System Test Description (STD)

Terma case

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2 Stakeholders

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3 Scope

The origin of this section is the section "Scope" in the F-SRS-2014-V1 document.

3.1 Identification

3.2 System-overview

The goal of the system is to protect the aircraft from enemy incoming missiles by deploying flares and chaffs. It also provides threat information to the information computer, which interacts with the pilot. It is possible for a technician to load the system with chaffs and flares. During the preparation phase before the missions, the system informs the technicians about the current amount of chaffs and flares present on the aircraft.

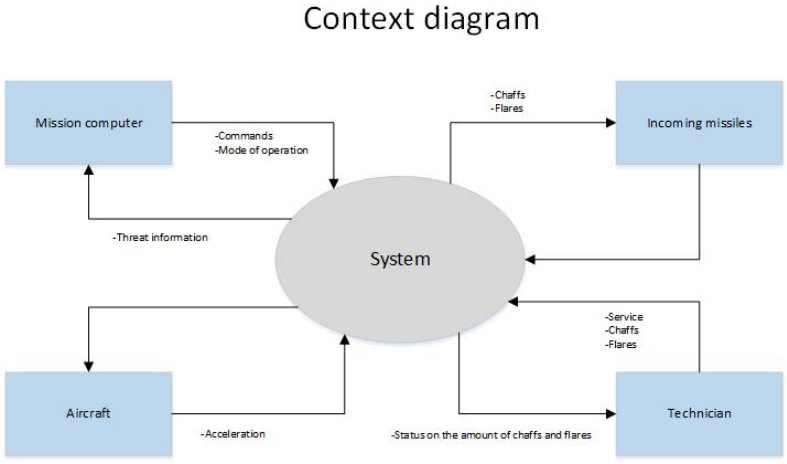

Figure 1: Context diagram

3.3 Document overview

In this document tests are identified as ReqNoXX-T. The XX is a number mapping to the requirement number in the document F-SRS-2014-V1.

4 Referenced documents

5 Test preparations

This section contains the preparations required for all tests.

ReqNo1-T
Requirement: *The system shall comprise at least three modes, manual, semi-automatic and automatic.*
The ability for the pilot to select each mode is tested.

Preparations needed:

- None.

ReqNo2-T
Requirement: *Manual mode shall dispense the program selected by the pilot. The pilot may select payload, and dispense direction as defined by UR-2.*
The operator will dispense the desired payload in the desired direction. All combinations of payload and direction is tested.

Preparations needed:

- Manual mode is selected.

ReqNo3-T

ReqNo4-T
Requirement: *Automatic mode shall initiate an intelligent threat re- sponse without pilot interaction.*
This test verifies that the cockpit unit, in automatic mode, can send a signal to the dispenser.

Preparations needed:

- Automatic mode is selected.

ReqNo5-T
Requirement: *The pod shall include a minimum of eight standard magazines.*
This test verifies that the pod includes a minimum of eight standard magazines.

Preparations needed:

- None.

ReqNo6-T

ReqNo7-T
Requirement: *The cockpit unit shall be able to power ON and OFF the dispensing system and the MWS.*
The MWS and dispenser assembly is turned on and off. In each state the the result is verified.

Preparations needed:

- The system main power source must be turned on.

ReqNo8-T
Requirement: *The system shall be able to dispense a minimum of two payloads within 0.1 sec.*
Using manual mode, the operator tries to dispense two payloads simultaneously. It is measured whether the payloads are dispensed within 0.1 sec.

Preparations needed:

- A stop-watch must be provided.

ReqNo9-T

ReqNo11-T
Requirement: *The System shall be able to erase prior defense patterns and usage statistics upon receiving the string 'zeroize' from the mission computer.*
This test verifies that the system is able to erase prior defence patterns and usage statistics.

Preparations needed:

- None

ReqNo12-T
Requirement: *The cockpit unit shall communicate with the MWS via a MIL-STD-1553-B data bus.*
This test verifies that the cockpit unit and the MWS communicate with the MIL-STD-1553-B data bus.

Preparations needed:

- None.

ReqNo13-T

ReqNo14-T
Requirement: *Threat information will be provided by the Electronics Control Unit (ECU).*
It is tested that threat information is supplied by the ECU when a threat is simulated.

Preparations needed:

- A method for simulating threats must be supplied.
- A method for reading the interface I-IF-MWSCTRL defined in section 6 of F-DDD-2014-V1.

ReqNo15-T
Requirement: *The system shall provide the aircraft mission computer with status information and built-in test results.*
Test-software installed on the mission computer requests status information and built-in test results from the system. The test-software verifies that the received data is correct.

Preparations needed:

- Test-software for the mission computer must be developed.

ReqNo16-T

ReqNo17-T
Requirement: *The system status on individual LRU level shall be provided by cockpit unit.*
This test verifies that the Cockpit Unit can provide status updates from the Pod.

Preparations needed:

- The Pod must be attached to the plane.

ReqNo18-T
Requirement: *The MWS must receive navigation data from the aircraft mission computer with a latency of no more than 10 ms. Navigation data includes aircraft attitude,heading, altitude and GPS data.*

This test verifies that the MWS receives navigation data from the aircraft mission computer within the allowed time range.

Preparations needed:

- Test navigation data including attitude, heading, altitude and GPS data must be loaded on the aircraft mission computer.
- A high precision stop-watch must be provided.

ReqNo20-T

ReqNo21-T
Requirement: *Introduction of the system may not compromise the operation of the current weapon systems.*
Current weapon systems are tested with the self-protection suite installed.

Preparations needed:

- All current weapon systems must be available for testing.

ReqNo22-T
Requirement: *The system shall include a hardware implemented safety interlock to prevent dispensing on ground.*
It is assured that the aircraft is touching the ground. Then it is tried to dispense payloads. It is observed whether the system dispenses the payload or not.

Preparations needed:

- None.

ReqNo23-T

ReqNo24-T
Requirement: *The system shall be able to erase sensitive data upon input from a discrete zeroize signal from aircraft.*

This test verifies that the zeroize signal is received by the cockpit unit.

Preparations needed:

- The cockpit unit main power must be turned on.

ReqNo25-T

ReqNo26-T

ReqNo27-T
Requirement: *The pod structure must be functional when exposed to steady state acceleration levels of 4g forward, 2.5g backward, 22g upward or 10g downward.*
The pod structure is subjected to steady accelerations, and then inspected for damages that may reduce functionality.

Preparations needed:

- A test setup to create the required steady state accelerations must be provided.

ReqNo28-T
Requirement: *The total weight of pod cannot exceed 270 kg.*
The total weight of pod measured is measured using a weighing scale. It is noted whether the weight is above or below 270 kg.

Preparations needed:

- Weighing scale must be provided.

ReqNo29-T

ReqNo41-T
Requirement: *The pod shall be operational at temperatures of maximum 95 degrees Celcius on outer skin and 152 degrees Celcius on leading egde for a maximum of 25 minutes.*
This test verifies that the pod is operational at the given temperatures and places for 25 min.

Preparations needed:

- A thermometer must be provided.

ReqNo30-T
Requirement: *The system shall include a hardware implemented safety interlock to prevent dispensing on ground.*

This test verifies that the hardware implemented safety interlock prevents dispensing on ground.

Preparations needed:

- The aircraft must be grounded.
- The mode must be set to manual mode.

ReqNo31-T

ReqNo35-T
Requirement: *The physical dimensions of the pod cannot exceed 0.5×0.5×5 meter.*
The dimensions of the pod is measured using a measuring tape.

Preparations needed:

- A measuring tape must be provided.

ReqNo36-T
Requirement: *The aircraft has to be loaded with the payloads before take-off.*
The aircraft is loaded with payloads before take-off. In air it is attempted to dispense the payloads. It is checked whether the loaded payloads are dispensed.

Preparations needed:

- None.

ReqNo37-T

ReqNo38-T
Requirement: *Technicians must be educated in maintenance of the system.*
This test verifies that the technicians are licensed in maintaining the system.

Preparations needed:

- None.

ReqNo39-T
Requirement: *The chaffs and flares shall be transported in accordance to Military Standard Transportation and Movement Procedures (MILSTAMP).*

This test verifies that the chaffs and flares are transported in accordance to Military Standard Transportation and Movement Procedures (MILSTAMP).

Preparations needed:

- None.

ReqNo40-T

6 Test descriptions

This section contains descriptions of the tests.

ReqNo1-T
Requirement: *The system shall comprise at least three modes, manual, semi-automatic and automatic.*
The ability for the pilot to select each mode is tested. The operator will select each mode(manual, semi-automatic, automatic), using available inputs to the mission computer to confirm that these modes exist.

Inputs:

1. Manual mode.
2. Semi-automatic mode.
3. Automatic mode.

Outputs:

1. Confirmation of manual mode from the system to the mission computer.
2. Confirmation of semi-automatic mode from the system to the mission computer.
3. Confirmation of automatic mode from the system to the mission computer.

Expected result:

- Entering each mode is confirmed by the mission computer.

ReqNo2-T
The operator will dispense the desired payload in the desired direction. All combinations of payload and direction is tested.

Inputs:

- Desired dispensing combination.

Outputs:

- Chaffs or flares.

Expected result:

- The dispensed payload is either chaff or flare corresponding to the one selected. The payloads are dispensed in every selected direction.

ReqNo3-T

ReqNo4-T
Requirement: *Automatic mode shall initiate an intelligent threat response without pilot interaction.*
A threat is simulated and the cockpit unit sends a signal to the dispenser. The dispenser then dispenses the payload.

Inputs:

- Simulated threat

Outputs:

- Chaffs or flares.

Expected result:

- The cockpit unit sends a signal to the dispenser. The dispenser then dispenses the payload.

ReqNo5-T
Requirement: *The pod shall include a minimum of eight standard magazines.*

The test official verifies that the pod includes a minimum of eight standard magazines.

Expected result:

- The pod includes a minimum of eight standard magazines.

ReqNo6-T

ReqNo7-T
Requirement: *The cockpit unit shall be able to power ON and OFF the dispensing system and the MWS.*
The test official turns on the dispenser assembly and the MWS using the mission computer. It is verified that the dispensing assembly and the MWS is on. Similarly turning off the MWS and dispenser assembly is also verified.

Inputs:

1. Switch on
2. Switch off

Outputs:

1. The MWS and dispenser assembly turns on.
2. The MWS and dispenser assembly turns off.

Expected result:

- The MWS and dispenser assembly can be turned on and off.

ReqNo8-T
Using manual mode, the operator tries to dispense two payloads simultaneously. It is measured whether the payloads are dispensed within 0.1 sec.

Inputs:

- Manual mode
- Dispensing command

Outputs:

- Confirmation of manual mode from the system to the mission computer.
- Two payloads.

Expected result:

- The two payloads are dispensed within 0.1 sec.

ReqNo9-T

ReqNo11-T
Requirement: *The System shall be able to erase prior defense patterns and usage statistics upon receiving the string 'zeroize' from the mission computer.*

Inputs:

- 'zeroize' string

Outputs:

- Confirmation of erasure.

Expected result:

- The system has erased prior defense patterns and usage statistics.

ReqNo12-T
Requirement: *The cockpit unit shall communicate with the MWS via a MIL-STD-1553-B data bus.*
The test official verifies that the communication bus between the cockpit unit and the MWS is a MIL-STD-1553-B data bus.

Expected result:

- The communication bus between the cockpit unit and the MWS is a MIL-STD-1553-B data bus.

ReqNo13-T

ReqNo14-T
Requirement: *Threat information will be provided by the Electronics Control Unit (ECU).*
A threat i simulated. By monitoring the interface I-IF-MWSCTRL(defined in section 6 of F-DDD-2014-V), it is then verified, that threat information is provided.

Inputs:

- A simulated threat.

Outputs:

- Threat information

Expected result:

- The threat information is provided by the ECU.

ReqNo15-T
Test-software installed on the mission computer requests status information and built-in test results from the system. The test-software verifies that the received data is correct.

Inputs:

- Command that requests status information and built-in test results.

Outputs:

- Status information
- Built-in test results

Expected result:

- The status information and built-in test results is provided by the system.

ReqNo16-T

ReqNo17-T
Requirement: *The system status on individual LRU level shall be provided by cockpit unit.*

Inputs:

1. Status request for all Pod components.

Outputs:

1. Status information from all Pod components to the cockpit unit.

Expected result:

- All status information is sent from the cockpit unit.

ReqNo18-T
Requirement: *The MWS must receive navigation data from the aircraft mission computer with a latency of no more than 10 ms. Navigation data includes aircraft attitude,heading, altitude and GPS data.*

Navigation data is sent from the aircraft mission computer to the MWS. The time elapsed from the start of transmission to the end of reception is measured.

Inputs:

1. Navigation data from aircraft mission computer
2. Start transmission time stamp

Outputs:

1. Navigation data in the MWS
2. End reception time stamp

Expected result:

- The navigation data is received by the MWS.
- The time difference between the start and end timestamps is less than 10 ms.

ReqNo20-T

ReqNo21-T
Requirement: *Introduction of the system may not compromise the operation of the current weapon systems.*
Every current weapon system is tested. The test of each weapon system is carried out as described by the test description of that system.

Inputs:

- Appropriate test input for each weapon system.

Outputs:

- Appropriate output of a successful test for each weapon system.

Expected result:

- All weapons systems operate as before the self-protection suite was installed.

ReqNo22-T
It is assured that the aircraft is touching the ground. Then it is tried to dispense payloads. It is observed whether the system dispenses the payload or not.

Inputs:

- Command that makes the system dispense payloads

Outputs:

- A warning signal from the cockpit unit interface.

Expected result:

- The system will not dispense on ground. Instead a warning signal will be provided from the cockpit unit.

ReqNo23-T

ReqNo24-T
Requirement: *The system shall be able to erase sensitive data upon input from a discrete zeroize signal from aircraft.*

Inputs:

- 'zeroize' string

Outputs:

- Confirmation of erasure.

Expected result:

- The cockpit unit recieves 'zeroize' string and initiates the erasing of prior defense patterns and usage statistics.

ReqNo25-T
Requirement: *The zeroize signal shall be received by the cockpit unit.*

The zeroize signal is transmitted to the cockpit unit.

Inputs:

1. Zeorize signal transmission

Outputs:

1. Zeorize signal reception by the cockpit unit

Expected result:

- The cockpit unit receives the zeroize signal

ReqNo26-T

ReqNo27-T
Requirement: *The pod structure must be functional when exposed to steady state acceleration levels of 4g forward, 2.5g backward, 22g upward or 10g downward.*
Each acceleration level and direction specified in requirement no. 27 of F-SRS-2014-V1 is applied the pod structure. The pod structure is then inspected for damages that may reduce functionality.

Inputs:

- Acceleration levels and directions specified in requirement no. 27 of F-SRS-2014-V1.

Outputs:

- None.

Expected result:

- The pod has no damages that may reduce functionality.

ReqNo28-T
The total weight of pod measured is measured using a weighing scale. It is noted whether the weight is above or below 270 kg.

Inputs:

- None.

Outputs:

- Weight.

Expected result:

- The weight of the pod is below 270 kg.

ReqNo29-T

ReqNo41-T
Requirement: *The pod shall be operational at temperatures of maximum 95 degrees Celcius on outer skin and 152 degrees Celcius on leading egde for a maximum of 25 minutes.*

The pod is heated to 95 degrees Celcius on outer skin and 152 degrees Celcius on leading egde for 25 min.

Expected result:

- The pod is still operational.

ReqNo30-T
Requirement: *The system shall include a hardware implemented safety interlock to prevent dispensing on ground.*

The test official verifies that the system includes a hardware implemented safety interlock.
The test official attempts to dispense the payload.

Inputs:

1. Hardware implemented safety interlock
2. Dispense payload signal

Outputs:

1. No outputs

Expected result:

- The system includes a hardware implemented safety interlock.
- When the payload dispensing is attempted, nothing happens since the hardware implemented safety interlock prevents dispensing on ground.

ReqNo31-T

ReqNo35-T
Requirement: *The physical dimensions of the pod cannot exceed 0.5×0.5×5 meter.*
The dimensions of the pod is measured using a measuring tape.

Inputs:

- None.

Outputs:

- Dimensions.

Expected result:

- The dimensions of the pod does not exceed 0.5×0.5×5 meter.

ReqNo36-T
The aircraft is loaded with payloads before take-off. In air it is attempted to dispense the payloads. It is checked whether the loaded payloads are dispensed.

Inputs:

- Payloads

Outputs:

- Payloads

Expected result:

- The aircraft is able to dispense the payloads that are loaded on the aircraft.

ReqNo37-T

ReqNo38-T
Requirement: *Technicians must be educated in maintenance of the system.*

Expected result:

- The technicians have attended and passed the maintenance course provided by Terma A/S.

ReqNo39-T
Requirement: *The chaffs and flares shall be transported in accordance to Military Standard Transportation and Movement Procedures (MILSTAMP).*

The test official verifies that the chaffs and flares are transported in accordance to Military Standard Transportation and Movement Procedures (MILSTAMP).

Expected result:

- The chaffs and flares are transported in accordance to Military Standard Transportation and Movement Procedures (MILSTAMP).

ReqNo40-T

7 Requirements traceability

Every requirement has a test associated to it, e.g. "Req. No 1" is tested in the test "ReqNo1-T".

8 Other