# Outstanding Recovery Team Tasks and IREC Compliance Checklist

June 2025

## Introduction

This document outlines remaining technical tasks for the Recovery Team as per the *Recovery Team Orientation Guide – June 2025*. These tasks are essential to achieving full subsystem readiness, safety, and flight qualification under IREC standards. The tasks are grouped by category, and an appendix provides a summary of IREC rules for reference.

# 1 Outstanding Tasks from Recovery Guide

## 1.1 1. FSM Transition Validation

- Simulate and verify Finite State Machine (FSM) transitions: `PRE_FLIGHT_GROUND` to `POST_FLIGHT_GROUND`.

- Log each transition and verify correct logic for Drogue/Main deployment.

- **Reference:** Section 1.1, Figure 21 – Recovery Orientation Guide.

## 1.2 2. SPI Flash & SD Logging Verification

- Test telemetry data logging to SPI Flash and SD Card during simulated flights.

- Validate post-landing data integrity.

- **Reference:** Section 2.2.1 – Onboard Logging.

## 1.3 3. Base Station Telemetry Display

- Confirm the base station interface displays telemetry (FSM state, battery, GPS, altitude).

- Simulate full MQTT stream and verify dashboard rendering.

- **Reference:** Section 2.3.1 – N4-Basestation.

## 1.4   4. Alarm System Module Testing

- Verify alarm module activation (buzzer/lights) before ignition.

- Ensure hardware connections follow safety schematic.

- **Reference:** Section 2.2.2 – Alarm System Module.

## 1.5   5. Key-Switch Failsafe Testing

- Confirm both igniter and trigger modules reject commands unless key is turned ON.

- Perform safe ignition simulation to verify.

- **Reference:** Section 2.2.2 – Failsafe Mechanism.

## 1.6   6. Shear Pin Validation

- Test that ejection charge exceeds minimum shear pin loads:
  - Drogue = 380 N
  - Main = 285 N

- Adjust pin or charge mass as needed.

- **Reference:** Section 2.4 – Pyrotechnic Deployment.

## 1.7   7. Full Recovery System Simulation

- Conduct dry-run recovery test via drone drop or tethered test.

- Track deployment stages, telemetry logs, and beacon feedback.

- **Reference:** Sections 1.3, 2.4 – Full System Integration.

## 1.8   8. Pi Camera Streaming and SD Logging

- Test live video stream to base station and simultaneous SD card recording.

- Validate hardware/software reliability over test duration.

- **Reference:** Section 2.3.2 – Video Recording Subsystem.

# 2 Categorized Task Breakdown

## 2.1 1. Hardware Diagnostics & Fixes

- Check which flight computer boards have working flash memory and fix the ones that don't.

- Check the Cansat and design dummy payloads for mass balancing.

- Inspect and revise bulkhead and coupler designs.

- Redesign parachute cords using available nylon for better strength.

- Fix the beacon code initialization bug (improper use of `#define`).

## 2.2 2. Mechanical Design & Simulation

- Design a protective casing for the Pi video streamer.

- Redesign the camera casing with clear shield and reduced turbulence (simulate CFD).

- Design 3-piece recovery system (split rocket into stringed segments).

- Simulate and account for vibration, range, interference, and power supply effects.

## 2.3 3. Parachute System

- Procure new parachutes (ask for exact number needed).

- Work with a tailor to fabricate parachutes.

- Conduct deceleration tests (e.g., using car towing).

- Test parachute deployment using pyrotechnics or static launches.

- Research parachute folding and packing.

- Design parachute enclosures.

- Test crimson vs black powder for deployment.

- Fix or implement ejection code in flight computer firmware.

- Design safe connection for 3-piece recovery with strings.

## 2.4   4. Electronics & Software Integration

- Assemble avionics bays and validate prints.

- Add port holes for Pi camera ribbon.

- Validate parachute ejection logic in firmware.

- Implement communication switching (WiFi <->beacon).

- Improve filtering of barometer and IMU data using a Kalman filter.

- Study FreeRTOS configuration for improved task scheduling.

- Explore use of ESP32 promiscuous mode for extended range.

## 2.5   5. Video Telemetry & Storage

- Validate camera dimensions and fit into CFD-optimized housing.

- Integrate video stream into N4-Basestation.

- Ensure robust onboard data logging (SPI Flash, SD, etc.).

- Improve resilience to vibration and power loss.

## 2.6   6. Documentation & Research

- Review IREC and Spaceport guidelines thoroughly.

- Study:

  - N3.5 Recovery Report
  - N4-FC Pi Stream Report
  - N4-Basestation code

- Research modern parachute folding strategies.

- Deepen knowledge of FreeRTOS and embedded communication.

# 3   Task Distribution by Team

## Avionics Team

- Assemble avionics bays and validate against current design prints.

- Implement and simulate FSM transition logic (`PRE_FLIGHT_GROUND` to `POST_FLIGHT_GROUND`).

- Develop and test parachute ejection logic within the flight computer firmware.

- Fix beacon initialization logic and communication bugs.

- Program communication switching between WiFi and beacon protocols.

- Integrate Kalman filtering for barometer and IMU sensor data.

- Validate SPI Flash and SD Card logging of telemetry packets.

- Study and apply FreeRTOS configuration for task scheduling.

- Explore ESP32 promiscuous mode for extended telemetry range.

- Verify alarm system module functionality (buzzer, lights).

- Validate key-switch failsafe logic on igniter and trigger modules.

## Telemetry Team

- Stream and log video data from Raspberry Pi to base station.

- Validate live video streaming and simultaneous SD card recording.

- Integrate video telemetry with the N4-Basestation dashboard.

- Test MQTT-based telemetry communication end-to-end.

- Display FSM state, battery level, GPS, and altitude on the dashboard.

- Confirm accurate logging of telemetry data during simulation flights.

- Monitor and assess system performance under signal interference and power variability.

- Simulate MQTT stream using mock data for visualization verification.

- Ensure backup of all telemetry and video feeds for recovery.

## Parachute Team

- Procure new parachutes and confirm required dimensions and strength.

- Coordinate with tailor to fabricate parachutes to specification.

- Design and fabricate parachute enclosures for mechanical restraint.

- Design and validate shear pin setups (Drogue: 380 N, Main: 285 N).

- Test parachute deployment using pyrotechnic ejection tests.

- Conduct deceleration testing using car tow method.

- Test and compare crimson vs black powder for ejection performance.

- Research and implement proper parachute folding and packing methods.

- Design and assemble string-based 3-piece recovery layout.

- Validate system for preventing collision and maintaining CG during recovery.

- Support drone-based full recovery system simulations and log data.

# Appendix A: IREC Key Technical Requirements (Summary)

*Note: Refer to the IREC 2025 Rulebook for complete definitions and procedures.*