Horizon 3.4 New Features

Video Related Features

- **Annotation** It is now possible to draw, add text and user defined icons to the incoming video stream. The annotations are saved in the video file.
- **Video image rotation** It is possible to rotate the video image ninety degrees at a time by pressing a button on the video window. This feature is useful in camera systems that display the image sideways or upside down in some camera orientations.
- **Toggle video overlay** The video overlay can be turned on and off.
- **fly-by-camera and orbit-by-camera** When in fly-by-camera mode, the autopilot flies towards the location on the ground where the camera is pointing. When in orbit-by-camera mode the autopilot will orbit the location on the ground where the camera is pointing.
- **Faster MPEG 4 video compression** The processing power required to perform MPEG-4 compression of the video stream has been reduced.
- **Supports MPEG-2 encoding video adapters** The Horizon video system works with video adapters that perform hardware MPEG-2 encoding. Note that these video adapters introduce a delay into Horizon. Note that MPEG-2 video compressors introduce several seconds delay in the video stream. This is a result of the compression process and cannot be avoided.
- **Supports multiple PTZ camera gimbal arrangements** Different pan/tilt camera mechanisms have different gimbal arrangements. Horizon now has options to support three different arrangements.
- **Video History** The Horizon map tracks which areas have been covered by the video and will highlight areas that have and have not been viewed.
- **Video Footprint** The Horizon map draws the camera footprint on the map.
- **Video Location** The Video window will display the location on the ground of the cursor in the window as well as the location on the ground of the center of the video window.
- **Crosshair** The video window will overlay a crosshair on the video signal
- **Controp Payload** The autopilot supports the Controp D-Stamp 3G payload

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Advanced joystick control

- **Programmable update rates from 5 to 50hz** The Horizon joystick plug-in has options to support servo updates as fast as 50hz.
- **Exponential and Dual rates** Each joystick axis can be designated as having linear, exponential or dual rate response similar to RC joysticks.
- **Trim supports** Each joystick channel can be trimmed.
- **Servo presets** Servos can be moved to a specific orientation at the push of a button on the joystick.
- **user defined buttons** Each joystick can have up to sixteen buttons and each button can be programmed with one of over forty definable functions. The possible functions include engaging patterns, initiating threads, moving servos to their preset values, change autopilot mode (RPV, UAV, GPIC, Arcade), select UAV and more.
- **Absolute or percentage display** Servo positions can be displayed as absolute or percentage values.
- **Multiple joystick support** Running two Horizon joystick plug-ins allows two joysticks to operate simultaneously.
- **Mouse Control** Allows the joystick to take control of the mouse.

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Map Related Features

- **Improved map rendering** Older versions of Horizon did not support as many map formats nor did they render high resolution maps well.
- **Map rotates** Using an external compass to determine the laptop's orientation, Horizon can rotate the map so that it is in the same orientation as the ground. To accommodate moving vehicles, this feature can also use heading information from a GPS receiver.
- **UAV symbol definable** The symbol that Horizon uses to display the UAV's position can be configured.
- **UAV Information** Airspeed, target airspeed, altitude and target altitude information are displayed simultaneously at the UAV's location.
- **Location of interest markers** The operator can place markers on the map that are locations of special interest.
- **Radio range indicator** During flight a polygon that shows the maximum line of sight radio range can be plotted on the map.
- **Safe terrain indicator** During flight a polygon that shows regions where no terrain conflicts exist can be plotted on the map.
- **Terrain look ahead** Horizon will display a warning if a terrain conflict is imminent.
- **Radio range look ahead** Horizon will display a warning if the UAV is about to fly out of line of sight radio range.
- **No Fly Zone look ahead** Horizon will display a warning if the UAV is about to fly into a no-fly zone as marked on the map.
- **Look here** Horizon will point the camera at a location selected on the ground.
- **Search Pattern** Horizon will take a set of vertices and generate a search pattern to cover the area enclosed by the vertices.
- **Go here** Horizon allows the user to right click on a location on the map and will fly to that location. The operator can also specify a location in lat/lon, UTM or MGRS format.
- **Payload Footprint** Displays the outline of the area that the camera can view on the map.
- **Payload History** Allows the Horizon Operator to highlight all of the points on the map where the camera has visited.
- **More Sensors** Horizon now supports up to 24 sensors in three tabs.
- **More User Definable Buttons** Horizon now supports up to 24 user definable buttons in three tabs.
- **More Sliders** Horizon now supports up to 12 sliders and the range of each slider is programmable.
- **Rulers** Horizon now supports multiple user defined rulers on the map

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Other New Features

- **Fly by radiomodem** – With a joystick connected to your PC it is possible to manually pilot a UAV over the datalink. This feature is also available using a joystick plugged into a dedicated microcontroller connected between the laptop running horizon and the radio modem used to communicate with the autopilot. A redundant datalink version is available with the LRC.
- **Anyspeed follow me** Horizon will update the current position of the GCS on the map and will move the origin of a pattern based on the GCS's position. This feature can be used to implement any speed follow me. A training mode is also incorporated into the follow me plug-in to allow the user to simulate a moving ground station.
- **Antennae pointing** Horizon will calculate the heading to a UAV and point an antenna at the UAV. Currently antenna pointing is implemented using a servo and compass. Multiple antennas are supported for multiple UAVs.
- **Lat/Lon goto** The autopilot can fly to an arbitrary location. The location can be entered manually via Lat/Lon, UTM and MGRS. The location can also be specified by clicking on the horizon map.
- **Retrieve a fly file** The operator can download the current set of commands in the autopilot and save them in a fly file for future use.
- **Improved communications diagnostics** New fields have been added to the autopilot to assist in diagnosing communications problems.
- **GPS SNR** New fields have been added to the autopilot to provide GPS SNR information.
- **Waypoint import** (comma separated files, ESRI shape files) Horizon has the ability to import waypoints from comma separated files or ESRI shape files.
- **Checklist** Multiple user definable checklists are now supported by Horizon.
- **GUI ADC calibration** The calibration of external sensors has been simplified with a gui based calibration application. Both the ADC calibration tool and the autopilot support temperature calibration
- **Button plug-in** The button plug-in horizon plug-in extends the number of buttons that Horizon can support.
- **Error monitor** The error monitor is a background task that provides error history for multiple UAVs and can provide user defined auditory warnings based on error code. The error monitor program can be configured to pop up a checklist upon detecting an error condition. Separate checklists can be configured for different errors.
- **Log viewer** The datalog viewer can now read telemetry, user defined telemetry and simulator output files. The log viewer also records vrs data as well as fly file data from the flight. The log viewer can also perform user defined calculations on fields in the log file and can smooth data. The log viewer can also perform a Fourier transform on, and statistical analysis of, selected data. The log viewer can also smooth data.

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- **Sensor plug-in** Horizon includes a plug-in that can be configured to display up to eight user selectable sensor values in a manor similar to sensors displayed on Horizon. Time graphs of sensor data can also be displayed. Sensor values outside of predefined limits can generate an error. Multiple sensor sets can be configured with this plug-in depending upon the end users requirements. Horizon supports up to four user defined sensor sets that can be launched directly from the view menu. Currently these are configured to display GPS signal strength, communications error rates within the autopilot, servo outputs and servo inputs. These four menu items can be renamed and the plug-in reconfigured to display other data.
- **Circuit monitor plug-in** Horizon includes a plug-in specifically designed to monitor the launch and recovery process of a small UAV. The circuit monitor allows the operator to view the progress of the UAV as it proceeds through the circuit. The circuit monitor provides bump and abort features and allows the operator to change parameters of the circuit. The circuit monitor will track the progress of multiple UAVs and provide an audible warning when a UAV enters a circuit. The circuit monitor also provides an abort feature on UAV launch.
- **Waypoint editor command options** The Horizon waypoint editor now has options to associate up to eight arbitrary autopilot commands with each waypoint. These commands can be used to move servos as well as set fields and other more advanced features.
- **UAV Ownership** The operator can now acquire and release ownership of a particular UAV. So long as the operator has ownership, only the operator may make changes to the UAV's operating parameters and upload fly files.
- **Balloon Launch** Horizon can simulate a balloon launch.
- **Multiple Autopilot Support** The simulator can be configured to simulate an MP2028^{g}, an MP2128^{g} or an MP2128^{heli}. Previous versions would only simulate an MP2028^{g}.
- **User defined fatal error messages** The system integrator can define fatal error message strings. These fatal errors can be initiated within the autopilot and the system integrator can set an appropriate error message to display.
- **Custom splash screen** Horizon can display a custom splash screen upon startup. Contact MicroPilot support for further information.
- **Blimp simulator** Horizon includes a 6 degree of freedom simulator for a blimp/airship. This simulator is automatically engaged if the autopilot is programmed for blimp operation.

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New Features of the MP2128^{g} and MP2128^{heli}

- **Faster inner feedback loops** The inner loops that control the UAV's control surfaces can be run at variable rates between 30Hz to 120Hz
- **Faster servo updates** PWM servo pulses can be generated at rates selectable between 50Hz and 120Hz
- **Datalog Error logging** Error conditions such as divide by zero are captured in the datalog along with the instruction address where the error occurred.
- **Vibration Data Capture** High speed rate gyro and accelerometer data can be captured and downloaded from the autopilot. A Fourier transform can then be performed on the data in order to determine the frequency range of any vibrations.
- **5 Hz or 30 Hz datalog** The datalog will record at either 5 Hz or 30 Hz.
- **5 Hz or 30 Hz user telemetry** User telemetry can be transmitted at either 5 Hz or 30 Hz.

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New features of the MP2028^{g}, MP2128^{g} and MP2128^{heli}

- **Calculated waypoints** waypoints can be built from separate fields within the autopilot.
- **True circle** the autopilot will hold a radius rather than using waypoints to build a holding pattern
- **New commands** The autopilot now supports the commands: waitInRange, waitOutOfRange, skipInRange, skipOutOfRange, waitHdgInRange, waitHdgOutOfRange, skipHdgInRange, skipHdgOutOfRange commands.
- **DGPS support** The autopilot will support DGPS data over the same datalink as the ground station.
- **Novatel GPS** The autopilot supports high precision, carrier phase, ultra high rate Novatel GPS receivers. This support includes support for Novatel format corrections over the datalink.
- **Smooth feedback loop transition** The autopilot will smooth transitions from one feedback loop to another in the pitch axis.
- **Camera pointing** The autopilot will maintain a camera pointed at a predefined location. The autopilot will also translate autopilot rate gyro information into the camera axis. Multiple gimbal arrangements are supported.
- **User defined datalog fields** The autopilot supports up to twenty four user defined fields in the datalog.
- **Divide by zero checking** In the event that the autopilot performs a divide by zero a fatal error is set. Previously divide by zeros were trapped but no error was set.
- **Faster user telemetry** The autopilot will transmit user telemetry at 30hz or 5hz
- **Dial up datalink** (i.e. Satellite phone) The autopilot supports Iridium sat phones.
- **Code improvements** A number of changes were made to the efficiency of the autopilot code.
- **RC Arcade mode** The autopilot supports a variety of arcade modes where the pilot controls the target pitch and roll. These arcade modes are available either using a joystick over the datalink or an RC transmitter
- **Improved compass operation** Additional calibration fields improve compass performance.
- **Operating limits** It is possible to program maximum and minimum target speeds and altitudes into the autopilot.
- **Improved communications error reporting** The autopilot now includes fields that report error rates and types within the MP2028/2128 as well as the size of the communications buffers.
- **Improved processor utilization reporting** The autopilot now includes fields that report the amount of processing time consumed by the inner and outer loop as well as the processor time remaining.
- **True HWIL** MicroPilot has a true hardware in the loop simulator that uses a sensor-less autopilot connected to PWM and ADC boards and allows the autopilot to be flown with a matlab based simulator.

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- **Minimum thread rate** The autopilot now has an option to ensure that all threads execute at a minimum of one command every 200 milliseconds.
- **VRS file CRC check** The autopilot validates the VRS settings with a crc check at initialization time and during operation.
- **New heading fields** The autopilot now has two fields that hold the heading from the heading from the GCS to the UAV and the heading from the UAV to the GCS.
- **Feature Lockout** The autopilot incorporates two fields (disableMpMode and disableGcsCmds) that allow the system integrator to disable various autopilot features. The field disableMpMode disables RPV mode, fly by camera mode, orbit by camera mode etc. The field disableGcsCmds disables the setting of the desired speed, altitude and heading from Horizon as well as waypoint goto, and initiating patterns and threads from Horizon. Together these fields can be used to prevent inappropriate modes during critical flight phases (i.e. you can disable rpv mode until after takeoff and initial climbout).
- **Scratch fields for customer data** The autopilot now incorporates fifty scratch fields for customer data.

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New Features of the MP2128^{heli}

- **Roll and Pitch trim** The autopilot supports fields to add a trim to the desired roll and desired pitch. This is useful in some helicopter applications.
- **Velocity control feedback loop structure** The autopilot feedback loops have been reconfigured to provide a velocity hold feature.
- **Arcade Modes** Helicopter applications have access to three different arcade modes: attitude (where the RC transmitter controls attitude); velocity (where the RC transmitter controls the X and Y body velocity of the helicopter); and position (where the RC transmitter controls position). Options exist to allow the operator to switch between these modes in flight. In addition an altitude hold arcade mode can be configured separately from these arcade modes.
- **On/Off ground detection** an on/off ground detection method has been provided in order to allow the autopilot to determine when it is in flight. This detection method operates both with and without an AGL and provides for heuristics to prevent false transitions.
- **Auto Takeoff and Landing** the autopilot provides an autonomous takeoff and landing feature.
- **Heli specific datalog** The datalog auto-detects heli versus fixed wing modes and automatically adjusts the fields to suite the appropriate mode. The data log viewer also automatically adjusts itself based on the mode.
- **Helicopter simulator** Horizon includes a helicopter simulator. The autopilot simulator will automatically choose the helicopter simulator if the autopilot is set in helicopter mode.
- **Helicopter and Fixed wing Support** The autopilot will fly both helicopters and fixed wing aircraft.
- **Faster Attitude Update** The attitude update filter executes at 200 hz.

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