BLACK WIDOW · Research Program · RESEARCH SUMMARY

Completed milestones · platform state · seven Phase I technologies

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1.1 1. Program in one paragraph

The program validates **seven Phase I research technologies** on the modular flight carrier **BW-C45**: **Mission OS**, **FlyScout**, **EPM**, **OWL**, **ALBATROSS**, **GNSS-denied navigation**, and **Digital Twin** — plus shared laboratory infrastructure.

Positioning: research · modelling · field verification — not a serial product.

1.2 2. Current stage

Parameter	Status
Program stage	Print scope complete → dry structural assembly in progress · Phase I funding requested
BW-C45 platform	85 components printed (79 canonical STL) · dry structural assembly in progress
Program TRL (overall)	2–3 → Phase I exit target: 4–5
External Phase I funding	Requested
Flight / bench measurements	Not yet conducted

1.3 3. Completed work (summary)

The team in-kind milestone includes:

- **CAD** — full BW-C45 digital assembly; parts tree (79 canonical STL positions → 85 physical pieces)
- **Manufacturing** — 100% canonical print scope complete (Creality K1 Max ×2; PETG / PETG-CF / LW-PLA)
- **Dry Assembly** — dry structural assembly of plastic airframe in progress (no avionics yet)
- **PDR** — preliminary design review: geometry, mass budget, aerodynamic assumptions, risk register
- **Engineering package** — print specifications, calculations, Master Book / manufacturing baseline

Detailed physical evidence is listed in the **Completed Work Summary** (Evidence section on the website).

1.4 4. Technology portfolio status (high level)

Thread	Current state	Phase I
BW-C45 (carrier)	PDR · dry assembly	Integrated flight demonstrator
EPM	Lab prototype / concept	n≥50 bench tests
FlyScout	Concept	Prototype + bay integration
OWL	Modelling / CAD inserts	Ground + flyover measurements
ALBATROSS	Modelling	SITL + paired flights
Mission OS	TRL 2–3	TRL 4 (module), campaign logs
Digital Twin	Chain planned	M1 GO/NO-GO report
GNSS/VIO (flight without GPS)	VIO/SLAM modelling	Protocols and architecture (Phase I) · hardware bench and supervised flight (Phase II)

Full technology overview — internal repository document, not published on the website.

1.5 5. Seven Phase I research technologies

1. **Mission OS** — web platform TRL 2–3 → TRL 4; campaign logs and telemetry
2. **FlyScout** — compact inspection platform; bay integration after separation
3. **EPM** — module separation ≥98% at n≥50 bench cycles
4. **OWL** — aerodynamic inserts produce a measurable effect (ground + flyover measurements)
5. **ALBATROSS** — algorithm reduces energy use vs baseline (SITL + paired flights)
6. **GNSS-denied navigation** — VIO/SLAM: protocols and architecture (Phase I); hardware bench and supervised flight (Phase II)
7. **Digital Twin** — XFOIL / JSBSim / SITL chain; M1 GO/NO-GO report before flight tests

*The **BW-C45** carrier is the shared flight platform for all seven technologies; it is not counted as a separate technology.*

1.6 6. Next step

Phase I funds the transition from dry assembly to a **flight-ready platform**:

- avionics and propulsion integration
- ground protocols and controlled flight tests
- validation reports for **each of the seven technologies**
- measured datasets for grant reporting

Phase I budget (standard): $84,000 · 24 months.
Turnkey package: $96,667 · ~30 months (see Turnkey Budget RC3 · 45 UAH/USD).

1.7 7. Scope limits of this public document

This summary does not include: CAD/BOM, suppliers, locations, personnel data, detailed calculations, or internal PDR protocols.