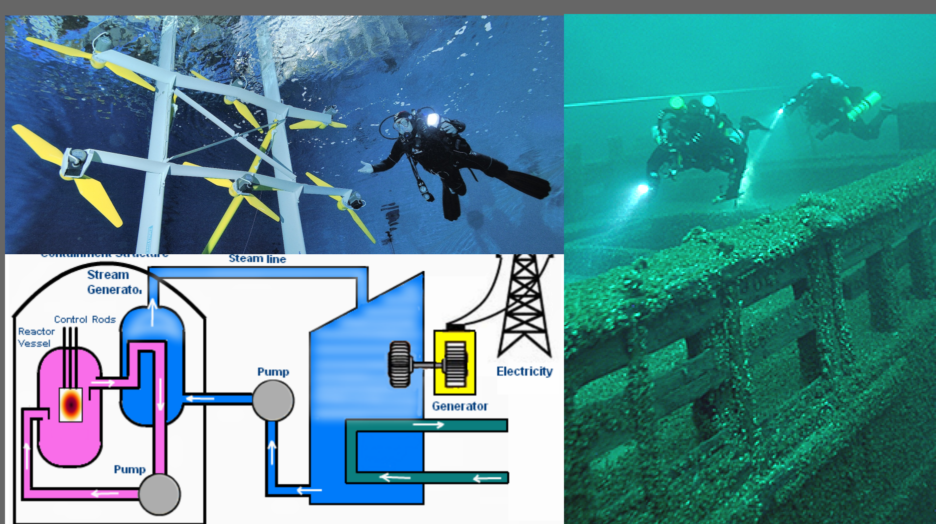
An octopus-inspired soft-bodied underwater vehicle.

F. Giorgio-Serchi, G.D. Weymouth

1. Rationale

-most operations at sea require support from divers or ***robots***,

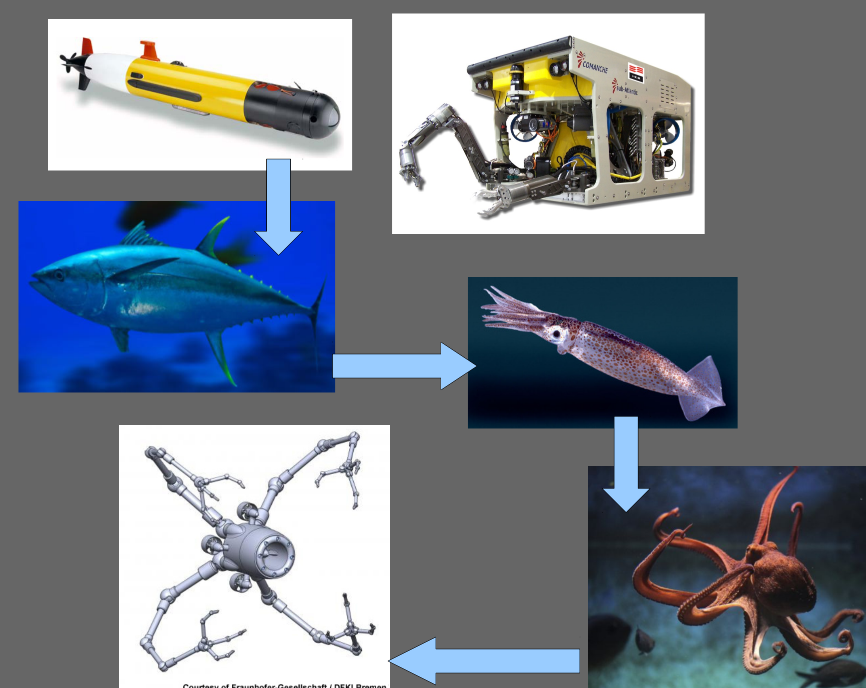
-several scenarios are ***far too challenging*** for state-of-the-art sub-sea technologies:
[1] cluttered environments,
[2] proximity to sub structures,
[3] environmental disturbances
[4] persistent autonomy,
[5] prolonged operation.



2. Aim and Objectives

-design an innovative kind of unmanned sub-sea vehicles:
[1] enhanced efficiency,
[2] enhanced maneuverability
[3] enhanced survivability

-use aquatic organisms as the source of inspiration



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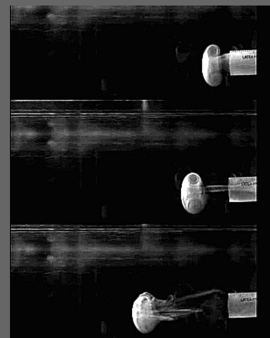
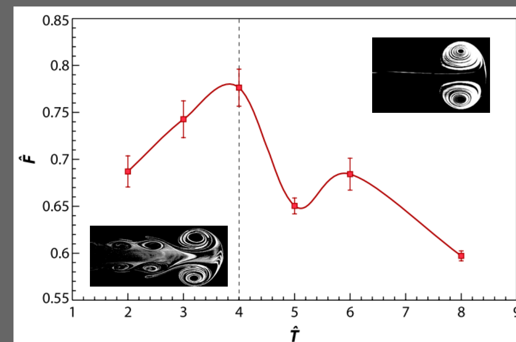
3. Research Background

Pulsed-jet propulsion

Vortex ring aided thrust:
-for L/D=4 excess thrust
-for L/D>8 equal to jet

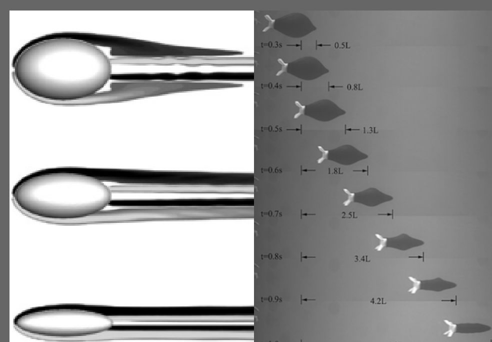


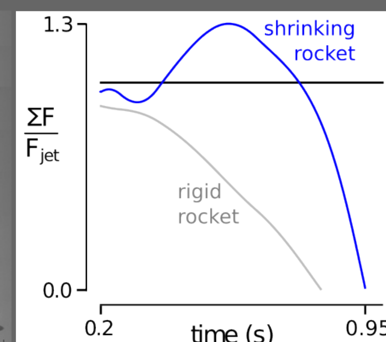


Added-mass recovery

Shape-change variation during body acceleration generates positive thrust

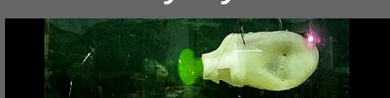
$$F = -\frac{\mathrm{d}}{\mathrm{d}t}\left(m_a U\right) = -\dot{m}_a U - m_a a,$$

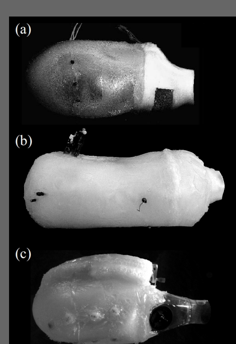


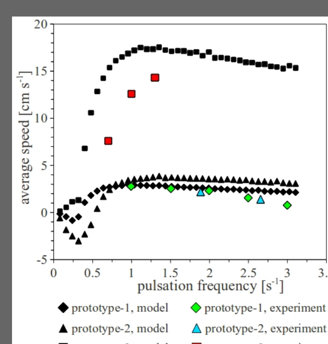


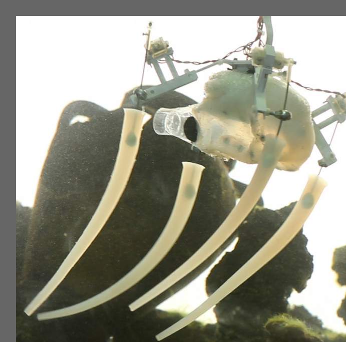
Bodily compliance

Compliant vehicles underactuation and soft-body dynamics



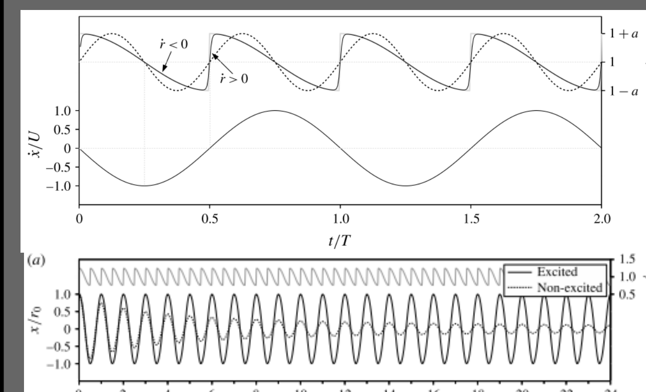


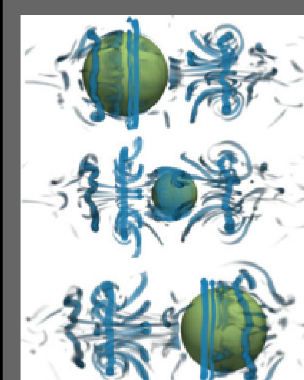




4. Progress so far

-numerical study of shape-change routines for optimal added-mass recovery exploitation,
-analogy with parametrically excited shape-changing oscillator damped to undamped transition.





The shape-change alone can drive the onset of resonance in oscillators which are immersed in a dense medium.

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