



UNIVERSITY OF KENTUCKY

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SENATE COUNCIL

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November 27, 2006

Dr. Kumble Subbaswamy, Provost
University of Kentucky
Lexington, KY 40506

Dear Dr. Subbaswamy:

I am requesting your approval for the creation of a new research center in the College of Engineering entitled "Institute of Research for Technology Development" (IR4TD). The proposed institute is the outgrowth of more than a decade of industrial support for Dr. Kozo Saito and his research team in the area of coatings technology through the Painting Technology Consortium (PTC). The new Institute will facilitate expanded opportunities for faculty, research and technical support staff, and students beyond the fields of vehicle and coating equipment manufacturers, which have historically provided the bulk of the support for the PTC.

Total external support for the coatings technology initiative at UK since 1993 is expected to exceed \$7 million through the end of the current fiscal year. In addition, Toyota Engineering and Manufacturing Americas (TEMA) has just informed Dr. Saito that Toyota Motor Corporation has approved a gift in the amount of \$1 million, which will be matched with \$1 million from the Research Challenge Trust Fund, to provide a new endowment to underwrite the operational costs of the new institute. Further funding is likely from Toyota and members of its supplier network over the next few years.

I am attaching a document, originally developed by Drs. Saito and Grulke, in which the mission, objectives, and funding of the Institute are outlined in considerable detail. I am not requesting additional funding from the University to support the creation of the Institute. This proposal has been approved by the faculty in the College of Engineering. By copy of this letter, this proposal is being routed concurrently to Dr. Kaveh Tagavi, Senate Chair.

I trust that you will be supportive of this new initiative.

Sincerely,

Thomas W. Lester
Dean

Attachment

Cc Associate Vice President Staben
Dr. Grulke
Dr. Saito
✓ Dr. Tagavi

**ACADEMIC ORGANIZATION AND STRUCTURE COMMITTEE REVIEW
AND CONSULTATION SUMMARY SHEET**

Proposal Title: Proposal to Create Institute of Research for Technology Development

Name/email/phone for proposal contact: Kozo Saito, Ph.D., saito@engr.uky.edu; 257-6336 x80639

Instruction: To facilitate the processing of this proposal please identify the groups or individuals reviewing the proposal, identify a contact person for each entry, provide the consequences of the review (specifically, approval, rejection, no decision and vote outcome, if any) and please attach a copy of any report or memorandum developed with comments on this proposal.

Reviewed by: (Chairs, Directors, Faculty Groups, Faculty Councils, Committees, etc)	Contact person Name (phone/email)	Consequences of Review:	Date of Proposal Review	Review Summary Attached? (yes or no)
Mechanical Engineering Faculty	Dr. Keith Rouch, Chair Mechanical Engineering 257-6336 x80637 rouch@engr.uky.edu	Unanimous Vote to Approve	August 30, 2006 (department faculty meeting)	Yes (faculty meeting minutes)
College of Engineering Faculty	Dean Thomas Lester, Ph.D. College of Engineering 257-1687 lester@engr.uky.edu	Unanimous Vote to Approve	September 6, 2006 (full faculty meeting)	Yes (letter from Dean Lester)
Senate Committee on Academic Organization and Structure				

AGENDA
Faculty Meeting, Wednesday August 30, 2006
3:00-4:00 PM (Eastern Time) 2:00-3:00 (Central Time)
CRMS 309 ITV to Paducah

Call to Order

Approval of Minutes of Previous Meetings (circulated)

Chair's Report

Hiring Plans and advertisement (prior version attached)

Committee Reports & Proposals

Proposal (attached) for Institute of Research for Technology Development (IR4TD)
Committee of: Saito, Brock, Male, Seybert, and Tagavi

Unfinished Business

New Business

Adjournment

Tentative Dates for Future Meetings:

September 20

October 18

November 15

December 13

**Mechanical Engineering
Faculty Meeting Minutes
Wednesday, August 30, 2006**

Attendees: Rouch, Saito, Stephens, LeBeau, Male, Smith, Seigler, Tagavi, Seybert, Khraisheh, Badurdeen, Brock, Smith, Menguc, Baker, Murphy, Capece, Parker (by proxy), Prewitt, Fisher

Meeting called to order at 3:05 p.m.

Motion by Male, seconded by Tagavi, and passed unanimously to approve the meeting minutes of April 19, 2006.

Chair's Report: Welcome to new faculty in attendance, Michael Seigler. Charles Lu has also joined at Paducah.

Thanks to everyone's flexibility in course scheduling for this semester.

WKU/UK joint program faculty will meet on Friday, September 8th to discuss the committee operating rules and course rotation. Thanks to those teaching to WKU and to those on the joint program faculty for their participation in this program.

Proposal for Institute of Research for Technology Development (Saito): The concept for such an institute was presented to the ME faculty last academic year and was approved for further development. Committee members consist of Brock, Tagavi, Seybert, Male and Saito.

Motion made by Tagavi, seconded by Stephens, and passed unanimously to endorse the proposed Institute of Research for Technology Development (IR4TD). This proposal will be presented to the College next Wednesday, September 6th at 2:00.

Faculty Hiring (Rouch): The Dean has tentatively approved one faculty position to fill for Fall 2007. We need to determine our priorities to allow posting of position announcement. The schedule for interviewing needs to be moved up from last year to reduce difficulties in obtaining startup and funding.

Seybert: Why has the Dean only approved one position? We have larger course enrollments in undergraduate sections of required courses, and insufficient graduate courses.

Rouch: The Dean is aware of this and has indicated that ME (or possibly CE) would be the first department in the College to receive any new positions that come from the University.

Last year's search committees will meet and form a recommendation to be presented at the next meeting of the priority areas to be considered, and the search committee makeup based on those areas. Approved by general consensus.

Dr. Gao's status: The Dean has approved a one-year leave without pay extension for Dr. Gao. (E-mail information from Dean Lester was reviewed.)

Paducah Program (Murphy): Transfer student numbers have declined dramatically over the last few years due to the community college split from UK. We are looking at having Sarah Liu teach a distance learning statics course to Owensboro in order to create more interest in engineering in that area and generate future transfers to UK. Other recruitment efforts (college-wide) are in progress, including academic fair in mid-October.

Meeting adjourned at 4:05 p.m.

Circulated: August 31, 2006

Approved:

Proposal to Create the Institute of Research For Technology Development (IR4TD)

Presented to

Faculty of the College of Engineering
University of Kentucky
Lexington, KY 40506

By

IR4TD Committee (Brock, Male, Seybert, Tagavi, and Saito)
Department of Mechanical Engineering
University of Kentucky

Executive Summary

This proposal seeks to establish an Institute of Research for Technology Development (IR4TD) within the College of Engineering (CoE). Research for Technology Development (R4TD) means that research is directed to technology development as its goal. The R4TD is more often called as Research for Development (R4D); and in this proposal we use R4D and R4TD alternatively. R4D approach defines new relationships between a university's technical and academic leadership and an industry sector's need for new solutions. The proposed institute will address industry problems by conducting multi-disciplinary research, drawing on a wide array of technical and scientific fields. To accurately represent the multi-disciplinary aspects, we call this new organization an *institute* rather than a *center*.

The proposed institute builds on the work of Kozo Saito's team, which began in 1992 when Dr. Saito (a faculty member in mechanical engineering) initiated a productive industry-university partnership with Toyota. Support from Toyota has grown from \$50,000 per year to over \$500,000 per year, and clients have multiplied to more than a dozen, resulting in average annual funding over the past three years of approximately \$1.5M (see Attachment 1). His team's work has led to evolutionary and revolutionary changes in manufacturing industries, particularly in the areas of coatings and surface inspection processes, products, and engineering systems.

The expansion of Dr. Saito's team into an international institute has been carefully evaluated from the business side with the help of Ms. Granetta Blevins, a local consultant. Starting in the summer of 2004, the R4TD team worked with Ms. Blevins to plan new value-added services, expand its customer base, and to move into new manufacturing industry sectors. Discussions with current and potential clients showed that R4TD project support would increase significantly under the proposed international institute structure. The client list has already expanded beyond vehicle and coating equipment manufacturers to include carbon nanotube producers, steel and aluminum industries, and environmental pollution prevention and fire safety equipment companies. There is also a significant opportunity to move the R4TD team's coating and surface inspection technology into the marine and bridge coating industries.

The Commonwealth has already committed \$1.436 million for equipment; our client companies will donate plant-scale prototyping equipment valued at \$0.50 million and the University of Kentucky will cover fit-up costs of \$0.976 million. A multi-million dollar endowment from a major sponsor is also under discussion to establish a sustainable financial base for IR4TD.

The proposed IR4TD will create further spin-off technologies. An excellent example is the Vortecone (details in Attachment 5) which was developed to capture paint particles but can also be transformed to capture small particulates from coal-fired power plants. A small high technology business can spin-off from IR4TD sponsors to commercialize this new device.

INTRODUCTION

This proposal seeks to establish a new institute within the College of Engineering to be called the Institute of Research for Technology Development (IR4TD). A stepped-up version of the Painting Technology Consortium (PTC) established in the College in 1999, the new institute's purpose is to directly and effectively respond to ever-increasing requests from industry for immediate and long-term solutions to process problems and challenges.

The PTC needs to be stepped up because its client list is expanding beyond vehicle and coating equipment manufacturers to include carbon nanotube producers, steel and aluminum industries, and environmental pollution prevention and fire safety equipment companies (Attachment 1). Currently two research faculty, one research staff, and four post doctoral fellows work at PTC. The IR4TD will provide new and expanded opportunities for more faculty, research and technical support staff, and graduate students to participate (estimated growth is provided in Attachment 2).

The R4D team has a long history of industry-supported projects (Attachment 1). Figure 1 shows the twelve year funding profile for this team. The estimated funding for FY 05-06 is about half of the first year target of the Institute (\$877,000); it seems likely that the Institute funding can track the anticipated pattern for the first three years. Attachment 2 shows the expected funding and personnel profiles over a five year period. Total funding is expected to increase from \$1.6 million to \$3.2 million while total personnel associated with the Institute should increase from 17 to 47 researchers, creating opportunities for CoE faculty, staff members and graduate students to participate in multi-disciplinary research and technology development.

This expansion will support UK's strategic plan (Goal 6, Objective 3): "The University will accelerate industry-funded research and partnerships, technology transfer, and business development to advance Kentucky's economy...we must seize opportunities to develop further our intellectual property, corporate relationships, and business ventures, and we must enhance our efforts to fulfill the vision and promise of the Coldstream Research Campus." It will also support the College's strategic plan:

- 4.2 Enhance Research Infrastructure
 - S1. Actively pursue more support from the University for research equipment and start up funding for new research initiatives.
 - S2. Pursue funding and other donations from private and government agencies for research equipment and facilities.
- 4.3 Increase the Number of Research Personnel Appointments
 - S1. Increase the number of research personnel appointments in centers and departments

APPROACH

To stress the way research and development are integrated in our work, we call our approach R4D – research for development. R4D is a demand-pull rather than a supply-push approach. Rather than approach companies with our research interests, we respond to the needs of clients who approach us.

The potential danger in this approach is that we could be drawn away from important research to provide an endless series of quick fix solutions. The PTC team has not found that to be an actual danger. Instead, the approach has worked to help us build industry relationships that continue to grow and to offer us more challenging and complex problems. In addition, the approach provides an excellent education for our graduate students in tackling pressing industry problems, working as a team, accepting responsibility, coping with real budgets and real deadlines, communicating effectively with clients and understanding their point of view. Thirdly, a client may see a problem with the current process where we can see in fact that they have come to the limits of a current technology so that a new generation technology or even a radical new approach to the whole question is needed. In this situation, the “R” of our work is not simply paired with the “D” but tied directly to needed innovation.

Overall, this approach leads to:

- high probability of immediate in-plant benefit to the company,
- high likelihood that new technology needs will be accurately identified-- thus, new generation technologies that fit efficiently into the company's manufacturing systems, and the potential for discovering “quantum leap” (revolutionary) solutions that can be transferred to other industries,
- very high percentage of successful proposals (> 60%).

Two Kinds of Innovation in R4D: Incremental and Major

(1) In-plant improvements

The corporate client identifies manufacturing issues that have significant impact on its costs structure. The R4D team proposes concepts for in-plant improvements that could be integrated into the company's manufacturing systems, might be encoded in hardware or software products, and could meet improved efficiency and production targets while remaining within the cost basis of the plant. Because solutions need to be fitted into existing manufacturing systems, prototyping is essential. Project tasks may be completed within 3-12 months, depending on the urgency of the manufacturing issue. This part of our work is what the recent Department of Commerce report *Manufacturing in America* calls “incremental innovation.” Where the first kind of innovation is major and dramatic, this second type of innovation is “the steady improvement in products and manufacturing processes within major technology lifecycles. Such improvement involves many less dramatic improvements, but collectively these innovations have a significant effect.”

(2) New generation technology development

During the in-plant improvement phase, the team is able to identify quantum leaps in technology that are needed for greater gains in manufacturing efficiency, energy

reduction and reduced environmental impact (major innovations). Further work is directed toward developing and commercializing new generation technology opportunities. The Vortecone[®] technology for capturing particle emissions in spray painting is a prime example of the R4D project cycle, in which analysis of a problem led to the development of a patentable device which can be transferred to other applications outside its first intended use. The R4D team has been adept at identifying such technology transfer opportunities, ones that have resulted in many awards and contracts from new industry sectors. As another example, the team is now transferring "quantum leap" solutions for the surface inspection of vehicle coatings to the marine coating and bridge coating industries, for which significant cost and environmental savings are expected.

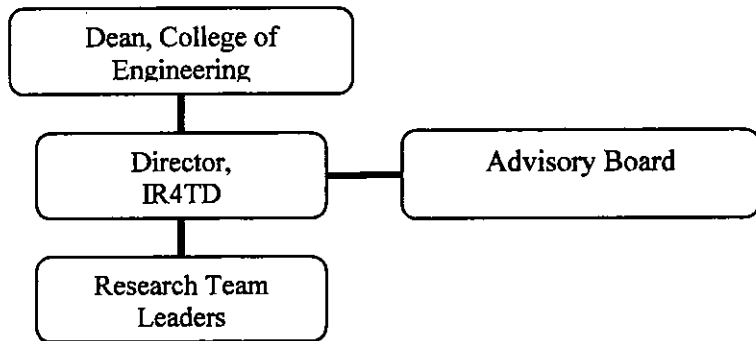
Opportunity for Start Ups

IR4TD activities will create new technologies, some of which will be commercialized by starting small high technology businesses, licensing technology to IR4TD industrial collaborators, spin-offs from IR4TD sponsors, and technology transfer to companies that are not sponsors of IR4TD projects. The preferred route will depend on the technology, the potential markets and selecting commercialization methods that have a high probability of success. Private industry will benefit from in-plant improvements in their existing operations, licensing agreements, workforce cost savings due to trained graduates hired, start-up company revenues, and knowledge spillover into other products or processes. Recently a spin-off company, Vortecone Inc., was formed in order to commercialize the Vortecone technology, originally invented to capture over-spray paint particles and now capable of being modified to capture ash released from coal-fired power plants. Attachment 5 provides background on Vortecone applications.

ADMINISTRATIVE STRUCTURE

The proposed institute will be administered by a director who will report to the Dean of the College of Engineering. An advisory board will be formed and Director of IR4TD will appoint board members. Initially there are three different appointments: one year, two year and three year appointment. After this first phase, each board member can be appointed up to three terms (the initial appointment plus two three-year-term appointment). The advisory board will meet regularly to review the Institute's progress and advise on future direction.

IR4TD will operate as a membership organization. Companies who seek assistance from IR4TD will be required to become members (structure is detailed in Attachment 4).



Organizational chart for proposed Institute of Research for Technology Development.

LOCATION & NEW LABORATORIES

The College of Engineering at the University of Kentucky does not have research space suitable for large scale equipment. Fortunately, the University has agreed to locate IR4TD at the Coldstream Research Campus. The cost estimate for converting 10,000 square feet of floor space to accept the prototyping equipment, purchasing scale-up equipment, and installing it is \$2,412,000. The state is providing \$1,436,000, the University of Kentucky will provide \$975,600 in fit-up costs, and IR4TD's industrial sponsors will donate at least \$500,000 in equipment. Coldstream Research Campus space will facilitate the rapid growth of the institute, can be occupied immediately, provides the kind of flexible space needed for state-of-the-art work, and is a cost-effective solution for prototyping facilities. Coldstream Research Campus can also house spin-off companies created by successful research projects.

The laboratories will make the institute unique in the U.S.: prototyping facilities open for funded projects, all installed at one location. Seven laboratories are initially planned for the facility (Attachment 3):

- The Laser Diagnostics Laboratory
- The Paint Inspection Laboratory
- Wet Spray Paint Laboratory
- Prototype Testing Facility for Automobile Surface Coating and Other Applications
- Computational Fluid Dynamics Simulation Laboratory
- Conceptual Design Laboratory
- Nanomaterial Synthesis Laboratory

The IR4TD team anticipates significant equipment contributions from its industrial partners, including the donation of industrial scale sprayers, paint booths, and other large scale equipment. These donations are predicated on building fit-up to accommodate their utility requirements and installation fixturing. The priority order for developing these

laboratories is based directly on the research project needs of IR4TD customers. While some of the industrial sponsors have elements of these labs, no sponsor has all of the facilities, nor would they be willing to share what they do have with competitors. These unique labs will ensure that project sponsors will want work done in Kentucky.

ANTICIPATED FUNDING

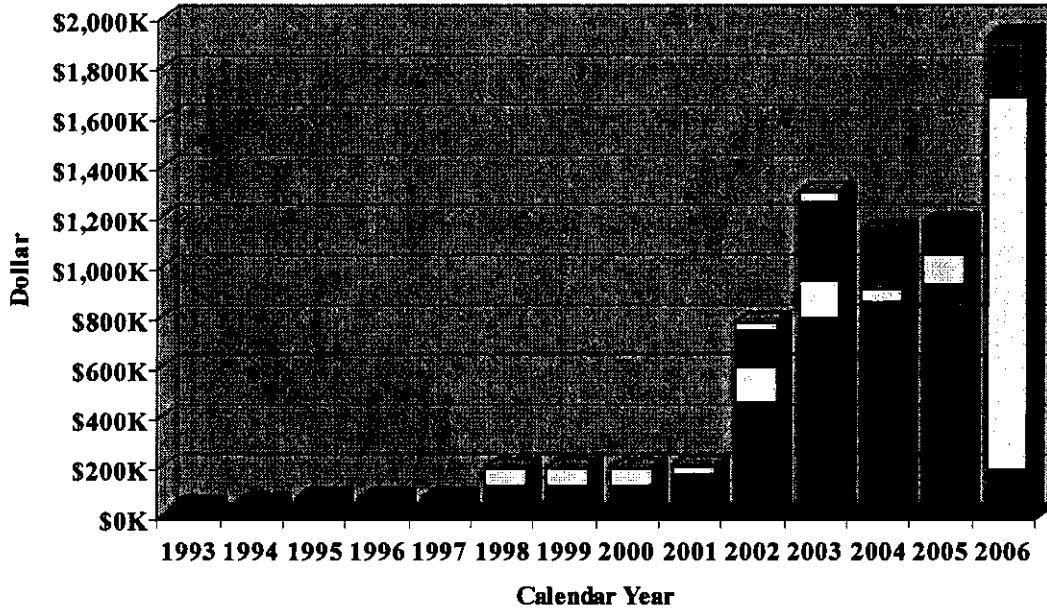
The new institute is estimated to be able to generate over \$11.7 million in sponsored research over the first five years. In this way the institute becomes important to Kentucky's economic development. IR4TD can be part of Kentucky's strategy for capturing an increased share of international automotive R&D investment, establishing an international incubator for new automotive collaborative partnerships in Kentucky through state-of-the-art technology and corporate diplomacy, and creating mechanisms to more rapidly connect innovative intellectual property with the vehicle market place.

It is important to note that IR4TD will continue to perform basic research which has no immediate applications, but which underpins the R4D projects which do have specific immediate goals and purposes. Basic research is like the root of a tree and R4D projects are the branches, bearing the fruits of our work: solutions to industry problems and new technologies. For the R4D tree to grow healthy and every year bear much fruit, its roots should expand constantly and stay strong so that enough nutrient can be absorbed and brought up through the trunk and branches.¹

¹ For further information about the dual role of R4D and basic research, see K. Saito, Lecture Note on Development of Research Partnership between University and Industry, Hanoi University of Technology and Toyota Motor Vietnam, Hanoi, Vietnam, October 2005.

Attachment 1: Team Funding History

Figure 1: Team Funding History 1993 to June 2006
 (Funding does not include the forecast for second half of 2006)

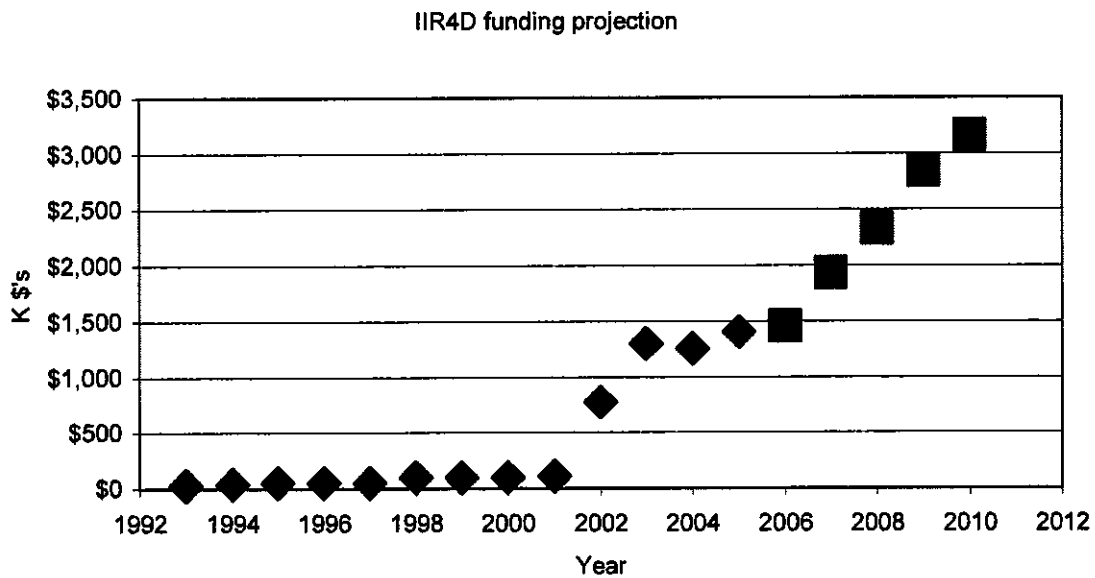
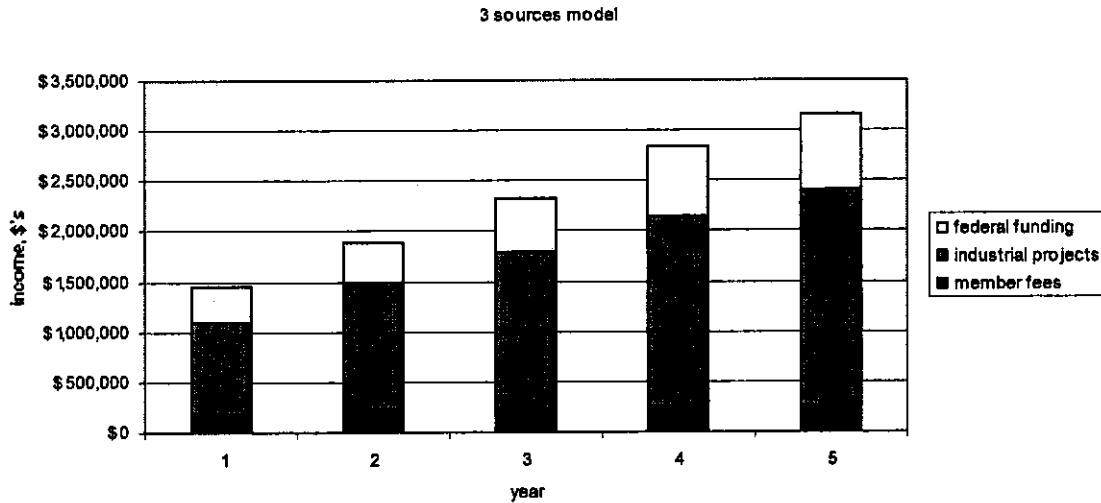


■ Toyota*	■ Admatechs	■ Angell	□ CMC+	□ DCI**	■ Honda
■ KOEP++	■ KSTC	■ KY EPSCoR	□ Mitsui	■ NASA	■ Nippon Steel
■ Nissan	■ NSTC-Navy	■ ORNL***	■ Prime Finish	□ Trinity	

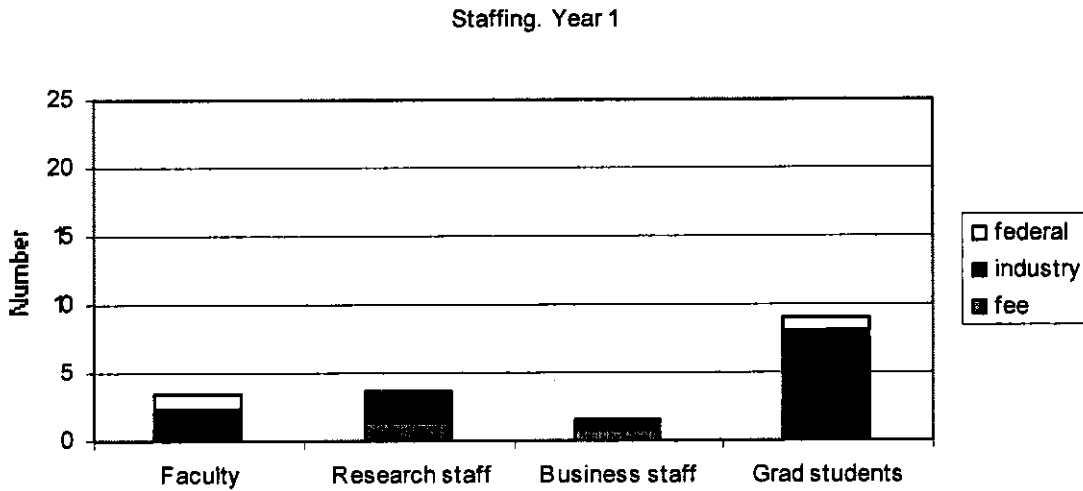
*Toyota includes: Georgetown-KY, North America Erlanger-KY, Toyota-Japan
 +CMC: Central Motor Wheel of America Paris-KY
 **DCI: Kentucky State Department of Commercialization and Innovation Program
 ++KOEP: Kentucky Office of Energy Policy
 ***ORNL: Oakridge National Laboratory

Attachment 2: IR4TD Projected Growth

There are three funding sources for the growth of the Institute. The following figure shows the estimated income for the first five years of IR4TD from member fees, industrial sponsored research projects, and federal awards. In contrast to many other university/industry research centers, industry research projects will be the primary funding source. Over two-thirds of the current funding of the team is from industrial sponsors, a consequence of the team's methods for research project marketing and development. The next figure shows the funding projection attached to the funding history.

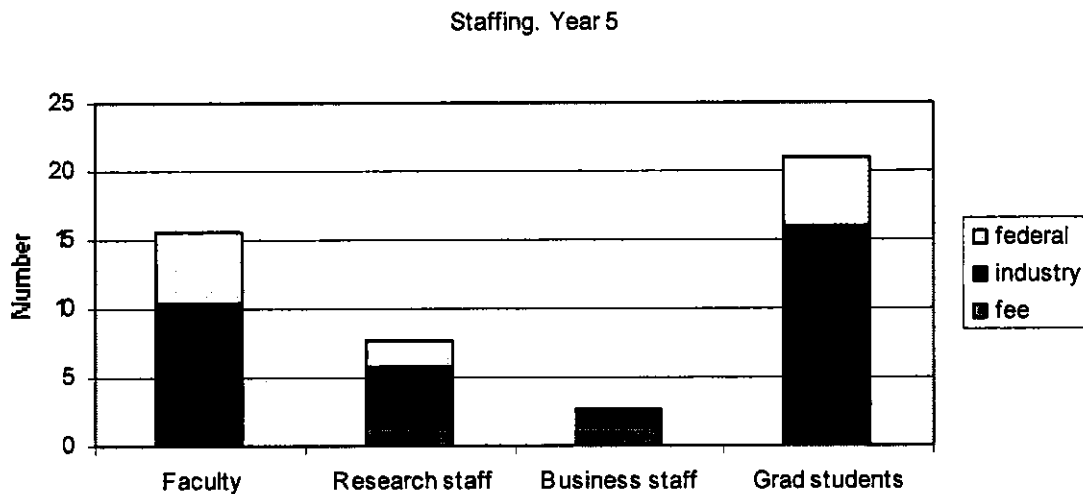


Institute staffing projected over a five year period is illustrated in the following figure.



The staffing objectives are to 1) bring existing College of Engineering faculty, and new faculty, into the Institute's research mission to expand IR4TD's scope of work and capabilities, 2) expand the research staff and provide them with bridge funding between industrial research projects, 3) add business and marketing staff to provide the rapid accounting response required in a commercial environment, and 4) enlarge the graduate student pool available for projects.

The following figure shows projected staffing levels in the fifth year of the Institute. Faculty involved in Institute projects have increased from 3 to 16 (most of these will have other research outside of IR4TD), research staff are increased from 4 to 7, the business staff is 3 and the graduate students have increased from 9 to 21. Only the director, the research staff, and the business staff salaries are "back-stopped" by bridge funding (via the fee structure and other sources). The remaining personnel are supported on industrial and federal research grants.



Attachment 3: Facility Support

The key research need is for prototype equipment near or at the manufacturing process scale. This will allow testing of new equipment, new manufacturing processes, and new technologies before they are handed over to production. Because of the general downsizing of industrial research, this "link," an element useful to nearly all of IR4TD's customers, is not generally available.

The Coldstream Research Campus has significant benefits for this project. Because preliminary design work on prototyping equipment has been completed, some IR4TD work can start as soon as prototype laboratories are constructed. Mechanical infrastructure is in place to accommodate laboratory development. Common area conference rooms, and training facilities not generally available in other facilities will be used for meetings and visiting scientists. The University of Kentucky's telecommunications in the facility will allow seamless connectivity for data needs, including access to UK Library services.

Coldstream Research Campus – prototype equipment (\$1,436,000)

A 10,000 square foot laboratory will be equipped with prototyping equipment for coating technology, laser diagnostics for coating inspection and scale modeling.

The prototyping laboratory will have an environmental control system that would be configured, depending on the requirements of IR4TD funded projects, to serve as a high-end paint spray booth for automotive and marine coating application or as a controlled testing area for large-scale models, e.g., Vortecone prototype for power plants (Attachment 5). Automotive coating systems account for 50% of the energy used in manufacturing as well as much of the plant-based volatile losses and solid waste generation. Energy used for ship and marine coatings may account for as much as 25% of their total manufacturing costs. Sustainable coating systems for large scale engineering structures require more energy efficient and environmental friendly application processes, coating defect identification methods, coating removal and repair techniques and *in situ* flaw detection methods. Efficient development of sustainable coating solutions will require a multidisciplinary approach that integrates material, modeling and equipment issues in an institute that combines the expertise and on-the-job application of industry with a team combining experienced and new young researchers, scientists, engineers, and students.

The remodeled area will also house laboratories that will operate at the industrial scale. These laboratories will serve as research areas for Laser Diagnostics, Surface Inspection, Scale Modeling, and Computational Fluid Dynamics Simulation. At a later date two other laboratories currently housed in the College of Engineering Campus site will be moved to the Coldstream Research Campus site.

Attachment 4: Member Benefits

Business

IR4TD membership will include the Commonwealth of Kentucky, industries, other institutions of higher education, and, as appropriate, local governmental agencies, and regional and local economic development organizations. The IR4TD will actively recruit previous, current, and new research sponsors as well as other agencies/organizations to IR4TD membership. A membership fee structure is required in order for the IR4TD to apply for certain federal grants, including Industrial/University Cooperative Research Centers (NSF). Industrial member fees may be used for the recruitment of new full members, marketing and educational activities of IR4TD, and administrative support of IR4TD. Annual Membership fee for the first 5 years shall be as follows: Founder - \$25,000/year, Partner - \$10,000/year, Supporter - \$5,000/year, and Affiliate - \$1,000/year. Industry members will also be encouraged to finance IR4TD research projects, collaborate directly with IR4TD researchers, and recruit new industrial members. Corporate members can expect:

- **Research** by a world-class research team with novel technology, prototyping facilities, high performance computing, an accomplished technical staff, and UK technical testing facilities;
- **Collaboration** on joint projects that reduce research costs for common problems;
- **A portal** to unconventional, creative thinking;
- **Shorter time cycles** for solutions to industry problems;
- **Leveraged support** of seed projects to identify revolutionary new technology;
- **Regular research communications** with student, staff and faculty;
- **A stable IR4TD research team.**

Potential IR4TD business members include, but are not limited to, the following: Toyota (TMC, TMMK, TEMA), Nissan, Honda, Ford, DaimlerChrysler, Sherwin Williams, Mitsui Trading Corp., Admatechs, Asahi Sunac, Nippon Steel, IBM, Durr, Dana, Central Motor Wheel of America, Fanuc, Keyence, Toyota supply-chain partners, and other-supply-chain partners.

Commonwealth of Kentucky

The Commonwealth shall be an ex-officio member of the IR4TD with full membership privileges to include attending IR4TD membership meetings and shall be a fully pre-paid attendee of any IR4TD workshops or training seminars. IR4TD agrees to send the Commonwealth (1) an annual technical report indicating the sponsor, project title, a generalized statement of work and generalized results to-date; (2) an annual report listing all companies requesting IR4TD services, (3) an annual list of membership and research sponsors; (4) notification of all IR4TD member meetings and IR4TD workshops and training seminars; (5) an annual Intellectual Property report; and (6) when expended, a quarterly financial status report describing the use of Commonwealth funds.

IR4TD agrees that the University of Kentucky Research Foundation shall provide a financial report (required only when funds are expended) on a quarterly basis to the Commonwealth. If the IR4TD Director, Professor Kozo Saito, leaves the University of Kentucky, the Commonwealth shall be immediately notified.

Attachment 5: Vortecone for Emission Control

Problem & Opportunity

720 coal-fired power plants in the U.S. emit 76 million tons per year of fly-ash. The EPA is currently mandating reduction of particulate emissions by coal-fired power plants with a new focus on small particles less than 2.5 μm in diameter. There is no current technology to effectively capture the small particulate and mercury emissions from coal-fired power plants. In addition, there are other particle losses at coal solids transfer points in power plant conveying equipment. These losses are also difficult to control and remediate.

Special Kentucky Concern

These issues affect both Kentucky's coal industry as well as Kentucky power plants that use coal. New green technology to recover small particulates and to remediate particulate losses at transfer points would help make the continued use of coal in power plants a viable option both economically and environmentally.

Costs and Results: Current and Project

Currently, Kentucky coal-fired power plants use electrostatic precipitators to recover fly ash particles from coal combustion gases. The installed cost of these precipitators varies, depending on the fraction of fly ash removed, as dictated by environmental regulations when the plant was granted a permit. Typical costs of this technology, based on units (about 500 MW each) now in service in Kentucky, are given below. Note that as particulate recovery approaches 100%, cost increases exponentially.

Permit date (commissioning)	Particulate Recovery, %	Technology cost, \$'s/MW
1973	98.5	\$ 5,600
1977	99	\$ 19,100
1981	99.5	\$ 39,700

Special Kentucky Opportunity

New green technology that could either reduce the recovery cost, improve the percent recovered, or both, would improve the market position of coal as a boiler fuel and also help Kentucky's coal-fired utilities update their facilities. A Kentucky-based company that develops, manufactures and services new green technologies for coal-fired power plants would help enable continued use of coal for power generation while boosting the Commonwealth's image as producers of innovative and socially beneficial technology.

Proposed Solution: Modify the Vortecone for Fly-ash Capture and Coal Dust Recovery

The Vortecone, invented jointly by Dr. Kozo Saito's UK research team and Toyota engineers, captures small (sub-micron) particles of over-sprayed paint using special vortex chambers. Toyota in-plant tests proved the Vortecone to be highly effective both in capturing paint particles and in reducing energy costs. This patented device is now a developed and fully commercial technology, currently in use in seven Toyota assembly plants both in Japan and in the US.

Cost Savings Through Vortecone Adaptation for Fly Ash —Roughly 33%

The inventors are confident that the Vortecone can be adapted to effectively and economically capture small airborne particulates like fly-ash and sub-micron particulate matter. The equipment cost (installed) of the adapted Vortecone would be \$12,500 per MW, roughly one-third less than the conventional electrostatic precipitator system (as shown above).

The cost estimate for a 500 MW power unit is based on actual cost data for existing Vortecones with the addition of scale-up of Vortecone capacity by a factor of 20, capture efficiency at greater than 99.5%, capture of particles below a specific gravity of 1 (silica-rich centosphere fly ash) and above a specific gravity of 1 (heavier particulates) and fabrication with Hastelloy C to handle abrasive fly ash.

Capture of Coal Dust at Transfer Points

The Vortecone could also be adapted to recovery of fugitive coal dust at solids conveying transfer points. This modification is less extensive and less challenging; it could be done using Vortecones similar in capacity to those already in use industrially, without changing their fabrication materials.

Vortecone Research, Time Line, and Major Obstacle

(a) Research

Estimates are based on the fact that development of the original Vortecone for paint droplet capture required scale-up by a factor of 10 and use of Vortecone technology to treat hot side exhaust gas from a coal-fired boiler would require a further scale-up factor of 20. Prior scale-up research would be used for small-scale tests of a modified Vortecone design; creation and testing of a larger-scale prototype would follow. The new Vortecone technology would then be installed in new coal-fired utilities.

(b) Time Line

The first year's work would involve data collection, analysis, design and building of the prototype. The second year would be devoted to testing, design refinement, field-testing of a working version and implementation of a fully functional commercial model.

(c) Major Obstacle – Prototype Facility Lacking

However, a major obstacle to successful progress exists--there is no available UK facility usable for full-scale prototyping. Dr. Saito's team has been exploring the creation of such a facility at the UK Coldstream Research Campus, to test this and other innovative technologies now in progress. Coldstream's director estimates the cost of such a facility at \$2.5M. IR4TD will attract industrial collaborators to help identify and refine the design constraints and requirements, among them a utility that would be first to adopt the technology in a new coal-fire plant. Time is an important concern, as the EPA will promulgate new regulations shortly which would be applied to any new construction.



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PROVOST BUDGET OFFICE

January 9, 2007

Kaveh Tagavi, Chair
University Senate Council
201 Main Building
CAMPUS 0032

Dear Dr. Tagavi:

I am writing, on behalf of the Provost, concerning the feasibility of establishing a research center in the College of Engineering entitled "institute of Research for Technology Development" (IR4TD). The proposed institute is the outgrowth of more than a decade of industrial support for Dr. Koso Saito and his research team in the area of coatings technology through the Painting Technology Consortium (PTC). The new Institute will facilitate expanded opportunities for faculty, research and technical support staff, and students beyond the fields of vehicle and coating equipment manufacturers, which have historically provided the bulk of the support for the PTC.

Total external support for the coatings technology initiative at U.K. from 1993 through the end of the current fiscal year is expected to exceed \$7 million. In addition, Toyota Engineering and Manufacturing Americas (TEMA) has just informed us that Toyota Motor Corporation has approved a gift in the amount of \$1 million that will be matched with \$1 million from the Research Challenge Trust Fund. These funds, as well as probable additional funds from Toyota and members of its supplier network over the next few years, will provide endowment earnings necessary to fund the operational costs of the new institute. No additional funding from within the University will be required for support of this Institute.

This program has sufficient resources to ensure faculty and student success. I am certifying this program as administratively feasible.

Sincerely,

Karen T. Combs
Vice Provost for Budget and Administrative Services

Cc: Kumble Subbaswamy
Heidi Anderson
Jeannine Blackwell
Connie Ray
Phil Kraemer

Provost Budget Office
355 Patterson Office Tower • Lexington, Kentucky 40506-0025
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Brothers, Sheila C

From: Melissa C. Newman [mnewman@uky.edu]
Sent: Thursday, April 19, 2007 10:43 AM
To: Brothers, Sheila C
Subject: Re: RE: College of Engineering: Institute of Research for Technology Development (IR4TD).

Sheila

All members who have voted are in support of this proposal.

M

-----Original Message-----

From: "Brothers, Sheila C" <sckinn1@email.uky.edu>
To: "Newman, Melissa" <mnewman@uky.edu>
Date: Thu, 19 Apr 2007 10:37:45 -0400
Subject: RE: College of Engineering: Institute of Research for Technology Development (IR4TD).

Just checking on this - I'll need word from you by Monday if this is to be approved by the Senate this semester. :-)

Sheila

Office of the Senate Council

Phone: (859) 257-5872

Fax: (859) 257-8375

From: Melissa Newman [mailto:mnewman@uky.edu]
Sent: Monday, April 02, 2007 3:59 PM
To: Hertog, Brittney; Frost, Chris; Moliterno, David J; fox@uky.edu; Hertog, James K; Yates, J W; Newman, Melissa; Houtz, Robert L; Brothers, Sheila C; Jasper, Samuel J; Garrity, Thomas F
Subject: College of Engineering: Institute of Research for Technology Development (IR4TD).

Hey Folks!

I have not had anyone ask for a face to face meeting on this proposal so I am sending out the "Official" e-mail Ballot on the development of the College of Engineering: Institute of Research for Technology Development (IR4TD). Please respond by April 17, 2007.

Thanks

Melissa

Approve _____
Disapprove _____
Abstain _____