APPLIED EARTH SCIENCES PROGRAMS
IN SELECT FEDERAL AGENCIES:
Final Report

Verne Kaupp
University of Missouri

Charles Hutchinson
University of Arizona

February 24, 2009

Introduction

We examined Earth science applications programs in several Federal agencies to support strategic planning efforts of the Applied Sciences Program of the Science Mission Directorate (SMD), in the National Aeronautics and Space Administration (NASA). The study examined seven programs, all of which seek to apply Earth science results to various levels of decision making including policy, management, and operations Federal, state, and local agencies. The results of this comparison will be used by the ASP to help guide its strategic planning, partnership development, and tactical implementation relative to these other Federal programs.

The objectives of the study were to characterize (1) Strategic Planning – the approaches that have been employed by comparable programs in other agencies that seek to move Earth science results to operational use, (2) Tactical Implementation – the mechanisms that have been used to make those connections, and (3) Program Administration – the institutional environments in which they are implemented. We also share our opinions of the relative efficacy of these programs.

There were seven programs in our study:

- Research Applications Laboratory (RAL), a division of the National Center for Atmospheric Research (NCAR) with "nominal" support (see discussion) from the National Science Foundation
- Institute for the Study of Society and Environment (ISSE), now a component of RAL at NCAR.
- Regional Integrated Sciences and Assessments (RISA), a program within the Climate Program Office (CPO) of the National Oceanic and Atmospheric Administration (NOAA)
- Sector Applications Research Program (SARP), a program within NOAA CPO
- Transition of Research Applications to Climate Services (TRACS), a program within NOAA CPO
- Center for Satellite Applications and Research (STAR), a program within the National Environmental Satellite, Data and Information Service (NESDIS) of NOAA
- Remote Sensing Application Center (RSAC) of the U.S. Forest Service (USFS) in the U.S. Department of Agriculture (USDA).

Our purpose was to describe (1) how each program conducts strategic planning and sets 3 – 5 year goals; (2) how it fulfills its mission and vision and satisfies its stakeholder's requirements; (3) how it provides value for major program operational elements; and (4) how it enhances decision-making.

Approach

Our process began with a review of published information on each organization, dealing primarily with their websites. The preliminary work was intended to develop a general understanding of the programs' missions and – to the degree possible – their partners, how they operated, and the projects they undertook. The review was followed by a site-visit and interviews with key personnel at each program to develop a more detailed understanding of how they (1) strategically planned their program, (2) tactically implemented programs, and (3) how they administered component projects (i.e., staffing, funding, timelines/life cycles, and metrics). Appendix A provides expanded discussion of the findings, observations, and notes common across all seven programs. Appendix B lists observed features unique for each program. Appendices C – I provide a summary of our literature review and interview notes for each organization visited. Table 1 provides a comparison of characteristics of the seven applied sciences programs and is explained in detail in the following Analysis section.

Analysis

Strategic Planning

Each of the programs surveyed has a Mission statement describing what it currently does and most have a Vision statement describing the context in which it operates and what it wants to do in the future. All programs considered strategic planning to be important for success by establishing 3 – 5 year goals that provide guidance and promote fulfilling the program's Mission (and Vision) while also helping to track evolving operational needs. Part of the planning process was identification of the customer/stakeholder community.[1]

Programmatic Models

In simplifying the continuum of programmatic models, consider the principal three ways to quantify the elements discussed for public policy change that range between formal structured process (typically top-down) a more flexible adaptive approach (typically bottom-up);[2,3] 1) Systems Analysis, 2) Planned Change, and 3) Disjointed Incrementalism. At one extreme, Systems Analysis considers the whole range of hypothetical possibilities (similar to the planning necessary, for example, that Microsoft must invest in developing a new operating system) and designs accordingly. At the other extreme, Disjointed Incrementalism considers only the here-and-now and then moves on to consider how alterations might be made at the margin (similar to a periodic Microsoft Update); it is goal-directed and initiated to obtain a specific outcome. In between, Planned Change represents a deliberate attempt on the part of some agent to bring about desirable alterations in a system (similar to the Microsoft Service Pack) but not necessarily at the margins; it is also goal directed and initiated to obtain a specific, but normally larger, outcome.

---

[1] For example, ten years ago, RAL reviewed its funding profile. At that time, their budget was around $9M/year, all of which came from the Federal Aviation Administration (FAA). Based on the review, they made a strategic decision to diversify their funding portfolio. It is now about $27M, and FAA continues to contribute about $9M to that total.

[2] Charles Lindblom, *The Science of Muddling Through,* Public Administration Review, 19 (Spring, 1959), 79-85

[3] Vehzkel Dror, *Muddling Through – Science or Inertia?* Public Administration Review, 24 (September, 1964), 153-157

Among the seven Applied Science Programs examined, Disjointed Incrementalism and Planned Change are more common than Systems Analysis. Uniquely, STAR apparently applies a Systems Analysis approach, but uses the other two as well. Those programs that respond most directly to user requests, such as RSAC, work mostly within the Disjointed Incrementalism model and to a lesser degree with the Planned Change model.

TABLE 1. CHARACTERISTICS OF APPLIED SCIENCE PROGRAMS

	NCAR		NOAA				USFS
	RAL	ISSE	RISA	SARP	TRACS	STAR	RSAC
Strategic Planning							
Mission and Vision	MODERATE	STRONG	STRONG	STRONG	STRONG	STRONG	STRONG
Programmatic model							
Formal Process	NA	MODERATE	MODERATE	MODERATE	MODERATE	STRONG	STRONG
Flexibile	STRONG	STRONG	STRONG	MODERATE	MODERATE	STRONG	STRONG
Drivers							
Parent organization / external	STRONG	STRONG	MODERATE	STRONG	MODERATE	STRONG	MODERATE
New science	STRONG	STRONG	STRONG	MODERATE	STRONG	MODERATE	MODERATE
PI / PM initiative	STRONG	MODERATE	WEAK	WEAK	WEAK	STRONG	STRONG
Point-of-entry	OPS	POLICY	POLICY	MGMNT	OPS	MGMNT	OPS
Leverage	STRONG	MODERATE	STRONG	MODERATE	WEAK	WEAK	MODERATE
Implementation							
Stakeholder segmentation							
Sector	STRONG	WEAK	WEAK	STRONG	NA	WEAK	WEAK
Region	MODERATE	STRONG	STRONG	WEAK	NA	WEAK	STRONG
Other	MODERATE	WEAK	WEAK	WEAK	STRONG	STRONG	MODERATE
Stakeholder involvement							
"Loading dock"	NA	MODERATE	NA	NA	MODERATE	STRONG	MODERATE
Partner capacity building	STRONG	MODERATE	STRONG	MODERATE	WEAK	MODERATE	STRONG
Web enabling	STRONG	MODERATE	NA	NA	STRONG	NA	STRONG
Administration							
Time lines							
Project duration	Years	End of $	15 Years	2 years	5 Years	3 - 7 Years	1-many years
Budget							
Total	~$27M	~$2M	~$5M/yr	~$3M/yr	NA	$20M	$5M
Amounts for major program elements	~$12M	~700K	Leveraged	~$300K	~$500K/5y	$24M	$60K
Staffing							
FTE / WYE levels	~200-300	8	1 1/2	2	1	95 +120	10 + 45
Management model	Divisional	Divisonal	Functional	Functional	Functional	Divisional	Matrix
Performance							
Measures (quantitative)	STRONG	STRONG	MODERATE	WEAK	NA	MODERATE	MODERATE
Accomplishments (qualitative)	STRONG	MODERATE	MODERATE	MODERATE	NA	MODERATE	STRONG

Also part of the programmatic model is the approach taken to selecting new projects. The continuum here is between a formal, top-down solicitation process at one end and an opportunistic, bottom-up process of responding more or less directly to user requests at the other. This is something of a false dichotomy, however, as most Programs use a hybrid approach consisting of well-designed solicitations crafted for significant core elements in support of the Program's mission and vision, complemented by an entrepreneurial scientific and engineering staff who closely cultivate partners/customers to conceive new projects in response to expressed needs.

The ASPs under NOAA, with its top-down Agenda, generally use a more formal approach, and RSAC is an example of the bottom-up approach, responding to the "cry for help from the ground" with a fairly open annual solicitation. Some specific differences in the processes for planning and selecting new projects among the studied programs can be seen to be manifestations of the factors that drive strategic planning (see next section).

RAL is a laboratory within NCAR. At RAL, strategic planning occurs at the laboratory (organization) and the program (division) levels. At the laboratory level, planning establishes 3 – 5 year goals that promote mission and vision. At the program level, planning considers laboratory goals and objectives but also responds to the evolving needs of the customer, or those agencies that contract for RAL research support. RAL identifies and selects new projects internally (word-of-mouth -- success breeds success), through customer cultivation/dialog, program development (marketing), directives from NCAR, new user requirements, new science, and PI initiative. Overall, PIs within RAL were acknowledged as the primary driving force within the program because of (1) their individual scientific insight into the potential that a new development might have in the applied science arena and (2) their ability to champion it within the organization tended to trump most organizational obstacles. Recognizing the critical role they play in the success of the overall program, management developed a "project manager's bill of rights" that gave them wide latitude to operate and considerable autonomy.

ISSE is a research group within NCAR. At ISSE, strategic planning derives from the entrepreneurial efforts of its staff and focuses on programmatic drivers such as *requirements, new science,* or *key results* to fulfill the long term requirements of its partner/customer/stakeholder base. ISSE responds to external (e.g., NASA; NSF) solicitation/proposal opportunities as the most typical vehicle for selecting new projects. Other ways are largely opportunistic and include word-of-mouth, customer cultivation, program development (marketing), direction from or opportunities within NCAR, user requirements, new science, and PI initiative.

RISA is a program in NOAA that funds external research groups, usually based in universities. At NOAA, a formal *Agenda* defines the climate-change research focus for the agency. Within the RISA program office, most strategic planning is driven by views received from annual scoping meetings with regional communities of existing and potential stakeholders. This ensures their sustained connection to the community and the relevance of their program. RISA identifies and selects new projects through a directed but very limited solicitation (these are regional projects in scope and implementation). The RISA Program Manager crafts a core program with a regional focus and then prepares a general solicitation to build around the core to which universities (often with regional partners) respond. Solicitations for new RISA projects/teams follow considerable interaction between the RISA management and targeted decision-makers. At SARP, the Program Managers craft a solicitation which provides program core sectoral direction in support of both SARP and NOAA goals. At TRACS, strategic planning is intended to transit emerging science to operations in support of the Agenda. SARP and TRACS primarily identify and select new projects through a solicitation approach similar to that of RISA.

STAR is the internal research branch of NESDIS. Strategic planning at STAR is aimed at fulfilling long term requirements for satellite research at NOAA. STAR conducts the research but rarely pushes results to operations. New STAR projects are (1) proposed by individual NOAA researchers, (2) identified by other NOAA user needs, or (3) directed by NOAA management. Directed solicitations are often used to build around a core element of another NOAA project.

RSAC is a research group within the USFS that responds directly to the needs of the National Forests. At RSAC, strategic planning is loosely guided by national steering committees and field sponsors. Currently, strategic planning shows the business model evolving away from technology transfer and towards provision of field services. New RSAC projects are proposed by individual field centers (i.e., National Forests) and reviewed and prioritized by the RSSC[4].

Drivers

The strategic planning process in each of the programs was driven by up to three factors (all of which overlap to some degree):

(1) Parent organization direction (or a higher level external influence such as the Climate Change Science Program). External drivers were perhaps the most common (with the example of RAL being the most significant exception). Because they are parts of larger organizations that are driven by their own larger strategic interests with which they must align (e.g., NOAA *Agenda*).

(2) Opportunities or demands that arise from new science or technologies. New developments may provide obvious new programmatic avenues of activity.[5]

(3) PI and PM initiative. Not surprisingly, Principal Investigators (PIs or the researchers who undertake or lead projects within or outside the organization), and Program Managers (PMs who manage programs consisting of projects within the organization), tended to have the most impact on the general direction and vitality of programs.

No program was driven by a single factor. The parent Mission and Vision statements were often cited as the guiding influences (e.g., RAL, ISSE, SARP, and STAR). New science or requirements were cited by RAL, ISSE, RISA, and TRACS, and PI or PM initiative were cited by RAL, STAR, SARP, and RSAC as being influential.

Leveraging / Point-of-entry

In this context, to "leverage" is to mobilize resources external to the research organization to fund a program or the projects within it. "Point-of-entry" is the primary decision-making level the program seeks to engage in the target agency (i.e., policy, management, operations).

The ability to leverage tended to be a function of how closely a program served the needs of the host agency. For example, RSAC serves almost exclusively the needs of USFS and "external" funds come from other divisions of USFS. Similarly, STAR was created to meet the needs of

---

[4] Remote Sensing Steering Committee – membership drawn from the technology and resource field staff.
[5] For example, over the past five years, the dramatically intensifying wildfire regime of the western U.S. provided a new and important opportunity for RSAC to develop MODIS direct broadcast capability for operational use.

NESDIS and only occasionally works to support other agencies (even within NOAA). Both RSAC and STAR are focused on delivering products to the operational levels of their host agency.

Other programs are highly leveraged (RAL, ISSE and RISA).[6] Each of these tended to focus on working directly with partner agencies to meet those agencies' needs and generally, but not always, working to provide support to the highest (policy) levels of decision making.

Overall, ISSE and RISA tended to focus on the policy levels of partner organizations; SARP and STAR targeted management levels; and RAL, TRACS and RSAC worked primarily with the operational (on-the-ground) levels.

Tactical Implementation

Stakeholder segmentation

Cultivating customer and community partnerships is essential in bridging the gap between science and operations. STAR is the only program that does not cultivate partnerships because NOAA is its customer and it does not normally push results all the way "to the ground" (operations). All other programs highlighted the need to have close and routine interaction with the agencies they seek to serve.

We focused on Sector, Region, and Other (Thematic) approaches by which programs segmented or organized their population of real and potential stakeholders. NOAA considers that there are two fundamental ways to segment the world. One is regional, or geographic. The argument is that actors within a region are confronted by the same sets of problems imposed by a broadly shared climate, environment, economy and even society. Conversely, it is possible to view the world and its inhabitants as being organized around sectors or broad economic lines. This view argues that sectors (e.g., agriculture, aviation, urban development, or water management, etc.) are confronted differentially by any given set of considerations (e.g., climate). Of course, there are other ways to view the world that may cross-cut or transcend these divisions such as technology that are typically indifferent to sectors and regions.

As in most of the analysis presented here, few programs fall neatly into any one approach. However, because most agencies serve a specific sector, there often may be a distinct sectoral tendency. RAL and SARP approach applications opportunities from a sectoral perspective. However, host or partner national agency programs are often implemented regionally, and many partners may be regional entities. As a result, ISSE, RISA and RSAC strongly focus on Regional issues and RAL shows a moderate interest. TRACS and STAR are organized largely around technology and work to bring a specific technology into operational use. There were instances where RAL and RSAC tended to respond to technology opportunities that were neither sectoral nor regional.

[6] RAL receives only about 5 percent of its total budget from NSF, the remainder coming from other partner Federal agencies. Because RISA addresses regional issues, they have significant buy-in from local and regional agencies, ranging from 3-5x (estimated by the Program Manager). Moreover, RISAs have lifespan of at least 10 years and thus the opportunity to build long-term relationships and secure support among multiple partners is enhanced.

Stakeholder involvement

The purpose of applied science is to take existing or new science, use it to solve a problem that confronts a stakeholder, and pass it along to the stakeholder for routine use. In the pursuit of achieving this end, each program has evolved its own individual culture that has been shaped by the institution of which it is a part: How it is organized, its general approach to problem-driven research (as opposed to curiosity-driven research), and how it seeks to engage its stakeholder or client in defining the problem, developing a solution, and implementing it in the stakeholder organization.

The challenge for applied science is achieving the transition from research to operations in a way that is effective and economical.[7] First, although the basic science questions may be answered already (e.g., "What are the physical processes that cause icing on aircraft control surfaces?"), they may not be specific enough to design operational solutions that work in the real world (i.e., "So what do we do to (a) prevent icing of aircraft control surfaces, or (b) de-ice those surfaces within the engineering and operational constraints of actual aircraft?"). RAL noted that, "current science is seldom sufficient" to satisfy operational requirements. As a consequence, additional research is typically required and a simple "hand-off" of science is rare. Regardless, before research is begun, the first task of the applied scientist is to define (1) the problem that confronts the stakeholder, and (2) the technical, institutional, and budget environment in which the solution will be implemented. To achieve this, the stakeholder/partner/client must be involved in the enterprise and engage in a sustained dialog.

We considered three general modes of stakeholder involvement. The first is the "loading dock" approach[8] in which a problem and a candidate solution are identified, either by the PI or stakeholder or the two in collaboration, and the PI performs the work with little direct or sustained interaction with the stakeholder. Conceptually, the PI develops a product and places it on the loading dock (i.e., a report or published article) with the expectation that the stakeholder will take it and adopt it as a component of their operation. This passive approach may work in well-structured command-driven organizations (e.g., military) but, otherwise, is ineffective with unpredictable outcomes.

The second involves a more deliberate and intimate engagement with the stakeholder. Here, we define it as capacity building because of the intimate and iterative interaction between the PI and the stakeholder organizations. In this approach, the PI becomes fully embedded with the stakeholder organization and is able to develop a robust understanding of the issue and the constraints in which the stakeholder operates so that together they can develop an optimal solution to the problem. Moreover, in this approach the stakeholder is able to develop a better understanding of the science that is being applied and the mechanisms by which it is

---

[7] This challenge has been the focus of several National Research Council reports (e.g., National Research Council. 2003. *Satellite observations of the Earth's environment: accelerating the transition of research to operations*. National Academy Press. Washington) and a specific directive in their recent Decadal Survey (National Research Council. 2007. *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond*. National Academy Press. Washington. http://www.nap.edu/catalog/11820.html

[8] Cash, D.W., J.C. Bork, and A.G. Patt. 2006. Countering the loading-dock approach to linking science and decision making: Comparative analysis of El Niño/Southern Oscillation (ENSO) forecasting systems. *Science Technology Human Values* 31(4): 465-494.

implemented. By developing a solution that fits, and preparing the stakeholder to employ it, an effective transition from research to operations can be achieved.[9] Obviously, this requires an understanding of and commitment to the approach by both the PI and partner organizations, and an explicit investment by the partner to actively take the solution and move forward.

The third approach is built on the same principles as the capacity-building approach in the nature of the relationship that must be built between the PI and stakeholder to define a problem and develop a solution. However, with the erosion of Earth science skills within much of the workforce of most potential partner agencies, and the rise of ubiquitous web-enabled resources, there has been movement toward developing and implementing web-based tools to provide science products to a wider range of users.[10] The intent is to provide a more refined customized product that does not require additional processing and only minimal analysis, and fits seamlessly into a desktop working environment. As noted by RAL, this general approach recognizes that the science products required for decision making may not be an element of a structured DSS, and may be as simple as expert opinion.

We distinguish among three types of organizations. The first is divisional, in which the enterprise is organized according to a top-down division of labor, typically hierarchical with well-defined lines of authority (i.e., policy, management, operations). The second is functional, in which the organization is built more "organically" around the tasks/projects to be performed or the products to be delivered. Hierarchy, if one exists, is not necessarily rigid. The third is a matrix in which "divisions" are functionally defined based on the skills they represent (e.g., database; analysis/modeling; graphics). Divisions are crosscut by projects/programs that mobilize skills contained within the divisions.

RAL (organized along divisional lines) develops products customized (tailor-made) for individual paying customers (RAL is ~100% self-sustaining). RAL makes several points: (1) work with pure science (as opposed to applied) wherever it is found, (2) a decision support system or its enhancement is not the only valuable end point (e.g., advice, expert opinions, etc., are equally valid and important), (3) products are developed iteratively with the customer (the antithesis of the loading dock approach), and (4) Program Managers/PIs are entrepreneurial and applications-oriented scientists/engineers who work well with people. At RAL, they are autonomous and have budget authority (PM Bill of Rights).

At ISSE (loosely organized along divisional lines) the approach is a collection of in-house PI-led *projects*, each having a decision support product that is a regionalization of climate considerations. Rather than solving a specific problem, like RAL, ISSE's strategic function is focused on identifying and promoting a policy impact at some point in the future. Policy makers are the normal customer. ISSE works closely with its decision makers (In their words, its, "*Decision-maker and scientist hold on to each other and roll down a hill*"). Most new ideas are generated in-house, and vetted through the proposal route. Some new project ideas come from NCAR.

[9] ISSE describes the process as, "The decision-maker and scientist hold on to each other and roll down a hill"

[10] RAL makes a significant point by noting that it employs more programmers than any other division at NCAR.

At RISA (organized along functional lines), the approach is led by an external PI and consists of a regional consortium of interested parties working collectively to solve pressing problems within a region. RISA's strategic function is to provide mechanisms to supply climate forecasts that can be used to improve management and public policy decisions in coping with these key societal and economic needs. RISA's management conducts *Scoping Meetings* to evolve and adjust its *Agenda*. In Phase 1 (gap-driven), stakeholders identify issues, assess and prioritize them. In Phase 2, an open competition is held for the next region; anticipating a new significant regional project focusing on seasonal/interannual climate forecasts of regional economic value. RISA projects do not have any fixed *end-of-project*; it is expected that projects will become largely self-sustaining.

At SARP (organized along functional lines), the approach relies on external PI-led multidisciplinary teams with personnel necessary to complete the proposed effort, a solicitation-based project designed to systematically build an interdisciplinary knowledge base for climate-related research findings for resource management challenges in social and economic sectors. SARP draws upon personnel from within NOAA, if needed. SARP uses directed but broad gauge solicitations to pursue directions laid out by the *Agenda*. SARP projects are typically interdisciplinary (incorporating both physical and social scientists) and may result in *prototypes* or go *end-to-end* providing tools, methodology, knowledge, forecasts, and information for resource management and decision support. Flexible management is valued (or as they assert, "*Rigidity kills creativity*").

TRACS (organized along functional lines) is new, with no established track record. It evolved from the NOAA Climate Transition Program (NCTP) and has inherited ongoing projects, with the first scheduled for completion in late 2008. TRACS is intended to develop or enhance climate products and services; build capacity among decision makers; understand, access, and use climate-related decision support tools; and ensure that NOAA and its partners (Federal, regional, state, and the private sector) are capable of routinely delivering climate information to the public. At the time that this was written, there was no program manager and the FY09 budget was uncertain.

STAR (organized and managed in three divisions) is the science arm of NOAA NESDIS for using data from satellites to initiate research to assess current conditions and predict future changes on the Earth, to understand long-term changes in the environment, and to promote societal benefit from a suite of satellites. The STAR strategic approach is built on internal PI-led teams of NOAA scientists, contractors, and university researchers. Projects include developing algorithms and models and creating products and tools, and projects end when the NOAA need has been satisfied. STAR is NOAA-centric, and employs a loading dock approach. STAR rarely pushes research to the ground. New projects are usually initiated by individual NOAA researchers, other NOAA needs, directions from management, needs for new science, etc. The normal process is to define particular research objectives by looking for gaps to fill, write a proposal, and have it reviewed – typically by the SPSRB (Satellite Products and Services Review Board). STAR projects are usually interdisciplinary, incorporating scientists with applications orientation, specialists in particular sensor physics, physical scientists, and others drawn from NOAA, NASA, or universities. Flexible management is valued.

RSAC (presently organized along functional lines, but evolving towards matrix management) is organized into five program areas providing technology evaluation and development and training support in the use of remote sensing, GIS, image processing, and GPS for all resource applications with primary emphasis on ecosystem management. The process at RSAC is to capture and respond to the "*cry for help from the ground*" with individual National Forests serving as the "ground." Proposals are prepared internally and selected by the agency-wide RSSC. Typically, an internal Project Manager is a leader, functions as an entrepreneur, and is vested with both authority (including budget) and responsibility (being essentially autonomous) to conduct and complete a project. Most strategic planning is aimed at fulfilling long-term requirements for remote sensing and geospatial research and development that contributes to the depth of fundamental understanding and meets operational and societal needs. RSAC conducts the research *in-house* to prepare tailor-made products in response to individual field-center proposed needs, makes them robust for operational field use, and transitions them to the field. Projects are typically designed to be completed within a year but may evolve into self-sustaining programs when transferred to the field.

Program Administration

Budget

RAL and STAR are relatively large programs with total budgets exceeding $20M annually. ISSE and SARP are relatively small programs with annual budgets of ~$2M. RISA, TRACS (expected size of budget), and RSAC are about the same size as the Applied Sciences Program with total annual budgets of ~$5M, although RSAC is increasing the amount of cost-reimbursable work that it performs (from other parts of USFS).

Timelines

Timescales for projects vary considerably among programs. RAL allocates whatever the customer need requires throughout an ongoing relationship (years); ISSE expects a project to be completed when the allocated funds are expended (perhaps 3 years); RISA has no fixed project end (expects projects to be self sustaining and intends them to survive for many years); SARP funds projects for 6 – 24 months; TRACS will probably follow its predecessor and fund projects for up to 5 years; STAR expects projects to be completed within 3 – 7 years; and RSAC tries to complete research projects within 1 year, but successful projects may become imbedded ongoing programs with no end point (e.g., Burned Area Emergency Response, BAER).

Staffing

Each program has a unique staffing model. RAL presently has ~150 projects being worked in-house by 200 – 300 scientists and engineers. [Note: RAL considers its success to be, in part, due to the fact that it has the largest concentration of software engineers at NCAR.] ISSE presently has 8 projects (1 large project accounting for about 1/3 of the total budget) being worked largely externally, not in-house. Its model is flexible; normally an ISSE scientist is a PI, leading a team of social and physical scientists that are university-based. Currently, there are 8 staff members working on ISSE projects. RISA presently has 8 active projects, 1 inactive project, and 1 in review. It has 1 ½ program managers at NOAA coordinating and providing oversight for all aspects of past, present and future projects. There is no NOAA staff presently assigned to any of the projects. SARP presently has ~20 active projects. It has 2 program managers providing oversight for all aspects of the projects. There are no NOAA staff presently assigned to any of the projects, but SARP can draw upon NOAA personnel as needed. TRACS presently has 5 active projects inherited from its predecessor program that are being completed. There are no NOAA staff presently assigned to TRACS (the previous director left NOAA this summer) but TRACS can draw upon NOAA expert staff from wherever it resides within NOAA. STAR presently has >50 active projects. It has ~ 95 NOAA scientists, 120 contractors, and university researchers working on STAR projects. RSAC presently has 9 active projects being worked for the current year. It has 10 Forest Service employees, 45 contractors, and university researchers working those projects.

Performance Assessment

Common quantitative measures of performance cited are:

- No specific measures of performance (All).
- Loss-of-life rates (RAL Microburst)
- Number of publications (ISSE, SARP).
- Number of web hits (ISSE).
- Number of users of products, or sustained demand (RAL, ISSE, RISA, RSAC).

Major qualitative accomplishments cited are:

- Functioning, long-term projects demonstrate value more than any metrics (RISA).
- Increasing non-core funding (STAR, RSAC)
- Milestones met (RAL, ISSE, and STAR).
- Movement of science into routine operations (RAL, STAR, RSAC).
- Oversight panels/stakeholder reviews (RISA, SARP, TRACS, and STAR).
- Congressional support (RISA)
- Retention of services by satisfied customers for successive projects (RAL)
- Persistence of program long-term (e.g. 15 years, RISA)
- Positive outside reviews (RISA)

Conclusions

Seven Earth science applications programs in place at several Federal agencies were selected and analyzed to support program planning efforts of the NASA SMD Applied Sciences Program. The objectives of the study were to develop an understanding of the strategic approaches that have been employed to move research results to operational use, the tactical mechanisms that have been used to make these connections, the institutional environments in which they are implemented, and their perceived efficacy.

The overarching direction that emerges from a consideration of these programs is for NASA to invest more in cultivating a community of practice, and to work as closely as possible with users over significant time periods so that these relationships become a source of innovation and the basis for robust utility in NASA science applications.

Clearly, each Applied Sciences Program is unique with individual drivers, processes, and expectations and it would likely be mistake to adopt a single unyielding approach. The following

Conclusions and Recommendations derive from the aggregation of analysis from this study but are focused with the NASA program in mind. We did not try to synthesize the average program from these results as that academic exercise was not a part of our scope of work.

Keys to Success

Guiding principle – If we remember that the primary objective of an applied sciences program is to cross the "valley of death" and carry science results to operations. The job is made more difficult by the fact that the current state of the science is generally insufficient for applications. Thus additional research to improve and make it more robust for applications is essential. With this understanding, the following points may serve as guides:

- **Effective and current strategic plan** – A well defined Strategic Planning process was reported to be important at each organization studied; none of them embraced an *ad hoc* process for planning. Most strategic planning was reported as focusing on well-crafted Mission and Vision statements with supporting 3 – 5 year goals and objectives that track both evolving parent organization mission and vision and changing long term needs in the customer-base.
- **Guidance and alignment drivers -** The strategic planning process in each of the programs was driven by up to three factors; *parent organization direction, opportunities,* and *PI or PM initiative*. All programs recognized guidance from a combination of the three with the parent Mission and Vision statements often cited as the major guiding influence to insure alignment between the applied sciences program and its parent organization. A PM who is perceived as a member of and champion for the community is essential.
- **Established formal solicitations process** – Designing a program around significant programmatic core elements and using a well-defined solicitations process crafted to promote necessary research and development for (a) expanding the depth of fundamental scientific understanding for operations and (b) fostering the transfer of knowledge and technology to meet stakeholder/customer decision support needs was important.
- **Customer and community partnerships** – Cultivating an intimate and ongoing involvement of community and customer partners in the entire process is crucial to bridging the gap between science and operations. Applied Sciences Programs need to have close, routine, and continuing interaction with the entities they seek to serve. A PM who is perceived as a member of the community again is essential.
- **Management empowerment** – Project Managers (PMs) and Principal Investigators (PIs) must be vested with both authority (including budgetary) and responsibility (autonomy) to conduct and complete successful projects.
- **Management accountability** – while perhaps autonomous, PMs and PIs must be held accountable to senior management and review boards with annual program review demonstrating that it satisfies the strategic plan and goals, meets stakeholder needs and end-user community requirements, and provides significant information for decision makers.

- **Diversified funding portfolios** – Avoid stagnation by continuously diversifying the program scope and discover new science results for operational decision support; enhance the Applied Sciences Program's value and diversify its funding portfolio.

Best Practices

- **Flexible and adaptive management practices** – Management needs are usually unique for a project. Having a rigid, fixed management process does not appear to work well. Project Managers are typically responsible for the development of programs, methods, and pilot projects, and for crafting solicitations which integrate with both with the parent organization, stakeholders, and user community needs. Flexible and adaptive management practices, with no fixed protocol, or right way to do things provides the greatest latitude for success.
- **PIs and PMs drawn from their respective communities of science** – Typically, having a PMs and/or PIs as respected members from the communities they support promotes program acceptance (buy in) by the communities and improves the overall level of program achievement.
- **Deliberate and explicit leadership within the communities of science and practice** – It is recommended as a best practice to be heavily involved in appropriate communities, symposia, conferences, and workshops as expediencies for bringing a program and community together, and for discovering evolutionary movements of the community that may prove invaluable for the program.
- **Budget leverage** (creating broader multi-disciplinary projects from other assets) – The capability to mobilize external resources to fund a program is key to both sustainability issues and scope of a project. It can also be argued that leverage is another concrete measure of success.
- **Multi-disciplinary/multi-functional staffing model** – Having the right number and mix of program managers, internal staff, and external personnel as appropriate is crucial for meeting milestones and completing objectives on schedule. The typical mix includes scientists and /or engineers with applications orientation and who work well with people, specialists in a particular scientific or engineering field, physical or social scientists, university collaborators, etc., and the number of each required is project dependent.
- **Performance measures** – Performance criteria is important for determination of success. All programs surveyed applied *ad hoc, ex post facto* criteria; using whatever appeared to be right for the application at hand. Nevertheless, performance measures must be defined at the start of a project, not tailored to force success at the end. Most projects cited literature review, both oral and written, as a measure, but none thought it to be more than a weak verification that work was done.
- **Defined end point** (even if there is none)- Planning for the end of a project, transferring the results to an end user, and sustainability considerations for an application functioning in operations must be established at the start of a project, not after the fact at the end. It is not usually good practice to decide that a project is finished when the budget is expended, when a review boards says it is, or when the PI, PM, or decision-maker/community say it is.

Final Comments – Notes for NASA

A number of ideas emerged from interviews with the seven studied Applied Sciences Programs that may prove useful for NASA's Applied Sciences Program consider.

- RAL – NCAR stresses the importance of working with users (continuously iterating), showing users what is possible, identifying needed connections, and establishing the right culture and obtaining the right people.

- NOAA CPO– Consider having a joint solicitation with NOAA on: water resources, fire management, agriculture, or health. Also, consider joint workshops and other collaborations. Consider adopting a sectoral dimension of climate change at the Applied Sciences Program. Consider how NOAA needs can become part of the design process for new missions in keeping with the strategy proposed in the NRC Decadal Survey (possibly in a meeting between NASA and NOAA).

- NOAA NESDIS – STAR extends an invitation to the Applied Sciences Program Director to attend an SPSRB meeting. The Decadal Survey provides a new opportunity for including the operational communities' needs at the start of a new mission design; perhaps the Applied Sciences Program and STAR might collaborate on doing that with STAR providing the "cry for help from the ground" for consideration.

- USDA USFS – RSAC requests that NASA maintain Direct Broadcast capacity ("We are as far out on the 'bleeding' edge as you can get!"). Allow meaningful input to the mission design process. We would like to emphasize the importance of NASA's partnership in conserving and managing our forest resources. Data continuity is essential (it provides a National context).

Appendix A - Literature review and interview notes: NCAR RAL (Research Applications Laboratory)

Date:	Interview	7 May 08

Location:

Address:	3450 Mitchell Lane
City:	Boulder, CO 80305

Attendees:

Name	Phone	E-Mail Address
Roy M. Rasmussen	303 497 8430	rasmus@ucar.edu
Thomas T Warner	303 497 8401	warner@ucar.edu
David J. Gochis	303 497 3809	gochis@rap.ucar.edu
Thomas M. Hopson	303 497 2705	hopson@ucar.edu
William T Meyers	303 497 8412	meyers@ucar.edu
Bruce Carmichael	303 497	
David	303 497	
Charles Hutchinson	520 621 8568	Chuck@Ag.arizona.edu
Verne Kaupp	573 882 0793	KauppV@missouri.edu

Summary of information obtained

- **Strategic Planning**
  - **Mission and Vision**
    - http://www.rap.ucar.edu
    - **Mission** –
      - To facilitate the transfer of the information, expertise, and technology it develops – RAL conducts significant applied scientific research – to government agencies (U.S. and foreign), public, and private sectors.
      - To conduct directed research that contributes to the depth of fundamental scientific understanding, to foster the transfer of knowledge and technology for the betterment of life on earth, and to support technology transfer that expands the reach of atmospheric science:

    - To support technology transfer that expands the reach of atmospheric science
    - To conduct directed research that contributes to the depth of fundamental understanding
    - To foster the transfer of knowledge and technology for the betterment of life on Earth
  - **Vision** - RAL will continue to serve as an integrator across NCAR laboratories and divisions, across the public and private sectors, and particularly across the wide divide that traditionally exists between the research and operational sectors. RAL will also continue to strive toward more integration of subsystems within our engineered solutions (for example, coupling various types of numerical models to achieve a desired solution, and further merging of sensor-based and model-based solutions).
  - The ability to integrate not only weather subsystems, but to integrate stakeholders' non-weather subsystems (rules of practice, crew scheduling, cost/loss assessment models, etc) has been one of the keys to the success of past RAL R&D efforts. This integration paradigm will not only be continued but be exploited as much as possible. Significant system efficiencies and operational efficiencies result from this type of integration, and thus it will remain a standard in system design for RAL.
  - Much attention has been given recently to the concept of "system of systems" integration, implying complete interoperability and interconnectivity among all master system components. RAL will work to this universal, high-level design in its system development when it makes sense for individual stakeholders, but will deviate when this approach gets in the way of a simpler, more operationally efficient and cost-effective solution.
- **Strategic function within its parent organization**
  - RALs purpose is to promote technology transfer; "*Science in service to society"*. RAL expands the reach of atmospheric science into weather-sensitive human endeavors that are not currently using weather information or are using weather information in inefficient ways.
  - As the principal laboratory responsible for aviation weather projects for the National Center for Atmospheric Research (NCAR), The Research Applications Laboratory (RAL), composed of the former Research Applications Program and the Developmental Test Bed Center, has been the recognized leader in aviation weather research and technology since 1980.
  - Through an agreement with the Federal Aviation Administration (FAA), RAL scientists and engineers work closely with other centers and agencies, as well as the aviation industry, to improve the timeliness, accuracy, and presentation of weather information to better predict, detect and warn of atmospheric hazards that significantly affect aviation commerce.
- **3-5-year goals and objectives**
  - The operational attainment of an improved capability for detecting and forecasting relevant mesoscale weather phenomena.
  - Transfer of this capability into weather-sensitive sectors of the economy
- **Programmatic model and architecture**
    - The RAL process is driven by whatever works – No set protocol.

        - It is essentially problem-driven and the normal process is to work backwards from the desired solution to a promising result
        - *Named activities* can be developed around a customer's requirements, new science, or by and entrepreneurial personality
        - RAL develops products customized (tailor made) for individual paying customers
            - Flexible and adaptable to evolve with customer's continuing needs.
            - Built upon entrepreneurial scientific and engineering staff
            - Customer base is primarily external to NCAR, but internal customers are acceptable

- **<u>Tactical Implementation</u>**
    - **Major program elements**
        - To paraphrase, *the RAL Mission is to "move science forward". How does it do that:*
            - Work with *pure* science (wherever it is found) to obtain a desired application
                - Note that "*current state of the sciences is generally not sufficient"*
                - Users' needs generally require more research (e.g., de-icing)
            - Attempt is to promote a straight forward *technology transfer*
            - Further note the elements of a *Decision support system* are not the only potential result: advice, expert opinions, etc., are equally valid products
        - *Continuous* iteration with sponsor (there is no loading dock)
        - Program managers are autonomous and have budget authority (PM Bill of Rights). Reconsidering this to retain an identity.
        - Research leading to improved weather information.
            - Transfer to operational sector (RAP in operational stream only in prototype demonstration stage)
            - Education and training
            - Safety (regulation) matters
            - Expert advice
            - Publication of scientific papers
        - Development of algorithms and expert systems
            - Automated products: Improved information by combining the best of different
              approaches (e.g., combined icing algorithm; merger of detection, nowcast, forecast, climatology)
            - Integrated decision algorithms incorporating user context
        - Delivery systems - an often necessary function of a successful technology transfer organization
            - Bypass federal agencies as necessary (e.g., delivery of aviation products to AWC, airlines, private vendors). Necessary to sustain support for further research.
            - Airport weather systems (LLWAS/TDWR, Hong Kong, Taiwan, Juneau)
            - Army TECOM meteorological data system
            - Weather information in the cockpit (developmental)
        - Public and private advocacy

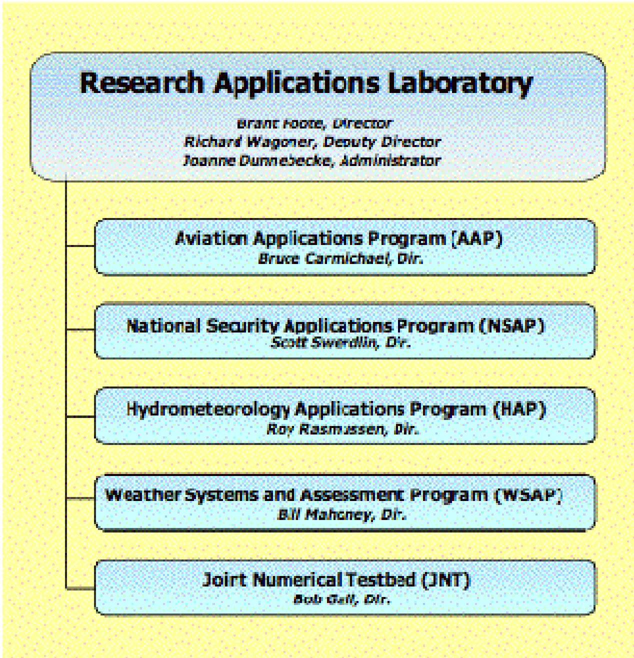
- **Types of projects; number of each type of project**
  - Aviation and range weather
    - Icing
    - Snow and freezing precipitation
    - Thunderstorms
    - Turbulence
    - Wind and wind shear
  - Public weather (Weather Windows)
  - Numerical weather prediction
  - Hydrometeorology
    - Rainfall estimation
    - Thunderstorm auto-nowcaster
    - Coupled run-off forecasting
    - Evaluation of rain enhancement techniques
  - Other transportation applications
  - System engineering
  - Turn-key systems
- **How the program identifies and selects new projects**
  - RAL promotes itself by:
    - Word of mouth – Success breeds success
    - NCAR forwards opportunities as it discovers them
    - Cultivating its customers
    - Program development (otherwise known as *Marketing*)
  - Drivers: User requirements? New science? PI personality? Yes. Yes. Yes.
  - Research and development projects funded by users of weather information.
  - Strong outreach (marketing) program
  - Understanding customer activities
  - Matching capabilities to requirements
  - Education in the "art of the possible"
  - Criteria for going after or accepting work
    - Match to vision and strategic plans (including fit to NCAR)
    - Opportunity for creative research and engineering development
    - Opportunities for involvement of university or other scientists outside RAP
- **Project information: Project numbers, timescales, project team composition**
  - 95% of the cost of all projects is paid by the customer (including infrastructure)
    - E.g., FAA & NASA are primary customers (pay the bills) for projects such as the "*microburst*" project, and NOAA is the recipient (with no cost for development)
    - In this example, NOAA sustains the project in normal operations and the technology is "*free*" for U.S. usages, but available at a cost (royalty) to international clients.
    - E.g., other projects are fully funded directly by the customer.
  - Project numbers: ~ 150 "named projects" in the latest reporting year (2007)
  - Timescales: Annual reviews
  - One of seven major divisions of NCAR
  - About 200 (as many as 300 people), approximately half are atmospheric scientists, and half are engineers

- ## Program Administration
  - **Budget (total and amounts for major program elements)**
    - Total budget: ~$27M income
      - Increasing trend from ~ $8M in '93
      - FAA normally ~ $8M – 12M
      - Result of deliberate effort to diversify income portfolio (i.e., not just FAA)
    - Costs are "*named activity*" specific
    - Royalties are paid by foreign users of RAL results, but not by U.S. users
  - **Staffing: Staffing model, staff expertise, FTE/WYE levels**
    - Staffing model: Can shrink or grow as necessary – Very flexible.
    - Staff expertise: Built upon an entrepreneurial scientific and engineering staff.
    - Staff size: ~ 200 – 300 scientists and engineers at the present
    - RAL differentiates between "*pure*" scientists and "*application-oriented*" project scientists
      - Pure scientists do science (tenure-like process of promotion)
      - Project scientists do science, write proposals and manage projects
      - Both are expected to publish, but more emphasis for pure
    - Highest concentration of software engineers in NCAR within RAL
  - **Organization chart**
  - **Management model**
    - Each project, *"named activity*" is managed by a Project Manager with authority as well as responsibility vested within his function
    - RAL Project Managers are card-carrying scientists, come from the community, and seem themselves as part of the community
    - RAL culture is *entrepreneurial* rather than *entitled* (deliberate transformation from the "entitled" scientist typical at NCAR)
    - RAL solicits personnel with an applications mentality who are:
      - Entrepreneurial spirits,
      - Work well with users, and
      - Write good proposals (Darwinian process)
    - Customer directed, entrepreneurial "*named activities*"
    - *Named activities* are typically defined by the customer
    - Flexible and adaptable, evolving with change customer needs and trends
    - RAL avoids stagnation by:
      - Constantly hiring new, entrepreneurial people – promotes growth and ideas (Darwinian realities)
      - Collaboration with scientists from around the world – promotes innovation and diversification
    - RAL believes that a program built solely on the *Solicitation* model results in a hodge/podge program
      - There needs to be a core element and direction
      - Well-designed, directed solicitations can then be used to build around the core
  - **Funding sources**
    - Primarily, funding derived from paying customers
    - Little, if no direct NSF funding

- **Performance**
  - **Evidence of success**
    - Being retained by a customer for successive projects is a clear statement of success
    - FAA projects, such as the *Microburst* example
  - **Measures of performance**
    - Metrics
      - NCAR doesn't require specific analyses of success.
      - Some societal impact assessment is often used to demonstrate value for a given "*named activity*" – A qualitative assessment
        - Fatalities in the Microburst project is an exceptional quantitative metric
      - Being retained for successive projects speaks louder than any arbitrary metric
  - **Major accomplishments**
    - Achievements such as the FAA *Microburst* project
    - NSF presents the RAL results/successes when justifying its existence, even though NSF didn't invest a single dime in a "*named activity – "This science has resulted in this socio-economic benefit …"*
      - *Applications results sell better than scientific achievements – Lives saved, etc*
      - Sore point to RAL is that NSF doesn't pay a cent, but claims the successes

- **Keys to Success**
  - Growth for diversification of the portfolio (in terms of sponsors)
  - Innovation – Personnel turnover leads to innovation
  - Opportunistic staff
  - Well-designed Strategic Plan
  - Hard work
  - Team work
  - Dialogue – talking – with customers about their needs and trends
  - Dialogue with the community (at meetings, symposia, etc.)
  - Working together with our customers and ourselves
  - Horizontal organization
  - Budget authority given to Project Managers
  - Project-oriented organization rather than functional organization – Now revisiting this concept to maintain some degree of identities
  - Most software engineers of any division at NCAR

- **Notes for NASA**
  - Work with users continuously (iterate)
    - Users understand product, contribute to development
    - Helps build capacity in the sponsoring agency
  - Show users what is possible (accelerate the discovery process)
  - Identify needed connections
  - Establish the right culture and obtain the right people


Research Applications Laboratory
Brant Foote, Director
Richard Wagoner, Deputy Director
Joanne Dunnebecke, Administrator
Aviation Applications Program (AAP)
Bruce Carmichael, Dir.
National Security Applications Program (NSAP)
Scott Swerdlin, Dir.
Hydrometeorology Applications Program (HAP)
Roy Rasmussen, Dir.
Weather Systems and Assessment Program (WSAP)
Bill Mahoney, Dir.
Joint Numerical Testbed (JNT)
Bob Gall, Dir.

Appendix B – Literature review and interview notes: NSF NCAR RAL ISSE (Institute for the Study of Society and Environment)

Date:	Telephone Interview	16 June 08

Location:

Address:	3450 Mitchell Lane
City:	Boulder, CO

Attendees:

Name	Phone	E-Mail Address
Linda Mearns	303 497 8117	LindaM@ucar.edu
Charles Hutchinson		
Verne Kaupp		

Summary of information obtained

- **Strategic Planning**
  - **Mission and Vision**
    - http://www.isse.ucar.edu/
    - **Mission** – to improve societal welfare in the context of natural and changing climate and weather. ISSE conducts interdisciplinary research on 1) societal activities related to climate and weather at the individual, economic, and political levels, 2) the consequences of those activities on the atmosphere and the environment, and 3) effective communication of this science to decision-makers and managers for coping with weather and climate risks.
    - **Vision** - to play its part in producing high quality research and helping society make the best possible choices to ensure an economically prosperous and environmentally sustainable future.
  - **Strategic function within its parent organization**

- Formerly a part of the Societal-Environmental Research and Education Laboratory (SERE) laboratory, ISSE has been moved and is now (since May 08) a part of the RAL (Research Applications Laboratory). The following information assumes that the focus of ISSE and its organizational role remain the same; climate services.
- Increasing societal vulnerability to atmospheric phenomenon such as hurricanes, floods and droughts underscores pressing concern over the state of human society's complex relationships with our fragile planet. Human activities have played a complex role in the interaction between the atmosphere and the environment, resulting in unprecedented weather and climate changes.
- Society now stands at a formidable cross-road: we must move toward sustainable land and natural resource use and commit to protecting the global commons (our atmosphere and biosphere).
- As awareness of the crucial choices before us has grown in different segments of society (policy makers, research community, industry, educators, and civic society), we see a palpable shift in the relationship between science and society. While curiosity-driven research at the science-environment-society interface must remain important, more direct engagement of the scientific community with these segments of society to help address the specific challenges we face is on the horizon.
- ISSE is poised and ready – through first-class science at the society-environment-atmosphere interface and meaningful collaborative engagement with social actors – to play its part in producing high quality research and helping society make the best possible choices to ensure an economically prosperous and environmentally sustainable future.

- **3-5-year goals and objectives**
  - Research agenda is focused on identifying and promoting a policy impact somewhere down the road
  - ISSE goals are:
    - Conduct research that integrates human-environment interactions with atmospheric and Earth-system dynamics
    - Conduct research that produces knowledge for use in decision making.
    - Conduct research on Earth system and societal interactions through active engagement with stakeholders to develop conceptual frameworks for improved use of scientific information for society's benefit
  - Act as an integrative force across NCAR and within the university community and maximize the societal benefit of NCAR's research by informing the Earth-systems dynamics community of societal needs relevant to their research.
- **Programmatic model and architecture**
  - PI-led "*named activities*"
  - End product, typically, is decision support at the policy level
    - Regionalization of climate considerations
    - Web-based approach

- **Tactical Implementation**
  - ISSE is generally in the business of developing Integrated Regional Application Plans
  - Who is the customer?
      - Policy makers
    - Partners
    - Universities
- **Customer engagement**
  - "Decision maker and scientist hold on to each other and roll down a hill."
- **Types of projects; number of each type of project**
  - One larger assessment program
  - ~ 7 smaller, individual, efforts
- **How the program identifies and selects new projects**
  - New ideas are received via the proposal route
  - "*Entitlement*" generates some new ideas
- **Project information: Project numbers, timescales, project team composition**
  - Projects – 1 large project and ~ 7 smaller ones
  - Timescale – Work to the end of the money
  - Project team composition – ISSE scientific staff and PI
- **Why is ISSE at NCAR?**
  - To leverage the significant physical science capacity at NCAR

- **Program Administration**
- **Budget (total and amounts for major program elements)**
  - ~ $2M – Total budget derived from NSF
    - One "*named activity* – $692K
    - All the rest – $1,308K
  - In addition, other projects and funding are possible (currently about 20% external)
    - ~ $500K *soft money* at the present
    - Previously, a significant amount of external funding was obtained
    - Significant external funding is available, if ISSE chooses to expand in that direction
- **Staffing: Staffing model, staff expertise, FTE/WYE levels**
  - 8 scientists
  - PI-led "*named activities*" – PI is typically an ISSE scientist
  - Staffing model – ISSE scientific staff with university participation
  - Staff expertise – Social / physical sciences, especially in Integrated Regional Application Planning
- **Organization chart**
- **Management model**
  - PI-led projects – "*named activities*"
  - Flexibility and adaptability – Evolving to track changing needs and trends
  - Partnerships, where feasible
  - No real accountability in place beyond the need to justify existence periodically to NSF

- **Funding sources**
  - Internal "*entitlement*"
  - Other divisions at NCAR can "contract"
  - External available, but not currently a priority

- <u>**Performance**</u>
  - **Evidence of success**
    - *Buzz* -- visibility within the community
  - **Measures of performance**
    - Metrics
      - # of publications and oral presentations
      - # of users
      - # of web *hits*
    - End of project (*named activity*) identified by
      - End of money
      - When community, decision maker is satisfied
      - No transferability, yet – Future effort to do that
  - **Major accomplishments**
    - Introducing social sciences to Earth atmospheric and climate physical sciences
    - Producing Integrated Regional Application Plans with a policy impact somewhere down the road

- **Keys to Success**
  - **More institutional support**
  - **Leveraging / creating broader multi-disciplinary projects**
  - **Working to integrate the social sciences with Earth atmospheric and climate physical sciences**

Appendix C – Literature review and interview notes: NOAA cpo RISA (Regional Integrated Sciences & Assessments)

Date:	Interview	4 Jun 08

Location:

Address:	1315 East-West Highway 12th Floor
City:	Silver Spring, MD

Attendees:

Name	Phone	E-Mail Address
Caitlin Simpson	301 734 1251	Caitlin.Simpson@noaa.gov
Charles Hutchinson		
Verne Kaupp		

Summary of information obtained

- **Strategic Planning**
  - **Mission and Vision**
    - http://www.climate.noaa.gov/cpo_pa/risa/
    - The Regional Integrated Sciences and Assessments (RISA) program, started in 1995, supports research that addresses complex climate sensitive issues of concern to decision-makers and policy planners at a regional level.
    - **Mission** – to help in realigning our nation's climate research to better serve society,
    - **Vision** – to adopt a new paradigm of stakeholder-driven climate sciences that directly address society's needs and concerns.
  - **Strategic function within its parent organization**
    - The RISA program is designed to support integrated research among the physical, natural, and social sciences to analyze how climate affects resource

    management and how climate science, forecasts, and impacts information could be used to improve management and public policy decisions.
    - The current RISA purpose is to provide information that decision makers can use to cope with
        - Drought (NIDIS)
        - Understanding climatic influences on wildfire
        - Assessing climate impacts on the
            - Transportation sector
            - Coastal communities
            - Human health
        - Helping farmers, ranchers, and fishermen to use climate information to produce the nation's food and fiber crops, etc.
    - One of the key questions NOAA faces is how to improve the link between climate sciences and society.
- **3-5-year goals and objectives**
    - As climate prediction skill improves, much of the nation stands to benefit from regional RISA activities. The RISA goal is to conduct the kinds of research and product development needed to help society make decisions in the face of climate variability and change, using experts from NOAA and other partner institutions.
    - Traditionally the research has focused on the fisheries, water, wildfire, and agriculture sectors. The program also supports research into climate sensitive public health issues. Recently, coastal restoration has also become an important research focus for some of the teams.
- **Programmatic model and architecture**
    - The RISA program began with university-based efforts in regions of the United States where recent advances in integrated climate sciences held the greatest promise to assist decision-making. Much of the first-generation RISA success built on breakthroughs in predicting variability, change, and impacts of climate processes occurring in the tropical Pacific Ocean. This is the area where El Niño and La Niña conditions, which affect much of the western and southern United States, as well as Mexico, originate.
    - RISA scientists provide information that decision makers can use to cope with drought, understand climatic influences on wildfire, and assess climate impacts on the transportation sector, coastal communities and human health. Stakeholders can use such information to evaluate potential climate change impacts on water supplies and hydroelectric power and support disaster management planning. RISAs are helping farmers, ranchers, and fishermen use climate information to produce the nation's foods and fibers, and Pacific Islanders to figure out how to weave climate information into their quest for sustainability.

Tactical Implementation

- **Major program elements**
    - The Regional Integrated Sciences and Assessments (RISA) Program is helping to realign our nation's climate research to better serve society. Established by NOAA in the mid-1990s, RISA projects point the way toward a new paradigm of

stakeholder-driven climate sciences that directly address society's needs and concerns.

- Major elements are (see figure and table at end of report):
  - Alaska Center for Climate Assessment and Policy (ACCAP)
  - California Applications Project (CAP)
  - Carolinas Integrated Sciences and Assessments (CISA)
  - Climate Assessment of the Southwest (CLIMAS)
  - Pacific RISA
  - Climate Impacts Group (CIG)
  - Southeastern Climate Consortium (SECC)
  - Western Water Assessment (WWA)
- Projects Formerly Funded Through RISA
  - New England Integrated Sciences and Assessments (NEISA)
- Fundamental science or continuing to do what they do
  - Pushing the envelope for climate change/adaptation
  - Not necessarily fixated on using the most recent satellite data
  - Using what works and is continuously available

- **Types of projects; number of each type of project**
  - Typically, RISA funds projects with a human dimensions perspective focusing on seasonal/interannual climate effects forecasts of regional economic value
- **How the program identifies and selects new projects**
  - RISA management conducts competitive *Scoping Meetings* to address changes in its *Agenda*
    - Phase 1 – Stakeholders identify issues, assess and prioritize (gap driven)
    - Phase 2 – Open competition for next region
      - Solicitation – Geographic competition, not thematic
      - Review – Conducted by thematic team and university experts
      - Duration – Flexible, but current expectation is for re-competition every 10/15 years with a major review 5 years out (Previously, there was no consideration for a forced ending point)
- **Project information: Project numbers, timescales, project team composition**
  - Project numbers: 8 current projects (1 previous project and 1 in review)
  - Timescales: No official duration, or end point
  - Project team composition: The RISA research team members are primarily based at universities though some of the team members are based at government research facilities, non-profit organizations or private sector entities.

Program Administration

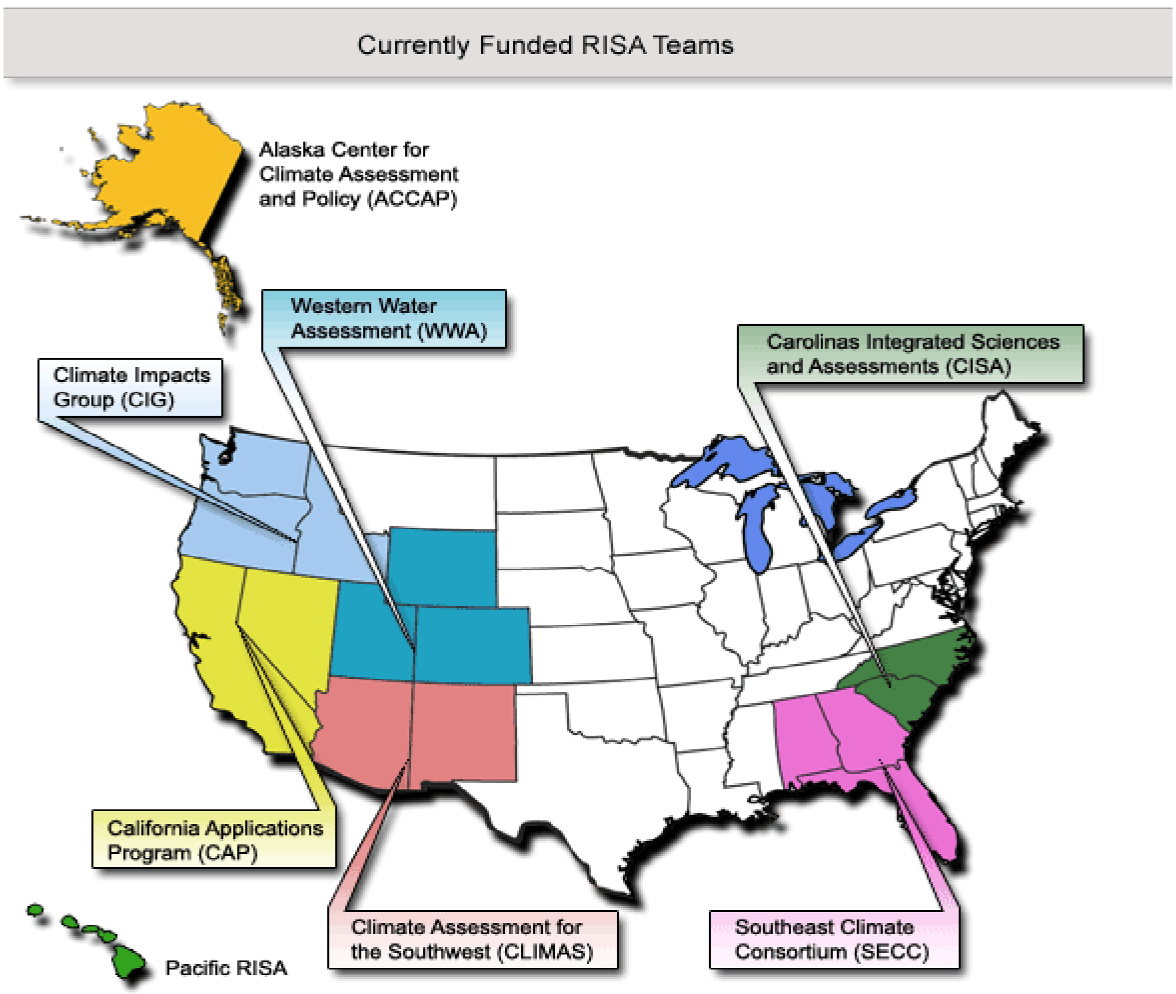
- **Budget (total and amounts for major program elements)**
  - $5M is the total program budget (for all 9 projects)
  - The program is so highly leveraged through other sources (e.g., states), the Program Director estimates it would require ~ $50M of direct NOAA funding to accomplish the same results
- **Staffing: Staffing model, staff expertise, FTE/WYE levels**

    - RISA has, effectively, 1 ½ Program Managers at NOAA for all its projects
    - Staffing model: There is no NOAA research staff (only management). Projects are regional in nature, typically PI-led, and regionally-staffed.
  - **Organization chart**
  - **Management model**
    - Standard contract/grant management
    - Flexible management allowing a team to define its objectives and approach.
    - Adaptable management encouraging evolution of projects; allowing them to follow changing needs and trends
    - Oversight provided by RISA management to ensure program is effective
  - **Funding sources**
    - NOAA provides a small part of total regional funding, typically < $500K
    - Most funding comes from interested stakeholders in a region

- **<u>Performance</u>**
  - **Evidence of success**
    - 15-year program survival
    - Management (sometimes) uses RISA success stories
    - Stakeholders becoming very vocal in support of the RISA program
    - Anecdotes / Testimonials
    - Steering committee reports
    - 5-year review by outside panel and university researchers
    - Stakeholder reviews
  - **Measures of performance**
    - Metrics
      - Core performance is measured
      - Peer review publications
      - Stakeholder forum
    - Workshops
      - Periodic PI meetings
      - On demand – CLIMAS (Climate Assessment for the Southwest)
      - C-PAWs (NOAA-sponsored Climate Prediction Assessment Workshop)
  - **Major accomplishments**
    - Existing, functioning projects demonstrate, more than any metrics, their value and accomplishments, particularly in the leveraging.
    - Victim of own success – Doing things on the cheap and now everyone wants to participate
    - Scientific community accepts RISA for decision support – It's the place to go for information
    - Congressional support
    - Long-term survival

- **Keys to Success**
  - Creating an atmosphere of being the 'place to go'.
  - Scientific community accepts RISA for decision support
  - Flexible and adaptable management
  - Evolution of a project to follow changing needs and trends

- Notes for NASA
  - **Consider having a joint solicitation on:**
    - Water resources
    - Fire management
    - Agriculture
    - Health
  - **There is no current focus at RISA on Decadal Survey issues**
    - This is the focus of the external Climate Advisory Board
    - RISA makes use of those data, observations, and model results, irrespective of origin that provide provides needed decision support and answers



RISA Locations

Alaska Center for Climate Assessment and Policy (ACCAP)

California Applications Project (CAP)

Carolinas Integrated Sciences and Assessments (CISA)

Climate Assessment of the Southwest (CLIMAS)

Pacific RISA

Climate Impacts Group (CIG)

Southeastern Climate Consortium (SECC)

Western Water Assessment (WWA)

Projects Formerly Funded Through RISA

New England Integrated Sciences and Assessments (NEISA)

Appendix D - Literature review and interview notes: NOAA cpo SARP (Sector Applications Research Program)

Date:	Interview	4 Jun 08

Location:

Address:	1315 East-West Highway 12th Floor
City:	Silver Spring, MD

Attendees:

Name	Phone	E-Mail Address
Nancy Beller-Sims	301 734 1205	Nancy.Beller-Simms@noaa.gov
Charles Hutchinson		
Verne Kaupp		

Summary of information obtained

- **Strategic Planning**
  - **Mission and Vision**
    - http://www.climate.noaa.gov/cpo_pa/sarp/
    - The Sectoral Applications Research Program (SARP) supports the overarching goals of the NOAA Climate Program to understand and describe climate variability and change to enhance society's ability to plan and respond by developing the knowledge base, decision support tools, capacities and partnerships in sectors affected by climate in a substantial and increasingly visible way. SARP is designed to catalyze and support interdisciplinary research, innovative outreach and education activities that enhance the capacity of key socio-economic sectors to respond to and plan for climate variability and change through the use of climate information and related decision support resources. The program is designed to systematically build an interdisciplinary and

expressly applicable knowledge base and mechanism for the creation, dissemination and exchange of climate-related research findings and decision support resources critical for understanding and addressing resource management challenges in vital social and economic sectors (e.g., coastal resources, water, agriculture, health, etc.).
    - SARP is ~2 ½ years old and grew out of the Human Dimensions of Global Change Program
- **Strategic function within its parent organization**
    - SARP is designed to systematically build an interdisciplinary and expressly applicable knowledge base and mechanism for the creation, dissemination and exchange of climate-related research findings critical for understanding and addressing resource management challenges in vital social and economic sectors (e.g., coastal, water resources, agriculture, health, etc.).
- **3-5-year goals and objectives**
    - The overarching goals of SARP include:
        - The provision of new and/or synthesized science-based knowledge that results in the identification of impacts and societal vulnerability, and the enhanced capacity to cope with and adapt to climate variability and change in key socio-economic sectors;
        - The enhanced and increasingly sophisticated use of climate information and related decision support resources in sector-specific decision making on various scales (e.g. local, state, national, international);
        - The provision of sector-specific (e.g., agriculture, forestry, fisheries) insight and feedback related to stakeholder needs and capabilities that contribute to the development of an increasingly effective and relevant climate research and decision support effort; and
        - The development of partnerships and linkages designed to advance the infusion of climate information in sector-specific decision making processes through involvement with interagency efforts (e.g., Climate Change Science Program), Federal initiatives (e.g., National Integrated Drought Information Service), and broader NOAA mandates and goals (e.g., coastal resource management).
- **Programmatic model and architecture**
    - SARP pursues its objectives through the establishment of sector-based projects (e.g., current projects focus on Coastal Resource Management, and Drought/Water Resources Management) that are composed of a combination of competitive applications research/decision support resource development, outreach and community building, including the creation of productive partnerships with sector-specific decision making and technical entities. These activities are conducted within a sectoral framework that provides a construct for defining: the nature, requirements and capabilities of a relatively bounded suite of stakeholders; the applications and decision support research priorities and associated interdisciplinary community to tap into (or to stimulate) to address these needs and priorities; and the key partners needed to effectively create, disseminate and apply climate information in a particular sector. The identification of these sectors depends upon NOAA priorities, program budgets, and input from the Federal, research and decision making communities.

- From a programmatic perspective, these sector projects can be viewed as organizing/integrating systems that serve as a plane for understanding and addressing many complex socioeconomic issues that are influenced by climate, and for developing linkages with specific decision makers and partners. While a common framework and approach will be utilized for all of the SARP sector projects (e.g., stakeholder requirements workshops, competitive funding opportunities to advance decision support resource development), the exact nature of the research activities and partnerships developed for each is, and will be, highly influenced by a sector's information needs, partners, and state of readiness: no one-size-fits-all.
- Flexibility is the key. No two projects are necessarily alike. It's an adaptive process to stimulate innovation and enhance results. ("Rigidity kills creativity.")
- Sector-specific projects.

- <u>**Tactical Implementation**</u>
  - **Major program elements**
    - Program almost exclusively uses well-directed, but not detail specific solicitations to pursue directions laid out by an *Agenda* in support of decision-makers
      - Mail review process
      - Office assessment & prioritization
    - Economic sector orientation for design of solicitation and proposals accepted and funded.
  - **Types of projects; number of each type of project**
    - Projects are expected to build a unique sectoral knowledge base
    - Academia, NGOs, etc., all PI-led projects.
    - SARP projects are typically interdisciplinary (physical and social scientists) and may result in "prototypes" or go "end-to-end" providing:
      - Tools, methodology, knowledge, forecasts
      - Decision support
  - **How the program identifies and selects new projects**
    - The program is informed by an *Agenda* that is:
      - A tool for planning budgets, identifying need for review panels, defining a research focus and appropriate solicitations, etc.
      - Defined by NOAA needs
    - Current *Agenda* research focus includes:
      - Exploring CCSP considerations for water
      - Drought – NIDIS
      - Community involvement – Conference / workshops participation
      - Science community involvement with NOAA
        - Workshops
        - CCSP
        - Meetings
      - Other NOAA needs
    - Reviewing the *Agenda* is an annual (or possibly more frequent) process (internal)

- For each sector effort, SARP will:
  - Identify key climate-sensitive decision making processes and information needs, including gaps in understanding of socio-economic impacts and awareness of existing and emerging decision support resources.
  - Increase the awareness and understanding, on the part of the general public and specific decision making sectors, of climate variability and change, and the potential use of climate science, products and services through outreach and education activities.
  - Catalyze and develop innovative decision support resources and tools, and advance their prototype implementation and evaluation.
  - Foster sustainability of NOAA research by involving decision makers and technical entities as partners from the inception of the project.
  - Provide focused feedback in terms of decision making needs and capacities to NOAA, the Climate Change Science Program (CCSP), National Academy of Sciences, the broader research community, and other stakeholders in climate research and applications.

- **Project information: Project numbers, timescales, project team composition**
  - Project numbers: ~ 20 projects initiated at any one time (some 30 projects to date)
  - Timescales: 6 – 24 month long projects are solicited
  - Project team composition: PI-led teams comprised of different social science disciplines or across the disciplines of the social, natural and physical sciences.

- **<u>Program Administration</u>**
  - **Budget (total and amounts for major program elements)**
    - Total annual proposal funding generally available: ~$3M
    - Awards generally fall in the $50K - $300K range
    - Awards generally are in the 6 – 24 mo range
  - **Staffing: Staffing model, staff expertise, FTE/WYE levels**
    - Projects are typically PI-led multidisciplinary teams with personnel necessary to complete the proposed effort
    - SARP does not have a research staff beyond the Program Manager (Nancy Beller-Simms) for the Human Dimensions of Global change Research Program (HDGCR) and the Program Director (Lisa Farrow Vaughan) for Environment and Development responsible for the development of programs, methods and pilot projects which integrate socially-defined needs with science and technology for the purpose of fostering sustainable development
    - SARP draws upon personnel from within NOAA, if needed.
    - SARP uses partners/partnerships both from within and outside NOAA – Strong partnerships are important
  - **Organization chart**
  - **Management model**
    - Standard contract management
    - Flexibility and adaptability permitting changes as circumstances warrant
    - Seeking creativity but avoiding rigidity (“Rigidity kills creativity”)

- Funding sources
  - Standard NOAA process

- **Performance**
  - **Measures of performance**
    - Success is, in some sense, measured by:
      - Admittedly expedient, but # of publications (satisfies normal requirements)
      - Measure of NEW awareness 'out there' about SARP results (i.e., "buzz")
      - Increase in usage of tools, results, information, etc.,
      - Program review is continuous and steering towards next year's program announcement
      - A delicate balance in trying to prove or review success
      - Considering a National Academy book, *Metric Book* for future use[11]
      - National Academy is currently conducting a performance assessment for NOAA (SARP being one program)
    - Transferability: Plan for the end of a project and transfer the results to the end user
    - Understand your audience, your community and seek to support it
    - Sustainability is important for future projects, but not the current ones
    - Accountability: To senior management and review boards demonstrating that a project
      - Satisfies the SARP strategic plan and goals,
      - Meets stakeholder needs and end-user community requirements, and
      - Provides important information for decision-makers.
  - **Major accomplishments**
    - Success story – Kathleen Miller (NCAR) – Game Theory Approach to Fisheries
    - Final Project Review in consideration for future projects.

- **Keys to Success**
  - Creativity – In program managers and scientists promote innovative projects / solutions
  - Flexibility – In management to promote an adaptive process to stimulate innovation and enhance results (rigidity kills creativity)
  - Accountability – To senior management and review boards
  - Outreach / education – Spread the word / enlist new users
  - Partnerships – Within / outside NOAA – Strong partnerships are important
  - Approach – Sector-specific – Drill down as far as necessary (be flexible) and permit some projects to end at "prototype" stage and require others to go "end-to-end"
  - Transferability – Plan for end-of-project and transfer to end user
  - Community – Understand your community
  - Sustainability – Important but not yet implemented (future objective)

---

[11] NRC. 2005. *Thinking Strategically: The Appropriate Use of Metrics for the Climate Change Science Program*. National Academy Press. Washington. 162 p. SARP-Analysis&Report-24June08 cfh notes.doc

- **Notes for NASA**
  - Consider adoption of a sectoral dimension of climate change for the Applied Sciences Program
  - Consider joint funding announcements, joint workshops, collaborations
  - *Decadal Survey* – Consider how NOAA needs can become part of the design process for new missions. They are interested (meeting between Koblensky and Freilich?)

Appendix E – Literature review and interview notes: NOAA cpo TRACS (Transition of Research Applications to Climate Services)

Date:	Interview	19 Jun 08

Location:

Address:	1315 East-West Highway 12th Floor
City:	Silver Spring, MD

Attendees:

Name	Phone	E-Mail Address
Caitlin Simpson	301 734 1251	Caitlin.Simpson@noaa.gov
Charles Hutchinson		
Verne Kaupp		

Summary of information obtained

- **Strategic Planning –** (A new program director has not been named)
  - **Mission and Vision**
    - http://www.climate.noaa.gov/cpo_pa/nctp/
    - **Mission** - to apply new research in a timely manner, a research enterprise focused on understanding and applying emerging science and technology to user needs, and effective and efficient processes and procedures to ensure the timely transfer of research to operational status or information services in meeting mission responsibilities.
  - **Strategic function within its parent organization**
    - Application of the best available science and technology for meeting NOAA's mission.
    - The TRACS Program transitions experimentally mature climate information tools, methods, and processes, including computer related applications (e.g.

web interfaces, visualization tools), from research mode into settings where they may be applied in an operational and sustained manner.

- **3-5-year goals and objectives**
  - TRACS primary goal is to generate sustained delivery of useful climate information products and services to local, regional, national, and international decision and policy makers. TRACS seeks not only to support implementation of these transitions, but also to learn from partners how to better accomplish technology transition processes for public goods applications and improved risk management.
  - The objective of TRACS is to fund projects to:
    - Develop or enhance climate products and services, build capacity among decision makers
    - Understand, access, and use climate-related decision support tools or technologies, and
    - Ensure that NOAA and its partners (federal, regional, state, and the private sector) are capable of routinely delivering climate information to the public.
- **Programmatic model and architecture**
  - What TRACS is:
    - TRACS supports partnerships to transition climate time-scale products and services.
    - TRACS is designed to compliment on-going research partnerships and catalyze interactive learning among researchers, operational entities, extension agents, and end-users developed under the RDS SARP and RISA Programs—or in other similar ventures involving NOAA and its stakeholder communities.
    - TRACS should build bridges between decision support research and operations capabilities and partners.
    - TRACS proposals should focus on developing means of communication and feedback, and on deep engagement with the operational and end-user communities over a finite period, but should also help establish relationships and trust that will endure over time.
    - TRACS is intended to transition research applications that have been tested in practice "downstream" of major research activities, have the potential to be reliably applied, and are on the cusp of being ready to "hand-off" for regular and sustained delivery and/or use.
    - TRACS may help facilitate transition into applications of products and services developed in "test-beds".
    - TRACS proposals may focus on local, regional, or national scale decision support tools and systems.
    - TRACS focuses on climate time-scales, but welcomes work on the interaction among climate and weather research and decision-making.
    - TRACS proposals should rigorously identify and evaluate the benefits to society of the transition project.
  - What TRACS is not:
    - TRACS is not an operational or services activity by itself, but by design functions as a bridge to effect research transitions through partnerships with operational entities.

        - TRACS does not support major "upstream" research and development (R&D) for observing, modeling, or forecast systems, including the funding of "test-beds".
        - TRACS is not intended to be a means to develop "from scratch" end-to-end research applications, to support initial contact with operational or user partners, or to explore more broadly the development of climate services (these activities are supported more generally by the NOAA SARP and RISA Programs, along with the rest of the Climate Program Office portfolio).

- **Tactical Implementation**
    - TRACS is a new program with no clear track record as of yet. It is redesigned from the NOAA Climate Transition Program (NCTP)
        - It was created in the 2004/5 funding cycle
        - The first project is expected to be completed in late 2008
    - There is currently no program director for the TRACS program (Josh Foster was the program director for FY2006/7 grant cycle).
    - It is unclear whether or not there will be funding for TRACS projects for FY2008
    - The way this is supposed to work is:
        - RISAs (geographic regions) – endeavor to improve interactions with local and regional stakeholders to determine climate service needs; increase the utility of climate information for decision makers; advance science and provide feedback into research; field test and refine new products; and link research with planning and operations.
        - SARPs (economic sectors) – identify and promote research and application priorities that foster improved decision support for fundamental climate-related issues in key socio-economic sectors (e.g., coastal, water resources, agriculture, health, etc.).
        - TRACS (research to operations) - facilitates transition of climate information tools into operational products to meet user/decision maker requirements, develop a deliberate bridge for research to applications, advance focused scientific research, and increase scientific capacity. NOAA research laboratories contribute to the research to operations process through collaborations with the operational branches of NOAA to transition climate research into usable regional prediction products and services.
        - TRACS is designed to accommodate four types of transition project partnerships:
            - Within NOAA units
            - From external partners to NOAA
            - From NOAA to external partners
            - Among external (NOAA) partners (using NOAA funds)
        - Programs are designed around the following key elements:
            - Transitions (i.e. a focus on partnerships where technology hand-offs occur),
            - Research applications (i.e. experimentally developed and tested, end-user-friendly information to support decision making), and
            - Climate services (i.e. the routine and timely delivery of that information, including via partnerships).

- Note the Figure describing the TRACS partnership model provided on the last page of this report
- **Types of projects; number of each type of project**
  - 5 projects being completed from the original NCTP
  - At least one TRACS project is being worked
- **How the program identifies and selects new projects**
  - It is suggested that successful projects should include the following elements, as well as address the program goals and objectives. These conditions are:
    - Clearly defined climate time-scale dimension to the problem and solution/tools, even if applied to weather time-scale decision support;
    - Clearly defined decision maker, research, operations and extension partners--including all participants involved in proposal preparation is highly recommended;
    - A management plan including project description, roles and responsibilities of partners (i.e. team interactions), and detailed methodology and timeline (i.e. how components will be integrated and implemented), with a duration less than 5 years;
    - Benefit analysis (rigorous valuation of socio-economic, ecosystem, or other measurable benefits), including outline of methodological approaches for evaluation;
    - Address post audit evaluation (validation, verification, refinement, maintenance, etc.) to determine at the end of the project if the transition has been achieved and is sustainable;
    - Formal agreement between participants (if possible) - represented as signatures on the proposal and/or more formal documents, such as, Letters of Support or Memoranda of Understanding (MOU);
    - Demonstrate generally how the project supports NOAA mission goals.

- **Project information: Project numbers, timescales, project team composition**
  - No real information provided
  - Currently funded projects from FY05

Primary Investigator	Project Title	Year Funded
Comrie, Andrew, Ph.D., University of Arizona	A Distributed Interactive Access and Resource Interface For Fine-Scale Climate Data	2005
DeGaetano, Arthur T., Ph.D., Cornell University	Transitioning an Assessment of Impact-Producing East Coast Winter Storms to Decision-Support Tools for Emergency Management and Coastal Restoration	2005
Hu, Q. Steven, Ph.D., University of Nebraska	Transition of Weather and Climate Forecasts into Effective Decision-Making Tools	2005

Rigor, Ignatius, Ph.D., University of Washington	Forecasting the Condition of Sea Ice on Weekly to Seasonal Time Scales	2005

OAR Partnership Program FY 2005

Primary Investigator	Project Title	Year Funded
Hentschel, Margit, Director, ICLEI, Western Region Capacity Center	Climate Safe Cities (a project managed by the NOAA Climate Transition Program (NCTP) under NOAA's Office of Oceanic and Atmospheric Research Partnership Program)	2005

"ICLEI Climate Resilient Communities (CRC)
Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments"
The guidebook is available at: RISA Climate Impacts Group (CIG)

- o

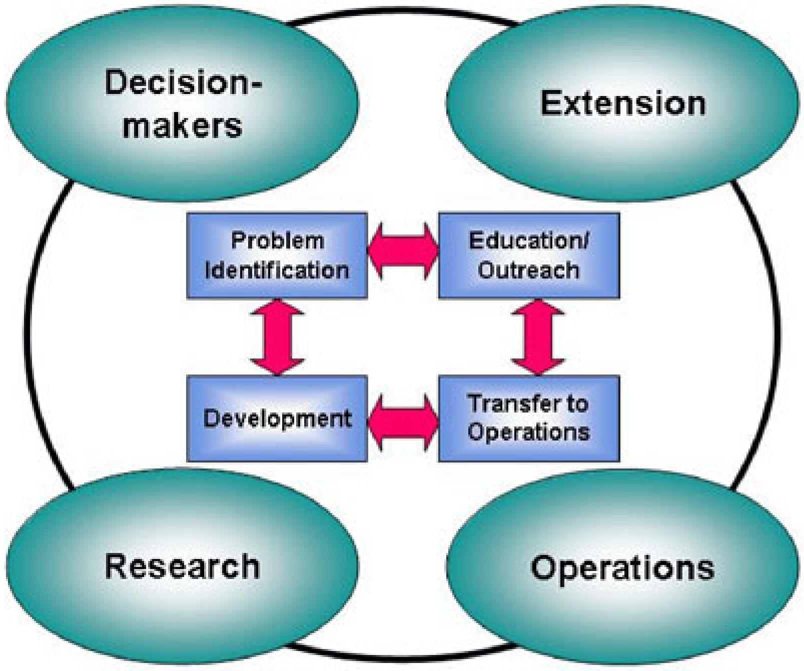
- **<u>Program Administration</u>**
  - **Budget (total and amounts for major program elements)**
    - TBD
  - **Staffing: Staffing model, staff expertise, FTE/WYE levels**
    - No NOAA scientific staff assigned to the program, but the intent is draw upon expert staff from wherever it resides across NOAA
  - **Organization chart**
  - **Management model**
    - Standard contracts / grants management
  - **Funding sources**
    - TBD

- **<u>Performance</u>**
  - **Evidence of success**
    - No track record, as of this time.
  - **Measures of performance**
    - Metrics
      - TBD
    - Workshops
      - TBD
  - **Major accomplishments**
    - TBD

- **Keys to Success**
  - **TBD**

- **Notes for NASA**

Figure 1: TRACS Partnership Model



Appendix F –Literature review and interview notes: NOAA NESDIS STAR (Center for Satellite Applications and Research)

Date:	Interview	2 June 08

Location:

Address:	5200 Auth Road Suite 701
City:	Camp Springs, MD

Attendees:

Name	Phone	E-Mail Address
Steve Goodman	301 763 8127 x132	Steve.Goodman@noaa.gov
Mitch Goldberg	301 763 8127	Mitch.Goldberg@noaa.gov
Kent Hughes	301 763 8127	Kent.Hughes@noaa.gov
Ingrid Guch	301 763 8127	Ingrid.Guch@noaa.gov
Charles Hutchinson		
Verne Kaupp		

Summary of information obtained

- **Strategic Planning**
  - **Mission and Vision**
    - http://www.star.nesdis.noaa.gov/star/contact.php
    - The Center for Satellite Applications and Research (STAR) – formerly the ORA (Office of Research and Applications – is the science arm of the National Environmental Satellite, Data and Information Service (NESDIS), which acquires and manages the nation's operational Earth-observing satellites. NESDIS provides data from these satellites, and conducts research to make that possible.

    - **Mission** – (from the STAR web site) to transfer satellite observations of the land, atmosphere, ocean, and climate from scientific research and development into routine operations, and to offer state-of-the-art data, products and services to decision-makers. STAR's mission is designed to be consistent with and supportive of the NOAA mission.
    - (from a recent briefing) To provide NOAA with scientific research and development to accelerate the transition of state-of-the-art satellite data systems, products, and services to operations for use by land, atmosphere, ocean, and climate user communities.
    - **Vision** – To guide mission requirements in each of the five NOAA strategic goals:
        - **Ecosystems** — Protect, restore, and manage use of coastal and ocean resources through ecosystem-based management.
        - **Climate** — Understand climate variability and change, to enhance society's ability to plan and respond.
        - **Weather and Water** — Serve society's needs for weather and water information.
        - **Commerce and Transportation** — Support the nation's commerce with information for safe, efficient, and environmentally sound transportation.
        - **Critical Support** — Provide support for NOAA's mission, including its observing systems, which are critical for obtaining measurements of more than 500 environmental properties.
- **Strategic function within its parent organization**
    - The United States invests billions of dollars every year in satellites and data, in order to monitor the ever-changing environment of Earth. The Center for Satellite Applications and Research *(STAR)* uses the data from satellites to offer sound information about the Earth.
    - STAR is the science arm of the National Environmental Satellite Data and Information Service (NESDIS), which acquires and manages the nation's Earth-observing satellites. STAR supports NESDIS and NOAA in their mission to assess current conditions and predict future changes on the Earth, and to understand long-term changes in the environment.
    - STAR is separate and distinct from NOAA Research, the distinction being that STAR is primarily responsible for satellites and satellite projects through NESDIS for NOAA. Some satellite work is done outside of STAR, but not much.
- **3-5-year goals and objectives or priorities**
    - STAR supports NESDIS (in particular) and NOAA (at large). The following have been identified as NOAA (and thus, STAR) priorities
        - Early warning for temperature, humidity, vegetation, soil moisture
        - Air quality — wet deposition trends, composition of aerosols, global distribution of ozone, forest fires
        - Sustainable agriculture practices
        - Programs to acquire satellites
- **Programmatic model and architecture**
    - STAR is an Office (under NESDIS) with 3 divisions
        - SMCD – Satellite Meteorology and Climatology Division – Mitch Goldberg

        - SOCD – Satellite Oceanography and Climatology Division – Kent Hughes
        - CoRP – Cooperative Research Programs – Ingrid Guch
    - STAR is NOAA (NESDIC) centric, with a perpetual user base
        - Most customers are other NOAA units
        - This is true for all 3 division, but to different degrees
    - STAR conducts research
        - Other NOAA or University PIs takes those result and make them robust for operational use
        - The goal is to transition results to operations at NOAA (or, possibly, at other Federal agencies, or state and local users)
    - STAR rarely pushes research to the ground.

- **<u>Tactical Implementation</u>**
    - STAR is the satellite research center for NESDIS. As such, it is responsible for initiating research to promote societal benefit from a suite of satellites. To do this, it both manages acquisitions and exploitation. STAR has an Integrated Product Team.
    - For the exploitation effort, STAR conducts research, develops algorithms and models, creates products and tools, and ends its effort when the NOAA need has been satisfied. On occasion, this requires going end-to-end and pushing something all the way to the troops on the ground; but not often.
  - **Types of projects; number of each type of project**
    - Satellite Meteorology and Climate Division – Provides the primary research, development and transition-to-ops support for atmospheric and land remote sensing activities in NOAA
        - Operational Products Development – Soundings, winds, clouds, hazards, aviation weather, validation
        - Sensor Physics – Radiative transfer, sensor calibration, sounding algorithms, trace gas retrievals, air quality, new satellite instrument development
        - Environmental Monitoring and Climate – Vegetation, snow, ice, aerosols, radiation budget, clouds, precipitation, temperature
    - Satellite Oceanography and Climatology Division – Provides the primary research and development support for oceanic remote sensing within NOAA
        - Ocean Sensors – Ocean Color, ocean Surface Winds, Sear Surface Temperature, Satellite Altimetry
        - Marine Ecosystems and Climate – Sea ice, coral reef bleaching
        - Ocean Dynamics and Data Assimilation – Surface currents, Sea Floor
    - *Cooperative Research Program* (CoRP)—consisting of federal government scientists—are collocated with a cooperative institute managed by a university to more fully realize the societal benefits of increased exploitation of data from NOAA satellites. ,Partnerships with these five *cooperative institutes or centers* enable CoRP to conduct innovative research with current and future remote-sensing specialists:
        - Cooperative Institute for Climate Studies (CICS), University of Maryland, College Park, Maryland

        - Cooperative Institute for Meteorological Satellite Studies (CIMSS), University of Wisconsin, Madison, Wisconsin
        - Cooperative Institute for Oceanographic Satellite Studies (CIOSS), University of Oregon, Portland, Oregon
        - Cooperative Institute for Research in the Atmosphere (CIRA), Colorado State University, Fort Collins, Colorado
        - Cooperative Remote Sensing Science and Technology Center (CREST), City College of City University of New York, New York, New York, and participating institutions: Bronx Community College (NY), Bowie State University (MD), Columbia University (NY), Hampton University (NY), Lehman College (NY), University of Maryland Baltimore County, and the University of Puerto Rico-Mayaguez.
  - **How the program identifies and selects new projects**
    - Where do ideas come from?
      - Individual NOAA researcher
      - Other NOAA user needs
      - Directed by management
    - What is the normal process followed to identify a new project and have it approved for research?
      - Define the research objectives, in particular, by looking for gaps
      - Write proposals
      - Have it reviewed – Typically by the SPSRB (Satellite Products and Services Review Board) with responsibility to provide oversight management for acquiring Meteorological, Climatic, Terrestrial, Oceanographic, and Solar Geophysical satellite products and services required to support Civilian and National Security Missions
      - Obtain funding
      - Conduct research
  - **Project information: Project numbers, timescales, project team composition**
    - Project numbers – > 50 total projects
    - Timescale – Typically, 3 – 5 years but end-to-end projects usually run 5 – 7 years
    - Project team composition – NOAA scientists, contractors, university researchers

- **Program Administration**
  - **Budget (total and amounts for major program elements)**
    - $20M (not counting acquisitions) - $45M (with acquisitions counted)
  - **Staffing: Staffing model, staff expertise, FTE/WYE levels**
    - Staffing mode – NOAA scientists, contractors, university researchers
    - Staff expertise
      - Scientist with applications orientation and who work with people,
      - Specialists in a particular sensor physics
      - Physical scientists (land, ocean, atmosphere)
      - University collaborators
      - NASA personnel (e.g., ROSES)
    - FTE/WYE levels – Approximately 95 NOAA, 120 contractors
      - SMCD – Approximately 1/3 of the total
      - SOCD – Approximately 1/3 of the total

        - CoRP – Approximately 1/5 of the total
        - Remaining staff are in administration
    - **Organization chart**
    - **Management model**
        - Standard contracts / grants management
        - Flexibility – Leads to success
        - There is no rigid process – Rigidity leads to rigor mortis
        - Process – Different for each division
        - Accountability – Crucial (Oversight is necessary)
        - SPSRB and Oversight panels – Provide guidance
    - **Funding sources**
        - Primarily NOAA internal funding; some outside funds (e.g., ~ $1 – 2 M for NASA ROSES projects)

- **<u>Performance</u>**
    - **Evidence of success**
        - It is obvious (to whom?) when research results are valuable for applications and moved into routine operations
    - **Measures of performance**
        - Metrics
            - Success is measured in a different way for each *named activity*
            - SPSRB (Satellite Products and Services Review Board) – Defines success for some projects
            - Oversight panels – Define success for some projects
    - **Major accomplishments**
        - Completing activities and having the fruits of the effort adopted "on the ground"
        - Conducting research, moving it to applications, having it adopted in routine operations
        - See the STAR home page for recent accomplishments

- **Keys to Success**
    - Right people
    - Right staff expertise
    - It doesn't hurt to have a perpetual customer

- **Notes for NASA**
    - Invitation extended to Applied Sciences Program Director to attend the next SPSRB
    - Decadal Survey – Provides a new opportunity for including the operational communities' needs from the beginning of new mission design. Perhaps the Applied Sciences Program and STAR might collaborate on that with STAR providing the "cry from the ground" for consideration.

Appendix G – Literature review and interview notes: USDA USFS RSAC (Remote Sensing Applications Center)

Date:		18 Jun 08

Location:

Address:	2222 W. 2300 South
City:	Salt Lake City, Utah

Atendees:

Name	Phone	E-Mail Address
Brian Schwind	801 975 3765	bschwind@fs.fed.us
Brad Quail	801 975 3737	bquayle@fs.fed.us
Charles Hutchinson		
Verne Kaupp		

Literature Review Summary

- **Strategic Planning**
  - Mission and Vision
    - http://www.fs.fed.us/eng/rsac
  - Strategic function within its parent organization
  - 3-5-year goals and objectives
  - Programmatic model and architecture

- **Tactical Implementation**
  - Major program elements
  - Types of projects; number of each type of projects
  - How the program identifies and selects projects
  - Project information: Budget levels, timescales, project team composition

- **Program Administration**
    - Budget (total and amounts for major program elements)
    - Staffing: Staffing model, staff expertise, FTE/WYE levels
    - Organization chart
    - Management model

- **Performance**
    - Measures of performance
    - Major accomplishments ("advertisements")

Interview Notes Summary:

- **Program Purpose**
    - Original Purpose was to develop technology for the Field centers (National Forests) and transfer it to them
    - Now, RSAC is building a service relationship with the Field (They are in the process of understanding the needs of the Field and meeting them).
- **Business Model**
    - The business model is drifting, moving toward more of a service center for the field
        - Field capacity in remote sensing has failed to develop
    - Moving away from the established training model
- **Program Areas (5)**
    - IAAA – Inventory-Analysis-Accuracy Assessment
        - From research to an operational end
    - LSP – Liaison and Special Projects
        - Primarily oriented towards aviation (UAV work with Ames)
        - Some law enforcement focus
        - Fire mapping projects
    - IRS – Integration of Remote Sensing
        - BAER – Burn Area Emergency Recovery (~$400K/yr)
        - Technology evaluation – Test in operations and transfer to the Field
    - Training and Technology Awareness
        - Education (Distance & Virtual) – Becoming more service oriented
        - Less hands-on for the future, more web
    - Operations
        - Operational Remote Sensing support
        - Mostly fire support
        - Provide Direct Readout capability
- **Program Approach**
    - 5 Program Area Leaders – Function as entrepreneurs
    - Flexible and adaptable
    - In-house staff (use collaboration as necessary)
    - Success – Defined by "sustained operations" (i.e., adoption, or sustained use of and demand for product)
    - Metrics – Not used yet – Metrics are expected in the future
    - Accountability – Demonstrate accomplishments to an internal audience

      - Leverage accomplishments to secure program longevity
    - **New Projects -- IRS**
      - Proposals – "Cry for help" – Field oriented
      - Review and prioritization – RSSC (Remote Sensing Steering Committee – Membership drawn from the technology and resource (Field)
      - Accepted projects are worked by the within RSAC by unit staff
      - Current year statistics – One year efforts
        - 20 submitted from the field
        - 9 were accepted and funded
        - Total Budget -- $250K (+/-)
        - Range -- $15K - $60K
    - **RSAC Budget**
      - Total yearly budget -- $5M
    - **Project Load**
      - ~ 90 "Named Activities" – "Projects"
    - **Staff Size**
      - Total staff – 55 – Present number (sister Geospatial Technology Center has ~ 80)
      - 10 are Federal employees
      - 45 are contract employees
    - **Funding Considerations**
      - Base level – Shrinking
      - Reimbursable – Growing – Defined as projects brought to RSAC from outside
      - IRB -- $100M (+/-) – Information Resources Board (Agency-wide)
        - Presently – 9 projects – Up to $700K, each
        - IT – Information Technology projects
        - IA – Inventory Analysis projects
      - Collaboration – Work with Academia (Proposals to other sources – e.g., NASA)
- **<u>Keys to Success</u>**
  - Develop & foster end-user relationships
    - Promote 2-way communications
    - Be sensitive to the needs of end users
    - Strive to identify & fill gaps / fit a niche
  - Develop interagency partnerships & relationships
  - Complete projects on time and within budget
  - Accountability
    - Publish
      - Grey literature & white papers ("How to's" for the field)
      - Peer reviewed papers
      - Reports & tips to end users
      - Demonstrate accomplishments to internal audience
  - Leadership that is pro-active, not reactive
  - Prove autonomy to program leaders
    - Budget
    - Approach

        - Needs
    - Provide immediate access to program & contract staff
    - Eliminate micromanagement – at all levels
    - Heavily involved in hosting biennial Remote Sensing conference (they feel it enhances their credibility and demonstrates their leadership)
        - Internal
        - External
        - Important role in bringing the community together
- **Success**
    - Technology transfer
    - Sustained demand
        - RSAC hasn't, yet, disabled *any* service
- **Notes for NASA**
    - Maintain Direct Broadcast capacity ("we are as far out on the 'bleeding' edge as you can get!")
    - Allow meaningful input to mission design process
    - Emphasize the importance of NASA's partnership in conserving and managing our forest resources
    - Data continuity (National context)
- **Final Notes**
    - Currently in the process of changing the management structure from project stove-pipes to functional matrix style