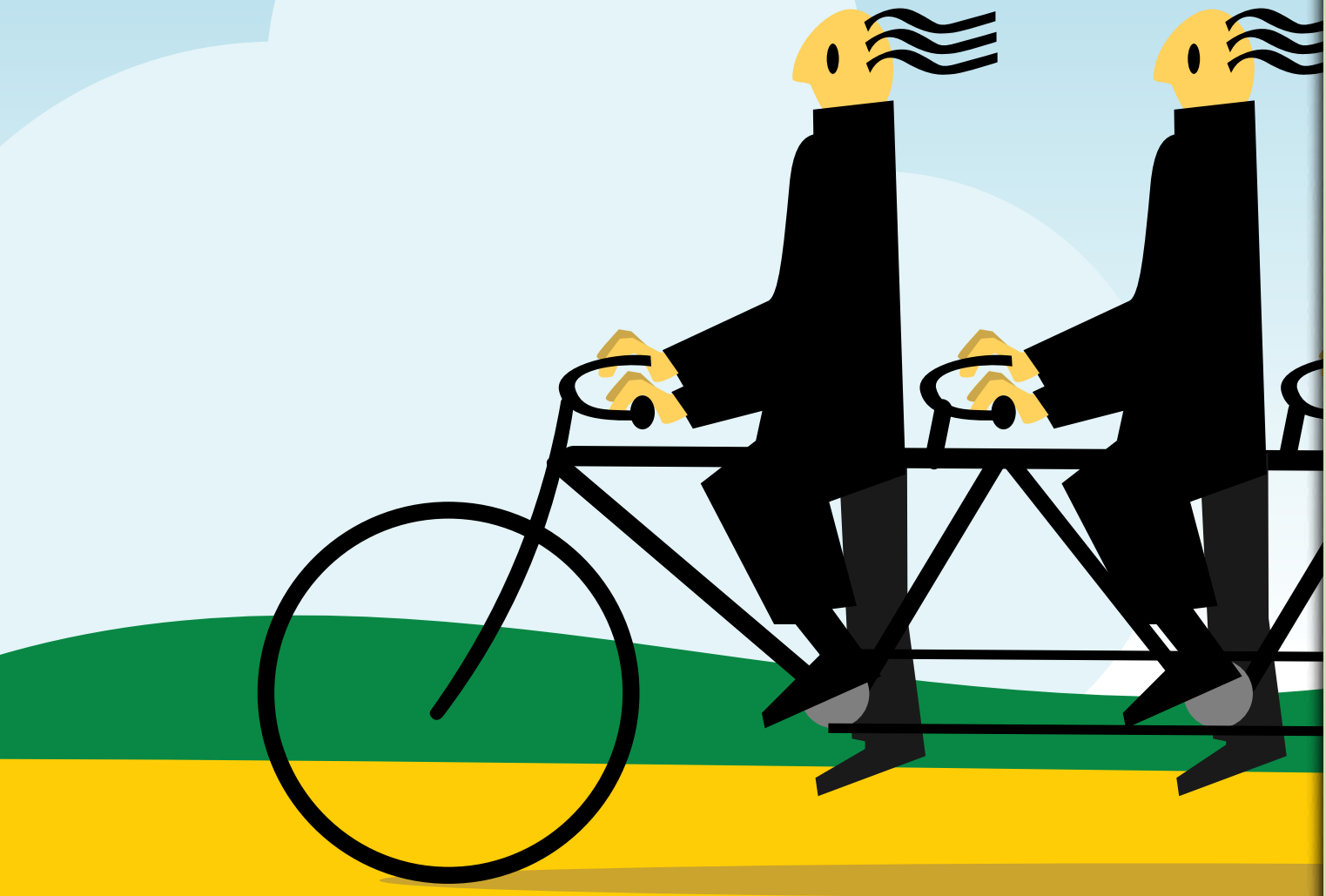
BY MELBOURNE G. BRISCOE

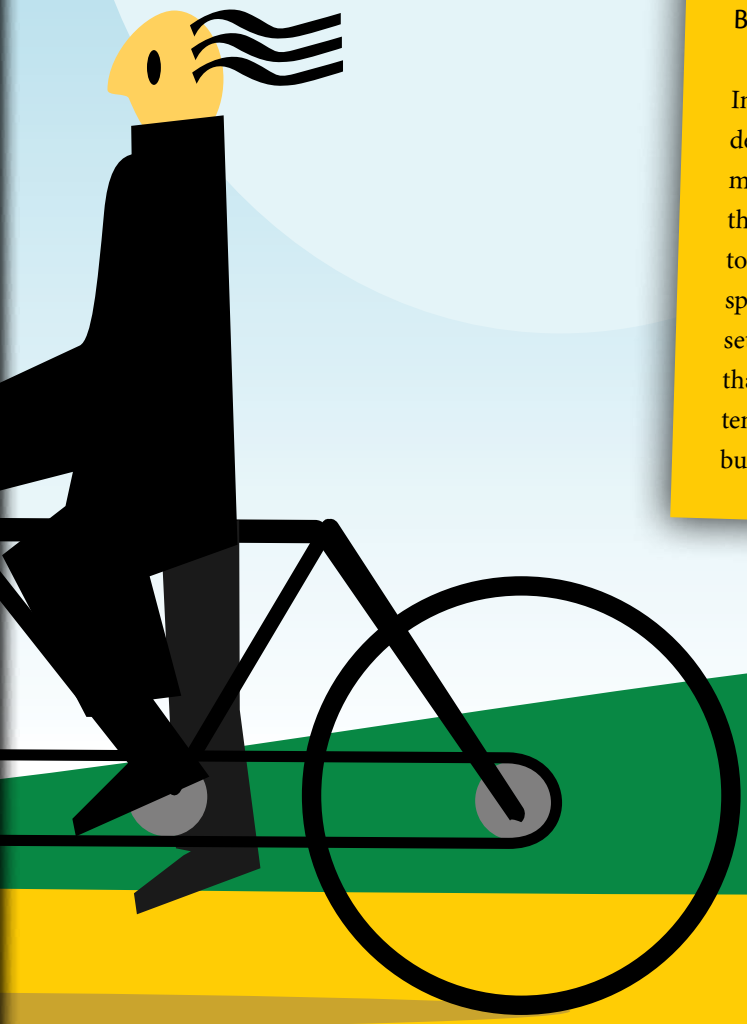
Collaboration in the Ocean Sciences

Best Practices and Common Pitfalls



As collaboration among ocean scientists becomes more necessary and common, those who attempt to plan, organize, and implement joint research projects are discovering that collaboration is more difficult than they first thought. Collaboration is often a trial-and-error methodology that takes time to get right. Ocean scientists can learn from people whose entire careers are built on studying and describing collaboration, its principles and best practices, and what can go wrong. There are books on collaboration, professors of collaboration, and genuine experts on collaboration.

This article extracts and distills some of that wisdom on collaboration and puts it into the context of ocean sciences. We need good collaborations in the ocean sciences, and cannot afford—nor should we be satisfied with—homegrown, do-it-yourself efforts when professional and scholarly expertise is available to us.



BOX 1. SHORT STORY

In the early 1980s I was up for tenure at Woods Hole, and my department chairman came to me and asked why so many of my publications were jointly authored. I proudly explained that I enjoyed working with other people, it gave me a chance to learn new things and new approaches, and it allowed me to spend time on problems that were not in the center of my skill set and knowledge base. He seemed unhappy and commented that it might not be possible for me to get any credit towards tenure except for the single-authored papers. He is gone now, but that cultural attitude in the ocean sciences lingers on.

WHY COLLABORATE?

Why should we collaborate? Why bother? Why share the credit? Isn't the best science done by smart people sitting alone in a room? Don't tenure committees downplay multiple-author papers?

There are three compelling reasons to collaborate:

- **The problem of interest is too big or too broad for you (or your organization) to tackle alone.** As much as you would *like* to go it alone, the problem you want to tackle is too much for you. It is tempting to try to carve off just a piece—your piece—and do that alone, but this approach can be dangerous. It can miss the heart of the problem, its connections, context, and greater picture, and change a real problem into a toy problem. Our goal should not be to find problems that we can solve, but rather to seek problems that need solving. Thus, collaboration may be essential for *real* problems.
- **You need to share resources and/or assets.** *Example: You have the ship and instruments but the other person has the technicians.* Or, by sharing, you can both afford to work on your similar and related problems. The need to share is increasing as money gets more difficult to find; collaboration may be necessary.
- **Sponsor mandates.** *Example: The National Oceanographic Partnership Program (NOPP) demands collaboration among several sectors; its managers want to see knowledge and resources spread, not coalesced.* Because some applied funding sponsors want to see the results of research affect operations and practices, they demand some collaborative work between the researchers and the practitioners so the end result of the research doesn't just end up in a dusty journal.

In addition, it can be more fun to work with other people—the sharing of ideas and excitement is part of what makes science worth doing.

On the other hand, collaboration may not be advantageous. Some typical reasons given might be:

- **Loss of independence/flexibility.** I can't just do what I want, so it is harder to "follow the thread" and to work on my own schedule.
- **Benefits not worth the risks/complexity.** I don't see what I might gain by entering into this set of constraints.
- **Disagreement on mission/goals.** We want to do different things in different ways, so a collaboration would be a constant fight.

BOX 2. SHORT STORY

In the mid-1980s, the Department of Defense (mandated by Congress!) announced a new opportunity for research money, called the University Research Initiative Program (URIP). It was overtly intended to get separate groups working together to do things they could not do alone. The intensity of the proposed collaboration (as well as the objective of the collaboration) was a criterion in judging the proposal. We formulated a team from Woods Hole, MIT, and Harvard to work together to try to insert telemetered, real-time ocean data (Woods Hole and MIT) into predictive ocean models (Harvard) that would allow adapting the observational program to be more appropriate to the dynamical state of the ocean. We wrote a terrific proposal full of excitement and good intentions, but knew nothing of any of the "best practices" and "common pitfalls" that this article discusses. We discovered none of the best practices, and all of the common pitfalls. We got our money and did our (individual) work, but as a collaborative URIP, it was a failure. We were about a decade ahead of ourselves in the technologies we were trying to develop and use, and perhaps two decades ahead of ourselves in how to manage a difficult collaboration. An interesting sidelight is that the program still exists but is now called the Multidisciplinary University Research Initiative, to be even more specific about the kind of collaboration that is desired.

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- **Bureaucratic structures.** Who wants more paperwork, meetings, and email? In larger collaborations, there might need to be agreed project schedules, newsletters, joint reports. Jeez. Go away!
- **Who gets the credit?** Will this help me with tenure, or hurt me? Will the next sponsor think you did all the work? Whose name is first on the paper? (We can always write two papers, with our names interchanged…)
- **Insufficient *quid pro quo*.** It looks like I will have to put a lot into this effort; will I get at least that amount back out? (Cohen, 1995)
- **Who is in charge?** I don't want to get bossed around…yet I don't want all decisions to have to be made by committee or consensus.

The National Academy of Sciences (1999) held an interesting workshop on overcoming barriers to collaborative research. It included categorizing the barriers into three major groupings: (1) culture, management, and goal alignment; (2) institutional incentives and integration of research and educational missions; and (3) proprietary rights.

Nevertheless, for all the barriers, collaborative science is on the rise. Figure 1 suggests the average number of authors per article (in *Science* magazine) more than doubled between 1966 and 2000, while the maximum number of authors per article quadrupled (Clouse, 2007; Mussurakis, 1993; Khan et al., 1999). Other studies have given similar results (e.g., Glinzel, 2002).

The drive toward collaboration is inevitable if researchers are addressing more difficult and more interdisciplinary problems than in the past. Ocean science is headed toward more collaboration, even if there are perceived disadvantages. We may as well accept it, and do it as well as we can. Ocean science *must* head toward more collaboration, because many of the research and applications questions we face demand teams of scientists and engineers (and probably social scientists and economists). A scan of the problem areas outlined by the US Commission on Ocean Policy (2004) reveals very little that can be addressed by one person working alone. Such solitary ocean science will always be important and valuable, but we must realize it cannot tackle many of the emerging problems. [Spoiler warning: Sermon coming…] Those who prefer to work alone should not denigrate those who prefer to work in teams, and vice versa.

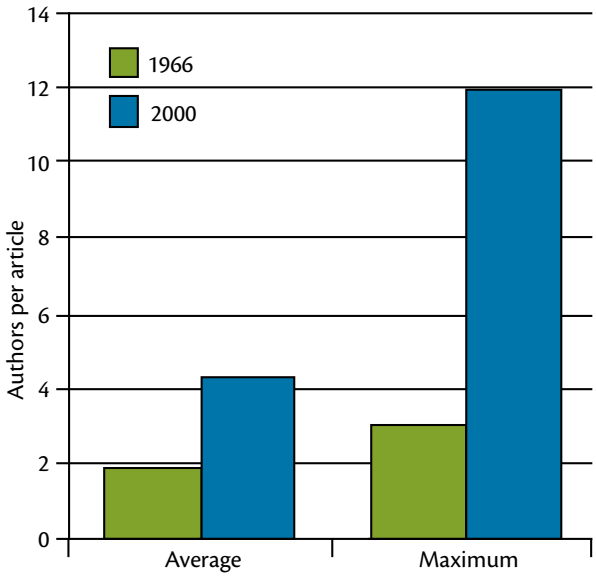


Figure 1. Increasing collaboration is suggested by the increasing number of authors on papers in *Science*, from 1966 to 2000. *(Clouse, 2007)*

COLLABORATION CONTINUUM

Some are deterred by the concept of collaboration, seeing it as a black-or-white situation where either you are working alone, or all the difficulties and pain of working with other people are in play. In fact, most collaboration is gray. It is a continuum from pure independence to complete and total integration and merger of organizations. "Collaboration" is often used as the umbrella term, but within the field of scholarly collaboration studies, the experts and specialists have developed a set of descriptive words for an increasing dependence on other people and each other. For example:

- **Independent**: *You do your thing, I'll do mine.*
- **Cooperate**: *Let's tell each other what we are doing.*
- **Coordinate**: *If you do this, I'll do that.*
- **Collaborate**: *Let's formally agree to the following objectives and actions, and who will do what, and let's write it down.*
- **Integrate/Merge**: *Let's just merge our organizations instead of trying to do everything in a coordinated/collaborative way.*

Partnership, alliance, coalition, consortium, union, federation, association, team, group: these terms describe the collection of players, without specificity about how, and how intensely, the players will work together. We often make the mistake of thinking that by calling ourselves a coalition, or something similar, we've made real progress.

The key is to identify the appropriate place in the collaboration continuum for your project: why buy into the full machinery of written working agreements if all that is needed is to share your ship schedules? Conversely—and this, in my opinion, is a major difficulty in the ocean sciences—if the shared project really requires serious attention to a high level of formal collaboration, it is unwise to try to do that on a smile, a handshake, and good intentions. Those informal agreements are all nice things, but the experts tell us that they are not enough. Think of it as a pre-nuptial agreement; there is the excitement and bloom of starry-eyed collaboration, but you may need to work through some

BOX 3. SUCCESS FACTORS FOR COLLABORATIONS

Mattessich et al. (2001) and Winer and Ray (1994) discuss 20 factors related to success in a collaboration. These items are extracted from about 40 studies of successes and failures. In any particular collaboration, not all of the factors are equally important. Ensuring the positive aspects of all 20 factors would not guarantee a successful collaboration, but ignoring all 20 would likely doom it.

1. Factors Related to the **Environment**
   - A. History of collaboration or cooperation in the community
   - B. Favorable political and social climate
   - C. Collaborative group seen as a legitimate leader

2. Factors Related to **Membership Characteristics**
   - A. Mutual respect, understanding, and trust
   - B. Members see collaboration as in their self-interest
   - C. Ability to compromise
   - D. Appropriate cross section of members

3. Factors Related to **Process and Structure**
   - A. Members share a stake in both process and outcome
   - B. Multiple layers of participation in the organizations
   - C. Flexibility
   - D. Development of clear roles and policy guidelines
   - E. Appropriate pace of development (…it takes time…)
   - F. Adaptability

4. Factors Related to **Communication**
   - A. Open and frequent communication
   - B. Established informal relationships and communication links

5. Factors Related to **Purpose**
   - A. Concrete, attainable goals and objectives
   - B. Shared vision
   - C. Unique purpose

6. Factors Related to **Resources**
   - A. Sufficient funds, staff, materials, and time
   - B. Skilled leadership and facilitation

What all the collaboration scholars and experts are saying is that you collaborate to achieve what you cannot do alone; otherwise, it is disadvantageous. You need to build a shared vision, have clearly defined work, ensure you iron out conflicts and work through trust issues, identify pilot projects, have an evaluation strategy for results, and openly and honestly assess your ability to work together. It might be the wrong group or the wrong problem, or both.

hard times. The point of the agreement is to help the collaboration succeed, not to provide a fallback for failure.

Let's look at some of the characteristics of these different collaboration levels, progressing from lower-intensity to higher-intensity efforts.

Cooperation

- Shorter-term, informal relationships
- Shared information
- Separate goals, resources, structures

Examples:

- Putting your organization's name with others on a letter to Congress
- Co-sponsoring an event
- Listing information in a directory

Coordination

- Longer-term effort around a project or task
- Some joint planning and division of roles
- Some shared resources, rewards, and risks

Examples:

- Collocate offices but do not change the way the organizations work
- Hold monthly briefing meetings and exchange information
- Do short-term joint planning to complete a project

Collaboration

- Long term
- Intense, durable, pervasive, sustainable
- New structure with commitment to common goals
- All partners contribute resources and share rewards and leadership
- Focused on developing human capacity and financial resources
- Formally and clearly organized—authority clearly defined
- Organizations agree to influence and be influenced by others

McKendall (1995) describes the full continuum of collaboration definitions, from simple networking to full collaboration. Figure 2 is from her study. For collaboration, she characterizes the aspects involved as:

- **Relationship**: must be deliberately designed
- **Mission/Goals**: aimed at solving common problems, with solutions that emerge from dealing constructively with differences; all parties see mutual benefits
- **Risk**: higher than cooperation or coordination, so the rewards must be worth it
- **Resource Sharing**: shared risks, responsibilities, and rewards
- **Process**: emergent (adaptive, learn as you go)

Page 61 of Mattessich et al. (2001) provides a compilation of the fundamental elements of cooperation, coordination, and collaboration, as characterized by vision and relationships; structure, responsibilities, and communication; authority and accountability; and resources and rewards.

Continuum of Collaboration Definitions				
	Networking	**Cooperation**	**Coordination**	**Collaboration**
Relationship	not deliberate	only mutual agreement	more formal agreement	deliberately designed
Mission/ Goals	no common goals	work together on joint goals; no commonly defined mission structure or planning effort	work together on program specific goals; more compatible missions	solve common problems; solutions emerge from dealing constructively with difference; mutual benefit
Risk	low risk	limited risk	limited risk	high risk
Resource Sharing	exchange of information	some resources and rewards shared	some resources and rewards shared	shared risks, responsibilities, and rewards
Investment	short term	limited	limited	sustained relationship and effort; more durable and pervasive
Process	none	focused	focused	emergent

Figure 2. Factors facilitating interorganizational collaboration. *(McKendall, 1996)*

In the ocean sciences, we have a lot of examples of collaboration at different intensities. These sometimes express themselves as top-down versus bottom-up, and distributed versus centralized. Figure 3 gives an example of this interplay. We are most experienced at the single-discipline, single-institution efforts in the lower right corner. These are most common because the jargon is similar within a single field, we (presumably) know the people and have long relationships with a lot of trust built up, things can be more informal because we are not crossing institutional or sector boundaries, and money can be easily shared (if necessary). However, how many times has this easiest-of-all-possible collaborations gone awry? At the other extreme (upper left) is the Census of Marine Life (COML): top down as a structure, highly distributed, buttressed with steering committees, program offices, agency support for the entity. Other similar examples are WOCE, JGOFS, and almost any program with four or five capital letters as a name. In the middle is the wide range of multidisciplinary, multi-institutional efforts that might only involve a few people but are neither simple to form nor simple to keep functioning well. Part of the reason these middle- ground efforts may not function well is that they require some formal aspects to their structure (like COML), but we prefer to try to make them work as if they were all people in the same department in adjacent offices. *Lesson*: Let the intensity of the collaboration match the needs of the shared problem, and let the structure of the collaboration match the needs of the intensity.

BEST PRACTICES

Out of all this scholarly study and background, we can derive a short set of "best practices" that surely must be attended to regardless of the intensity of the collaboration. The details will depend on the specific problem, people, and intensity. For example, the first best-practice (a shared vision) is of minimal importance for a two-person, informal cooperation, but is absolutely essential for a full-up formal collaboration. (Note that six people coming together to define a collaborative project and coming away with six "objectives" is likely not a shared vision, but rather a waste of time!) The components of these best practices are:

- Shared vision
- Impact/outcome/product benchmarks/milestones
- Interdependent system developed to address issues and opportunities
- Roles, time, and evaluation formalized
- Formal and written links
- Resources and budgets developed jointly
- Clear and strong leadership (not diffuse or assumed)
- Trust level high (takes time)
- Productivity high (early successes)
- Ideas and decisions shared
- Highly developed communication system

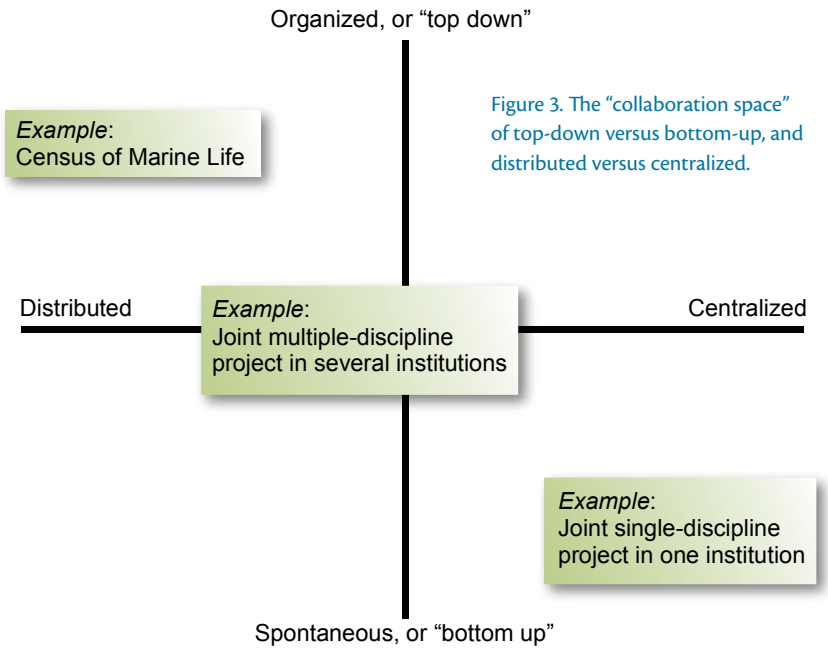
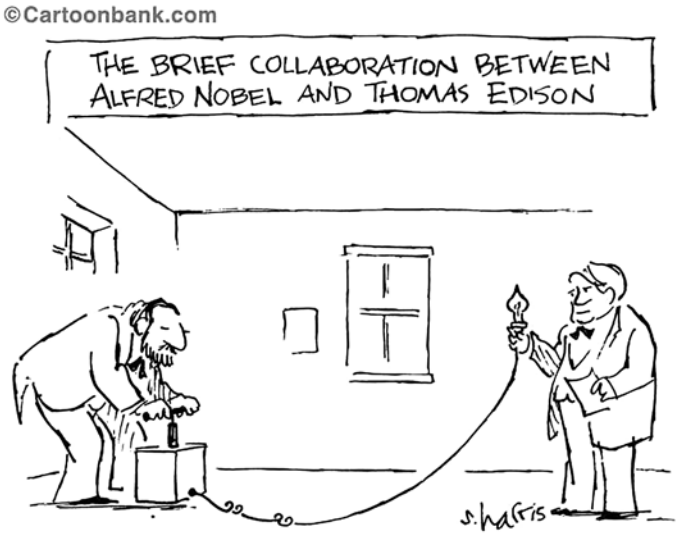


Figure 3. The "collaboration space" of top-down versus bottom-up, and distributed versus centralized.

COMMON PITFALLS

Together with the best practices above, the literature and wisdom in the field of collaboration suggests these common pitfalls:

- Assuming the mission/goals are shared
- Not "buying into" the shared objectives
- Unwilling to compromise
- Unclear alliances, leadership
- "Knowing" what's wrong and offering ready-made answers
- Lacking diversity (skills, backgrounds) in a partnership



- Failing to listen to one another
- Failing to engage customers/users
- Avoiding meaningful action
- Thinking success is self-evident

HOW TO PROCEED?

There are many techniques to initiate fruitful and robust collaborations. You can seek these out in the collaboration literature, in strategic-planning guides, and from experienced facilitators. It is all too common in the ocean sciences to go it alone, to assume nobody else can help, to try to do it yourself. I suppose this comes from the self-sufficient idea of the smart scientist working alone. It is, however, a bad idea, if you are treading into territory where experts and experience actually exist, to ignore their body of knowledge and try to do it yourself.

SUMMARY AND CONCLUSIONS

The truth of the matter is that you always know the right thing to do. The hard part is doing it.

— Norman Schwarzkopf

If you are only going to remember three things as you enter into collaboration (or at lesser intensity, cooperation or coordination), they are:

- Develop clearly defined and trusting relationships; this may require written working agreements as to who will do what by when, to eliminate potential confusion.
- Focus on results and productive actions to provide those results.
- Don't box yourself in; have a supple and robust organizational structure.

Collaboration in the ocean sciences is critical to addressing emerging ocean problems, and is worth the effort. It allows you to work with other people who stimulate your thinking and share your excitement, and it allows you to tackle problems you can't solve alone. But if collaboration is worth doing, it is worth doing well. I hope this summary of the lessons from others helps you in your own efforts.

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