VII. MANAGEMENT

1. ORGANIZATIONAL STRATEGY AND STRUCTURE

The main function of MDITR Management is to:

1. Define clear goals for the Center (with input from the SAB and EAC)
2. Allocate resources to enable attainment of Center goals
3. Organize Center-wide activities (e.g. meetings, reports)
4. Review progress and results
5. Refine goals

Additionally, MDITR Management will facilitate the operation of the Center by

6. Providing clear expectations of all Center participants (including the area of responsible research conduct)
7. Ensuring effective communications to enable teamwork
8. Reviewing and reconstituting the Center's membership when needed
9. Promoting Center activities to interested audiences
10. Disseminating Center outputs (IP, publications, educational tools, data)

The scale, complexity, and nature of the cooperative agreement underlying all STCs distinguish these awards from traditional NSF individual investigator awards. As a result, STCs are far more dependent on strong organizational management capabilities for success than are single investigator projects. These management capabilities must be developed "on the fly" – similar in many ways to the challenges faced in a startup company.

MDITR is meeting this challenge by welcoming change, recruiting new talent, and demonstrating adaptability. Our organization has evolved substantially over the last reporting period:

- Four key PIs at our principal partner, the University of Arizona, have relocated to the Georgia Institute of Technology (one Associate Director, two Research Thrust Leaders). In the space of a few months, Seth Marder, Bernard Kippelen, Joseph Perry, and Jean-Luc Brédas moved a total of 30 MDITR participants to Atlanta, GA. A new intellectual property rights agreement was negotiated between our seven academic partner institutions. The addition of Georgia Tech to our participating institutions brings important new research and educational resources to MDITR and provides us with a strategic diversity pipeline in the Southeastern U.S.

- We have recruited a new Managing Director, Dr. Glen Shen (hired Dec 2004). Shen is a former tenured professor at the University of Washington who brings technical and management experience from academia, a biotechnology startup, and the federal government (AFRL). Given MDITR's academic base, its close association with DoD, and its growing roster of industrial affiliates, Shen will ensure that our Center stays on mission.

- We have recruited a half-time IP and Industrial Relations Manager, Dan Doll (hired summer of 2003; supported through matching funds). Doll is experienced in technology development having worked with university researchers and tech transfer offices to identify commercialization partners. Doll will play a critical role in overseeing the intellectual property interests of our broad-based Center while fostering productive relationships with IAP members and other external collaborators.

- We have recruited a K-16 Education and Public Outreach Specialist, Dr. Carmen Sidbury, at Georgia Tech (hired Dec 2004; supported by STC and GT matching funds). Sidbury is a Ph.D. Mechanical Engineer with over a decade of opto-electronic experience in the telecommunications industry and 15 years of commitment to community service and outreach programs for youth. Sidbury will play a lead role in MDITR's diversity building strategy.

- We have consolidated our web design function at the U. of Arizona and negotiated a 1/3 STC appointment for Eric Aislinn at UW as an information technology specialist (supported by matching funds). Aislinn has optimized our videoconferencing protocols and LAN. Also a webmaster, Aislinn will eventually support the UA team as time allows.

MDITR's overall organization is depicted in Appendix B. This chart breaks out research, education/KT/diversity, and administrative capabilities and shows linkages to our advisory bodies. The two-way arrows connecting Research with Education/KT/Diversity boxes emphasize that the success of these endeavors depends on thorough integration. Diversity leads have been designated at each of the three principal partner institutions (Carmen Sidbury-GT; Neal Armstrong-UA; Jasmine Bryant-UW) to ensure that the goal of diversity enhancement underlies all our research and education thought processes and activities.

Despite the addition of a new partner university and new personnel into our Center, we are maintaining a simple management structure in accord with a recommendation made at our 2003 Site Review. Our main governing body is the MDITR Management Team comprised of individuals representing all key management and program niches (members include all those named in Appendix B organization chart except the UW Dean of the College of Arts and Sciences and the SAB chair). These individuals reside at our three principal partner institutions and meet at least biweekly. Subsets of the Management Team are tasked with executive decision making. For example, in the case of seed grant awards, deliberations by the Associate Directors and technical Thrust Leaders are facilitated by the Managing Director who then formulates a set of recommendations for the Director, Larry Dalton. Major decisions about our Education Programs involve a different but clearly identifiable subset of the Management Team. For critical Center decisions and for periodic programmatic review, the SAB and EAC are also involved.

On a final note, we have adopted a new logo for our Center (see Annual Report cover page). The logo depicts the three primary colors of white light (red-blue-green) passing through a triangular prism. This light-based theme and suggested applications are central to MDITR's photonics mission. The circular periphery emblazoned with member university acronyms connotes partnership and integration. In some respects, arriving at this design reflects our discovery of MDITR's core identity in this, our second year of existence.

2. MANAGEMENT PERFORMANCE AND MANAGEMENT INDICATORS

The extent of fulfillment of functions 1-10 described earlier provides a useful measure of the management team's effectiveness. We identify the following related performance indicators and comment briefly on strides taken in year-2 of our operations:

- Structure of planning and coordination activities

- *(see section 4 below)*
- Use of MDITR internal website database for data gathering
  - *(see section 4 below)*
- Recruitment strategies and results
  - (see section 1 above)
- Number of airline trips logged between partner institutions
  - 56 since Aug 1, 2003
- Number of academic departments joining in STC activities at lead partner universities (UW, GT, UA)
  - 13 in total (7 at UW; 3 at GT; 3 at UA)
- Nature and efficacy of internal review mechanisms
  - Research and education thrust leaders formally update the Management Team semi-annually. Meetings with the Strategic Advisory Board and Education Advisory Committee are held annually. New summary spreadsheets have been devised to increase awareness by the Management Team of past and current proposed, operating, and cost-share budgets. For our Seed Grant Program, new annual report and proposal requirements have been implemented and an evaluation form has been designed for rating prospective applicants. Based on this process, six STC seed grants will be awarded in year-3.
- Representation by STC in the greater research and education communities, locally, nationally, and internationally.
  - Owing to the far-reaching potential of MDITR research in commercial and defense applications, our STC has been extremely active in national and international research discussion and planning. For example, MDITR PIs have participated in DOE, DARPA, AFRL/AFOSR and numerous US Nanotechnology/IT/Microcircuit conferences, workshops, and advisory/review panels. In the past year, our PIs have traveled to China, the UK, France, Belgium, and Italy for international conferences and reviews. MDITR has met with numerous corporations, six of which have signed on as Industrial Affiliates and many others that are active research and knowledge transfer partners (see VIII.8). On the education front, MDITR hopes to achieve national impact via collaboration with the ANLO, Norfolk State University, and several other universities with diverse student populations. All these and other interactions are listed in chapter VIII and described more fully in chapters II, IV, and V. As a pioneer in interdisciplinary IT research MDITR is playing a major role in shaping new programs (including related Center proposals) to realize new technologies and educate our future workforce.
- Relationships with and impacts on our home institutions
  - In year-2, MDITR has continued to foster new opportunities and develop new resources at its home institutions. For example, MDITR has stimulated a campus-wide Photonics Initiative at the UW. 15 PIs met on April 7, 2004 to share their research interests and decide upon a quarterly meeting framework. Similarly, MDITR is rallying existing diversity resources at UW, UA, and GT to find areas of common ground (e.g. 22-member UW ad hoc diversity group convened in Mar-04; active collaboration established with FOCUS at GT). New faculty with STC interests have been appointed at the UW (e.g. Chen (Applied Physics Lab), Ginger (Chemistry) and Georgia Tech (e.g. Bunz (Chem), Graham (Mech. Eng), Brandt and Durgin (ECE)). MDITR has enabled UW's leveraging of $1.5M support from DARPA to expand laboratory space in the Chemistry Department and Bernard Kippelen has just opened a new 3,500 ft^2 lab facility at Georgia Tech. The Arizona Board of Regents funded an Improving Teacher Quality (ITQ) Grant (Talanquer, UA) helping to support our development of educational web-based modules for K-12.

3. MANAGEMENT PROBLEMS

As mentioned in part 1 of this chapter, institutional and personnel changes played an important role in our second year. Some of these were driven by necessity; others were conscious decisions to bring new skillsets into the Center. While some might perceive relocation and turnover as a negative, in our view, a healthy, year-old enterprise should welcome organizational and personnel changes as the outcome of an ongoing evaluation of strengths and weaknesses and a search for the right mix of personalities. Given the success of the changes made this past year, we expect the rate of personnel change to decrease markedly in year-3.

While the institutional diversity of MDITR is a major asset, it is also clearly a challenge insofar as communication and collaboration is concerned. Our seven partner universities host anywhere from one to fifteen PIs supported by STC funds (more if affiliates are included). We expect the number of partner institutions to grow as successful seed grant recipients are awarded formal subcontracts. MDITR spans three corners of the U.S. and four time zones. Thus, meetings are hindered by both geographic distance and time-of-day differences. Above all, PIs have a diversity of commitments beyond the STC; hence, it is a struggle to actively engage 100% of our membership. Measures to manage this dilemma are described below (section 4). MDITR Management is also prepared to rescind funding and/or membership in cases where participation and collaboration by PIs is consistently weak.

4. *MANAGEMENT AND COMMUNICATIONS SYSTEMS*

Beyond the telephone and e-mail, integration of our STC depends largely on three communications vehicles: (1) videoconferencing, (2) the MDITR internal website/database (http://convex.stc.arizona.edu/MembersOnly/index.cfm), and (3) face-to-face meetings.

Our Polycom videoconferencing tools were acquired in January of 2003. Units were quickly distributed to our partner institutions, but familiarization with the hardware took many months. In August, the various units located at UW, Arizona, Georgia Tech, and USC could still not reliably connect for more than 30 minutes and maintain video, audio, and computer data projection simultaneously. Problems were compounded by personnel change at UW, weak vendor technical support, and variable Ethernet network quality within UW's chemistry conference rooms. By winter 2003, we established stable operating protocols. Currently, we have regular biweekly videoconference meetings for the MDITR Management and Education Teams (spaced in alternate weeks). Special videoconference meetings are scheduled for thrust leader interactions, budget discussions, etc.

By investing substantial effort into our internal website capabilities during years-1 and 2, our hope has been that this resource will quickly blossom into a principal information conduit and binding force for our Center. The key here is to provide resources that provide members with an incentive to log on frequently. At present, all members can access a comprehensive member directory, Center templates (e.g. logo, letterhead, PowerPoint slides), and our newly launched "Responsible Conduct of Research" certification shortcourse (see section III.4 and Appendix E). A separate, secure, IAP website has also been implemented for the benefit for our industrial affiliates. The biggest dividends will pay out when Center participants become accustomed to routinely logging their activities into our extensive online database. By doing so, members will have instant knowledge of such things as submitted papers, conferences attended, invention disclosures, confidentiality agreements, and the whereabouts of graduated students. The scientific community-at-large will also benefit as our MDITR public website (http://stc-mditr.org/) selectively incorporates live data from the internal database. The MDITR public website has been substantially improved and relaunched as of April 28, 2004. The process of preparing this annual report has increased the level of activity logging into our database, but many PIs are simply too busy to deal with data entry (this problem will exist no matter how elegant the database design). Thus, we have worked closely with departmental administrators and students to capture this information. The MDITR internal website/database will be presented at the upcoming August STC Directors' Conference at Cornell University and strategies for sharing this resource will be discussed.

Face-to-face meetings are time consuming and expensive but for some purposes, there is no substitute. In year-2 of operations, MDITR participants logged over 50 airline trips between campuses for meetings and to conduct research activities. We have developed strategies to combine our most essential meetings for the sake of time and travel efficiency. For example, we combined our 2004 Annual Scientific Retreat with our first ever IAP Expo this past February. Two days were spent reviewing and planning our STC research program, after which key PIs, graduate students, and postdocs stayed an additional day to share talks and posters with enthusiastic representatives from our industrial affiliate companies. We managed to schedule these meetings around the 2004 AAAS annual meeting in Seattle over President's Day Weekend. The AAAS agenda included a special symposium entitled "21st Century Photonics" organized by our Executive Director, Alvin Kwiram. Seven MDITR PIs and one IAP member presented at this all-day session.

On the horizon, a second IAP EXPO is slated for the fall 2004 in Atlanta, Georgia, to be hosted by Georgia Tech. Our next annual retreat will combine education and research components to maximize participation and emphasize integration of these core activities (our year-2 education retreat was held separately September 2003). Georgia Tech will also host an educational workshop in Summer of 2005. Annual meetings with our Strategic Advisory Board and Educational Advisory Committee are planned for summer 2004. To help spread the word about our Center, we have printed our first brochure for distribution to all participants and interested parties (Appendix C).

5. INTERNAL AND EXTERNAL ADVISORS

STRATEGIC ADVISORY BOARD

	Name	Affiliation
1	Ray Baughman	University of Texas at Dallas
2	Neal Dempsey	Bay Partners
3	Christos Dimitrakopoulos	IBM
4	James Dye	Michigan State University
5	Susan Ermer	Lockheed Martin Advanced Technology Center
6	Stephen Forrest	Princeton Mat. Inst., Optoelect. Components
7	Petra Franklin	Vault Capital
8	Peter Gunther	ETH, Zurich
9	Waguih Ishak	Agilent Labs
10	Rick Lytel	Sun Microsystems, Inc.
	Name	Affiliation
11	Admiral William Owens	Teledesic, LLC
12	Rick Rashid	Microsoft
13	Elsa Reichmanis	Bell Laboratories, Lucent Technologies
14	James Rottsolk	Cray Inc.
15	Martin Smith	Preston Gates

16	Jonathan St. Clair	Boeing
17	**Edel Wasserman (Chair)**	DuPont

EDUCATIONAL ADVISORY COMMITTEE

	Name	Affiliation
1	Beatriz Cardelino	Spelman College
2	Sally Jackson	UA
3	**Alvin Kwiram (Chair)**	UW
4	Rhys Lawson	UW
5	Patricia MacGowan	WA State Math. Eng. Sci. Achievement
6	Judy Mansfield	Heritage College
7	Kenneth Marks	Tacoma Public Schools
8	Maresi Nerad	UW
9	Lynn Nixon	Agilent Technologies
10	Paul Ohme	CEISMC - Georgia Tech
11	Greg Phelan	Seattle Pacific U
12	Emile Pitre	UW
13	Philip Reid	UW
14	Martin Smith	Preston, Gates, Ellis LLP
15	David Szatmary	UW
16	Patricia Wasley	UW
17	Carin Weiss	Seattle Community College District

INDUSTRY AFFILIATES

	Name	Affiliation
1	Gregory Clark	Ford Motor Company
2	Ermer, Susan	Lockheed Martin Corporation
3	Brian King	Eastman Chemical Company
4	William P. Krug	Boeing Corporation
5	Michael Lee	Fujitsu Corporation
6	Ruth Ann Mullen	Battelle

6. CHANGES TO THE CENTER'S STRATEGIC PLAN

Over the past year an ad hoc working group appointed by the Director grappled with the task of revising the MDITR strategic plan. On the one hand, members of the Center felt that the goals they had set for the Center were very challenging and could have truly revolutionary impact. To be sure, others have suggested similar and maybe even more ambitious goals in the past. But it is one thing to set a goal, and quite another to have a reliable strategy for achieving it. Thus, one might say that "all cancer research is incremental" since the war on cancer was declared a quarter of a century ago and progress has been slow in achieving the goal of curing cancer. However, if a research team was to devise a creative strategy that would reduce cancer deaths for one particular type of cancer by 80% that would be considered dramatic. And if the technique used were applicable to a wider variety of cancers, then the approach would be considered revolutionary. The Center believes that we have a strategy for making a dramatic impact on the field of molecular photonics, electronics, and opto-electronics, and that the elements of that strategy were laid out in the original Strategic Plan.

Having said that, the Working Group also recognized, in agreement with the Site Visit Team's observation, that the way the vision and goals were presented in the Strategic Plan did not convey that message as succinctly and forcefully as it might have. Further, the document did not address the question of what the long term impact might be from the point of view of the public. To that end, we have tried to simplify the **statement** of the goals although their **essence** remains largely unchanged. We have also prepared and intend to add a supplement to the overall Strategic Plan that provides a better sense of where some of the initial applications might occur and how it would affect the consumer. While the overall structure and goals of the center remain largely the same, there have been some adjustments both in investigator support and in emphasis based on productivity as well as a better sense of what is feasible given the preliminary work that has been carried out.

A significant effort was made at the Scientific Retreat in February to ask every participant and particularly the Thrust Leaders to identify those "stretch goals" that we should aiming for, and to think in terms of visionary objectives that might realistically be achievable within the span of a decade. Although these conversations were fruitful, the team noted repeatedly that the goals outlined earlier were still very ambitious and by no means assured. Nevertheless, if they could be achieved they were convinced that the impact would be both widespread and profound. Thus, for example, the goal of achieving an r_{33} of order 1000 is considered by savvy observers as a truly heroic goal, but if achieved would have enormous impact in fields as diverse as telecommunications, transportation and homeland security. Likewise, developments outlined in light sources could ultimately lead to large area white light sources that could replace the traditional light bulb but do so much more as well. We consider that revolutionary, although the steps required to get there are indeed incremental. However, specifying those steps and demonstrating that they are both reasonable and within probable reach is necessary for those who are charged with the task of judging the merits of the proposal and work plan.

Appended below is the first cut of a revised Vision, Mission and Goals statement. This draft will require additional refinement within the Center and then further review and modification by the full Strategic Advisory Board. Although one can obtain some feedback from individual members of the SAB by email and phone calls, that mechanism is not as an productive as a brain-storming session involving face-to-face exchanges. We intend to to pursue such an exchange later this summer when we meet with our SAB.

DRAFT VISION & MISSION STATEMENT

Our Vision:
To advance the scientific understanding of engineered non-traditional (organic, hybrid, and nanostructured) materials for next generation information technology (IT) in order to make these materials practical for widespread usage in relevant photonic, electronic and opto-electronic devices, just as silicon is currently utilized for electronic signal processing. Our vision also includes training a workforce, with improved diversity, that is capable of effectively implementing next generation IT technology.

Our Mission:
To predict the signal processing properties of bulk non-traditional IT materials from basic molecular and structural information; to design and fabricate useful devices with novel electronic, photonic, and opto-electronic performance that can benefit virtually every sector of society; and to integrate the research and education missions so that the impact on society in terms of economic activity, workforce training, and development of human potential will be palpable and long-lasting.

Our Goals:

1. To understand, design and synthesize molecular systems and to learn how to incorporate them effectively into material structures in order to achieve unprecedented properties as required for next generation electro-optic devices. This will involve

a. dramatic improvement of molecular hyperpolarizability values via new chromophores in order to achieve a bulk non-linear coefficient, r_{33}, of 1000 or more, (i.e., approx. 300 times greater than current inorganic-based technologies allow) using standard host polymers and typical poling conditions

b. incorporation of these chromophores into novel dendrimer and self-assembled structures in order to approach the maximum value of the non-linear coefficient allowed by the intrinsic molecular properties of the chromophore, and

c. optimization of material properties so as to achieve reproducible devices with long-term stability in terms of optical flux and thermal as well as electronic cycling.

2. To develop an organic-based materials platform with improved charge transport, charge injection, light harvesting, and light-emission properties that will enable fabrication of low cost, large area, printable electronic circuits on plastic substrates for the processing, storage, and display of information. This will involve

a. development of new, more efficient photo-voltaic materials that will allow for the fabrication of large area, flexible, and cost-effective light harvesting devices for practical solar energy conversion

b. creation of photo-patternable organic light sources in order to achieve brilliant and inexpensive light-emitting displays as well as general lighting applications, and

c. advancement of our understanding of molecular electronics in order to achieve commercial viability through the development of practical organic field-effect transistors, memories, capacitors and photodiodes.

3. to develop new insights and strategies for creating and processing materials in order to make the fabrication of unique nano-engineered structures for a new generation of high-performance, low-cost, active photonic and electronic devices both feasible and routine. This will involve

a. 3D fabrication at the 50 nm level over cubic centimeter volumes including designed defect structures.

b. integration of electro-optic materials, χ^3, and amplifying polymers into micro-resonators and [active] photonic [crystals] devices, and

c. on-chip integration of organic photonic materials and devices with semiconductor devices to create entirely new classes of signal generation, processing, and detection capabilities.

All of these goals will be pursued in the context of educational programs designed to train the next generation of educators, industry employees, and entrepreneurs. Coordinated efforts will be made to actively encourage young people of all backgrounds

to choose science and engineering fields for their careers. By creating opportunities for life transforming experiences, by careful attention to mentoring our undergraduate and graduate students, and by ensuring adequate support both social, intellectual and financial, we seek to develop a more diverse and dynamic workforce in this field.

And just as the work on solid state physics at Bell Labs and the invention of the transistor did not mean that all further applications of that revolutionary technology were controlled, developed and manufactured by Bell Labs, so the dramatic advances in organic photonics already made by the Center and its investigators will not mean that all applications will be imagined and defined by the Center. But there is little doubt that a revolution has been launched and the Center will be at the heart of the coming transformations (our vision of a few such transformations is presented below). To that end a major part of the Center's activities also includes knowledge transfer that can stimulate the creation of new enterprises today so that the nation's economy of tomorrow will remain vibrant and competitive.

Expected High Level Technical Impacts:

- New optical materials and devices that enable high performance, low cost, manufacturable technologies that affect many sectors of society
- Integration of photonic and electronic technologies in computers (faster chips) and defense (e.g. replacement of strictly electronic technologies with hybrid photonic-electronic technologies in new generation aircraft)
- Distributed sensing devices with higher sensitivity, accuracy, and reliability for Homeland Security
- Higher performance, higher efficiency, more affordable optical networks (long haul)
- MDITR as the R&D partner of choice for industry on innovative materials and devices for information technology
- Materials and devices that enable fly and drive by light
- Technologies for increased safety on the roads: collision avoidance and seeing through fog
- Technologies for low cost modulation/demodulation components to put super high bandwidth in the home
- Improved technology for identifying individuals
- Distributed optical sensing of current and voltage for intelligent management of power grid
- Computer based screening of optical materials targets to reduce R&D costs for industry