The impact of new information infrastructures in understanding and forecasting the European Seas and coasts: ICTS SOCIB, a **C**oastal **O**cean Observing and Forecasting **S**ystem based in the **B**alearic **I**slands, Horizon 2020 and RIS3 Strategies.

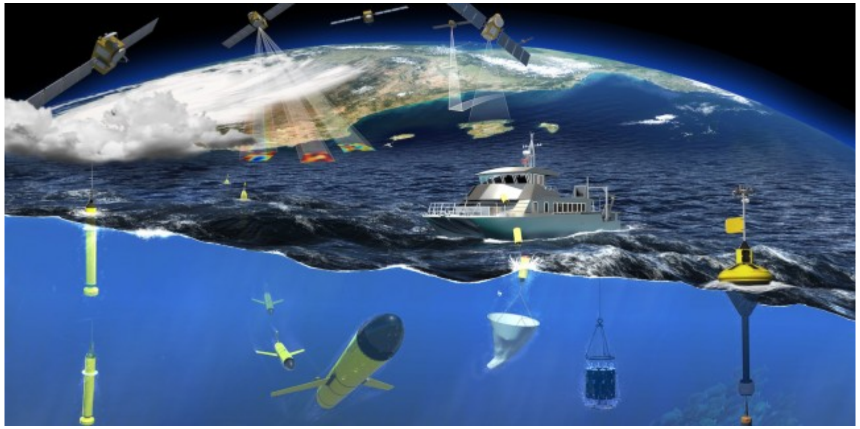
Joaquín Tintoré and the SOCIB/IMEDEA TMOOS team

SOCIB and IMEDEA (UIB-CSIC)

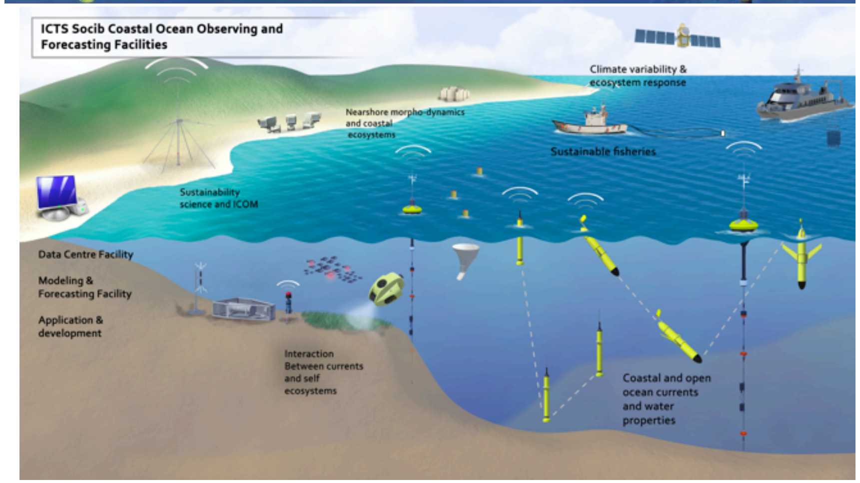
http://www.socib.eu

MRI and SOCIB: key element for increasing Horizon2020 competitiveness and implementation of RIS3 strategies in Europe.

- New technologies have allowed a crucial **change of paradigm** in ocean observation: from ship based observation to multi-platform integrated observing systems.



- International trend: **towards new observing systems**, Europe response to this challenge, EC, DG's, JPI Oceans.



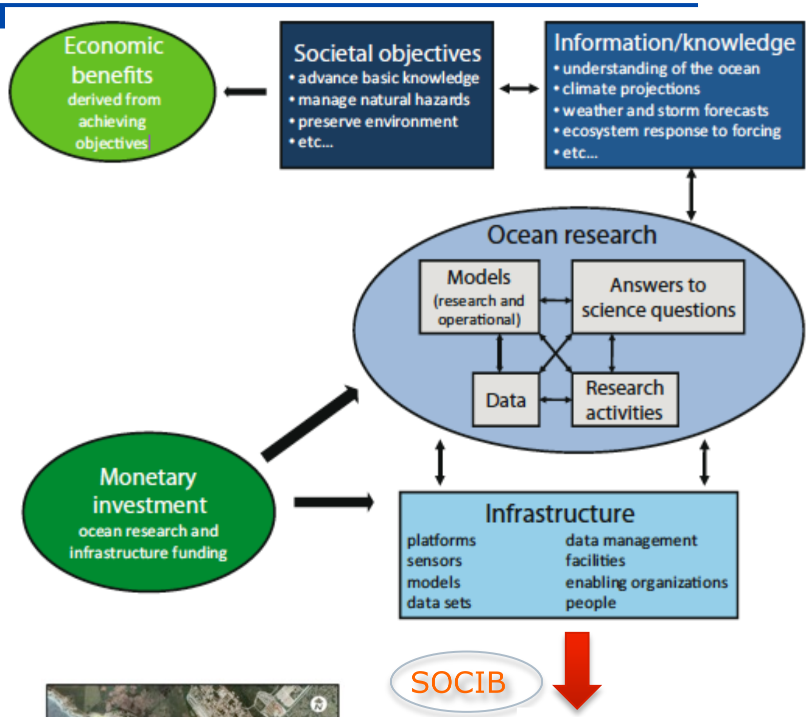
- SOCIB is one of the leading elements of the European response: a **multi-platform distributed and integrated facility of facilities**, open to international access that provides free, open, quality controlled and timely streams of data &forecasting products and services. ICTS MINECO.

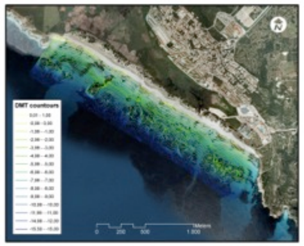
MRI and SOCIB: key element for increasing Horizon2020 competitiveness and implementation of RIS3 strategies in Europe.

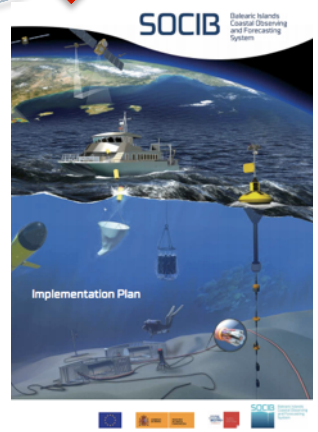
- SOCIB **drivers & singularities**: science, technology development and capacity to respond to strategic society needs. Extends from nearshore to open ocean.

- Implementation Plan 7/2010. Design 2009-2010; Construction 2010-2102; Operations 2012-2021. Strong Partnership CSIC-IEO-UIB, in Europe and internationally IMOS, OOI-IOOS,Neptune-Venus, etc.

- Innovation: new role **Marine Research Infrastructures for** PPP.







Innovation in oceanographic instrumentation

3 elements:

- Oceans complexity imply and drive a need for improvement of instrumental capacities

- The innovation process, complexity and incubation time

- The key to success

(Curtin and Belcher, TOS, 2008)

Innovation in Oceanographic Instrumentation

BY THOMAS B. CURTIN AND EDWARD O. BELCHER

INTRODUCTION

The tools of oceanography include instruments that measure properties of the ocean and models that provide continuous estimates of its state. Major improvements in tool capabilities lead to leaps in understanding, and this increased knowledge has many practical benefits. Advances in tool capabilities are sometimes viewed as an objective of basic research, a viewpoint reflected in the basic research funding category of "science and technology" (S&T).

The complexities of and incubation times for advancing instrumentation are often not fully appreciated, resulting in unrealistic expectations and discontinuous support. Greater understanding of the process of innovative instrument development can contribute to sustaining it. Innovation can be incremental or radical depending on performance gains (Utterback, 1994), stimulated or suppressed depending on institutional factors (Van de Ven, 1989; Office of Technology Assessment, 1995), and sustaining or disruptive depending on value propositions (Christensen, 1997). For example, going from a Nansen to a Niskin bottle was an incremental innovation, whereas going from bottle casts to CTD profiles was a radical innovation. Moored current meters incrementally advanced from film recording of gauges, to mechanically digitized signals on reel-to-reel tape, to solid-state analog, to digital conversion and memory. Radical innovation of current-field measurement came with the acoustic Doppler current profiler.

In large organizations, stimulated innovation often occurs in research departments, particularly when the projects have champions: "the new idea either finds a champion or dies" (Schon, 1963). In other parts of the same organization, innovation may be suppressed by the costs associated with re-integrating a system and minimal perceived competition. The incubation time of the computer mouse from inception to wide use was 30 years. In oceanographic observation, where synoptic coverage is an objective, a sustaining innovation would be a sampling platform with improved propulsion that doubles its speed. A disruptive innovation would be a new platform with much *slower* speed, but with much longer duration and a low enough cost to be deployed in great numbers. Here, we will focus on radical, stimulated, disruptive innovation that involves both science and engineering.

To motivate continued investment in basic research, the histories of many radical innovations, ranging from the transistor to radar to the Internet, have been documented (Bacher, 1959; Hetrick, 1959; Becker, 1980; Hove and Gowen, 1979; Allison, 1985; Abbate, 2000. The Defense Acquisition History Team at the US Army Center of Military History is also preparing a document on this subject.). These cases clearly demonstrate that "rapid" innovation in

The innovation process (for advancing oceanographic instrumentation)

Complexity of innovation process: needs to be known, to avoid unrealistic expectations and/or discontinuous support.

Incubation time: 15-30 years (computer mousse, 30 years). Gliders 10 years. ¿?

Innovation can be incremental or radical, stimulated or suppressed.

The innovation process (for advancing instrumentation)

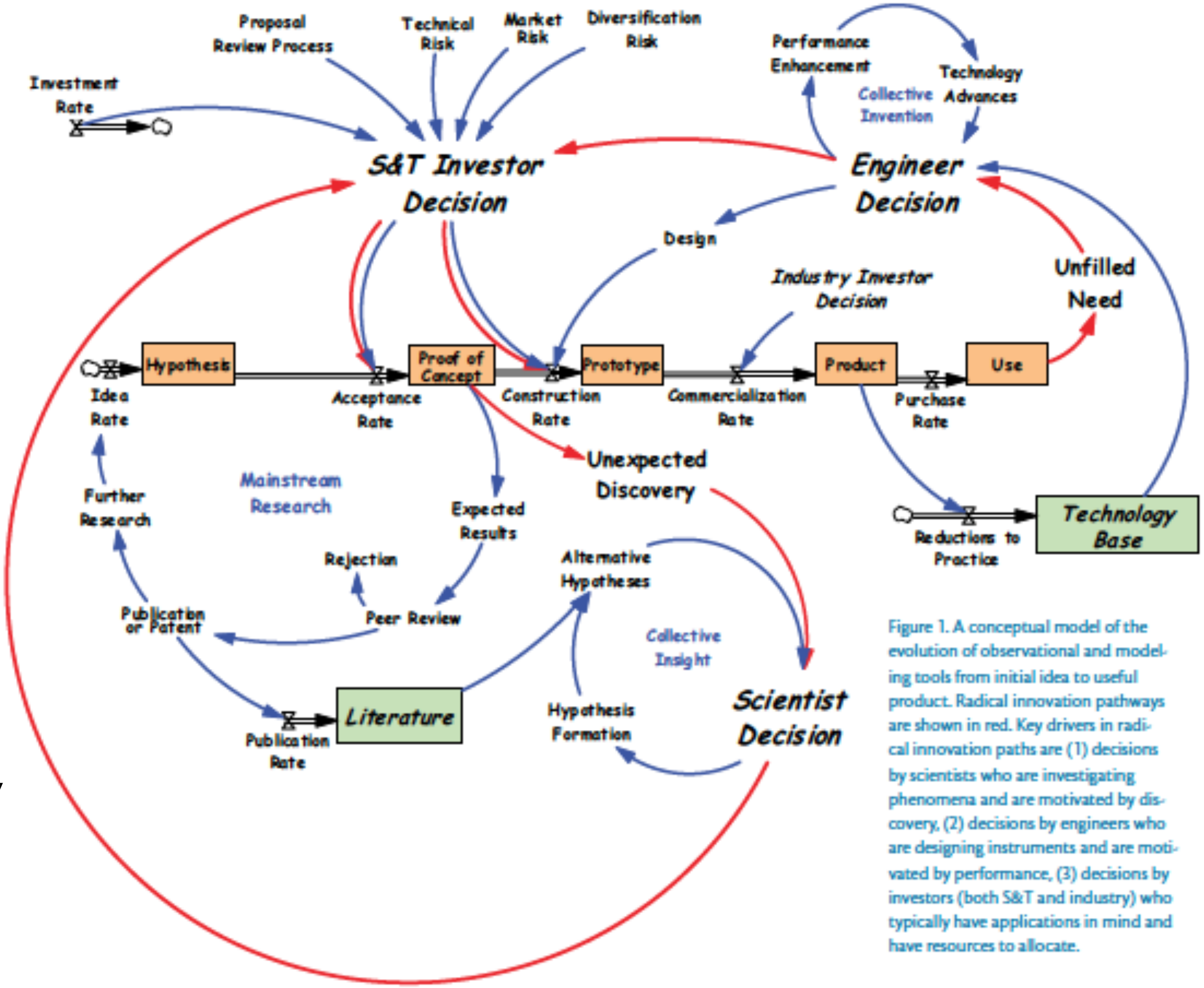


Figure 1. A conceptual model of the evolution of observational and modeling tools from initial idea to useful product. Radical innovation pathways are shown in red. Key drivers in radical innovation paths are (1) decisions by scientists who are investigating phenomena and are motivated by discovery, (2) decisions by engineers who are designing instruments and are motivated by performance, (3) decisions by investors (both S&T and industry) who typically have applications in mind and have resources to allocate.

(Curtin and Belcher, TOS, 2008)

The innovation process (for advancing instrumentation)

Why is it important? : we need synoptic coverage

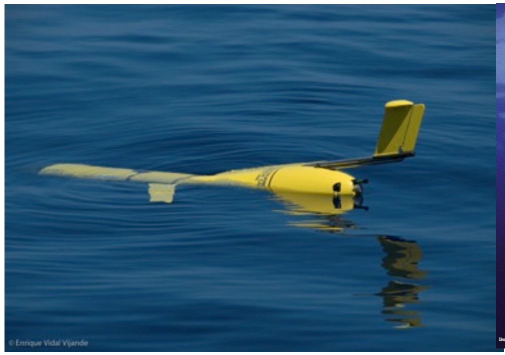
And… "Every time a new instrument has arrived,

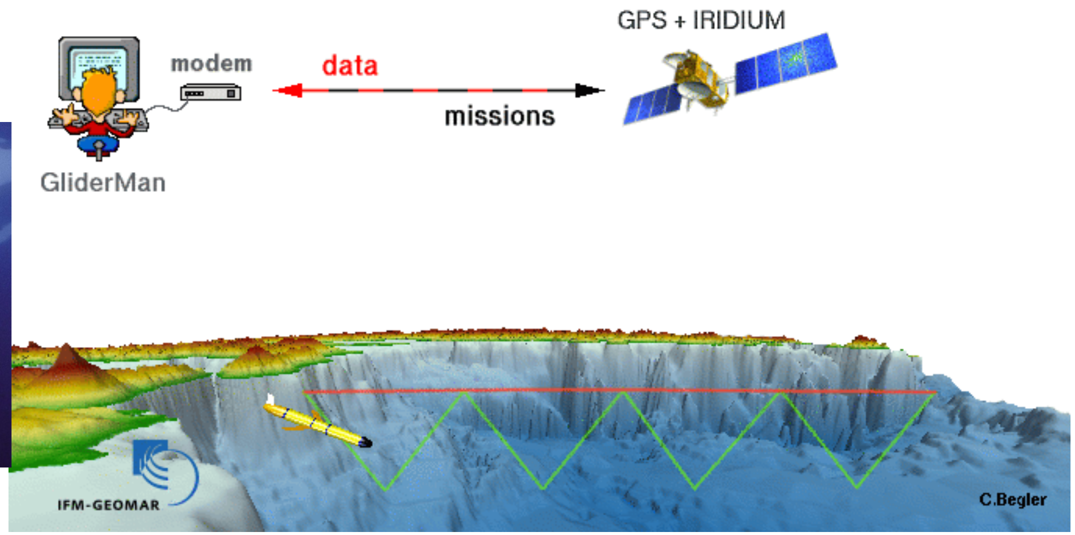
new key findings"…

Examples of innovations:

- Ships → Public – Private transfer
- Satellites → Ocean Weather..
- CTD → Micro-structure,
- Buoys- ARGO profilers →
- Currentmeters (rotor to ADCP) → Spectrum…
- Gliders → Submesoscale - …

The innovation process (disruptive, gliders)





Incubation time for gliders; ½

Why?: …

… "A coherent set of scientists, engineers, and investors that envisioned the scientific goal, understood the technology potential and sustained the funding" (Curtin and Belcher, TOS; 2008).

The key to success for radical innovation in oceanographic instrumentation

1. Visionary leadership
2. Close coupling between science and engineering
3. A coherent investment strategy based on distributed, coordinated resources
4. Effective processes for communication, feedback, and contingency planning.
5. Incentive to assume responsibility for risky instrumentation development projects without undue career jeopardy.

In summary: work in collaborative, multidisciplinary teams, be tenacious and focused on long term objectives while producing short-term success, and find creative champions among funding agencies and investor organizations.

The role of new marine research infrastructures: MRI/ ICTS SOCIB….for Horizon2020 and RIS3.

→ Need to…(in line with SOCIB original … -2007- drivers):
RESPOND TO THE 3 KEY DRIVERS

- Science Priorities – (ok!)
- Strategic Society Needs (more listening!, policy makers & managers endorsement), MSFD (GES); Energy, Tourism, etc.
- New Technology Developments (companies, social society endorsement)

<u>MRI, ICTS, SOCIB…. are particularly well placed</u> (in particular for responding to H2020, RIS3, etc….)

<u>For this…</u>

→ **Need to define a JOINT STRATEGY (international level, more than coordination, Partnership !, towards MRI core, EU competitiveness…**

→ **Need support for re-orienting science evaluation system and tools generally used: maintaining scientific excellence but also getting closer to society.**