SGER: New Off-Grid Networks in Rural and Wild Environments

1 Summary

This is a proposal to scout new systems of sensor networks that are critical for "off-grid" use. In places where support is remote, where there is little or no conventional power or communications grid, and where environmental extremes and other hazards may pose further challenges, innovative kinds of sensing and communications systems are needed. Part of our idea is to explore rural or wilderness networks by internetworking among modes that are usually disjoint: *e.g.,* ecological sensing, animal-borne systems, and rural community nets (as in clinics and schools). This can be regarded as "advanced cyberinfrastructure" with application to environmental problems, one of the key areas in the recent Atkins report[1].

In particular, we plan to explore networking system challenges in island areas, like the Bay Islands of Honduras. Technically, effective monitoring of these ecosystems requires both water and land-based systems. There are intriguing opportunities to put sensors and cameras on both marine and terrestrial animals. And of course, there are nearby settlements which, if they could be conveniently networked, would afford many synergies. We also will examine crisis areas as possible pilot or test zones.

Such systems would be broadly useful in many environments, but acute problems can drive them now. Reefs are dying around the world at an alarming rate, yet those ecosystems remain poorly monitored, in part because innovative infrastructure has not yet been extended to instrument them. If (or more likely, when) truly severe ecological crashes occur, current methods are inadequate for understanding and monitoring. War-torn regions needing to rebuild are another pressing example.

Aside from tackling particular field problems, research in these veins could help to significantly extend networked infrastructure. This is a grand challenge, because most of the world is rural, not urbanized. Yet despite critical needs and broader opportunity, a thrust like this is a risky proposition at research universities like MIT. It requires considerable field time and a lateral mix of interdisciplinary skills. MIT seeks to create a larger and more effective program of international field science and engineering efforts, and if successful, this SGER probe will be a key step in mapping that strategy, and developing the program, along with an emerging roadmap for developing these essential new infrastructures.

For all of these reasons — the inherent challenges of off-grid networks; the very large potential domains of application; urgent ecological and humanitarian crises; and the need to work much more fluidly across disciplines in order to most effectively develop infrastructures and deploy them internationally in the field — the proposed plan is a crucial step in our research.