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Test & Evaluation Master Plan

Reference Design — How a programme adopting this UAS architecture could structure its T&E;

STATUS — REFERENCE DESIGN / CONCEPT DOCUMENT. This document is a design contribution, not a programme deliverable. It describes a proposed approach, structure, or analysis that researchers at FOI, FMV, Försvarsmakten, or defence industry partners may adapt when building their own prototypes or running their own programmes. FSG-A does not operate a UAS programme at the scale or maturity this document describes; no organisational roles, test schedules, logistics facilities, or maintenance processes named within are currently active. Any dates, RPN scores, MTBF values, budget figures, or organisational structures are **illustrative examples** intended to show how a real programme might approach the subject — they are not commitments, plans, or claims of current capability.

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Revision History

Version	Date	Author	Description
0.1 DRAFT	2026-04-19	FSG-A	Initial draft reference design. Illustrative TEMP structure showing how a funded programme adopting the FSG-A architecture might organise its test and evaluation activities. All dates, budgets, and organisational roles are example placeholders for a real programme to replace.

1. Executive Summary

This reference-design TEMP sketches how a funded programme adopting the FSG-A UAS architecture might structure its Test and Evaluation activities from analytical baseline through to operational deployment. The plan covers the four conceptual subsystems: Fischer 26 baseline airframe, Fischer 26E tier-2 variant, Lisa 26 command-and-control system, and the MANET communications backbone.

The structure here is phased, with five illustrative go/no-go gates between analytical baseline and operational deployment. Each phase shows the kinds of deliverables, acceptance criteria, and responsible roles a real programme would need to define. FSG-A itself is not running this programme — the document exists so that FOI, FMV, Försvarsmakten, or a defence prime contractor can use it as a starting point when scoping a real T&E; campaign.

What FSG-A has actually completed. The FSG-A reference work has reached Phase 0 only — analytical baseline with 63 mathematical proofs, 47 SDK stress tests, and 33 Fischer 26/26E capability checks passing in software simulation. Everything beyond Phase 0 requires a funded programme with physical hardware, test facility access, and a certification-authority partnership.

2. Technology Readiness Level Reference

The NASA / DoD Technology Readiness Level scale provides a shared vocabulary. Where the FSG-A reference sits on this scale is shown below; everything from TRL 4 onwards would be programme work, not FSG-A work.

TRL	Name	Status in FSG-A Reference	Exit Criteria (illustrative)	Phase
1	Basic principles observed	Concept explored	Literature review, physics proofs	Reference
2	Technology concept formulated	Concept documented in wiki	System architecture documented	Reference
3	Analytical & experimental proof of concept	CURRENT — SITL + SDK only	63 provable claims; SDK stress tests green; SITL validation — this is what FSG-A has done	Reference
4	Component validation in lab environment	Requires funded programme	Physical prototype of critical subsystems; bench test data	Programme Year 1
5	Component validation in relevant environment	Programme work	Flight test of Fischer 26 prototype; Arctic bench tests	Programme Year 2
6	System/subsystem demonstration in relevant environment	Programme work	STANAG 4671 flight-test campaign; Försvarsmakten exercise integration	Programme Year 2-3
7	System prototype demonstration in operational environment	Programme work	Exercise participation; GUTE II live endpoint integration	Programme Year 3
8	System complete and qualified	Programme work	Type certification; production-represent ative hardware validated	Programme Year 4
9	System proven in operational environment	Programme work	Operational deployment with recorded combat effectiveness	Programme Year 5+

3. Illustrative T&E; Phase Structure

A typical programme is organised in phases with explicit deliverables and go/no-go gates. The table below shows one plausible structure; a real programme would adjust based on its funding cadence, facility access, and certification authority requirements.

Phase	Typical Focus	Deliverable	Go/No-Go Gate
Phase 0: Analytical Baseline	Math proofs, SITL validation, design review	Provable claims; FMEA; SBOM	SDK passes, proofs consistent — FSG-A reference reaches this point
Phase 1: Component Bench Test	Individual subsystems tested in lab	Bench test reports per subsystem	All bench tests pass with documented margins
Phase 2: Integration Test	Subsystems integrated, lab-level system test	Integration test report	End-to-end SITL→hardware parity verified
Phase 3: First Flight Campaign	Airframe flight envelope expansion	Flight test reports	Airworthiness envelope cleared per STANAG 4671
Phase 4: Operational Test	Exercise participation, user-in-the-loop evaluation	Operational assessment report	Försvarsmakten acceptance
Phase 5: Certification	Type certification, production audit	Certification package	Full military type approval

4. Subsystem Test Matrix (illustrative)

Each subsystem concept has an illustrative test method, target phase, and pass criterion. 'Current Status' refers to the FSG-A reference — in a real programme, this column would track actual progress.

Subsystem	Test Method	Phase	Pass Criterion	Current Status
Wing structure	Static load test to 3.8g ultimate	1	No permanent deformation; STANAG 4671 §21	Analytical (proof)
Battery pack	Cold-soak at -40°C, discharge to cutoff	1	≥70% capacity retained; no thermal event	Bench pending
Autopilot	SITL Monte Carlo 1000 sorties	0-1	<0.1% catastrophic fault rate	Complete (SITL)
EKF3 + SLAM	GPS-denied flight test [illustrative duration]	3	Position drift bounded [illustrative threshold]	Analytical
CRPA beamformer	Jammer injection bench	1	Null depth adequate on known jammer bearing [illustrative target]	Design review
H.265 + KLV pipeline	MISB ST 0601 parser verification	1	100% KLV tag round-trip	SDK verified
Lisa 26 detection	Benchmark against annotated dataset	1	YOLOv8 mAP target [illustrative] on Nordic dataset	In progress
Dempster-Shafer fusion	Synthetic multi-sensor trials	0	Fused confidence > individual sources	Complete
L3 decision gate	Adversarial test scenarios	2	Zero false L3 triggers against civilian traffic	Test design complete
IFF heartbeat	HMAC tamper injection	1	100% rejection of modified signatures	SDK verified
MANET resilience	Node-removal stress test	2	100% connectivity within 30 s after 30% node loss	SITL pending
GUTE II handoff	End-to-end target handoff SITL	2	JSON payload accepted by FMV test endpoint	Endpoint not yet available

5. Measures of Effectiveness and Performance

MOE (Measures of Effectiveness) evaluate whether the system achieves operational objectives. MOP (Measures of Performance) evaluate technical characteristics. The targets below are design-intent values documented in the FSG-A wiki; a real programme would validate each one through its own testing.

Measure	Type	Target [illustrative]	Test Method	Frequency
Single-pass detection rate	MOE	[illustrative]	YOLOv8 benchmark vs annotated dataset	Per training iteration
Coverage area per sortie	MOP	[illustrative]	Mission planning simulation	Per sortie profile
End-to-end decision latency	MOP	[illustrative]	SDK instrumentation	Per release
Link range in chosen radio band	MOP	[illustrative]	Over-the-air range test	Flight test
L3 gate false-positive rate	MOE	[illustrative — target zero]	Adversarial red-team scenario set	Per model update
Fratricide incidents	MOE	Target zero	IFF heartbeat injection test	Continuous (live)
MTBF airframe	MOP	[illustrative]	Reliability growth testing	[illustrative cadence]
Training-to-competency time	MOE	[illustrative]	Assessment of trainee cohort	Per cohort
Exchange ratio vs comparable adversary munition	MOE	[illustrative]	Wargaming + publicly reported operational data	Annual doctrinal review

6. Test Infrastructure Requirements

The following facilities and instrumentation support a real T&E; programme. FSG-A as an open-design contributor does not own these facilities — this section describes what a funded programme would need to arrange.

6.1 SITL Environment

ArduPilot SITL simulation. Supports Monte Carlo mission execution, synthetic sensor injection, and adversarial scenario testing. This is what FSG-A uses and what is available to any programme adopting this architecture.

6.2 Bench Test Lab (Phase 1 requirement)

Required capabilities: RF anechoic chamber (for antenna and SDR testing), thermal chamber covering the operating envelope, vibration table (MIL-STD-810 profile), structural test rig (for wing static load test), oscilloscope / spectrum analyser with bandwidth adequate for the chosen radio bands [illustrative — programme to finalise based on final radio choice].

A real programme would typically partner with FOI, SP, RISE, Chalmers, or a defence prime contractor for facility access. FSG-A does not own such facilities.

6.3 Flight Test Range (Phase 3 requirement)

Required: segregated airspace with radar surveillance, telemetry ground stations, optical tracking, and recovery capability. In Sweden, the Vidsel test range (Norrbotten) operated by FMV is the primary candidate. Phase 3 requires formal range access agreement.

7. Data Management

A real T&E; programme logs all test data in structured form, version-controlled and archived for the programme lifecycle. Test reports typically follow a standard template: Objectives, Methods, Results with raw data links, Analysis and findings, Recommendations. NATO AQAP 2110 calls for 10-year test-data retention.

The FSG-A reference does not generate test data beyond SITL logs; all operational-test data belongs to the programme running the physical test campaign.

8. Risk Management Hooks

Typical T&E; risks for a programme adopting this architecture include: (a) physical prototype funding gap, (b) test facility access, (c) component supply chain (particularly Silvus ITAR), and (d) certification authority engagement cadence. Each maps to an entry in the reference Risk Register (FSG-A-RISK-001).

9. Roles (examples — to be filled by real programme)

In a real programme, roles are filled by named personnel with documented qualifications. The following are illustrative role types a programme would typically instantiate:

• Technical Office: overall T&E; strategy, data management, reporting.

• Engineering: test execution, bench test development, flight test support.

• Safety Officer: oversight of hazardous tests; FMEA updates after each major test event.

• Försvarsmakten / FMV partner: operational test participation; certification sponsorship.

• FOI partner: independent analysis, facility access, scenario validation.

FSG-A does not currently staff these roles.

10. References

DoD 5000.02 — Operation of the Defense Acquisition System (US Department of Defense).

NATO AEP-02 — NATO Test and Evaluation Procedures.

NASA TRL Handbook (NASA/SP-20205003605).

STANAG 4671 Ed. 1 — UAV Systems Airworthiness Requirements.

FSG-A-FMEA-001 — Reference Design Failure Mode Analysis.

FSG-A-RISK-001 — Reference Design Risk Register.

FSG-A wiki https://fsg-a.com/ — technical baseline.