

Testing Elios 3's spot thickness measurements' accuracy vs. manual devices

In partnership with Arnaud Pollien, Certified UT Level 3 Technical Manager at Quality Control NDT S.A



Flyability partnered with Arnaud Pollien, a Certified UT Level 3 Technical Manager at Quality Control NDT S.A., to conduct a study on the precision of the measurements done by the Elios 3 UT payload compared to manual testing with a high-resolution hand gauge. The results demonstrate that the differences between both devices are well within industry-accepted tolerances (<< 0.1mm in the thickness range of 2-20mm), indicating that the Elios 3 UT easily qualifies as a measurement tool to perform UT spot measurements.

Overview

Since its release in 2022, the Elios 3 has become a key instrument in the inspector toolbox for performing close-up visual inspections and surveys in hard-to-reach spaces. With more stringent inspection requirements and growing needs for better and more efficient data capture, sectors like oil and gas, maritime, power generation and mining are turning to the Elios 3 to conduct safer, faster and cheaper inspections, challenging traditional methods.

With the introduction of the UT Payload, the Elios 3 is now capable of taking UT spot measurements in confined spaces and at height.

This report details the results of testing the new payload's accuracy in comparison with the most commonly used ultrasonic spot measurement method: manual gauging. It will demonstrate that the Elios 3 UT Payload has similar accuracy to the manual device, even with variations in the thickness and coating of the targets. This positions the Elios 3 as a true alternative to traditional methods for more efficient inspections, with no compromise on accuracy.



Introducing Arnaud Pollien NDT level 3 testing specialist

Arnaud Pollien, a Certified UT Level 3 inspector with over 20 years of experience in ultrasonic testing, works for Quality Control NDT, specializing in ultrasonics. He conducts non-destructive testing in both laboratory and client settings, ensuring equipment integrity across industries like oil and gas, chemical, aerospace, and theme park rides. He holds a certification from the American Society for Non-Destructive Testing (certificate number 193588).



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"The partnership with Flyability started well before the idea of comparative testing emerged. It originated from a mission conducted in an old water tank, which stood 15 meters high and had restricted access. Observing the Elios 3 UT collect dozens of measurements at height within minutes, while mapping its surroundings, was really impressive. It showed some clear safety advantages, eliminating the need for rope access or scaffolding."

Arnaud Pollien

NDT Level 3 Testing Specialist at Quality Control NDT S.A



Test setting

Arnaud was invited to Flyability's testing facilities in Paudex, Switzerland to conduct a series of manual measurements on targeted points. Meanwhile, Clément Vincent, Mechanical Design Engineer for the UT Payload at Flyability, performed measurements on the same targeted points flying the Elios 3 UT drone. Both results were then compared.

01. Targets

To comprehensively evaluate the payload's capabilities, we tested four targets, each measuring 15×15 centimetres and featuring both coated and non-coated sections. Steel plates were selected for analysis because of their widespread use across different industrial assets. The thickness of the plates varied: one was 1.99 mm, the second 3.70 mm, the third 7.63 mm, and the fourth 20.12 mm.



02. Testing devices

Olympus EPOCH 650

For manual testing, Arnaud Pollien used an Olympus EPOCH 650 equipped with the Olympus M208-RM 20MHz probe. The choice of this device was driven by its ability to provide highly accurate measurements.



Elios 3 UT Payload

On the other side, Clément conducted the measurements while flying the Elios 3 drone (Serial Number: E300SA22440030) equipped with the UT Payload. This payload, developed in collaboration with Cygnus Instruments, features twin crystal piezo-composite transducers, ideal for assessing heavily corroded metals, and the M1-OEM-CP323 Ultrasonic Thickness Gauge (UTG) board. It offers two measuring modes, Echo-Echo mode, or Single-Echo, adaptable based on surface coatings. For this test, the Cygnus T5B-CSL 5MHz (Serial ID: BP0001C) probe was chosen for its versatility in measuring targets B, C, and D. Then, the Cygnus T7A-CSWB 7.5MHz (Serial ID: BS0009C) probe was used to measure the thinnest plate (target A, 1.99 mm) and targets B and C.



03. Scanning methods

Measurements were conducted using the echo-to-echo method. This approach was chosen for its repeatability and accuracy, especially when measuring through coatings. Both devices were calibrated using a certified step wedge.



Test results

In total 8 points were measured. The results came back as follows:

		Olympus EPOCH 650		Elios 3 UT Payload		
Reference target	Actual target thickness*	Result	Deviation	Result	Deviation	
A with coating	1.99	1.98	-0.01	1.99	0.00	
A without coating		1.98	-0.01	1.98	-0.01	
B with coating	3.70	3.69	-0.01	3.77	0.07	
B without coating		3.69	-0.01	3.69	-0.01	
C with coating	7.66	7.70	0.04	7.70	0.04	
Reference target		7.70	0.04	7.67	0.01	
C without coating	20.12	20.12	0	20.05	-0.07	
D without coating		20.17	0.5	20.05	-0.07	

*Measurements taken using a caliper

Explanation of the results

The Elios 3 UT measurements results align closely with those obtained manually. They showed a maximum deviation of 0.07 mm, well within the industry standard tolerance of less than 0.1 mm for thicknesses ranging from 2 to 20 mm.

Conclusion

When taking spot measurements, the study confirmed that the Elios 3's UT Payload performance is comparable with a manual gauge and easily meets the industry standard requirements. These results emphasize the Elios 3's suitability as a dependable tool for UT spot measurements across various industries, providing a safer, quicker, and more efficient alternative to traditional methods. As industries impose stricter inspection standards, the Elios 3 proves itself as a valuable asset for conducting inspections without compromising on accuracy.



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"Live A-scans from the Elios 3 UT are stable, and peaks on waveforms can be easily identified through a clean and simplistic interface on the drone's Cockpit app. The Elios 3 UT successfully integrates the Cygnus probe and easily qualifies as a robust measurement tool."

Arnaud Pollien

UT certified level 3 Technical manager at Quality Control NDT S.A

N.D.T. SA	Route de l'Industrie 32 CH-1072 Forel (Lavaux) Tel.: +41(0)21 781 08 78 Fax: +41(0)21 781 08 79 info@qualitycontrol.ch www.qualitycontrol.ch	Measurement report (UT thickness measurement)			Report N° Rapport N° Affair N° Affaire N° Page	11851 24-030119 1 / 1
Customer: Client:	FLY	ABILITY SA	Material: Matière	steel (S355)		
Order N°:	Email S. Zampieri		Certificate N°:	N/A		
Part/Drawing N°:	thick	ness targets	Applicable specifications:	ASTM E797 rev. 2021		
Nb parts in lot:		4	Technique N°:	TP-UT-10116		3
Extent of inspect: Etendue contrôle:	spot n	neasurements	Acceptance Criteria Critères d'acceptation		N/A	

Goals, apparatus, samples and operating method:

Results:

Local thickness measurements have been conducted on 4 steel plates having known, regular, thicknesses. The plates had a smooth surface, locally covered with a paint of unknown composition. Plate A had a thickness of 1.99mm, plate B 3.70mm, plate C 7.66mm and plate D 20.12mm.

A calibrated UT generator (Olympus Epoch 650 with 20MHz probe M208-RM) was used to get reference UT thickness measurements.

The goal was to compare the results with the UT payload of an inspection drone (Elios 3, S/N E300SA22440030 with Cygnus UT payload). The drone was using a Cygnus T5B-CSL probe, except for the thinnest plate, where a Cygnus T7A-CSWB probe was used. The measurements were taken at the same position on the known thickness plates.



Figure 1: plates with known thicknesses used for comparison between a

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	Actual target thickness*	Olympus EPOCH 650		Elios 3 UT Payload	
Reference target		Result	Deviation	Result	Deviation
A with coating	1.99	1.98	-0.01	1.99	0.00
A without coating		1.98	-0.01	1.98	-0.01
B with coating	3.70	3.69	-0.01	3.77	0.07
B without coating		3.69	-0.01	3.69	-0.01
C with coating	7.66	7.70	0.04	7.70	0.04
Reference target		7.70	0.04	7.67	0.01
C without coating	20.12	20.12	0	20.05	-0.07
D without coating		20.17	0.5	20.05	-0.07

IVIC	easurements taken u	sing a caliper			
*1=conform to specifications 2=conforme after reparations 3=non-conform - rejected	Name	Level	Date	Visa	Observations
Inspector	A. Pollien	3	04.03.2024	All	
Approval L III	A. Pollien	3	05.03.2024	1.60	2
Customer					



Prepared in partnership with Quality Control NDT S.A.





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