Brushless Motor Tester - Release Plan

System Overview

The brushless motor tester is a modular system for testing and characterizing brushless motors in the 1,000-28,000 Kv range, powered by an external bench supply (0-18V, 0-40A) with integrated measurement, control, and data logging capabilities.

Minimum Viable Product (MVP)

Goal: Prove core functionality with minimal feature set for basic motor characterization.

Included Components:

1. **Hardware:**
    - Power Management Module (basic - no braking)
    - Motor Controller Interface (Remora only)
    - Measurement Module (voltage, current, eRPM only)
    - Main Control Unit (Pi Pico)
    - Basic 3D printed fixture
    - Simple connector panel
2. **Features:**

    - Manual voltage control (via slot car controller or potentiometer)
    - Real-time display of: input voltage, input current, motor current, eRPM
    - Basic Kv estimation (from eRPM and voltage)
    - Single test capture with timestamp
    - CSV export via USB to PC
3. **Display:**
    - 128x64 OLED showing live metrics only
4. **Safety:**
    - Hardware voltage/current limits (fixed, not programmable)
    - Basic protective enclosure

MVP Exclusions:

- Automated test profiles
- Persistent storage of multiple tests
- Resistance/inductance measurement
- Braking current measurement
- Thermal monitoring
- Comparisons and advanced analytics
- Alternative eCom support

MVP Success Criteria:

- Successfully measure and display motor parameters in real-time
- Generate one exportable CSV file per test session
- Safe operation with protective limits

- Estimated Kv within 5% of known good motors

Release 1 Product

Goal: Full-featured product meeting all high-priority requirements with selected medium-priority features.

Additional Components vs MVP:

1. **Hardware Additions:**
    - Regenerative braking circuit
    - Phase resistance/inductance measurement circuit
    - Programmable voltage/current limiters
    - Color TFT display (320x240 or larger)
    - Rotary encoder interface
    - SD card for local storage
    - Improved fixture with adjustable mounts
    - Optional thermal sensor interface
2. **Software Additions:**
    - Test profile engine (create, save, execute sequences)
    - Persistent storage of test results (100+ tests on SD card)
    - Test labeling and organization
    - Multiple test comparison view
    - Calculation of derived parameters (efficiency, torque estimate, etc.)
    - Profile editor (on-device)
    - USB data export with bulk transfer

    - WiFi monitoring (optional via Remora)

3. **Features:**
    - Multi-step automated test profiles
    - Adjustable motor pole configuration
    - Support for 6, 8, 12 pole motors
    - Load testing capability (with external load)
    - Test result browser with filtering
    - Comparison mode (overlay 2-3 tests)
    - Resistance and inductance measurement
    - Braking performance measurement
4. **Display Enhancements:**
    - Multi-screen UI with navigation
    - Graphical plots of test data
    - Profile configuration interface
    - Results library browser

Release 1 Exclusions (Future/Low Priority):

- Motor weight/balance/shaft accuracy measurement (external tools)
- Remora tuning capabilities
- Gearing recommendations
- Alternative eCom support
- Advanced thermal mapping
- Network connectivity beyond WiFi monitoring

Release 1 Success Criteria:

- Execute 5-step automated test profile without intervention
- Store and retrieve 100+ test results
- Accurately measure resistance/inductance
- Generate comparison charts on-device
- Export professional-quality test reports
- Meet all high-priority requirements from specification

Component Development Independence

Parallel Development Tracks:

Track 1 - Power & Motor Control:

- PMM hardware design
- MCI adapter board
- Remora integration testing

Track 2 - Measurement Systems:

- MSM circuit design
- Sensor selection and testing
- ADC calibration procedures

Track 3 - Control & Software:

- MCU firmware architecture
- Profile execution engine
- Data acquisition loops

Track 4 - User Interface:

- Display selection and driver development
- UI/UX design
- Menu system implementation

Track 5 - Mechanical:

- Fixture CAD design
- Motor mount system
- Enclosure prototyping

Track 6 - Desktop Software:

- CSV analysis tools
- Report generation
- Configuration utilities

Integration Points:

- **Hardware Integration Test:** Week 8-10 (connect all modules)
- **Software Integration Test:** Week 10-12 (end-to-end firmware)
- **System Integration Test:** Week 12-14 (complete MVP)
- **Release 1 Integration:** Week 20-24 (full feature set)

Development Timeline Estimate

MVP (3-4 months):

- Weeks 1-4: Component design and procurement
- Weeks 5-8: Individual module development
- Weeks 9-12: Integration and testing

- Weeks 13-16: Refinement and documentation

Release 1 (6-8 months total):

- Weeks 17-20: Advanced feature development
- Weeks 21-24: Integration and testing
- Weeks 25-28: Beta testing and refinement
- Weeks 29-32: Documentation and release preparation

Open Source Considerations

Repository Structure:

```
 /hardware
   /power-management
   /measurement
   /enclosure-cad
/firmware
   /core
   /drivers
   /profiles
/software
   /analysis-tools
   /configuration-tool
/documentation
   /assembly-guide
   /user-manual
   /api-reference
```

License Recommendations:

- Hardware: CERN Open Hardware License or TAPR OHL

- Software: MIT or Apache 2.0
- Documentation: Creative Commons BY-SA

Commercial Model Options:

- Assembled kit sales
- Premium support subscriptions
- Custom profile development services
- Training and consulting
- Branded accessories and test fixtures