollars, that is 85 million euros[15] to which another 16 million dollars (12 million euros) for the engine must be added for a likely fly-away cost of around 100 million euros per aircraft. This sum could decrease should the productive rate of the plant reach values comparable to those initially planned, i.e. 24 aircraft per year.

In relation to the second point, the most important prospective business connected to the F-35 program will be the maintenance and upgrade activity on the fleet of aircraft deployed in Europe for the next 40 years. At present, the only existing infrastructures that respect the safety standards laid down by the United States for F-35 maintenance are the Lockheed Martin factory in Fort Worth (Texas) and the FACO at Cameri. It is therefore essential that our country should exploit to the full this competitive advantage by advocating the FACO as the only F-35 maintenance centre (MRO&U) for the whole of the European and Mediterranean region, and also by ensuring that it is FACO that supplies support to the American Armed Forces aircraft deployed across our continent. This favorable situation should be exploited by making a move ahead of potential European competitors and acting along two parallel tracks: on the one hand, engaging Lockheed Martin and the American Government so that they undertake a written commitment to designate Cameri as the regional MRO&U and, on the other, taking steps to develop a network of European alliances in support of Cameri, involving primarily Holland, Norway, Great Britain and Turkey with adequate compensation. The maintenance and upgrade of the F-35s, if carried out in our country, will guarantee a progressive transmission of know-how on the aircraft. It is a fact that, for commercial reasons, America's technology export restrictions tend to relax as years go by as aeronautical projects mature, and there is no reason to suppose that with the F-35 this custom will change.

Thirdly, in order to optimize the technological and economic returns of the F-35 program on the Italian hi-tech industrial chain as a whole, the priority is to increase the number of Italian enterprises involved in the project. At present there are a number of PMI that have expressed interest in being involved both in the structural and the sensor, motor and logistic support parts. In this regard, Lockheed Martin states that there may be business opportunities for such initiatives for an overall value amounting to 2 billion dollars. However, the need remains for this country's overall system to make the nation's PMIs aware of such opportunities and to assist them in the qualification process with Lockheed Martin, checking the quality of the procedures undertaken and respect for fair play on the part of the United States. An essential aspect to be considered is the best strategy to adopt in order to overcome United States severity in terms of the NDP norms (National Disclosure Policy[16]). We consider that a successful approach would be to avoid setting up generalized negotiations, but to ask for a review, case by case, of the NDP with respect to the single part of the F-35 program in which an Italian PMI wishes to participate.

In this way the American partner would be obliged to give exact, full answers without having recourse to the generic overall intellectual protection of entire systems of the F-35 aircraft. Through a gradual, precise and constant approach of engagement with the American counterpart on single business opportunities relative to the Joint Strike Fighter, the Ce.S.I. is of the opinion that there is a good chance of increasing the economic returns for the overall Italian system in the project by involving a wider range of national productive organizations.

Lastly, it is in the national interest to move as soon as possible towards integrating the F-35 with weapon systems of European concept in order to optimize the logistic features shared with the Eurofighter line (with a consequent limitation of costs) with operative capabilities superior to those of comparable American weapons. Our country should claim equality of treatment on a par with the United States' other allies (such as Israel and Norway), insisting on the fact that the integration of European weapons should be reasonably priced. In this field also, we advise a precise stage-by-stage approach to involve the American counterpart on 3 specific aims: the immediate integration of the European long-range air-to-air missile Meteor (with which an agreement with Great Britain is possible, resulting in cost-sharing) and that of the Storm Shadow cruise missile, the only national "strategic" weapon and main deterrent system in the possession of our Air Force. These weapon systems should ideally be made available for the F-35 immediately following the first upgrade after the 3F software configuration as has been planned for the arms of the Norwegian and Israeli allies. At a later date, when such equipment has been completed, it would also be possible to consider the integration of the short-range Iris-T air-to-air missile.
The integration of European weapon systems on the F-35 is a critical point in the future development of the F-35 program in our country as it involves elements of national and technological sovereignty that are of primary importance.

Over the last ten years our country together with our European partners has invested huge resources in developing missile weapon systems that are integrated at a continental level. Such weapons (Meteor, Storm Shadow, Iris-T) will make up the natural operative equipment of the Eurofighter aircraft and consequently they must also be integrated on the F-35, for obvious reasons of economy and standardization.

14 Ce.S.I.'s estimate
15 Exchange rate used: 1 euro = 1.3 dollars
16 NDP: the body of norms regulating the transfer of United States classified information to third countries or international organizations.

VI. Conclusions

Italian participation in the F-35 program is the result of a strategic vision that has continued through several legislatures and that chose Lightning II as the best platform to satisfy the operative needs of the Italian Armed Forces and as the ideal project to transfer part of the state-of-the-art know-how in new stealth technology to the nation's industry, given the total lack of any European project of this type.
In spite of development difficulties, delays and rising costs (common to all major technically-advanced weapon system projects), the decision of the Italian Air Force to opt for the F-35 and its low-detectability features for the interdiction component, has proved particularly appropriate from an operative viewpoint. In fact, the post-2020 environmental context will see the proliferation also in the Mediterranean scenario of decidedly high performance air defense missile systems (Russian class S-300, Chinese HQ-9).

The need to have an aircraft with stealth features would have become apparent last September should our military deployment have been called upon to operate in the Syrian context and obliged to confront "robust" air defense such as that of Bashar Assad's regime. In such circumstances, had it been available, an aircraft with the F-35's features could have been used not only in attack missions, but also in the essential missions of electronic warfare and intelligence.

Again from the operative viewpoint, since the F-35's multirole features strongly favour air-to-ground activity, the Air Force opinion regarding the need to have available two operative lines with complementary characteristics has been proved equally correct. Thanks to its excellent aerodynamic design, the Eurofighter will in fact be the main instrument in carryingout fundamental defense and air superiority missions and will continue to evolve as a multirole machine in supporting ground troops, while the F-35 will be a more strategic platform in a deterrent and dissuasion role.

Lastly, considering the "all stealth" configuaration to be featured in the first line of aircraft for the U.S. Air Force, U.S. Navy and Marines after 2025 (based on the duo F-22 Raptor for air superiority and F-35 for interdiction), the presence of the Lightning II also in the Italian Air Force and Navy is the main guarantee of future inter-operability between Rome and Washington's air instruments. There is no doubt that in missions like those in Kosovo in 1999 and in Libya in 2011 requiring mixed attack packets beween the United States and allied countries, the only Air Forces to take part in operations together with U.S. aircraft will be those having aircraft with identical stealth characteristics, to avoid losing the operative advantage given by low detectability.
In view of the considerations so far expressed, the recurring hypotheses on giving up the Italian F-35 program would lead to consequences that should be analyzed in detail.

From the operative viewpoint, given the few years of operative life remaining for the present Tornado and AMX lines, as of 2020 a considerable capability gap would materialize. The consequence would be the effective cancellation of the national interdiction and ground attack component while waiting to identify a potential replacement, which in any case will not have the characteristics of low detectability and electronic attack. The F-35 is in fact the only fighter-bomber of western conception to have stealth features, as the other comparable planes are respectively the Russian Sukhoi T-50 and the Chinese aircraft Chengdu J-20 and Shenyang J-31.

From the financial, industrial and political points of view, although there are no real contractural penalties should we give up the purchase of the F-35s, it is essential to spell out that more than 2 billion dollars have already been spent on financial contributions to the development of the aircraft and the building of the FACO at Cameri for the assembly in Italy of the planes for our Armed Forces and for the Royal Dutch Air Force. An Italian withdrawal, therefore, would cause the loss of all the huge public resources invested, the reconversion of the Cameri plant to other activities, and the embarrassment of having to inform Amsterdam that they can no longer count on the Italian assembly line for the production of their aircraft in spite of the agreement officially signed last September. In addition to this, all the investments made by the Italian enterprises involved in the program would suddenly become useless.

Even a possible further reduction of the national order (already cut from the original 131 aircraft to 90), besides being operatively nonsensical (given the slender means available compared with the costs borne to create the F-35 line and support it adequately), would be a remarkable waste of economic resources seeing that the Cameri assembly line would operate at productive regimes absolutely out of scale with what was originally planned. Furthermore, in this case, Lockheed Martin would also make a proportional cut (in accordance with the Partners' agreement) in the industrial return agreed upon for our country, leading to further considerable economic loss. These circumstances would mean an extremely substantial increase for each aircraft for the State finances given that the construction of the wing box alone represents approximately 60% of the cost of construction the aircraft's frame.
Given all these facts, in the opinion of the Ce.S.I. the best option is to continue with the program keeping to the current numbers, bringing as much pressure as possible at a political level for a greater role for national industry, a complete capability development to employ European-developed weapons and the enhancement of the Cameri plant.

Given the level of the Italian partnership in the program and the number of aircraft to be purchased (90), our country is in the best political and industrial position to request from Lockheed Martin and the American Government: the inclusion in the F-35 program of other Italian enterprises interested; the integration of the European Meteor, Storm Shadow and Iris-T missiles in place of the lower-performing United States systems; and a written commitment for the transformation of the FACO at Cameri into the one and only Center for Maintenance,

Repairs, Overhauls and Upgrades (MRO&U) in the European and Mediterranean area, not only for the F-35s of partner nations but also for those of the United States Armed Forces stationed throughout our continent.

The achievement of these three objectives would generate a domino effect in technology, employment and industry of the greatest possible importance for the next forty years, guaranteeing the survival of national capability to design high technology in the fields of aerospace, missiles and electronics. Futhermore, it would bring about the passage of hi-tech technologies from military to civil industry in the sectors of I.T., composite materials, and metalworking, potentially applicable in an enormous number of ways.

In conclusion, the Ce.S.I. believes that the F-35 program in its current state is certainly not a perfect program, and that there is indeed substantial room for improvement. However, from the military, strategic and industrial viewpoints, there is still every potential to transform it into a success rather than a failure. It is therefore the entire Italian System that must decide whether to accept the challenge, taking to completion a program of such breadth, or withdraw to a position of refusal and lose a fundamental opportunity as well as the two million dollars at least of public money that has so far been invested.

ANNEX 1
Italian enterprises involved in the F-35 program:

Aerea (Milan)
Aero Sekur (Aprilia –LT)
AleniaAeronautica (Cameri –NO; Foggia and others)
Avio Aero (stabilimenti di Rivalta -TO; Pomigliano d'Arco -NA)
Aviogei (Aprilia LT)
CIRA (Capua- CE)
Elettronica Melara (La Spezia)
Forgital (Vicenza)
Gemelli (Rome)
Logic (Rome)
MBDA Italia (Rome)
Mecaer (Borgomanero –NO)
Microtecnica (Torino, Luserna San Giovanni, Brugherio –MB)
Moog Casella (Genova)
OMA (Foligno)
Oto Melara (La Spezia)
Piaggio Aero Industries (Finale Ligure-SV; Genova)
Rotodyne (Saronno – VA)
S3LOG (Rome)
Samputensili (Ortona –CH)
Secondo Mona (Milan)
Selex ES (Genova, Montevarchi, Cisterna di Latina, Pomezia, Roma, Turin, Campi Bisenzio)
Sirio Panel (Montevarchi)
TCS Group (Torino)
Vitrociset (Roma e Capo San Lorenzo –CA)
York (Milan)

ANNEX 2
Recommendations of the latest annual report of the DOT&E for the year 2013:

• adapt the time schedule of the System Development and Demonstration stage (SDD) to the historical growth rate of the aircraft regarding the development of both software and weapon integration (according to DOT&E estimates, the 2B software will be ready for integration on the aircraft not in May but in November 2015);

• plan objective achievement estimates relating to armament integration tests more realistically; ensure that such tests be adequately supported right from the planning stage through accurate data analysis;

• finance and plan the necessary flights, at the SDD stage, intended to proceed to the development of the V-Sim verification software for the assessment of the F-35s' performance in combat simulation activity;

• track and publish control metrics on the F-35's flight software stability. Such metrics should be oriented towards "mission achievement" and should register every deviation in performance on the part of the aircraft's processors and sensors.

• plan and install a security system to intervene in case of ballistic damage to the cooling systems and fuel transfer systems. Determine the potential vulnerability of the electric system. Consider inserting an alarm system for the F-35Bs to warn the pilot should the vectoring mechanism of engine thrust (essential in vertical landing) be out of action through combat damage;

• map the interval between maintenance operations on the aircraft to specify when they were carried out in order to preserve the aircraft's low detectability, and when they were targeting other activities;

• plan an assessment campaign on the performance of the 2B software to compare its performance with that of other aircraft of the present generation using the same process used at the time of the assessment of the F-22's performance.

About Ce.S.I.

Ce.S.I. - Centro Studi Internazionali, is a Rome-based institute founded in 2004 by Andrea Margelletti. Its activities are spurred by numerous requests from a wide array of clients who are drawn to the institute because of its record of excellence and professionalism in the fields of foreign and security policies. Central to the mission of Ce.S.I. is the constant and active interest of its associates in current political affairs and in-depth political analysis.
Our objective as an institute of political analysis is to understand and to explain, in the shortest time and in the clearest way possible, complex events occurring on the global scale. Our intention is that of furnishing the analytical tools which enable the policy-makers to adjudicate and decide on their own. Differing from academic institutions and most Italian think-tanks, the institute is characterized by the relatively short response-time to a crisis, producing up to date and objective analyses for our clients when they are needed most.
The work of Ce.S.I. finds its peak in the analyses which, with steady, timely and dynamic updating, provide information and objective interpretations. Our focus is contributing to the moulding of a nuanced and unbiased approach to the world, promoting, when possible, innovative perspectives usually shunned by the mainstream media.
The issues which are crucial to Ce.S.I.'s analyses are centered on the internal and international political dynamics of those countries which Italy regards as of paramount importance for its interests in the world, especially the wider Middle East, Africa, Asia and the Balkans. Central to our work are security and defense policies, with particular focus on terrorism and counter-terrorism issues.
What Ce.S.I. brings to the fore is a multifaceted approach, which must be based on certain essential aspects, the comprehension of which is vital to interpret the dynamics of an ongoing phenomenon. In this perspective, Ce.S.I., an entirely private and independent institute, strongly believes that in order to better understand what goes on in the world it is necessary to have direct contact with all of its actors. For this reason, it is very important for us to establish relations with State and non-State entities, particularly from the Middle East, where in some cases official institutions experience difficulties in listening to and connecting with influential local actors.
With respect of this, and especially thanks to frequent and long-established trips to the areas in question, Ce.S.I. is able to relate directly with countries, personalities, officials, non-state actors and resistance movements, in order to produce in depth analyses on the most topical issues and on the possible developments and opportunities in a context of crisis. By coming into contact with local realities Ce.S.I. analysts are able to transfer their experiences and their local knowledge to our clients, so that they can have the clearest possible perspective to deal with the complexity and the sensitive intricacies of the modern world.

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