AIRMAN XB-70 Development Roadmap Summary

The AIRMAN XB-70 & XB-70 Pro handheld flight computers aim to significantly boost pilot situational awareness, precision navigation, and safety standards. The product development is strategically divided into four core domains:

- Embedded Systems: Initial sensor integration, advanced AHRS, GPS, and avionics functionalities (EFIS, HSI), finalised with rigorous testing and certification readiness.
- Software (GUI/Application): User-centric GUI design, comprehensive flight calculations, advanced visual guidance, 3D post-flight analytics, live weather/ traffic integration, secure cloud compatibility.
- Hardware: PCB prototyping and refinement, sensor and RF module integration, optimized enclosure design for sensor accuracy, keypad interface, and regulatory compliance preparation.
- Linux BSP (Yocto): Base BSP setup, advanced kernel customization, real-time avionics performance, secure encrypted firmware and cloud integrations, extensive validation testing.

Embedded Systems Development

🔷 Phase 1: Setup & Initial Integration

- Establish embedded development environment.
- Configure and test basic functionality of NXP i.MX 8M Nano EVK.
- Initial integration and basic data acquisition from:
  - IMU (Bosch BMI088)
  - Magnetometer (Bosch BMM350)
  - Barometric Pressure sensor (Bosch BMP390)
  - Temperature & Humidity sensor (Sensirion SHT45-AD1F)
- Setup initial communication protocols (SPI, I²C).

🔷 Phase 2: Advanced Sensor Integration

- Implement sensor fusion algorithms for accurate Attitude and Heading Reference System (AHRS).
- Integrate additional sensors specific to XB-70 Pro:
  - Ambient Light Sensor (TI OPT4041)
  - Carbon Monoxide (CO) Sensor (Figaro TGS5042)
  - Ublox NEO-F9P GPS (High-precision WAAS capability)
- Radio navigation integration (ADS-B IN/OUT, VOR/DME, ILS).

🔷 Phase 3: Real-time Data & EFIS Integration

- Implement real-time sensor data handling and interrupt-based processing.
- Integration of Electronic Flight Instrumentation System (EFIS) including:
    - AHRS, G-Force, Barometric Altitude, Vertical Speed, OAT, CO Monitoring, Slip/Skid indicators.
- Integration of Horizontal Situation Indicator (HSI) for GPS-denied scenarios.
- Optimize performance for avionics-grade responsiveness and reliability.

🔷 Phase 4: Testing, Optimization & Certification Prep

- Conduct rigorous embedded systems testing (accuracy, latency, robustness).
- Field testing and simulated flight scenarios validation.
- Prepare embedded systems for avionics regulatory certification (DO-178C alignment).

Software Development (GUI & Application Software)

🔷 Phase 1: GUI & Software Architecture

- Define software architecture and detailed GUI wireframes (Qt-based).
- Minimalistic UI/UX design emphasizing readability and intuitive navigation.
- Initial implementation of keypad and touchscreen interaction (Pro model).

🔷 Phase 2: Core Calculation & Navigation Functionalities

- Develop primary algorithms for:
  - Pre-flight Calculations (Great Circle, Rhumb Line, Wind corrections, MTOW, PET, PSR, Fuel Planning, V-Speeds, CG).
  - Radio Navigation (Holding patterns, Frequency/Wavelength, VOR/DME, ILS, ADF/NDB calculations).

🔷 Phase 3: Advanced Visualizations & Integrations

- Integration of advanced GPS visual guidance (waypoints, distance/time visualization).
- Implementation of comprehensive live Weather & Traffic visualization (ADS-B, FLARM, TIS-B, FIS-B).

- Develop detailed Post-flight 3D flight path analysis (360° viewing, geospatial data integration, Jeppesen chart integration).
- Implement Secure cloud integration with AES-level encryption and multi-platform (Android, Windows, iOS) compatibility.

🔷 Phase 4: Software Optimization & Final Deployment

- Comprehensive system testing and GUI responsiveness improvements.
- Performance optimization, handling real-world edge cases.
- Prepare detailed software documentation and final software package for deployment.

Hardware Development

🔷 Phase 1: Prototyping & Basic PCB Development

- Initial PCB schematic design based on i.MX 8M Nano EVK, sensor array, and battery management.
- Prototype preliminary hardware setup (basic EVK-based design validation).

🔷 Phase 2: Advanced Hardware Integration & PCB Revision

- Advanced PCB revision integrating:
  - Additional sensors (CO, Ambient Light, GPS).
  - RF modules (ADS-B IN/OUT, VOR/DME, ILS radio modules).
- Optimize PCB design for sensor sensitivity, noise management, and RF shielding.

🔷 Phase 3: Enclosure Design & EFIS Optimization

- Detailed mechanical enclosure CAD modeling (similar dimensions to Anbernic R36S).
- Optimize enclosure perforations to ensure accurate sensor readings (pressure, temperature, humidity, CO).
- Finalize keypad layout and optional backlight integration (XB-70 Pro).

🔷 Phase 4: Manufacturing Readiness & Certification

- Refine design-for-manufacturability (DFM) and prepare hardware for mass production.
- Conduct environmental and functional compliance testing (CE, FCC, EMI/EMC standards).
- Finalize hardware documentation for certification.

Linux BSP Development (Yocto Project)

🔷 Phase 1: Linux BSP Initialization

- Base BSP setup using Yocto Project for i.MX 8M Nano EVK.
- Initial Linux kernel customization for minimum boot time and basic device driver support (MIPI Display, USB-C).

🔷 Phase 2: Advanced Kernel & Driver Development

- Complete Linux device driver integration for all sensors, GPS module, and RF modules.
- Implement custom kernel modules for AHRS, HSI, EFIS data processing.
- Kernel tuning for avionics-grade real-time performance and stability.

🔷 Phase 3: Real-time Performance & Security Enhancements

- Optimize kernel for real-time embedded avionics operations.
- Implement AES encryption mechanisms for secure firmware updates and cloud communications.
- Secure boot configuration and data handling protocols.

🔷 Phase 4: Comprehensive BSP Testing & Release

- Conduct extensive BSP performance testing under simulated real-world scenarios.
- Final validation and stability testing.
- Prepare and deliver detailed BSP documentation, final Linux build, and source code repository.

🚩 Overall Recommended Project Timeline:

- Phase 1 (Setup & Initial Designs): 3–4 Weeks
- Phase 2 (Advanced Integration & Development): 6–8 Weeks
- Phase 3 (Performance Optimization & Feature Completion): 6–8 Weeks
- Phase 4 (Testing, Validation & Finalization): 6–8 Weeks

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