



# Generation of Rapid Civil Alerts by Satellite On-Board SAR Processing

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Knowledge for Tomorrow



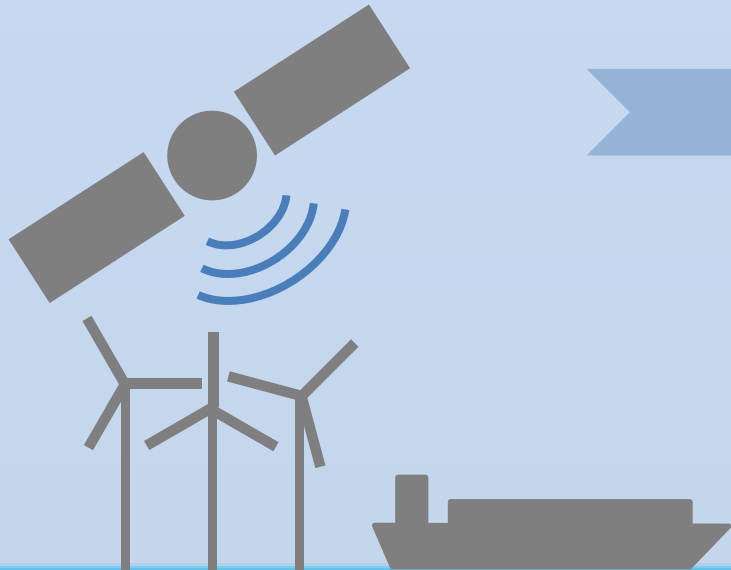
## Project Overview



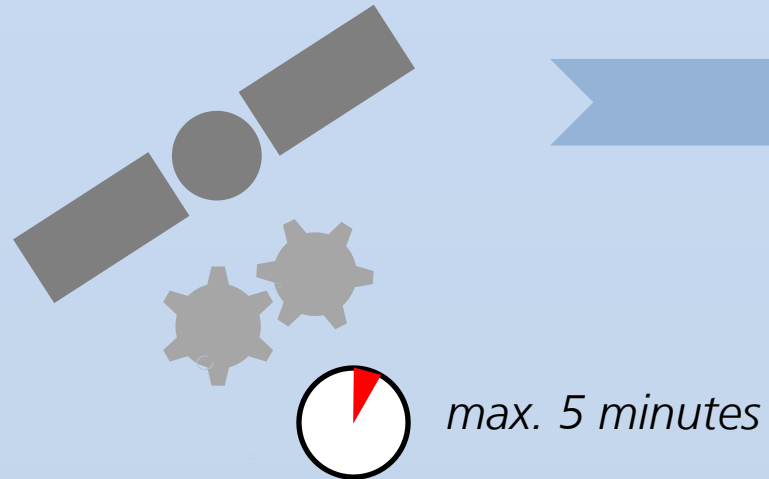
- Development of prototype on-board satellite processing system for SAR and optical instrument data
- Design includes 7 MPSoC boards for processing and data handling, as well as a TX/RX subsystem
- Delivery to end user within 5 minutes after acquisition, saving satellite travel time to nearest ground station
- Beneficial for maritime situation awareness as position of ships or wind speeds change rapidly



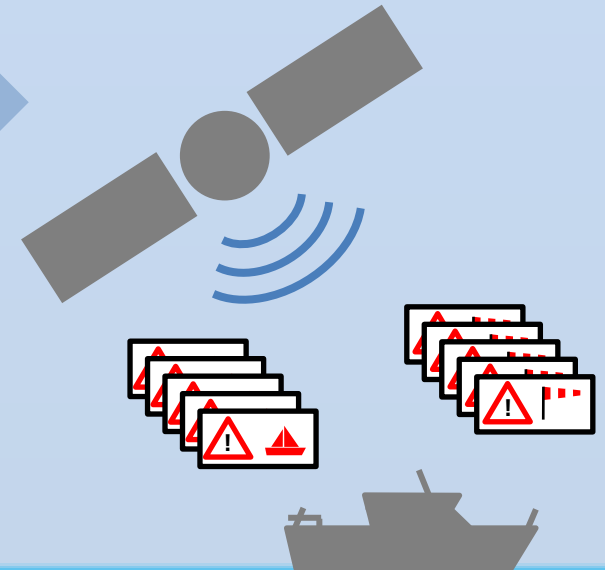
### Satellite raw data acquisition



### Satellite on-board processing



### Alerts downlink to end user



# SAR processing board



**Multi-Processor System-On-Chip (MPSoC)**  
Xilinx Zynq UltraScale+ ZU19EG

**Programmable Logic (PL)**  
FPGA 16nm FinFET+, 6.2M ASIC gates capacity; 5 GB DDR4-2400

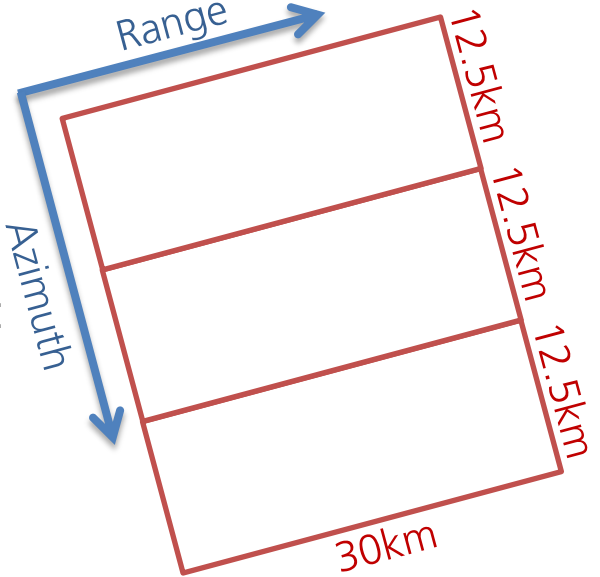
**Processing System (PS)**  
Quad-core ARM Cortex-A53 @ 1.2 GHz; 4 GB DDR4-2133

# Acquisition properties

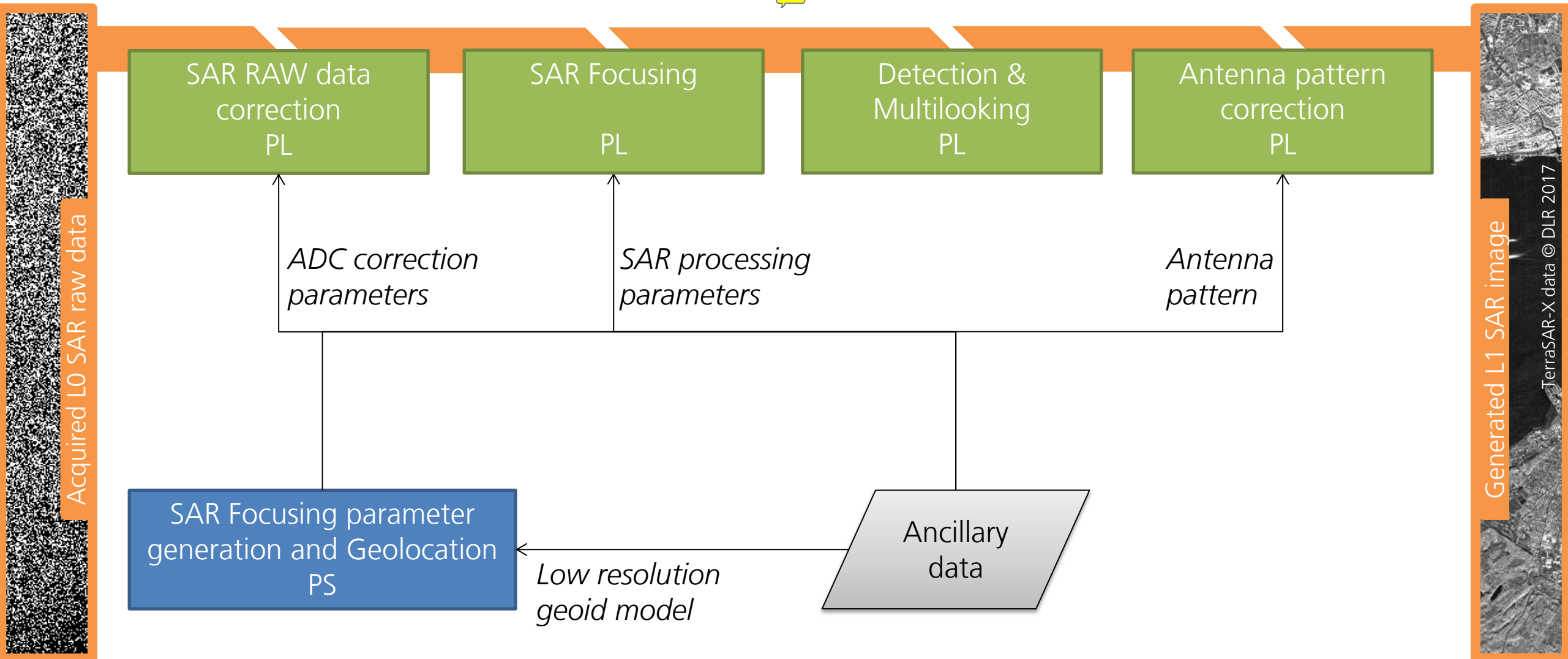
- Scenes based on TerraSAR-X StripMap data downscaled to about 6m resolution
- Inverse SAR processor developed to create L0 raw data similar to instrument output
- Up to three raw data blocks of 8192 x 32768 points each



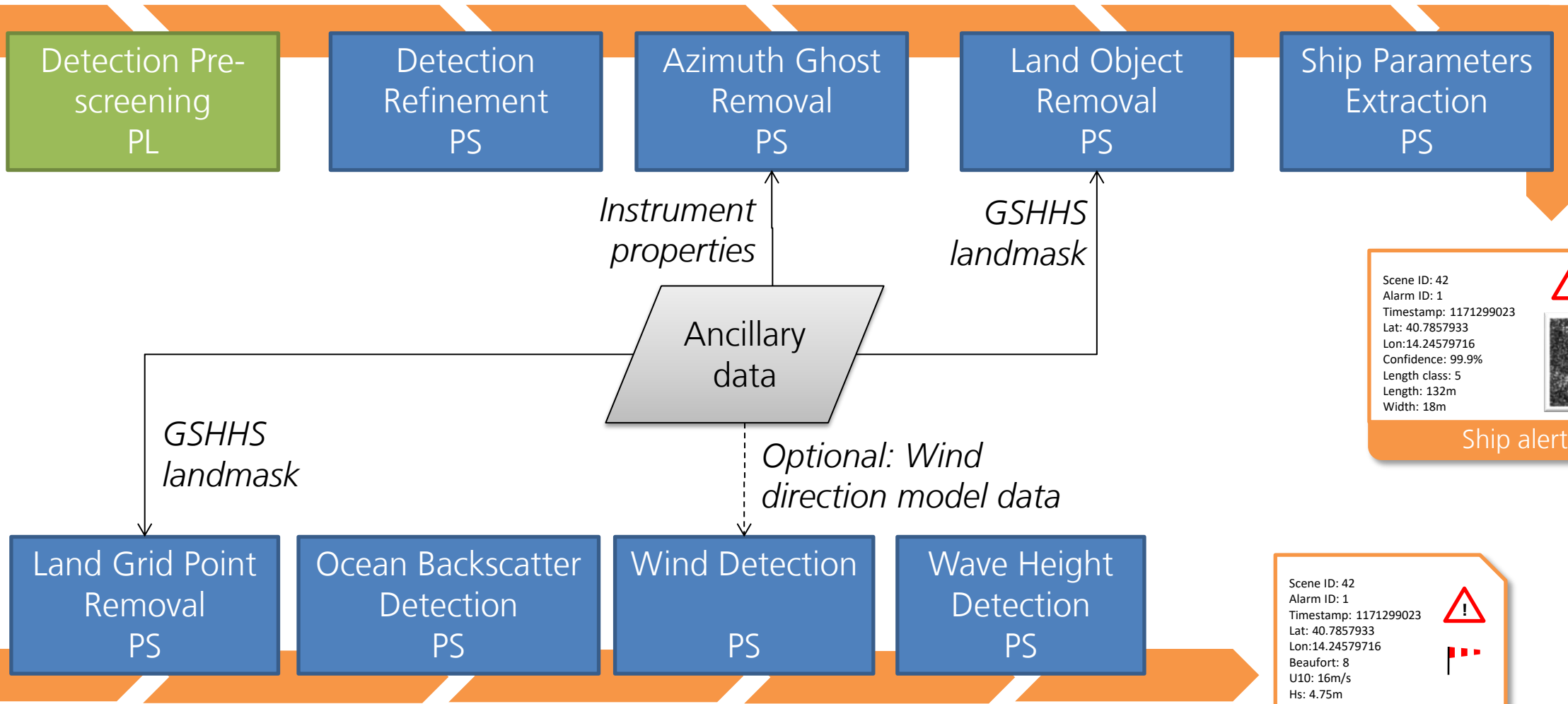
- Coverage area (single/min): 12.5km x 30km (375km<sup>2</sup>)
- Coverage area (triple/max): 37.5km x 30km (1125km<sup>2</sup>)



# L0 to L1 SAR RAW data processing



# L1 to L2 SAR product generation – ship detection and extreme weather



Scene ID: 42  
Alarm ID: 1  
Timestamp: 1171299023  
Lat: 40.7857933  
Lon: 14.24579716  
Confidence: 99.9%  
Length class: 5  
Length: 132m  
Width: 18m

Ship alert

Scene ID: 42  
Alarm ID: 1  
Timestamp: 1171299023  
Lat: 40.7857933  
Lon: 14.24579716  
Beaufort: 8  
U10: 16m/s  
Hs: 4.75m

Weather alert



## Achieved processing times

- One block
  - L1: 4.4s
  - L2:
    - Ship detection: 30.0s
    - Extreme weather: 34.9s
  - Total: 34.5s (ship) / 39.4s (weather)
- Three blocks processed in ~120s
- Additional time for data handling and transfer: ~90s
- Alerts delivered to end user **2-3 minutes** after acquisition

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More information on the EO-ALERT project on [www.eo-alert-h2020.eu](http://www.eo-alert-h2020.eu). The EO-ALERT project is coordinated by DEIMOS Space, Madrid, Spain

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