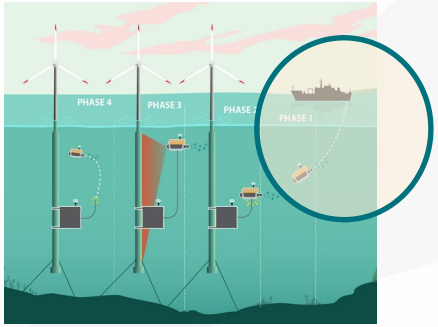


Example 5

AUV-borne position estimation from Doppler,
AHRS, and measurements of ranges-only to known beacon
(e.g. on docking station)

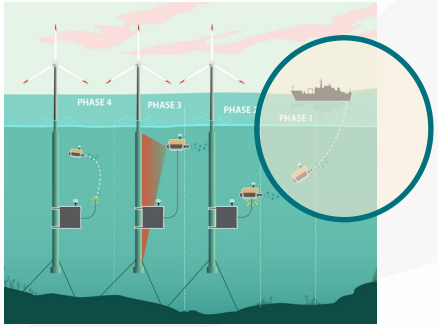
Doppler – velocity measurements

Yaw measurements (AHRS)

Range measuring device – measurements of range wrt fixed beacon

Filtering Structure

Position and velocity estimates



Example 5

Complementary Filter Structure

Underlying Design Model

current velocity

Doppler measurement

$$v_m = v_w = v - v_c$$

$$v = v_w + v_c$$

$p = (x, y)^T$

inertial position

$v = (\dot{x}, \dot{y})^T$

inertial velocity

p_b – *beacon position*

r_m - range measurement

$$\frac{d}{dt}p = v_c + v_w + \xi_1$$

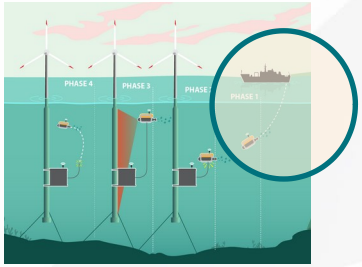
$$\frac{d}{dt}v_c = 0 + \xi_2$$

state noise

$$r_m = ||p - p_b|| + \eta$$

measurement noise

Example 5



Complementary Filter Structure $v_m = v_w = v - v_c$

$v = v_w + v_c$

$p = (x, y)^T$

inertial position

$v = (\dot{x}, \dot{y})^T$

inertial velocity

current velocity

$+v_c$

input v_w

r_m

$\hat{v}_c$ v $\hat{v}$ $\hat{p}$

$\int$ $\int$ $||\hat{p} - p_b||$

$K_1(t)$

$K_2(t)$