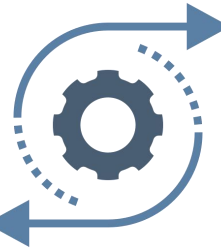# Getting to know DotLas Plus

*A **Transboundary** Product Solution with **A Brand New Concept to the Industry***

1+1>2 is true.

by Jackie Cheung   2025FEB

Hello! My name is DotLas Plus.

I'm also known as GNSS RTK Hybrid Supreme.

When RTK Meets SLAM

① What's DotLas Plus? Why 1+1 > 2?

Look at DotLas Plus...

inbuilt round-plate GNSS antenna
(for satellite signals tracking)

inbuilt GNSS mainboard
(RTK receiver + RTK-based SLAM)

inbuilt RX radio module
(to enable itself as an RTK rover)

smartwatch-like LED screen
(touch screen operation, user friendly)

inbuilt dual-cam facing forward
(5 MP each, for visual SLAM)

laser scanner Livox Mid-360
(SLAM + merged applications)

scanner protective cover
(robot sense, extraterrestrial looking)

inbuilt single-cam facing downward
(2 MP, for AR stake-out)

handgrip battery exclusive
(known as iGrip, compatible to all RobotSLAM)

RTK rover pole connector interface
(screw hole underneath handgrip to install pole)

Getting to Know DotLas Plus

Literally, DotLas is a highly integrated device capable of point (= dot) measurement and laser scanning. That's how this new compound word DotLas came.

When used in RTK mode, it would be working as a rover only because it's too costly to use it as a base station receiver, and it's a big waste of money for the scanner sleeping on the tripod. With both internal radio module and inbuilt 4G telecom module, UHF and NTRIP are possible so that it fits all markets.

When used in SLAM mode, it's just quite similar to other SLAM handhelds for indoor capture. On the other hand, it enjoys much better satellite signals tracking performance compared to other SLAM handheld devices equipped with an external black aviation antenna stick. Moreover, PPK standby is good for further improving point cloud accuracy.

Basically, the merged applications of GNSS and SLAM is the miracle of this deep integration. Without the mix&match, it makes no sense to work with a receiver more than 1.5kg. Then, these merged applications actually empower the GNSS side, as laser scanner is quite a powerful sensor to be integrated.

It's time to explore why 1+1 > 2…

How did **DotLas Plus** come? Why **1+1＞2** ?

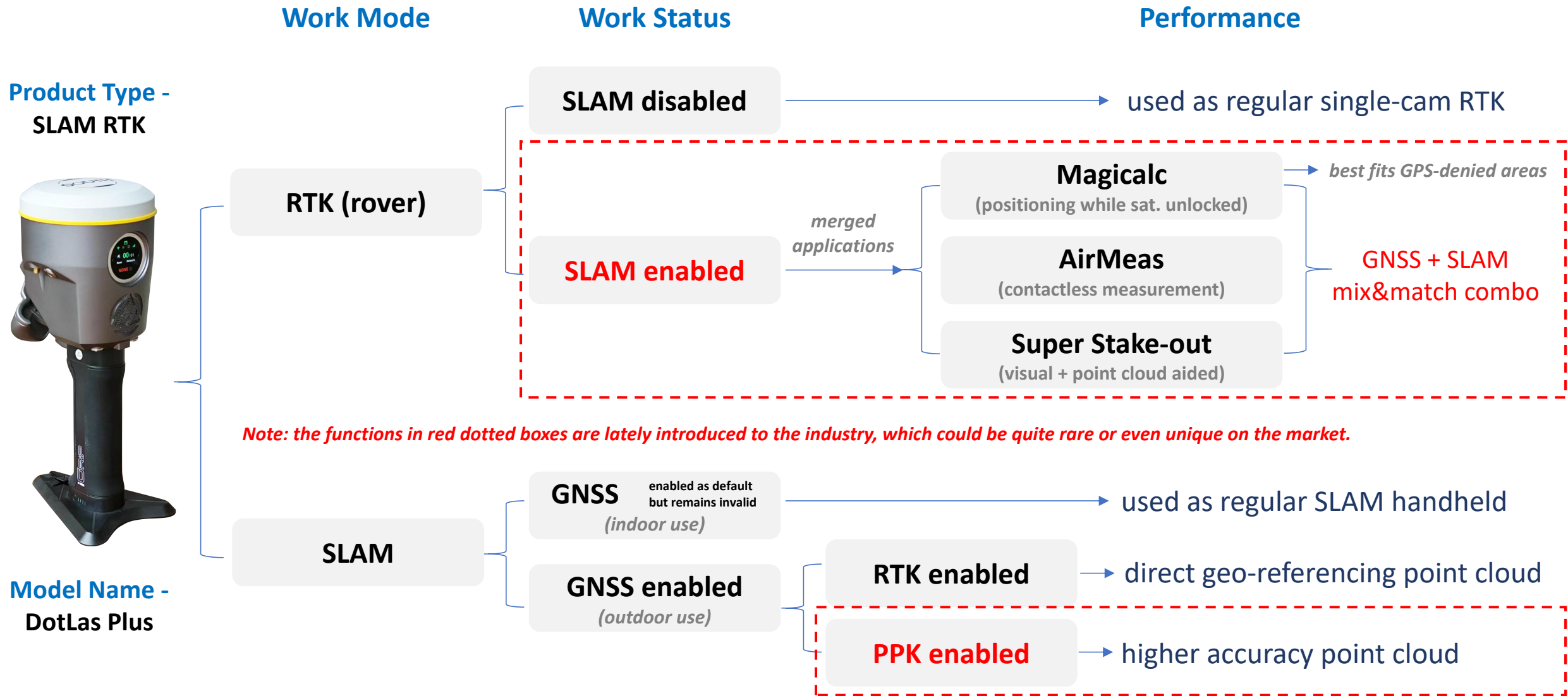**Point or say Dot measurement**

(used as a single-cam GNSS RTK rover)

↓

Plus → **Merged Applications**

(Plus refers to something extra)

↑

SLAM Laser Scanning

(used as a SLAM handheld)

How does **DotLas Plus** work?

Work Mode **Work Status** **Performance**

Product Type -
SLAM RTK

SLAM disabled → used as regular single-cam RTK

RTK (rover)

SLAM enabled *merged applications* → **Magicalc** *(positioning while sat. unlocked)* → *best fits GPS-denied areas*

AirMeas *(contactless measurement)*

Super Stake-out *(visual + point cloud aided)*

GNSS + SLAM mix&match combo

Note: the functions in red dotted boxes are lately introduced to the industry, which could be quite rare or even unique on the market.

GNSS enabled as default but remains invalid *(indoor use)* → used as regular SLAM handheld

SLAM

GNSS enabled *(outdoor use)* → **RTK enabled** → direct geo-referencing point cloud

PPK enabled → higher accuracy point cloud

Model Name -
DotLas Plus

When RTK meets SLAM, it's truly **1+1＞2** from DotLas Plus.
It's an RTK rover, and it can be a SLAM handheld. Still, you may enjoy its distinguished merged applications!

Software for **DotLas Plus**

Fieldwork

- **SurvStar,** to deploy regular modules for RTK use and SLAM module for SLAM & merged applications

SLAM Process

- RobotSLAM Engine

Note: the software SurvStar will be engineered to a decathlon with full gear, instead of GNSS RTK fieldwork only.

DotLas Plus can be primarily working as a GNSS RTK rover...

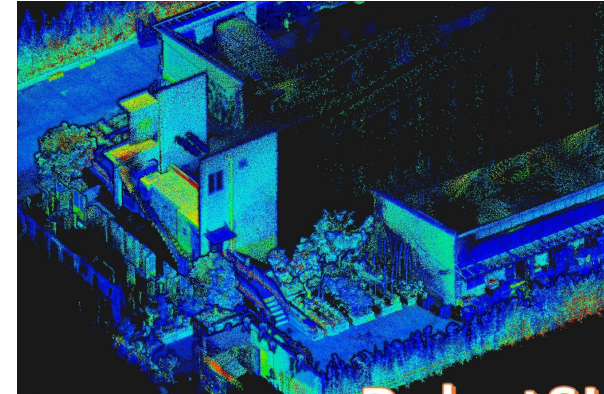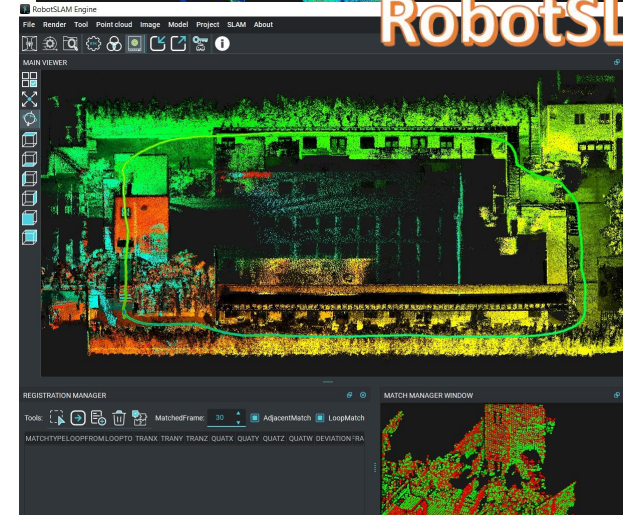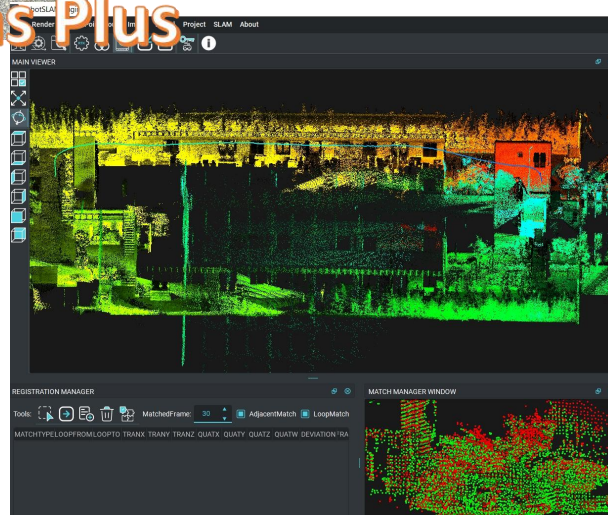**Connect NTRIP or UHF**

Point Survey

Tilt Survey

DotLas Plus can be also working as a SLAM handheld…
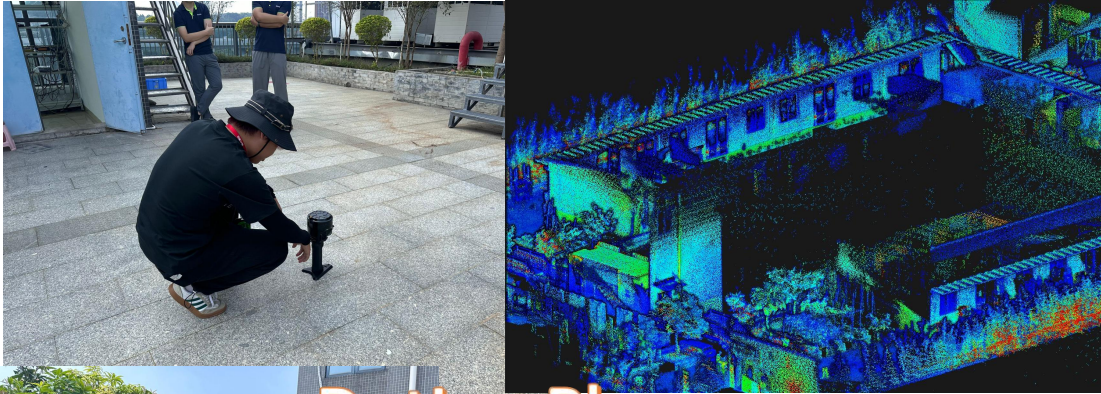

DotLas Plus

RobotSLAM Lite

In terms of SLAM performance, DotLas Plus can do what RobotSLAM Lite (or other model equivalent) does. Still, it's a SLAM handheld equipped with inbuilt GNSS board and round-plate antenna.

DotLas Plus vs RobotSLAM Lite and other similar models...

Model	DotLas Plus	RobotSLAM Lite	Other SLAM handhelds (similar to RobotSLAM Lite)
Laser Scanner Sensor	Livox Mid-360	Livox Mid-360	Livox Mid-360
Scan Range	70m max.	70m max.	70m max.
GNSS Mainboard	✔	✘	Some have, not all
GNSS Antenna	round-plate	✘	black stick typical
RTK Mode	✔	✘	✔
PPK Mode	✔	✘	Only GVI introduced while others don't have
Realtime Point Cloud	✔	✔	✔
Colorized Realtime Point Cloud	✔	✘	✘
Merged Applications	✔	✘	✘

GNSS features the core technology in geo-spatial industry…
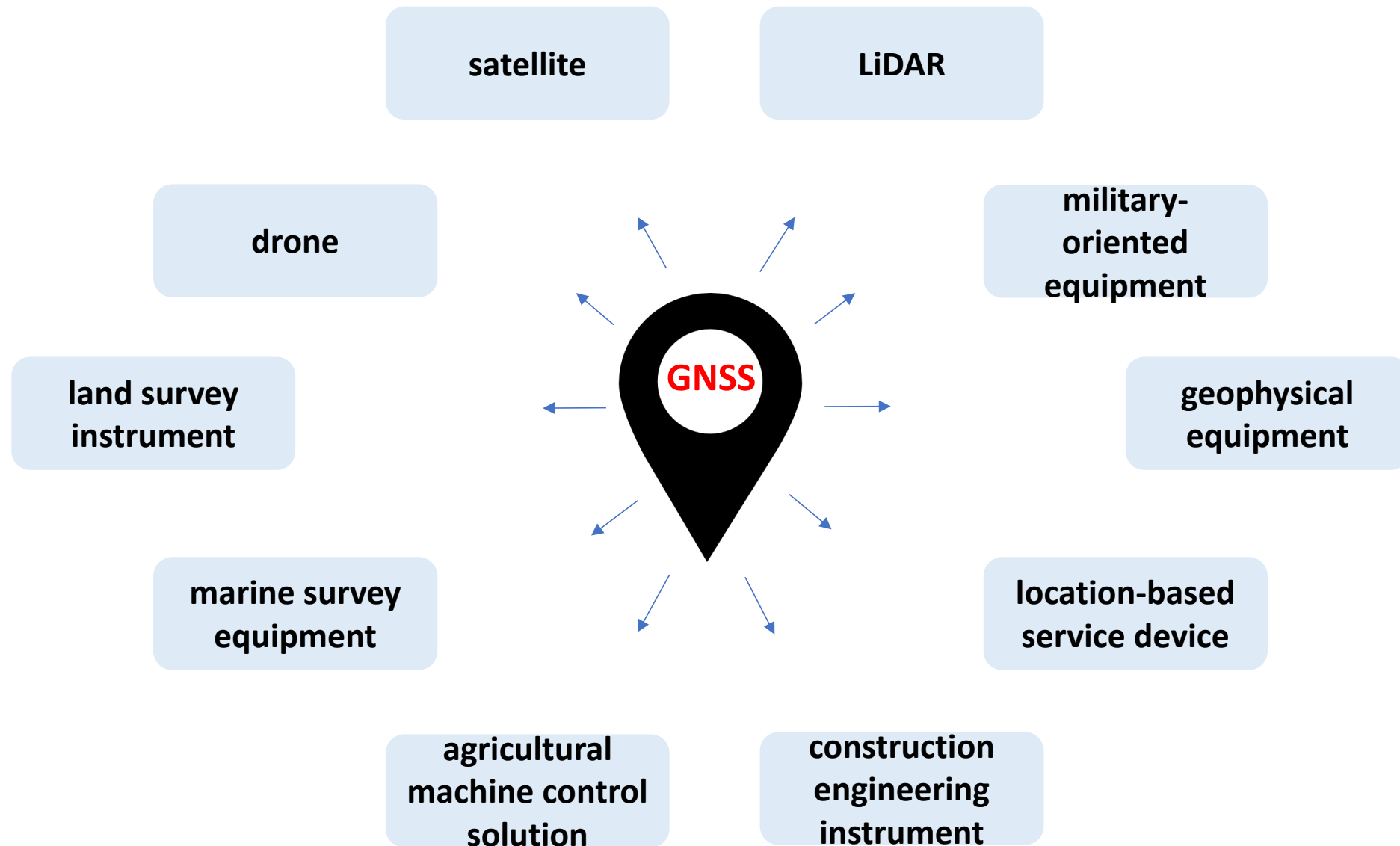
SLAM brings mobile laser scanning from outdoor to indoor…
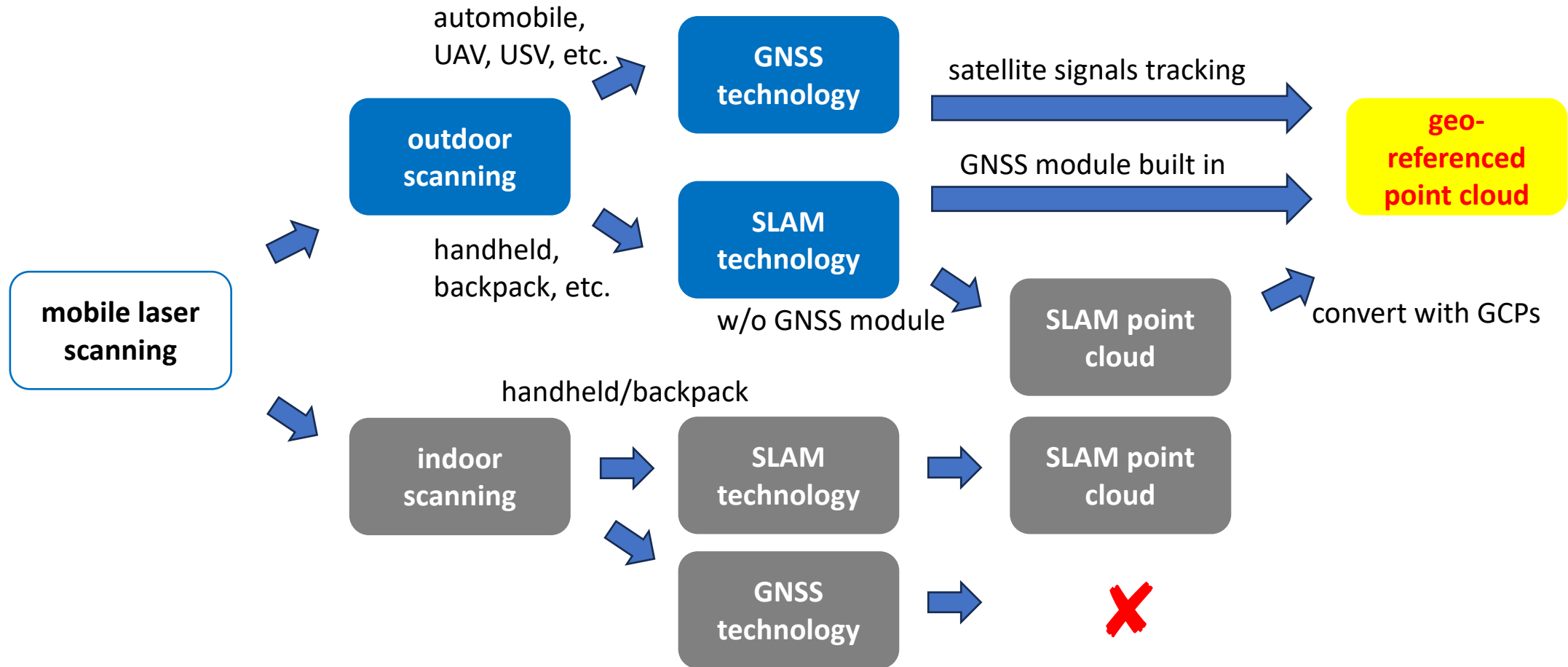
SLAM brings mobile laser scanning from outdoor to indoor, which was not possible in the past due to lack of satellite signals for differential positioning. Now SLAM helps in another way by laser or visual SLAM algorithm.

mobile laser scanning – outdoor applications

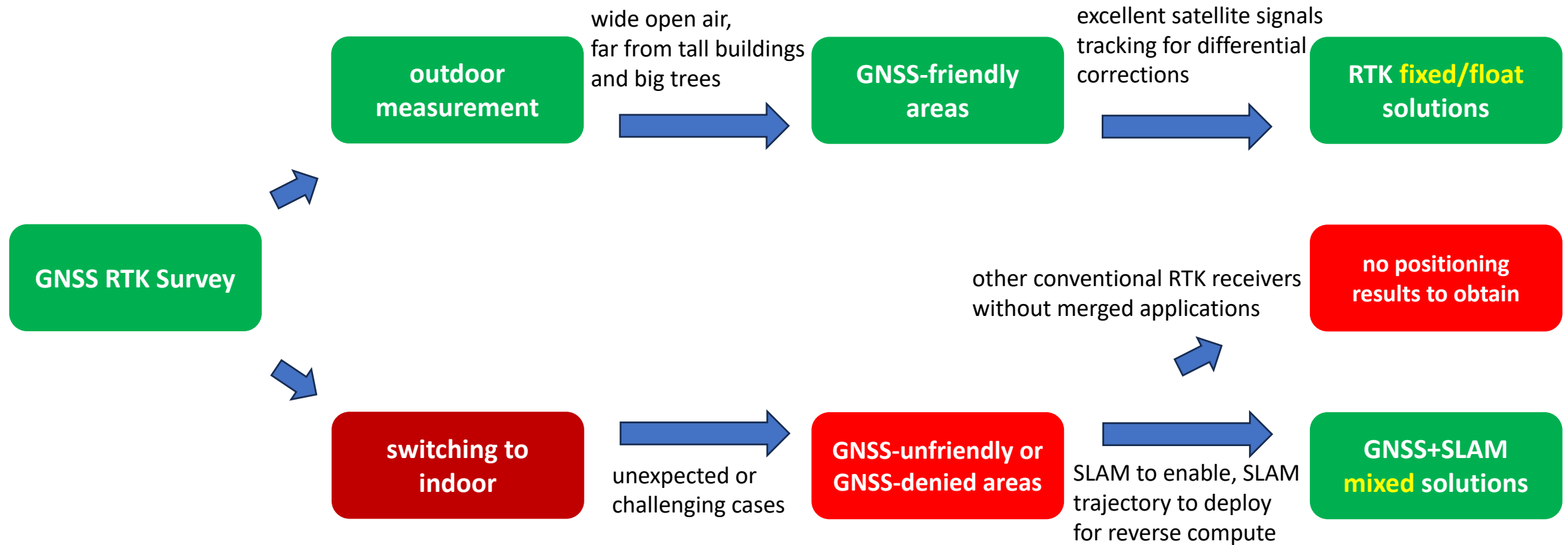# mobile laser scanning – indoor applications

SLAM brings mobile laser scanning from outdoor to indoor, which was not possible in the past due to lack of satellite signals for differential positioning. Now SLAM helps in another way by laser or visual SLAM algorithm.

SLAM brings GNSS positioning from outdoor to indoor…

outdoor measurement

wide open air, far from tall buildings and big trees

GNSS-friendly areas

excellent satellite signals tracking for differential corrections

RTK fixed/float solutions

GNSS RTK Survey

other conventional RTK receivers without merged applications

no positioning results to obtain

switching to indoor

unexpected or challenging cases

GNSS-unfriendly or GNSS-denied areas

SLAM to enable, SLAM trajectory to deploy for reverse compute

GNSS+SLAM mixed solutions

SLAM brings RTK measurement from outdoor to indoor, especially those GNSS-unfriendly or GNSS-denied areas, by enabling SLAM to deploy for reverse computation, from which the newly introduced Mixed Solutions could be available.

GNSS positioning – outdoor – **fixed/float solution**

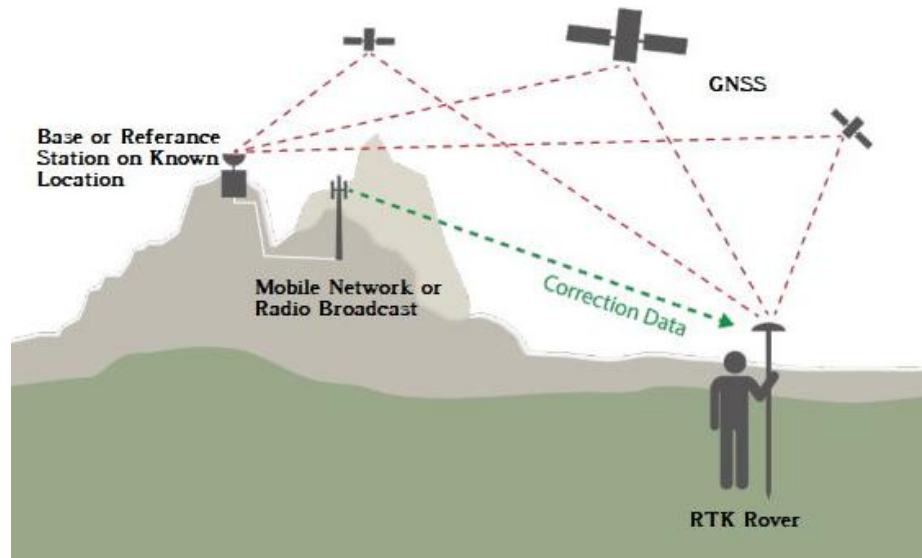**GNSS positioning** – indoor – **mixed solution**

SLAM brings RTK measurement from outdoor to indoor, especially those GNSS-unfriendly or GNSS-denied areas, by enabling SLAM to deploy for reverse computation, from which the newly introduced Mixed Solutions could be available.

GNSS positioning in different environments

Case 2: rover connected to commercial satellite system, working outdoors still

Case 1: rover connected to base or reference station, working outdoors

Case 3: rover working indoors fails to track satellite signals but turns to SLAM

Base or Referance Station on Known Location

Mobile Network or Radio Broadcast

GNSS

Correction Data

RTK Rover

RTK Rover

GNSS-friendly areas

GNSS-friendly areas

GNSS-unfriendly or GNSS-denied areas

PPP (Precise Point Positioning)

RTK Fixed/Float Solution

GNSS+SLAM Mixed Solution

When it's hard or even impossible to track satellite signals, how to proceed with GNSS positioning in GNSS-unfriendly and GNSS-denied areas?

There're some challenges always when doing GNSS RTK survey...
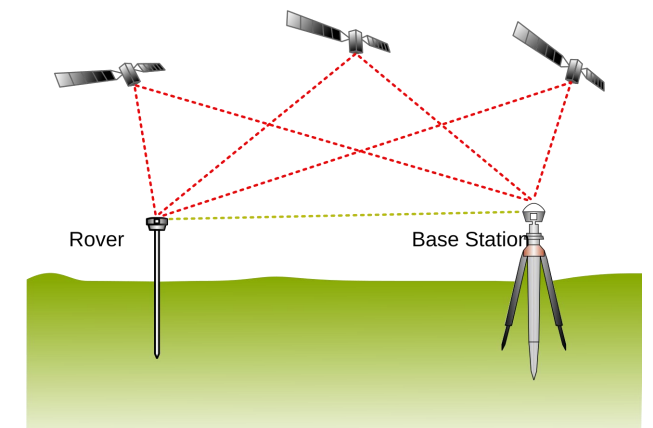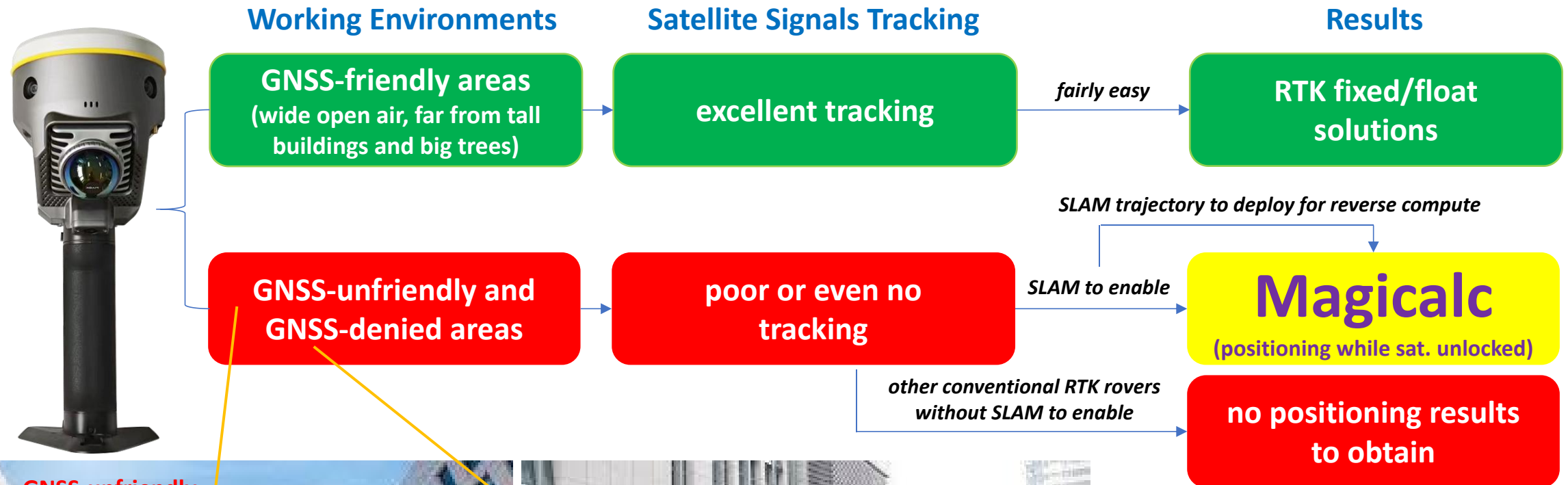
wide open air, without any obstruction

semi-open air, with certain obstructions

easy

hard

Comparably speaking, it's always easier to do GNSS RTK survey in wide open-air environments without any obstruction. However, in practice, it's likely to encounter some challenges, like semi-open-air environments with certain obstructions.

What will happen **when RTK meets SLAM**?

Working Environments

Satellite Signals Tracking

Results

GNSS-friendly areas
(wide open air, far from tall buildings and big trees)

→ **excellent tracking**

fairly easy → **RTK fixed/float solutions**

GNSS-unfriendly and GNSS-denied areas

→ **poor or even no tracking**

SLAM trajectory to deploy for reverse compute

SLAM to enable →

Magicalc
(positioning while sat. unlocked)

other conventional RTK rovers without SLAM to enable →

no positioning results to obtain

GNSS-unfriendly

GNSS-denied

Rover   Base Station

Only the KEY manufacturer(s) might be able to bring out real GNSS + SLAM combo...

Some GNSS manufacturers might not have the R&D team and ready products of SLAM. Without SLAM knowledge, it's hard to bring out mixed solution.

SLAM integration companies find it a big challenge to develop regular GNSS RTK, which could take years of solid foundation.
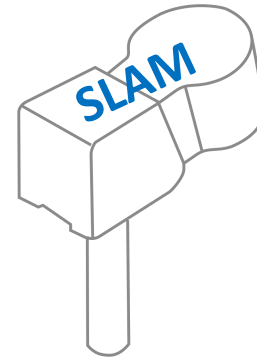
GNSS

SLAM

Only a giant manufacturer could handle these 2 parts easily due to complete facilities in R&D and rich experience in both GNSS and SLAM.

Getting to Know DotLas Plus Mix&Match Combo, merged applications:

1. Magicalc = Magic + calculation (Positioning while Satellites Unlocked)

With DotLas Plus, it's possible to obtain coordinate information in GNSS-unfriendly or even GNSS-denied areas. The SLAM trajectory will help to reverse compute the positional result and continue point measurements when satellites are unlocked. The Magicalc accuracy mainly depends on the unlocked duration, SLAM trajectory distance, and texture details of the new environment.

2. AirMeas = Air Measurement (Contactless Measurement)

Have you heard about iPhone AirDrop? AirMeas is somewhat similar to this principle or saying. For some inaccessible zones, DotLas Plus may help to measure in the way of SLAM data capture within scanning range. Just imagine how to measure the center of the manhole cover on the ground, center of a router device installed overhead, etc. Go to the point in pano image overlaid with colorized point cloud, and you will obtain the coordinate automatically instead of reaching there physically. Theoretically speaking, it's superior to image photogrammetry RTK and laser ranging RTK.

3. Super Stake-out

On the market, AR stake-out has been applied to more and more RTK receiver models. Basically speaking, AR stake-out goes with visual aided methodology. With DotLas Plus, it's still possible to perform stake-out in the way of pano image overlaid with colorized point cloud, which is actually a powerful reverse application of AirMeas.

Getting to Know the DotLas Plus Merged Applications...

Magicalc
(positioning while satellites unlocked)

AirMeas
(contactless measurement)

Super Stake-out
(based on image + point cloud)

Getting to Know Magicalc…

Magicalc = Magic Calculation

In RTK work mode, enable SLAM for the special work status, then it's possible to obtain the positioning results in GNSS-unfriendly or even GNSS-denied areas based on SLAM trajectory reverse computation.
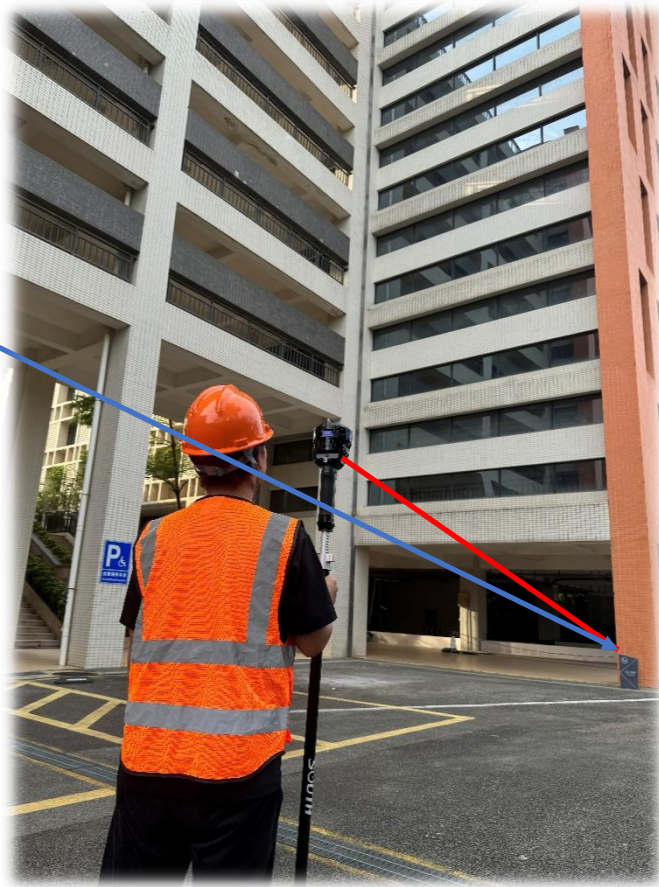
open air outside

indoor, with no satellite locked
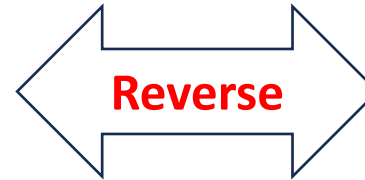
Getting to Know AirMeas and Super Stake-out...

To measure the unknown point that is inaccessible based on image + point cloud

To reach the known point for stake-out with multi-assist based on image + point cloud

What if that location is inaccessible (in some other scenarios)?

Photogrammetry RTK or laser ranging RTK can contactlessly measure that point also, but DotLas Plus may obtain plenty more because it collects millions of point in 3D way.

Reverse

AirMeas
(contactless measurement)

Super Stake-out
(based on image + point cloud)

Let's clarify RTK-based SLAM and SLAM-based RTK (in the English language logic).

SLAM RTK

Defined as SLAM-based RTK receiver

RTK as core, SLAM to supplement

SLAM functions added onto RTK

Used as RTK receiver and SLAM handheld separately

Mix&match to bring out merged applications, 1+1＞2

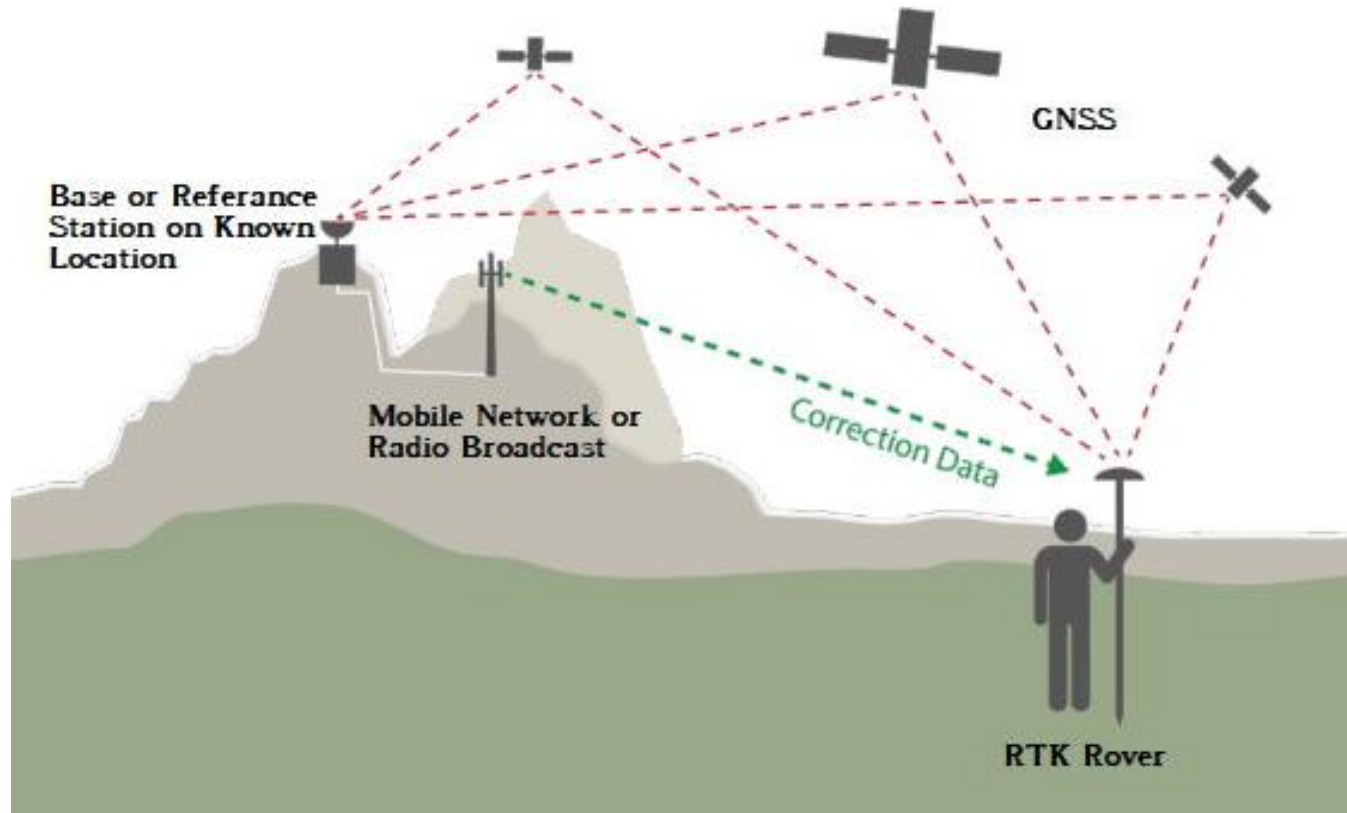## RTK SLAM

Defined as RTK-based SLAM handheld

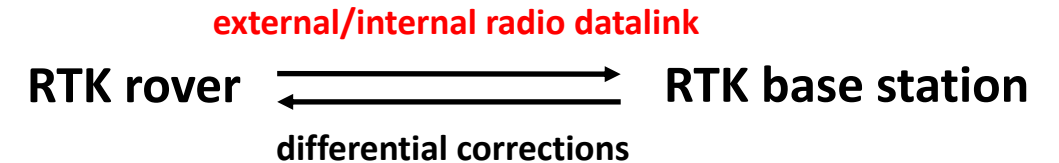**SLAM as core, RTK to supplement**

RTK functions added onto SLAM

Mainly used as SLAM, RTK function extra

SLAM use mainly, somewhat like 1.5 or less than

GNSS RTK positioning

UHF mode:

external/internal radio datalink

RTK rover ⟶ RTK base station
⟵
differential corrections

Ntrip mode:
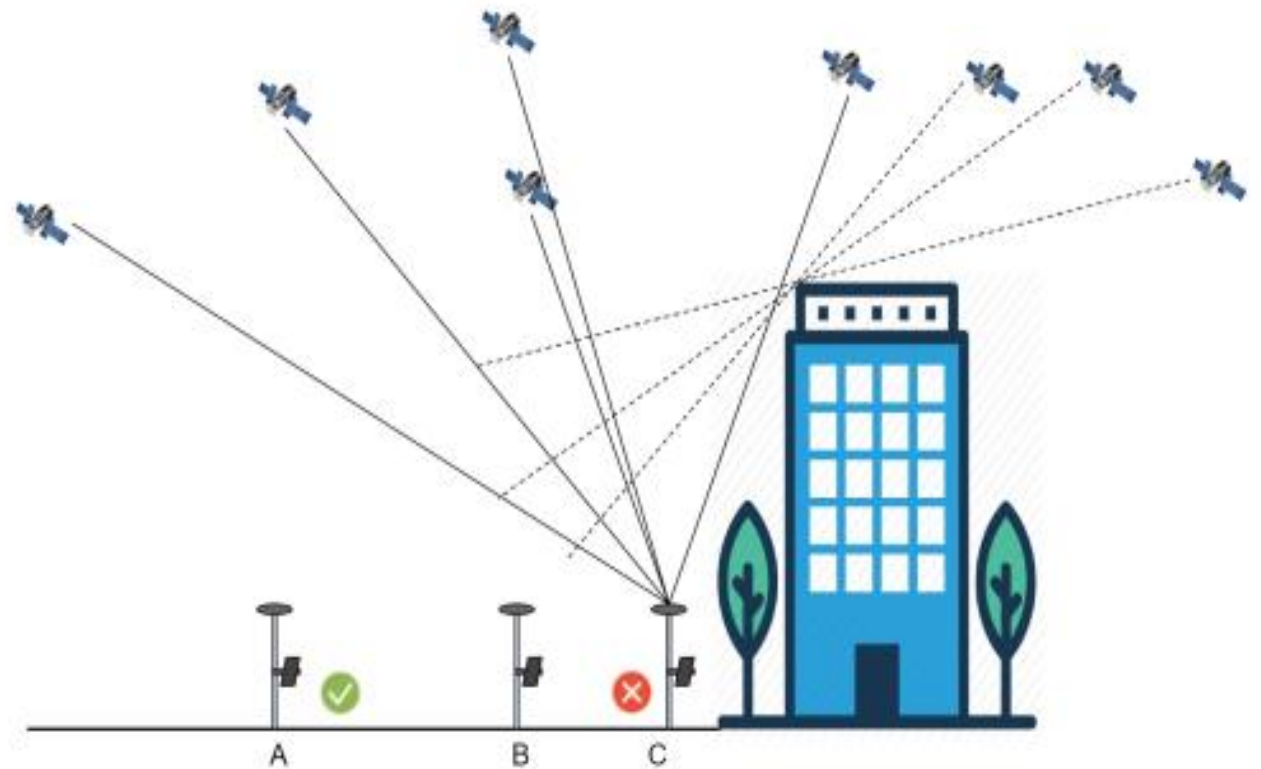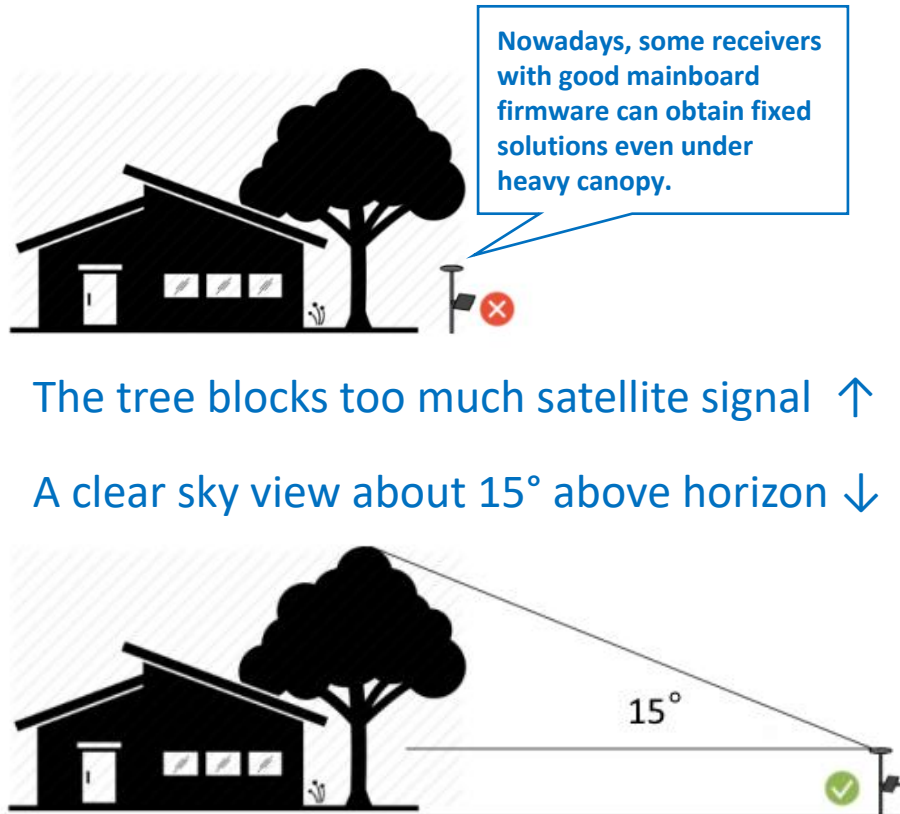
4G telecom

RTK rover ⟶ Sat-Ref CORS
⟵
differential corrections

RTK (Real Time Kinematic) positioning is a satellite navigation technique used to enhance the precision of positional data derived from satellite-based positioning systems, also known as GNSS (Global Navigation Satellite Systems) such as GPS, GLONASS, Galileo, and Beidou.

RTK fixed solution

Nowadays, some receivers with good mainboard firmware can obtain fixed solutions even under heavy canopy.

The tree blocks too much satellite signal ↑

A clear sky view about 15° above horizon ↓

15°

in terms of **BETTER** positioning performance, **A > B > C**

To get a fixed solution, make sure that
1) the RTK rover is placed in good sky-view conditions
2) the RTK rover is not hindered by buildings or trees
3) the RTK rover keeps either stable radio datalink or fast internet connection with the base

About Fixed solution & Mixed Solution

Fixed Solution

means that the GNSS RTK rover and its allocated base station can simultaneously track at least five satellites in common, and then the rover keeps receiving differential corrections from the base station, which is already widely acknowledged in the geospatial community.

RTK
FIXED

Mixed Solution

refers to a reverse computed result scientifically derived from the time synchronization of SLAM trajectory and earlier positional records, which well interprets the Mix&Match Combo. By unlocking the combined power of GNSS+SLAM, it sets out **A Brand New Concept to the Industry** indeed.

GNSS+
SLAM
MIXED

About Fixed solution & Mixed Solution

RTK FIXED

no satellite signals tracking

GNSS positioning - indoor ✗
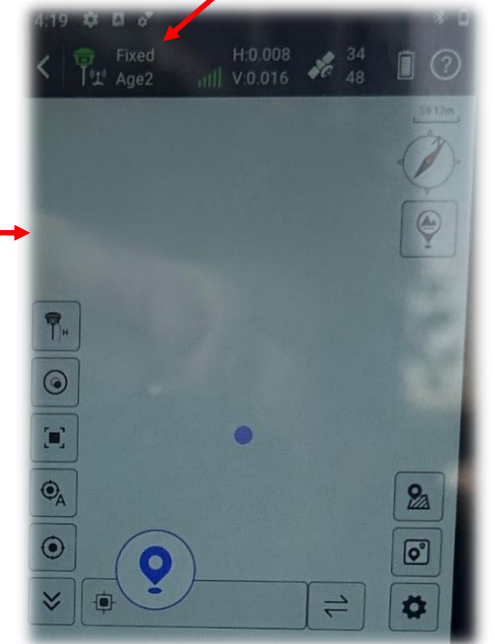
GNSS+ SLAM MIXED

SLAM to enable and deploy

GNSS positioning - indoor ✔

Outdoor Test 1 - Wide Open Area

FIXED

With regular RTK and DotLas Plus, it's fairly easy to get **Fixed** both!
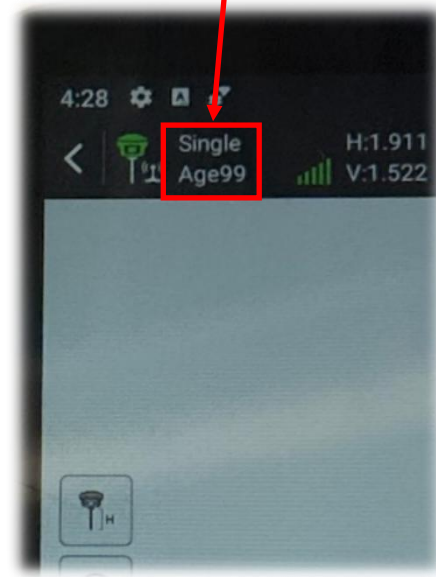
Outdoor Test 2 - GNSS-unfriendly Area

DotLas Plus failed to get **Fixed** but managed to get **Mixed Solution**!

close to overhead architecture, the Golden Egg
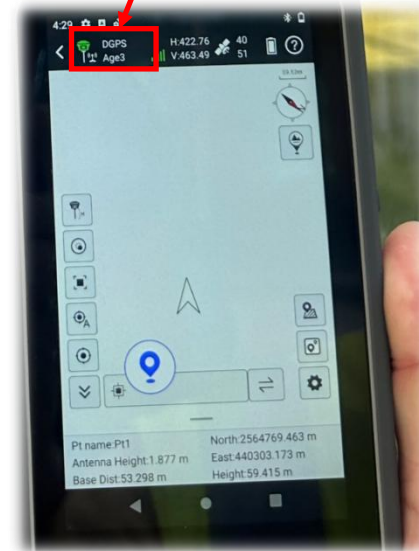
Regular RTK failed to get **Fixed**!
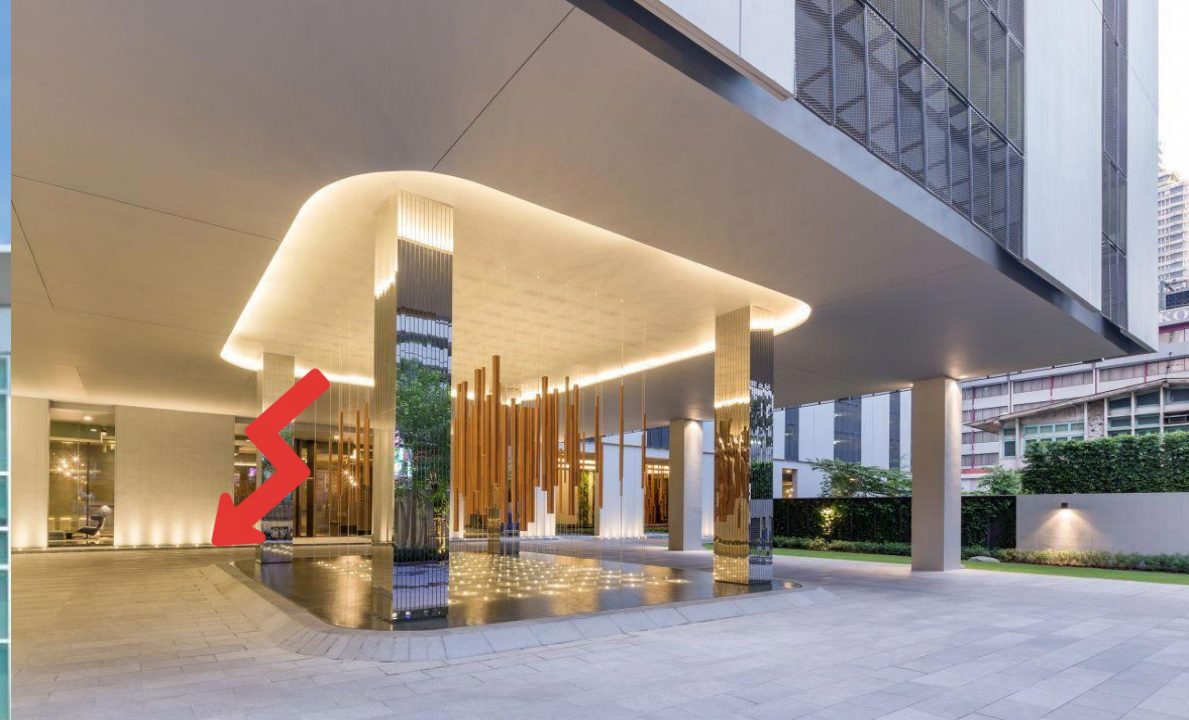
Outdoor Test 3 - GNSS-unfriendly Area

DotLas Plus failed to get **Fixed** but managed to get **Mixed Solution**!

Right under the architecture, the Golden Egg

Regular RTK failed to get **Fixed**!

There could be some challenges with GNSS RTK survey when moving to obstructed areas...

There could be some challenges with GNSS RTK survey when moving to obstructed areas…

7 Architects Create 7 New Community Spaces Beneath a Disused Japanese Overpass

Save

Written by **Tom Dobbins**   Published on May 17, 2018

A +100 meter stretch of land beneath a train overpass in Koganecho, a district of Yokohama, Japan,

Let's see other RTK-based SLAM handheld models on the market...

CHC RS10

Share S10

GVI O1

Feima SLAM2000

Geosun GS-100G

GoSLAM RS100i backpack

XGrids Lixel L2

Only CHC put the round-plate antenna inside. To what extent it's used as an RTK receiver, unknown yet.

All other manufacturers just put a black stick aviation antenna outside, to install externally, and that's for direct geo-referencing purpose only. So all of those are just considered as RTK-based SLAM handheld. However, in terms of satellite signals tracking performance, black stick antenna is not so good as round-plate antenna.

Where Merged Applications might fit...

pipeline network investigation

piping engineering layout

pipeline as-built survey & renovation

Where Merged Applications might fit...

house corner point measurement

flyover as-built survey

Where Merged Applications might fit...

urban street renovation

rural drainage pipeline renovation

Where Merged Applications might fit...

port as-built survey

bridge pier measurement

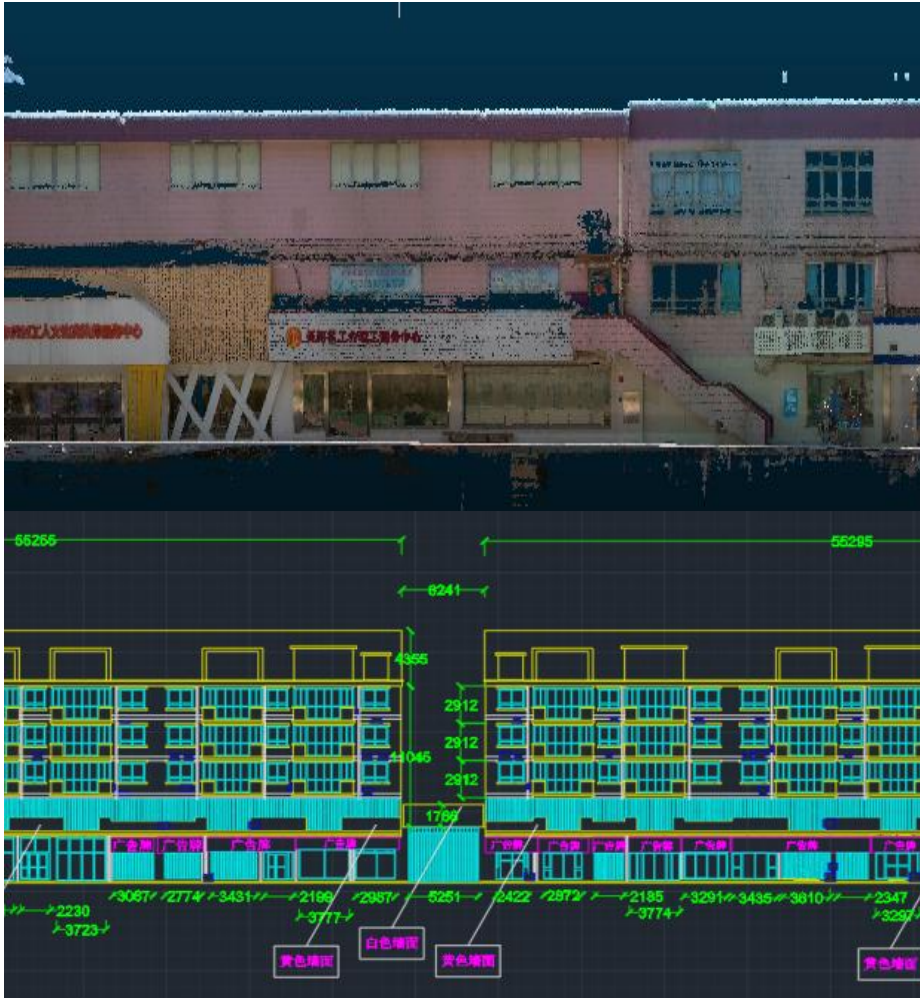# Where Merged Applications might fit...

bank position & water level measurement
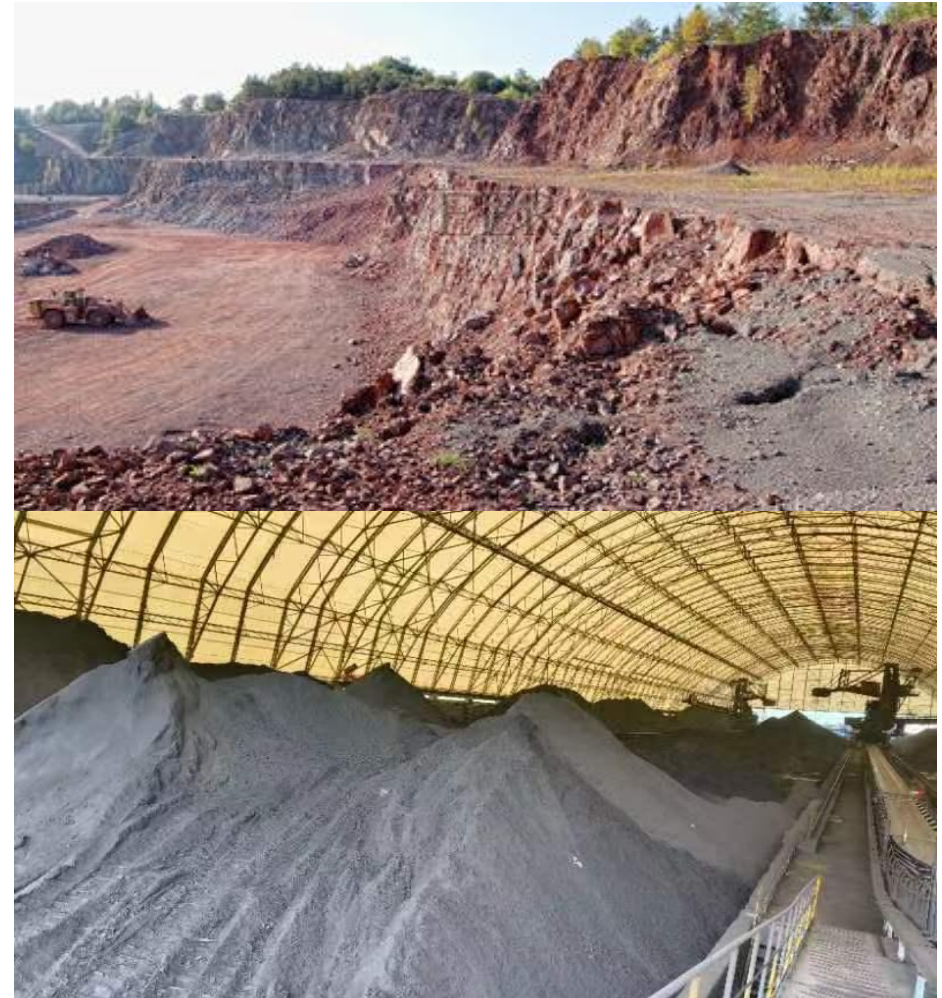
slope maintenance & reinforcement

# Where Merged Applications might fit…

old building renovation

stockpile volume calculation

So far, there's only one similar product available on the market, CHC RS10.

Product		DotLas Plus	RS10
RTK Function	**NTRIP Datalink**	✔	✔
	UHF Datalink	✔ (by internal radio)	✘
	AR Stake-out	✔ (by single-cam)	✘
SLAM Function	Scan Type	fixed scanner	rotary scanner
	Scan Range	max. 70m	max. 120m
	PPK Mode	✔	✘
GNSS + SLAM Merged Application	Positioning while Sat. Unlocked	✔ (known as Magicalc)	✔ (known as SFix)
	Contactless Measurement	✔ (known as AirMeas)	✔ (known as Vi-LiDAR)
	Super Stake-out	✔	✘
Physical	**LED Screen**	✔ (touch operation)	✘
	Net Weight	approx. 1.7 kg	approx. 1.9 kg

When looking into GNSS RTK side,

Product	DotLas Plus	RS10	all other RTK models
RTK functions	✔	✔	✔
SLAM functions	✔	✔	✘
GNSS + SLAM merged applications	✔	✔	✘
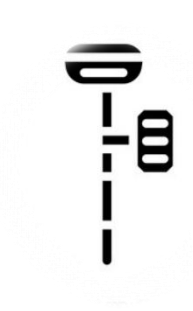
Conclusion: compared with other RTK models, DotLas Plus may work as a SLAM handheld device extra and enjoy GNSS + SLAM merged applications as well.

When looking into SLAM handheld side,

Product	DotLas Plus	RS10	all other SLAM handhelds
RTK built in	✔	✔	Some have, not all.
RTK antenna	Round plate antenna board built in for better satellite signals tracking performance	Round plate antenna board built in for better satellite signals tracking performance	Black aviation antenna stick installed externally, weaker in satellites signal tracking
PPK mode	✔	✘	Only GVI introduced while all the others don't have.
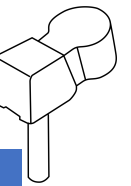
Conclusion: compared with other SLAM handhelds, DotLas Plus enjoys better satellite signals tracking performance due to its inbuilt round plate antenna board. Still, PPK mode could further improve the point cloud accuracy.

How to market DotLas Plus? Just put yourself into the end user's shoes,

Case 1: I wanna buy a new RTK product with latest technology…
- DotLas Plus could be the right choice, coz' it came from 2 existing hottest methodologies in survey industry, GNSS and SLAM.

Case 2: I use RTK more often, but sometimes SLAM is needed…
- DotLas Plus could be the right choice, and you may experience 1+1 > 2 and be impressed by something unexpected and amazing.

Case 3: How can I continue ground measurements while moving from open-air environments to GNSS-unfriendly or even GNSS-denied areas?
- Enable SLAM function in RTK work mode, and you may enjoy Magicalc with DotLas Plus, to achieve positioning while satellites unlocked.

Case 4: With my existing SLAM handheld, though equipped with RTK, I suffered quite much from weak satellite signals tracking coz' it seems that the black aviation antenna stick has limited performance.
- DotLas Plus provides much better satellite signals tracking due to the round plate antenna board built in. Then, you may get RTK fixed more easily while scanning.
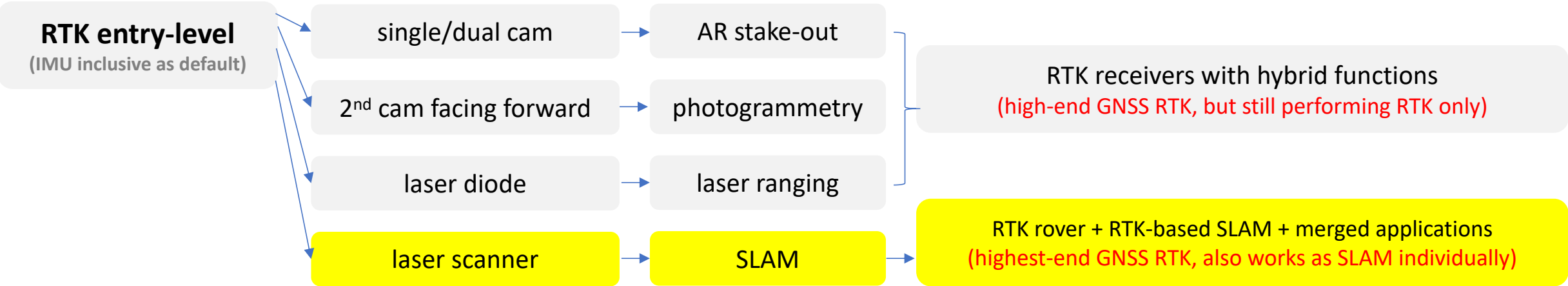
Plenty more…

How to differentiate the GNSS RTK hybrid models on the market?

Grade	Feature	Data Capture	Functionality, Principle & Sensor					
			Tilt Survey	AR Stake-out		Laser Ranging	Visual Positioning	SLAM
			INS	visual-aided		reflectorless	photogrammetry	satellite-independent LiDAR mapping
			IMU module	Single-cam	Dual-cam	Laser Diode	Dual-cam	Laser Scanner
Entry-level	the fundamental	point measurement turning into points, lines, and polygons	✓					
Hybrid Lite 1	single cam		✓	✓				
Hybrid Lite 2	dual cam		✓		✓			
Hybrid	EDM reflectorless		✓		✓	✓		
Hybrid Ultra	visual positioning	3D reality capture	✓		✓		✓	
Hybrid Supreme	SLAM		✓	✓				✓

Everybody says their model is hybrid, so how to tell DotLas Plus from the other so-called hybrid models?

From above, it's inferred that the GNSS RTK receiver integrated with laser scanner (delivering SLAM functions) belongs to Hybrid Supreme grade, the top of all.

RTK entry-level
(IMU inclusive as default)

- single/dual cam → AR stake-out
- 2nd cam facing forward → photogrammetry
- laser diode → laser ranging

RTK receivers with hybrid functions
(high-end GNSS RTK, but still performing RTK only)

- laser scanner → SLAM

RTK rover + RTK-based SLAM + merged applications
(highest-end GNSS RTK, also works as SLAM individually)

Refer to different grades of South GNSS RTK models...

entry-level
model: Galaxy G4 — RTK receiver + IMU → fundamental use → basic model

hybrid lite
model: Insight V2 — RTK receiver + IMU + single-cam → + AR stake-out

hybrid
model: ALPS2 — RTK receiver + IMU + single-cam + laser diode → + AR stake-out + laser ranging

hybrid ultra
model: Inno8 — RTK receiver + IMU + dual-cam → + AR stake-out + photogrammetry

hybrid ultra plus
model: ALPS1 — RTK receiver + IMU + dual-cam + laser diode → + AR stake-out + photogrammetry + laser ranging

All such hybrid models still perform point measurements ONLY!

hybrid supreme
model: DotLas Plus — RTK receiver + IMU + laser scanner → single-cam RTK + SLAM handheld + merged applications → **SUPER hybrid 1+1 > 2**

How do different grades of GNSS RTK work under different conditions?

Grade	leveling needed	work with satellite signals	work without satellite signals	intervisibility needed	visual record	SLAM mode
Entry-level	No	Yes	No	No	No	No
Hybrid Lite 1	No	Yes	No	Yes	No	No
Hybrid Lite 2	No	Yes	No	Yes	No	No
Hybrid	No	Yes	Slightly Yes	Yes	Yes	No
Hybrid Ultra	No	Yes	Slightly Yes	Yes	Yes	No
Hybrid Supreme	No	Yes	Yes	Yes	Yes	Yes

Obviously, GNSS RTK hybrid supreme is the most powerful one, and can perform much more compared to other grades.

Why DotLas Plus?

If you buy a single-cam RTK receiver,
it can be used as an RTK receiver only, not more than that.

If you buy a SLAM handheld device,
it can be used as a SLAM device only, not more than that.

What if you take DotLas Plus?

- GNSS RTK receiver (single-cam rover, NTRIP + UHF) ☑

- SLAM handheld (with inbuilt GNSS mainboard & round-plate antenna) ☑

- Mix&Match combo, merged applications ☑

Publicize more on Truly 1+1 ＞ 2 for outstanding gimmick

In GNSS RTK market

What other brands of single-cam AR stake-out RTK models can do, DotLas Plus can do as well.

In SLAM handheld market

What other brands of SLAM handheld (integrated with scanner sensor Livox mid-360) can do, DotLas Plus can perform even better!

For GNSS+SLAM Merged Applications

DotLas Plus still can bring amazing features while other regular RTK models and SLAM handhelds can NOT!

1 + 1 ＞ 2

GNSS   SLAM   GNSS + SLAM + Merged Applications

FAQs
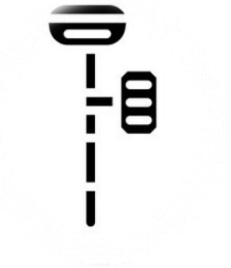
1. Is DotLas Plus an RTK receiver or a SLAM handheld?

A1: It's an RTK receiver and at the same time, it's a SLAM handheld as well. In other words, it's a ground-breaking new product highly integrated with GNSS and SLAM. When used in GNSS mode, it's a rover ready to access via NTRIP and UHF both, a very flexible and multi-functional solution. Then, when used in SLAM mode, it's a powerful handheld laser scanning device with inbuilt round-plate antenna, which fits both indoor and outdoor operations. So, with one unit, you may enjoy GNSS and SLAM both. Additionally, as the 2 existing hottest methodologies are integrated into one device, the merged applications are destined to refresh the mind of the market, like value-added services.

*(please refer to slide #7, How does DotLas Plus work?)*

FAQs
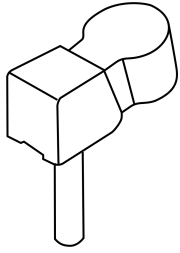
2. What is it like if I compare it with other regular SLAM handheld products on the market?

A2: First thing first, most of the other SLAM handheld equipped with RTK antenna just feature a small black stick antenna, and its satellite signals tracking performance is less satisfactory when compared with round plate antenna. In this case, DotLas Plus shall be better at fixed solutions in no time. More importantly, DotLas Plus can be working as an RTK receiver while those SLAM handheld could not.

(please refer to slide #12 & #46 for more details)

FAQs
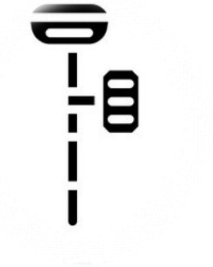
3. How about the positioning accuracy performance when doing measurements in GNSS-unfriendly or even GNSS-denied areas?

A3: Actually Magicalc is the most difficult part in merged applications, as it's a challenge to do RTK measurements in GNSS-unfriendly or even GNSS-denied areas. The SLAM trajectory distance, texture details and unlocked duration are very important to the results. Now, we might control up to 1%, in other words, roughly speaking, 1cm error per 1m movement, or put it further, 10cm error per 10m movement.

(It requires super understanding of both GNSS and SLAM knowledge, and our R&D team keeps working hard to improve it step by step. Please always keep in touch with us for more updates.)

DotLas Plus

Take me, Date me

1+1 > 2 is true.