TRAFICOM
Finnish Transport and Communications Agency

Guidance for FSTD operators

Revised on 16 Dec 2025

TRAFICOM

Contents:

1 Preamble

This leaflet presents guidance for FSTD operators and is published by the Finnish Transport and Communications Agency (Traficom). The information is based on requirements of CS-FSTD(A), CS-FSTD(H), Part-ORA and Part-ARA (see EU Commission Regulations 290/2012 and associated AMCs and GMs). When there is any difference between this leaflet and the regulations, the regulations overrule.

In this document, the words 'FSTD operator' mean the organization that either is holding an FSTD qualification certificate or is applying for such. Note that in the European requirements, a notable responsibility and workload is on the FSTD operator. In many other aviation domains, the manufacturers are certified. In FSTD domain, the whole responsibility of the device is on the FSTD qualification certificate holder. (The FSTD operator may outsource tasks; however, it remains the responsible organization.) This emphasizes how robust processes and good competency the FSTD operator should have. The FSTD operator must *demonstrate* to the competent authority that it fulfills the requirements (see ORA.FSTD.100). This leaflet has been prepared to help the FSTD operator in understanding what is expected from them.

This leaflet represents Traficom's policies and interpretations. It is important to understand that in other EU/EASA member states the methods and interpretations may vary. Always discuss matters with your own competent authority (see ORA.GEN.105).

2 Changes

List of changes to this document:

30 Nov 2023	Layout changes
16 Dec 2025	Editorials through the whole document. Changes to the following sections: • Guidance for actions after the evaluation – Section was fully revised • Continuous oversight performed by Traficom – List of documents was revised • Guidance on FSTD operator's processes – ISMS was added • Guidance on cyber security (Part-IS) for FSTD operators - amended slightly

3 Guidance on how an organization can gain its first FSTD qualification certificate

There are many steps to be taken and each step has multiple details to be covered. The organization should have a solid project plan on how to progress towards FSTD qualification. Please note that ARINC Report 434 ('Synthetic Training Device (STD) – Life Cycle Support') and Report 438 ('Guidance for Acceptance of Flight Simulation Training Devices') give very good guidance on this process.

For an organization to gain its first FSTD qualification certificate:

- **The operator (i.e. the applicant organization) must fulfil requirements set in Part-ORA and its AMCs.**
  The organization should have adequate personnel resources and competencies. Its processes should be described in manuals. Please see other pages of this leaflet to better understand what **processes** the organization must establish. The authority performs an audit when the operator's manuals have been found adequate. The evaluation process of the FSTD will be continued only after a successful audit.

- **The device must fulfil requirements set in CS-FSTD(A) issue 2 or CS-FSTD(H) initial issue.**
  The table below presents the main steps that the operator must take in order to ensure that the FSTD is compliant with the requirements. The table is based only on the main steps presented in the regulations. The steps are presented in a typical chronological order.

  Please note that there could be other steps in addition to these steps. For example, the operator could plan to check the device already at the manufacturer's factory, but that is not mandatory and is therefore not included in the table below.

Step	When it should happen
Management of change Any process has its hazards and risks. Those should be identified and mitigated. The mitigation actions should control how the whole project (i.e. how each step and process are being reinforced and monitored to ensure that they are compliant and that safety is not compromised. Please see ORA.GEN.200 paragraph (a)(3) and its AMCs concerning management of change.	Initial risk assessment as the very first action with subsequent follow-ups and revisions through the whole process.
Contract between FSTD manufacturer and operator	About 6-12 months before device should be qualified.
Technical specification of the FSTD Comprehensive document describing the device's capabilities, its technical architecture, software quality, and so on.	At the same time as the contract.
Project plan The operator should have a clear plan on what, how, when and by whom should be performed to go through the project. Management of change should affect this.	After a contract has been signed.
Contact the authority as soon as possible Purpose is to initiate discussions on the validation data. Please see AMC1 FSTD(A).300 paragraph (a)(2)(iii).	After a contract has been signed.
Validation data roadmap (VDR) Please see Appendix 2 to AMC1 FSTD(A).300 or Appendix 2 to AMC1 FSTD(H).300 and RAeS 'Aeroplane Flight Simulator Evaluation Handbook' Appendix A.	As early as possible after the contract is signed.
Application part A Please see AMC1 ORA.FSTD.200. Give precise information on the simulated aircraft an on its equipment (e.g. what optional equipment/systems are installed).	Min 3 months before planned evaluation.
FSTD operator's manuals Deliver also a filled copy of the table presented in GM2 ORA.FSTD.100. See GM1 ORA.FSTD.100 for further guidance on the manuals.	Min 2 months before planned evaluation.
Authority audits the FSTD operator The organization should demonstrate that it has established an organization with adequate resources and competencies and that its processes are ready to begin maintaining and operating an FSTD.	About 1.5 month before planned evaluation.

Table continues on the next page.

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Step	When it should happen
Manuals of the simulated aircraft Manuals such as AFM, FCOM, QRH, avionics manuals as applicable, and so on.	About 1.5 month before planned evaluation.
Acceptance testing manuals When an FSTD is built, the device must be tested very carefully to ensure that it a) fulfils the requirements, b) functions as described in the aircraft's manuals, and c) feels correct to fly. Testing documentation normally consist of 1) comprehensive testing manuals, 2) checking of all malfunction, and 3) CS-FSTD(A/H) table of functions and subjective tests	Blank copies ready well in advance, but min about 1.5 months before planned evaluation. When the evaluation begins, everything must be signed.
Instructor station (IOS) manual The instructors should be able to learn how to use the IOS by reading this manual.	About 1 month before planned evaluation.
Malfunction descriptions Each malfunction should be described: what failure is simulated and what consequences it should have. Please see ARINC report 442 paragraph 4.7.	About 1 month before planned evaluation.
Proposed MQTG and Application part B The operator must provide its statement that it has carefully checked the proposed MQTG themselves and finds it acceptable. So the operator must also send Application part B (see AMC1 ORA.FSTD.200). The evaluation will happen only when the MQTG is acceptable also to the authority. This is written in CS-FSTD(A/H): '*Any QTG deficiencies raised by the competent authority should be addressed prior to the start of the on-site evaluation.*'	30 days before planned evaluation.
Specific visual models The operator should define the specific visual models. See CS-FSTD(A/H) table of functions and subjective tests for visual system.	Few weeks before the evaluation.
Enough time to fix all defects and make tuning There are always surprises. The operator must reserve enough time so that they are able to fix and close all possible defects and problems that arise. Please see ARINC report 434-1 chapter 3.	Last weeks before the evaluation.
Finalization of FSTD operator's procedures For example, all the logs should be established and ready, etc.	Last weeks before the evaluation.
Dossier GM3 ORA.FSTD.100 requires the operator to provide a 'dossier'. It is a folder with the main information on the simulator. That is the last step for the operator to ensure that everything is in place and OK and that they are ready to demonstrate that to the authority.	1-2 weeks before the evaluation.
Application part C See AMC1 ORA.FSTD.200. It is the operator's final confirmation that the device is ready to be qualified.	7 days before the evaluation.
On-site evaluation The authority arrives for an initial evaluation. See for example AMC3 ARA.FSTD.100(a)(1). The evaluation consists of briefing, testing of the device (QTG and functions and subjective testing), debriefing, preparation of an evaluation report. The operator goes through the dossier elements in the initial briefing and tells how each elements demonstrates compliance.	When everything above is ready.
Corrective actions The authority monitors and follow-ups how the operator makes corrections to the issues that are identified in the evaluation report. AMC5 ARA.FSTD.100(a)(1) presents that "these defects should be rectified and the competent authority notified on such action within 30 days."	30 days after the evaluation.

Please note that the presented schedule (i.e. column 'when it should happen') in the table is only indicative. The timeline may be affected by the FSTD qualification level (e.g. FFS or FNPT) and on the operator (i.e. applicant) in question. Please establish early discussions with the authority and present a project plan and proposed schedule.

4 Guidance on the documentation to support an initial FSTD evaluation

The previous section gives guidance on the steps before an initial FSTD evaluation. This section gives guidance on the documentation required before an initial evaluation can happen. This section partly repeats the previous section.

In order to prepare for the evaluation and to perform the evaluation quickly, it is requested to deliver a set of information before the evaluation. Please deliver the information preferably by email (e.g. one or multiple pdf files) to the authority as early as possible before the agreed evaluation date. If email is not possible, please contact Traficom to agree on an alternative arrangement. In case of any questions regarding the requested documentation, please contact Traficom.

The requested information (i.e. 'dossier', see also GM3 ORA.FSTD.100 paragraph (c)):

1. Formal application (parts A, B and C) for the qualification (see AMC1 ORA.FSTD.200). Mention clearly what features are requested to be listed in the 'Additional capabilities' section of the certificate.
2. FSTD operator's management system manual and FSTD operations manual and any other similar and relevant manuals if they have not been delivered before
3. Planned actions to give adequate training to FSTD maintenance personnel to be able to maintain the new device (e.g. competencies related to the new FSTD and to the simulated aircraft type. See ARINC report 432)
4. Management of change analysis and risk mitigation (see ORA.GEN.200 and associated AMCs)
5. Detailed technical specification of the device (see ARINC report 434-1 paragraphs 3.2 and 3.4 and 13.2). Documentation should also cover information on the software load and module architecture since that will affect the evaluation methods (e.g. how to check system integration) and configuration control procedures.
6. Flight manuals (e.g. FCOM, AFM, POH, QRH, etc.) for the simulated aircraft (note that the flight manual should be exactly for the simulated individual aircraft serial number so that it fully offers the best performance and system reference data for the FSTD)
7. Manuals for the avionics manuals (for example FMS pilot guide) if not included in the flight manuals (e.g. FCOM)
8. MQTG and a statement of the operator's assessment of the MQTG (e.g. pending concerns with the QTGs)
9. VDR (note that it should be part of MQTG)
10. Manual or document for comprehensive functions and subjective testing of the device. (Note that this document is expected to cover all required items and aspects carefully, for example malfunctions in all phases of flight to ensure correct behavior of the simulation. The testing should use methods presented in RAeS 'Aeroplane Flight Simulator Evaluation Handbook' Volume 2. The functions testing should be based on comparing the FSTD with the applicable manuals, e.g. FCOM, AFM, etc.)
11. Plan / schedule for the annual QTG and subjective & functions tests
12. Program for scheduled preventive maintenance and list of documentation that supports maintenance actions (E.g. schematics, illustrated parts, maintenance manual, etc. See ARINC report 434-1 paragraph 4.1 and report 446.)
13. IOS manual (i.e. a document describing the features and how to use IOS, see ARINC report 446 chapter 3)
14. List of simulated malfunctions including their descriptions and effects (see ARINC report 442 paragraph 4.7)
15. List of genuine aircraft parts (i.e. hardware, computers and software) that are used in the FSTD
16. List of all airport visual databases including for each scene: name of the airport, ICAO code, type of visual scene (i.e. certification database, specific or generic) and additional capabilities (e.g. snow model, EGPWS, etc.)
17. List of customer options regarding avionics (e.g. radio altimeter call-outs, etc.)
18. Only for aeroplane FFS level C and D to be qualified under CS-FSTD(A) issue 2: see separate Traficom's checklist
19. Only for FNPT: Engineering report on how the validation data was built (see AMC1 FSTD(A).300 para (a)(5)(iv) or AMC1 FSTD(H).300 para (a)(5)(iv))
20. List of open technical defects
21. Any other information considered relevant by the operator (e.g. possible new features to be qualified, known noticeable system limitations, etc.)

If there are any changes to this data or to these documents at any later stage, please report the changes. The information listed above is known as the 'dossier'. **The FSTD operator's representative is kindly asked to represent the dossier also during the evaluation briefing and tell how each element demonstrates compliance**.

Detailed information and purpose of the documentation can be found in ARINC Report 446.

5 Guidance on the documentation to support a recurrent FSTD evaluation

Begin preparations by agreeing the date(s) and hours for the evaluation (i.e. subjective test flight and QTG rerun tests) with the authority preferably at least 3 months before the planned date and preferably even 6-9 months in advance. It is also advisable to agree on the team composition with the authority well in advance. Please see another page regarding the personnel to participate on the evaluation.

In order to prepare for the evaluation and to perform the evaluation quickly, it is requested to deliver a set of information before the evaluation. Please submit the information by email (e.g. as one or more PDF files) approximately two weeks before the agreed evaluation date. If email submission is not possible, please contact Traficom to agree on an alternative arrangement. If you have any questions, please do not hesitate to contact Traficom.

The requested information (i.e. 'dossier', see also GM3 ORA.FSTD.100 paragraph (d)):

1. Contact information of the persons participating on the evaluation
2. Reliability data month by month: training hours, number of complaints mentioned in the technical log, training hours lost, availability rate, summary of complaints per ATA and FSTD main sections (see AMC2 ORA.FSTD.100 and ARINC report 433)
3. Total number of training hours since initial qualification
4. Details of main failures leading to training interruptions or multiple occurrences of certain same failures
5. List of main FSTD user organizations over the last 12 months with approximate number of training hours for each
6. List of open defects (if any) including open defects from recurrent subjective testing
7. Copy of the hardware and software update / change logs of the device
8. Planned future hardware and software updates / changes
9. In case of FFS or FTD, a brief description of what aircraft standard or individual aircraft (serial number or registration number) is simulated and how service bulletins and airworthiness directives are being followed including a list of actions based on them
10. List of target and running dates of all recurrent QTG tests and status of the tests (e.g. 'OK' or 'out of tolerance') and additional information if applicable (e.g. plans of actions for out of tolerance tests)
11. Copies of recurrent functions and subjective test records (i.e. 'fly-out' records)
12. Results of scheduled internal audits and additional quality inspections (if any) and summaries of actions taken
13. Brief description of navigation database updates (i.e. geographical area of valid data, update periods and source of both FSTD's ground station data [GSD] and simulated aircraft's GPS / FMS databases)
14. Log of emergency stop / cut-off testing
15. List of all airport visual databases including for each scene: name of the airport, ICAO code, type of visual scene (i.e. certification database, specific or generic) and additional capabilities (e.g. snow model, EGPWS, etc.)
16. Status and closure dates of all the items raised in last evaluation report
17. If recurrent QTG test results are saved in electronic format (e.g. pdf), please send them to expedite the evaluation
18. Any other information considered relevant by the operator (e.g. possible changes to the qualification certificate, known noticeable system limitations, etc.)

Long descriptions are not needed, but only a briefly indication of the status of the items and/or to attach relevant documents. If it is considered that some of the information is not applicable to the FSTD in question, please explain briefly why it is so. The FSTD operator should have all this information, so it is just a matter of putting it all together.

The information listed above is known as the 'dossier'. **The FSTD operator's representative is kindly asked to represent the dossier also during the evaluation briefing and tell what the information indicates about the device and about the FSTD operator's activities and how it demonstrates compliance**.

6 Guidance for the persons participating on the evaluation

The operator should arrange the following personnel to participate in the evaluation (see AMC2 ARA.FSTD.120):

- An instructor with a valid type or class rating
- Technical support person
- Other personnel as seen necessary (to participate on briefings or in the FSTD if the number of seats allow)

Note that if the operator itself does not have an instructor with a valid type or class rating, it is desirable and advised to arrange such a pilot from the operator's main customer.

The authority will provide the following personnel to participate on the evaluation:

- Technical inspector who acts also as the team leader.
- Flight inspector who will be acting as pilot flying (PF) for some or most part of the flying. He/she may not always be type rated on the type in question, so the instructor's help on type knowledge is required and appreciated.

Regarding the evaluation, the instructor and technical support person are kindly requested to note that:

- The purpose of the evaluation is to ensure that the FSTD device complies with the technical requirements and also to help the operator notice where improvements could be recommended.
- The FSTD evaluation is targeted on the device and not on the pilots or on any other personnel.
- You are part of the evaluation team. Therefore, you are requested to act in a fair and unbiased manner. Please consider that you are working for the authority during the evaluation.
- The inspectors tell all the time what will be done next. There will be no surprises such as malfunctions without briefing them first.
- The authority's inspectors have prepared a plan (i.e. a program) for the functions and subjective test flight. It will concentrate on route flying, system checks and system malfunction, engine failures, emergencies, etc. This plan is the target for the flight but it may be changed during the flight depending on how much time is spent on different issues. The bottom line is that the evaluation will concentrate most heavily on those training items (e.g. windshear, OEI, TCAS, EGPWS, malfunctions, etc.) where real aircraft can't be used for training. Note also that part of the subjective test flight will be performed intentionally outside the normal flight envelope. Note that the nature of the testing is *sampling*. In other words, some maneuvers are (somewhat randomly) selected to be tested but please mention your observations and/or concerns on any other topics also.
- There will be a briefing before the flight. The test flight plan will be quickly briefed during this meeting. This way the whole team knows what to expect and may give comments on the plan if needed.
- The authority selects a sample of QTG tests to be performed as part of the evaluation. Tests will be performed both in automatic and manual test modes. Also, the results of annual QTG results will be evaluated so please ensure that the annual results and MQTG are readily available during the evaluation.
- Pilots should continuously consider how this training device differs from the real aircraft. Please share your thoughts on this to the other team members spontaneously.
- FSTD evaluation is teamwork and the team needs your co-operation. All the work is being performed together.
- If you see, hear, feel or otherwise discover or notice anything abnormal, please mention it to the other team members to further investigate it together.
- Please act calmly and do not rush. Especially if something is under investigation (i.e. a possible defect or noncompliance is being investigated), please *suggest* actions to the team (e.g. to reset a system) before *making* any actions.
- There will be a de-briefing after the subjective test flight. The results of the defects (if any) will be discussed in the debriefing. Please feel free to share your opinions and comments during the de-briefing. Normally all items should be corrected within 30 days (see AMC2 ARA.FSTD.100(a)(1) point (b)), but it is acknowledged that some items may be impossible to be corrected within such time frame. The operator can request a longer rectification period for some item(s) during the debriefing.
- The inspectors will prepare an official evaluation report as soon as possible after the evaluation. It will be delivered to the operator.

7 Guidance for actions after the evaluation

Traficom will prepare an official evaluation report as soon as possible after the evaluation. It will be delivered to the operator. You are requested to read and sign the report. With the signature, you confirm that you have received the document. If you disagree with what has been written in the report, please report that for further discussion.

The evaluation report includes definitions of the item categories and classifies the items that the evaluation team has made. Where applicable, open the items in the operator's internal defect log so that they are visible to all the users of the device and initiate the corrective action processes. The evaluation report presents what actions are required and what is the dead line for them. By default, the deadline of 30 days as set in AMC2 ARA.FSTD.100(a)(1) point (b) should be followed.

Within 30 days of the evaluation, please submit a status report covering all items listed in Section 6 of the evaluation report. If the corrective actions cannot be completed by the deadline, please report what has been done to date and when and how each item is expected to be closed.

Below is presented an imaginary example (text with *italic* font) of what format the status report could use. The format of the status report is free, but it must clearly indicate what actions the operator has taken to rectify each individual item.

Status report concerning B737 FFS evaluation on 1 Aug 2022 *Date of this report: 30 Aug 2022 (revision 1)*

Area	*Description from evaluation report*	*Actions taken*	*Deadline*	*Status*
Subjective/ functional	*Left hand side dome light is inoperative.*	*Burnt bulb changed. Tested to operate OK.*	*1 Sept 2022*	*closed on 2 Aug 2022*
Subjective/ functional	*NAV station ident's were not audible through cockpit loudspeaker (but were OK through headsets).*	*Error was tracked to audio control software. A software modification for system simulation must be prepared. We need support from FFS manufacturer. This issue is expected to be closed by 20 Sept 2022.*	*1 Sept 2022*	*open*
Objective	*Rerun QTG test 2A8 was out of tolerance.*	*TLA potentiometer was changed and test rerun acceptably. Result is attached. Maintenance program was updated to monitor condition of the potentiometer.*	*15 Aug 2022*	*closed on 4 Aug 2022*
Management system	*Preventive maintenance log shows that many tasks are not performed.*	*Full details on this finding is in the attached finding report. Short summary: Root cause was identified. As an immediate reaction, monitoring of task status is done through the FSTD maintenance team weekly meeting. Pending actions to be done by 20 Sept 2022: A) Process description in FSTD manual will be revised; B) Audit and inspection program will be revised to add oversight on this process.*	*1 Sept 2022*	*open*

If a further revision(s) to the status report needs to be prepared, the same document can be revised so that changed parts can be easily recognized, for example such as:

Status report concerning B737 FFS evaluation on 1 Aug 2022 *Date of this report: 18 Sept 2022 (revision 2)*

Area	*Description from evaluation report*	*Actions taken*	*Deadline*	*Status*
Subjective/ functional	*Left hand side dome light is not functioning.*	*Burnt bulb changed. Tested to operate OK.*	*1 Sept 2022*	*closed on 2 Aug 2022*
Subjective/ functional	*NAV station ident's were not audible through cockpit loudspeaker (but were OK through headsets).*	*Error was tracked to audio control software. A software modification for system simulation must be prepared. We need support from FFS manufacturer. This issue is expected to be closed by 20 Sept 2022.* ***Update** on 18 Sept 2022: Software modification was installed and tested by TRI and by maintenance to work correctly.*	*1 Sept 2022 → Deferred to 20 Sept 2022*	*closed on 18 Sept 2022*
Objective	*Rerun QTG test 2A8 was out of tolerance.*	*TLA potentiometer was changed and test rerun acceptably. Result is attached. Maintenance program was updated to monitor condition of the potentiometer.*	*15 Aug 2022*	*closed on 4 Aug 2022*

As can be seen, such a table is a simple tool for the operator to track the actions related to the items, target dates, etc. This way also the progress and history of the items can easily be tracked. This is just one example of a status report format.

The FSTD operator is responsible for the corrective actions. Status reports are needed so that Traficom can monitor the FSTD operator's actions. If the FSTD operator fails to deliver appropriate status reports, Traficom may perform more oversight (e.g. ad-hoc audit) or limit the FSTD qualification certificate.

8 Guidance on configuration control

FSTD operator is required to establish appropriate configuration control methods and procedures. See requirements:

- ORA.FSTD.105 item (c): definition of configuration control
- GM1 ORA.FSTD.100 item (m)(2): configuration control procedures should be described in a manual
- ORA.FSTD.110 and AMC1 ORA.FSTD.110 and GM1 ORA.FSTD.110: management of FSTD modifications
- ORA.FSTD.230 and AMC1 ORA.FSTD.230(b): changes to FSTD devices
- AMC1 ORA.FSTD.100 item (c)(1)(xi): CMS audits should cover configuration control procedures

The following list presents elements of efficient configuration control:

- ARINC report 434-1 chapter 6 presents very good information on efficient configuration control. It is said that a configuration control system should be established to document each and every change that is made to the hardware or software of an FSTD. This will allow correlation between changed made and any negative effects caused by those changed. Proper configuration control will allow recovery back to a known baseline.
- Configuration control for FSTD devices means basically all the actions and (proactive) processes to ensure that the FSTD software and hardware integrity is continued at the required level. Understanding the technical aspects of the FSTD device (e.g. real avionics boxes and their compatibility, nature of re-hosted software, etc.) is vital.
- FSTD areas to be covered by configuration control procedures are as a minimum:
    - software (e.g. software, system modules, QTG scripts, settings, etc.)
    - hardware (e.g. cards, transducers, PC, avionics boxes, motion system parts, etc.)
    - visual databases (e.g. specific scenes)
    - navigation databases (e.g. FMS, ground station data)
    - version changes (i.e. changing FSTD from one configuration to another, if applicable)
- Other areas where configuration control is needed are for example management of customer options.

The main phases of configuration control regarding changes in FSTDs:

1) **Development**
   For example, planning and specification of update, then modification of source codes, etc.
2) **Acceptance**
   For example, implementation of software into test load to be tested by subject matter expert, SME, according to documented methods and principles, such as sampling and targeted subjective testing, QTG testing, testing for software regression, re-emergence of old bugs, etc. The acceptance should ensure that the modification is validated. This phase nearly always requires engineer's and pilot's (e.g. instructor) perspective in order to determine if changes are minor or major and how they impact.
3) **Documentation**
   Logging of all changes; what has been done, how, why, when and by whom.
4) **MQTG revision**
   MQTG is a living document that represents the current situation of the FSTD. So it is an output of configuration control process. MQTG shall be revised (and delivered to the authority for approval) whenever an update affects it. When the authority approves the MQTG change, the associated FSTD configuration is declared as acceptable. Also MQTG revisions must be traceable.
5) **Release to training**
   The change is implemented in the training load. Software loads should be named in systematic manner (e.g. 'development load' and only one 'training load'). Software backups and versions (e.g. differences between software modules and loads, possibility to revert back to older software modules, etc.) should be managed. Appropriate change logs should be established.

These five main phases must be described in manuals. Responsibilities for the different phases need to be clearly defined. The operator must know and understand all the changes to the device. Even if it outsources large parts of configuration control to the manufacturer, the operator is still responsible for its device and of the configuration control.

Authority performs oversight on the configuration control. FSTD evaluations are sampling of the device's condition on a specific moment. In order to grant the FSTD qualification certificate, the competent authority must have a good reliance that the FSTD operator is able to maintain the integrity of the device's hardware and software at the required level and make changes in the FSTD whenever necessary. Therefore, good and efficient configuration control is essential. It helps the FSTD operator itself to track changes and to determine root causes of problems. Configuration control can save effort, time and therefore also money for the FSTD operator.

9 FSTD modification checklist template

It recommended that the FSTD operator establishes a checklist that is used and archived for every single FSTD modification. (See also ARINC report 433-2 paragraph 3.1.5.) The table below can be used as a basis for a checklist on how all the modifications of an FSTD should be managed:

Task / procedure	Notes and sign-off by the responsible person
1. Description of the update A description of the change target and the reason for the change, as well as how the update will be implemented.	[notes are written here] Load release notes from the manufacturer are attached: [ ] Yes / [ ] No Name, signature and date:
2. Expected effects in simulation Describe what characteristics are expected to be affected. List also all the QTG tests that may be affected.	[notes are written here] Name, signature and date:
3. Information to the authority (ORA.FSTD.110 para (c)) In case of major modification (see GM1 ORA.FSTD.110), the authority should be noted well in advance and copy of the message attached to this checklist.	Modification is major modification: [ ] Yes / [ ] No → If yes, authority has been informed: [ ] Yes Name, signature and date:
4. Date(s) of the update work	The modification work was performed on these dates: Name, signature and date:
5. Changed hardware parts List of changed hardware parts, or 'N/A' if not applicable.	[notes are written here] Name, signature and date:
6. Changed software modules List of changed software modules, or 'N/A' if not applicable.	[notes are written here] Name, signature and date:
7. Functions and subjective testing Detailed description on what functions and subjective testing was performed (e.g. what flight phases, maneuvers, system functions, failures, etc.) and by whom. Testing should include: a) testing of changes, b) sampling of areas that should not have been affected, c) regression testing, d) testing of integration.	[notes are written here] Separate notes on testing are attached: [ ] Yes / [ ] No Is the scope of the testing adequate: [ ] Yes / [ ] No Name, signature and date:
8. List of QTG tests performed after the update All the QTG tests listed in item 2 above should be performed and ensured to be acceptable. Some sampling also on other tests should be performed to ensure that there are no negative effects on those.	[notes are written here] Did the update affect any QTG test: [ ] Yes / [ ] No → If yes, it is a major modification and the authority must be informed. Name, signature and date:
9. MQTG revision	Is a MQTG revision needed: [ ] Yes / [ ] N/A → If yes, is it approved by the authority: [ ] Yes / [ ] No Name, signature and date:
10. Logs All applicable logs are updated	[notes are written here] Hardware log has been updated: [ ] Yes / [ ] N/A Software log has been updated: [ ] Yes / [ ] N/A Defect log has been updated: [ ] Yes / [ ] N/A Name, signature and date:
11. Software backup	Is a software backup performed: [ ] Yes / [ ] N/A Name, signature and date:
12. Release to training use This row is reviewed and signed off by a dedicated person having the authority to release modifications to training use. (This row is part of the compliance monitoring.)	Are all items above acceptable: [ ] Yes / [ ] No Software load named as 'Training load': [ ] Yes / [ ] No Modification is released to training use: [ ] Yes / [ ] No Name, signature and date: → This checklist is archived as the last step.

10 Guidance on reporting FSTD modifications to the authority

ORA.FSTD.110 presents information regarding modifications to FSTD. This requirement states that 'the organization shall inform the competent authority in advance of any major changes to determine if the tests carried out are satisfactory.' In other words, for example the following hardware or software changes shall be reported to the competent authority in advance:

- an update that affects the handling of the simulated aircraft
- an update that affects the performance of the simulated aircraft
- systems operation of the simulated aircraft
- any major modifications of the motion
- any major modifications of simulated flight controls
- any major modifications of the visual system (either display or image generation)

If in doubt whether a change is major or minor, please report the modification to Traficom in advance.
See also GM1 ORA.FSTD.110.

In case of such modification please report the following information well in advance to Traficom:

1: FSTD identification code (i.e. what device a change concerns)

2: Information on the nature of the modification:
   - A written description of the modification
   - A written rationale for the modification (i.e. why it is made)
   - Initiative for the modification (e.g. FSTD operator, FSTD manufacturer, aircraft manufacturer or mandatory change)
   - Information on the type of modification, such as:
     - validation data, please specify details of the new validation data roadmap (VDR)
     - software
     - aircraft cockpit
     - flight controls
     - motion
     - visual
     - instructor station
     - host computer or interface
     - other, please specify

3: Information on the modification assessment:
   - What areas of simulation are affected, for example:
     - aircraft handling
     - aircraft performance
     - aircraft systems
     - other, please specify
   - List of affected tests of the MQTG
   - Primary reference document (PRD) used for the technical requirements of the modification

4: Information on the modification implementation:
   - Who will implement the modification (for example FSTD operator, FSTD manufacturer or contractor)
   - When (i.e. on what dates) will the modification be installed
   - When (i.e. on what dates / hours) will the modification be assessed by the FSTD operator
   - Who (i.e. name and title) will be assessing the modification

Please send the above-mentioned information together with any applicable attachments if necessary. Based on this data, Traficom will decide whether a special evaluation is needed or not. Traficom will also ask to provide further information if necessary.

11 Guidance on Master Qualification Test Guide (MQTG) and validation data

The Master QTG (MQTG) is a very important documents for the qualification of an FSTD. This page gives guidance on how the FSTD operator should ensure that the MQTG and associated validation data documents are acceptable. The principles presented below may help the operator's in establishing their procedures and manual description on this.

The operator should establish adequate personnel with adequate competencies to work with these documents. The operator should review the MQTG draft carefully and only when satisfied with it, deliver it to the competent authority. When the authority is satisfied with the MQTG, it will stamp and sign the document. Further revisions to the MQTG are likely and the operator should have a robust process to manage the revisions.

Master Qualification Test Guide - MQTG

The operator should carefully check the proposed MQTG, for example on the following aspects:

- Preamble text to include all required information. See whole CS-FSTD(A/H) and especially AMC1 FSTD(A/H).300 (paragraph (a)(6)).
- Statements of compliance as required. See whole CS-FSTD(A/H) and especially Appendix 1 to CS FSTD(A/H).300.
- That all required tests are included in the MQTG. See CS-FSTD (A/H) 'Table of FSTD Validation Tests'. See also VDR to ensure that all listed tests are included.
- That all the tests include the required elements. See whole CS-FSTD(A/H) and especially AMC1 FSTD(A/H).300 (paragraph (a)(6)(ii)(I)) for a summary of the main elements.
- That all tests are within required tolerances.
- That tests comply with CS-FSTD(A/H) and RAeS Aeroplane Flight Simulator Evaluation Handbook Volume I. For example, the testing methods must ensure integrated testing (see CS-FSTD(A/H) for further information on this).

Validation Data Roadmap - VDR

The basic idea of VDR is to easily see a summary (in matrix format) of the validation data source for each QTG test. For example, if too many tests (or too many tests in a certain section only) are based on engineering data (instead of flight test data), the VDR may not be acceptable. The operator should check the VDR to ensure that:

- The VDR has clear revision information.
- The VDR clearly states which organization is responsible for it.
- The VDR includes information on all applicable tests.
- The VDR states all the required information, explanations and rationales. See Appendix 2 to AMC1 FSTD(A/H).300 and especially its paragraph:

  > "The document should include rationale or explanation in cases where data or parameters are missing, engineering simulation data are to be used, flight test methods require explanation, etc., together with a brief narrative describing the cause/effect of any deviation from data requirements. Additionally, the document should make reference to other appropriate sources of validation data (e.g. sound and vibration data documents)."

- Requirements of Appendix 7 to AMC1 FSTD(A/H).300 are fulfilled. Very important is the following text in this requirement talking about the accepted hierarchy of data sources (i.e. 1st flight testing, 2nd engineering simulation, 3rd aircraft performance data, 4th other, such as footprint). Rationales should be clearly presented in the VDR.
- If engineering validation data is to be used, it has to fulfill requirements of AMC7 FSTD(A).300 and AMC8 FSTD(A).300 for aeroplanes and AMC6 FSTD(H).300 and AMC7 FSTD(H).300 for helicopters. Note especially that the cases must be 'confined to changes that are incremental in nature and that are both easily understood and well defined' and that 'a representative set of integrated proof-of-match cases' must be produced.

Engineering report (FNPT only)

CS-FSTD(A/H) presents that the validation data of FNPT must be approved as a separate process. The data and its sources should be presented in an engineering report. The report should justify how and why each test is representative of the simulated aircraft class or group. Validation data may include, for example, flight test data, but it may also be derived from documentation. Suitable, objective sources include flight manuals, academic textbooks, NASA reports on flight test results, aircraft specifications, and handling-qualities criteria. Information on aircraft performance (i.e. a stable condition) is easy to acquire. But data on aircraft stability (i.e. a dynamic situation) is more difficult to acquire. The 'feel' of flying is largely affected by the stability. Therefore, a generic FSTD should not be too stable nor too unstable. Again, the engineering report should justify why and how the FNPT is characteristic of the simulated aircraft class or group.

See AMC1 FSTD(A).300 paragraph (a)(5)(iv) and AMC3 FSTD(A).300 paragraph (b)(4) for aeroplanes. See AMC5 FSTD(H).300 paragraphs (e)(4) and (b)(4) for helicopters.

12 Recurrent QTG testing as a process for the FSTD operator

There have been misunderstandings regarding the principles of QTG testing and on the principles of comparing the results. The following text gives guidance on that area. FSTD operators should have a clear and documented process for all phases of QTG testing. Text below presents the phases of generation and use of QTG in chronological order.

1. Establish adequate personnel with adequate competencies to work with the QTG. There should be certain persons who may perform the tests and those who have the authority to approve the results.
2. Review the MQTG draft carefully (see also another page in this leaflet). Ensure that:
   - You are satisfied with QTG test results.
   - Testing is integrated (e.g. control mode such as 'direct driven' vs. 'math pilot').
   - The flight control inputs in the tests have a good match with the validation data.

   Prepare a statement on the MQTG draft and deliver it to the authority (see AMC1 ORA.FSTD.200).
3. Ensure that the authority approves the MQTG (i.e. stamps & signatures) and that you manage its becoming revisions appropriately.
4. Divide annual tests to be performed progressively (i.e. at least 4 times a year and tests within different sections for each quartile). It is recommended to perform or sample some tests in manual mode also (especially tests in 2A section).
5. Recurrent QTG testing should function as a routine process and as a loop:

   A. Perform the tests according to the test plan.

   B. Analyze the results. Perform the necessary calculations (e.g. for phugoid response, visual tests, and motion cues). Make associated markings on the prints.

   C. Compare the results (i.e. initialization & results) with validation data (see AMC1 FSTD(A).300 paragraph (a)(5)). Parameters with specified tolerances must remain within tolerances and all other parameters must support the QTG test case also.
      - Validation data for FFS is the flight test data (or engineering simulation data). Tolerances are applied between flight test data and the QTG result.
      - Validation data for FNPT is footprint data (i.e. MQTG). Tolerances are applied between QTG result and the MQTG result.
      - Validation data for FTD is the flight test data (or engineering simulation data). For aeroplane FSTDs (see CS-FSTD(A)), note that for *some tests* (not all) there are differences between tolerances for initial (CT&M) and recurrent evaluations (i.e. numerical tolerances applied between QTG and MQTG footprint).
      - If the test of FFS or FTD is not within tolerances, compare the result with MQTG. If the QTG is identical to the MQTG, then the result is OK. So MQTG was initially approved by the authority and if the result today is identical to MQTG (even though it may be momentarily out of tolerances), then the authority is still satisfied with the results today.

        → Compare the FFS or FTD results to MQTG in every case. If the result has explicitly changed from MQTG (even if it is still within tolerances), there must be a rationale for the change through the configuration control (e.g. change of hardware or software). QTG is an objective way to ensure that configuration control functions! See RAeS 'Aeroplane Flight Simulator Evaluation Handbook' Volume 1 paragraph 1.3.1 for more information on this.

   D. If the test is not within tolerances, perform it again and/or perform a software reload before next re-run. (What do you mark in QTG log in case of failed test?) If the result is still poor, try the test in manual test mode for de-bugging purposes. Write a defect (i.e. 'snag') and fix the issue. If a test result is and remains poor (i.e. out of tolerance), contact the authority. It is always easier than to give that as a surprise to the authority in the evaluation.

   E. Approve the result. → Mark date, signature and other data (e.g. write text 'as in MQTG') as appropriate.

   F. Archive the result. → If archive is electronic, establish back-ups.

   G. Continue this loop from item A.

6. CMS makes audits to review the QTG process and checks annual results. Also the authority makes evaluations and audits to confirm that QTG results and QTG process are satisfactory.
7. Configuration control may need to explain why and when the results have begun to go out of tolerances. It is important to archive results and make appropriate log entries so that you can revert back to old results and data when necessary.
8. MQTG is a living document. In case of software or hardware changes, the MQTG may need a revision. Prepare the revision and deliver that to the authority for approval.
9. Continuous improvement and SMS affect QTG also. Changes to QTG test program may be needed if you need/want to ensure that some tests give continuously good results (e.g. run certain test two times per year instead of only one time per year to confirm calibration of a certain area). See guidance on SMS in this leaflet.

13 Guidance on periodic maintenance of FSTDs

To ensure that an FSTD operates correctly and reliably, the operator should perform periodic maintenance. See ARINC report 434-2 chapter 7. The persons doing the maintenance should be competent to perform the maintenance tasks. The documentation (e.g. maintenance program and work instructions) should be clear, and the tasks should be logged.

The periodic maintenance program is typically largely based on the program that the FSTD manufacturer recommends. It is likely that the manufacturer has recommended a program that tries to be suitable to any FSTD operator. Still, it is inevitable that local conditions are different and each FSTD is still an individual device. Some examples of local conditions that are different for different FSTD operators:

- Outside air temperature (e.g. equator vs. polar circle)
- Outside air humidity (e.g. tropical area vs. dry plains)
- Sand particles in the air (e.g. desert areas)
- Earthquakes (e.g. volcanic areas)
- Amount of dust in the building
- Reliability of local electrical power grid

The above-mentioned examples have an effect on the life cycle of electronics and mechanical systems. Appropriate measures can be taken against the above-mentioned examples. The maintenance program should be based on the manufacturer's recommendations but should also consider the local conditions. For example, if the FSTD is operated in a building close to Sahara Desert, it is likely that the electronics should be vacuumed often to remove the small sand particles that the air carries.

The maintenance program may be changed as evidence is received that something has to be done more often or that it is not necessary to do something as often as the manufacturer recommends. In fact, any mature FSTD operator should be making changes to the maintenance program during the life span of the FSTD because the challenges are likely to be different at different phases of the life span. It is likely that a 20-year-old FSTD will need a different maintenance program compared to the program that was sufficient when the device was new. For example, the cable connectors will wear out due to vibrations and corrosion as time goes by. Any intermittent loss of signal or voltage in the cable will lead into wrong behavior of the FSTD. Consequently, the maintenance program should recognize this and perform appropriate periodic checks and maintenance to ensure that the FSTD functions correctly and reliably (see ORA.FSTD.115 paragraph (a)(1)). Any changes to the maintenance program should be justified and documented so that the operator can later track what was changed and why it was changed.

Even when the maintenance program is customized and modified as time goes by, the parts and systems still have only a limited lifespan. For example:

- The mechanical parts of the control loading (e.g. push rods, joints, etc.) or motion system will wear out and the build-up of free play will be noticed by the pilots.
- The electrical power units will become unreliable (e.g. due to drying of condensers) with fluctuating voltages. The pilots will notice this by any sort of intermittent issues with the FSTD.

In other words, performing the same maintenance program all over again is not enough. At some point it is necessary to perform also a 'heavy maintenance' to replace major assemblies (e.g. control loading components, motion legs, electrical units, etc.). Should such a heavy maintenance be performed with a certain interval or as an 'on-condition' basis? Also the availability of spare parts play a role here. It is likely that any electrical components will become obsolete at some point. Therefore, it is wise to take benefit of the safety management system (SMS) when considering the time for a heavy maintenance. (See other pages of this leaflet regarding the SMS.) Such a process takes all the evidence (e.g. reliability data, availability of spare parts, feedback from the users, failed tests, performance indicators, etc.) into account and then makes an objective decision on how to mitigate the issue.

14 Guidance on Performance Based Navigation (PBN) requirements

Aviation has been moving quickly away from conventional navigation solutions (e.g. VOR, NDB) towards performance based navigation (e.g. GNSS solutions). Therefore, there is a need to give PBN training in FSTDs. The technical FSTD regulations do not (yet) fully cater PBN aspects, and therefore further guidance is needed. Since the PBN training is given in FSTDs and the FSTDs must correspond to real aircraft, we can conclude that the criteria for PBN in FSTDs is basically the same as in real aircraft.

In short, FSTDs should fulfill the technical regulations that concern PBN in real aircraft. And the FSTDs should support all the training needs. Therefore, please refer to the following regulations:

- EASA Part-SPA, Subpart B gives guidance on PBN flight operations.
- Commission Regulation (EU) 2016/539 amends Part-FCL by implementing PBN training requirements. It specifically says that training shall be 'performed in an appropriately equipped FSTD'.
- Annex I to ED Decision 2016/008/R (i.e. AMC and GM to Part-FCL amendment 2) gives details on PBN pilot training requirements.
- AMC and GM to Part-NCC Amendment 5 gives a good summary on applicable PBN regulations.
- Airworthiness criteria for PBN were formerly in EASA AMC-20, but are now published in CS-ACNS.
- ICAO Doc 9613 ('Performance Based Navigation (PBN) Manual') is the top-level document on which EASA requirements are based on. There are some subtle differences between EASA and ICAO, so therefore Doc 9613 can be used as reference only.

FSTD flight training elements for PBN are listed in AMC1 SPA.PBN.100. Note that system failures and abnormal procedures are to be trained also. The FSTD should be capable to support positive training on all required aspects.

Navigation specifications

PBN concept consists of different navigation specifications. Each specification has its own requirements for example concerning navigation accuracy, what navigation sensors may be used, etc. GM1 SPA.PBN.100 Table 1 shows the required navigation accuracy (nm) for each navigation specification:

Navigation specification	FLIGHT PHASE							
	En route		Arrival	Approach				Departure
	Oceanic	Continental		Initial	Intermediate	Final	Missed	
RNAV 10	10							
RNAV 5		5	5					
RNAV 2		2	2					2
RNAV 1		1	1	1	1		1	1
RNP 4	4							
RNP 2	2	2						
RNP 1			1	1	1		1	1
A-RNP	2	2 or 1	1–0.3	1–0.3	1–0.3	0.3	1–0.3	1–0.3
RNP APCH (LNAV)				1	1	0.3	1	
RNP APCH (LNAV/VNAV)				1	1	0.3	1	
RNP APCH (LP)				1	1		1	
RNP APCH (LPV)				1	1		1	
RNP AR APCH				1–0.1	1–0.1	0.3-0.1	1–0.1	
RNP 0.3 (H)		0.3	0.3	0.3	0.3		0.3	0.3

Numbers specify the accuracy level — no specific approval required — specific approval required

Note that RNP APCH is the name of the *navigation specification*. Earlier the associated approach charts were named for example as '*RNAV (GNSS) Rwy 22L*' approach, but nowadays the charts say '*RNP Rwy 22L*'. Note that RNP AR APCH means approaches that are named for example as '*RNP Rwy 22L*' but where the chart says for example *'Special aircrew and aircraft authorization required'*. Currently only some aircraft and avionics are certified to RNP AR APCH.

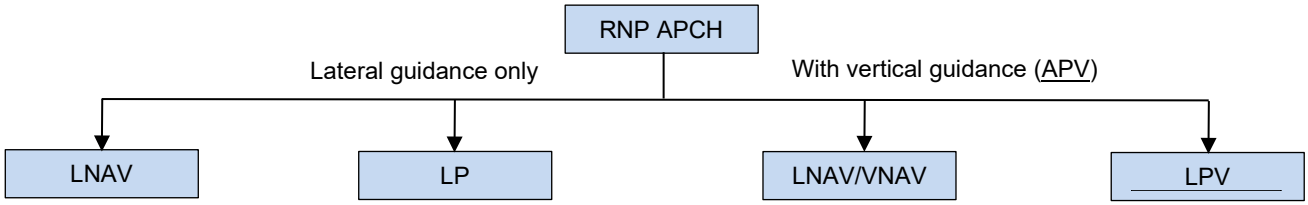
15 Guidance on PBN requirements for FSTDs

It is very important that the FSTD uses correct navigation sensors (e.g. GNSS, IRU, DME and VOR and their combinations such as DME/DME, DME/DME/IRU or DME/VOR) when operating in accordance with a certain navigation specification. Basically, GNSS is the primary sensor, but other sensors may be used as well, especially in case of system failures. EASA CS-ACNS and ICAO Doc 9613 give detailed information on what sensor is required and if AP/FD is required to be used. Aircraft's flight and avionics manuals should state the how the requirements are met.

Historically there have been just two kind of approaches: precision approach (e.g. ILS and the new GBAS Landing System GLS) and non-precision approach (e.g. VOR, NDB or LOC approach). PBN concept implemented a third kind of approach: approach procedure with vertical guidance (i.e. APV). APV utilizes lateral and vertical guidance to the pilots, but is not as accurate as precision approach.

RNP APCH can be performed by using different procedures and different technologies (e.g. LNAV, LP, LNAV/VNAV, LPV). These have different approach minima, as presented in the approach chart. All the associated functions should function correctly in the FSTD. The FSTD operator should apply for each RNP APCH minima that is requested to be added to FSTD qualification certificate. Each different procedure has different indications and functionalities:

- **LNAV** means lateral navigation (e.g. by CDI). RNP APCH to LNAV minima is a non-precision approach. It is expected to be flown as continuous descent final approach (CDFA) whenever possible.
- **LP** means localizer performance with the space-based augmentation system (SBAS) such as EGNOS, WAAS, MSAS or GAGAN. Guidance is only lateral. RNP APCH to LP minima is a non-precision approach.
- **LNAV/VNAV** means approach with both lateral and vertical guidance. VNAV guidance may be based on barometric air pressure ('Baro-VNAV' or 'APV-baro') or SBAS. RNP APCH to LNAV/VNAV minima is an APV approach.
- **LPV** means localizer performance with vertical guidance, i.e. approach with both lateral and vertical guidance with the space based augmentation system (SBAS). RNP APCH to LPV minima is an APV approach.



If any navigation specification (such as RNP APCH or RNP AR APCH) are requested to be added to the FSTD qualification certificate, the FSTD operator should demonstrate to the authority that:

1. Requirements of applicable EASA CS-ACNS are fulfilled. Note that a re-hosted FMS or a real aircraft box are often more likely to function correctly. But fully simulated panel mounted GPS units often do not have all the required features and can't be qualified for example to RNP APCH but only for en-route navigation.
2. Manuals of the simulated aircraft and avionics (e.g. AFM, FCOM, etc.) indicate that the applied navigation specification is certified for the real aircraft configuration.
3. Operation and indications of systems are correct in normal and abnormal situations (including engine failure during approach) in all flight phases (i.e. well documented functions and subjective testing) and in accordance with the flight and avionics manuals.
4. There are selectable system failures (e.g. loss of navigation accuracy, RAIM, etc.) with correct indications (e.g. not only an 'RNP CAPABILITY LOST' message, but also all the associated FMS pages show associated changes such as increased estimated position uncertainty and changed coordinates) and with FDE function where installed. Reversion of modes should function in accordance with the flight and avionics manuals and above-mentioned regulations.
5. Simulated atmosphere is correct. Baro-VNAV approaches have a lowest allowed outside air temperature, since the temperature affects the approach angle.
6. The barometric altimeter temperature error should be simulated.
7. Integration of different avionics systems (e.g. integration between FMS and AP/FD, synoptics, etc.) is correct.
8. Integration of the whole FSTD (e.g. alignment of visual system and approach track).
9. Databases are managed to keep them current. Users of the FSTD are informed on what approaches are available (e.g. often either the FMS or visual database support only a limited number of RNP approaches).
10. Recurrent functions and subjective testing checks PBN in the future also.
11. FSTD operator's personnel who perform the testing should have adequate competence.

Note that RNP AR APCH is the highest PBN capability. Those approaches include approaches to airports with dangerous terrain (e.g. Innsbruck, LOWI). Note that there are different criteria for RNP AR APCH if the required navigation accuracy is 0.3 nm or below that. FSTDs should be tested to each applied accuracy. EASA's principle is that RNP AR APCH can be added to FSTD qualification certificate only if the EGPWS system is a real aircraft system. In other words, EASA does not allow software simulated EGPWS systems to be used with RNP AR APCH.

16 Continuous oversight performed by Traficom

When Traficom grants an FSTD qualification certificate, Traficom begins a process of continuous oversight of the device and of the FSTD operator. Due to this, the operator should be prepared for these three items:

- unannounced inspections
- certain documents to be sent to Traficom on a semi-annual basis
- ad-hoc audits and/or evaluations (only if necessary)

The unannounced inspections do not normally include flying with the FSTD, but are mainly targeted on the documentation and procedures (e.g. QTG, tech log, complaints, configuration control, reliability data, management system, etc.). These inspections are intended to last for a short time.

Ad-hoc audits and/or evaluations will be performed only if certain indicators show that the operator's compliance with regulations is under question. Basically, if the operator has a successful record on Traficom's evaluations and audits and inspections, these ad-hoc inspections are not needed.

Traficom requests all the Finnish FSTD operators to send the following documents for each FSTD device 6 months after the last recurrent evaluation:

1. List of targets and running dates of recurrent QTG tests (for the last 6 months or for the whole year however more convenient for the operator) and status of the tests (e.g. 'OK' or 'out of tolerance') and comments if any (e.g. plans of actions for out of tolerance tests).
2. Copy of the hardware and software update / change logs of the device.
3. Reliability data month by month: training hours, number of complaints mentioned in the technical log, training hours lost, availability rate, summary of complaints per ATA and FSTD main sections (see AMC2 ORA.FSTD.100).
4. Status report on all items of the last recurrent evaluation report, and any outstanding items from previous evaluation reports
5. List of all technical defects of the device (i.e. both open and closed items)

The documents should include information regarding at least the last 6 months (i.e. from previous evaluation).

The above-mentioned documents can be sent to Traficom as they are. In other words, there is no need to create a separate new document for this report. Therefore, sending this data should be an easy and quick task. Traficom will present questions related to the data if necessary.

Your co-operation is well appreciated. Please do not hesitate to present questions to Traficom on these.

17 Guidance on compliance management system (CMS) for FSTD operators

ORA.GEN.200 requires the FSTD operator to have a management system. The management system shall have a function to monitor compliance of the organization with the relevant requirements (ORA.GEN.200 paragraph (a)(6)). Such a function is generally known as a compliance management system (CMS).

Part-ORA and its AMCs and GMs represent the processes that the FSTD operator should establish. Especially GM1 ORA.FSTD.100 lists and describes these processes. It can be said that the core processes of the FSTD operator are:

1) Management system processes (i.e. compliance monitoring and safety management system, see requirements in ORA.GEN). This includes processes such as auditing, inspections, review board meetings, risk identification and mitigation and so on.
2) QTG management process
3) Functions and subjective testing (i.e. 'fly-outs') process
4) Configuration control (see ARINC report 434-1 chapter 6 and report 433-2 paragraph 3.1.5)
5) Preventive maintenance (see ARINC report 434-1 chapter 7)
6) Defect rectification (i.e. 'snag' handling, i.e. reactive maintenance, see ARINC report 434-1 chapter 8)
7) Reliability analysis (see ARINC report 433-2)
8) Personnel training and maintenance of their competency (see ARINC report 432)
9) Safety instructions for personnel and users
10) Spares and tools management
11) Manual administration and document control
12) Reporting to the authority (e.g. accidents, planned major modifications, lengthened technical problems, etc.)
13) Preparations for evaluations

(The list above includes references to ARINC reports that represent good information and guidance on what is the purpose and expected elements of those processes. It is recommended to familiarize with those documents.)

The main elements of these processes are listed on the following pages of this leaflet.

The CMS should monitor the compliance and measure the effectiveness of these processes. Compliance is monitored, for example by performing inspections and audits (see GM3 ORA.GEN.200(a)(6)). The auditors should be competent and independent. In other words, the audits must be carried out by persons not responsible for the function, procedure or products being audited. Note that FSTD processes include special functions that are not so common within other aviation domains. For example, software configuration control can be considered as such and requires special expertise. It is important that the auditor has competency to audit the processes.

The core processes should be described in a procedures manual (see AMC1 ORA.GEN.200(a)(5) paragraph (b) and GM1 ORA.FSTD.100 paragraph (m)). The manuals and process descriptions should be unambiguous and clear. It is encouraged to use text, checklists and process charts as applicable and suitable for the process in question. Detailed process descriptions help ensuring that personnel know what and how is expected to be done.

Traficom audits the FSTD operators. Intervals between the audits is defined by the results of all the oversight that Traficom performs. The audit dates are announced and agreed well in advance. Traficom’s audits are targeted at the above listed processes. Auditing includes discussion, interviews, document sampling, etc. The operator should be able to show evidence on how each process is functioning and how their efficiency has developed. Traficom prepares an audit report and delivers it to the FSTD operator. In case of findings, the audit report represents deadlines for corrective actions.

18 Guidance on FSTD operator's processes

Previous page lists the FSTD operator's expected processes. The table below shows further characteristics and elements of those processes. The table below should help auditors in determining if the expected elements have been established. The elements should be described in manuals.

Process	Purpose of the process	Important elements needed to accomplish the process
Management system (CMS and SMS)	To oversee all actions and to proactively identify potential weaknesses and ensure corrective actions.	• Declaration if the organisation is complex or non-complex • Applicable standards and requirements (and their distribution to personnel) • Policy • Objectives, targets and how they are being measured • Organisation and required resources • Oversight plan (including oversight of subcontractors if applicable) • Audits and inspections • Management of change • Hazard identification and mitigation • Root cause analysis • Corrective actions • Reporting (by anyone at any time) and handling of reports • Management reviews/meetings • Declaration of responsibilities and accountabilities • Just culture • Continuous improvement • Emergency response
Information security management system	To identify and manage information security risks affecting aviation safety.	• Identify information security risks • Manage the information security risks • Detect information security events • Identify those information security events with potential impact on aviation safety • Respond to, and recover from, those information security incidents • Information security management system (ISMS)
QTG management	To objectively show that the FSTD meets the required tolerances.	• Competency to perform and analyse tests • MQTG and management of its revisions • Test schedule • Test acceptance methods • Archiving of results • Process description (including what to do if test is out of tolerances) • Regulations easily available (e.g. PRD and RAeS guidance manual) • Clear responsibilities
Functions and subjective testing	To test the device in various conditions to see if the device feels and functions as expected.	• Competency to perform tests • Annual plan for fly-outs • Pilot briefing methods (testing purpose & criteria) • Process description and responses (e.g. composition of team) • Program / checklist for fly-outs • Log / records of fly-outs
Configuration control	To maintain system integrity, trace change impacts, and restore the baseline.	• Development of change (e.g. specification and planning) • Acceptance & testing of updates • Log of changes (who, when, why, what, how…) • Documentation of performed testing • List of installed and compatible parts • Checklists and work instructions (e.g. version change, database updates) • Software backups
Preventive maintenance	Maintenance and servicing to minimize in-training faults and subsequent lost training time.	• Competency to perform tasks • Maintenance program (e.g. weekly, monthly, annual, 5-year, aging components) • Maintenance manuals, wiring diagrams, parts catalogue, etc… • Daily readiness check (process, checklist, log, training for persons…) • Log of performed periodic maintenance • Constant reviewing of program/schedule (e.g. add items or change intervals) • Software backups • Tools

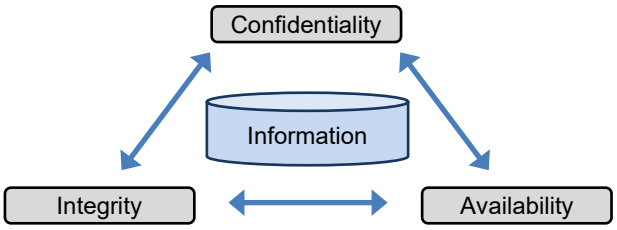
Table continues from the previous page.

Process	Purpose of the process	Important elements needed to accomplish the process
Defect rectification	To return a failed system to acceptable status with a methodological approach.	• Competency to perform tasks • Log of all defects (including maintenance actions on them) • List of open defects (with wording that is meaningful to pilots) • Diagnostics tools (detect and log failures of subsystems) • Classification of defects (major/minor, training impact…) • Defect deferral procedure • Principles of pilot testing (when necessary) • Authorization to sign off (i.e. clear) defects • Process description (including debugging principles)
Reliability analysis	To identify any system(s) having reliability problems and needing maintenance.	• Statistics of downtime, availability, snags per ATA/LRU, etc. • User quality ratings • Responsible person to gather data • Trend analysis • Data assessment by appropriate persons (e.g. management meeting) • Frequency of data review
Personnel training and maintenance of their competency	To ensure that personnel is competent to perform their tasks.	• Required competencies (consider aircraft types and age of FSTDs) • List of required initial and recurrent trainings • Means to estimate/measure competency levels • Internal training material ready and available
Safety instructions for personnel and users	To ensure that all persons are aware of safety in the vicinity of an FSTD.	• Placards, signs, exit route markings, safety zones • Fire detection & extinguishing equipment, etc. • Presentation/briefing for the users • Log of given safety briefings • Training for maintenance personnel (e.g. harnesses, lifting devices) • Periodic testing of emergency response plan (ERP)
Spares and tool management	To have structured methods on spares and tools.	• List of critical spares to be maintained in stock all the time • Separation methods between new, failed and repaired parts • Testing methods of repaired parts • Periodic checking of manufacturer's availability of spares (to avoid obsolescence) • Responsibilities on who should update stock (purchasing, log, etc.) • List and log of tools to be calibrated including deadlines • Responsible persons for tool calibration process
Manual administration and document control	To have a structured method for documentation of processes and procedures, and for document retention.	• Management system manual • FSTD procedures manual with description of each core process • Document archive • Data retention for required period • Backups of electronic data • Policy for document identification (i.e. dates, logo, revision markings…) • Authorized persons to publish/revise manuals, work instructions, logs, etc.
Reporting to the authority	To share all applicable information with the authority.	• Clear responsibilities (e.g. who sends the information) • Criteria on when to report prolonged defects/problems • Manual description on what and when to report • Checklists (e.g. for configuration control) have reminders to report when applicable
Preparations for evaluations	To be ready to demonstrate to the authority that the FSTD can be qualified.	• Sending application and agreeing on dates well in advance • Calendar reservations to FSTD and personnel • Preparations for dossier (see GM3 ORA.FSTD.100) • Responsible person for presenting the dossier to the evaluation team • Procedures to check that the device and documentation are ready • Procedures to coordinate the process (e.g. checklist, communications, etc.) • Preparedness for corrective actions (e.g. enough maintenance time)

19 Guidance on cyber security (Part-IS) for FSTD operators

Information is an asset which has value to an organization and consequently needs to be suitably protected.

Confidentiality, integrity and availability are known as the 'CIA triad'. *Confidentiality* means that information is not made available or disclosed to unauthorized individuals, entities, or processes. Information *integrity* means maintaining and assuring the accuracy and completeness of data over its entire lifecycle. This means that data cannot be modified in an unauthorized or undetected manner. For any information system to serve its purpose, the information must be *available* when it is needed.



At the time of world wide web, data breaches, malicious attacks, identity thefts, all sorts of cyber-crimes, and even cyber-terrorism and cyber-warfare, information security is very important for us all. Aviation sector is a prime target for cyberattacks. Aviation stakeholders have systems that contain 'big data' including vast amounts of personal data (e.g. passport and credit card information of individuals) and information needed to run the system (e.g. locations and status of each aircraft). In addition, the stakeholders have confidential and safety critical data. It is no surprise that the number of cyberattacks and spying on aviation sector has increased at an alarming rate. EASA has published a requirement Part-IS. It concerns information security. The operators must comply with this rule at the latest by 22 Feb 2026.

The main idea of information security is that a secure system (e.g. a software) does only what it is supposed to do – and nothing else! The vulnerabilities should be mitigated to ensure that the system can't be exploited to do anything else. Part-IS requires taking a safety approach to information security. All the associated risks should be assessed and managed. It means, for example, not only blocking software vulnerabilities but also considering human factors (e.g. exposure to 'phishing'), and processes. Information systems are composed of three main portions: hardware, software and communications. They should be protected by applying policies and practices for 1) organizational security, 2) personal security, and 3) physical security.

All this applies to FSTD operators too. An FSTD device can't work correctly if its software is wiped out, gets corrupted or is altered. Any such event would take time and be expensive to recover. Because of this, it would be wise to do the following:

- To keep the FSTD fully separated from the internet (WAN) and the organization's local area network (LAN).
- To connect the FSTD to the internet only temporary when it is agreed with the device manufacturer to do certain work with the device. The connection should be run through a professional grade firewall system.
- To restrict and prohibit to plug a USB key or hard-drives to the FSTD to prevent worms, viruses and tailored attacks.
- To have good backups of all the FSTD's hard drives to be able to recover to a known functioning state.
- To have the configuration of the equipment (e.g. router and switch settings) known to be able to restore the setting if a 'factory reset' should become necessary.
- To control the access to the FSTD room and computers.

FSTD operators often have lots of data (e.g. logs, customer data, etc.) and information kept in shared drives or in a cloud. For example, QTGs, flight test data, flight manuals and such are proprietary data and intellectual property. They may also include information that is critical for aviation safety and could be used for harmful purposes. Criminals and spies try to acquire such data. It is essential that information is protected adequately, for example by user authentication, using only necessary privileges, white listing and black listing of allowed connections, logging of when, where and by whom the system and any file or folder was accessed, and so on. Backups of such data should be performed frequently. The backups should be tested to ensure that they work. All the information should be maintained in a location not accessible to unauthorized persons.

Part-IS requires organizations to manage information security risks with a potential impact on aviation safety, including risks affecting IT systems and data used for civil aviation purposes. Although FSTD training is not real flight, information security issues may still have safety consequences, for example through negative training (e.g. unintended or unauthorized changes to FSTD behavior) or the compromise of safety-critical information. Existing FSTD configuration control and testing processes already help ensure stable device behavior; however, Part-IS adds an explicit information-security perspective, focusing on protection against malicious intent and tampering with systems or data, as well as incident detection, response and recovery.

FSTDs give us also a chance to protect the aviation system from cyber threats! Real aircraft operations may be affected by GPS jamming, ADS-B spoofing, COM/NAV frequency spoofing or interference, or cyber-attacks on aircraft systems, ATC, data-link, company flight dispatch and so on, affecting the *availability* or *integrity* of these services. The aviation system should be resilient to handle these. Pilots can be trained to develop the competence to manage such situations. FSTDs provide a safe environment for this type of training. Have you ensured that your FSTD supports training in these areas?

20 Guidance on safety management system (SMS) for FSTD operator

It is acknowledged that SMS is a fairly new issue, especially for the FSTD industry. Traficom has prepared the below mentioned guidelines to help the Finnish FSTD operators to know what Traficom expects from SMS of FSTD operators.

Definitions

SMS is a (safety and business oriented) hazard identification, risk assessment and hazard mitigation and avoidance system while CMS is an independent system that measures how effectively management system (including SMS) is functioning. Both of these are part of the whole management (MS) system of the operator. CMS is clearly described and required by AMC1 ORA.GEN.200(a)(6). SMS is clearly described and required by AMC1 ORA.GEN.200(a)(3). The required SMS is in line with ICAO's SMS standards (see EASA's explanatory note to Part-ORA, Decision 2012/007/R).

Regulation (EC) No 216/2008 Annex III item 3.a.1.ii states: "A training organization providing pilot training must meet the following requirements: implement and maintain a management system relating to safety and the standard of training and aim for *continuous improvement* of this system." So, operators must have both SMS and CMS systems, and they must target at continuous improvement.

SMS contents for FSTD operator

Note that the SMS for an FSTD operator may and should include items from *anything* around the FSTD business. The idea of the SMS is to build a business approach to safety. Most often when the financial risks are reduced, also the risks of accidents and/or negative training are reduced. Hazards can't be fully eliminated but mitigation actions should reduce hazards to an acceptable level.

Note that SMS is concentrated heavily on human error, i.e. to develop processes so that the number of human errors would decrease and that occasional single human errors would not result in a catastrophe. In FSTD domain, the SMS should also concentrate on the technical aspect (e.g. reliability) of the device.

Safety of the pilots and maintenance personnel in the simulator environment is basically already covered by the local national health and safety regulations and by performing safety feature checks and preventive maintenance. So, the SMS should not concentrate only on those items. But if hazards are recognized with those, then risks should be mitigated.

There are no real flight operations on FSTD devices. So real *flight safety* is not *directly* at risk on FSTD flights. But if the pilots receive ***negative training*** in FSTD, their *flight safety* in real aircraft may be endangered *after* FSTD training. Negative training means that if the pilots learn wrong skills or procedures (e.g. due to FSTD limitations or problems), they will apparently use those skills or procedures in real aircraft which again (might) endanger flight safety. The avoidance of negative training should be highlighted and emphasized by the SMS. So, SMS should relate to training delivery. See official definition of negative training' and 'negative transfer of training' from GM11, Annex I to ED Decision 2015/012/R.

Hazards for negative training can be for example: 1) errors/limitations in system simulation (e.g. wrong electrical distribution, diverging AP, wrong EFIS symbols, etc.), 2) wrong feel of cockpit hardware, 3) wrong handling cues such as wrong control forces, 4) mismatches between visual database and charts, 5) wrong cues of motion system, and so on.

Identified hazards can be related to existing or potential conditions that might cause negative training and an aviation accident or incident in the future. Risk severity and likelihood of negative training hazards can most often only be estimated (i.e. and educated guess). Experienced instructors could be considered as experts to estimate these.

Flight operators and FSTD operators are encouraged to exchange information related to identified hazards. For example, identified FDM problem areas might interest FSTD operator to check if the FSTD functions well in those areas.

SMS coverage of the whole organization

SMS for an operator should be an 'umbrella'. In other words, SMS should extend to cover the whole operator and all its parts and actions. In addition, SMS should cover also the actions of subcontractors. SMS should have access and receive data from all other actions (e.g. reliability data, complaints, quality reports, audit reports, QTG results, subjective and function test results, authority's reports and letters, log data, management review records, manuals, anonymous reports, etc.). Based on all the information available, SMS should identify hazards and determine the associated risks and define the required mitigation actions. This process is continuous and should be effective. Oversized, too complex or excessive mitigation actions are not desirable since they increase the risk of further human error (or 'practical drift').

Effectiveness of SMS should not be measured (by CMS or by the authority) by the sole number of how many hazards SMS has recognized. Instead, effectiveness should be measured by analyzing the whole SMS as a process: does it concentrate on most relevant hazards first, is the whole process clear, is the risk assessment appropriate, do the mitigation actions work as planned, etc.

Whenever possible, SMS mitigation actions should use the already existing processes (e.g. to edit preventive maintenance program or to perform QTG tests or subjective tests more often). So it is not (always) necessary to start a completely new process to perform some mitigation actions.

21 Examples on SMS actions for FSTD operator

To better describe the avoidance of negative training, the following imaginary examples are presented below:

Example 1:

An FSTD operator operates an older full flight simulator. The reliability data (as prepared according to ARINC Doc 433) shows that there are sometimes severe problems with calibration of control loading. This leads to long interrupts in training due to maintenance actions and ordering of spare parts.

SMS is able to recognize this problem due to the input from reliability data. SMS recognized that these issues lead to a risk of financial losses and also on negative training since wrong control forces give totally wrong cues for the pilots. (Note that the error in calibration develops gradually and not in an instant.) So, this issue is a hazard to the operator.

SMS determines that as mitigation actions; the spare parts stock must continuously have more parts for the control loading system. In addition, the SMS determines that certain control loading tests (for the channel in question) must be performed with an interval of 3 months (instead of the interval of 12 months required by regulations). Also, the preventive maintenance program is changed to include cleaning and checking of certain potentiometers of the control loading system. In addition, this issue is emphasized on the daily readiness test.

This way the operator is continuously monitoring the calibration of the control loading and can take further actions if any hints of calibration issues are noticed. (Note that it is quicker and cheaper to fix the calibration problem when it is has not yet developed into a severe problem.) In the long run, in this example SMS saves money and also at the same time reduces the risk of negative training! CMS is able to measure the effectiveness of the mitigation actions, for example by checking the spare parts stock and QTG results.

Example 2:

An FSTD operator operates several full flight simulators from different manufacturers and of different ages. During the last year, there have been several complaints about the behavior of some simulators. Even though the complaints have been on different simulators and on different systems, the root cause analyses have shown that all these complaints have been caused by loading the wrong software load (i.e. software version) on the simulator's host computer.

Due to the received complaints and due to the root cause analysis, SMS is able to recognize that the configuration control procedures are not working correctly. SMS recognizes that the risk of such problems is some training time losses and weakening of the operator's reputation (i.e. both cause financial losses). SMS also recognizes that such problems can cause noticeable negative training.

SMS determines that as mitigation actions; the operator must edit the names of the software loads so that there would be no space for confusion on the appropriate software load for training purposes. Therefore, all the valid training loads in all the devices are renamed as 'Active training load'. In addition, SMS determines as another mitigation action that written instructions for maintenance staff for the loading of the host computer and also for the whole configuration control process are prepared.

This way the operator is reducing the probability of further mistakes of loading the wrong software load. SMS saves money and prevents negative training. CMS is able to measure the effectiveness of the mitigation actions by doing random checks on the loaded host software load versions and by checking the configuration log system. Also, CMS checks if in the future similar complaints will appear again.

Example 3:

An FNPT has an approved and installed autopilot (AP). The users report occasional cases where the AP has been unable to couple to approach mode or has started diverging oscillations during approach. It is recognized that such behavior can result in negative training.

It is noted that the problem disappears after reloading the device's software. The problem is moved to hold items list (HIL) and the root cause is investigated with the help of the FSTD manufacturer. In the meanwhile, the daily readiness check program of the FNPT is modified so that the use of AP is tested daily by the instructors before daily training sessions. And the information in HIL is of course briefed to students so that they are aware of occasional problems.

Example 4:

An operator is purchasing a new FTD device. During the first year of its use there are multiple new software loads released by the manufacturer. The operator notices that new software loads often re-emerge old faults that were corrected in earlier loads. While individual faults are classified as minor, the SMS determines that overall there is a major problem with the configuration control and that there is a risk of negative training in the future if such problems continue.

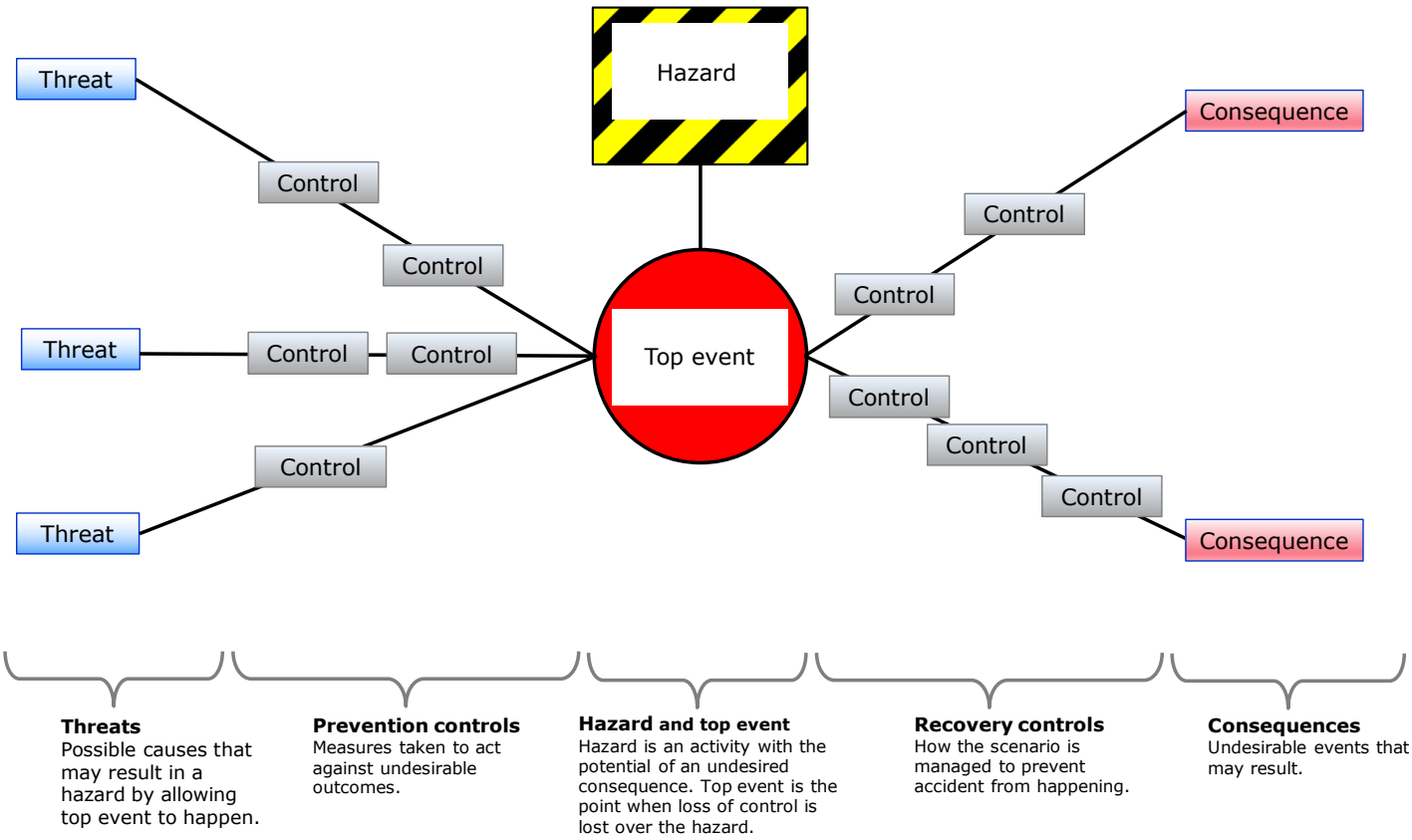
The operator audits the manufacturer's configuration control procedures and requires corrective actions. The operator requires better documentation (e.g. change logs) for each new load. The operator also establishes more effective software update testing procedures for itself to carefully test each software load before they are released to training use.

22 Examples on SMS risk assessment by using bowtie method

Safety management system (SMS) should identify the risks and take actions to mitigate them. While multiple methods for this are available, one popular method is to use a so-called bowtie. It is a graphical method where it is easy to see causal connections, i.e. what may lead to undesired consequences. The bowtie is a group of elements that together slightly resemble a shape of men's bowtie.

Lots of very good and detailed information on bowties can be found at: https://www.caa.co.uk/Safety-Initiatives-and-Resources/Working-with-industry/Bowtie/

Main elements of a bowtie are presented below. The bowtie is prepared by first considering the hazard and top event which means the point when loss of control is lost over the hazard, i.e. the moment when things have failed so that an accident is possible. The hazard and bowtie are drawn into the middle. Then the possible triggering factors (i.e. threats) are considered and drawn on the left. Each threat is mitigated by coming up with certain preventive controls. These can be for example processes, equipment, etc. The possible outcomes (i.e. consequences) are drawn to the right. And again, certain recovery controls are decided. Their purpose is to re-gain control of the system once the control has been lost during the top event. While this certainly sounds abstract, the bowties on the following pages clarify the concept.

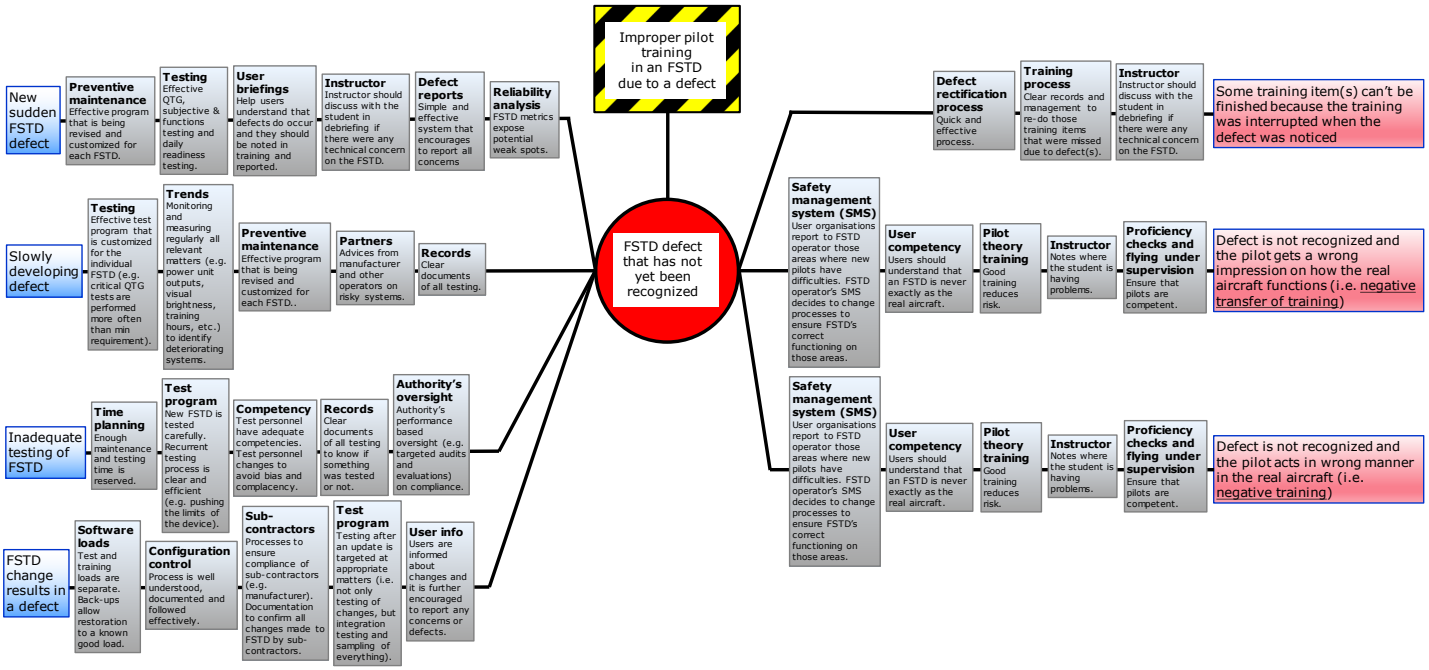


Traficom has prepared bowtie analyses on some of the important FSTD associated risks. Some of these bowties have been reviewed and expanded together with Finnish FSTD operators. Such co-operation between authority and operators is vital to ensure that all associated organizations know how they can and should enhance safety. The bowties below surely are not fully comprehensive, but give some ideas on how the FSTD operator, ATO and authority affect safety and how important all FSTD operator's processes are to maintain safety.
It is important to understand that the regulations present only the minimum requirement. The operators should review their risks and strengthen their processes (i.e. do more than just the minimum requirement) to ensure that risks are mitigated. This could mean, for example, performing certain tests more often than what the requirements state. It is strongly recommended to acquire ARINC Report 434-1 '*Synthetic Training Device (STD) – Life Cycle Support*' which presents valuable information on how to maintain an FSTD operational.
Bowties below have very small font size to accommodate them into this paper. Text can be seen better by zooming in.

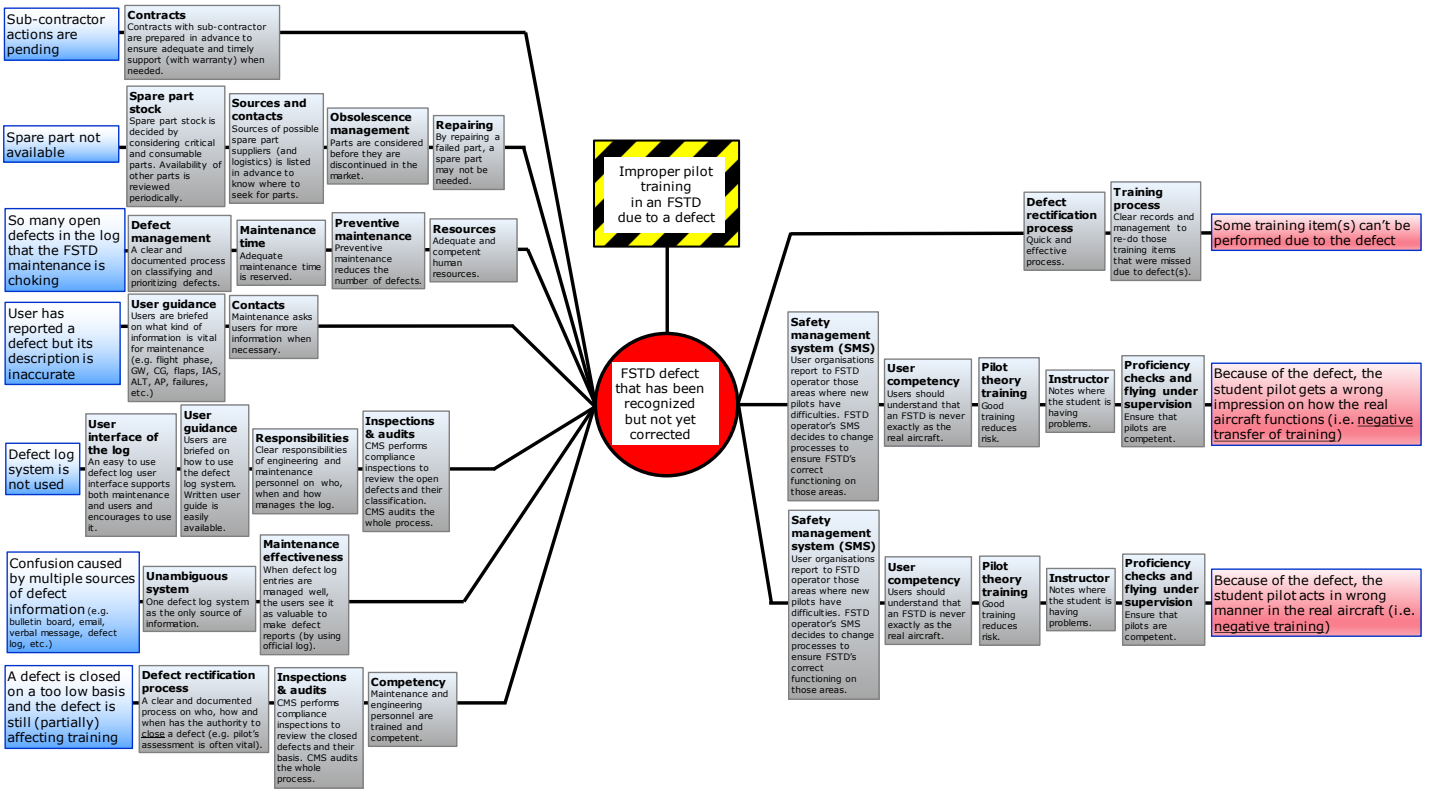
Note that the bowtie examples below show just high-level elements. An FSTD operator should always meet the *minimum requirements.* And the purpose of SMS is to *strengthen* and take *maximum benefit* from all the elements and processes. In other words, an FSTD operator's SMS should find methods of how to modify the controls (i.e. grey boxes) to exceed minimum requirements and mitigate risks. Remember that risks are always different for each FSTD operator, building, device type, etc. Therefore, consider the bowties below only as examples on **high level** elements that should be further considered in **detailed level**. For example, the minimum requirement for a daily readiness check can be easily fulfilled. But to ensure that negative training of an individual FSTD in question is mitigated, it should be considered what exact actions (e.g. daily calibration, monthly lubrication, etc.) should be done and how (e.g. a maintenance tasks and a checklist) and by whom (i.e. trained and competent maintenance representatives). The details and weaknesses of each FSTD and process should be considered and then actions should be taken to strengthen those.

Bowties below show only a few examples. Operators should consider also all other hazards (e.g. in separate bowties) such as the installation of new FSTD, changes in organization and so on.

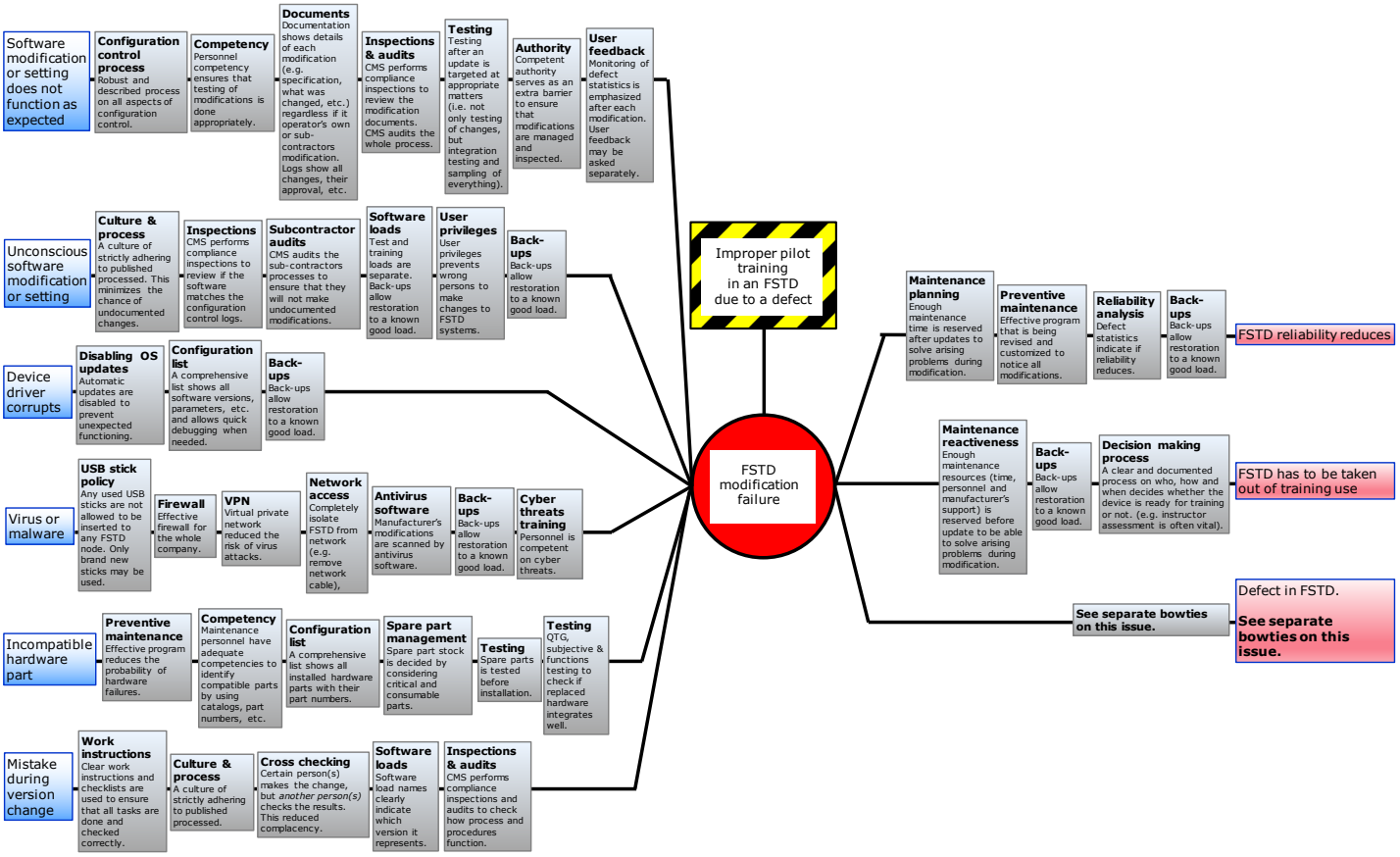
Bowtie on the risk of FSTD defect that has not yet been recognized



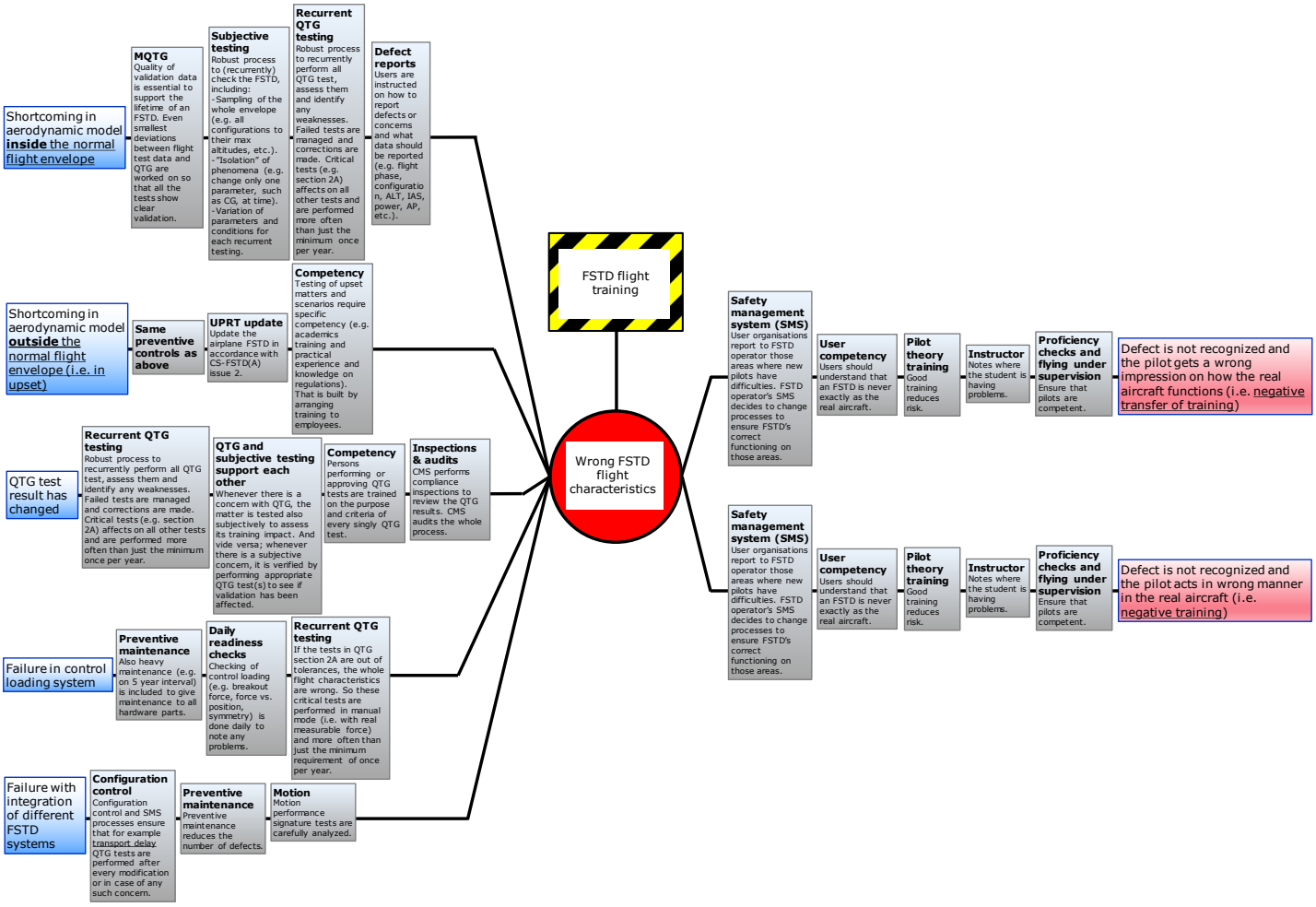
Bowtie on the risk of FSTD defect that has been recognized but not yet corrected



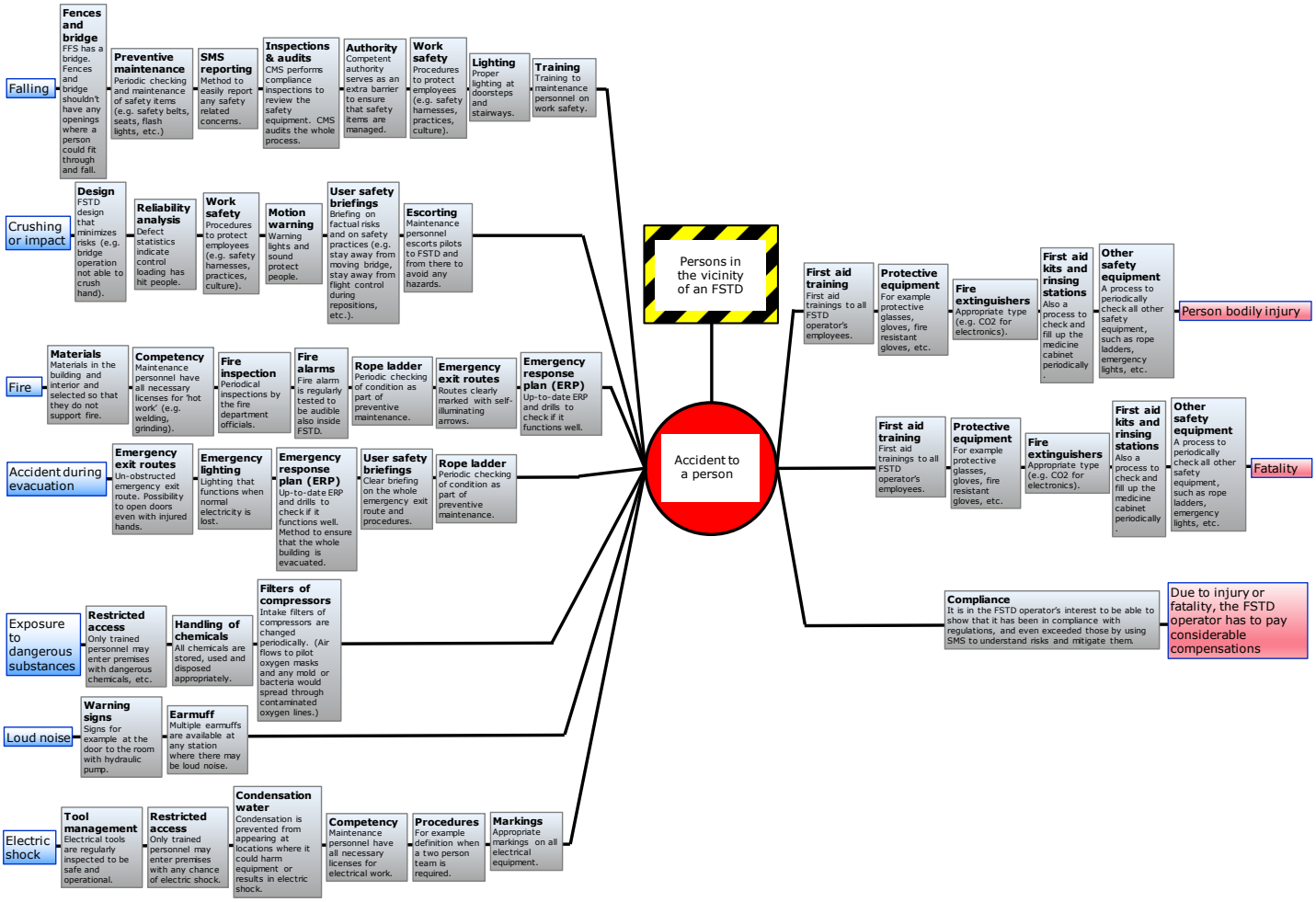
Bowtie on the risk of FSTD modification failure



Bowtie on the risk of wrong FSTD flight characteristics



Bowtie on the risk of accident to a person in the vicinity of FSTD



23 CS-FSTD(A) issue 2 evaluations of FFS levels C and D

A separate checklist can be found by using the link on the bottom of this page.

CS-FSTD(A) issue 2 implements technical requirement that support upset prevention and recovery training (UPRT). An aeroplane upset is an undesired aeroplane state characterized by unintentional deviations from parameters experienced during normal operations. An aeroplane upset may involve pitch and/or bank angle deviations as well as inappropriate airspeeds for the given conditions.

Updating a full flight simulator (FFS) from an older primary reference document (PRD) to CS-FSTD(A) issue 2 requires implementing the following main elements:

- Defining FSTD validation envelope
- Instructor station feedback tools
- Upset scenarios
- Increase fidelity of the approach-to-stall simulation by objective testing (and similarly for full stall which is voluntary but must fulfill the requirements if it is to be qualified)
- Increase the fidelity of the simulation of the engine and airframe icing effects

Note that an update of an FFS to be qualified under CS-FSTD(A) issue 2 is considered as a major update (see ORA.FSTD.110 and its AMC and GM).

It is important to understand that CS-FSTD(A) issue 2 offers the FSTD operator to make a choice whether to apply for option A or B below:

A. Device to be qualified for approach-to-stall only.
   The FSTD qualification certificate would not indicate anything, since this is the required fidelity level.
B. Device to be qualified for full stall.
   The FSTD qualification certificate would indicate full stall as an additional capability.

It is also important to understand that CS-FSTD(A) issue 2 enables to use different kind of validation methods for high angle of attack, approach to stall and stall model. Data sources may be from the aeroplane original equipment manufacturer (OEM), the original FSTD manufacturer/data provider, or other data providers acceptable to the competent authority (see for example AMC10 FSTD(A).300 paragraph (d)). Note that AMC11 FSTD(A).300 gives guidance to proceed if it is not possible to provide the required validation data for the new or revised objective test cases to support FSTD qualification for stall and approach to stall. In such cases, so called footprint method may be used. For the testing of the high-altitude cruise and turning-flight stall conditions, these maneuvers may be subjectively evaluated by a qualified SME pilot (see AMC10 FSTD(A).300 paragraph (e)) and addressed in the required statement of compliance (SoC).

CS-FSTD(A) issue 2 is the most notable technical FSTD requirement in Europe for a long time. Very many (or actually most) full flight simulators will be updated to meet CS-FSTD(A) issue 2 requirements. This is a very heavy burden for the whole FSTD industry. Especially the FSTD operator's often need good guidelines to easily understand the whole big picture. **Because of these reasons, it was justified to prepare a special checklist of the new requirements that CS-FSTD(A) issue 2 implements to FFS level C and D. Traficom has prepared such a checklist. It has been published at:**

https://www.traficom.fi/en/transport/aviation/flight-simulators-and-other-fstds

Note that the checklist in the above url address is published under Creative Commons license. Therefore, anyone can make changes to the document. Traficom is kindly inviting anyone to make enhancements to this checklist so that all the associated parties (e.g. FSTD operators, FSTD manufacturers, data providers and authorities) would benefit from those changes.

24 Guidance on the use of special conditions

The qualification basis for any initial FSTD qualification is CS-FSTD(A) issue 2 for aeroplane FSTDs and CS-FSTD(H) initial issue for helicopter FSTDs (see ORA.FSTD.205). Those certification specifications (CS) contain requirements for 'traditional' aircraft and FSTDs. If the simulated aircraft is not an aeroplane nor a helicopter but something else (e.g. eVTOL, tilt-rotor aircraft, etc.), or the FSTD is using novel technologies (e.g. virtual reality, mixed reality, augmented reality, etc.), the mentioned requirements need to me modified and/or amended by using special conditions. In other words, the qualification basis may also be 'special conditions', as is prescribed in the following requirements:

- ORA.FSTD.210 paragraph (a)(3)
- ARA.FSTD.100 paragraph (c)

The intent is to evaluate the FSTD as objectively as possible. So, the use of special conditions should not substitute objective tests by subjective assessment.

The use of special conditions require that the applicant demonstrates that the use of special conditions ensure an equivalent level of safety to that established in the applicable certification specifications. In practice, it takes a lot of effort and studies to demonstrate that an equivalent level of safety is established. It is expected that the demonstration should show studies and statistics in an academic manner. A study could focus on performing the applicable training tasks in the device for a group of pilots and/or student pilots. The observed behavior and transfer of training of a group of pilots and/or student pilots should be described and compared to a control group of students doing same exercises in a 'traditional' FSTD.

At the time of writing this, Traficom has not yet received any application for the usage of special conditions. If such an application should arrive, Traficom would take benefit and quite far follow the interpretations published by EASA:

- EASA document 'FSTD Special Conditions development and assessment'
  - Direct link to the document: https://www.easa.europa.eu/en/downloads/137722/en
  - More information on the document: https://www.easa.europa.eu/en/newsroom-and-events/news/fstd-special-conditions-development-and-assessment-process-published-easa

- EASA document 'FSTD Special Conditions for the use of Head Mounted Displays (HMD) combined with a motion platform with reduced envelope'
  - Direct link to the document: https://www.easa.europa.eu/en/downloads/137723/en
  - More information on the document: https://www.easa.europa.eu/en/domains/aircrew-and-medical/flight-simulation-training-devices-fstd

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