



TBC Aerial Photogrammetry - Why?

TBC's aerial photogrammetry workflows for surveyors **improve constantly to stay competitive** in the marketplace.

TBC includes not only **third-party UAV support** but goes further to offer **easy advanced data handling** (baseline processing for RTK models, high automatic input data recognition).

TBC focuses on **simple user experience + project setup + processing**

Along with TBC's broad support for different field sensors, industry-leading survey adjustment routines, + robust client deliverable options, offer the most compelling argument for surveyors to **start + stay + finish in TBC** for their aerial surveying projects.

Or **Fly to Finish**

Workflow Improvements

COLLECT



Full third-party support & adding constantly RTK drones for direct baseline processing support



Workflow Improvements

Streamlined setup + quicker speed



PROCESS



Workflow Improvements

CREATE



Higher quality deliverables

Workflow Improvements

Point cloud feature extraction,
CAD tools, + exports



CONSUME

Workflow Improvements

COLLECT



Streamlined setup + quicker speed

CREATE



Point cloud feature extraction,
CAD tools, + exports

Full third-party support & adding
constantly RTK drones for direct
baseline processing support

PROCESS



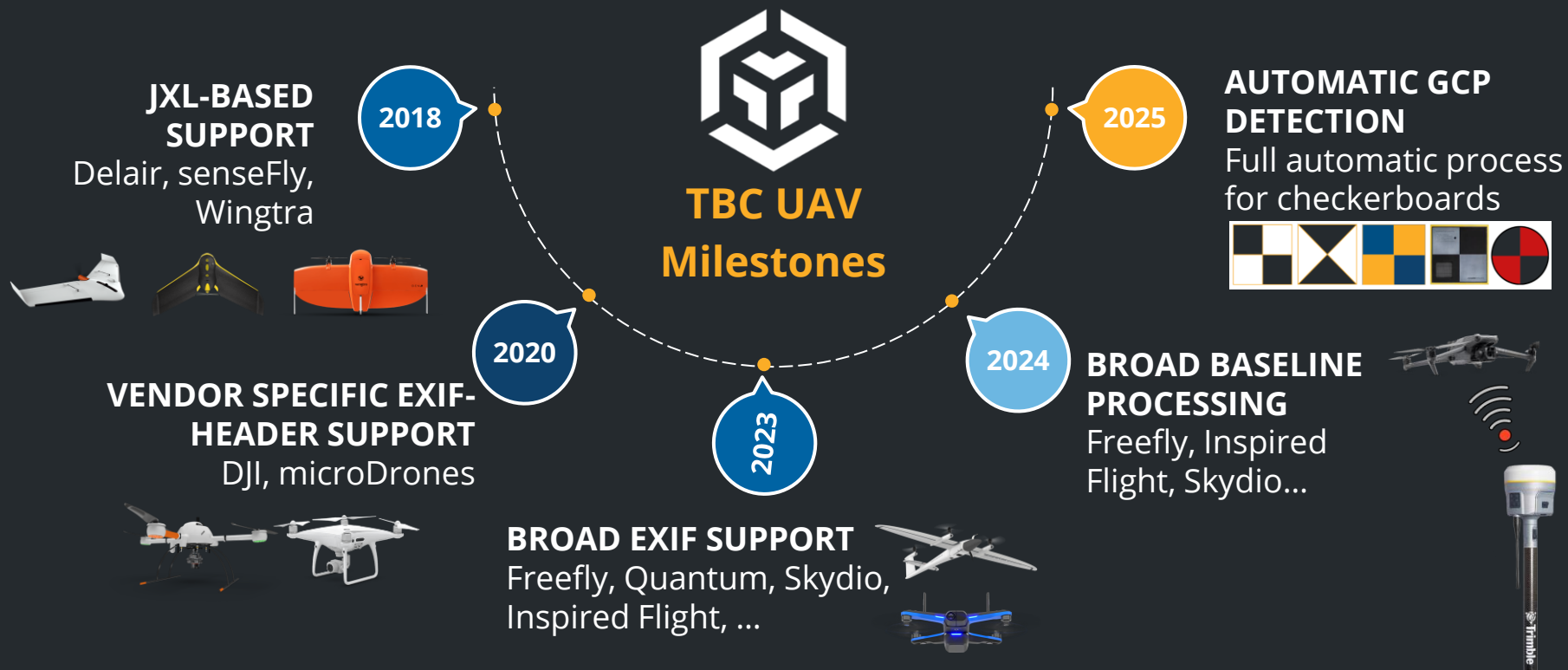
Higher quality deliverables

CONSUME





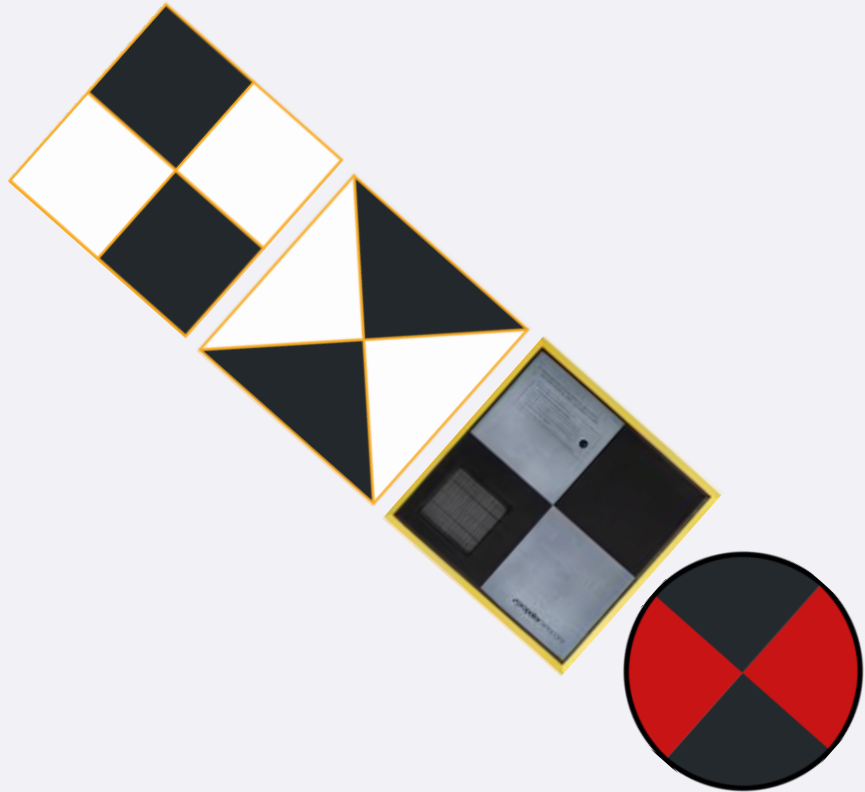
Collect with any UAV today



Automatic Ground Control Target Point Detection

NEW

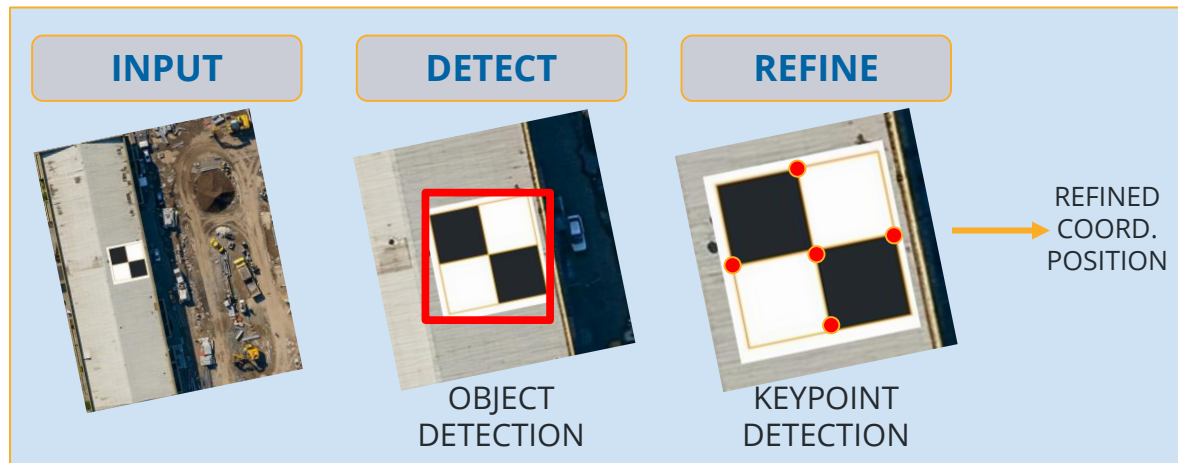
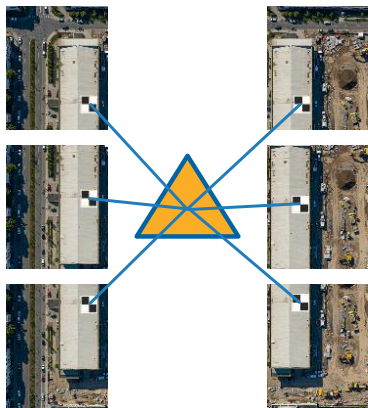
[Data + Video Link](#)



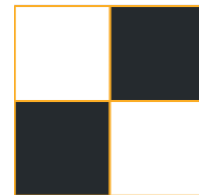
Automatic Ground Control Point Detection



METHOD



SUPPORTED TYPES



WHY

- Reference drone data to surveyed control points in multiple images

HOW

- Place ground control points on known surveyed locations
- Find targets in images

BENEFITS

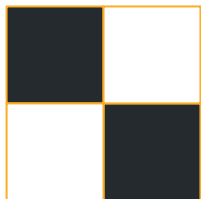
- **Enhanced reliability:** Measuring all GCPs in all images improves photogrammetric adjustment.
- **Increased accuracy:** Automatic matching measures targets more precisely than manual methods.
- **Faster automation:** Automation captures all measurements quickly and automatically.

Object Detection Accuracy

3 Class Model:

VS.

1 Class Model:



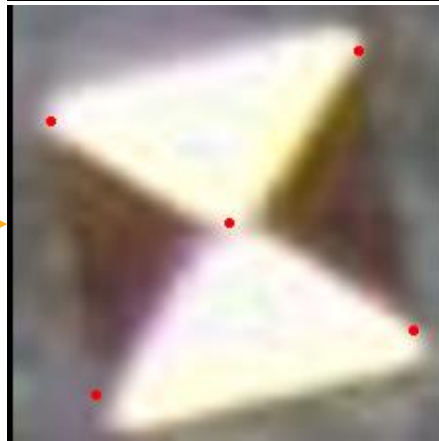
Class Name	Correct	Wrong Class	Missed
Square Targets	249	1	8
Diagonal Targets	90	1	0
Round Targets	19	0	0

Class Name	Correct	Missed
All Targets	360	8

The results are looking good, but statistically we would like to enhance for the future the engine, which would benefit from more diverse training data.

Please contact me thomsa_widmer@trimble.com or ask for access to add training data at the following Google Drive Link:
https://drive.google.com/drive/folders/1vZIRAssJAGMmbKEWModv_6nUmILdaLXG?usp=sharing

HOW



OBJECT DETECTION:

- Results from object detection passed to keypoint detector

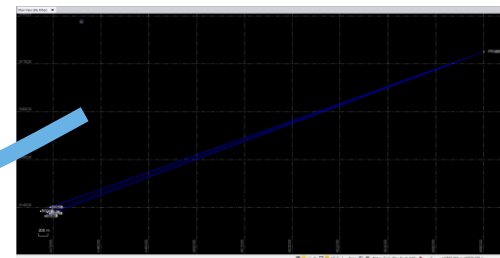
KEYPOINT DETECTION:

- 5 Points produced by keypoint detector representing the center and edge of the target

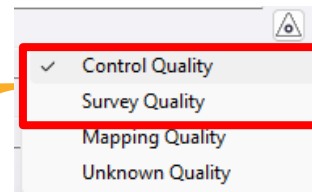
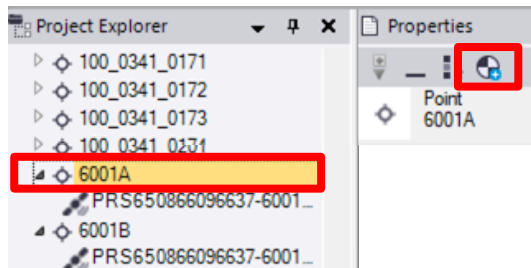
CREATE **NEW**
PROJECT



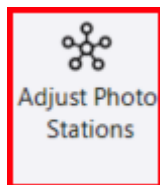
IMPORT PROJECT SETTINGS
GROUND CONTROL
IMAGES
BASE STATION



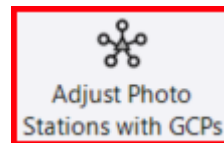
DEFINE QUALITY OF GROUND CONTROL



ADJUST
PHOTO
STATIONS



ADJUST PHOTO
STATIONS WITH
GCPs



SELECT
ADJUST PHOTO STATIONS WITH GCPs

SWITCH THE TAB TO ABSOLUTE ADJUSTMENT

CLICK WITH YOUR MOUSE INTO THE **POINT ID**
FIELD, TO SET THE FOCUS ON IT

CLICK WITH YOUR MOUSE A CONTROL IN THE
PROJECT EXPLORER AND PRESS "+" BUTTON

REPEAT STEP 3 - 5 FOR ALL GCPs

RUN AUTOMATIC TARGET DETECTION

The screenshot shows the 'Adjust Photo Stations with GCPs' application window. It includes a toolbar with icons for file operations, a 'Mission' dropdown menu set to 'UAS Flight Mission', and two tabs: 'Absolute Adjustment' and 'Results'. The 'Absolute Adjustment' tab is active, showing a 'Control Points' section with a 'Point ID' input field and a '+' button. Below this is the 'Project Explorer' panel, which lists several points: 100_0341_0169, 100_0341_0170, 6001A, 6001B, 6002A, 6002B, and 6003A. The point 6003A is highlighted with a yellow background and a dashed border. At the bottom of the window is a large button labeled 'Run automatic target detection'. Numbered callouts (1-6) indicate the sequence of actions: 1 points to the application icon, 2 points to the 'Absolute Adjustment' tab, 3 points to the '+' button, 4 points to the highlighted point 6003A, 5 points to the 'Point ID' field, and 6 points to the 'Run automatic target detection' button.

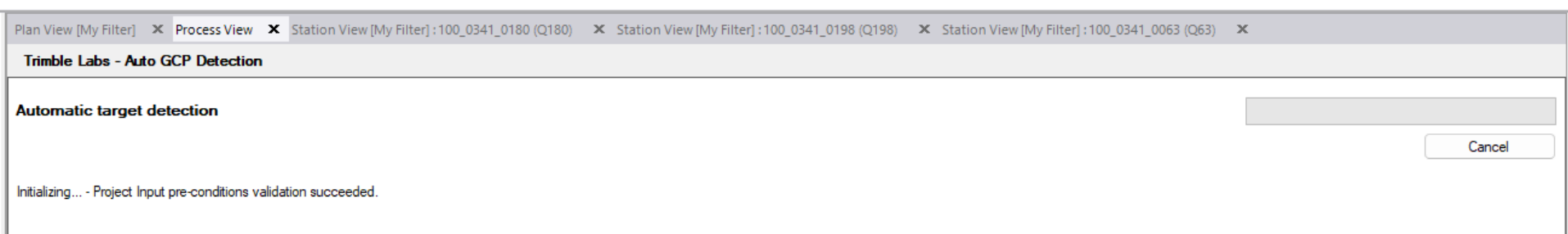
1 Adjust Photo Stations with GCPs

2 Absolute Adjustment Results

3 Point ID: +

4 6003A

5 Run automatic target detection



GCPs CAN **CHANGE STATUS** TO

- DISABLED
- CHECK POINT

Control Points
Point ID:

Point ID	Observations	Quality	Status
6001A	8		Enabled
6002A	29		As check
6003A	11		Enabled
6004A	26		Enabled
6005A	22		Enabled

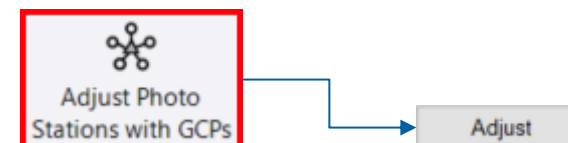
MEASURE MANUALLY POINTS IF NEEDED

100_0341_0034 (Q34)	Enabled	Auto	
100_0341_0035 (Q35)			
100_0341_0033 (Q33)	Enabled	Auto	
100_0341_0016 (Q16)	Enabled	Auto	
100_0341_0021 (Q21)			
100_0341_0036 (Q36)			
100_0341_0032 (Q32)	Enabled	Auto	

DELETE SINGLE MEASUREMENT POSSIBLE WITH PAPER BIN

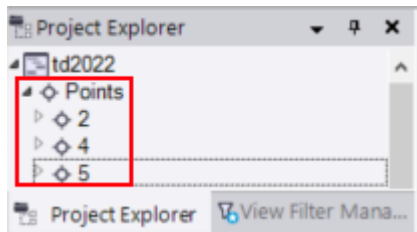
Photo Station ID	Status	
100_0061_0081 (Q81)	Enab...	
100_0061_0082 (Q82)	Enab...	
100_0061_0080 (Q80)	Enab...	
100_0061_0083 (Q83)	Enab...	
100_0061_0047 (Q47)	Enab...	

RUN **ADJUST** WITH GCPs



1

SELECT POINT FROM PROJECT EXPLORER
POINT IS AUTOMATICALLY ADDED TO
POINT ID



3

NAVIGATE WITH MOUSE
WHEEL + RIGHT-MOUSE-
BUTTON CLOSER TO THE
GCP

CLICK THE GCP - A
MAGNIFIER WINDOW
OPENS. **MAKE** YOUR
PRECISE MEASUREMENT
IN THE MAGNIFIER



2

CLICK THE PLUS BUTTON
A NEW STATION VIEW WINDOW
OPENS
READY FOR MEASUREMENT OF THE GCP



4

NEW STATION VIEW WINDOW FOR THE SAME
GCP OPENS READY FOR MEASUREMENT

Point ID	Observations	Quality	Status
2	1		Enabled

REPEAT STEP 3
UNTIL ALL
STATIONS DONE

Photo stations seeing point 2:			
Photo Station ID			Status
100_0061_0016 (Q16)			Enabled
100_0061_0017 (Q17)			

PLACE MOUSE INTO POINT ID WINDOW
REPEAT STEP 1-4 FOR NEXT GCP



Height Shift for RTK Flights

NEW





Height Shift for RTK Flights

WHY

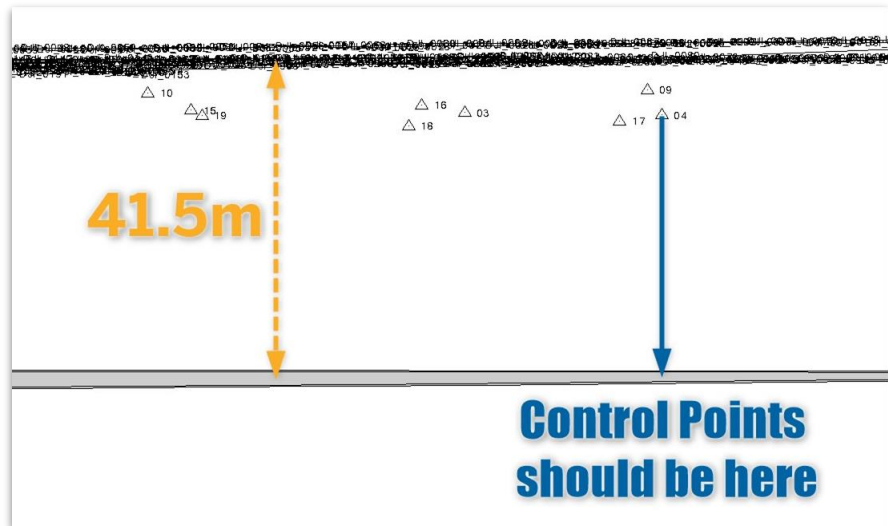
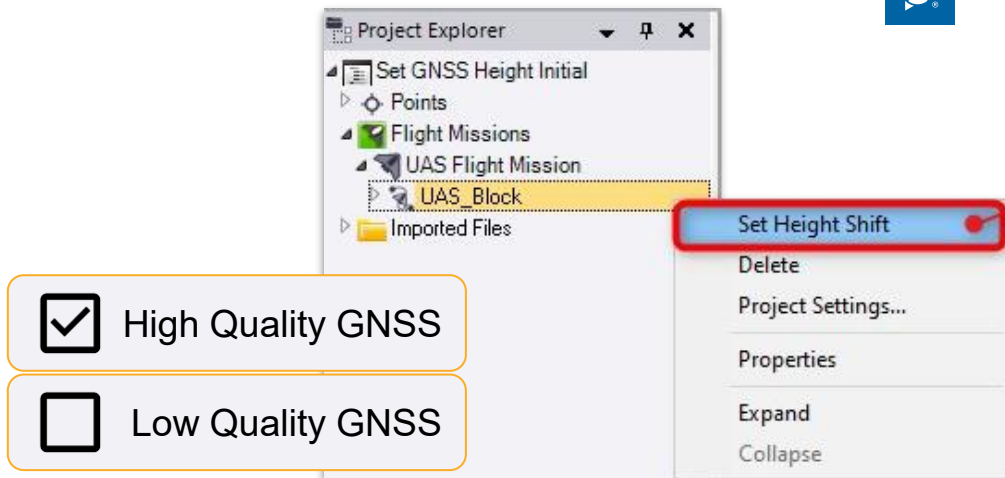
- Some RTK flights need a fix height correction, due to wrong entered antenna height or known missing shift corrections

HOW

- Use "Set Height Shift" from Project Explorer
 - UAS Block Entry

BENEFITS

- Avoid small constant height shifts:** The corrected altitude will allow the user to align GNSS and GCPs positions to achieve higher accuracies in the final deliverables



Support DJI Matrice 4E Baseline Processing

NEW





Support DJI Matrice 4E Baseline Processing

WHY

- Reduce needed number of GCPs for a project

HOW

- Fly RTK
- Record trajectory data
- Optional Recommendation: Use a Trimble Base Station (T02 / T04)

BENEFITS

- **Easy implementation:** Import Images with trajectory data and Drag & Drop your T02 base station into TBC. Go!
- **Increased accuracy:** TBC uses the newest Trimble baseline processing engine for sophisticated results
- **Flexible solutions:** Besides T02/T04, you can use CORS Stations, VRS Now services, and Post RTX service*

Vendor	Drone	Model Name	TBC Version
DJI	Mavic 3	M3E	5.81
DJI	M300 P1	ZenmuseP1	5.80
DJI	Phantom 4 RTK	FC6310R	5.50
DJI	Mavic 3	M3M	2024.1
DJI	M350	L2	2024.1
Skydio	X10	VT300	2024.1
Skydio	X10	V100	2024.1
FreeFly	Astro	ILCE-7RM4A	2024.1
FreeFly	Astro	ILX-LR1	2024.1
DJI	Matrice 4E	M4E	2025.1

*Post RTX only for base station



Broad Baseline Processing

		IMAGE	Offset	Time Stamp	Trajectory	Ephemeriden	BASE	ANTENNA
	UX5	JXL			T02 T04			ANTEX
	DJI	EXIF	XMP	MRK	OBS	NAV	NAV	ANTEX
	FreeFly	EXIF	XMP	TBC XML	<YY>O		NAV	ANTEX
	Inspired Flight	EXIF		TBC XML	<YY>O		YYP, YYN, YYG	ANTEX
	Skydio	EXIF	XMP	XMP				ANTEX
	Wingtra	EXIF	XMP					



What Targets Do You Use?

1

Checkerboard



Bowtie

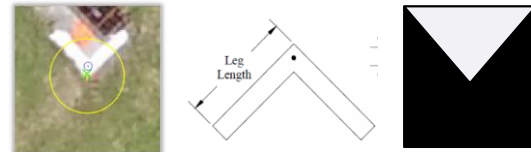
3

Moles



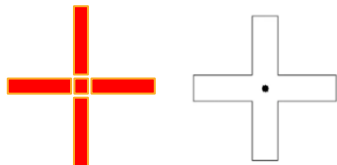
5

Chevrons



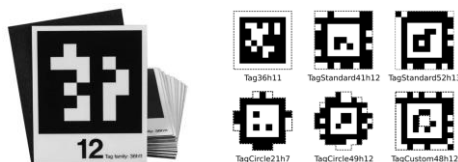
2

Cross-Hair



4

Coded Targets



6

Other

Elimination of moving objects

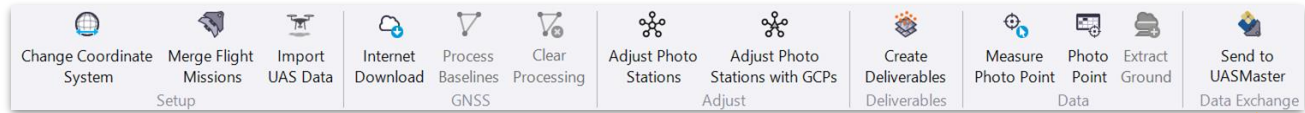
Full automatic elimination of moving objects



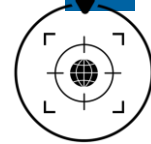
TBC 5.80



Simplified Processing Workflow

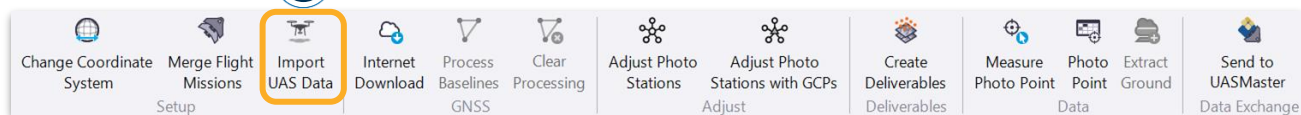


LEFT to RIGHT Approach on Photogrammetry ribbon



Simplified Processing Workflow

1

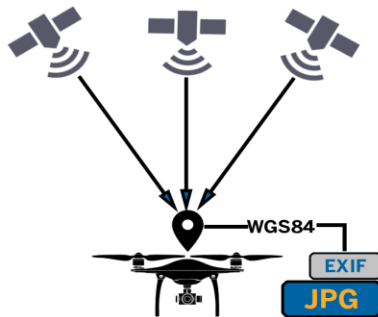


LEFT to RIGHT Approach on Photogrammetry ribbon

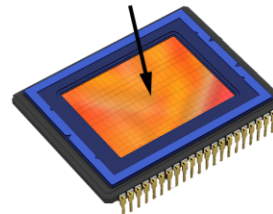
1

IMPORT

Drag + drop your drone data,
GNSS processing optional



Every pixel on frame sensor
created at same time



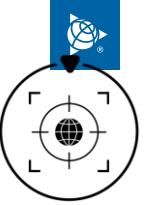
UAS Import Report

Number of sections: 2
[UAS Import Report](#)
[UAS Camera senseFly S.O.D.A.](#)

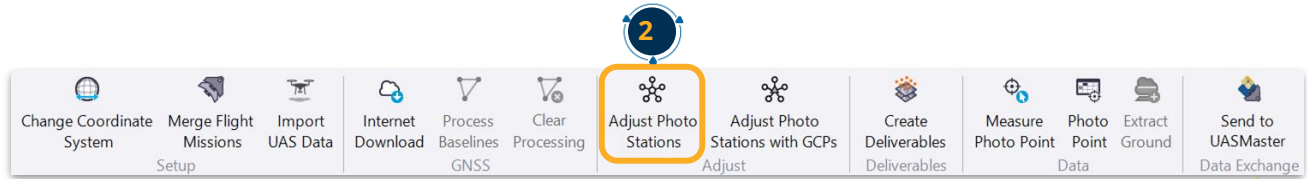
Date imported: 3/28/2023 12:46:20 PM

Statistics	
Images found:	138
Images with EXIF:	138
Images with XMP:	138
Images with RTK:	138
Distinct cameras:	1
Minimum RTK Quality [RtkFlag]:	16
Average lat error [RtkStdLat]:	0.038
Average lon error [RtkStdLon]:	0.038
Average elevation error [RtkStdHgt]:	0.052
Average altitude [RelativeAltitude]:	-
Used camera:	senseFly S.O.D.A.
Used pixel size [um]:	2.410
Used focal length [mm]:	10.600
Used relative altitude:	150.0000 m

No .T0x file was found in the import directory.



Simplified Processing Workflow

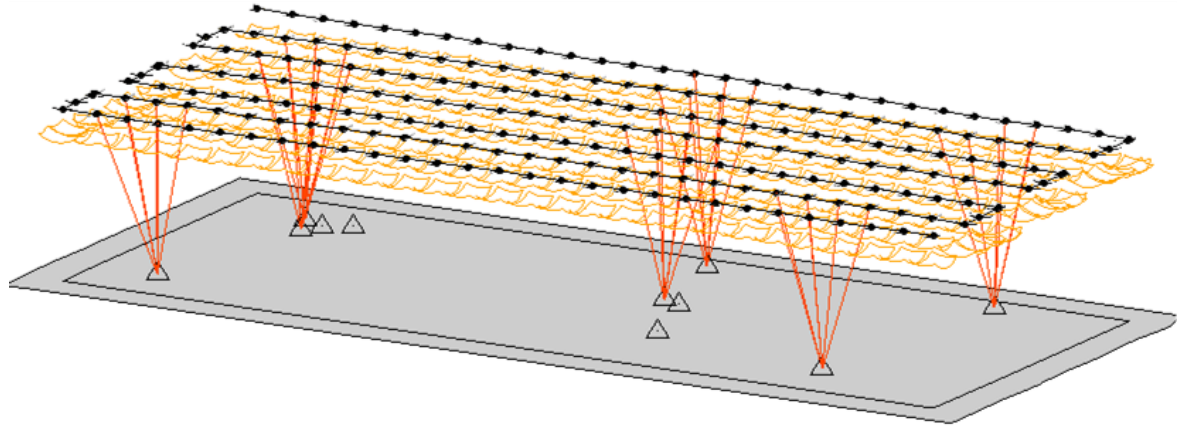


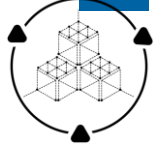
LEFT to RIGHT Approach on Photogrammetry ribbon



PHOTO ADJUSTMENT

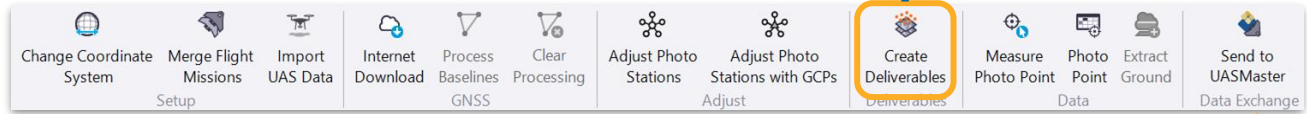
Highest accuracy in image matching and precision



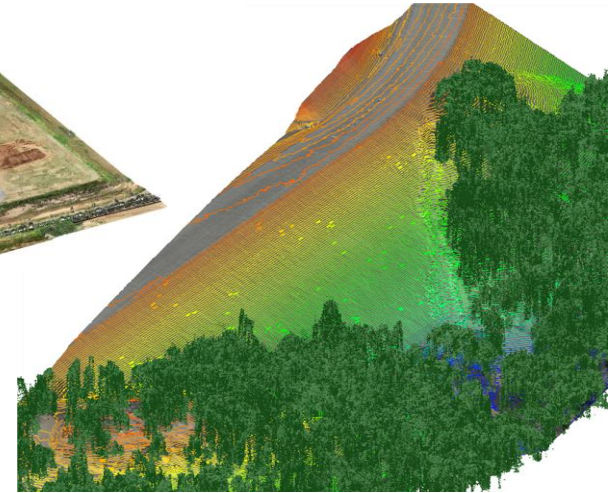


Simplified Processing Workflow

3



LEFT to RIGHT Approach on Photogrammetry ribbon



DELIVERABLES

Highest quality true-orthophoto
in challenging conditions