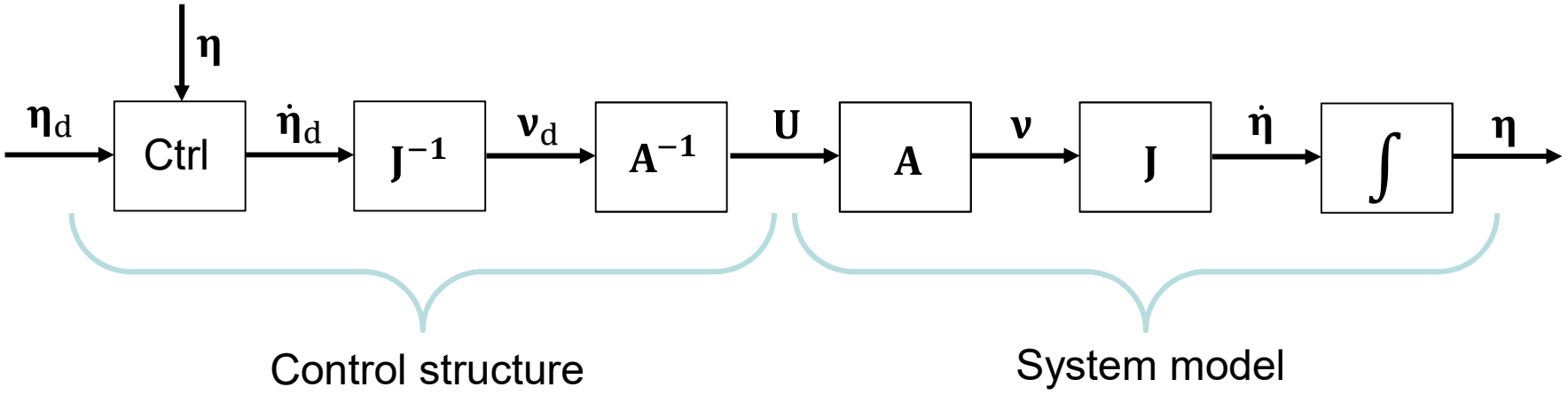
IV – Control Structure

Control Structure

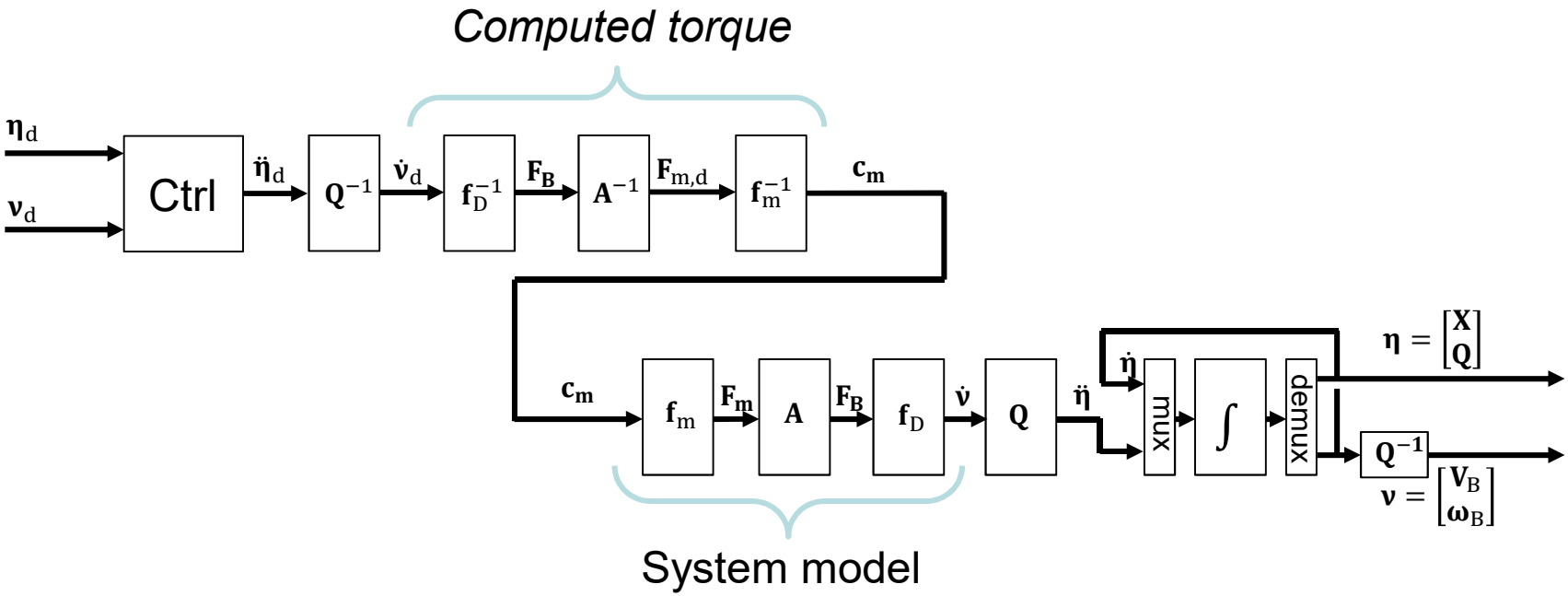
- Control / Simulation duality



Perfect control achievement (known and perfect model) : $\boldsymbol{\eta} = \boldsymbol{\eta}_d$

Control Structure

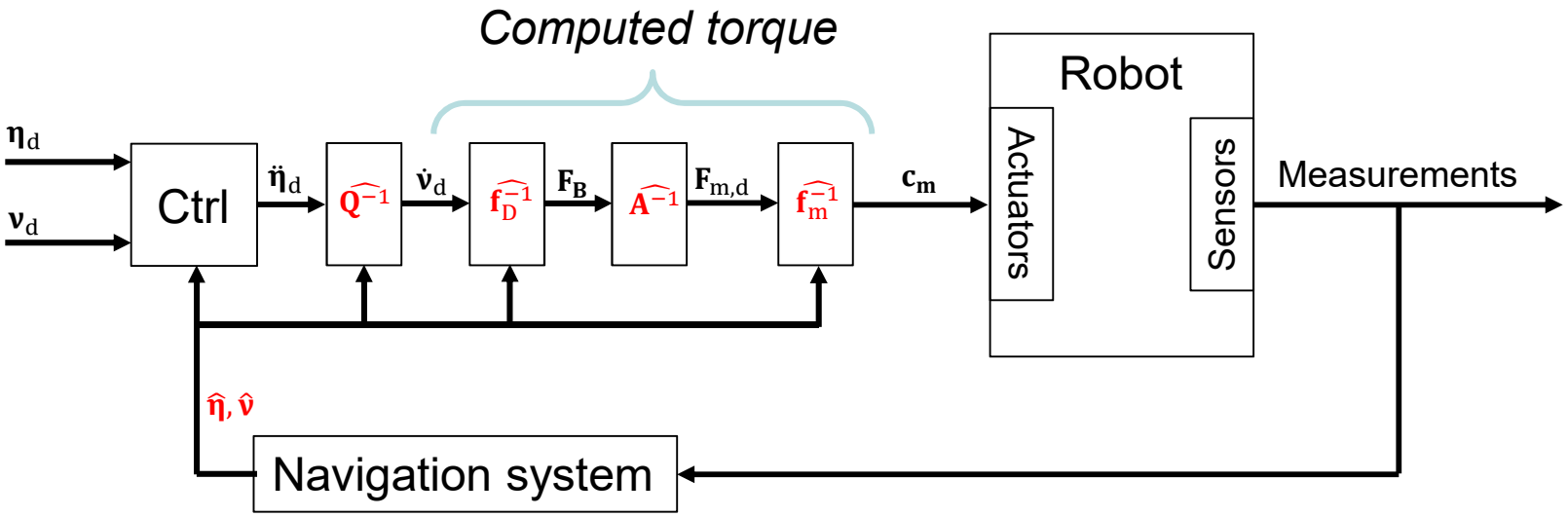
- Control / Simulation duality



Perfect control achievement (known and perfect model) : $\begin{cases} \boldsymbol{\eta} = \boldsymbol{\eta}_d \\ \boldsymbol{\nu} = \boldsymbol{\nu}_d \end{cases}$

Control Structure

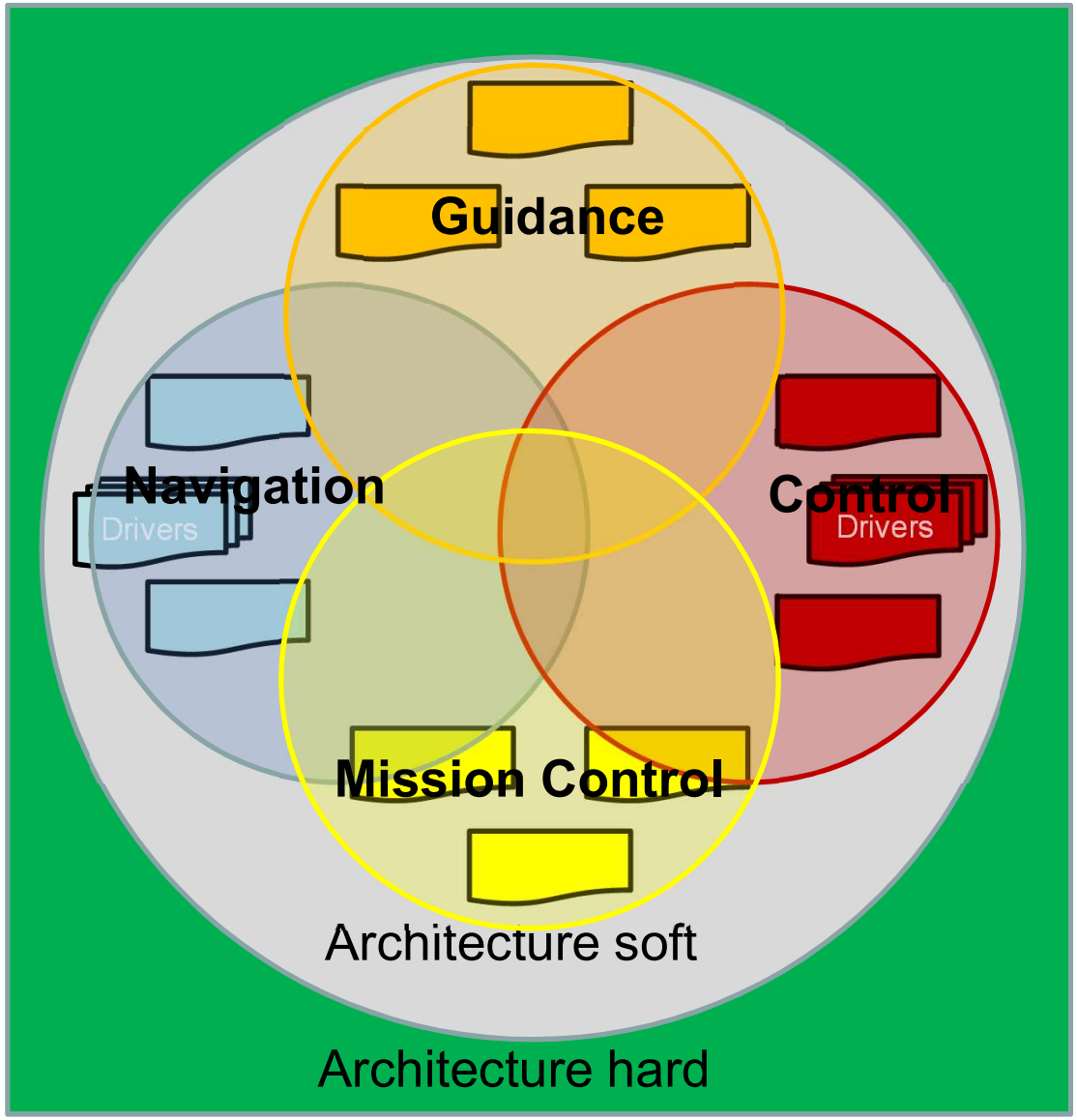
- Control



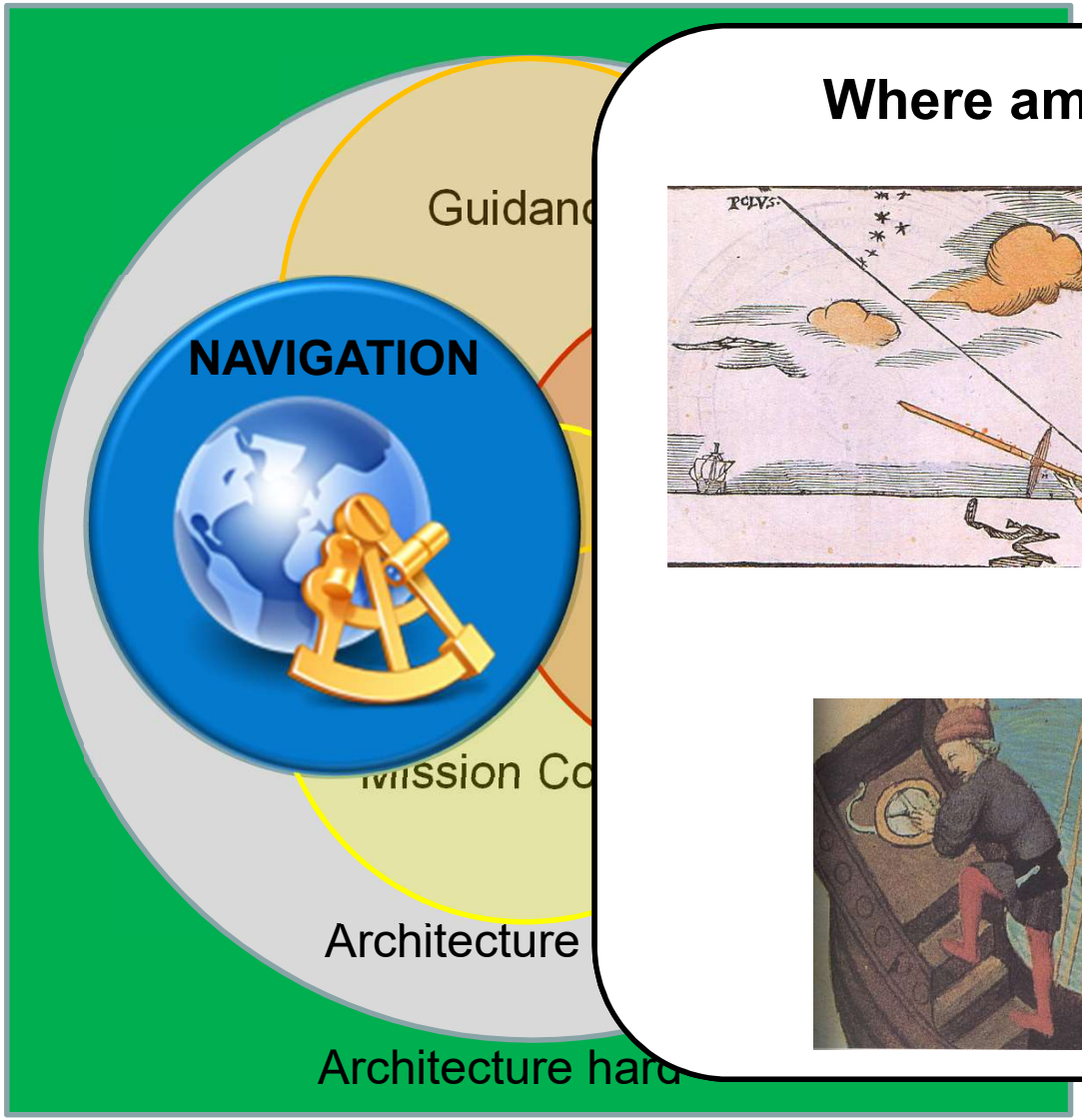
Model necesarilly imperfect ($\widehat{\mathbf{Q}^{-1}}$, $\widehat{\mathbf{f}_D^{-1}}$, $\widehat{\mathbf{A}^{-1}}$, $\widehat{\mathbf{f}_m^{-1}}$) and noisy measurements ($\hat{\boldsymbol{\eta}}, \hat{\boldsymbol{\nu}}$)

→ Control Robustness ?

The EuRobots

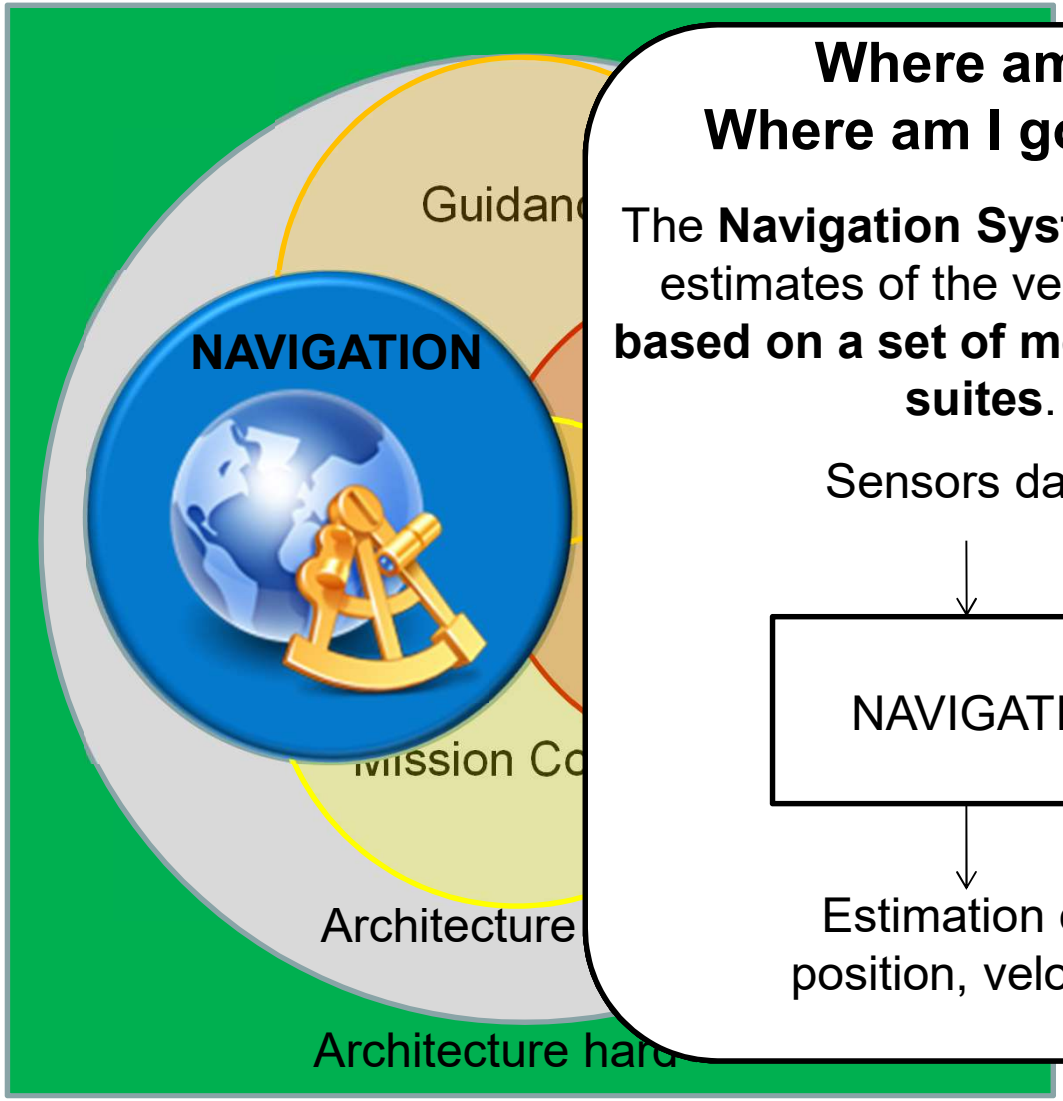


Navigation



Where am I ?

Navigation



Where am I?
Where am I going to?

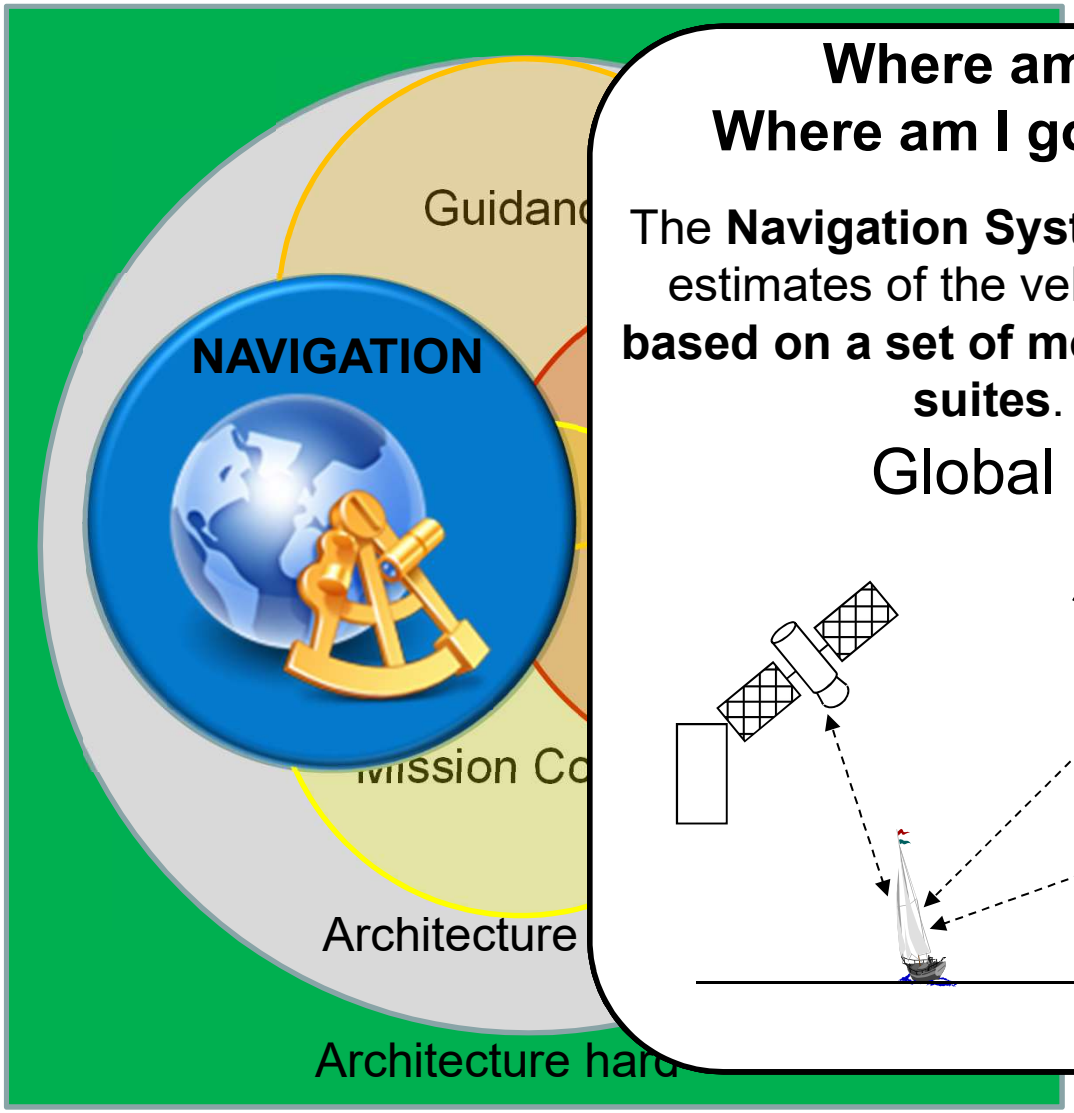
The **Navigation System** provides estimates of the vehicle states **based on a set of motion sensor suites**.

Sensors data

NAVIGATION

Estimation of position, velocity

Navigation



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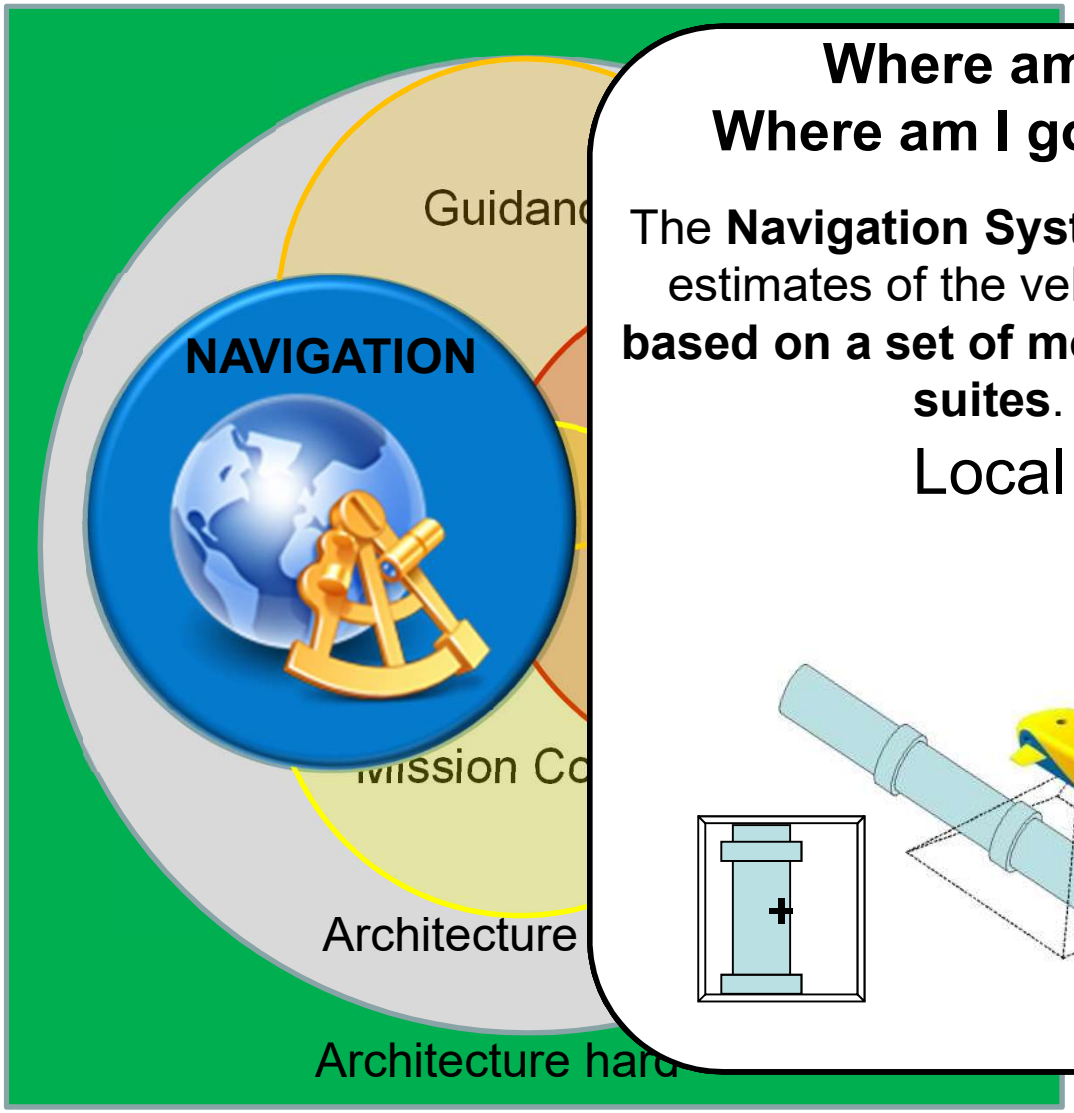
Global

Navigation



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Where am I going to?

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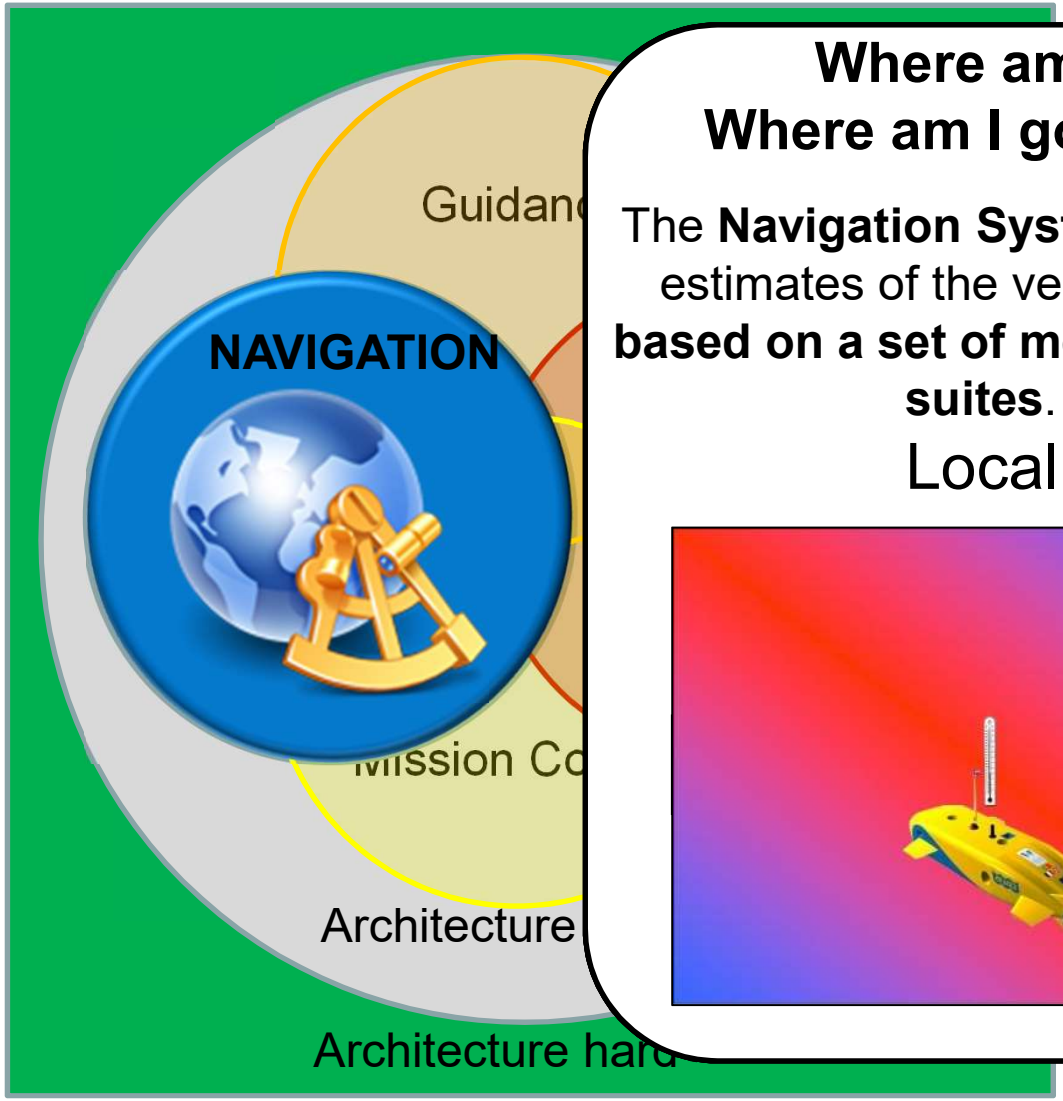
Local

Navigation



Where am I?
Where am I going to?

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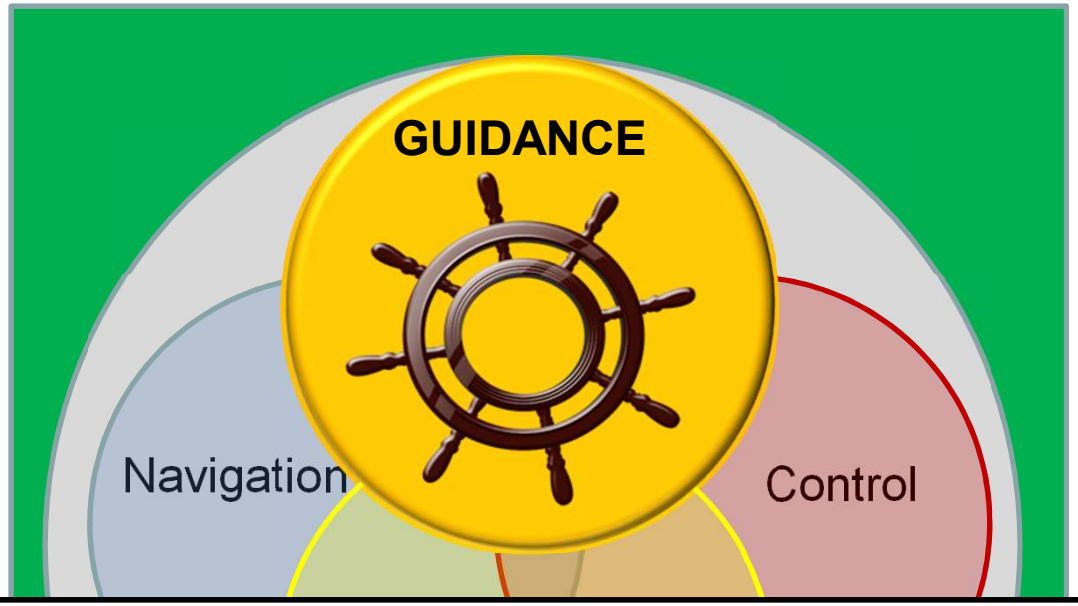
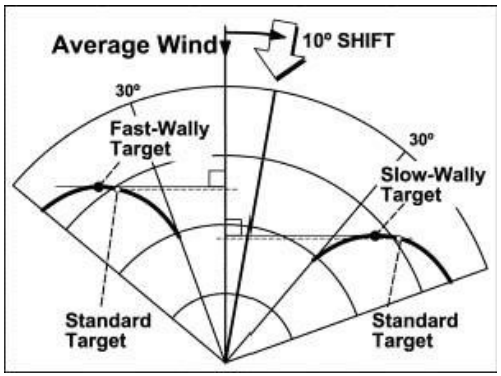
Local

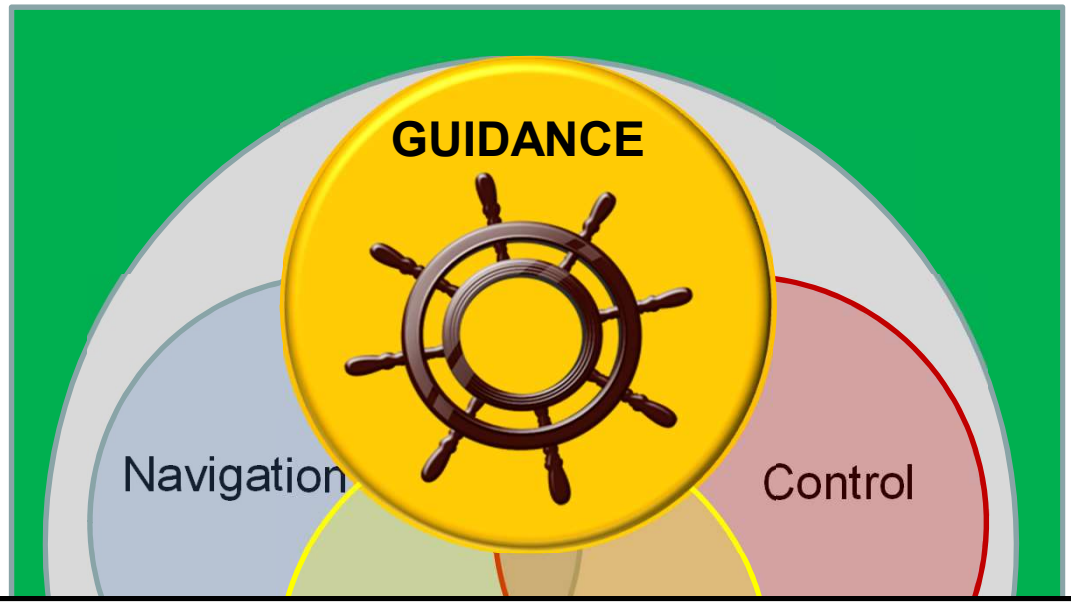
Guidance



How approaching the objective?

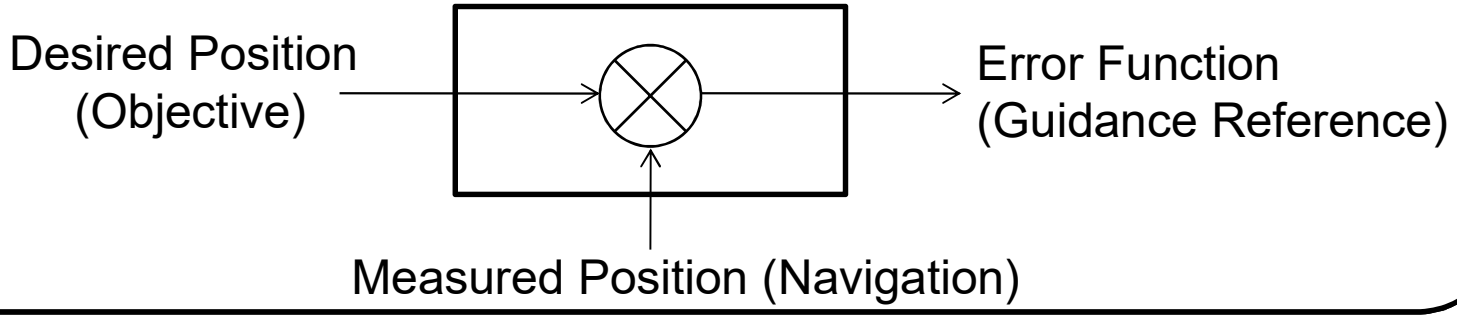


Guidance

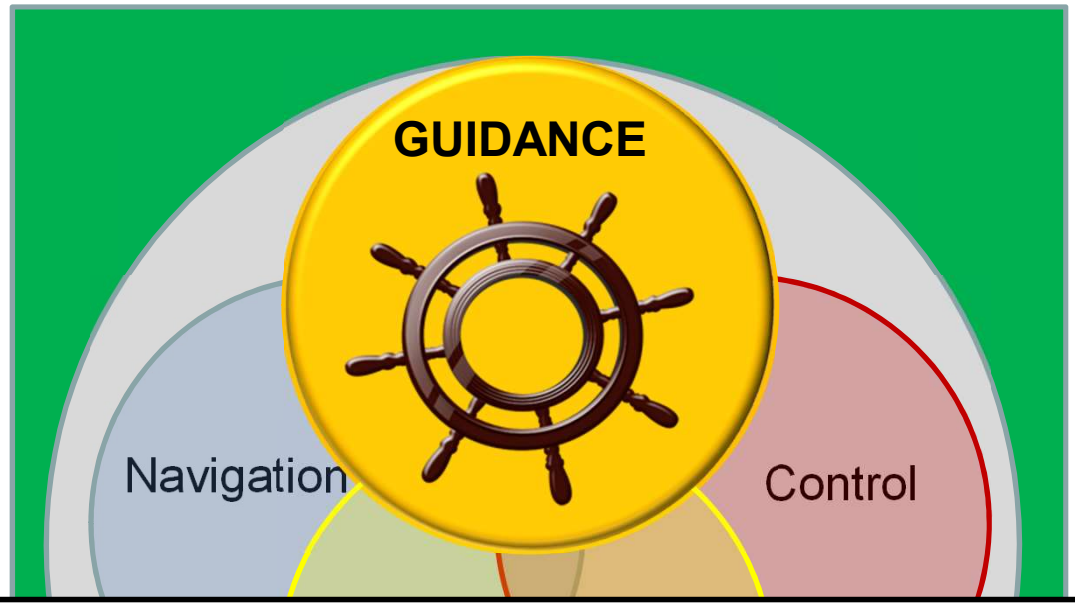


How approaching the objective?

The **Guidance system** processes Navigation/Inertial reference trajectory data and output **set-points for desired vehicle's velocity and attitude**



Guidance



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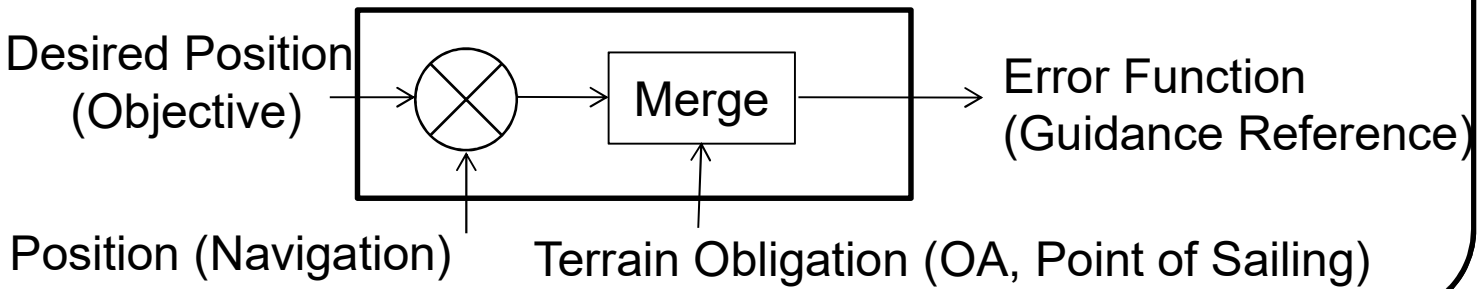
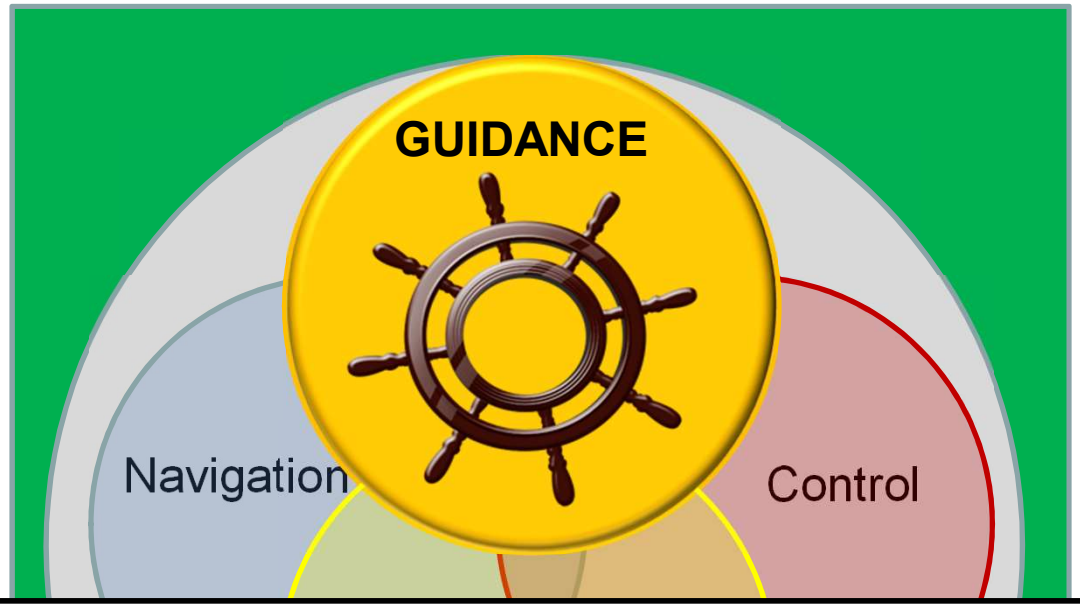


Guidance



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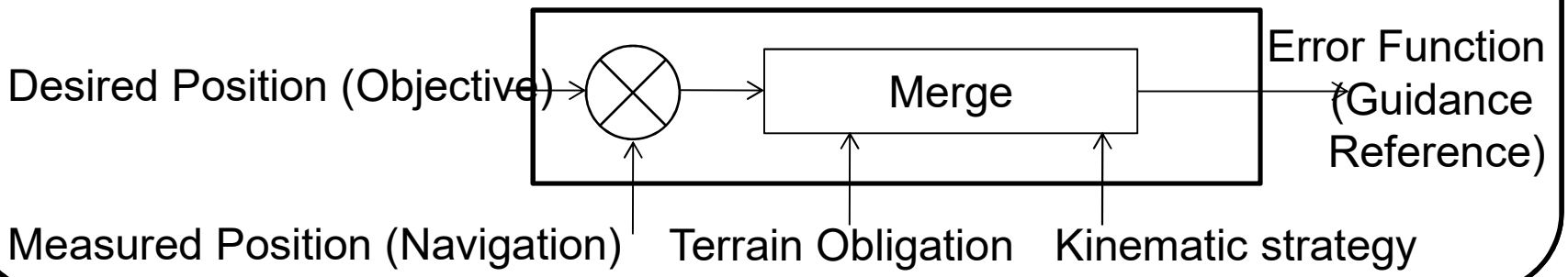


Control

How should I move THAT way ?

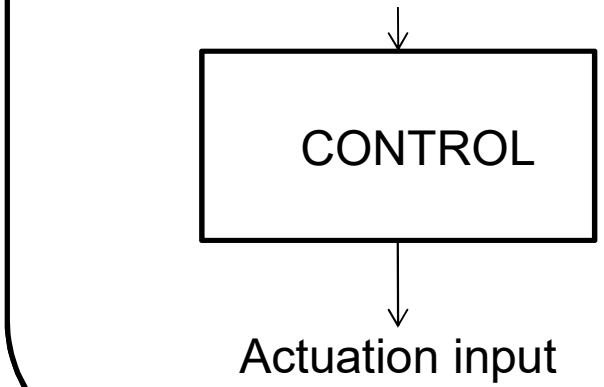
The **Control system** generates actuator signals to drive the actual velocity and attitude of the vehicle to the values **provided by the Guidance system**.

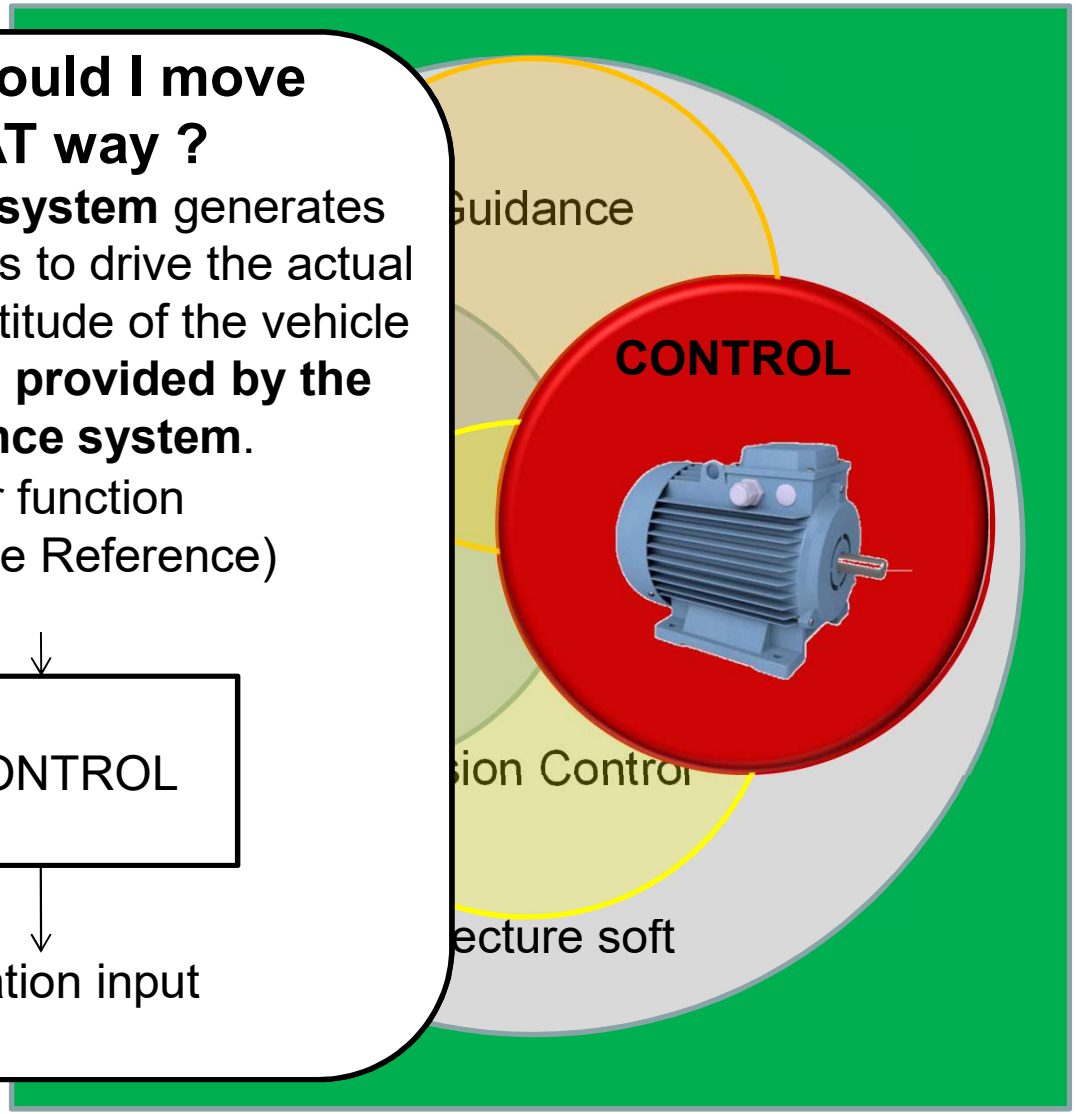
Control

How should I move THAT way ?

The **Control system** generates actuator signals to drive the actual velocity and attitude of the vehicle to the values **provided by the Guidance system**.

Error function
(Guidance Reference)





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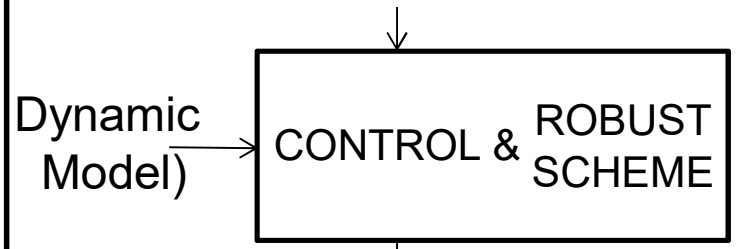
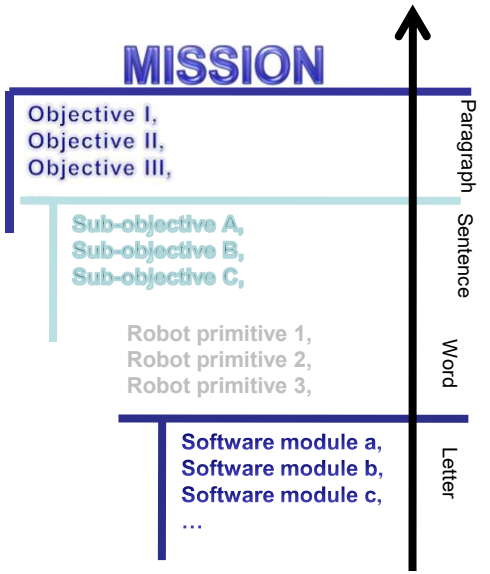
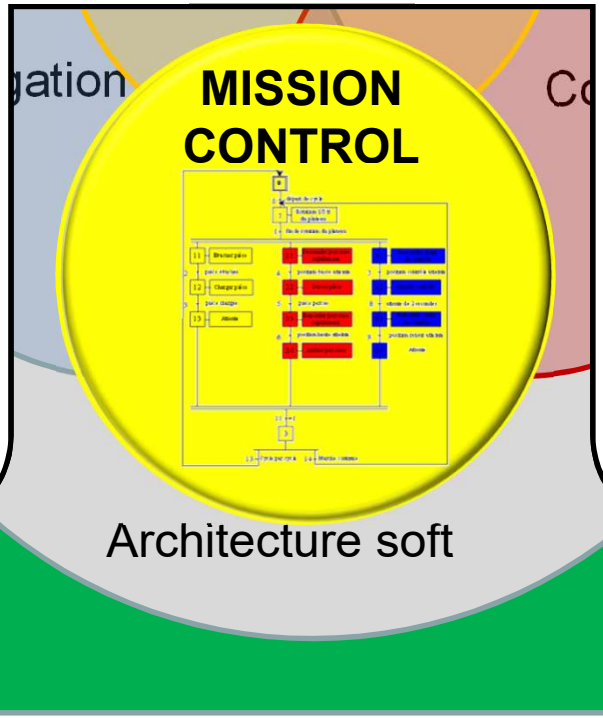


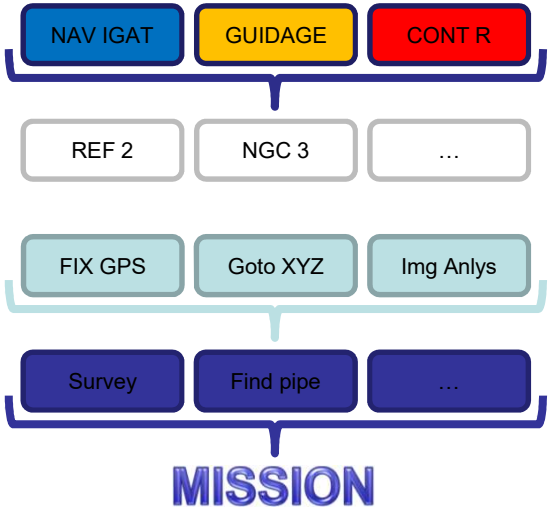
Actuation input

Mission Control

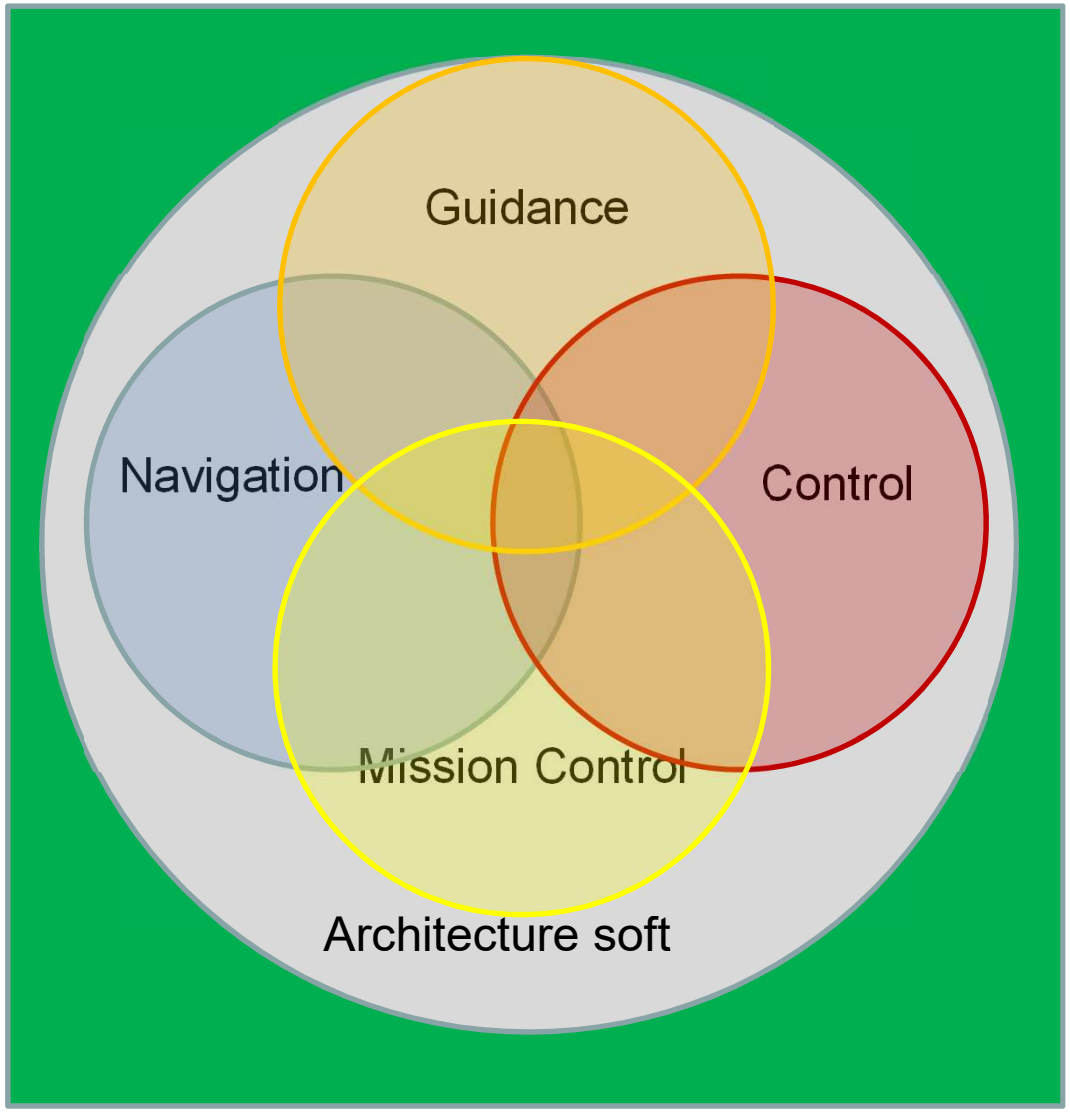
How Do I manage my objectives, my mission?



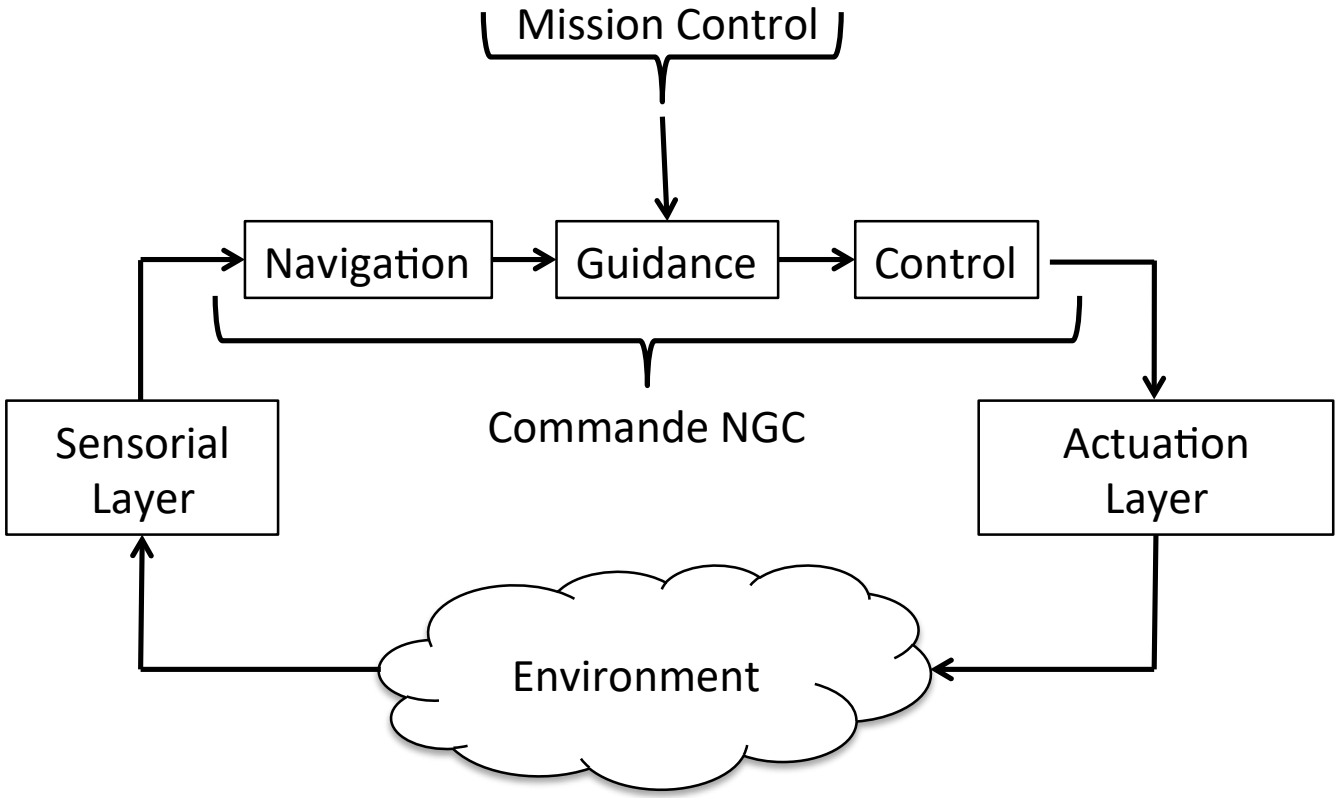




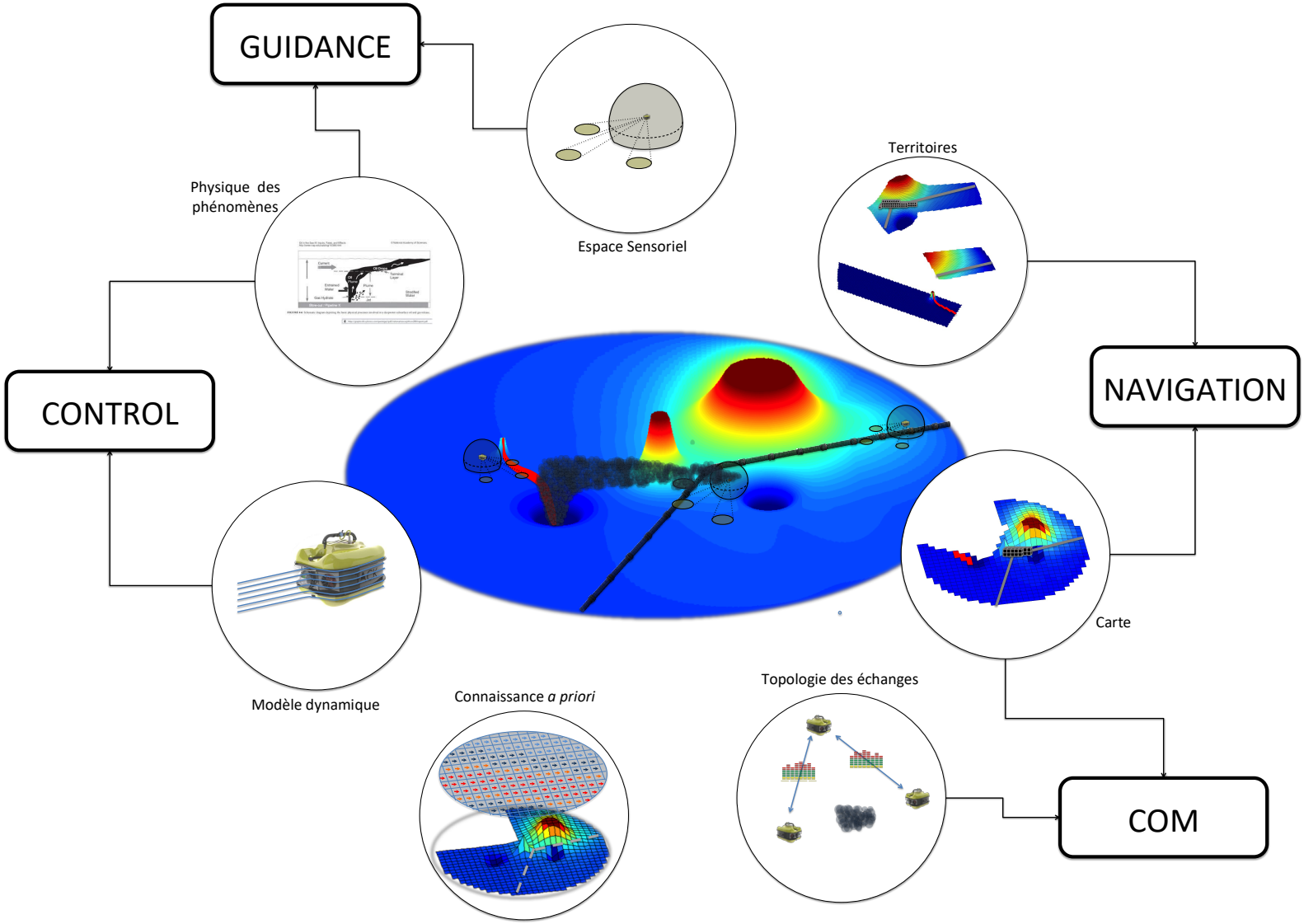
Functions


Guidance
Navigation
Control
Mission Control
Architecture soft

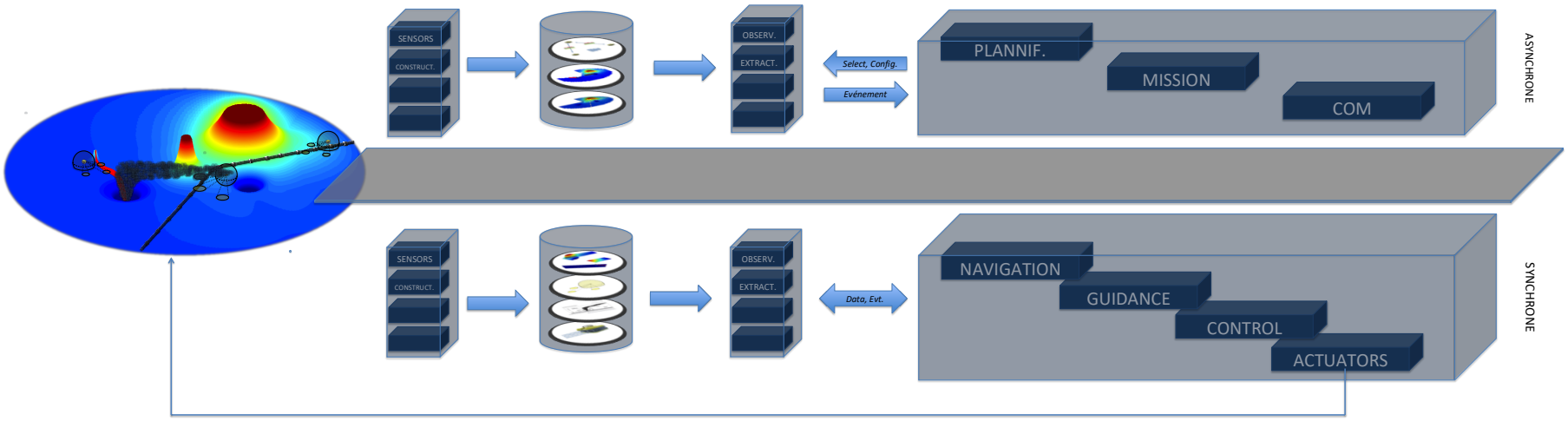
S-NGC-A control structure



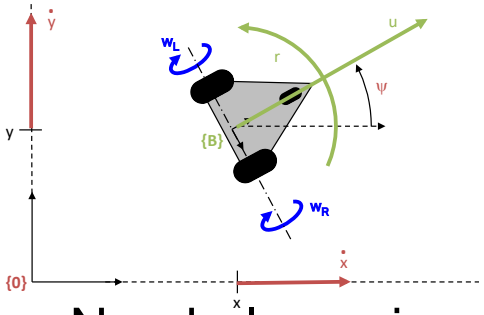
Sensorial Layer



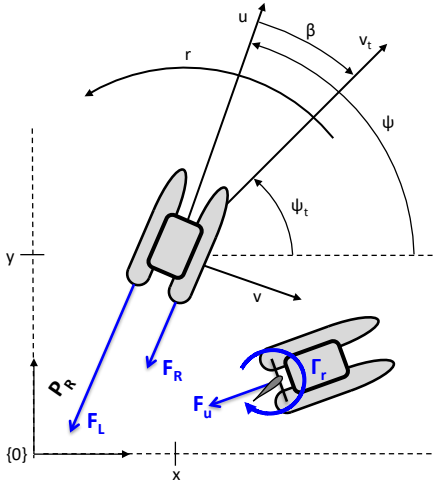
Sensorial Layer



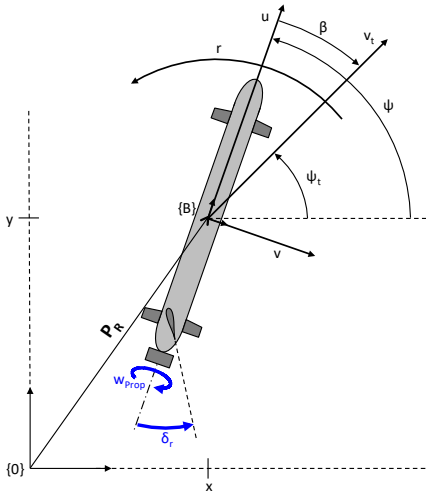
Actuation Layer



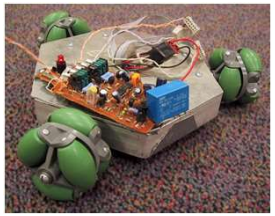
Non-holonomic

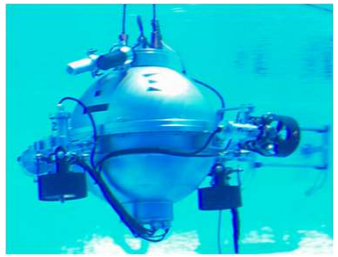


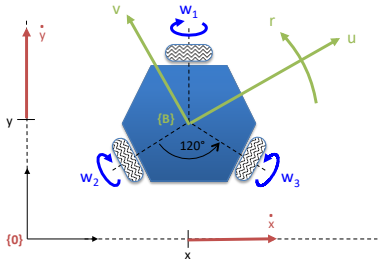
Under-actuated

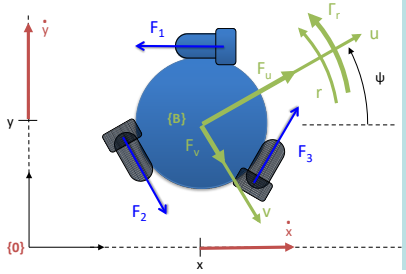


Iso-actuated

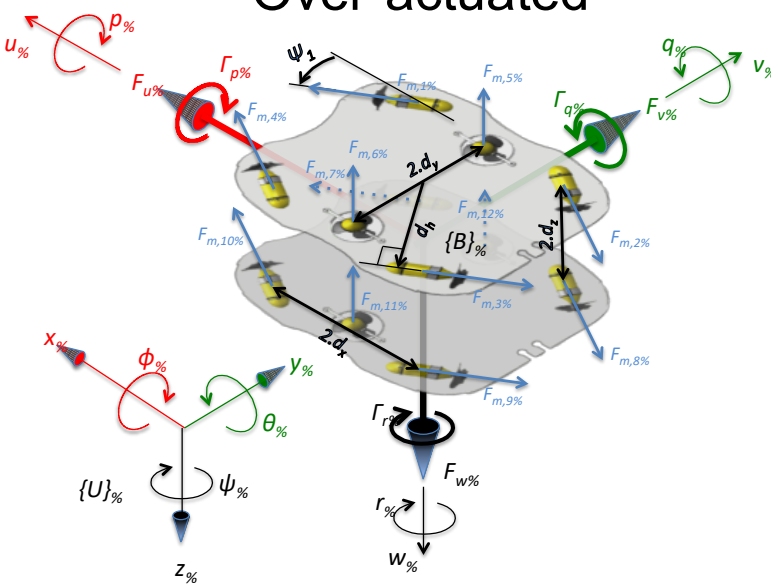








Over-actuated



Control functions

- Mission Control:
  - Define and sequence objectives, sub-objectives…
- Sensorial layer:
  - Build current model of the environment
- Navigation:
  - Estimate system state
- Guidance:
  - Strategy of approach to the objective
- Control:
  - Compute actions to be applied on the environment
- Actuation layer :
  - Compute actuators inputs, manage redundancy (if exists)