




XXV FIG Congress  
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**ASSESSING THE QUALITY OF AN UAV-BASED ORTHOMOSAIC AND SURFACE MODEL OF A BREAKWATER**

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 SINFIC

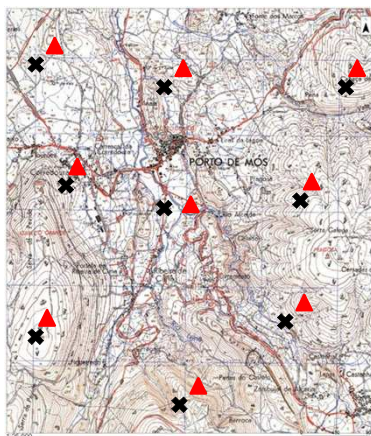
## Test if a map is suitable

by comparing the positions of points with corresponding positions determined with a higher accuracy

- **United States.** Scale 1/5000: no more than 10% of the points tested shall have an error larger than 1.25m
- **Portugal.** Scale 1/5000: no more than 1% of the points tested shall have an error larger than 0.35m



## Test if a map is suitable



- Accuracy
- Precision



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## The paper

- INTRODUCTION
- THE BREAKWATER OF ERICEIRA
- THE UAV FLIGHT
- DATA PROCESSING
- STATISTICS TO TEST THE DIFFERENCES OF COORDINATES
- RESULTS OF APPLYING THE TESTS ON THE DATA
- CONCLUSIONS



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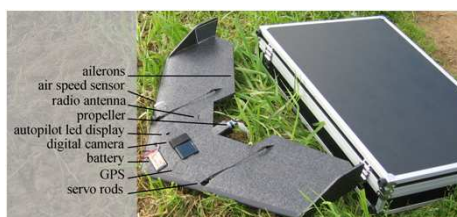
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## The breakwater of Ericeira



## The UAV (flight)



SenseFly Swinglet CAM + Canon IXUS 220 HS

## The UAV flight

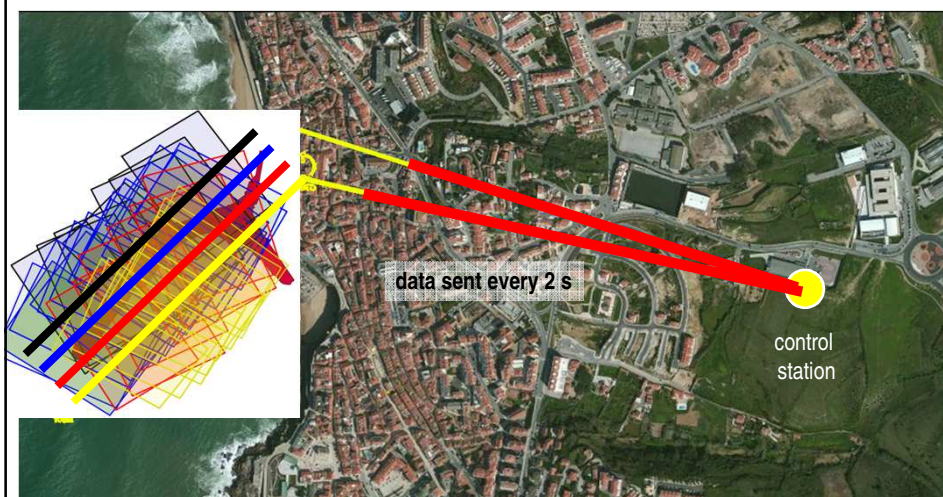


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## The UAV flight



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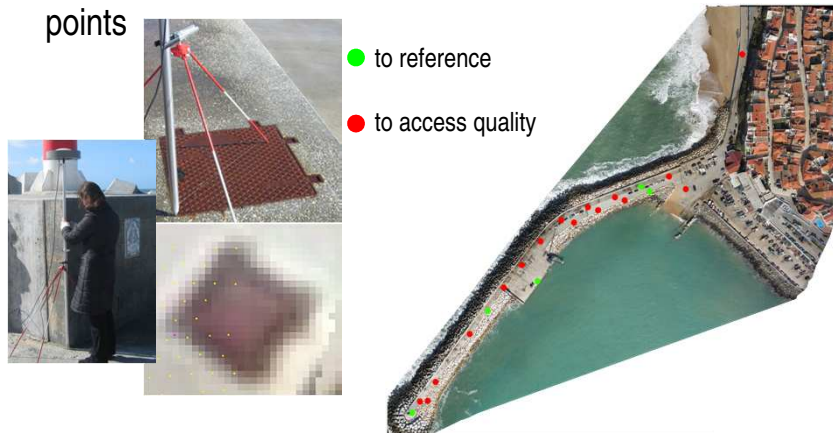
## Data processing

- it was produced a orthomosaic and a digital surface model
  - orthomosaic: ortho-rectification & mosaicking
  - digital surface model: derived from a point cloud
- planimetric error: 116 m at the end of the breakwater

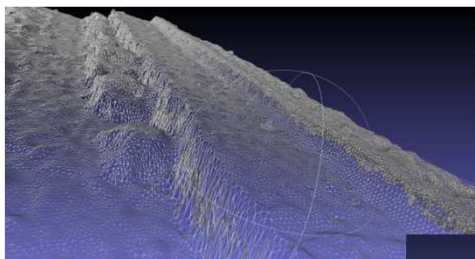


## Data processing

- the solution: to have the coordinates of some well identified points



## Data processing



Meshed surface that fits the point cloud



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## STATISTICS TO TEST THE DIFFERENCES OF COORDINATES

$$S_{XY} = \frac{1}{n-1} \sum_{i=1}^n (\Delta x_i - m_X)(\Delta y_i - m_Y) \therefore$$

$$v_{XY} = \frac{n(n-2)}{2(n-1)} \bar{m}^T S^{-1} \bar{m} \in F(2;n-2;\omega)$$

Test the accuracy and the precision

$$\sigma_j^2 = \frac{(t_j)^2}{q}$$

$$L_{\max} = \frac{S_X^2 + S_Y^2 + \sqrt{(S_X^2 - S_Y^2)^2 + 4(S_{XY})^2}}{2[S_X^2 S_Y^2 - (S_{XY})^2]}$$

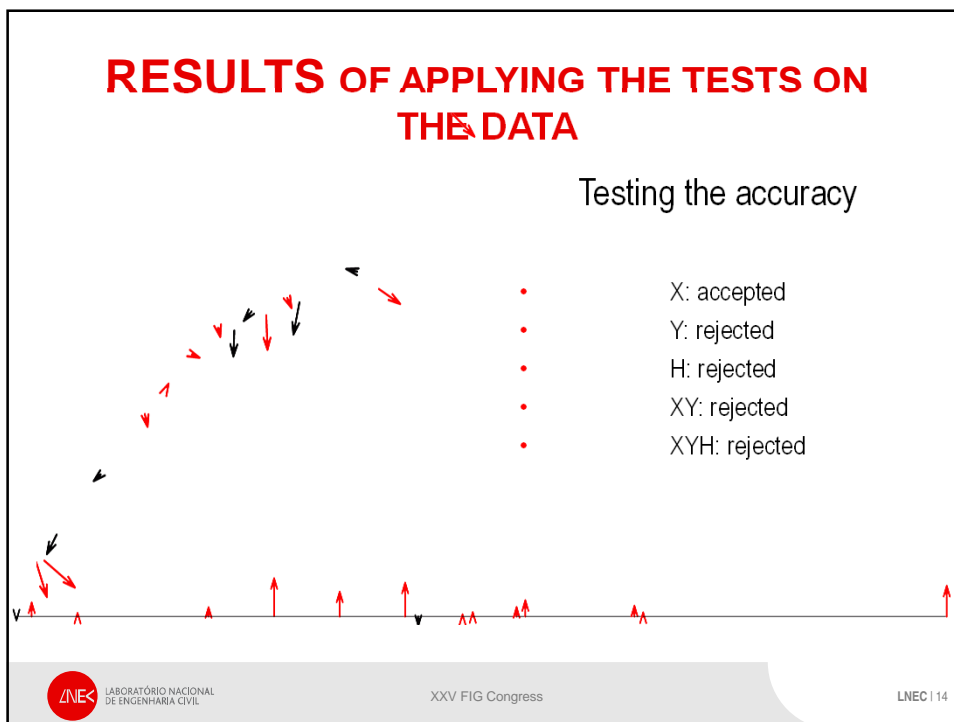
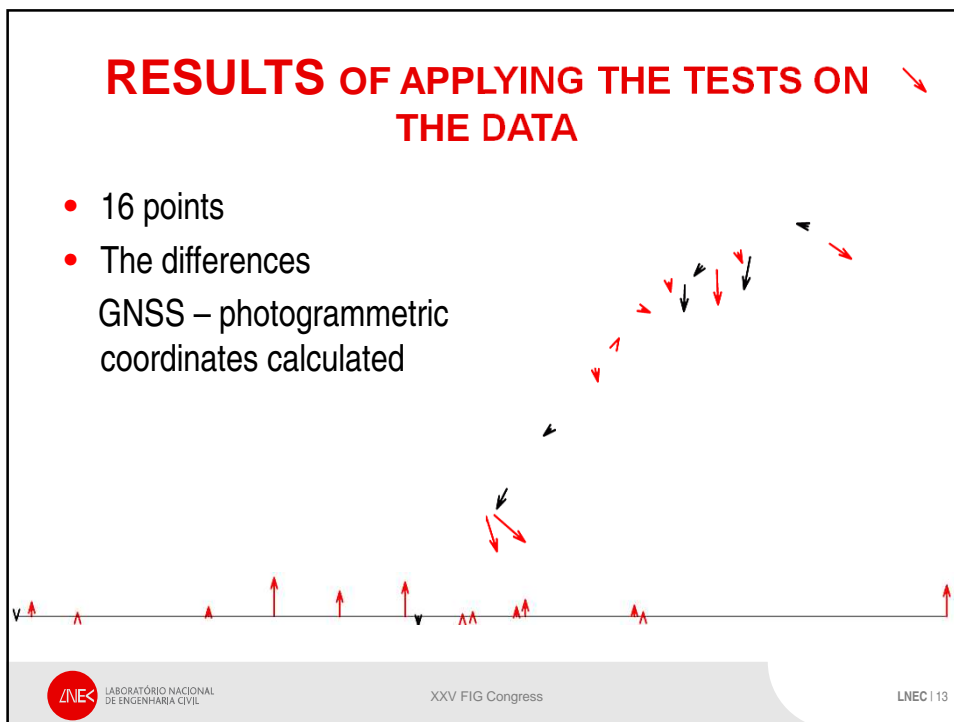
$$H_0 \equiv u \in \chi^2(n-1)$$



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## RESULTS OF APPLYING THE TESTS ON THE DATA

### Testing the precision

Class II: $t_{II} = 10$ cm	Class III: $t_{III} = 15$ cm	Class IV: $t_{IV} = 20$ cm
$u_x = 13.78$	$u_x = 6.12$	$u_x = 3.44$
$u_y = 13.83$	$u_y = 6.15$	$u_y = 3.46$
$u_H = 22.11$	$u_H = 9.83$	$u_H = 5.53$
$q=7.26$	$q=7.26$	$q=7.26$



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## CONCLUSIONS

To access the positional quality of products used to represent the surface of the Earth it should be used the **accuracy** and the **precision**

As an example of application was chosen data from an UAV flight done with bad conditions: strong wind, unknown position and attitude of the airplane, a structure surrounded by water. The tests performed indicate that the **accuracy was not achieved** while concerning the **precision the orthomosaic lies in Class III (15 cm) and the surface model in Class IV (20 cm)**



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