MINISTRY OF DEFENCE

Secretariat General of Defence and National Armaments Directorate
Directorate of Air Armaments and Airworthiness

FLIGHT SIMULATORS – ZERO FLIGHT TIME *CAPITOLATO*, CERTIFICATION, REGISTRATION, CONFIGURATION CONTROL AND TECHNICAL PUBLICATIONS

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1. GENERAL

Flight Simulators are systems that allow crews to be completely trained on an aircraft type. In particular, "Full Flight Simulators" (FFS) replicate a complete operating scenario in 1:1 reproduction scale of the aircraft cockpit. "Zero Flight Time" class simulators allow crews to train, performing flight hours valid to obtain and maintain their flight license. The fidelity of reproduction of the devices, of the equipment and of the IT technologies made available enable crew training at all phases of mission both in flight and on the ground. The visual reproduction and the reproduction of the forces that act upon the crew during operations in motion provide extremely high training and professional standards that for particular types of mission, avoid the need for personnel to use the real weapon system during training. Moreover, by accurately reproducing the real operational scenarios, it is possible to train the crew to operate in contexts that are difficult or sometimes impossible to replicate in reality.

In the civilian realm, the EASA issues the certification of training devices of commercial aircraft (simulators) on the basis of their simulation capabilities in terms of realism and performance with respect to the real operating system. In this respect, the persons, organizations or companies requesting the certification of a Flight Simulation Training Device (FSTD) has to prove to EASA that it complies with the requirements of the "CS-FSTD A" and "CS-FSTD H" standards respectively for flight training on airplane and helicopter. Over the last few years, the Italian Department of Defence – *Amministrazione Difesa* (A.D.) has acquired complex training systems such as Flight Simulators. Therefore, just as occurs in the civilian world, it is necessary to regulate the management of military "Zero Flight Time" FFS in terms of definition of their requirements, their certification, and their registration in the specific ZFT Registry of Military Simulators, configuration control and technical publications, to validate their use for training. For this purpose, this regulation defines the certification of ZFT FFS used to perform the tasks that are common to civilian simulators (certified or not by other Civilian or Military Authorities) and specific military tasks.

1.1 INTRODUCTION

For the issue of the Military Simulator Qualification Certificate by D.A.A.A., the Simulator System Design Responsible (SSDR) shall be recognized through a specific Service Bulletin – *Prescrizione Tecnica Applicativa* (PTA). At this end, aircraft according to the paragraph 3.1 of this regulation, the Company shall set up specific agreements with the Company that designed the simulator, in order to be recognized SSDR.

1.2 Aim

The purpose of this regulation is to regulate the processes relevant to the requirements definition (*Capitolato Tecnico* - Statement Of Work), certification, record in the Register, configuration control and Technical Publications of the FSTD simulator (Flight Simulation Training Devices), FFS class (Full Flight Simulator), "Zero Flight Time" identified hereinafter with the abbreviated term "simulators".

1.3 Applicability

The provisions of this regulation has to be applied to Flight Simulators FSTD, FFS class, "Zero Flight Time" that are:

- subject to a specific acquisition program of the *A.D.*, or acquisition by Government Agencies;
- of interest to the *A.D.* for which an Agreement against payment is entered into with the applying Company;
- of interest to other national, international and foreign Agencies.

Within the context of international programs, this regulation shall maintain validity according to the program agreements. Within this standard, the generic term "flight simulators" identifies the FFS flight simulators of military aircrafts, including Remotely Piloted Aircraft Systems (RPASs).

1.4 Related documentation

- AER(EP).0-0-2 Definizione e Regolamentazione del Sistema delle PP. TT. della Direzione Generale degli Armamenti Aeronautici (ARMAEREO) - Herein translated into: "*Rules and definitions for the Technical Publications system of the Directorate of Air Armaments and Airworthiness (D.A.A.A.)*"
- AER(EP).P-2 Omologazione di Tipo Aeromobile Militare, Omologazione, Idoneità alla Installazione - Herein translated into: "*Military Type Certificate and Qualification, System Qualification, Suitability for Installation*"
- AER(EP).P-6 Istruzioni per la compilazione dei Capitolati Tecnici per Aeromobili Militari – Herein translated into: "*Instructions for compiling Capitolati Tecnici for military aircrafts*";
- AER(EP).00-00-5 Valutazione, ed autorizzazione delle modifiche da introdurre nei materiali di competenza della D.G.A.A. – Herein translated into: "*Configuration Control. Preparation, assessment and approval of configuration changes to be implemented in materials for which D.A.A.A. is responsible*"
- AER(EP).P-7 Norma per l'iscrizione e la tenuta del Registro degli Aeromobili Militari (R.A.M.) Herein translated into:

"Regulation for recording and maintaining the military aircraft register – (*Registro degli aeromobili militari* – R.A.M.)

- CS-FSTD A Certification Specifications for Aeroplane Flight Simulation Training Device – 4 July 2012;
- CS-FSTD H Certification Specifications for Helicopter Flight Simulation Training Device – 26 June 2012;

1.5 Acronyms and definitions

The abbreviations and definitions of terms used in this standard are those of regulation AER.Q-2010. In addition to the provisions of AER.Q-2010, other abbreviations and specific definitions of the topics covered in this regulation are set out below:

TERMS/EXPRESSIONS	DEFINITION
FSTD - Flight Simulation Training Device:	Flight simulators are ground-based systems that replicate the behaviour in flight of an aircraft type, at various levels of fidelity and accuracy.
FFS - Full Flight Simulator	Simulator type characterized by a 1:1scale reproduction of the cockpit of an aircraft of a specific type or brand, model and version, including all its equipment and computing resources needed to reproduce the operations on the ground and in flight, a vision system to reproduce an external view out of the cockpit, and a motion system to reproduce the forces which act upon the cockpit/Flight deck and/or on the pilot.
Zero Flight Time ZFT	FFS simulators that allow crews to train and perform flight hours valid towards obtaining and maintaining their flight licenses.
FSTD Operational Characteristics	They define the use for which the simulator is designed and, than the tasks to be performed.
FSTD performances	Capability of the simulator to faithfully replicate the real features of the simulated aircraft in terms of: open loop handling quality, closed loop handling quality, dynamic performance of the entire aircraft within the flight envelope including ground effect, replication of the functions of avionics, both at the level of the man-machine interface (Cockpit) and at the machine-environment level of the simulated flight (reproduction of tactical scenarios, electromagnetic scenarios at the various frequencies, etc.)
SSDR	Simulator System Design Responsible

2. INSTRUCTIONS FOR PREPARING THE *CAPITOLATO TECNICO*

This paragraph contains the instructions for drawing up the *Capitolato Tecnico* (C.T.)-Statement Of Work of Zero Flight Time FFSs and defines, by reference to the specific configuration of the simulator and of the Military Aircraft to be simulated, the structure and the type of requirements that it shall contain.

2.1 Preparation of the *Capitolato Tecnico*

The relevant Technical Divisions shall issue a request for bidding on the basis of the Armed Forces' Operational Requirements. The Companies will respond to the Technical Divisions with bids, that in a dedicated document called "Technical Specification" shall provide a "performance oriented" description of the simulator being offered, in accordance with paragraph 2.2.1".

The Technical Specification shall be prepared by the Simulator System Design Responsible (SSDR) and submitted in a completed release, in accordance with the requirements of this regulation.

The Technical Divisions will assess the Technical Specification provided during the bidding phase, specifically assessing the compatibility of the requirements set out in the Technical Specification with the Operational Requirement of the Armed Forces with particular regard to the specific military tasks (operational missions and related emergencies) to be simulated. The Technical Specification will be subject to the preliminary assessment of the Vice Technical Directorate (VDT) 1st Office to ensure the faithful representativeness of the aircraft to be operate with crews trained though the simulator described in the specification in order to ensure flight safety. At this end the 1st Office will assess the simulator performance in terms of full representation of the simulated aircraft, concerning:

- open loop and closed loop handling quality;
- HMI (Human Machine Interface);
- Performance.

Subsequently, the Competent Division will agree with the SSDR any required amendments to these requirements. After the Part I requirements agreement, , the Technical Divisions, in accordance with this regulation and in coordination with VDT 1st Office, will prepare the *Capitolati tecnici*, based on the Technical Specification and completed with Part II (paragraph 2.2.2), that will come into effect after the approval of the Head of Department that supervises the Technical Division’s activities. Each original C.T. will be identified with an incremental number, signed and stored in a specific archive by the Technical Division which has prepared it. Moreover, a copy thereof shall be sent to the VDT 1st Office.

Upon signing the contract, the original *C.T.* will be stored together with the contract at the corresponding Technical Division.

2.2 Structure of the *Capitolato Tecnico*

The *Capitolato Tecnico* of the simulator is divided into two parts:

- PART I: Technical Specification (System Requirements Document).
  The set of the simulator's technical requirements; based on the operational requirement specified by the Armed Forces i.e. the tasks of the aircraft to be simulated.
- PART II: Regulatory Requirements and miscellaneous requirements.
  Set of various contractual requirements that are not the subject of the simulator Certification process, such as the requirements regarding the application of the mandatory regulations and other miscellaneous requirements.

For the format, the language and the management of amendment of the *Capitolato Tecnico,* the content of the AER(EP).P-6 regulation (in paragraphs 2.2, 2.3.1,2.3.2, 2.3.3 and 2.4) is applicable to simulators as for aircraft.

2.2.1. PART I Requirements

Part I of the *Capitolati Tecnici* defines the requirements of a Military Simulator required for Zero Flight Time certification. Therefore, Part I shall define, on the basis of the AFs operational requirement, the use of the simulator and the tasks that it shall carry out for ZFT use.

The requirements shall be defined in accordance with the tasks of the aircraft to be simulated. These tasks can be:

- common to civilian Zero Flight Time FFSs regulated by civilian-EASA regulations (CS-FSTD A and H respectively for fixed wing aircrafts and for helicopters).
- Military.

Generally, the military requirements determine, in addition to the introduction of specific additional requirements, also the need to make the typical requirements of a civilian simulator more restrictive.

Attachment “A” provides a guideline to define the minimum requirements of a military simulator, with the exception of those for Remotely Piloted Aircraft Systems (RPASs) that are reported in attachment “B”.

2.2.1.1 Military Simulators Based On Civilian-EASA One

The requirements definition of the military simulator based on civilian one according to the typical civilian tasks and military tasks, could optimize the timing of the Military Certification activities if the simulator already has an EASA certificate and the D.A.A.A. decides to use it (for the corresponding certification activities see paragraph 3.9).

2.2.2. Requirements of PART II

Part II of the *Capitolato Tecnico* defines:

- Technical/administrative requirements;
- Requirements concerning the application of the mandatory regulations;
- Miscellaneous requirements.

Part II is not part of the Certification process described in this regulation (paragraph 3); however, the requirements of Part II refer preparing activities for the issue of the Military Simulator Qualification Certificate.

Below are the details of the content of Part II:

- Technical/administrative requirements

  Part II shall include the following table which shows the basic performance, the tolerances and the corresponding reductions:

Performance	Base value	Tollerance		Reduction
		Cannot be	Can be reduced	

  The basic performance above, together with the respective tolerances are the minimum performance for acceptance. The basic performance to be included in Part II shall be determined taking into account the operational requirements set out in Part I in terms of specific design performance and the mission requirements that shall be met.

  For performance that is intermediate between those that cannot be reduced and the minimum ones, the reduction shall be applied in proportion to the difference with respect to the baseline performance plus the tolerance that cannot be reduced. For each of the performances that is present in more than one condition, a single reduction shall apply and precisely to the performance that determines the maximum reduction.

  In addition to the above, the corresponding Technical Division of the D.A.A.A. may require any other technical/administrative requirement deemed necessary for the specific acquisition program.

- Requirements concerning the application of the mandatory regulations
  - Quality Certification: the Part II of the *Capitolato Tecnico* shall specify the contractual regulations requirements applicable for the Quality Management System of the Design Responsible Company. The following requirement shall also be stated: "The work shall be performed according to best practices".
  - Military Simulator Certification: the Part II of the *Capitolato Tecnico* shall specify that the Simulator has to achieve Qualification Certification in accordance with paragraph 3 of this regulation and that accordingly, the Company has to submit the dedicated Certification Plan and the

Compliance Matrix in which, for each requirement set out in *Capitolato Tecnico* Part I, the method of demonstration will be identified or the combination thereof (Means of Compliance - MoC) with the regulation requirement satisfied. Subsequently, the Company shall present the MoE (Means of Evidence) for each MoC.

- Record of the Simulator in the Registry of Military Simulators – Registro dei Simulatori Militari (R.S.M): the Part II of the *Capitolato Tecnico* shall specify that each built simulator shall be recorded in the Registry of ZFT Military Simulators and registered as a ZFT in accordance with the content of paragraph 4 of this regulation.
- Technical Publications: the Part II of the C.T. shall specify that all required technical publications related to the simulator shall be issued in accordance with the content of paragraph 6 of this regulation.
- Configuration Control: the Part II of the *Capitolato Tecnico* shall specify that the Company shall set up processes suitable to manage the configuration of the simulators in accordance with the requirements described at paragraph 5 of this regulation. At this end, the System Design Responsible shall:
  - submit, when the contract becomes effective, a Company Application/Declaration for Recognition – *Prescrizione Tecnica Ditta (PTD - as per AER(EP).00-00-5*), in which it declares and warrants that it is the unique and exclusive responsible for the Design of the project and its parts i.e. it shall submit the licenses or delegated powers which entitle it to act on this and be accountable for it (see paragraph 3.1);
  - in conjunction with the Certification of the Military Simulator, define and formalize the base configuration document "as designed" (Design Standard);
  - when submitting each single Simulator for testing, define and formalize the base configuration document "as built" (Built Standard);
  - declare, through PTD, the list of 2nd level System Design Responsible, providing their acceptance documentation.

- <u>Miscellaneous requirements</u>

  Acceptance Testing: Part II of the *Capitolato Tecnico* shall define the methods and timing for acceptance testing, to verify that the simulator is compliant with the performance reported in the Military Simulator Qualification Certificate. Moreover, a time limit, in advance to the tender for acceptance date, for providing D.A.A.A. the Acceptance Test Procedure shall be specified.

  The Part II of the *Capitolato Tecnico* shall specify that the Acceptance Test Procedures is subject to D.A.A.A acceptance and that the acceptance test Board may carry out further tests/checks that it deems to be appropriate.

3. Military Simulator Qualification Certificate

The Certification of a Military Simulator is the formal recognition provided by D.A.A.A. through the issue of a "MILITARY SIMULATOR QUALIFICATION CERTIFICATE", that certifies the compliance of a configuration of the simulator with the requirements set out in the corresponding *Capitolato Tecnico*.

As per paragraph 2 of this regulation, the *Capitolato Tecnico* shall identify the simulator's representativeness of the simulated aircraft. Therefore, the Military Qualification Certification of the simulator, necessarily requires military Certification/Qualification of the corresponding Military Aircraft Type (AER(EP).P-2). For aircrafts that have entered into service in accordance with the old D.A.A.A. regulations which did not require to issue a Type Certificate, it is however possible to issue the certificate for the related simulator. In this case the simulator shall be faithfully representative of the aircraft designed according to its specification.

Proof that the configuration meets the requirements set out in the *Capitolato Tecnico* shall be provided by the System Design Responsible by Means of Compliance to be agreed with the D.A.A.A. A guideline of the list of MoC considered acceptable by the D.A.A.A. is given in Attachment "F" of the AER(EP).P-2 standard taking into account that for simulators, MoC 6 "aircraft flight tests" is to be interpreted as "flight tests of the simulated aircraft" (paragraph 3.4.1), the definition of MoC 5 is "ground tests on the simulator" (the simulator replaces the aircraft) and MoC 3 "safety analysis" is not applicable.

The results of the tests obtained within a development program can be used to support a certification, provided that the development test configuration is representative of the configuration subject to certification.

3.1 Company Responsible for Simulator System Design

The Simulator System Design Responsible (SSDR) or delegate thereof shall be recognized through the issue of a specific PTA. At this end the Company, in order to be formally appointed SSDR, shall satisfy the requirements set out in paragraph 2.2. of the AER(EP).00-00-5 regulation and prove that it has access to the necessary data of the simulated aircraft and to the related updates under specific agreements with the company that designed the aircraft itself.

3.2 Application for Certificate

The Certification application shall be submitted by the Simulator System Design Responsible to the D.A.A.A. VDT 1st Office and in copy to the UTT of the area of the Company and/or the airport where the prototypes will be produced.

This application shall contain:

- the reference to the contract and to its *Capitolato Tecnico*;
- as an attachment, the configuration document of the simulator;

- as an attachment, the Certification Plan: description of the complete certification program of the demonstration activities, including the time schedule thereof and the locations of the tests.

3.3 Application Analysis by D.A.A.A.

The D.A.A.A. VDT 1st Office will assess the submitted documentation to verify its suitability and therefore proceed with the approval of the Certification Plan.

3.4 Qualification Certification Matrix

The Company shall prepare a Compliance Matrix which correlates each requirement of the *Capitolato Tecnico* Part I with the demonstration methods to be used (Means of Compliance - MoC) and with all documents issued to demonstrate the compliance with requirements (Means of Evidence - MoE).

3.5 Certification Tests

The Company applying for the Certification, shall submit certification evidence coming from tests performed on units in the configuration under certification or on units in a configuration considered representative of this latter.

For military simulators based on civilian-EASA one, the CS- FSTD (A/H) may be used as guideline, to demonstrate compliance with the requirements arising from tasks that are common to civilian simulators set out in *Capitolato Tecnico* Part I.

The Company shall demonstrate the representativeness of the test item.

At its own discretion, the D.A.A.A. may decide about the presence of its own representatives in any phase of the tests.

The D.A.A.A. may authorise the Company to carry out the tests at Public Departments or Private University Laboratories, Research Centres, etc. that are suitably equipped.

In this case, free access to the premises where the tests are being carried out, shall be granted to D.A.A.A.'s delegates, at any time. The D.A.A.A. may order that the tests shall be carried out in whole or in part at suitable Military Laboratories. Access to these Military Laboratories or Departments can be granted, as observers, to the delegates of the Company.

3.5.1 Flight tests

To demonstrate the full representation of the simulator with respect to the simulated aircraft, the SSDR shall submit, in addition to the dedicated analyses, ground tests, etc., also the plan and the related report of the flight tests of the simulated aircraft aimed at collecting data to be used for verification and subsequent validation of the simulated data.

3.6 Certification Evidences

The applicant Company shall send to the D.A.A.A. VDT 1st Office in digital form, all Means of Evidence issued to demonstrate the compliance with all the requirements of *Capitolato Tecnico* Part I.

At the end of the design validation process, after the D.A.A.A. assessment of the evidence referred in the compliance matrix, the applicant Company shall provide to the D.A.A.A. a declaration of compliance with the applicable requirements (Part I of C.T.) and the D.A.A.A. shall issue the Military Simulator Qualification Certificate.

Attachment C contains the guidelines for preparation of the Declaration of Compliance with the requirements of the C.T. Part I.

3.7 International Cooperation Programs

For Simulators developed under contracts concluded by International Agencies or NATO agencies, i.e. under bilateral agreements between Italy and NATO countries, the Deputy Technical Director, considered the *Memoranda of Understanding* and the procedures agreed between the Countries participating in the program, will coordinate the related interfacing activities with the Certification Program in accordance with this regulation, via the VDT 1st Office.

The VDT 1st Office will use the evidence results collected at international level to support the issue of the national Military Simulator Qualification Certificate in accordance with this regulation.

3.8 Test Monitoring

The Company shall provide to the VDT 1st Office the updated schedule of the certification tests within 12 working days from the date of the test. If there is a particular need for supervision, the Head of the VDT 1st Office may require that the specialist of the certification team or of other designed Organization participate in the test. In this case, 10 working days in advance, the Company shall provide to the certification team and to D.A.A.A. representative, the relevant test procedure. The representative of the certification team responsible for the system under test will assess the procedure and confirm its suitability to the representative participating in the test. The D.A.A.A. representatives participating in the test shall specifically verify that the test is carried out in accordance with the procedure and report any discrepancies only to the certification team using a specific witnessing report.

3.9 Recognition of Certifications Issued by other Government Bodies or Authorities

If a Simulator, subject to Military Qualification Certification, has already a Certificate issued by another military or civilian recognized Authority (or is derived from a version of a Certified Simulator) the D.A.A.A. may, at its discretion, recognize that certificate and the related evidences, requiring the Company to provide

supplementary data when necessary. In any case it is necessary that the simulated military aircraft had been certified according to the same certification base of the aircraft simulated by the FFS already certified by the other Authority.

The D.A.A.A. will assess the possibility to recognize such certification, taking into account the applicable requirements, the process and the regulations adopted by the Authority that issued the certificate. Therefore, the D.A.A.A. will issue the Military Simulator Qualification Certificate only after having verified the compliance with the requirements of *Capitolato Tecnico* Part I. The applicant Company shall send to D.A.A.A., as an Attachment to the application, a copy of the Certificate issued by the other Authority and shall make available to D.A.A.A., the submitted supporting evidences. The Company will be the unique responsible for the timely and complete reporting of any change concerning the certificate issued by other Certification Authorities and used by D.A.A.A. to issue the Military Certificate.

If in an international development program, the simulator is certified by the appointed Agency, D.A.A.A. may accept certification activities performed by that Agency without any further evaluations and if the certified configuration matches the national one issue the Military Certificate. However also in the case that, D.A.A.A. recognizes a certification issued by other Government Bodies or Certification Authorities, the Certificate has to be issued, with its relevant Data Sheet (Technical Attachment) and Qualification Technical Report.

3.9.1 Military Simulators Based on Civilian-EASA One

In the specific case in which the Simulator subject to Military Certification has a Certificate issued by EASA, paragraph 3.9 applies with the following peculiarities:

- **Tasks of the simulator that match those of the civilian certificate (EASA)**

  If the *Capitolato Tecnico* does not require to carry out specific military tasks, since they are not required for the simulated aircraft or they are not AFs requirements, the D.A.A.A. may issue the Military Simulator Qualification Certificate, directly recognizing EASA's certification but taking into account the impact of any configuration differences between the military simulator and civilian one.

- **Presence of specific military tasks**

  If the *Capitolato Tecnico*, in addition to the common civilian certified tasks, requires to simulate also specific military tasks performed by the simulated military aircraft and required by the AF's operational requirement, the D.A.A.A. may issue the Military Simulator Qualification Certificate, recognizing the EASA certification taking into account the impact of the configuration differences between the military and the civilian simulators. If, whit additional evidences, the compliance with the military requirements is not demonstrated, the D.A.A.A. may issue a Limited Certificate in which the Data Sheet specifies that the

simulator is not certified Zero Flight Time for the part concerning the specific military tasks.

3.10 MILITARY SIMULATOR QUALIFICATION CERTIFICATE

The following information shall be reported in the Military Simulator Qualification Certificate to exactly identify the certified configuration and the relevant limitations:

- name of the simulator, type of the simulated aircraft and the Company that designed the simulator;
- details of the *Capitolato Tecnico*;
- configuration of simulator;
- main characteristics and limitations.

The Data Sheet, that describe the main features and limitations of the simulator, is an integral part of the Certificate. All C.T. Part I requirements, that have not been met or demonstrated, are reported in a specific appendix of the *Capitolato Tecnico*.

This appendix shall detail, for the requirements that have not been met or demonstrated, the limitations and/or mitigations that enable the issue of the Certificate, ensuring the full representation of the type of simulated aircraft.

The Certificate is based on the Qualification Technical Report, that contains a summary of the evaluations carried out and the list of the reference documentation used in the certification process. The Qualification Technical Report shall contain, in a dedicate appendix, the matrix with the details of the requirements of the C.T. Part I, the related MoC, MoE, any notes and additional comments. This Report is not attached to the Certificate and it is archived in the VDT 1st Office.

The Certificates, signed by the Director or his/her delegate, are drawn up in two original forms, one is kept and archived by D.A.A.A. and one is delivered to the Company. The VDT 1st Office shall keep the certificate for ten years after the date of final retirement from use of the simulated aircraft. This period is extended until the end of any technical, administrative and judicial investigation procedures in progress. In such circumstances, the extension of further time keeping of the Certificate will be subject to specific assessment. All the documentation produced to support the certification process shall be stored by the Company that is the certificate holder, for ten years from the retirement of the simulated aircraft, unless disputes occur.

3.11 Company Holding The Certificate

The Military Simulator Qualification Certificate can be issued by the D.A.A.A. to the simulator designer Company or to a licensee Company or to a delegated Company if they have:

- access to all the design data of the Designer Company;

- the capability to demonstrate the applicability and the suitability of the technical documentation issued by the Designer Company to all the applicable requirements;
- access to the necessary data of the simulated aircraft and to the related updates through specific agreements with the aircraft Designer Company .

For international partnerships, the D.A.A.A. may issue the certificate either to the Company or to the Italian Partner company, if at the time of the request the latter demonstrates:

- proper coordination with the other Partner Companies, to achieve the certification objectives;
- access to the requirements of the technical specifications of the systems designed by the other Partner Companies;
- access to technical evidence produced by the other Partner Companies to demonstrate the compliance with the requirements of the *Capitolato Tecnico* Part I and its internal capability to verify the applicability and the compliance with the requirements;
- access to the necessary data of the simulated aircraft and to the related updates through specific agreements with the aircraft Designer Company.

3.12 Certificate Suspended/Cancelled/Limited

The Military Certificate may, at the discretion of the D.A.A.A., be suspended or limited or cancelled if the system has caused in-service incident, formally communicated by the user, due to design mistakes and/or if the simulator is no longer representative of the simulated aircraft.

The suspension or cancellation of the Certificate forbids the use of previously certified material.

In the event that compliance with the requirements of Part I of the C.T. is not demonstrated, it will be possible, for specific A.D. needs, to grant a Limited Simulator Certificate, provided that the simulator's representativeness of the simulated aircraft type is demonstrated for specific mission for which zero flight time is ensured.

The simulators with Limited Certificate is allowed for use with specific instructions concerning the applicable limitations appropriately detailed in the Data Sheet (for example: if no VOR, the certificate will state the following limitation "The simulator is not certified "Zero flight time" for IFR flights).

For limited Certificate, the certificate form shall be marked by a large red stamp showing the wording “LIMITED” and the Data Sheet shall include the simulator specific usage limits. The limited Certificates shall be listed in the Registry of Military Simulator Qualification Certificates, with the wording "LIMITED".

Note

If the simulated aircraft has a Limited Military Qualification Certificate and the simulator is fully representative of it, the red stamp with the wording "LIMITED" shall not be affixed to the Military Simulator Qualification Certificate.

3.13 Changes to a Certified Military Simulator

Changes to a certified military simulator can be handled either by updating its certificate (paragraph 3.14 of this regulation) or by issuing Technical Prescriptions in accordance with the processes set out in the AER.00-00-5 regulation for the 1st Level of Configuration Items (paragraph 5 of this regulation).

It is the SSDR responsibility to coordinate with the company responsible of the change, if different from the SSDR, to demonstrate the effect of the change on the compliance with *Capitolato Tecnico* Part I requirements.

The Military Simulator Qualification Certificate is valid for the configuration reported in the certificate and for all subsequent changes authorised in accordance with the AER.00-00-5 regulation.

Any approved change to the simulated aircraft type, that impacts the simulator's representativeness of the aircraft (in terms of configuration, usage characteristics, etc.) has to determine the simultaneous update of the simulator's certificate. Otherwise, the simulator's certificate shall be suspended or limited or cancelled.

At this end, the Unit/Department/Body in charge of the simulator has the duty and responsibility to promptly notify the D.A.A.A. about any missing updates of the simulator versus the updates of the simulated aircraft type.

3.14 Military Simulator Qualification Certificate Update

This paragraph deals with changes that have a significant impact on the compliance of the simulator with the requirements of Part I. If the changes are to be made on all units of the same simulator, the certificate shall be revised. Otherwise, the basic and the amended configurations are both allowed, an addendum to the certificate shall be issued for the latter.

In any case the SSDR has to request a revision or an addendum of the certificate submitting the following documents:

- description of the changes to be made;
- requirements of C.T. Part I affected by the change;
- certification plan.

The revision to the certificate will be released by the D.A.A.A. to the Company that is already the holder of the certificate.

The addendum will be realised by the D.A.A.A. to the Company that is already the holder of the certificate or to another Company that demonstrates its suitability to

design and certify the change to the basic configuration either through its internal resources or through agreements with the Company holding the certificate.

3.15 Template of the Certificate

Templates of the Military Simulator Qualification Certificate, both in Italian and English language, are contained in attachment D.

The D.A.A.A. may modify the typographical layout of these templates to make them more suitable for their purpose, without requiring a new issue of this standard.

3.16 Simulator Certificate Register

The Qualified Simulators shall be registered in the Register of Military Simulator Qualification Certificates. The registry will be completed and updated by the VDT 1st Office that issues and stores the individual Certificates.

The Register of Military Simulator Qualification Certificates for FFS - Zero Flight Time Military Simulators, supported by a Computer Portal, is kept and managed by the VDT 1st Office, which is also responsible for the custody of the Certificates in paper copy and of the supporting documentation. The computer-based register contains the scans of the certificates and all the related supporting documentation (Data Sheet, Qualification Technical Report, request for approval, configuration document, qualification certification plan, approval of the plan, compliance matrix, declaration of conformity and Means of Evidence).

3.17 ACCEPTANCE TESTING

Only simulators whose project has obtained a Military Simulator Qualification Certificate can be submitted for acceptance test, except the limited cases set out below.

The D.A.A.A., for recognized urgent requirements, may authorize the temporary acceptance of the simulators whose design is still under certification process, provided that the following conditions are met:

- the D.A.A.A. has approved the Certification Plan, within the framework of the documentation that the proposing Company has already provided;
- formal commitment of the Company to replace (or possibly modify) the delivered simulator, without any additional burden for the A.D., under Qualification Certification process with a certified one that is equivalent and interchangeable;
- formal commitment of the Company to collect at its own expense all the CIs supplied during the certification process, without any compensation from the A.D. for the temporary use of said CIs.

4. Recording and Keeping of the Register of Military Simulators FFS - ZFT

The criteria and procedures used to record a Military Simulators (S/N-Serial Number) in the register of FFS - Zero Flight Time Military Simulators are set out below. The purpose of recording a specific Military Simulator (S/N) in the register is to uniquely identify the Military Simulators whose zero flight time use is authorized and regulated by the D.A.A.A. in accordance with this regulation and with its corresponding Certificate. The validity of the registration is subject to fully maintaining Configuration Control (including the applicable Technical Publications) during the use of the Simulator, in compliance with the applicable technical regulations.

4.1 Recording

Following the results of the Board of Acceptance Test, the Body requesting the record of the specific Simulator in the R.S.M., shall communicate to the VDT 2nd Office of the D.A.A.A. that the Simulator has been accepted. The request to record it, signed by the Head of the Local Technical Branch Office – *Ufficio Tecnico Territoriale* (UTT)/Agency, shall therefore include:

- the wording: "On date ….. at the conclusion of Acceptance Test, this UTT/Agency has accepted the Simulator S/N…"
- the reference to the contract;
- the wording "The Simulator configuration is compliant with Military Simulator Qualification Certificate n°. …. dated….";
- the list of approved and applicable manuals.

For a Simulator to be eligible to be recorded in the R.S.M. FFS ZFT, the following Technical Publications specific to the simulator and to the simulated aircraft shall have been approved (paragraph 6):

- for the simulator:
  - Maintenance Manual: Description of programmable and non-programmable maintenance procedures and their interval, calibration and repair procedures, test procedures, etc.
  - IOS (Instructor Operating Station Manual) Instructor manual.
  - Safety Manual: Description of the safety and emergency procedures for operation and maintenance of the equipment.
  - Document containing site requirements for the installation of simulators: power, environment, footprint of HW equipment, size, installation procedures, etc.
- for the simulated aircraft:
  - Flight manual;
  - Performance data;

- Checklist for flight crew;
- Flight functional checks;
- Checklist for acceptance flight Test and functional tests;
- Firing manual for non-conventional weapons (if applicable);
- Firing manual for conventional ammunition (if applicable);
- Checklist for flight crews (if applicable);
- Firing data (if applicable).

The D.A.A.A. will verify if the Simulator is entitled to be entered into the R.S.M. and will issue a letter signed by the Director or by a delegate thereof stating the clearance for “Zero Flight Time” use of the Simulator, and its S/N will be simultaneously entered into the Registry.

The D.A.A.A. shall inform the following Organizations about the record of the Simulator in the R.S.M.:

- The Armed Forces Staff or High Commands concerned (as appropriate);
- Competent UTT;
- Company involved;
- Any other Organizations involved in the assignment.

4.2 Limits of validity of the simulators record in the R.S.M.

The recording of an individual simulator in the R.S.M. ZFT identifies its configuration, its authorized use, and the applicable limitations of use defined in the corresponding Certificate and in the applicable technical publications. The recording validity is linked to the full compliance with the applicable regulations as well as the maintenance of the configuration control during the use of the Simulator. The no compliance with the above, automatically leads to the suspension of the record; this situation is to be reported to D.A.A.A. that proceeds to enter the suspension in the R.S.M. and reports it to the concerned entities. The R.S.M. shall be updated, entering the protocol number and the date of the suspension and the current status "Suspended". The suspension will terminate when the conditions that led to the suspension are removed.

4.2.1 Deletion from the Register

At the end of the Simulator lifetime, the AF or the organization that is using it, shall ask D.A.A.A. to delete the relevant S/N. Therefore, the deletion request, signed by the Head of the user organization (Director or equivalent), shall include:

- protocol number and date of the communication related to the recording of the simulator;
- S/N of the Simulator;
- reason for deletion.

Subsequently, D.A.A.A. will communicate the successful deletion from the R.S.M.. However, the simulator data/information will be kept in the register that will be

updated, reporting the protocol number and the deletion date and the current status: "Deleted from the Register".

The final deletion of the data of a specific simulator will take place after the disposal of the corresponding line.

4.3 Register of ZFT MILITARY SIMULATORS (R.S.M.)

The R.S.M. of FFS - Zero Flight Time is stored and managed by the VDT 2nd Office supported by a Computer Portal. The information contained in the register are:

- S/N of the Simulator (assigned by the Company);
- SSDR;
- Simulator Qualification Certificate;
- Armed Force/State Bodies that the Simulator is to be assigned to;
- Type of the simulated aircraft (fixed wing, rotary wing or remotely piloted);
- Military Aircraft Type Certificate of the simulated aircraft, or for the old programs without a Type Certificate, the technical specification of the aircraft;
- Date and protocol number of the assignment/suspension/deletion from the Register;
- Current State of the record (Suspended or Deleted from the Register).

The electronic register is a data base allowing to enter data and information related to each Simulator. It identifies the various fields that will be updated from time to time to reflect the changes of the registration status. The information contained in the register is then provided in a printed format with three sections:

1. FFS Zero Flight Time for fixed wing aircraft;
2. FFS Zero Flight Time for rotary-wing aircraft;
3. FFS Zero Flight Time for Remotely Piloted Aircraft System (RPAS).

When there is a change of status in the data base, the updated sections are reprinted. The printout of the various sections, divided by type of aircraft, will be printed exclusively in electronic format and digitally signed by the Head of the Office responsible for D.A.A.A. that formalizes its validity (CNIPA no. 45/2009 art. 21 par 8). The digital signature is affixed to the document in pdf format, after it has been created, using the data registered in the data base, for each type of aircraft. All signed reports are official documents that all together constitute the R.S.M. that is collected and archived on the D.A.A.A. intranet. The R.S.M. and the database of origin data will be subject to a daily back up. The R.S.M. can be accessed via the D.A.A.A. intranet, and so is the data base containing the data.

The paper printout of the R.S.M. has the structure shown in Attachment E.

5. CONFIGURATION CONTROL

Configuration Control of a Military Flight Simulator and related Configuration Items, certified and recorded by the D.A.A.A. in the of R.S.M., is subject to the requirements set forth in the AER.00-00-5 regulation with the exception of the requirements for the PTOAs (*Prescrizione Tecnica Operativa Applicabile – applicable technical operational change*) that are not applicable to simulators. In this regard, simulators are considered to be a single 1st level system and therefore the SSDR is responsible for the configuration control of the simulator itself and all its parts.

Specifically, to assign the technical code set out in paragraph 2.5.1 of the AER.00-00-5 regulation and in relation to the class "A" changes, the words "affect performance and/or airworthiness" is to be interpreted as "affect performance and/or the full representativeness of the simulated aircraft type".

6. TECHNICAL PUBLICATIONS

The acceptance process of Technical Publications applicable to Military Simulators is performed in accordance with the provisions of the AER.0-0-2 regulation. In any case, when accepting the Simulator's manuals, the Competent Division shall verify that the Company has included all the limitations indicated in the corresponding Military Simulator Qualification Certificate.

7. VALIDITY OF THE STANDARD AND TRANSITION PERIOD

This regulation will come into effect upon its approval.

- Simulators covered by a contract signed after the approval of this standard: for "Zero Flight Time" training, it is required the Simulator Certificate issued by D.A.A.A. in accordance with the processes and requirements set out in this regulation.
- Simulators covered by a contract signed before the approval of this standard: for "Zero Flight Time" training, the Simulators will be automatically certified by D.A.A.A., as an exception to the processes described in this regulation (issuing of the *Capitolato Tecnico*, sending the request for approval...), the certificate shall be issued by recognition of a certificate issued by another Authority or by assessing the technical documentation issued by the Company that designed it or the SSDR. In any case the simulator configuration shall be updated to reflect the changes applicable to the type of the simulated aircraft. At this end, the Body in charge of the simulator has the duty and responsibility to promptly notify D.A.A.A. about any missing updates of the simulator versus updates of the simulated aircraft type.

CAPITOLATO TECNICO

GUIDELINES FOR THE DEFINITION OF THE PART I REQUIREMENTS

Below are the guidelines to define the minimum requirements that a Zero Flight Time FFS Military Simulator has to satisfy in order to achieve the Certification by the D.A.A.A. These requirements are defined according to the task that the simulator shall carry out in relation to the aircraft type to be simulate. The tasks are divided into typical tasks of civilian simulators and specific military tasks. In any case, the *Capitolato Tecnico* shall define the requirements of the military simulator without necessarily distinguishing those of civilian origin and those specific to military tasks.

1. MINIMUM REQUIREMENTS TO CARRY OUT ZFT TASKS COMMON TO CIVILIAN FFS (EASA)

The minimum requirements to carry out the ZFT tasks common to civilian simulators are listed below in accordance with CS-FSTD (A/H) and related AMCs. For the definition of the corresponding tolerances, the content CS-FSTD (A/H) for FFS Level D are to be used as a guideline (in some specific cases the D.A.A.A. may decide to refer to the provisions for the Level C). These requirements shall be modified if they are impacted by any configuration differences between the military simulator and the civilian one.

- SIMULATORS OF FIXED WING AIRCRAFT

1. General

- A fully enclosed flight deck.
- Flight deck, a full scale replica of the aeroplane simulated. Equipment for operation of the cockpit windows shall be included in the FSTD, but the actual windows need not be operable. The flight deck, for FSTD purposes, consists of all that space forward of a cross section of the fuselage at the most extreme aft setting of the pilots' seats. Additional required flight crew member duty stations and those required bulkheads aft of the pilot seats are also considered part of the flight deck and shall replicate the aeroplane.
- Direction of movement of controls and switches identical to that in the aeroplane.
- Circuit breakers that affect procedures and/or result in observable cockpit indications properly located and functionally accurate.
- Flight dynamics model that accounts for various combinations of drag and thrust normally encountered in flight corresponding to actual flight conditions, including the effect of change in aeroplane attitude, sideslip, thrust, drag, altitude, temperature, gross weight, moments of inertia, centre of gravity location, and configuration.
- All relevant instrument indications involved in the simulation of the applicable aeroplane shall automatically respond to control movement by a flight crew member or induced disturbance to the simulated aeroplane; e.g., turbulence or wind shear.
- Communications, navigation, and caution and warning equipment corresponding to that installed in the applicant's aeroplane with operation within the tolerances prescribed for the applicable airborne equipment.
- Navigational data with the corresponding approach facilities. Navigation aids should be usable within range without restriction.

- In addition to the flight crew member duty stations, three suitable seats for the instructor, delegated examiner and competent authority inspector. The competent authority shall consider options to this standard based on unique cockpit configurations. These seats shall provide adequate vision to the pilot's panel and forward windows. Observer seats need not represent those found in the aeroplane but in the case of FSTDs fitted with a motion system, the seats shall be adequately secured to the floor of the FSTD, fitted with positive restraint devices and be of sufficient integrity to safely restrain the occupant during any known or predicted motion system excursion.
- FSTD systems shall simulate applicable aeroplane system operation, both on the ground and in flight. Systems shall be operative to the extent that all normal, abnormal, and emergency operating procedures can be accomplished.
- Instructor controls shall enable the operator to control all required system variables and insert abnormal or emergency conditions into the aeroplane systems.
- Control forces and control travel shall correspond to that of the replicated aeroplane. Control forces shall react in the same manner as in the aeroplane under the same flight conditions.
- Ground handling and aerodynamic programming shall include: (1) Ground Effect. For example: round-out, flare, and touchdown. This requires data on lift, drag, pitching moment, trim, and power ground effect. (2) Ground reaction -reaction of the aeroplane upon contact with the runway during landing to include strut deflections, tyre friction, side forces, and other appropriate data, such as weight and speed, necessary to identify the flight condition and configuration. (3) Ground handling characteristics - steering inputs to include crosswind, braking, thrust reversing, deceleration and turning radius.
- Wind shear models shall provide training in the specific skills required for recognition of wind shear phenomena and execution of recovery manoeuvres. Such models shall be representative of measured or accident derived winds, but may include simplifications which ensure repeatable encounters. For example, models may consist of independent variable winds in multiple simultaneous components. Wind models shall be available for the following critical phases of flight: (1) Prior to take-off rotation (2) At lift-off (3) During initial climb (4) Short final approach
- Instructor controls for environmental effects including wind speed and direction shall be provided.
- Stopping and directional control forces shall be representative for at least the following runway conditions based on aeroplane related data: (1) Dry (2) Wet (3) Icy (4) Patchy wet (5) Patchy icy (6) Wet on rubber residue in touchdown zone.
- Brake and tyre failure dynamics (including antiskid) and decreased brake efficiency due to brake temperatures shall be representative and based on aeroplane related data.
- A means for quickly and effectively conducting daily testing of FSTD programming and hardware shall be available.
- Computer capacity, accuracy, resolution, and dynamic response shall be sufficient to fully support the overall fidelity, including its evaluation and testing.
- Control feel dynamics shall replicate the aeroplane simulated. Free response of the controls shall match that of the aeroplane within the tolerances specified. Initial and upgrade evaluations will include control free response (pitch, roll and yaw controller) measurements recorded at the controls. The measured responses shall correspond to those of the aeroplane in take-off, cruise, and landing configurations. (1) For aeroplanes with irreversible control systems, measurements may be obtained on the

ground if proper pitot static inputs are provided to represent conditions typical of those encountered in flight. Engineering validation or aeroplane manufacturer rationale will be submitted as justification to ground test or omit a configuration. (2) For FSTDs requiring static and dynamic tests at the controls, special test fixtures shall not be required during initial evaluation if the MQTG or a similar document requested by DAA shows both text fixture results and alternate test method results such as computer data plots, which were obtained concurrently. Repetition of the alternate method during initial evaluation may then satisfy this requirement.

- One of the following two methods is acceptable as a means to prove compliance: (1) Transport Delay: A transport delay test may be used to demonstrate that the FSTD system response does not exceed 150 ms. This test shall measure all the delay encountered by a step signal migrating from the pilot's control through the control loading electronics and interfacing through all the simulation software modules in the correct order, using a handshaking protocol, finally through the normal output interfaces to the motion system, to the visual system and instrument displays. (2) Latency: The visual system, flight deck instruments and initial motion system response shall respond to abrupt pitch, roll and yaw inputs from the pilot's position within 150 ms of the time, but not before the time, when the aeroplane would respond under the same conditions.
- Aerodynamic modelling shall be provided. This shall include, for aeroplanes issued an original type certificate after June 1980, low altitude level flight ground effect, Mach effect at high altitude, normal and reverse dynamic thrust effect on control surfaces, aeroelastic representations, and representations of non-linearities due to sideslip based on aeroplane flight test data provided by the manufacturer.
- Modelling that includes the effects of airframe and engine icing.
- Aerodynamic and ground reaction modelling for the effects of reverse thrust on directional control shall be provided.
- Realistic aeroplane mass properties, including mass, centre of gravity and moments of inertia as a function of payload and fuel loading shall be implemented.
- Self-testing for FSTD hardware and programming to determine compliance with the FSTD performance tests shall be provided. Evidence of testing shall include FSTD number, date, time, conditions, tolerances, and the appropriate dependent variables portrayed in comparison with the aeroplane standard.
- Timely and permanent update of hardware and programming subsequent to aeroplane modification sufficient for the qualification level sought.
- Daily preflight documentation either in the daily log or in a location easily accessible for review is required.

2. Motion system

- Motion cues as perceived by the pilot shall be representative of the aeroplane, e.g. touchdown cues shall be a function of the simulated rate of descent.
- A motion system shall: produce cues at least equivalent to those of a six-degrees-of-freedom synergistic platform motion system.
- A means of recording the motion response time as required.
- Motion effects programming shall include: (1) effects of runway rumble, oleo deflections, groundspeed, uneven runway, centreline lights and taxiway characteristics; (2) buffets on the ground due to spoiler/speedbrake extension and thrust reversal; (3) bumps associated with the landing gear; (4) buffet during extension and retraction of landing gear; (5) buffet in the air due to flap and spoiler/speedbrake

extension; (6) approach to stall buffet; (7) touchdown cues for main and nose gear; (8) nose wheel scuffing; (9) thrust effect with brakes set; (10) Mach and manoeuvre buffet; (11) tyre failure dynamics; (12) engine malfunction and engine damage; and (13) tail and pod strike.

- Motion vibrations (non-mandatory): tests with recorded results that allow the comparison of relative amplitudes versus frequency are required. Characteristic motion vibrations that result from operation of the aeroplane in so far as vibration marks an event or aeroplane state that can be sensed at the flight deck shall be present. The FSTD shall be programmed and instrumented in such a manner that the characteristic vibration modes can be measured and compared with aeroplane data.

3. Visual System

- The visual system shall meet all the standards enumerated as applicable for FFS Level D according to CS_FSTD A and relevant AMC.
- Continuous, cross-cockpit, minimum collimated visual field of view providing each pilot with 180 degrees horizontal and 40 degrees vertical field of view. Application of tolerances require the field of view to be not less than a total of 176 measured degrees horizontal field of view (including not less than ±88 measured degrees either side of the centre of the design eye point) and not less than a total of 36 measured degrees vertical field of view from the pilot's and co-pilot's eye points.
- A means of recording the visual response time for visual systems.
- System geometry. The system fitted shall be free from optical discontinuities and artefacts that create non-realistic cues.
- Visual textural cues to assess sink rate and depth perception during take-off and landing shall be provided.
- Horizon and attitude shall correlate to the simulated attitude indicator.
- Occulting - a minimum of ten levels shall be available.
- Surface (Vernier) resolution shall occupy a visual angle of not greater than 2 arc minutes in the visual display used on a scene from the pilot's eyepoint.
- Surface contrast ratio shall be demonstrated by a raster drawn test pattern showing a contrast ratio of not less than 5:1.
- Highlight brightness shall be demonstrated using a raster drawn test pattern. The highlight brightness shall not be less than 20 cd/m2 (6ft-lamberts).
- Light point size - not greater than 5 arc minutes.
- Light point contrast ratio - not less than 25:1.
- Daylight, twilight and night visual capability as applicable for level of qualification sought.
- The visual system shall be capable of meeting, as a minimum, the system brightness and contrast ratio criteria as applicable for level of qualification souqht.
- Total scene content shall be comparable in detail to that produced by 10 000 visible textured surfaces and (in day) 6 000 visible lights or (in twilight or night) 15 000 visible lights, and sufficient system capacity to display 16 simultaneously moving obiects.
- The system, when used in training, shall provide in daylight, full colour presentations and sufficient surfaces with appropriate textural cues to conduct a visual approach, landing and airport movement (taxi). Surface shading effects shall be consistent with simulated (static) sun position.
- The system, when used in training, shall provide at twilight, as a minimum, full colour presentations of reduced ambient intensity, sufficient surfaces with appropriate textural cues that include self-illuminated objects such as road networks, ramp lighting and

airport signage, to conduct a visual approach, landing and airport movement (taxi). Scenes shall include a definable horizon and typical terrain characteristics such as fields, roads and bodies of water and surfaces illuminated by representative ownship lighting (e.g. landing lights). If provided, directional horizon lighting shall have correct orientation and be consistent with surface shading effects.
- The system, when used in training, shall provide at night, as a minimum, all features applicable to the twilight scene, as defined above, with the exception of the need to portray reduced ambient intensity that removes ground cues that are not self-illuminating or illuminated by ownship lights (e.g. landing lights).

4. Sound System
- Significant flight deck sounds which result from pilot actions corresponding to those of the aeroplane or class of aeroplane.
- Sound of precipitation, rain removal equipment and other significant aeroplane noises perceptible to the pilot during normal and abnormal operations and the sound of a crash when the FSTD is landed in excess of limitations.
- Comparable amplitude and frequency of flight deck noises, including engine and airframe sounds. The sounds shall be coordinated with the required weather. (non-mandatory):
- The volume control shall have an indication of sound level setting which meets all qualification requirements.

➢ HELICOPTER SIMULATORS

1. General
- A cockpit that is a full-scale replica of the helicopter simulated. Additional required crew member duty stations and those required bulkheads aft of the pilot seats are also considered part of the cockpit and shall replicate the helicopter.
- The cockpit, including the instructor's station is fully enclosed.
- Full size panels with functional controls, switches, instruments and primary and secondary flight controls, which shall be operating in the correct direction and with the correct range of movement.
- Lighting for panels and instruments shall be as per the helicopter.
- Cockpit ambient lighting environment shall be dynamically consistent with the visual display and sufficient for the training event.
- Relevant cockpit circuit breakers shall be located as per the helicopter and shall function accurately when involved in operating procedures or malfunctions requiring or involving flight crew response.
- Effect of aerodynamic changes for various combinations of airspeed and power normally encountered in flight, including the effect of change in helicopter attitude, aerodynamic and propulsive forces and moments, altitude, temperature, mass, centre of gravity location and configuration.
- Aerodynamic modelling which includes ground effect, effects of airframe and rotor icing (if applicable), aerodynamic interference effects between the rotor wake and fuselage, influence of the rotor on control and stabilisation systems, and representations of nonlinearities due to sideslip, vortex ring and retreating blade stall.
- Validation flight test data shall be used as the basis for flight and performance and systems characteristics.

- All relevant cockpit instrument indications automatically respond to control movement by a crew member, helicopter performance, or external simulated environmental effects upon the helicopter.
- All relevant communications, navigation, caution and warning equipment shall correspond to that installed in the helicopter. All simulated navigation aids within range shall be usable without restriction. Navigational data shall be capable of being updated.
- Navigational data with the corresponding approach facilities. Navigation aids should be usable within range without restriction.
- In addition to the flight crew member stations, at least two suitable seats for the instructor and an additional observer shall be provided permitting adequate vision to the crew members' panel and forward windows. Observer and instructor seats need not represent those found in the helicopter but shall be adequately secured to the floor of the FFS, fitted with positive restraint devices and be of sufficient integrity to safely restrain the occupant during any known or predicted motion system excursion.
- FFS systems shall simulate the applicable helicopter system operation, both on the ground and in flight. Systems shall be operative to the extent that normal, abnormal, and emergency operating procedures appropriate to the simulator application can be accomplished. Once activated, proper system operation shall result from system management by the flight crew and not require input from instructor controls.
- The instructor shall be able to control system variables and insert abnormal or emergency conditions into the helicopter systems. Independent freeze and reset facilities shall be provided.
- Control forces and control travel which correspond to that of the replicated helicopter. Control forces shall react in the same manner as in the helicopter under the same flight conditions.
- Cockpit control dynamics, which replicate the helicopter simulated. Free response of the controls shall match that of the helicopter within the given tolerance. Initial and upgrade evaluation shall include control free response (cyclic, collective, and pedal) measurements recorded at the controls. The measured responses shall correspond to those of the helicopter in ground operations, hover, climb, cruise, and auto-rotation.
- Ground handling and aerodynamic programming to include the following: Ground effect - hover and transition IGE. (Ground reaction - reaction of the helicopter upon contact with the landing surface during landing to include strut deflections, tire or skid friction, side forces, and other appropriate data, such as weight and speed, necessary to identify the flight condition and configuration. Ground handling characteristics - control inputs to include braking, deceleration turning radius and the effects of crosswind.
- Instructor controls for:

(i) wind speed and direction

(ii) turbulence

(iii) other atmospheric models to support the required training (non-mandatory):

(iv) adjustment of cloud base and visibility

(v) temperature and barometric pressure.

- Representative stopping and directional control forces for at least the following landing surface conditions based on helicopter related data, for a running landing: (i) dry (ii) wet (soft surface and hard surface) (iii) icy (iv) patchy wet (v) patchy icy.
- Representative brake and tire failure dynamics.

- (1) Transport delay. Transport delay is the time between control input and the individual hardware (systems) responses. As an alternative, a latency test may be used to demonstrate that the FSTD system does not exceed the permissible delay.
- (2) Latency. Relative response of the visual system, cockpit instruments and initial motion system response shall be coupled closely to provide integrated sensory cues. These systems shall respond to abrupt pitch, roll, and yaw inputs at the pilot's position within the permissible delay, but not before the time, when the helicopter would respond under the same conditions. Visual scene changes from steady state disturbance shall occur within the system dynamic response limit but not before the resultant motion onset.
- Self-testing for FSTD hardware and programming to determine compliance with the FSTD performance tests. Evidence of testing shall include FSTD number, date, time, conditions, tolerances, and the appropriate dependent variables portrayed in comparison with the helicopter standard.
- A system allowing for timely continuous updating of FSTD hardware and programming consistent with helicopter modifications.
- The FSTD operator shall submit a Qualification Test Guide (QTG) or a similar document in a form and manner acceptable to the DAA. A recording system shall be provided that will enable the FSTD performance to be compared with above document criteria.
- FSTD computer capacity, accuracy, resolution and dynamic response sufficient for the qualification level sought.
- Daily preflight documentation either in the daily log or in a location easily accessible for review.

2. Motion System

- Motion cues as perceived by the pilot shall be representative of the helicopter, e.g. touch down cues should be a function of the simulated rate of descent.
- A motion system: 6 degrees of freedom synergistic platform motion system.
- A means of recording the motion response time as required
- Special effects programming to include the following: (1) runway rumble, oleo deflections, effects of groundspeed and uneven surface characteristics; (2) buffet due to translational lift; (3) buffet during extension and retraction of landing gear; (4) buffet due to high speed and retreating blade stall; (5) buffet due to vortex ring; (6) representative cues resulting from: (i) touch down (ii) translational lift; (7) antitorque device ineffectiveness; (8) buffet due to turbulence.
- Characteristic vibrations/buffets that result from operation of the helicopter and which can be sensed in the cockpit. Simulated cockpit vibrations to include seat(s), flight controls and instrument panel(s), although these need not be tested independently. (non-mandatory).

3. Visual System

- Visual system capable of meeting all the standards of this paragraph and the respective paragraphs of validation tests as well as functions and subjective tests as applicable to the level of qualification requested by the FSTD operator.
- "Continuous" cross cockpit, minimum visual field of view providing each pilot with 180 degrees horizontal and 60 degrees vertical. (in alcuni casi la DAA valuterà l'accettabilità dei seguenti valori 150 degrees horizontal and 40 degrees vertical)
- A means of recording the visual response time for the visual system shall be provided.

- Visual cues to assess rate of change of height, height AGL, translational displacements and rates, during take-off, low altitude/low airspeed manoeuvring, hover, and landing.
- Test procedures to quickly confirm visual system colour, RVR, focus, intensity, level horizon, and attitude as compared with the specified parameters.
- A minimum of 10 levels of occulting. This capability should be demonstrated by a visual model through each channel.
- Surface (Vernier) resolution shall be demonstrated by a test pattern of objects shown to occupy a visual angle of not greater than 3 arc minutes in the visual display used on a scene from the pilot's eye point.
- Lightpoint size shall not be greater than 6 arc minutes.
- Daylight, dusk, and night visual scenes with sufficient scene content to recognise aerodromes, operating sites, terrain, and major landmarks around the FATO area and to successfully accomplish low airspeed/low altitude manoeuvres to include lift-off, hover, translational lift, landing and touch down.
- A visual database sufficient to support the requirements, including (i) Specific areas within the database needing higher resolution to support landings, take-offs and ground cushion exercises and training away from an aerodrome/operating site. Including elevated FATO, helidecks and confined areas. (ii) For cross-country flights sufficient scene details to allow for ground to map navigation over a sector length equal to 30 minutes at an average cruise speed. (iii) For offshore airborne radar approaches (ARA), harmonised visual/radar representations of installations. (iv) For training in the use of night vision goggles (NVG) a visual display with the ability to represent various scenes with the required levels of ambient light/colour.
- Daylight, twilight (dusk/dawn) and night visual capability for system brightness and contrast ratio criteria as applicable for level of qualification sought.
- The visual system should be capable of producing: Full colour presentations. Full colour texture shall be used to enhance visual cue perception for illuminated landing surfaces.
- The visual system should be capable of producing, as a minimum:
- (iii) A scene content comparable in detail with that produced by 6 000 polygons for daylight and 7 000 visible lightpoints for night and dusk scenes for the entire visual system. (in alcuni casi la DAA valuterà l'accettabilità dei seguenti valori 4 000 polygons for daylight and 5 000 visible lightpoints for night)
- Surface contrast ratio: Demonstration model Not less than 5:1.
- Lightpoint contrast ratio. Not less than 25:1.
- Highlight Brightness. The minimum light measured at the pilot's eye position should be:
- 20 cd/m2 (6 ft-Lamberts) (in alcuni casi la DAA valuterà l'accettabilità dei seguenti valori 17 cd/m2 - 5 ft-Lamberts)

4. Sound Systems

- Significant cockpit sounds, and those, which result from pilot actions corresponding to those of the helicopter shall be provided.
- Sound of precipitation, windshield wipers, the sound resulting from a blade strike and a crash condition when operating the helicopter in excess of limitations.
- Realistic amplitude and frequency of cockpit acoustic environment. (non-mandatory):
- The volume control shall have an indication of sound level setting which meets all qualification requirements.

2. MINIMUM REQUIREMENTS TO CARRY OUT MILITARY ZFT TASKS

To carry out ZFT tasks it is necessary to define specific requirements that are in addition to and/or amend those typical of a civilian simulator (set out in point 1).

NOTE

In case that, a military task determines the need to modify the parameters of a typical civilian requirement (set out in point 1) making it more restrictive, the *Capitolato Tecnico* shall only include the requirement that sets the most restrictive parameters.

The multiple differences among types of military aircraft and military missions determine the need to define these requirements case-by-case and to define the related tolerances/parameters/limits when preparing the *Capitolato Tecnico*.

2.1 GUIDELINE TO DEFINE THE REQUIREMENTS

This method requires dividing the simulator into 15 subsystems and identifying, for each system, the minimum requirements necessary to carry out the specific applicable military tasks. In this regard, the aforementioned 15 systems and the typical military tasks for fixed wing aircraft and helicopters are listed below.

SIMULATOR SUBSYSTEMS

1. **Instructor Operating Station - IOS**
2. **Visual**
3. **Motion**
4. **Sound**
5. **Cockpit**
6. **Perform and Flying qualities**
7. **Aircraft Subsystems (Electric, Hydraulic pneumatic, engine, anti icing and oxygen systems)**
8. **Weapon and Military Subsystems**
9. **Avionics (communication, navigation, identification, CAS, GCAS, Auto pilot and FMS)**
10. **Mil Sensors (radar, IIR, AIFF,MAWS, etc..)**
11. **Weather model**
12. **ATC model**
13. **Threats & Targets**
14. **Cooperative models**
15. **Integration**

➢ SIMULATORS OF FIXED WING AIRCRAFT - TASKS

Common to civilian simulators	**Ground operations**
	Normal flight ops
	Malfunctions
Military Task	**Abnormal Flight operations**
	Spins
	Departs
	Asymmetric Flight (asymmetry caused by engine(s) wing stores or mechanical failures)
	Flapless/slatless
	Ditching
	Trainer
	Forced Landing
	Aerobatics
	Fighter-general
	Defensive actions
	AAR A/A refuelling
	NVG operation
	IIR operation
	Fighter Air to Air
	Close in visual air combat (BFM, VID etc)
	Medium range visual air combat
	Beyond visual range Air to Air
	Fighter Air to Surface
	Visual Weapon employment Low level
	Visual weapon employment Medium level
	Sensor based weapon employment
	Close Air Support
	Reconnaissance medium level
	Reconnaissance low level
	Tactical Transport
	Non straight-in approach/landing
	Mountain operations
	Para drop
	Aerial cargo delivery
	Parachute extraction of cargo
	Rough field landing
	Short and narrow field operations
	Stuck cargo on delivery ramp
	Man on tail
	Threat recognition and reaction
	ECM & evasive manoeuvres
	Tanker
	air refuelling [delivering]
	air refuelling [receiving]
	Multi-ship operation
	Close formation flying
	Tactical Formation Flying
	Integrated Operations
	Mission rehearsal type I Fully
	integrated environment
	Mission rehearsal type II Flow and communication integration check

➢ HELICOPTER SIMULATORS – TASK

Common to civilian simulators	**Ground operations**
	Normal flight ops
	Malfunctions
Military Task	**Abnormal Flight operations**
	Spins
	Departs
	Asymmetric Flight (asymmetry caused by engine(s) wing stores or mechanical failures)
	Flapless/slatless
	Ditching
	Trainer
	Forced Landing
	Aerobatics
	Fighter-general
	Defensive actions
	AAR A/A refuelling
	NVG operation
	IIR operation
	Fighter Air to Air
	Close in visual air combat (BFM, VID etc)
	Medium range visual air combat
	Beyond visual range Air to Air
	Fighter Air to Surface
	Visual Weapon employment Low level
	Visual weapon employment Medium level
	Sensor based weapon employment
	Close Air Support
	Reconnaissance medium level
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	Tactical Transport
	Non straight-in approach/landing
	Mountain operations
	Para drop
	Aerial cargo delivery
	Parachute extraction of cargo
	Rough field landing
	Short and narrow field operations
	Stuck cargo on delivery ramp
	Man on tail
	Threat recognition and reaction
	ECM & evasive manoeuvres
	Tanker
	air refuelling [delivering]
	air refuelling [receiving]
	Multi-ship operation
	Close formation flying
	Tactical Formation Flying
	Integrated Operations
	Mission rehearsal type I Fully
	integrated environment
	Mission rehearsal type II Flow and communication integration check

CAPITOLATO TECNICO

GUIDELINES FOR THE DEFINITION OF THE PART I REQUIREMENTS FOR REMOTELY PILOTED AIRCRAFT SYSTEMS (RPASs)

The requirements sufficient for ZFT Certification of an RPAS simulator are set out below. Such requirements shall be defined/tailored during the preparation of the *Capitolato Tecnico*, according to the tasks that the simulator shall carry out and correlate to the type of simulated RPAS. The requirements are divided in requirements for the simulation of the Ground Control Station and in requirements for the simulation of the Air Vehicle.

- Ground Control Station

The simulator of the Ground Control Station shall be equal to the Simulated Ground Control Station except for the system that simulates the Air Vehicle that is covered below.

- Air Vehicle

The requirements of the Air Vehicle simulator take into account the following two cases:

1. Pilot External to the GCS

   Given that the feasibility of ZFT training for the take-off and landing phases shall be evaluated on a case by case basis and the applicable requirements defined, for the remaining phases of flight the simulator shall meet the "Visual" and "Sound" requirements typical of the command and control segment of the RPAS being simulated.

2. Pilot inside the GCS

   Simulators of Air Vehicles with pilot located inside the GCS shall at least have a "visual" that is representative of the images of the cameras that support the piloting.

LOGO OF THE COMPANY REQUESTING THE
MILITARY SIMULATOR QUALIFICATION CERTIFICATE

DECLARATION OF COMPLIANCE WITH THE CAPITOLATO TECNICO PART I OF THE FSTD - FFS _____

References:
1. *Capitolato Tecnico* _____ dated _____
2. AER(EP).P-3 Edition date _____
3. Certification Plan _____ dated _____
4. Compliance Matrix _____, Revision __ dated _____
5. Design Standard _____ dated _____

Applicability: SIMULATOR - FFS _____ P/N _____

On behalf of the Company _____

I declare

that the simulator _____ in the configuration "*as designed*" in Reference 5
meets

Technical Specifications Part I in Reference 1.

The activities for demonstration of compliance with the *Capitolato Tecnico* are detailed in Reference 4.
The activities to prove the compliance with the *Capitolato Tecnico* have demonstrated that the simulator _____ P/N _____ can be used for "Zero Flight Time" training for the aircraft type _____ Military Aircraft Type Certificate _____ * provided that it is used and maintained in accordance with the instructions and limitations set out in the applicable manuals approved by the DA.A.A.
The Company assumes the responsibilities related to being the holder of the Military Simulator Qualification Certificate issued by the Ministry of Defence, Directorate of Air Armaments and Airworthiness, as regards the configuration control, the coordination between the Design Organization and the Production Organization, the archiving of the documentation, the issuing of the manuals and the instructions to maintain the simulator's full representativeness respect to the simulated aircraft.

SIGNATURE OF TECHNICAL DIRECTOR
(or his delegate)

_____

* For the old programs that are not equipped with a Type Certificate, this wording must be replaced with: "can be used for "Zero Flight Hours" training for of the aircraft type _____ designed in accordance with technical specification _____."

MINISTERO DELLA DIFESA
Segretariato Generale della Difesa e Direzione Nazionale Armamenti
Direzione degli Armamenti Aeronautici e per l'Aeronavigabilità

CERTIFICATO DI OMOLOGAZIONE SIMULATORE MILITARE N°……

Si dichiara che il Simulatore (denominazione e P/N), progettato dalla Ditta (*identificazione della DRS Simultatore*), nella configurazione base identificata dal documento (*riferimento al documento di configurazione*) è stato certificato in accordo alla norma AER(EP).P-3 edizione…...

Il presente certificato

- **viene rilasciato alla Ditta (Nome e indirizzo della Ditta Detentrice)**
- **sancisce la rispondenza ai requisiti del Capitolato Tecnico/Specifica Tecnica N°…..., a meno delle *non-compliance* riportate nell'Appendice ….. dell'AllegatoTecnico;**
- **vincola l'uso all'addestramento "Zero Flight Time" relativamente all'aeromobile Tipo…. omologato dalla DAA con Certificati N°…. e N°…..(Omologazione di Tipo o Certificazione e Qualificazione), secondo le limitazioni riportate nell'Allegato Tecnico al presente certificato.**
- **è basato sulle evidenze tecniche presentate dalla Ditta (Identificazione della D.R.S.S.) e sulle valutazioni tecniche effettuate dalla D.A.A.A., in conformità alla Norma AER(EP).P-3 e riassunte nel Rapporto Tecnico di Omologazione N°……depositato presso la D.A.A.A. - VDT 1° Ufficio.**

Roma,

IL DIRETTORE
O SUO DELEGATO

Il presente certificato perde la sua validità se non aggiornato a fronte delle modifiche all'aeromobile simulato che impattano la rappresentatività del simulatore rispetto all'aeromobile.

- Nota: Per i vecchi programmi (in assenza di un certificato di tipo) il terzo bullet dovrà essere sostituito con: "vincola l'uso all'addestramento "Zero Flight Time" relativamente all'aeromobile …. progettato secondo la specifica tecnica_____, secondo le limitazioni riportate nell'Allegato Tecnico al presente certificato

MINISTRY OF DEFENCE
Secretariat General of Defence and National Armaments Directorate
Directorate of Air Armaments and Airworthiness

MYLITARY FULL FLIGHT SIMULATOR QUALIFICATION CERTIFICATE N°……

It is hereby certified that the Full Fight Simulator (Type and P/N), designed by (Simulator SDR identification), for the configuration described in document (reference to design standard configuration document), has been qualified according to AER(EP).P-3 edition…...
This certificate:

- **is released to company:**
  (Certificate Holder Name and Address)

- **declares compliance to the requirements of the Technical Specification/ Capitolato Tecnico N°……, except for the non-compliances reported in the "Military Aircaft Flight Simulator Qualification Certificate Data Sheet" Appendix……;**

- **Limits the use for "Zero Flight Time" training relevant to the Aircraft Type….. Qualified by DAA with Certificates N°….. and N°….. (Certification and Qualification), within the limitations reported in the Military Aircraft Fligth Simulator Qualification Certificate Data Sheet;**

- **is based on the technical evidences presented by (Simulator SDR Identification) and on the technical evaluations performed by Directorate of Air Armaments and Airworthiness according to AER.P-3 regulation requirements and summarized in the Qualification Technical Report N°….. filed in Directorate of Air Armaments and Airworthiness - Vice Technical Directorate 1st Office.**

Roma,

THE DIRECTOR
Directorate of Air Armaments and Airworthiness
(or his deputy)

This certificate is valid only if updated against the simulated aircraft changes regarding the Flight simulator representativeness of the aircraft

- For old programs (without a Type Certificate) the third bullet must be replaced with: "Limits the use for "Zero Flight Time" training relevant to the Aircraft ….. designed according to the technical specification……, within the limitations reported in the Military Aircraft Fligth Simulator Qualification Certificate Data Sheet;

Secretariat General of Defence and National Armaments Directorate

Directorate of Air Armaments and Airworthiness

Register of FFS Military Simulators – Zero Flight Time

S/N	SSDR	Military Simulator Qualification Certificate N°.	AF or SCs	Simulated Aircraft			Assignment/ Cancellation/ Suspension		Current Status
				Fixed Wing/rotary/RPAS	Type	Military Aircraft Type Certificate *	Date	Prot.	

D.A.A.A. RSM FFS ZFT

*For the old programs that are not equipped with a type certificate, in substitution of the reference to the certificate, the technical specification of the aircraft must be reported.