

*Avior offers unprecedented autopilot performance, accuracy, and capabilities in a small package.*



# ATI AVIOR 100 AUTOPILOT

The **ATI Avior 100** autopilot is an advanced design built around high performance, high quality, state of the art components and sensors. The CPU is a 600 Mhz OMAP 3503, offering 256 Mb of Flash and 256Mb of RAM. The core sensors include a VectorNav VN100T IMU and the Ublox Neo 6 GPS. The firmware is built around an advanced 15-state Kalman filter that blends the inertial and GPS sensor data to accurately estimate roll, pitch, and true yaw angles. The ATI Avior offers unprecedented performance, accuracy, and capabilities in a small package — at a competitive price.

**Available Summer 2011**

## Specifications

- Dimensions: 103mm x 82mm x 13mm
- Weight: 68grams
- Texas Instruments OMAP 3503 CPU (600 Mhz ARM Cortex-A8, up to 1200 Dhrystone MIPS)
- 256Mb RAM, 256Mb Flash, MicroSD slot
- I2C, SPI, 1-wire UART, High Speed USB Host and USB OTG, Ethernet
- 8 PWM in, 8 PWM out, 6 Analog in
- Professional double-sided SMT (Surface-Mount Technology) Mil-Spec available
- 5 - 44.4V input voltage range
- 0C < T < 85C rated
- VectorNav VN100/VN100T IMU
  - Accelerometer range: +/- 2g / 6g
  - Gyro range: 500 deg/sec
  - Magnetometer range: 6 gauss
  - Shock limit: 1000g (unpowered), 500g (powered)
- Advanced 15-state Kalman filter with true-heading estimation (INS/GNS)
- 100hz filter update rate
- Ublox Neo 6 GPS
  - 5 Hz navigation rate
  - Anti-jamming technology
  - Cold starts: 26 s, Hot starts: 1s
- Radio modem: direct plug-in support for Digi 900 Mz XTend modem — serial or IP connection provided for external modemand hardware.



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## Firmware Specifications

- IMU based stabilization and flight control — 15-state Kalman filter provides accurate roll, pitch, and “true” yaw angle estimates
- WGS-84 (great-circle) route navigation
- Unlimited waypoints (limited only by hardware RAM.)
- Supports fixed waypoint routes and “pattern based” routes that can be repositioned at startup or during flight
- Accurate onboard wind vector estimation
- Stable heading control (even in high wind operations)
- Autonomous flight mode; Command Augmentation flight mode; Manual flight mode.
- Circle holds (wind compensated)
- Altitude hold (pitch-based or throttle based)
- Speed hold (pitch-based or throttle based)
- Lost link return home safety feature
- Includes drivers for additional sensors and hardware
- Extensive on board data logging
- Real-time air-to-ground communication via an open, well documented API
- Able to directly control servo based pan/tilt camera mechanism with support for WGS-84 point holds and NED vector holds
  - Firmware uses a robust quaternion based formulation in combination with the Kalman filter based attitude estimate to compute the correct pan/tilt angle offsets for pointing the camera at the intended target independent of aircraft motion
  - Potential to leverage this internal math to drive more sophisticated stepper motor based pan/tilt mechanisms.
- Auto launch, auto land (under development)

## Base Station

- Base station hardware
  - Advanced IMU controlled pan & tilt antenna tracker (options for mounting on a moving platform)
  - Rugged laptop computer
  - Packaged in portable, rugged and waterproof cases
  - Self-contained power supply
- Base station software:
  - Real-time moving map
  - Interactive route creation
  - Supports pre-programmed routes and “pattern routes” that can be relocated (in flight) relative to a reference point
  - Glass cockpit-style instrumentation

- Live 3d flight visualization
- Extensive logging options available (both onboard and on-ground)
- Sophisticated data replay and visualization system

## Payload

- Autopilot computes a number of internal parameters that can be sent to a payload package: accurate location, and true attitude estimate — including yaw (critical for camera pointing applications), accurate local wind vector estimate, accurate true airspeed estimate
- Variety of communication interfaces available: UART, Ethernet, and USB

## Research & Engineering

- Significant portions of the firmware code base are licensed under the LGPL (open-source compatible)
  - Firmware is compiled with the GCC toolchain
  - Hooks can be provided for extending the firmware to support custom modules or to interface with custom payload packages
- Open APIs, open & documented logging file formats, open & documented telemetry protocol
- Hooks and interfaces to Avior FG which can be used to model and simulate the airframe, prototype flight control systems and higher level mission programming
- The autopilot firmware can be compiled as a standalone application that can run on a PC and interface to Avior FG for software in-the-loop testing
- The autopilot firmware running on the Avior hardware can be configured to talk to Avior FG via a network connection for hardware in the loop testing

## Training

- The extensive flexibility and connectivity of the Avior autopilot along with the open-source Avior FG flight simulator can be leveraged for pilot training, demos, and mission planning
- The built in scripting system offered by Avior FG offers the ability to script training scenarios from basic to advance

