mission planning and mission supervision

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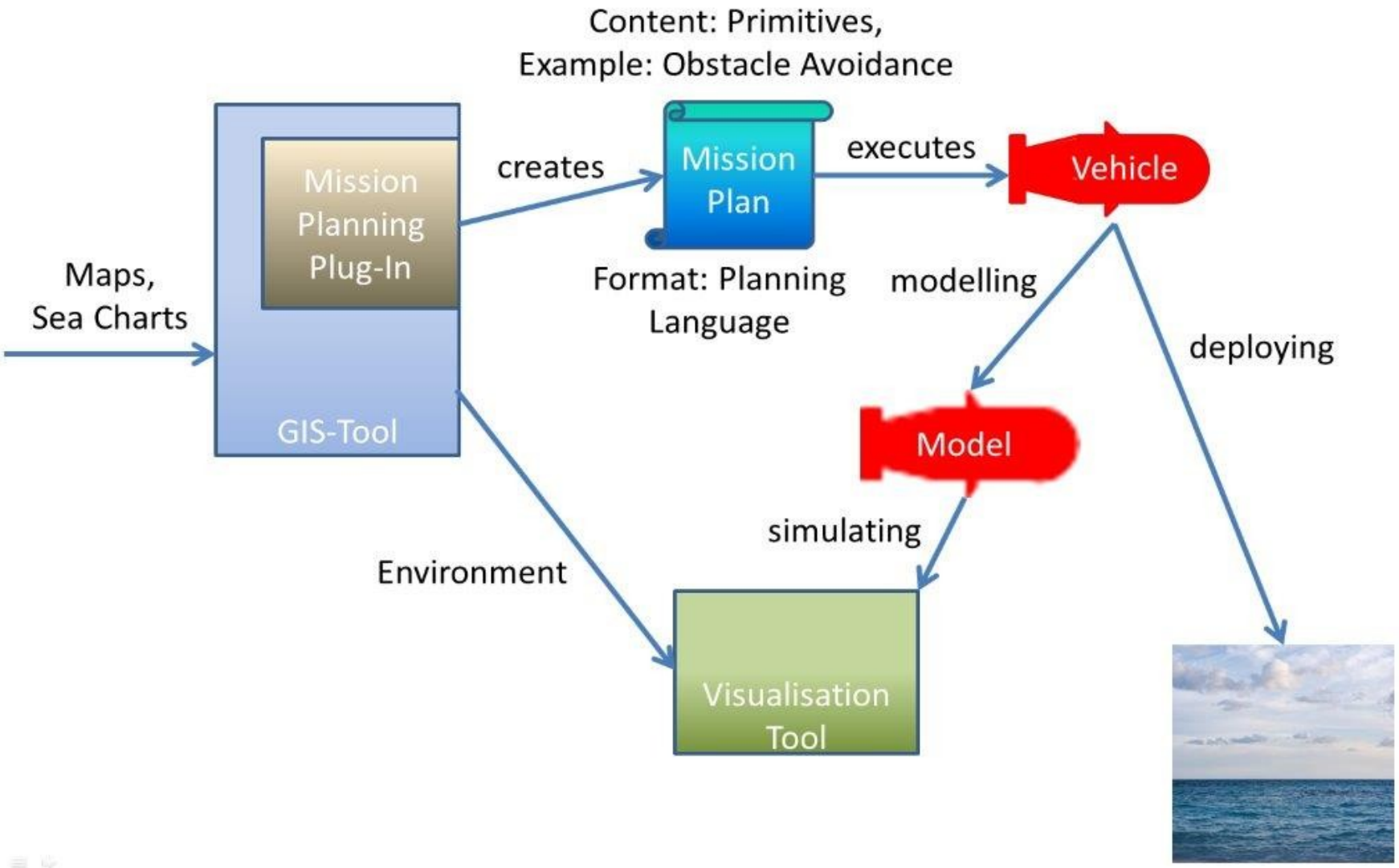
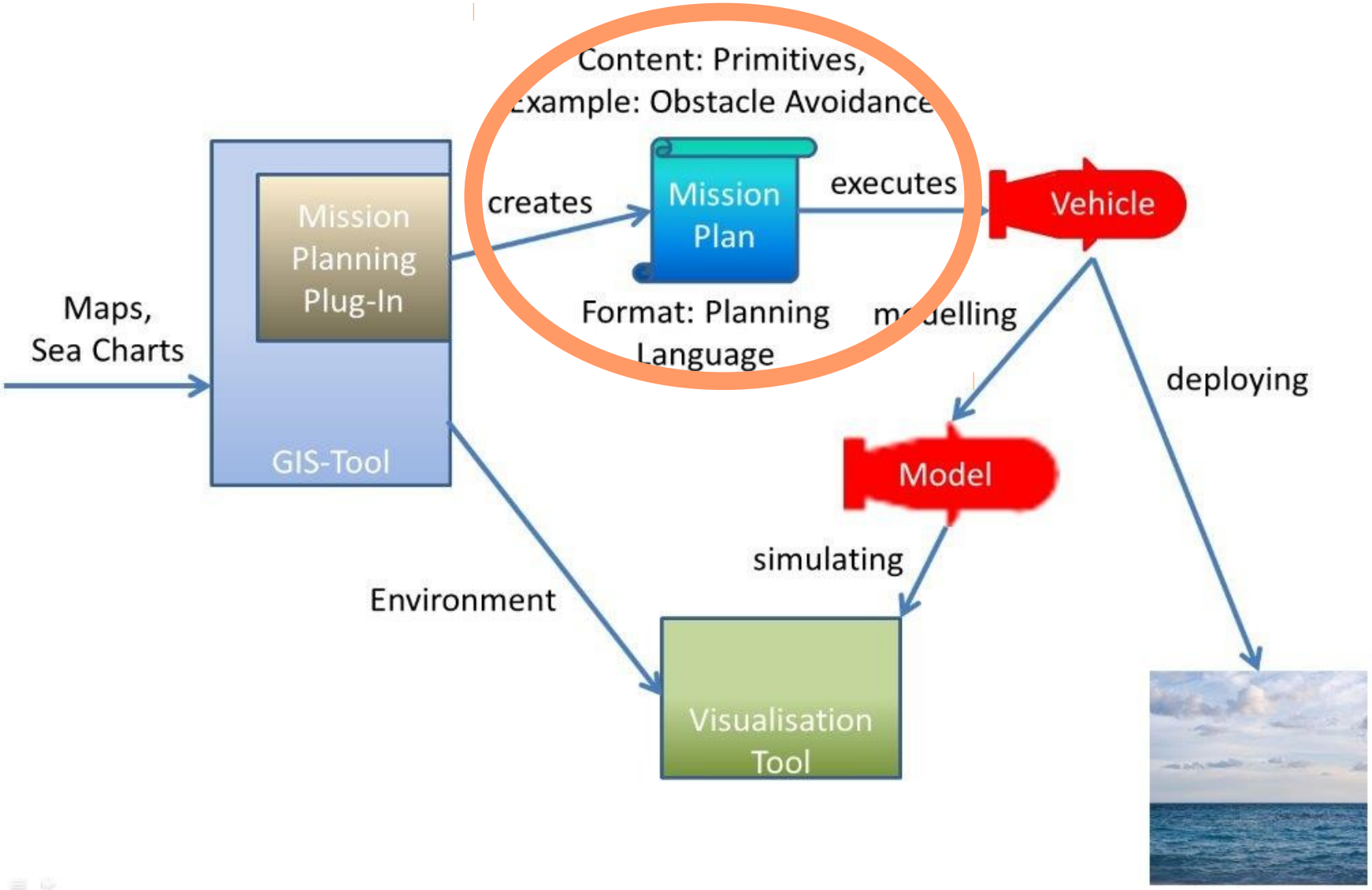
Overview


Content: Primitives,
Example: Obstacle Avoidance
Mission Planning Plug-In
GIS-Tool
creates
Mission Plan
executes
Vehicle
Maps,
Sea Charts
Format: Planning Language
modelling
deploying
Model
simulating
Environment
Visualisation Tool

Overview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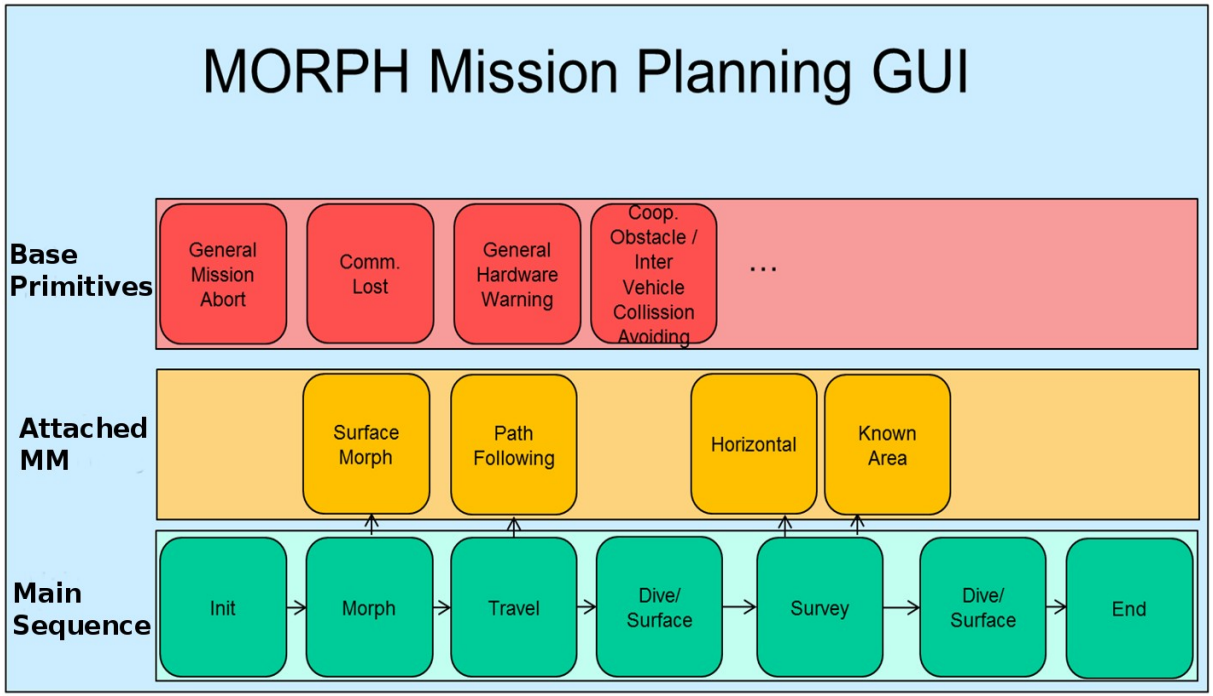
Planning paradigm

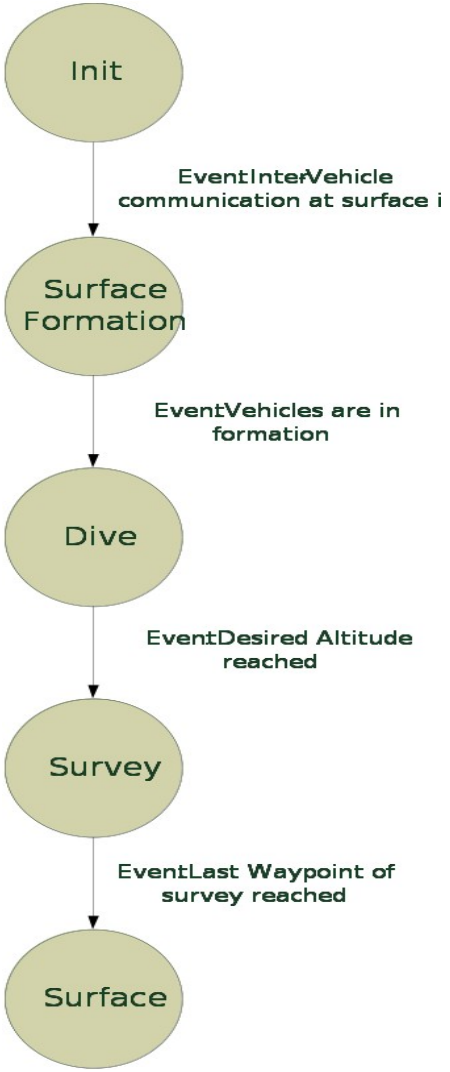
Problem: Planning of missions for teams of heterogeneous marine vehicles in event-driven scenarios

Solution: three-layered planning device with ‚Main Sequence' for MORPH Primitives (MPs), select MM according to MP and a third layer for Base Primitives (BP)



mission planning

- **Morph missions**
  - Define morph missions
  - Identify simplifications
  - Event driven
  - Derive primitives



mission planning

- **Morph missions**
  - Define morph missions
  - Identify simplifications
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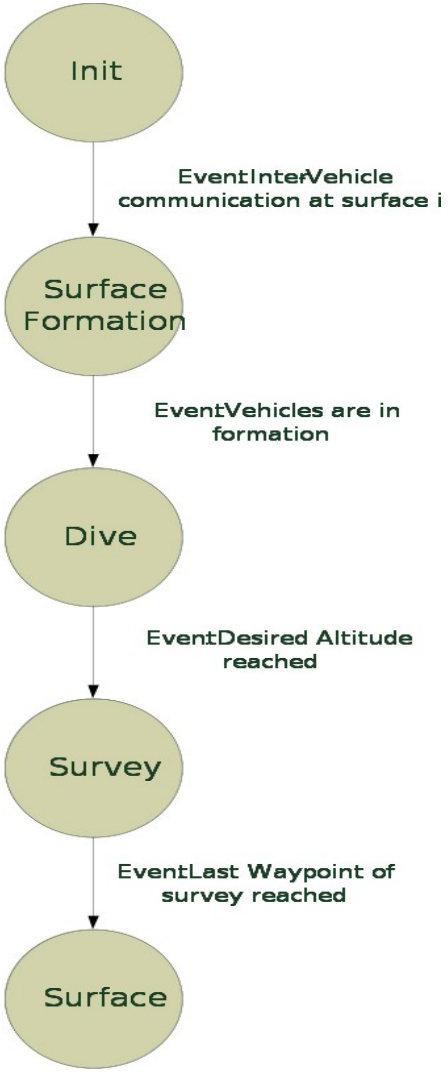
  - Derive primitives

- **List of MORPH Primitives (MP)**
  - Init, Morph, Travel, Survey, Dive, End
  - Outline plan for user



MORPH methods

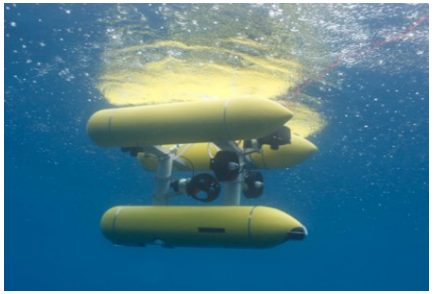
- Basic team related autonomous behaviour
- each MM will require a specific software algorithm to be developed and implemented

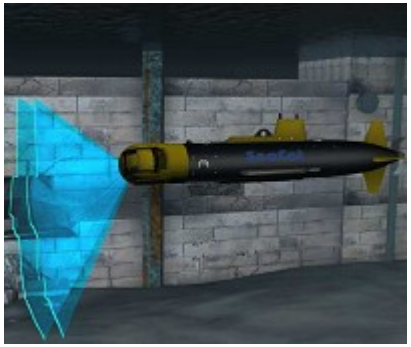
#	Name of MM	Description
1	Role Assignment	Before Deployment, load mission plans and create team
5	Surface Formation Build	2D Formation building at surface
6	General Formation Change	3D Formation building underater
7	Cooperative Path Following	Vehicles follow individual paths, velocity is adapted to preserve formation
9	Cooperative Approaching	like MM7, with amendment to detect an object

Table selected MM

missions planning

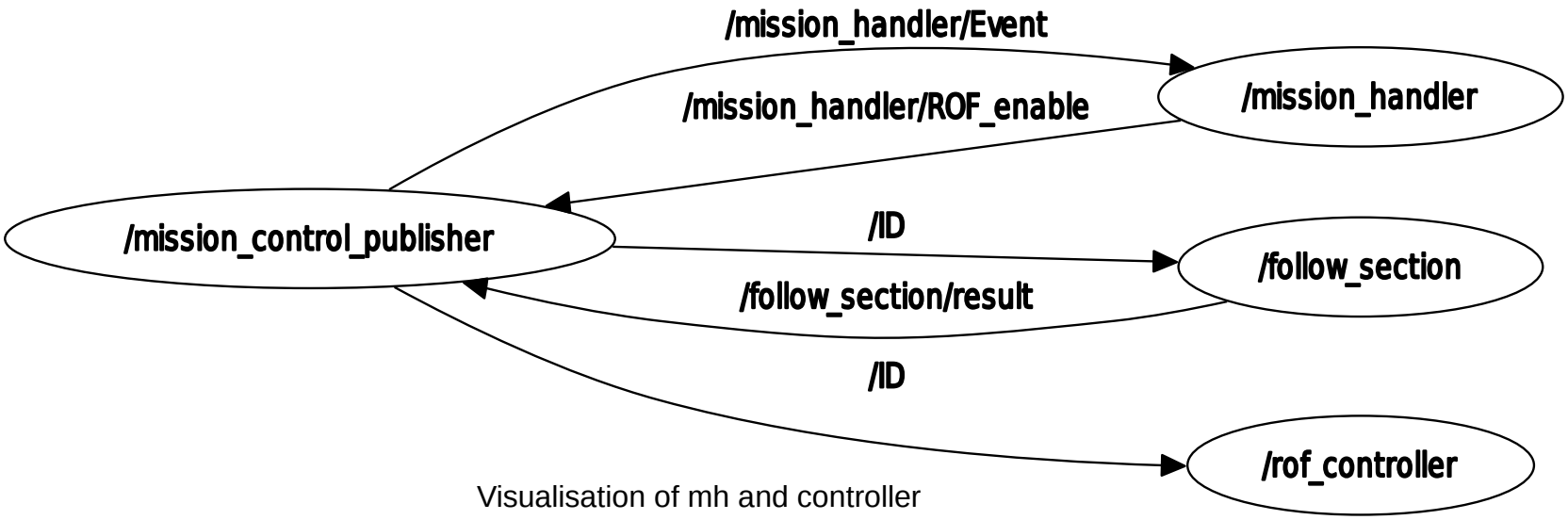
- **Vehicle level**





ROS

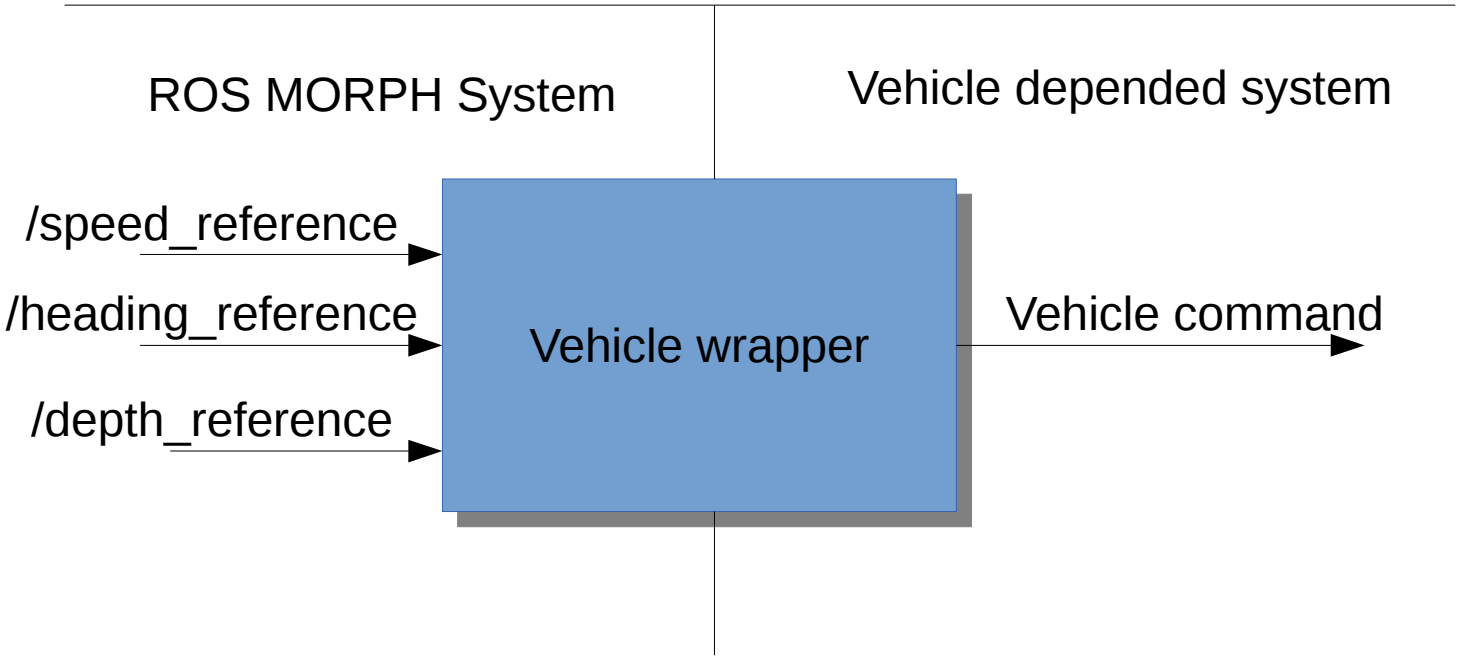
- **Using ROS**
  - middelware
  - provide communication
  - abstract vehicle abilities
  - seperate controllers
  - all partner can provide nodes



Visualisation of mh and controller

Single vehicle Primitives

- List of SVP defined
  - Example: set velocity, heading, altitude or depth
- All vehicle providers need to implement
- Translate to ROS



Base Primitives

- Security mechanisms
- Event driven
- Take over command in emergency situations
- Prioritisation needed

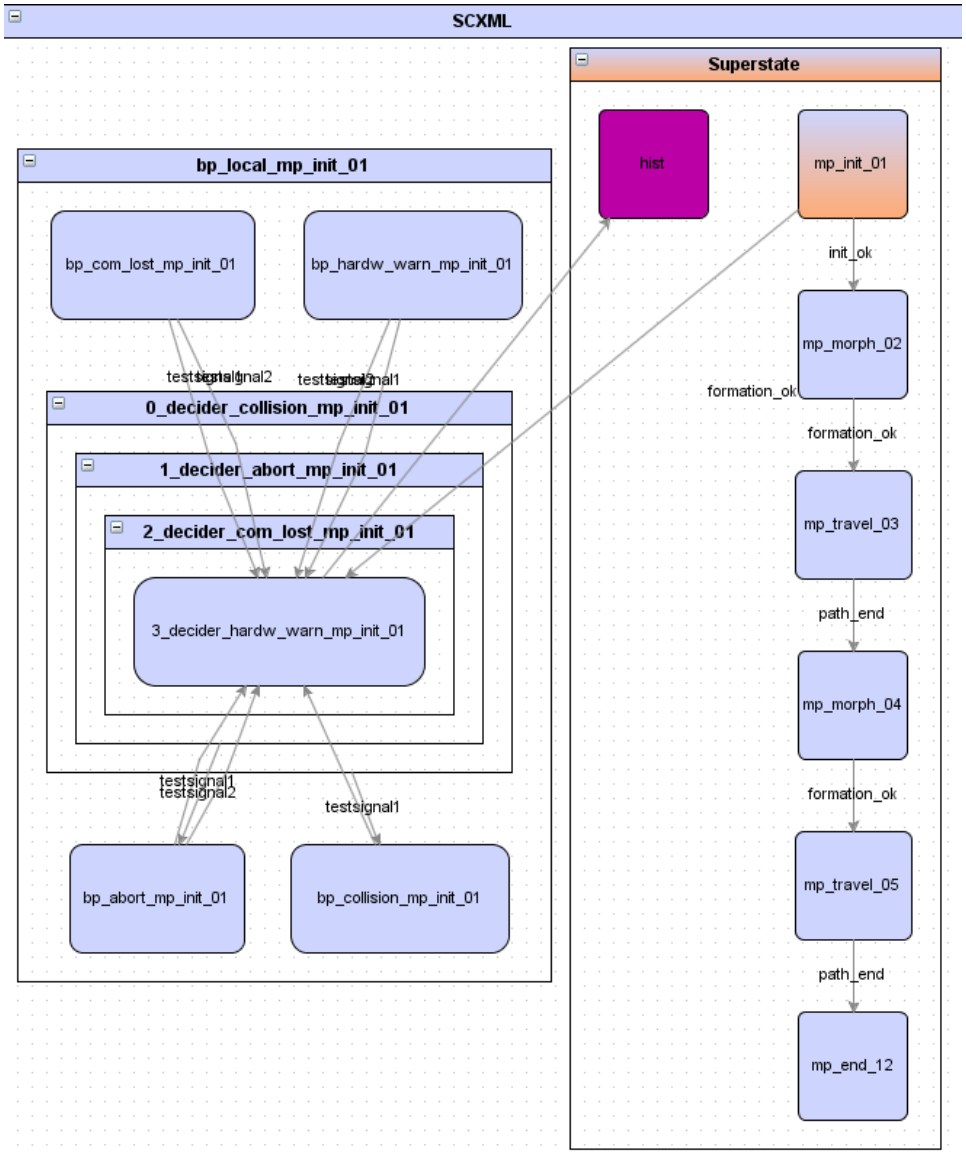
#	Name	What to do
7	General Mission Abort (GMA)	Bring vehicles to a safe surface position; follow a proceeding that was parameterized by user offline. Structure: MP Dive/Surface + SP Enhanced, MP End
8	Communication lost (to one/some or all vehicles)	Run MM Reestablish Communication (continue the current action, try to get in contact again, see below). After defined time, got to BP GMA (see above)
9	General Hardware Warning (e.g. Battery low, sensor failure)	Run MM General Hardware Warning (see below): Report to leader, in critical case activate BP GMA
10	Cooperative Obstacle / Inter Vehicle Collision avoidance	Activate MM of same name (see below)

Table Base Primitives

Planning Language

Mission Plans are stored in SCXML (Start Chart Extensible Markup Language)

- Human readable/writeable
- Parsers tested for a long time in many applications
- Event driven state change
- Prioritisation possible



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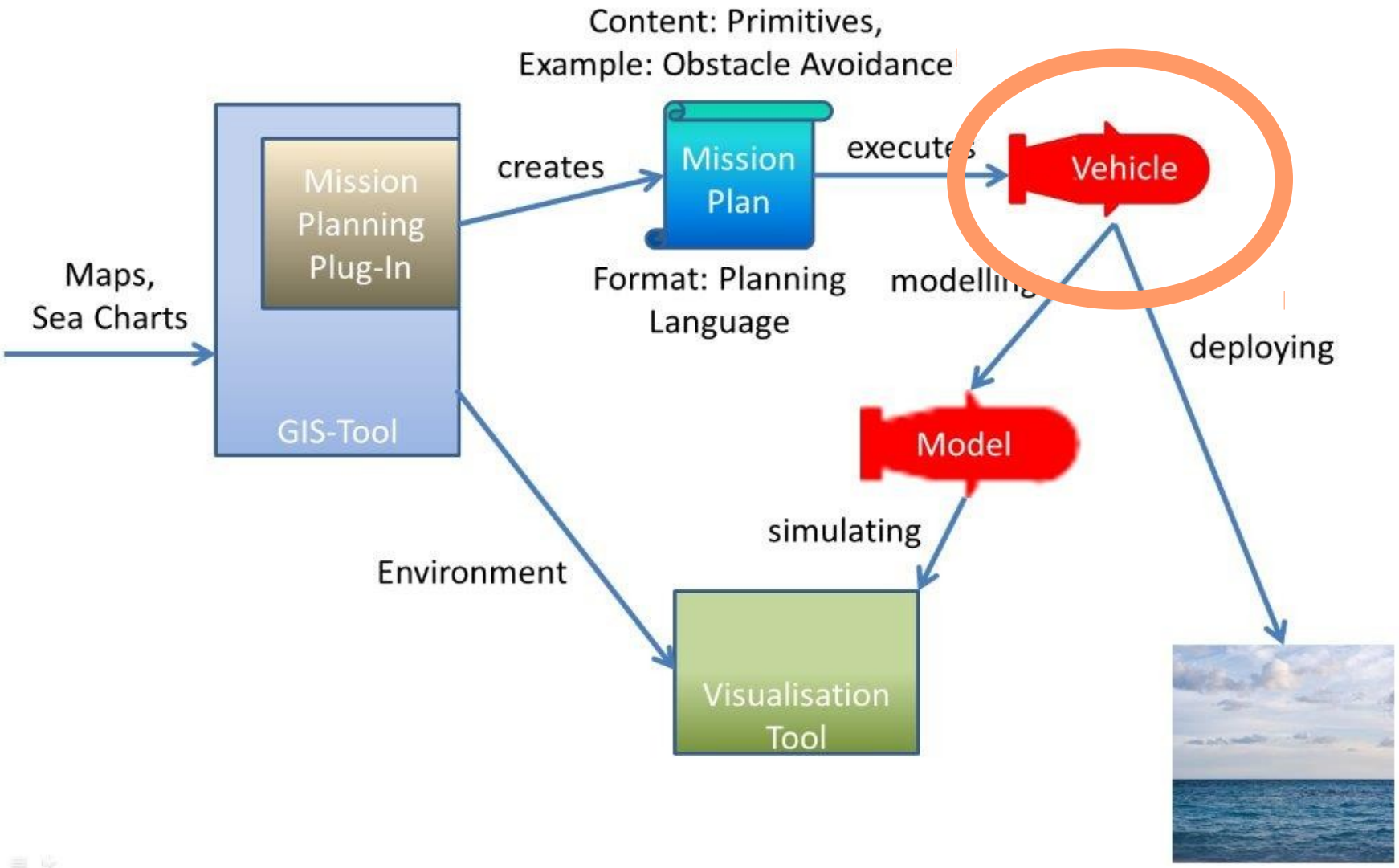
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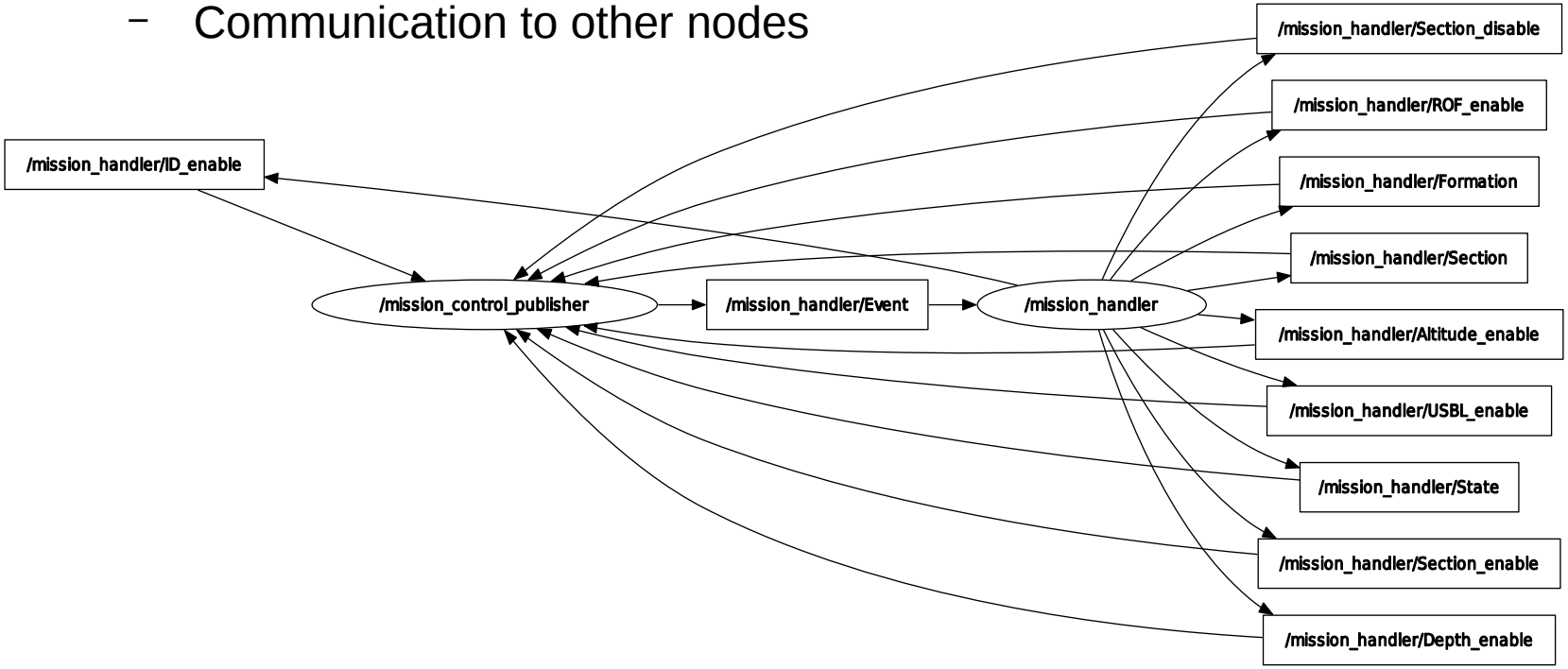
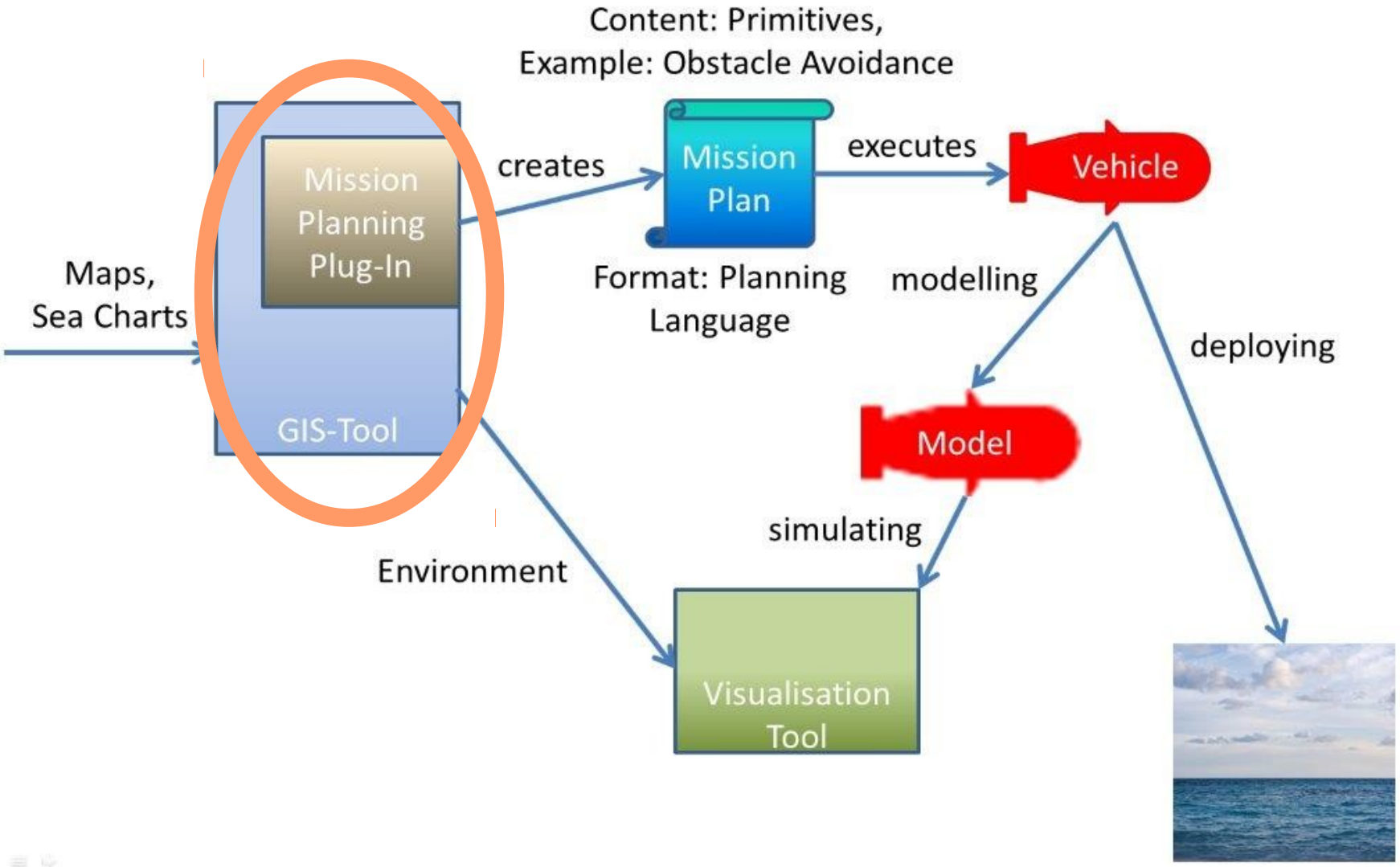
Mission handler

Mission Plans executes mission on vehicle

- Runs on every vehicle
- Send state / Synchronize vehicles
- Two parts
  - Statemachine
  - Communication to other nodes

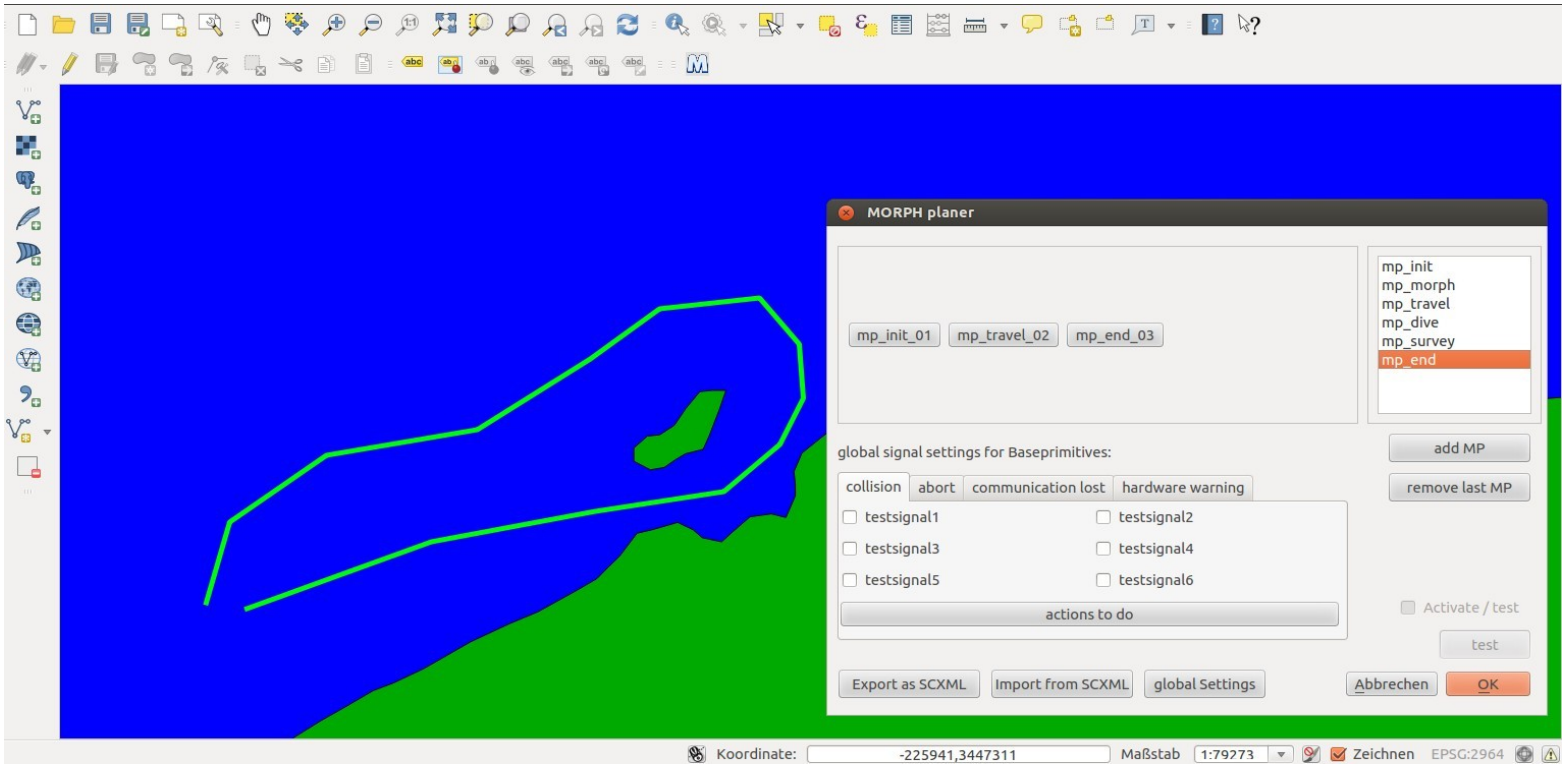


Planning GUI



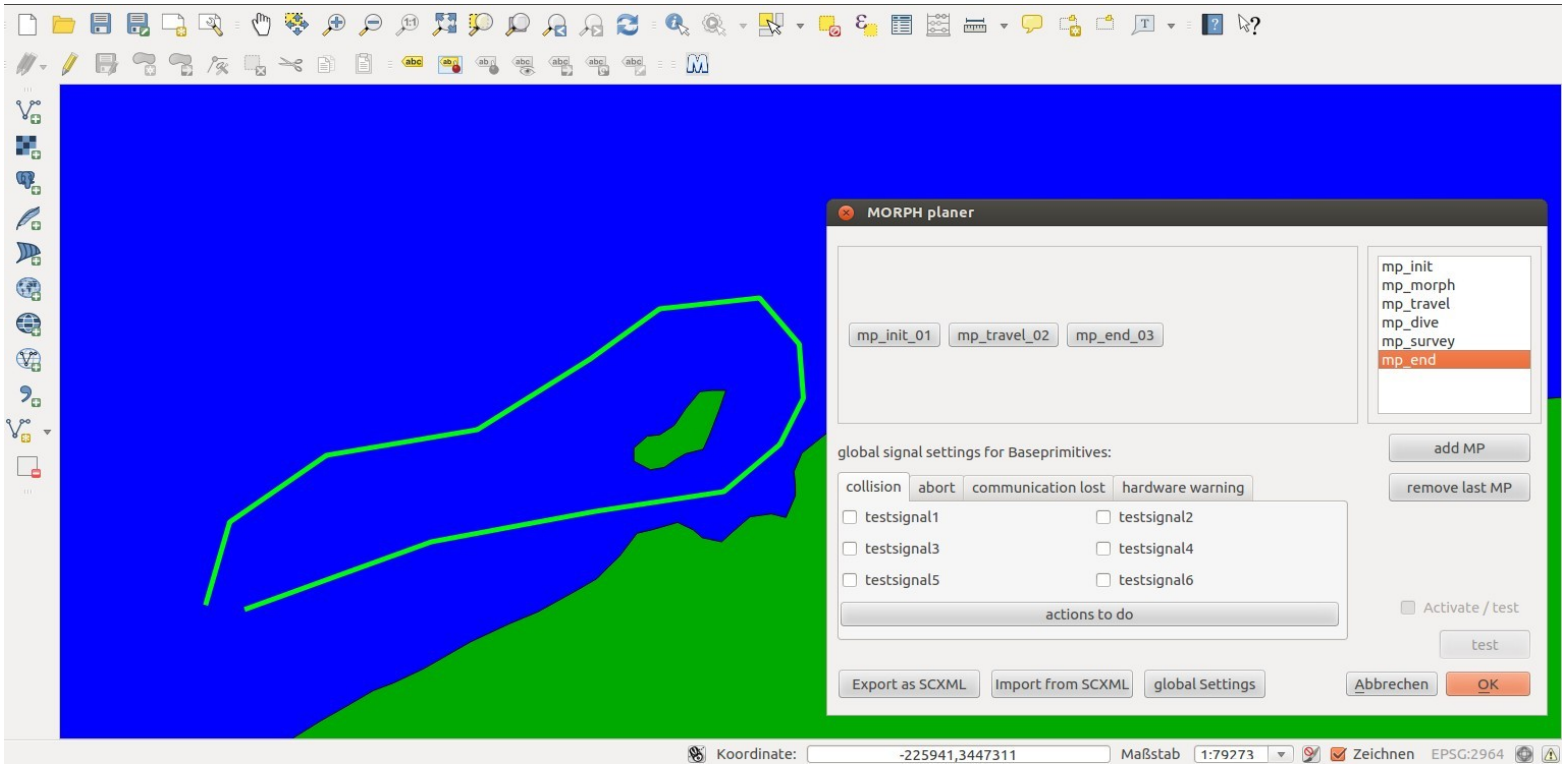
GUI

- **QGIS**
  - Support a wide range of spacial data
  - Modern qt framework
  - Nice plugin system



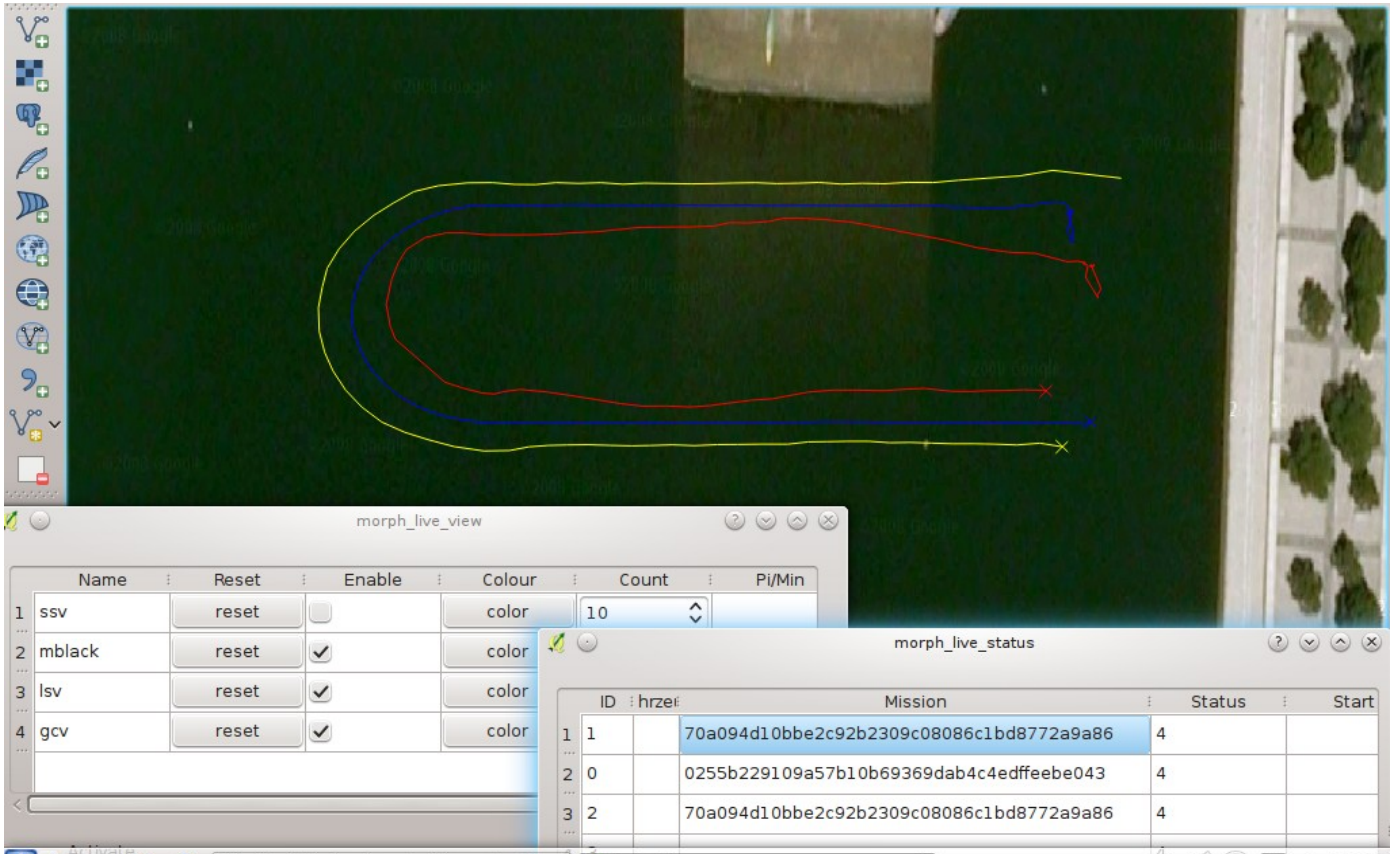
GUI

- **Planning**
  - Select MP
  - Parametrize MP
  - Import/Export Plan
  - Draw paths
  - Connect Events and BP
  - Connect Events and MP



GUI

- **Mission supervision**
  - Display vehicle position
  - Display vehicle state
  - Start/Abort missions



Thank you for your attention!