

Virtual Cockpit v2.6 & Commbox v1.1

New:

- Map Maker Utility
- Mission Simulator
- Laser Range Finder support
- Improved Deep Stall Landing
- Freewave modem support
- 12 PWM servo channel support
- SRTM and DTED Terrain data support

FEATURES

- User Optimized interfaces – single click access.
- Video and Telemetry Synch - to within a few milliseconds
- Geo-referenced maps (large map area).
- Terrain Elevation Data.
- Camera View “flashlight” overlaid on map display.
- Easy to use Mode support – readily accessible buttons.
- Intuitive Flight Planning - easy waypoint placement, management, & editing (click and drag).
- In-flight mission reprogramming and waypoint uploading.
- Dynamic re-tasking & adjustment.
- Flight plan save / retrieve.
- Fully configurable integrated precision data logging.
- User configurable Failsafes. (loss of comm., GPS, etc.)
- Telemetry data playback from within Virtual Cockpit.
- Integrated video (video & still shots, text / data overlays).
- Multi-agent – easy to fly multiple UAVs (autonomously or with pilot-in-the-loop) while receiving and monitoring real time status on all UAVs (battery voltage, telemetry, etc).
- Hardware-In-the-Loop simulation.
- Integration; Configuration, Warning, Sensor, and Servo configuration screens.
- Payload adjustable outputs and configuration screens.
- Real time graphing of PID loop performance.
- In-flight PID gain tuning - graphical PID loop selection.
- Priority messaging window - audible warning sounds.
- Remote TCP/IP connection – allowing 3rd party add-ons.
- Flight timer.
- Auto-trim; trims aircraft automatically & saves settings.
- 2-axis Gimbal camera and game pad controller support.
- Sensor calibrations; magnetometer, airspeed, alt above MSL.
- Convoy following support.
- Loiter Now mode supports user adjustments with a gamepad allowing for optimal orbits maximizing camera time on target.
- Easily editable XML settings files allow user customization of the Virtual Cockpit.



DESCRIPTION

The new Virtual Cockpit™ v2.6 ground control software for the Kestrel Autopilot System makes “click N’ fly” operation easy while providing powerful mission planning, monitoring, and in-flight adjustment tools. From multiple UAVs and easy to use “Mode” support to geo-referenced maps, the Virtual Cockpit provides elegant ground control for autonomous as well as pilot-in-the-loop operation. Now with new video and telemetry synch’ing, advanced convoy and extensive gimbal support. Controlling and managing multiple vehicles in the air (also convoy following support with movable home position) is made easier with new intuitive interfaces and real-time, always present, UAV status information for each UAV. The small, compact, Commbox v1.1 provides the wireless communications link.

Time to Flight – Systems Integrators

Our “Time to Flight” initiative focuses on the needs of Systems Integrators by reducing the complexities of integration, tuning, and configuration.

Keys to Success: 1) Mature Guidance & Control. 2) Intuitive and Successful Integration. 3) Repeatability.

TCP/IP Development Interface

An integrated TCP/IP server allows 3rd party plug-in applications to connect directly to the Kestrel Autopilot and access many of the advanced features of the autopilot. Developers can obtain this kit free of charge which includes an open source sample applet to get started.

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Ground Control Station

Virtual Cockpit Main Window – version 2.6

UAV Modes

Agent List (multi-UAV)

Heads Up Display (HUD)

Gimbal Position

Camera Flashlight view

Message Window (text and voice)

Pre-Flight Tools and Timers

Map and Layer Settings

Altitude and Speed Overrides

Multiple Geo-referenced Maps supported

Open / Close window pop outs as needed.

Flight Plan Controls

Waypoints

Takeoff & Landing Settings

#	Type	Spd (m/s)	Alt (m)	North (m)	East (m)	Latitude	Longitude	Time/Index	Radius (m)
1	Waypoint	14	100	654	-379	40.00320	-112.02361		
2	Waypoint	14	100	284	-412	39.99986	-112.02399		
3	Loiter	14	100	284	581	39.99986	-112.01231		50
4	Waypoint	14	100	702	745	40.00362	-112.01038		

Virtual Cockpit main screen – two UAVs in operation.

EASE OF USE

The Virtual Cockpit provides an easy-to-use interface to the Kestrel Autopilot System. Our focus has been to provide a clean, uncluttered main screen that provides easy access to all the flight and navigation capabilities of the autopilot. The Virtual Cockpit has been enhanced to make normal flight operation easier and more intuitive while providing different levels of autonomy. This includes the capability to place the autopilot into a number of pre-configured modes, for example: Go home, Loiter at current location, Take off, and Land. With just a click of the button the autopilot executes the desired action, leaving the ground operator to be able to observe other important tasks such as video monitoring. Multi-agent operation is easy and intuitive.



Ground Control Station

New features in the Kestrel Autopilot System:

Kestrel™ Autopilot: firmware version 8.3 (released November 1, 2008)

- **TASE Gimbal Support** - Ability to use the TASE gimbal with the same functionality provided by other supported gimbals including manual drive, gyro-stabilized mode, and GPS pointing modes.
- **Aerius Laser Range Finder Support** - Support added for the small, lightweight Aerius Photonics laser. Used as a ground sensor, the laser range finder adds terrain following capability as well as improved landing accuracy.
- **Improved Landing Accuracy** - Improved landing accuracy through vector path following and pitch feedforward capability.
- **Flaps / Flaperons** - User configurable for flaps and flaperons
- **Landing Gear Support** - Landing gear retracts and nose wheel control
- **Greater MSL Support** - Improved ability to incorporate and use MSL altitude or Height Above Launch.
- **Freewave Modem Support** - Freewave modems added to list of radios supported
- **Deep Stall Capability** - Support for deep stall landings and user-triggered deep stall with fixed pitch capability.
- **More Servo Channels** - Support for up to 12 PWM channels using the Servo Expansion Board.
- **Waypoint Servo Capability** - Automatically trigger a servo when the aircraft reaches a specified waypoint.
- **More Auxiliary Servo Functionality** - payload dropping, parachute deployment, gimbal bay doors.
- **Catapult Launch Capability** - Aircraft can now be configured to turn on throttle automatically during takeoff when an acceleration threshold is reached. This allows for safe, autonomous catapult launches.
- **Safe UAV Mode** - throttle is guaranteed to be off and servos undergo less stress in this mode intended for use on the ground or in transport.

Virtual Cockpit™: version 2.5 (released November 1, 2008)

- **Mission Simulator** - Embedded in the Virtual Cockpit is a powerful simulation and mission control tool called the Mission Simulator (MIS). This tool allows Virtual Cockpit operators to be trained without putting expensive hardware at risk. It also allows for multi-agent and single agent mission scenarios to be tested in the safety of a simulation environment built into the Virtual Cockpit.
- **Added Waypoint Functionality** - Routes can be constructed more easily with GoTo waypoints; Search areas can be automatically covered with waypoint paths with the simple drag of the mouse; Waypoints added more easily by Ctrl-left-clicking, greatly speeding up path planning.
- **Map Maker Utility** - New visual application for making maps for Virtual Cockpit. Interfaces with Google Earth and automatically generates map file. Launchable from Virtual Cockpit.
- **Terrain Data Support** - Support for SRTM and DTED Terrain Data built in to Virtual Cockpit. VC notifies aircraft of its local height above ground and reports this to user. Minimum HAG failsafe provided for aircraft.
- **Flight Summary Recording** - Virtual Cockpit now stores a flight log for each flight automatically for data retrieval and troubleshooting.
- **New Virtual Cockpit HTML Help** - HTML Help is now available in addition to all of Procerus' documentation manuals. Hitting F1 from any VC screen pulls up applicable help for that window.
- **Enhanced Coordinate System Support** - UTM, MGRS, and Lat/Lon fully supported. Improvements made to units display - Metric, English, and Nautical units now fully supported.
- **Camera Controls** - Change zoom, iris, gain, and shutter settings on the Sony Zoom Cameras.
- **New Payload Control Screen** - Control payloads such as the Aerius Laser Range Finder through the payload control window.
- **Flaps Scrollbar** - Adjust flaps in the right pull-out menu of Virtual Cockpit.
- **Improved MSL Support** - Switching between Height-Above-Launch and MSL Altitude better supported with waypoint checks implemented to prevent dangerous altitude settings.
- **Video Channel Selection** - Video channels can be tied to specific agents and automatically switched when a new agent is selected if a video switch is installed in the Commbx.



Ground Control Station

Virtual Cockpit Features:

- Support for RPM sensors and RPM monitoring
- Deep Stall Mode and Deep Stall Landing
- Parachute landing/configuration and control options
- User configurable payload and advanced mode buttons
- Video saved to shared memory for external access
- Gimbal support
 - Retractable gimbal support
 - Gimbal max/min angle limits
 - Zoom camera support
 - 2 axis stabilized gimbal support with manual control through joy stick.
 - TCP/IP access to gimbal position
 - Click-n-drag crosshair – gimbal follows and locks on target.
 - Standard Telemetry gimbal position information
 - Gimbal Mode status display in Artificial Horizon
 - Waypoint upload/download/editing abilities
 - Autopilot optimized gimbal loiters.
(point / click - Kestrel computes radius)
 - Terrain Elevation Data is used for gimbal pointing accuracy.
 - Gimbal position indicators on-screen.
 - “Flashlight” view on map to aid user.
 - Gimbal multi-point setup and configuration screen.
 - Smooth panning with hand controller.
 - Change gimbal mode with gamepad.
 - Debug File
- OnPoint Targeting support (see new Targeting Mode above)
- Video and Telemetry Synchronization to within a few milliseconds
- Advanced convoy following (easily position multiple UAVs relative to convoy)
- Advanced UAV modes: Targeting, Convoy
- Display Commbox GPS position on the map
- Choose between inductive current shunt
- Commbox video overlay enable / disable
- Audible joystick speed increase sounds
- GPS sync between Virtual Cockpit and Commbox
- Multiple Geo-referenced maps - includes world file generation and loading.
- Terrain Elevation Data and display – with user configurable Failsafe to keep UAV at specified height relative to the ground.
- Autopilot optimized gimbal loiters. (point / click - Kestrel computes radius)
- Take off timer for single user operation
- Password protection to disallow access to settings and configuration screens.
- Units of measure – user selectable: Metric, English, Nautical (miles per hour, knots, feet, meters, meters per sec)
- Flight plan list improvements makes changing and adding waypoints easier.
- Quick and easy waypoint upload using pop up box
- Ability to support an 8th servo channel through the Virtual Cockpit
- All settings are now stored in XML to facilitate different Virtual Cockpit setups
- Manual control now allows support for almost all direct input compatible joysticks. Users can remap buttons as desired.
- New Received Signal Strength Indication (RSSI) when using Maxstream modems.
- Registry settings moved to XML file making it easier to have different configurations for more than one VC installation.



BTC-40 gimbal: (360 degree, 76 grams)
2.75" high (including ball) x 1.5" Wide x 3.5" Long

Call for Pricing. A retractable version of the above gimbal is available as well an 88mm unit with a Sony zoom camera installed. (an IR option also available)



BTC-88R gimbal: (360 degree, 220 grams)
4.5" x 3.5" x 3.5"
10x optical zoom, 4x digital zoom
Retractable
Diameter: 3.5"



Ground Control Station

ROBUST FEATURE SET

The capability to harness the power of the autopilot through the Virtual Cockpit becomes evident when users are able to quickly re-task and reconfigure the autopilot while it's flying safely. A unique ability in the Kestrel Autopilot system is the onboard precision data logger. This feature allows the ground operator to data log variables and information directly onboard the autopilot at a high rate (up to 100 Hz). Using the simple interface of the Virtual Cockpit, operators can select from a large list the values that are required to be stored, the recording rate, and the recording time. When the autopilot has finished data logging, the Virtual Cockpit downloads the information and saves to either Microsoft Excel file format or Mathworks Matlab format.

Multiple UAVs Even Easier

The Kestrel Autopilot System is capable of flying and managing multiple aircraft at the same time (we've flown 4 and 5 at a time) from one Virtual Cockpit / Commbot ground control station. The UAVs all follow the ground station as it moves in a vehicle. If the "convoy" slows or stops, the UAVs enter a holding pattern at their designated locations, poised and ready to continue the convoy following route. All of this is autonomous.

Monitoring multiple UAVs can be a challenge. There are a number of status values to monitor, from autopilot battery voltage to loss of Comm and GPS lock failure. The Virtual Cockpit minimizes user load through text and audible warning sounds that are user configurable. An additional simplification is a message window that prioritizes warning messages as they need to be addressed.

We've added the ability for multiple aircraft to be positioned in relation to a moving convoy and to maintain their desired position regardless of whether the convoy stops, slows, or then begins to move in a completely different direction.

Leveraging this underlying foundational capability, new features have been added that allow the operator to set desired behaviors of each UAV with respect to distance from, and relative position and heading of, the convoy. Once a convoy begins to move again, the UAVs remember their position and maintain it accordingly. Convoy heading and speed are known due to the GPS on the ground station.

Features:

Mode Support - single click autopilot configurations

- RC mode - rates only, activated by switch on RC transmitter
- Manual mode - aircraft holds airspeed using pitch, (roll, airspeed, and throttle commands on ground station)
- Altitude mode - aircraft holds altitude (roll, airspeed, and altitude commands from on ground station)
- Nav mode - aircraft navigates to standard and loiter waypoints
- Home mode - aircraft flies home and loiters
- Take off mode
 - Take off Spiral - aircraft flies level to commanded altitude and spirals to desired altitude – automatically transitioning to Navigation mode at pre-set altitude
 - Take off Waypoint – aircraft flies to desired waypoint location and spirals to desired altitude – stays in spiral indefinitely until commanded otherwise
 - Take off Joystick – aircraft flies level until commanded differently by joystick – useful for clearing obstacles in takeoff path – transitions to Altitude mode at pre-set altitude
- Loiter now mode - aircraft loiters at current position
- Land mode - aircraft flies to landing point on map and lands
- Rally mode - aircraft flies to Rally point (landing Approach point)



Ability to manipulate UAV in a natural way without RC experience or RC controller.



Ground Control Station

Precision Data Logger and Telemetry Support

- Fully configurable including: 1) Sample rate (up to 100 Hz) 2) Log duration 3) Sample count
- Choose sensors and variables to log:
 - All sensors, control inputs, control outputs - PID data for gain tuning and analysis - Internal system variables
- When logging is complete, Virtual Cockpit downloads and saves to Microsoft Excel or Mathworks Matlab file format
- Telemetry Replay Window for replaying and analyzing flight

Integrated Video Support

- Play live video from airplane using a PCMCIA real time capture card
- Overlay state information as text onto video
- Snap single images from video with and without text overlay and save as a windows bitmap
- Record compressed video
- Select video size from 320x240 to 640x480

Integration and Configuration Screens

- PID Tuning screen for in-flight gain tuning along with real-time performance graph.
- Autopilot sensors screen for monitoring and calibrating autopilot sensors
- Servo adjustment screen for integrating control servos and payload servos
- General autopilot configuration for easy adjustments for different airplane setups

Hardware-in-the-Loop Simulation Environment – 6 DOF simulator for development purposes and gain tuning

- Simulation environment can be customized: Wind, Sensor and Actuator dynamics, Stability Derivatives.
- Video can be exported for target tracking or computer vision algorithm development

Customizable Payload Support

- 6 user configurable bi-direction I/O pins
- 2 analog inputs allows users to stream voltage readings to ground station at selectable rates
- Gimbal and Camera support
- Modem port mirroring allows users to have second processor onboard aircraft controlling autopilot
- Serial data pass-through port allows bi-directional communication with optional integrated sensors

