

**Needed - LOW ALTITUDE DJI Pilot app software enhancements - REVISION 3a:  
Prevent 90-95% of Low-Altitude-Related Crashes of the Inspire 1 (and Phantom 3)**

*Thanks to the multitude of contributors to this collation of low-altitude-related DJI Pilot crash-prevention topics, whether by email, telephone calls, or FAXs: Inspire and other UAV/quad pilots, MAV pilots (private/commercial/military, Coast Guard helicopter), systems engineers (IT/software, aeronautic, NASA, drone), photographers/videographers, etc., search and rescue folks, etc., personnel/staff with various DJI vendors around the US (who receive calls from their customers who have crashed their Inspires), DJI Technical Support (Online Technical Support staff, and LA Office telephone support staff), and from Forum.DJI.com and InspirePilots.com (where various crashes and near-misses are reported and discussed) - To all, we appreciate your many thoughts, recommendations, and critique, and have tried to include these now in the third revision of this document. To be fair to all who have submitted suggestions, and to promote discussion, imaginative thought, and innovation, we have included essentially all items submitted, and not tried to edit out those that are less practical or feasible, or if even possible. We are now requesting additional ideas, feedback and critique. Send this by email or FAX, or call me (contact info at end of this document)*

**These are the goals and the limitations of the enhancements to be discussed hereafter:** These proposals are **for the standard production model DJI Inspire 1, with NO added hardware/sensors or modifications to the existing sensors and other hardware.** Therefore, **any enhancements being considered must be ONLY software improvements to the DJI Pilot app** (and with the associated firmware modifications as well). Any enhancements **must be "cost-effective"**! After all, the Inspire 1 is only a \$3000 drone and not a 3 million dollar drone. It makes more sense to **look at data already being streamed out from the existing unmodified Inspire, and then to analyze how best the DJI Pilot app software (and firmware in some cases) might be modified/augmented to trigger screen-view or audio/voice altitude-related warnings -and- to set a very basic rough minimum (relative to "Home") altitude limitation** (allowing a bypass of minimum (relative) altitude restraint under very explicit circumstances) ... with **options toggles so as to best suit the specific needs of the particular pilot and the particular flight mission and conditions.** Some more limited DJI Pilot app software enhancements may be possible involving the low-altitude ultrasonic transducer system, and these will also be considered.

**Would hardware/software features of the Matrice 100 better meet the needs to avoid low-altitude crashes?** Some of the proximity sensor technology ("Guidance" avoidance system) of the Matrice 100 would certainly offer advantages, but they **DO NOT** serve a purpose of improving the safety of the current production Inspire 1. Furthermore, the Matrice 100 is not the primary video/photo platform offered by DJI, and it is still **this Inspire 1 that many mainstream semi-pro/pro photographers and videographers fly and all-too-frequently crash due to low altitude "incidents" (many are much better at video/photo skills than flying drones).** Therefore, it's important to enhance the existing DJI Pilot app to help avoid such accidents from occurring. Some of the features being developed via the Matrice may later be applied to the rumored/future Inspire 2? **Will there be an option for the Inspire 1 to be retrofitted with a similar "Guidance" avoidance system? ... If made a reality, most Inspire 1 owners would buy it!**

**Would the various Autopilot apps soon to be released for the Inspire fix the problem?** Many of the "search and rescue" and "land survey" needs would indeed be better addressed via Autopilot, including inadvertent low-altitude problems, **but** MOST pilots in most circumstances will not be flying with an autopilot app, and this does not solve the problem for the average Inspire pilot who may be paying more attention to video/photo goals than to low-altitude piloting decisions/skills. Most Inspire pilots on most flights usually do not have the advantage of utilizing a skilled Inspire videographer to operate the second camera controller. **However, many (or at least some) of the low-altitude-control features being developed as part of the autopilot software(s) might be incorporated into the DJI Pilot app, and these would be welcome enhancements.** Less crashes by (video/photo)-distracted Inspire pilots produces happier DJI customers ... and a crash these days means no Inspire at all for 6-8 weeks+ (the backlog at DJI Repairs).

**Please seriously consider these relatively limited DJI Pilot software feature enhancements (or at least some of them), most of which are already common on military drones and on manned commercial, military and some civilian aircraft.** These needed software enhancements would prevent about 90-95% of low-altitude-related Inspire (and Phantom 3) crashes/accidents (and would help to reduce the critical backlog of repair of Inspires). At this time, where there are already significant controversies about "drones", with more laws and restrictions being developed worldwide, **the last**

thing that DJI or the drone industry (or we as pilots) need are more inadvertent low-altitude incidents leading to crashes, particularly those that damage other persons, property, or belongings. DJI has already recognized this with “maximum altitude”, with “airport near-proximity restrictions”, and with “Washington DC restrictions”, and have made suitable DJI Pilot enhancements to handle these, and so it’s now time for “low-altitude” enhancements to be made a similar priority. These key warnings/alerts and low-altitude flight restrictions are particularly important in photo/video work, land surveys, agriculture applications, and search and rescue operations, where “Map View” is utilized significantly during flight by the actual pilot, and in situations where the camera is not in FPV use or used (taken over) by the second controller (camera) operator, or when the camera is fully down-facing. These are high-risk situations for Inspire 1 (or Phantom 3) survival, especially at distant operation where direct visualization is difficult or intermittently obstructed for the pilot or when the camera is in non-FPV flight direction (or being used by the other video camera controller operator). Not having a dedicated FPV camera for the pilot and a dedicated videography camera for the cinematographer CAN be problematic when shared!

**Please consider some or all of these:** *Items marked “<<Achievable>>” indicates that this could probably or possibly be accomplished with a software enhancement of DJI Pilot app (and sometimes associated firmware enhancements), without hardware or sensor system changes.*

1. **“Set Minimal Altitude”:** Similar to “Maximum Distance” and “Maximum Altitude” and “Failsafe Altitude (return home)” presets, have a preset for “Set Minimal Altitude”, with these specific sub-options (the pilot can easily change these enhancement options (or temporarily suspend these) during a flight):
  - a. Enter **“Minimal Altitude Value”:** [ \_\_\_\_\_ ] (in feet (imperial) or meters (metric)). <<Achievable>>  
... *example: 160 feet above “Home” [relative] ... with “Home” relative altitude considered “0”.*
    - i. Software button to click which would “set” the value to the current altitude being flown at that time (relative to the “Home” relative altitude of “0”) ...if “set”/“reset” while in flight.  
... **“[Set Minimal Relative Altitude to Current Altitude]”** <<Achievable>>
    - ii. This feature would likely work great in a completely flat flight operations area, where (relative) altitude-above-“Home” is the same as altitude-above-ground at say 500 feet away, but in many areas where we fly, this completely flat terrain is not at all the case. Instead, the terrain rises and falls away, hilly, and frankly, it’s more interesting to video in this setting of variable terrain.
    - iii. More typically, we may have to estimate (visually, from take-off position at the “Home” relative altitude “0”) a hill being say 50 feet high that is located say 1500 feet away with the tallest of the trees atop that hill being an estimated 90 feet tall ... and then, in another direction, maybe 1200 feet away, an estimated 25 foot high hill with a probably 150 foot high tower atop it. Visual estimates of tree heights, tower heights, hill heights, and building heights can be inaccurate, as might be the distance to be flown and/or direction of flight. Furthermore, the gradual rise in terrain elevation can be misleading and frequently underestimated. Relative contour elevation estimates derived from satellite maps (or topo maps) and estimated heights of trees/vegetation and buildings atop that map ground-altitude can also be misleading. So to be safe in this example, one could theoretically set the minimal (relative) altitude above takeoff “Home” to be 200 feet (but it would be MUCH safer to set the “minimal-altitude” value to be 250 or 300 feet above take-off “Home”-ground-level. Measured (relative) altitude (above “Home”) from the onboard Inspire systems could also be inherently inaccurate due to drift in both GPS/GLONASS systems and barometric sensors.
    - iv. Further problems might theoretically arise if the “Home” point was changed during flight from “Takeoff Home” to “Controller Home”, or if there was a change in “Controller Home” position. It is unclear as to how this might be handled.
  - b. **“Minimal altitude feature on/off (MASTER)”:** toggle OFF( ) - ON(X) ... <<Achievable>>  
**This is the “Master” toggle** for all of the other toggles listed below:  
These other sub-settings (options can be selected per pilot and flight mission needs) provide:
    - i. **Audio voice warning:** toggle OFF( ) - ON(X) <<Achievable>>  
... “Descending below minimal [relative] altitude set [at XX feet]/[at XX meters]”  
(or some other similar verbal announcement)

- ii. **Audio coded beep warning from controller:** toggle OFF( ) - ON(X) <<Achievable >>  
 ... <coded beep sound> from the controller.  
 ... *Would require firmware update as well ... only needed if the tablet volume has been turned down or if there is a tablet power failure.*
- iii. **Visual warning:** toggle OFF( ) - ON(X) <<Achievable>>
  - 1. Visual alert appears “Descending Below Preset Minimum [relative] Altitude [of XX feet]”  
*(or some other similar screen announcement, perhaps simpler message)*
  - 2. Clicking (or some other action) would produce a pop-up to allow in-flight changes in options/toggles and altitude value and a temporary bypass, etc.
- iv. **Prohibit flying at altitude lower than preset minimal-(relative)-altitude:** toggle OFF( ) - ON(X) <<Achievable>>  
 ... (this prohibition activates once Inspire ascends above minimal altitude value set) **except for:**
  - 1. **Except for:** Software/Screen-ordered or failsafe: “Go home”. <<Achievable>>
  - 2. **Except for:** Software/Screen-ordered or failsafe: “Auto-land” <<Achievable>>
  - 3. **Except for:** Manual land at (or near) “Home” location (as was set elsewhere in DJI Pilot app as either aircraft takeoff “Home” or controller “Home”). <<Achievable>>
  - 4. **Except for:** Lowering landing gear. <<Achievable>>
    - a. This would be important in the case of emergency landing situations (a way to quickly bypass this “minimal (relative) altitude” limit).
    - b. This could even be done if iPad/software loses power or connection (by using the controller to lower the landing gear). ... *requires firmware update.*
- v. **Temporarily bypass of altitude limit (as set) to allow lower flight operation:** a simple “[**BYPASS Minimal Altitude**]” button. <<Achievable>>
  - 1. Minimal altitude limit remains nonfunctional until again ascends above minimal (relative above “Home”) altitude value set. <<Achievable>>
  - 2. To reiterate, automatically reactivates “minimal (relative) altitude” limit once the Inspire again ascends above the pre-set “minimal (relative) altitude” value.
  - 3. Other possible conditions?
- vi. **Show “Minimal Altitude feature set” on main screen of DJI Pilot app:** toggle OFF( ) - ON(X) <<Achievable>>
  - 1. On “Camera” main page: toggle OFF( ) - ON(X) <<Achievable – needed?>>
  - 2. On “Map” main page: toggle OFF( ) - ON(X) <<Achievable – needed?>>
  - 3. When in use, clicking on this main-screen indicator will bring up a window to:
    - a. Option button to temporarily [**BYPASS Minimal Altitude**] limit, allowing temporary lower [relative] flight operation: (“minimum altitude” system automatically reactivated once again above the pre-set minimal altitude value)
    - b. Allow inflight changes in toggles (at least master toggle) and “minimal (relative) altitude” value. <<Achievable>>
- vii. **Indicate when ascends above “minimal (relative) flight altitude”:** toggle OFF( ) - ON(X) <<Achievable>>
  - 1. Voice announcement “ascending above the minimal [relative] altitude value set at [XX feet]” : toggle OFF( ) - ON(X) <<Achievable>>
  - 2. Visual alert appears “Ascending above Preset Minimum Altitude at [XX feet]” : toggle OFF( ) - ON(X) <<Achievable>>
    - a. Clicking goes to pop-up to allow inflight changes in toggles and altitude value.
      - i. Option button to temporarily [**BYPASS Minimal Altitude**] limit, allowing lower [relative] flight operation: (minimum altitude system automatically reactivated once again above the pre-set minimal altitude value)
      - ii. Allow inflight changes in toggles (at least master toggle) and “minimal (relative) altitude” value.

- c. **On takeoff, report “Minimal altitude” feature is on/off (master):** toggle OFF( ) - ON(X) <<Achievable>>  
 ... could have sub-toggles added for voice and screen alerts, or could leave these sub-toggles off.
- i. Audio voice announcement via “DJI Pilot” app iPad: “Minimum [relative] Altitude feature set for XX feet altitude” or “Minimum [relative] Altitude feature has not yet been set”.
    1. Need to delay this voice and visual screen announcement for 10-20 seconds until the other takeoff voice and visual screen announcements have been completed (such as “Landing gear raising”, etc.)
  - ii. Visually seen on “DJI Pilot” app iPad screen “Minimum Altitude Feature Set for XX feet Altitude”.
    1. Clicking goes to pop-up to allow changes in altitude value and toggle settings.
    2. Option button to temporarily **[BYPASS Minimal Altitude]** limit, allowing lower flight operation: (minimum relative altitude system automatically reactivated once again above the pre-set minimal relative altitude value)
  - iii. *This reduces the possibility of accidentally forgetting to set the minimal [relative] altitude setting or leaving an old incorrect setting ... assuming the wrong altitude could be disastrous.*
- d. **On takeoff, report “Failsafe Return Home Altitude” value:** toggle OFF( ) - ON(X) <<Achievable>>
- i. Audio voice announcement via “DJI Pilot” app iPad: “Failsafe return Home altitude set for [XX feet]/[XX meters]”. <<Achievable>>
    1. Need to delay this voice and visual screen announcement for 20-30 seconds until the other takeoff voice and visual screen announcements have been completed (such as “Landing gear raising”, “Minimal altitude setting”, etc.).
  - ii. Visually seen on “DJI Pilot” app iPad screen “Failsafe return Home altitude set for [XX feet] Altitude”.<<Achievable>>
    1. Clicking goes to pop-up to allow changes in Failsafe return Home altitude value. <<Achievable>>
  - iii. *This reduces the possibility of accidentally forgetting to set the failsafe return [relative] altitude setting or leaving an old incorrect setting ... assuming the wrong return home [relative] altitude could be disastrous.*
    1. *FYI: On at least 2 Inspire software/firmware updates in the past, no matter what had previously been set, the value after upgrade becomes “0”, which is dangerous, especially if the software upgrade occurs during flight operations. If this “failsafe-return-home” value had previously been set to 250 feet (relative to “Home”), and then, after the software update, unknown to the pilot, the “failsafe-return-home” has been changed to “0”, then, from a lower position, clicking “Go Home” would run the Inspire right in to a tree.*

**2. Limit Vertical Decent Speed Below a Specified Altitude above “Home” altitude:** <<Achievable>>

- a. In this case, **the pilot may be manually trying to force a more rapid (high-speed) descent of the Inspire** from a (relative) high altitude of say 300-500 feet, even in an auto-“Go-Home” situation or auto-“Land-Now” situation. If distracted, it is easy not to stop in time, and descend the Inspire right into the ground at high speed. This feature would make this much less likely to occur.
  - i. **Override pilot NEAR-GROUND (actually near-“Home” relative altitude) manual vertical descent speed (except in critical low battery situation) if descending to the same elevation as the aircraft takeoff “Home” location or controller “Home” location (depending on how set).**
    1. Activate vertical descent speed override: toggle OFF( ) - ON(X) <<Achievable>>
    2. Maximum Descent V.S. Value: [\_\_\_\_\_] F/S (or M/S). <<Achievable>>  
 ... example: 3 F/S
      - a. Must be lower than the default descent speed during “auto-land” actions.
    3. Activate at altitude of: [\_\_\_\_\_] feet above “Home” point (aircraft takeoff or controller elevation, depending on how set). ... example: “25” or “40” feet altitude (adjustable from say 0-100 feet) <<Achievable>>
    4. **Voice Announcement** (at set point) **“At [XX] feet above “Home” Ground Level – Slowing”:**

toggle OFF( ) - ON(X) <<Achievable>>

- a. Voice announcement would be as above (as an option)
  - b. Screen announcement “Nearing “Home” Altitude Level Warning at [of XX feet]” (as an option)
5. These reduce the chance of accidentally flying the Inspire into the ground.
- 3. Ground-Proximity Ultrasonic-Transducer-System Altitude Warning, and Near-ground Vertical Descent Speed Control:** <<Achievable (to a limited extent)>> – but *ONLY* works within 5-7 feet above the ground, not well over certain surfaces (such as water), and probably not well or dependably (or at all) if there is significant concurrent horizontal movement of the Inspire – In other words, the ultrasonic sensor system probably only works dependably if descending directly down, and maybe if traveling slowly horizontally within say 5-7 feet above the ground. So ... may be helpful in gear-up position, hovering over the ground or slowly moving horizontally?? **LOTS OF UNKNOWNNS HERE.** This system is certainly not the sophisticated avoidance “Guidance” system as used now in the Matrice 100.

In this case, instead of ground proximity radar that might be used in military drones, and in manned military, commercial, and some civilian aircraft, and instead of the Matrice 100’s “Guidance” avoidance system, we are forced primarily to use of the Inspire’s (and Phantom 3’s) fairly rudimentary low-powered ultrasonic transducer system, which has very significant limitations, as discussed above. Lots of unknowns here - so much of these ideas are speculative. Again, it’s not the “Guidance” system as used now in the Matrice 100. And again, **it would be wonderful to be able to retrofit this “Guidance” avoidance system to the Inspire 1.**

Nevertheless, consider the following options:

- a. **Vertical auto-descent speed limitation once Inspire’s ultrasonic sensor system has activated:**
  - i. **Override ultrasonic sensor vertical auto-descent speed on DJI auto-land, auto-home, etc. (except in critical low battery situation).** <<Achievable??>>
    1. FYI: After one of the Inspire updates, the vertical descent speed (after ultrasonic transducers see the ground) significantly increased (at least has increased from its previous slower vertical descent speed after activation of the ultrasonic transducer system). The Inspire now has harder landings than before the update.
    2. Activate this override: toggle OFF( ) - ON(X) <<Achievable ??>>
    3. Descending V.S. Value: [\_\_\_\_] F/S (or M/S). <<Achievable??>>  
... example: 0.3 F/S or 0.1 M/S
      - a. Must be lower than the default descent speed during “auto-land” actions, when the ultrasonic system usually slows the speed.
  - ii. **Why do this?** Sometimes, where there are conditions of grass or brush in the landing area, rocks and irregular surfaces, near ditches, vertical stalks, or with poor GPS coverage, or with low light levels, or when moving controller “Home”, descending at default near-ground ultrasonic-system-activated descent speeds can be hazardous to the Inspire (or Phantom 3), to others, and to property. This bypass of the default “auto-land” ultrasonic-triggered descent speed. This forces a slowdown to look carefully for such hard-to-see problems as vertical sticks, tree or weed spouts or stalks, fishing line, wire, ditches, etc., that might result in a crash.
- b. **Voice Report Ultrasonic Altitude-above-ground countdown when descending to a landing:** <<Achievable??>>
  - i. **Audio descent voice warning (countdown as approaching ground):** toggle OFF( ) - ON(X) <<Achievable ?? >>  
... “Ultrasonic altitude of [of XX feet]/[of XX meters] above ground”
    1. Reports at each one foot interval while descending, once the ultrasonic system picks it up. Particularly helpful in making distant and/or FPV landings, and/or with night landing, or when camera is pointed elsewhere (forward) while the Inspire to descending directly down for a landing, or in other difficult landing situations.

2. ... example: "8 feet" (if it is picked up this high)... "7 feet" ... "6 feet" ... "5 feet" ... "4 feet" ... "3 feet" ... "2 feet" ... "1 foot" ... "0.5 foot" ... "on ground" ... "props stopped".
  3. **On descending, height voice ULTRASONIC altitude reports on ascent and descent (instead on just descent):** ... toggle OFF(X) - ON( ) <<Achievable >>  
... once descends to a level that turns on the ULTRASONIC altitude-from-ground system, the reports are same as the above, but if the pilot is moving up and down in FPV mode, for instance, the reports are given every 1 foot, varying between 1-7 feet, as the pilot looks for a position to land, perhaps using FPV, and trying to avoid nearby sprouts and saplings and brush (in camera-view).
    - a. ... example: "8 feet" (if it is picked up this high)... "7 feet" ... "6 feet" ... "5 feet" ... "4 feet" ... "3 feet" ... "2 feet" ... "3 feet" ... "2 feet" ... "1 foot" ... "0.5 foot" ... "on ground" ... "props stopped".
  4. **Voice warnings on "Auto-Land", & "Auto-Home":** " ... toggle OFF(X) - ON( ) <<Achievable >>  
... because usually unnecessary when landing at "Home" location, in view of pilot.
- ii. **Why do this?** Allows for more controlled landing when landing in poorly visualized landing, especially when FPV and difficult to judge precise altitude above ground, or when the camera is pointed elsewhere (not providing desired FPV during the Inspire's landing) in the case of emergency or manual landings out of direct site of the pilot, or if landing at a distance at night, or if, in bright sunlight, having difficulty seeing the DJI Pilot app screen - at to left bottom (where the ultrasonic altitude above ground is shown).

**Analogous situations with other types of drivers or pilots or operators (with information communicated from the direct observer):** (where approaching an object, closing a gap, or docking ... verbal measurements are called out or radioed **FROM** the person (or voice interface) who has direct view of the approaching distances (who can provide the specific distance or height units) ... **TO** the pilot/driver/operator of a truck, tall forklift, helicopter rescue operation, docking spacecraft, hoist, crane, erection equipment, etc. ) ... example: "8 feet" (as the observer starts the countdown)... "7 feet" ... "6 feet" ... "5 feet" ... "4 feet" ... "3 feet" ... "2 feet" ... "1 foot" ... "0.5 foot" ... "docked" ... "engine/hoist/power stopped".

**Problem:** Pilot/driver/operator cannot, in many instances, always be able to directly see the area to be docked with or approached, and the pilot/driver/operator needs to have these values called out (or radioed) as a countdown until the docking or approach has been completed. These examples are analogous.

.... Examples:

- i. **Transport truck backing up to the loading dock,** with warehouse worker calling out decreasing numbers (a distance countdown) to the driver as the truck eventually docks to the warehouse loading dock.
- ii. **Coast Guard (or other rescue) helicopter lowering rescue swimmer, or basket, or sling to the deck of a ship** (or to a raft, or to the sea, or coastline, or rock amidst the whitewater rapids, or the roof of a house or car in a flood, etc.) while the rescue swimmer at the bottom calls out by radio specifying the estimated closing distance, as the hoist-line approaches its target. Similar situations apply to military settings.
- iii. **Spacecraft Docking:** a shuttle or capsule docking to a space station uses radar and laser, etc. to dock, but voice countdown is also used.
- iv. **Construction/Cranes:** The ground operator (or on-girder steelworker) estimates measurements and radios these back to the crane operator as he carefully lowers a piece of structural steel into its precise position. Countdown measurements here are critical.

- v. **Crane operators** of all sorts: at docks, at construction sites, spas moved to decks, AC systems moved to roofs, modular housing being constructed, etc. The spotter on the ground/roof/ship/dock radios countdown measurements to the crane operator .
  - vi. **Recreational vehicles and mobile homes** being backed into a site.
  - vii. etc.
- iii. *Thanks for outside recommendation here (voice distance countdown commonly used in spacecraft docking and in basket/sling-to-ground or sling-to-ship-deck level in USCG helicopter rescue hoists), etc., etc..*
- c. **Prohibit flying at ULTRASONIC-calculated-altitude lower than preset ultrasonic altitude (distance) above ground:** <<Achievable?? THIS IS QUESTIONABLE >>
- i. **Settings for this function:**
    1. Turn on **“ULTRASONIC-calculated minimal altitude”**: toggle OFF( ) - ON(X)  
... if set, activates once ascends above minimal above-ground ultrasonic-calculated-altitude value set.
    2. Enter **“Minimal Altitude above-ground Value”**: [ \_\_\_\_\_ ] (in feet or meters).  
... example: set at 4 or 5 feet above the current ground level below the Inspire.
    3. **“[Set Minimal ULTRASONIC-calculated-altitude to Current Altitude]”**  
<<Achievable>>  
... Software button to click would “set” the value to the current altitude being flown at that time (relative to ground) ...if “set”/“reset” while in flight.
  - ii. **Problems/limitations of the ultrasonic system:**
    1. Would probably not work above a certain very limited horizontal speed (because of latency and/or behavior of rudimentary weak ultrasonic transducer system).
    2. May not work over water and over certain other surfaces
    3. May not work at all?
    4. Other problems? ... lots of unknowns!
  - iii. **Prohibits flying below this minimal ultrasound-determined above ground altitude, except for:**
    1. Software-ordered or failsafe: “Go home”. <<Achievable??>>
    2. Software-ordered or failsafe: “Auto-land” <<Achievable??>>
    3. Manual land at (or near) “Home” location (as was set elsewhere in DJI Pilot app as either aircraft takeoff “Home” or controller “Home”). <<Achievable??>>
    4. Lowering landing gear. <<Achievable??>>
      - a. This would be important in the case of emergency land situations (a way to quickly bypass this minimal ultrasonic altitude limit).
      - b. This could even be done if iPad/software loses power or connection (by using the controller to lower the landing gear).
  - iv. **Temporarily bypass of minimal ULTRASONIC altitude limit (as set) to allow lower flight operation:** with a simple **[BYPASS minimum ultrasonic altitude]** button. <<Achievable??>>
    1. Minimal altitude limit remains nonfunctional until again ascends above minimal ULTRASONIC-measured altitude value set.
    2. To reiterate, automatically reactivates minimal ULTRASONIC altitude limit once again ascends above the pre-set minimal ULTRASONIC altitude value.
    3. Other possible conditions?
  - v. **Show “Minimal ULTRASONIC Altitude limit feature set” on main screen of DJI Pilot app:** toggle OFF( ) - ON(X)
    - a. On “Camera” main page: toggle OFF( ) - ON(X) <<Achievable ??>>
    - b. On “Map” main page: toggle OFF( ) - ON(X) <<Achievable ??>>
    - c. When in use, clicking on this main-screen indicator will bring up a window to:
      - i. Option button to temporarily [BYPASS] of minimal ULTRASONIC altitude limit, allowing lower flight operation: (minimum ULTRASONIC altitude system automatically reactivated once again above the pre-set minimal altitude value)

- ii. Allow inflight changes in toggles (at least master toggle) and minimal altitude value.

vi. **Why do this?**

1. (Possibly) allows hover or (maybe) very slow (how slow?) horizontal movement (outdoors (with GPS/ GLONASS + ultrasonic + optical flow) or Indoors (with ultrasonic + optical flow only) at a controlled minimal elevation above the ground (cannot go below this set “**minimal ultrasound-determined above ground altitude**”), while the landing gear is raised (and therefore allowing full “near-ground” use of gimbal for video and camera work). By doing so, there is much less risk of a gear-up crash into the ground with camera/gimbal damage. *This feature might be helpful, for instance, when following and close-up videoing a group of animals or persons walking up a trail gently ascending a hillside ... this would hopefully prevent flying the Inspire into the ground ... keeping the distance from ground constant while the relative altitude above “Home” takeoff location gradually increases.*
2. **More succinctly, allows very low altitude hover or possibly very slow horizontal flight in gear-up (gimbal/camera-down) video-on mode in FPV, with much less chance of inadvertent dropping the relative altitude above the ground, thus preventing or reducing the chance of gimbal/camera damage or full-blown crash into the ground.**
3. This is **particularly important when the rudder is used** (left stick movement to the right or left) **for rotation of the Inspire** to point to different headings (Mode 2), which is sometimes problematic, since the **same left stick is used for Inspire elevation** (up and down movement). Having both of these actions on the same stick and this close to ground makes it very easy to inadvertently apply slight down-lever to that left stick, and **thus inadvertently to fly the Inspire, camera/gimbal first, into the ground.**
4. **This might also allow slow creep in horizontal flight**, with an ultrasonic-system-controlled minimal-altitude protection, even when the Inspire 1 is very slowly traveling horizontally (creeping) **perhaps up and down a gradually slope** (a gradual rising or dropping off of the ground as the Inspire moves horizontally). This is **particularly important when the Inspire single operator is paying primary attention to videoing and photographic conditions and settings, instead of paying close attention to the piloting of the Inspire and making good flight-control decisions, and specifically, to the Inspire’s critical (relative) altitude above ground.**
  - a. **Considerations, possibilities, limitations and speculations, with limited knowledge of the capabilities of the ULTRASONIC Altitude sensors.** Since we know that the ultrasonic relative altitude (to ground) sensor system will never be safe for more than very slow speed travel (creeping) , perhaps:
    - i. **Limit the horizontal speed to XX? (1-2 MPH?), when using the Minimal ULTRASONIC Altitude limit feature**, and if attempts are made to increase the Inspire to a more rapid horizontal speed, then the Inspire could limit this attempt, by limiting that horizontal speed to a horizontal speed that can be handled by the system. <<Achievable?>>.
    - ii. So, theoretically, if traveling/flying low-altitude on a winding flat trail in the woods, one could set the “**Minimal ULTRASONIC Altitude limit feature**”, say to 4 or 5 feet above the ground, and the pilot can then set the Inspire camera to a forward position for FPV flight in a landing-gear-up status, and creeping forward down the trail, without worry about the Inspire dropping its altitude and injuring the camera/gimbal assembly while in the gear-up status. This would allow a FPV gear-up Inspire 1

- “Walk down the trail” in a relatively safe more relaxed fashion, even if the trail winds through the trees.
- iii. Now, what about the condition where the trail continues to wind through the woods, but now starts up the trail at say 15-20 degrees of slope going up the hill. In this case, the pilot would probably increase the FPV camera angle by 15-20 degrees to match the increase in trail slope, BUT, theoretically, the altitude would automatically be maintained to continue the **Minimal ULTRASONIC “Above-Ground” Altitude limit feature** which had continued to be set to 4 or 5 feet above ground.
  - iv. If this Minimal ULTRASONIC Above-Ground Altitude limit feature is being used, at any point that the Inspire senses that it is receiving weak, inconsistent, confusing, or in any way questionable information back from the ULTRASONIC sensor system (if the Inspire is moving too fast horizontally), then all horizontal forward speed could be slowed or stopped and enter a hovering status for safety.
  - v. It is hard to say how such a feature would handle going DOWN a hill, say at a 15-20 degree slope going down-hill, since this is a Minimal ULTRASONIC Altitude limit feature (NOT a Constant ULTRASONIC Above-Ground Altitude feature). The minimal ULTRASONIC Above-Ground Altitude limit feature would prevent ONLY a decrease in altitude. Under this condition, with no further vertical stick input, the Inspire would probably continue at the same altitude as it was at the top of the hill. This is NOT a “constant ULTRASONIC Above-Ground Altitude” setting. There is little point is approaching/discussing this possibility further until some of the more rudimentary questions about the ULTRASONIC Altitude features have been answered. By that time, systems from the Matrice 100 will have been tested, and perhaps an Inspire 2 will be released.
5. Of course, this does not prevent the Inspire, under the limited control of such very low-powered ultrasonic-minimal-altitude-control from running into a vertical object, such as a tree, sapling, bush, pole, building, wall, fence, etc. Nevertheless, this system could dramatically reduce the chance of running the Inspire camera/gimbal into the ground.
  6. Fortunately, technology derived from research via the Matric 100 and SDK (and perhaps from software developing from other sources, including from autopilot apps) ... may allow much better features and hardware to be added/included in the rumored Inspire 2 to perhaps be released later. **Or perhaps there may be an option for the Inspire 1 to be retrofitted with a similar “Guidance” avoidance system? ... Again, if made a reality, most Inspire 1 owners would buy it!**

Thanks for your interest in these software enhancements in the DJI Pilot app.

Please provide me feedback and other ideas.

*Dave Millsaps*

*... and from all the others who have submitted to this collection of ideas for DJI Pilot app low-altitude enhancements.*

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