



# THE ASSOCIATION

APRIL 2024 VOL.1

## DRONE TECHNOLOGY: RTK, PPK, GNSS: WHICH IS BETTER?

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With the arrival of drone technology, life in the reconstruction world has changed a lot. The days of playing out in the middle of traffic, dodging cars and hoping vehicles don't run over your equipment are almost a thing of the past. The accuracy in diagramming is something we've always strived for, and some of us risked our lives to get it! Now that drone technology is here and is improving every day, which is better: RTK, PPK, or GNSS?

Most of us are familiar with GNSS, or Global Navigation Satellite System, in one way or another. If you've used a drone, such as a DJI Phantom 2, 3, or even the early 4 series, you've used the GNSS system whether you knew it or not. GNSS data is used to determine a drone's location. This, however, sometimes results in inaccuracies due to such factors as satellite geometry and atmospheric conditions. It requires the use of ground control points; pre-identified, surveyed points on the ground used to calibrate and correct the drone's data post-flight. It's effective, but can require some labor intensive and time-consuming work.

A newer trend in drone technology uses RTK, or Real-time Kinematic Positioning, to correct the GNSS

signal inaccuracies of a drone. The farming community has been using a form of RTK for some time now in order to keep the equipment on track during planning and harvesting seasons. This accuracy helps keep the crop loss to a minimum. These corrections performed by the RTK are essentially made by calculating the positional discrepancies between a nearby base station and the drone, which results in centimeter level accuracy positioning. This high-precision positioning makes the mapping much more accurate.

Similar to RTK, the PPK, or Post-Processed Kinematic system improves the accuracy of GNSS data but differs in its approach to processing. Instead of correcting the drone's position in real time, PPK stores all the raw GNSS data, to be processed after the flight. This method is helpful when real-time correction is not realistic or in areas with poor communication infrastructure. However, PPK still requires some ground control points for validation and is recommended to allow 24 hours to pass before post-processing, which won't work in cases where a real-time solution is needed.

So now we're interested in RTK for our scene mapping...just how accurate is

RTK? RTK is a significant improvement with regards to the accuracy of GNSS data. Standard GNSS systems offer positioning accuracy within a few meters; RTK provides accuracy within 1-3 centimeters. This accuracy is achieved through real-time corrections transmitted from the RTK base station to the drone.

RTK technology corrects several common sources of error in GNSS data. These include ionospheric and tropospheric disturbances, satellite clock inaccuracies, and orbital errors. By addressing these errors in real-time, RTK ensures that the positional data gathered by drones is precise and reliable.

However, the accuracy of RTK is contingent on the distance between the drone and the RTK base station. Generally, the closer the drone is to the base station, the more accurate the corrections.

Many companies provide RTK or NTRIP (Networked Transport of RTCM via Internet Protocol) service for the base station. One such company, Point One, offers over 1400 broadcast points in a wide geographic area. The cost to use these stations varies, some charge a single use fee, while others

(Continued on page #2)

## MORE ABOUT: RTK, PPK, GNSS: WHICH IS BETTER?

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May charge a monthly or yearly rate for the service. It would be of great benefit to research these providers and what they offer long before investing in the time and equipment needed to make the RTK system work.

There are drawbacks to using an RTK enabled drone, one important drawback is that RTK drones need a constant and stable link. If you're flying in an obstructed area, trees, mountains, etc., or in a large area, power loss can occur and the signal can be corrupted. A loss of signal can lead to a loss of calibration data and potentially inaccurate gaps during flight.

Therefore, in order to get the best results, the user should:

- Place the base GPS receiver in a location with equal range in all directions
- Position the base GPS antenna so that it has a clear line of sight to the sky in all directions
- Place the GPS and radio antenna as high as possible.
- Do not place the GPS re-

ceiver, GPS antenna or radio antenna within 400 meters of a cellular tower, television tower or radar station.

- Don't set up the base station directly beneath or close to overhead power lines or electrical generation facilities.

So, you've got most things figured out, but you need equipment. In order to utilize a system such as a RTK, you'll need just a couple things:

You'll need a GNSS receiver that can receive and incorporate RTCM correction data, and a source of the RTCM correction data. This is a basic RTK GPS system which would include a local base station and a data link between the two. The GPS receiver can be mounted on a mobile platform, (think drone, car, etc.) and receives data from GPS satellites. The base station takes in and corrects the GNSS data with RTK, while the rover (again, think drone, vehicle, etc.), with an antenna communicates with the base station. Without a base station, the accuracy of the data is significantly reduced, often falling

back to the less precise capabilities of standard GPS.

You will also need a form of data collector, such as a handheld device or tablet; software for the point collection and stake out, and of course, accessories, such as surveying poles, brackets, etc.

So now, all we need is a drone! The prices of drones capable of operating in a RTK environment vary greatly. Costs may be as little as \$2,999 for an Autel RTK EVO II Pro 6k, to a DJI drone costing over \$10,000. Some DJI Mavic 2s have the capability to have a DJI RTK module added for slightly under \$700; or you could by the whole set up for around \$6,000.

I would imagine that as the use of RTK and PPK technology increases, the cost of these drones will eventually fall

Sources for this article:

[www.jouav.com](http://www.jouav.com) RTK v. PPK Drone mapping: What's the difference?

[www.pointonav.com](http://www.pointonav.com) Dront RTK: Everything You Need To Know, by Chris Dima

[www.Trimble.com](http://www.Trimble.com) Base Station Operation



Special Training  
Announcement!!

## You're Invited!!!

Don Harris, one of the original founders of the IACAI, is turning 80 here very soon!! As such, he would like to extend an invitation to any and all current and past members of the IACAI to stop by, wish him well and perhaps share some stories !!

Don's 80th birthday party will be held at the Turning Point Church, 3600 North Morton Street, Franklin, IN 46131, beginning at 1:00pm on Saturday, April 20th, 2024. There will be a big sign out front, so you can't miss it!!

## IACAI SKILL REVIEW



This issue of the IACAI Skill Review involves questions regarding a mix of questions from past issues.

1. A \_\_\_\_\_ transforms and multiplies the force developed by the brake chamber into a torque with applies the brakes via the brake camshaft.
  - A. Air brake reservoir
  - B. Check valve
  - C. Slack adjuster
  - D. Pre-tensioner
  
2. Elderly drivers often attempt to compensate for deteriorating abilities by:
  - A. Driving less frequently
  - B. Driving at or straddling the fog line
  - C. Driving during the daytime hours only
  - D. All the above are ways in which the elderly compensate
  
3. On heavy vehicles, the axle which serves only to support additional gross weight is called a \_\_\_\_\_ axle.
  - A. 3rd Axle
  - B. Supporting Axle
  - C. Tag Axle
  - D. Axillary Axle
  
4. True/False With regard to interstate highway conditions, the more emergency lighting that is placed on an emergency vehicle, the safer the emergency vehicle is.
  
5. The hardest color to see with the human periphery is:
  - A. White
  - B. Red
  - C. Silver
  - D. Black

Answers will appear in the next edition of the Association.

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The Association is published quarterly as a service to members of the Indiana Association of Certified Accident Investigators.

Articles submitted are the responsibility of the author; the IACAI assumes no responsibility as to an article's content..



## IIHS alters scoring criteria for updated moderate overlap front crash test

February 22, 2024

The Insurance Institute for Highway Safety is rolling out new scoring criteria for its updated moderate overlap front crash test to better account for variations in the position of the rear shoulder belt.

A new metric called the chest index factors in both the position of the shoulder belt on the rear dummy's chest and chest compression. Belt position itself is also evaluated as part of the holistic analysis of how well the restraints control the motion of the dummy during the crash. In addition, the range of shoulder belt positions considered acceptable has been expanded slightly.

Previously published ratings in the updated moderate overlap test, which was launched in 2022, have been adjusted on the Institute's website in conjunction with this announcement. The ratings of five vehicles improve, and eight receive downgrades.

"Most of these changes are part of a planned transition that we informed automakers we'd be making before we launched the updated test a year ago," said Jessica Jermakian, IIHS vice president of vehicle research.

"The new scoring eliminates an artificial benefit our initial ratings awarded for a high shoulder-belt position. Pressing ahead with a simpler program while we validated the new metric allowed us to start incentivizing vehicle improvements a year earlier."

IIHS [launched](#) the updated moderate overlap front test in 2022 after research showed that in newer vehicles the risk of a fatal injury is now higher for belted occupants in the second row than for those in front. This is not because the second row has become less safe. Rather, the front seat has become safer because of improved airbags and advanced seat belts that are rarely available in the back. Even with these developments, the back seat remains the safest place for children, who can be injured by an inflating front airbag, and the rating does not apply to children secured properly in child safety seats.

In the updated test, a dummy the size of a small woman or 12-year-old child is positioned in the second row behind the driver dummy.

For a vehicle to earn a good rating, there can't be an excessive risk of injury to the chest, among other body regions, as recorded by the second-row dummy. For the initial year of testing, IIHS engineers estimated the risk of chest injuries with a device that records the seat belt tension and the dummy's own chest deflection sensor — which measures how much the rib cage is compressed by the force of the crash.

To avoid delaying the launch of the program, they simply used a pressure mat to track the position of the shoul-

der belt and penalized vehicles when it exceeded a maximum height. Vehicles with shoulder belts higher than the cutoff could receive no better than a marginal rating for chest injury risk, regardless how little chest deflection the dummy's internal sensor recorded.

The new chest index takes into account both chest deflection and belt position, using a formula that the Institute has been validating for the past year to adjust the deflection metric based on distance of the shoulder belt from the internal sensor.

The pressure mat is still used to determine the maximum shoulder belt position during the crash. However, engineers now evaluate maximum belt position separately as part of their assessment of how well the restraints control the motion of the dummy during the test, which reduces the influence of shoulder belt height on the overall rating. In addition, the cutoff for a belt that is too high has been raised by 10 millimeters in recognition of the need for shoulder belts to accommodate occupants of various sizes. These changes were not part of the original phase-in plan.

The belt tension metric, which makes it very difficult for a vehicle without technology like pretensioners and belt force limiters to earn a good rating, remains unchanged.

VISIT US ON THE WEB @ WWW.IACAI.COM



## NHTSA Announces \$350 Million Grant for State Data Systems Upgrade

The National Highway Traffic Safety Administration invites states, territories and tribes [to apply for millions in grants](#) to upgrade and standardize state crash data systems to enable full electronic data transfer to NHTSA. The program will also enable intrastate data sharing and improve the accuracy, timeliness and accessibility of fatality data, including data about pedestrians, cyclists and other vulnerable road users.

The agency will set aside up to \$350 million for the grants, which are open to all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa, the Northern Mariana Islands, and the Secretary of the Interior, acting on behalf of an Indian tribe.

“These grants will mean more state data coming to NHTSA faster, which means we can put this information to good use in pursuing our shared safety goal – saving lives,” said Sophie Shulman, NHTSA’s Deputy Administrator. “State data tells us what’s happening on our roads and allows us to develop effective and responsive strategies, countermeasures, research, rulemakings, and consumer education campaigns.”

The State Electronic Data Collection program satisfies a Bipartisan Infrastructure Law directive. The law requires NHTSA to establish the SEDC program to provide grants to states to upgrade and standardize state crash data systems to enable full electronic data transfers to the agency.

NHTSA intends to award SEDC grants to states that detail how they will modernize and standardize their data collection systems.

Participating states and territories who are selected to receive grant funding will have five years to implement full electronic data transfers to NHTSA.

Applications are due by May 1, and NHTSA plans to award the grants by December 2024.

For more information on President Biden’s Bipartisan Infrastructure Law and directives to NHTSA, please visit our [BIL page](#). For information on this Notice of Funding Opportunity, please [click here](#).

## Training Announcements

May 20—23 (On-line) Motorcycle Collision Reconstruction \$1,400

Louis Peck, Lightpoint Data

Enrollment through his website:

[www.lightpointdata.com](http://www.lightpointdata.com)

This four-day class covers everything you need to know about motorcycle collisions by a top-notch presenter, Louis Peck! All from the comfort of

your home!

May 13-17 CDR Analysis and Applications \$1095

Northwestern CPS/Naperville, IL

Contact : [registration.nucps.northwestern.edu](mailto:registration.nucps.northwestern.edu)

May 20-24 Advanced Crash Recon w/ CDR Applications \$1095

Northwestern CPS/Naperville, IL

Contact: [registration.nucps.northwestern.edu](mailto:registration.nucps.northwestern.edu)

May 15-16 Crash Investigation/ Reconstruction Aerial Photogrammetrist \$695

Northwestern CPU/Countryside, IL

Contact: [registration.nucps.northwestern.edu](mailto:registration.nucps.northwestern.edu)

## NHTSA: APRIL IS DISTRACTED DRIVING MONTH

Distracted driving has become a deadly epidemic on our roads. Cell phone use — specifically, texting, talking, and social media use — has become the most common distraction. Other risky actions include adjusting the radio or GPS, applying makeup, eating and drinking. By driving distracted, you're robbing yourself of seconds that you may need to avoid a close call or deadly crash.

In 2021, [distracted driving](#) killed 3,522 people, and in 2022, 3,308 lives were lost.

The NHTSA defines Distracted Driving as driver inattention that occurs when drivers divert attention from the driving task to focus on some other activity.

A distraction-affected traffic crash is any traffic crash in which a driver was identified as distracted at the time of the crash.

Some stats include:

- Eight percent of fatal crashes, 12 percent of injury crashes, and 11 percent of all police-reported motor vehicle traffic crashes in 2022 were reported as distraction-affected traffic crashes.
- In 2022 there were 3,308 people killed and an estimated additional 289,310 people injured in motor vehicle traffic crashes involving distracted drivers.
- Five percent of all drivers involved in fatal traffic crashes in 2022 were reported as distracted at

the time of the crashes. Six percent of drivers 15 to 20 years old, 21 to 24 years old, 25 to 34 years old, and 75+ years old involved in fatal crashes were reported as distracted. Each of these age groups have the larger proportions of drivers who were distracted at the time of the fatal crashes.

- In 2022 there were 621 nonoccupants (pedestrians, bicyclists, and others) killed in distraction-affected traffic crashes .

The estimated economic cost of all motor vehicle traffic crashes in the United States in 2019 (the most recent year for which cost data is available) was \$340 billion, of which \$98 billion resulted from distracted-driving traffic crashes.

These costs represent the tangible losses that result from motor vehicle traffic crashes. However, in cases of serious injury or death, such costs fail to capture the relatively intangible value of lost quality-of-life that results from these injuries. When quality-of-life valuations are considered, the total value of societal harm from motor vehicle traffic crashes in the United States in 2019 was an estimated \$1.37 trillion, of which \$395 billion resulted from distracted-driving crashes.

In 2022 there were 3,047 fatal motor vehicle traffic crashes that involved distraction (8% of 39,221 fatal crashes) nationwide. These

crashes involved 3,124 distracted drivers since some crashes involved more than one distracted driver. Five percent (3,124 of 60,048) of drivers involved in fatal crashes were distracted. In distraction-affected traffic crashes, 3,308 fatalities (8% of 42,514 fatalities) occurred. Table 1 provides information on fatal traffic crashes, drivers involved in these crashes, and fatalities in distraction-affected crashes from 2018 to 2022. Much attention has been focused on the dangers of using cellphones and other electronic devices while driving. In 2022 there were 368 fatal traffic crashes reported as having cellphone use as a distraction (12% of all distraction affected fatal traffic crashes). For these distraction-affected crashes, the PCRs each stated that at least one of the involved drivers was talking on, listening to, or engaged in some other cellphone activity at the time of the crash. In 2022 a total of 402 people died in crashes involving at least one driver who was engaged in cellphone-related activities.

Over the past 5 years, the estimated number of people injured in distraction-affected traffic crashes has shown decreases and increases. The percentage of injured people in distraction-affected traffic crashes as a portion of all people injured has remained relatively constant.

*Taken from: NHTSA: Traffic Safety Facts: Distracted Driving in 2022*



For up-coming training information, please visit [www.IACAI.com](http://www.IACAI.com)

**REMEMBER THE DATE!!****PLEASE POST!!****Training Seminar****Crash Scene Processing (Series 1 of 3)****Wednesday, April 24, 2024****9:00 a.m.***Registration will begin at 8:30 a.m.***Mishawaka Police Department Training Room****100 Lincoln Way West  
Mishawaka, IN 46544**

2024 seminars will be a training series in which we will stage a live crash while teams of attendees will collect the at-scene evidence utilizing various methods and tools. This will include proper evidence collection from each vehicle, photos, video, UAV scene processing, EDR downloads, RTK, 3D scans, and a variety of other techniques. The second seminar will concentrate on properly analyzing the collected evidence to answer questions of how and why based on vehicle dynamics. Participants will calculate speeds based on approved theories and techniques, PDOF, acceleration/decel factors, and laws of motion. Concluding the series in our third seminar will be putting the investigation together in an investigative report with supporting legal documents like search warrants, vehicle/lamp/tire exams, scale diagrams, etc. to present in a mock legal proceeding with a traffic safety prosecutor.

**\$50 for members / \$75 for non-members**

Lunch is on your own

**REGISTER TO ATTEND AT THIS LINK****<https://forms.gle/Ddwrauk7VH8dPLMP7>**

Attendees will be invoiced and provided with a W9 at the end of the training.

For further information contact IACAI President Kip Shuter at [indianalACAI@gmail.com](mailto:indianalACAI@gmail.com)[www.iacai.com](http://www.iacai.com)[www.facebook.com/IndianalACAI](https://www.facebook.com/IndianalACAI)**PLEASE POST AND SHARE WITH OTHER CRASH INVESTIGATORS**

Please post or forward this to your training officer ASAP!