

## IRPS Achievements

- **Cooperative Project**
  - Technology Innovation brought from lab to Operational application
  - IRPS Service Demonstration ( IRPS Simulators+ Live demos)
  - IRPS/ LIMS showcase
- **Technology Integration & Showcase**
  - Mobile Robotic Platform : MRP development & Integration (PIAP, ISR)
  - LIDAR Measurement System Sensor :LIMSS development & Integration. (IAI, Scisys)
  - LIDAR Measurement System development & Integration (LLG,ISR,CS)
  - Mission Control Center MCC development & Integration (Scisys, CS)
  - **IRPS Global Reference 3D Model & IGRM development & Integration (CS, LLG)**

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### Polynomial, Solid 3D Model Faro Airport V-MAP

NAV Navigation

Virtual LIDAR

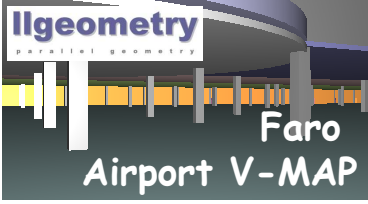
Model updates

3DV MCC Model export



- Unique 3D Solid Model for
  - Geometry calculation and Virtual LIDAR simulation
  - Visualization model exports

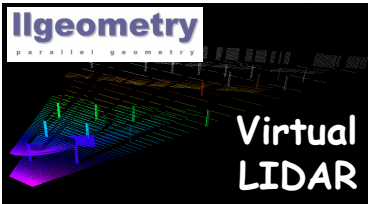
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Virtual LIDAR



### V-MAP application Virtual LIDAR



**Simulated LIDAR acquisition**


- Capability to simulate LIDAR acquisition and generate the corresponding data
- High level of performance for virtual data generation
- Applicable to Real Time applications on complex solid models

NAV Navigation

Simulated Changes Acquisition

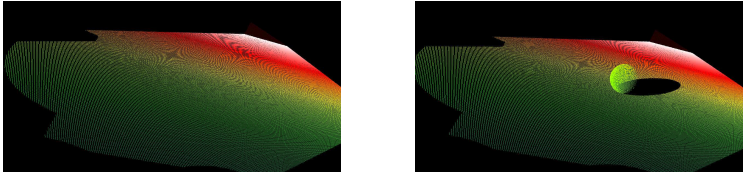
V-MAP updates




**V-MAP**  
Change Detection and Model Updates

- **Principles**
  - Relies on Virtual LIDAR capabilities
  - Consumes change candidate point clouds produced by real LIDAR acquisition
  - Matches them with the volumetric map or reference model of the environment, discriminate false positives
  - Reconstructs the corresponding geometry
  - Handles consistency over time, modification / refinement / suppression of previously detected changes



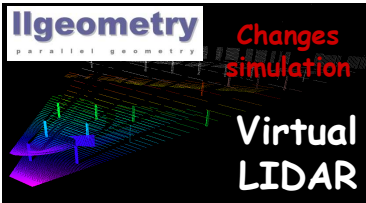
Obstacle detection principle

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**V-MAP**  
Change Detection and Model Updates

- Geometry reconstruction from real or Virtual LIDAR data
- V-MAP Faro model updates
- Exports wrap up primitives (Cylinders, spheres) and polygonal, meshed convex hulls for display within 3DV and MCC modules

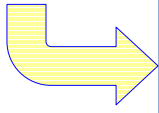


Virtual LIDAR

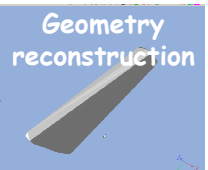


3DV Changes Visualization

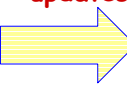
Point clouds




Geometry reconstruction




Model updates



Exports



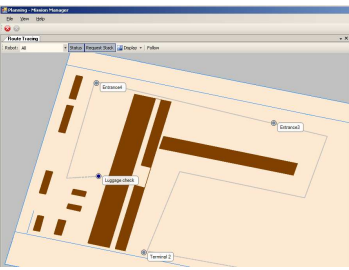
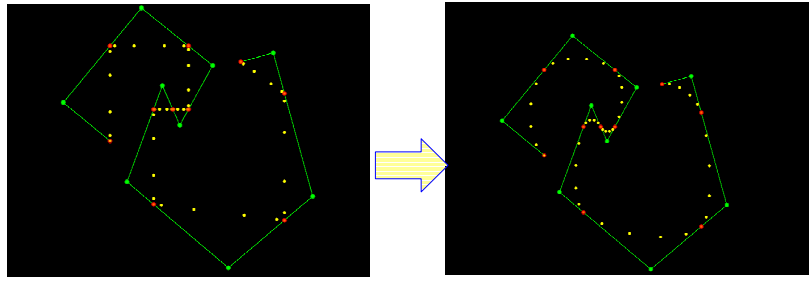


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## Navigation and Path Planning





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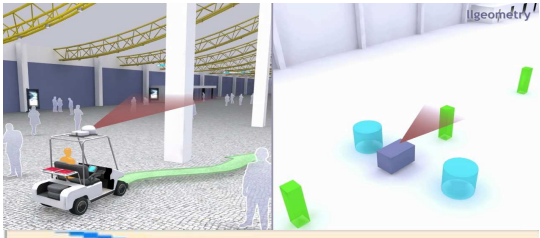
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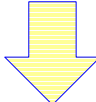
## Collision avoidance

**Model updates**

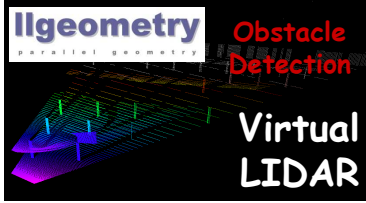


**Faro Airport V-MAP**



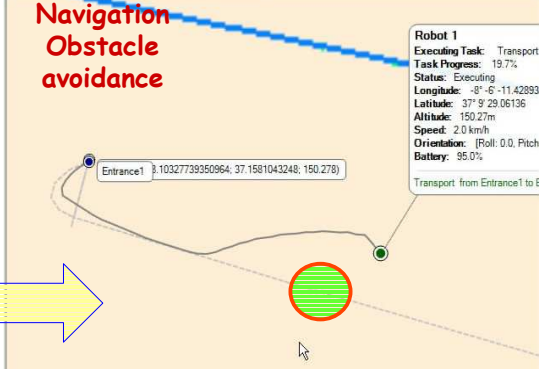


**Obstacle Detection**

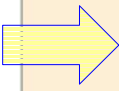


**Virtual LIDAR**

**Navigation Obstacle avoidance**



<b>Robot 1</b>
Executing Task: Transport
Task Progress: 19.7%
Status: Executing
Longitude: -8° -6' -11.42893
Latitude: 37° 9' 29.06136
Altitude: 150.27m
Speed: 2.0 km/h
Orientation: (Roll) 0.0, (Pitch) 0.0
Battery: 95.0%
Transport: from Entrance1 to 8



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1. Navigation module integrating MRP's mechanical constraints : Interface with ILLP Callback Library
2. Virtual LIDAR : Simulation of low level Change Detection, point cloud generation
3. Change detection and model updates
  1. Integration with T-MAP Change Detection output format : Point clouds consumption
  2. Convex hulls reconstruction
  3. Visualisation model updates : Polygonal exports and wrap up primitives to 3DV

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**Achievements**  
**Connected projects and activities**

- **Volumetric Mapping and Virtual LIDAR related applications**
  - Mars, Moon Exploration Rover Simulation (Canadian Space Agency and University of Waterloo) - Wheel - sand terrain contact model, obstacles and terrain sensing and acquisition
  - ASPIC Project - Critical Infrastructure Simulation - Nizza Airport Terminal Polynomial Mapping - NBC Simulation - Acquisition devices modeling



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