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Review of medical imaging devices for the integration of medical technology and earmold production and grant proposal development

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REVIEW OF MEDICAL IMAGING DEVICES FOR THE
INTEGRATION OF MEDICAL TECHNOLOGY AND
EARMOLD PRODUCTION AND GRANT
PROPOSAL DEVELOPMENT

by

Michelle L. Saltarrelli, B.A., M.S., CCC-SLP

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Audiology

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We hereby recommend that the dissertation prepared under our supervision by Michelle L. Saltarrelli, B.A., M.S., CCC-SLP

entitled REVIEW OF MEDICAL IMAGING DEVICES FOR THE INTEGRATION OF MEDICAL TECHNOLOGY AND EARMOLD PRODUCTION AND GRANT PROPOSAL

be accepted in partial fulfillment of the requirements for the Degree of Doctor of Audiology

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ABSTRACT

The first purpose of this study was to assess the feasibility of a medical device to replace the current method of earmold production. The medical device would be used to scan the external ear (i.e., external auditory canal and pinna), scan the dimensions to an imaging software system, and finally send the three-dimensional image electronically to a milling machine for the production of earmolds and hearing aid shells. Currently, audiologists use an eight step process described by Dillon (2001) which due to the invasive nature of the procedure presents potential complications to both the clinician and client. The potential complications discussed are infection control, liability risks for audiologists, and bodily harm of clients. In addition, the current method presents much variability of the earmold or hearing aid shell fit causing a high return rate from clients and potentially poor quality control. The methodology of reverse engineering implemented in abrasive computer tomography imaging was hypothesized to be the most feasible method to eliminate or reduce the risks associated with earmold impressions. An image of the external ear would be captured via an infrared camera then sent to a computer with compatible imaging software. An infrared camera with crystal clear display (CCD) and Materialise' Rapid Shell Modeling (RSM) software were identified to be the necessary equipment.

The second purpose of this study was to determine an appropriate request for proposal for continued audiological research of the determined medical device. The Research Competitiveness and Industrial Ties Research Subprograms of the Board of Regents Support Fund Research and Development Program was the request for proposal selected. This type of grant, if awarded, provides a greater potential for studies

to be awarded at the federal level. The Research Competitiveness Subprogram Proposal awards research that is innovative and conducted within a university which is a member of the Louisiana Association of Independent Colleges and Universities. This study meets the criteria delineated by the Louisiana Board of Regents.

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Author Michael J. Houck
Date 5/17/08

DEDICATION

For my husband, Jerome Saltarrelli, Jr., who continues to be my inspiration and “giving tree”.

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CHAPTER 1

INTRODUCTION

This dissertation will assess the feasibility of a medical device to replace the current method of earmold impression. Earmolds and earmold impression production have been available to audiologists and hearing aid dispensers since the 1920s (Microsonic, 1998). The materials (i.e., powder and liquid solutions versus silicone materials) have evolved with time; however, the method of production has undergone little change [e.g., open jaw method versus closed jaw; manual manipulation of the pinna (hold the pinna up and back)]. Dillon (2001) has provided a detailed explanation of the current earmold impression method.

The current earmold impression method defined by Dillon (2001) involves eight steps taking approximately 15 minutes for completion. However, a number of concerns exist with the current method. According to Pirzanski and Berge (2002), the current method and quality of earmold impression production has been significantly varied among audiologists resulting in poor fits and a 50% return rate for hearing aid shell remakes. A second issue with current earmold techniques is infection control. Devising an innovative, less invasive technique to obtain measurements for hearing aid shell production would significantly diminish the risk of infectious disease transmission. A third issue with current earmold impressions is the liability associated with this procedure. In a technical report submitted by the American Speech, Language, and

Hearing Association in 1994 reviewed professional liability and risk management in the profession of Audiology. The findings indicated that hearing aids including the earmold impression production were the second highest cause for malpractice claims with the highest claim being improper procedure treatment. This report supports the need for a noninvasive, innovative technique to obtain appropriate measurements for hearing aid shell productions.

REVIEW OF LITERATURE

Microsonic (1998) reported that good earmold impression techniques are paramount for practicing audiologists. The main objective when taking earmold impressions is to obtain a static pressure seal between the hearing aid earmold and the external auditory meatus, thus eliminating acoustic leaks. Macrae (1990) defined an acoustic leak as a pathway between the ear canal and hearing aid earmold where amplified sound escapes. If a static seal is not obtained, feedback and reduced amplification would result thereby reducing the sound quality provided by the hearing aid. The production of an accurate earmold impression depends on the audiologists' techniques, materials used, and the manufactures' production methods.

As stated previously, the current earmold impression method defined by Dillon (2001) involves eight steps taking approximately 15 minutes for completion. First, the audiologist inspects the pinna and ear canal using an otoscope. A clean, clear pinna and ear canal with little to no wax are optimal for earmold impression production. Second, the audiologist inserts a canal block using an otolight. The canal block is a small piece of cotton, wool, or foam which prevents the impression material from adhering to the tympanic membrane (i.e., eardrum). Third, the audiologist mixes the impression

material using a clean surface or disposable pad and spatula. The impression material may be a mixture of powder acrylic and liquid or paste.

Fourth, using a syringe the audiologist injects the impression material in the ear canal, and concha and helix of the pinna in one continuous motion. Beginning with the ear canal the audiologist pulls the pinna up and back for a deeper syringe insertion. Once the concha is filled and the impression material is slightly overflowing, syringing is complete. The fifth step requires a 7-10 minute wait until the material is dry. This wait time varies depending on the level of humidity. Sixth, the audiologist removes the hardened impression material. The patient is instructed to open and close her jaw several times as the audiologist pulls the patient's pinna in several directions to break the bond between the impression and skin.

Seventh, using the otoscope the audiologist inspects the ear. This step ensures that no material is left behind and the skin remains intact. Eighth, the audiologist completes a visual and tactile inspection of the impression to ensure impression quality. Upon completion, the appropriate infection control methods (e.g., autoclave) are employed for sterilization of the instruments. This current method of earmold impression is not only used by hearing aid companies to produce custom hearing aids but also by manufacturers for non-acoustic purposes (e.g., swimmers' plugs and hearing protection).

Dillon (2001) described a hearing aid as a miniature public address system consisting of a microphone, receiver, and battery. The microphone converts the acoustical energy of sound into an electrical signal then on to the amplifier to be converted back in to acoustic energy (Dillon, 2001). According to Dillon (2001), the

amplifier “increases the strength of the electrical signal before sending the signal to the receiver where the electrical signal becomes acoustical energy” (p.10). The battery provides the energy needed by the amplifier for proper functioning. The earmold impression worn by an individual provides the vital link in securing or coupling the hearing aid to the ear. Improper impressions may result in the reduction of benefits from the hearing aid. An incomplete impression will result in a poorly fitted hearing aid resulting in discomfort and loss of acoustical abilities (e.g., reduced sound quality).

In addition to hearing aid consumers, the current earmold impression method is used for other individuals seeking earmolds for various reasons. Martin (2005) delineated custom earmold products (e.g., swim molds and musicians’ plugs) which require non-hearing aid consumers to undergo the current earmold impression method. Martin also reported that earmold labs produce custom earmolds for newscasters’ and airline pilots’ earpieces. Custom earplugs are produced to attenuate sounds for hunters, musicians, employees exposed to hazardous noise, motorcyclists, and those who suffer from snoring spouses (Martin, 2005). In addition to attenuating sounds, custom earplugs prevent the induction of water into the outer and middle ear for medically fragile ears (e.g., tympanic membranes with surgically implanted pressure equalizing tubes which expose the middle ear to air and water).

As demonstrated by Martin (2005), the current earmold impression method is performed for an array of consumers including non-hearing aid consumers and hearing aid consumers. Studies have been conducted to determine the most appropriate earmold impression method and impression material to assist hearing aid consumers reach optimal benefits from their hearing aids.

Pirzanski and Berge (2002) gathered information regarding earmold technology via telephone interviews with earmold laboratories and hearing aid manufacturers. Interviews were conducted by 56 international doctoral students. Answers sought by Pirzanski and Berge included best impression materials (i.e., silicone or liquid and powder material), best impression viscosity (i.e., low, medium, or high), and client jaw movements while taking impressions. The information was provided by audiologists and laboratory representatives and based on the professionals' experience and in-house research data. Pirzanski and Berge found that silicone, due to its high viscosity yielded the best results for impression material. The researchers concluded that higher material viscosity causes stretching of the ear canal allowing for a tighter seal between the earmold and ear canal resulting in less feedback.

Pirzanski and Berge found that taking impressions while the client's jaw was open can also improve the odds of a secure earmold fit thus reducing feedback. The authors discovered that some audiologists employ the open jaw method and higher viscosity silicon due to the benefits received from that specific method. However, Pirzanski and Berge discovered that a secure fit is not only dependent on the earmold impression method employed by the audiologist, but also the manufacturer's method of production.

These researchers found that there were fitting variances of the hearing aid or earmold resulting in poor acoustical seals and reduced sound quality produced at different labs when provided with identical earmold impressions. Also, skills varied among audiologists, hearing aid dispensers, and earmold manufactures. For example, a perfect ear impression may be obtained by the audiologist; however, hearing aid

manufacturer one may not be able to reproduce an exact match like hearing aid manufacturer two. Pirzanski and Berge (2002) reported that these variances between manufactures could be minimized with an earmold impression scanning device. Until such a device becomes commercially available an accurate earmold impression is paramount for the hearing aid and/or custom earmold consumers.

Macrae (1990) conducted four experiments to determine the effects of earmold impression materials (e.g., silicon vs. acrylic), the practice of using one impression for multiple hearing aid earmold productions, the earmold-maker buildup of impressions, and the buildup of the impressions by the impression producer on static pressure seal of earmolds. The researcher stressed the importance of earmold impression production. First, Macrae selected 16 subjects to assess the seal of four types of commercial earmold impression material: silicone, acrylic, Polyplus, and Microlite. Results indicated that the presence or absence of the hearing aid earmold seal was independent of the type of material used for earmold impression. However, the one come factor found amongst all earmold materials was the longer the canal portion, the increased the probability for a static seal.

In the second experiment Macrae used one impression from each of the 16 subjects, he discovered that making multiple hearing aid earmolds from a single impression degraded the possibility for a static seal. Therefore, the study suggested that with the current earmold impression procedure, a new impression should be taken for every hearing aid or custom earmold order for the same consumer.

Macrae's third experiment investigated the effects of impression modification on the static pressure seal of the earmold. Two methods were observed using 20

subjects. The first method consisted of patting of the semidry impression material while in the client's ear by the audiologist. The second method consisted of the addition of wax to the hardened impression by the earmold manufacturer. The researcher found that when audiologists pat down the semidry impression material into the client's ear(s) does not increase the chance of obtaining a seal. Hence, audiologists may conclude that modifications made to the earmold impression while drying in the ear presents little benefit. Macrae (1990) also found that the addition of wax to the hardened impression by the earmold manufacturer did not increase the possibility for a static seal by the earmold.

The fourth experiment employed a multistage impression technique. For 20 subjects a preliminary impression was taken on the test ear. After the impression hardened, the impression was removed, inspected, and inserted back into the ear. Prior to reinsertion of the earmold to the ear, the earmold was coated with a thin layer of impression material on the ear canal portion of the mold. Each earmold had 6mm of tubing imbedded within it to obtain leakage data using an air pump with an impedance meter. The air pump was connected to the embedded tubing producing a slow increase of static pressure within the ear canal. Air pressure was increased to a maximum of 200 daPa and maintained at that level for five seconds. If there was no loss of pressure over the time of five seconds, the earmold was considered to seal the ear effectively. If leakage was determined, the impression was modified with the addition of impression material. This step was repeated until a static seal was obtained. The final stage required a thin impression material to be syringed into the concha portion of the ear. After the material was inserted the impression was reinserted. This final stage allowed a smooth,

detailed impression of the subject's ear. Due to the multiple stages and measurements, the procedure proved to be an effective method to obtain a static pressure seal within the ear.

Macrae's (1990) experiments emphasized the need for a good impression for an effective hearing aid earmold. An effective hearing aid mold insures a good static seal resulting in optimal gain, output, and comfort; therefore, increasing client satisfaction and decreasing the frequency of hearing aid readjustment sessions or returns.

Killion (2003) observed that "several fitting disappointments can be traced directly to improper earmold acoustics introduced by the earmold impression, or the instructions (from the audiologist) to earmold laboratory, or the earmold laboratory itself" (p.299). With the introduction of advanced, high-end technology hearing aids (i.e., digital hearing aids), an improperly designed earmold can diminish the benefit afforded by this technology (Killion, 2003). This researcher found that the majority of problems associated with hearing aids could be alleviated with careful attention to the earmold impression production.

Research conducted by Dillon (2001), Pirzanski and Berge (2002), Microsonic (1998), Macrae (1990), and Killion (2003) stressed the importance of hearing aid impression production. The hearing aid impression is the cornerstone to receiving optimal benefits from any style of hearing aid. Unfortunately, the current impression method is quite invasive which can present health and medical risks to both the client and the audiologist.

Medical Risks to the Client as a Result of
Ear Impression Production

Wynne, Kahn, Abel, and Allen (2000) conducted a study to provide audiologists with evocative examples where significant trauma was incurred to the outer and middle ear as a result of obtaining ear mold impressions using the current method. Wynne and his colleagues provided case reports of patients experiencing severe medical consequences secondary to the removal of the impression material. These patients were seen by skilled audiologists and hearing aid dispensers within their communities. The first case reported by the authors involved a 69 year-old male being fitted for bilateral in-the-ear hearing aids. Upon removal of the right ear impression material, the client reported a sensation of fullness and slight decrease in his hearing. Otoscopy administered by the audiologist immediately after impression removal, revealed adhesion of the impression material to the right tympanic membrane. Normal tympanograms were obtained prior to the impression procedure; however, an abnormal tympanogram (Type Ad) suggested abnormally high compliance of the right tympanic membrane. The client was referred to an otologist who removed the residual impression material. The client's right tympanogram returned to normal and the sensation of ear fullness dissipated.

The second case reported by Wynne and his coauthors was a 56 year-old male who was voluntarily participating in a hearing aid efficacy study. Upon removal of the impression by the audiologist, the subject reported severe discomfort, sensation of fullness, and decreased hearing acuity in the left ear. The staff neuro-otologist administered an otoscopic examination which revealed a large hematoma on the left tympanic membrane. The membrane was bruised by the otoblock. As a result of the

hematoma, an abnormal tympanogram (Type B) was present. The subject revoked his participation from the study and was monitored by the audiologist and neuro-otologist for several months. According to Wynne and his fellow researchers hematomas can degrade the integrity of the tympanic membrane resulting in perforations. After six months, the subject's left ear healed leaving no residual effects. The audiologist saved the earmold impressions, due to the patient's refusal to have more impressions produced when his hearing status warranted hearing aid instrument changes.

Wynne and co-authors reported a third case where a 63 year-old female incurred a large perforation resulting in a permanent hearing loss and vertigo secondary to the removal of the hardened impression material. In this case, the hearing aid dispenser did not perform otoscopy before the procedure nor did he insert otoblock dams. Immediately after the removal of the left impression, the client experienced severe pain, bleeding, vertigo, and a headache. A tympanoplasty repaired the tympanic membrane; however, hearing was not restored. Legal action was sought by the client resulting in a large settlement and the loss of the dispenser's license and practice.

The fourth case reported by Wynne and fellow researchers involved an 80 year-old male who was seen by a hearing aid dispenser. The hearing aid dispenser performed a visual inspection of the ear; however, otoscopy was not performed at that time. An otoscopy report completed by another dispenser three years prior revealed "old scarring" on the left tympanic membrane. During the impression procedure, the client did not report pain. However, after the removal of the material, otoscopy revealed that some of the material with the otoblock dam penetrated through the tympanic membrane and was located in the middle ear cavity. The client was referred to his primary care

physician who then referred him to an otologist. The otologist discovered that the material had adhered to the middle ear ossicles. The otologist removed the material anterior to the tympanic membrane and decided not to surgically explore the middle ear cavity. One month post trauma the tympanic membrane demonstrated signs of healing; however, a profound hearing loss resulted.

A traumatic perforation with perilymph fistulae endured by a 34 year-old male was the fifth case discussed by Wynne and his colleagues. According to the researchers, the client was receiving earmold impressions to obtain custom made hearing protection devices for his place of employment. Upon the removal of the right ear impression material the client reported severe pain with a loud pop. Otoscopy revealed that a large amount of the impression remained in the right ear canal. The authors reported that some of the material with the otoblock dam penetrated through the tympanic membrane and adhered to the ossicles. The referred otologist removed the material from the external ear canal, tympanic membrane, and the middle ear cavity. A tympanoplasty repaired the perforation. After recovery the client reported a profound hearing loss with severe vertigo. He returned to the operating room for the repair of a perilymph fistulae. Three months post-operation the symptoms did not subside resulting in limited participation of daily activities due to the severe, incapacitating vertigo. A vestibular neurectomy was performed; however, it did not remediate the vertigo. As result of the impression procedure, Wynne and associates reported that this young male became permanently disabled. The client also experienced parental and marital troubles as well. Litigation was sought and the audiologist's liability insurance and the audiologist himself were ordered to provide a large monetary settlement.

Due to the current invasive impression method, ear trauma is common. Ear trauma such as the cases reviewed above can be detrimental to medically fragile individuals. For example, individuals who present the medical diagnosis diabetes or hemophilia and endure a wound from the invasive impression method may suffer life threatening repercussions. The authors stressed that a risk management plan should be employed when removing earmold impressions from the ear canal. Financial coverage for such invasive procedures with high risks was also recommended.

In addition, young children under seven and individuals with neurological disorders (e.g., cerebral palsy with spasticity) are at high risk for anatomical damage, due to the level of difficulty to make an earmold impression on such clientele. These clients produce spontaneous and unpredictable bodily motions which may lead to anatomical harm when the instruments necessary for the production of earmold impressions are inserted into their external ear canals. Extreme caution and care must be exercised with this special population.

Professional Liability and Risk Management for the
Audiologist during the Production
of Earmold Impressions

According to the American Speech, Language, and Hearing Association (ASHA, 1994) claims against audiologists have been few; however, the incidence of claims is expected to increase. ASHA's rationale for their expectation for a higher number of claims include a greater number of audiologists, increased number of recipients, enhanced professional autonomy, enlarged scope of practice, and heightened public awareness (1994). According to ASHA, hearing aids were the second highest cause for malpractice claims. These claims included testing, fitting, dispensing, and the

use of hearing aids (ASHA, 1994). ASHA emphasized that awareness and education were two effective tools to avoid litigation. A risk management program for hearing aid selection, fitting, and dispensing may include assessing structural integrity of the anatomy prior to and immediately after the earmold impression, client education regarding potential risks involved, and the development of procedural checklists.

Wynne, Kahn, Abel, and Allen (2000) and ASHA (1994) both emphasized the risks associated with earmold impression production for both the client and the audiologist. In addition to the potential risks to the client, the audiologist is also at risk for exposure to infectious diseases as a result of the current earmold impression procedure.

Transmission of Infectious Diseases

Audiologists are exposed daily to sources that have the potential to transmit infectious diseases. The research conducted by Ballachanda, Roeser, and Kemp (1996) stated that infection control was a vital practice for all audiologists, due to the increased prevalence of infectious diseases. Ballachanda and colleagues revealed that diseases such as cytomegalovirus (CMV), hepatitis B (HBV), herpes simplex, and acquired immune deficiency syndrome (AIDS) are escalating. Exposure to contaminated earmolds and hearing aids can be a method of disease transmission from client to audiologist. In their study, the authors recommended the use of universal precautions (i.e., wearing personal protective equipment) when handling earmolds and hearing aids due to these instruments coming into direct contact with bodily fluids (i.e., cerumen and ear drainage). The researchers recognized that cerumen should be considered an infectious substance, because it may contain blood or mucus.

Overend, Hall, and Godwin (1992) conducted a study to determine the presence of organisms present on general practitioners' otoscopes and determine the physicians' perceptions of the risks for cross contamination. Without prior notice, the authors collected speculums from two clinics (one urban and one rural). Cultures were taken from each earpiece. The researchers discovered that most of the speculums presented micro-organisms. Nine percent of the speculums presented high risks of *Staphylococcus aureus* cross contamination. *Staphylococcus aureus* is a nosocomial (acquired through the hospital) via exposure to contaminated medical instruments. *Staphylococcus aureus* can result in superficial, pus producing lesions including boils and styles or can lead to more serious infections such as pneumonia and meningitis (Todar, 2005).

The second portion of their study consisted of a survey regarding general practitioner's infection control procedures, perceptions, and their clients' suspected perceptions. The survey was sent to 105 general practitioners. Eighty-five surveys were returned. Overend and fellow researchers found that 98% of the respondents believed that cross contamination could occur with dirty speculums. Ninety-five percent of the respondents believed that bacteria could be cultured from earwax. Eighty-two percent of respondents revealed that their clients would be concerned if a dirty speculum was used during otoscopy. However, thirty-five percent of the respondents admitted to using the same speculum for multiple clients. Overend and colleagues found that only 22% of the respondents cleaned the speculums between clients. Overend and co-authors demonstrated the risk of bacterial transmission via audiological equipment, and the limited infection control practices conducted by well-informed general practitioners.

In conclusion, studies have shown the risks involved for the clients and the audiologists with the production of earmold impressions. As stated previously, an impeccable impression is necessary for optimal hearing aid function. Unfortunately, the current method of earmold impression production is a skill that still requires mastery and even with years of experience accidents can occur. The development of a new, safe method for earmold impressions could increase hearing aid and custom earmold dispensing and decrease malpractice suits. Imaging is one method that may replace the current earmold impression method.

Imaging is a medical technique to see inside the body or some focal point (Merck, 2005). An imaging device would need to possess scanning properties to acquire the auricle measurements for the development of an earmold. Pirzanski and Berge (2002) reported that variations between manufactures could be minimized with an earmold impression scanning device.

Medical Imaging Devices

In investigating medical imaging devices not only the special characteristics necessary to scan the outer ear of humans is of concern, but also the need for high resolution. The human outer ear is comprised of epithelial tissue (skin), cartilage, and bone. The outer portion of the external auditory canal is composed of cartilage, and the inner portion (closest to the tympanic membrane) is composed of bone. A 1mm to 2mm layer of skin encases the pinna, external auditory canal, and tympanic membrane. The tympanic membrane is the first anatomical structure of the middle ear system. X-ray, computer tomography, ultrasound, magnetic imaging resonance, infrared, mechanical

devices, and abrasive computer tomography were reviewed to determine scanning and imaging capabilities as would be applied to the outer ear.

X-Ray

As stated by Merck (2005), x-ray imaging is the most common form of anatomical imaging. Discovered in 1895 by Professor Rontgen, x-ray technology has been a diagnostic tool necessary for anatomical imaging. Sandborg (1995) defined x-rays as “electromagnetic waves of the same nature of light, but with frequencies 100,000 – 1,000,000 times greater” (p.2). Sandborg revealed that image quality is highly dependent on contrast, sharpness, and noise. According to the researcher, anatomy with higher density and thickness (e.g., bone) will provide a greater image contrast, than anatomical areas with less density and thickness (e.g., cartilage and soft tissues). Sharpness was defined as the spatial resolution of the image and the “ability for the imaging system to detect a sharp edge” (Sandborg, 1995, p.16). The researcher stated that sharpness can be optimized by imaging a small focal point with close proximity to the receptor. According to the author, movement degraded an image’s sharpness. Noise, defined by Sandborg (1995), was variations in the image inconsistent with the anatomical structure.

Although x-ray is an appropriate instrument for diagnostic radiology, x-ray was judged by this investigator to be an inappropriate tool for a scanning device for earmold impressions. X-ray is an effective method to image hard tissue (i.e., bone); however, it has little effectiveness with softer tissues. Therefore, imaging of the cartilaginous portion of the ear may not provide good image quality resulting in a poor earmold impression.

Suhova, Chubuchny, and Picano (2003) revealed another disadvantage to using x-ray. The researchers stated that x-ray posed biological hazards to the clinician, clients, and the environment. Sandborg (1995) explained that x-rays are a form of radiation which can lead to cancer with exposure to high dosages. According to the author, characteristics of radiation damage are independent of the absorbed dosage. The occurrence of radiation damage varies between individuals and varying amounts of exposure. According to Juhl and Crummy (1993), a skull x-ray provided a maximum radiation dosage of 40 mrem. Due to the limited image quality and health risks associated with x-rays, this medical imaging device would not be appropriate for the purpose of earmold impression production.

Computed Tomography (CT) or
Computed Axial Tomography (CAT)

Computed tomography (CT) provides three-dimensional imaging of the body including soft tissue (i.e., brain and muscles). Juhl and Crummy (1993) explained that computed tomography obtains a cross-sectional image in lieu of a shadow image acquired by x-ray. This type of imaging employed x-ray to contrive anatomical images. Computed tomography uses fan-shaped x-ray beams to acquire 10 mm thick slices of the target anatomical structure (Juhl and Crummy, 1993). According to Hendee (1988), the fan-shaped x-ray beams were directed at many different angles to acquire the targeted anatomical image. With increased radiation dosage and scanning time, contrast resolution was improved (Juhl and Crummy, 1993). However, with slight bodily movement (e.g., breathing) image quality is degraded.

Computed tomography poses the same biological hazards as x-ray. According to Juhl and Crummy (1993), a CT of the head provided a maximum radiation dosage of

200 mrem. With continued exposure to x-ray via computed tomography, radiation damage would occur. Although image quality (e.g., resolution) was reported by Merck (2005) to be better with CT than x-ray imaging, because of its ability to capture soft tissues as well as bone; the biological hazards associated with radiation exposure supersede the purpose of this study. As previously stated with x-ray imaging, this medical imaging device would be inappropriate for the purpose of earmold impression production, due to its harmful properties.

Ultrasound

Dunn (1991) discussed the two main purposes for the use of ultrasound within the medical sector. The first purpose discussed by the author was the use of ultrasound to alter a medium (e.g., physical therapists use ultrasound to illicit advantageous biological affects on the damaged muscle of clients). The second purpose researched by Dunn (1991) was the employment of ultrasound for the extraction of information. The latter purpose is most appropriate for the use of ultrasound to obtain an image of the outer ear (i.e., pinna and external auditory meatus) for the production of an earmold impression.

As defined by Dowsett, Kenny, and Johnston (1998), ultrasound imaging uses the transmission and reflection of high-frequency mechanical waves. Using a directional receiver, distance was measured and a two-dimensional image is produced. Dunn (1991) reported that the “commonly held opinion in the medical field is that ultrasound is a most effective diagnostic tool for which no adverse effects have been reported from ultrasound examination” (p.266). However, Dunn provided the caveat that most studies had small sample sizes possibly contributing to the positive results regarding biohazards with ultrasound.

Defined by Juhl and Crummy (1993), “ultrasonography is the increase and decrease in pressure with frequencies above 20,000 Hz” (p.14). According to the editors, the frequency of ultrasound was the number of cycles that pass one area. Juhl

and fellow editor explained that an image is obtained when the ultrasonic waves are reflected back to the reflecting surface. With varying acoustical impedance (e.g., air to tissue, or muscle to bone) greater images were captured (Juhl and Crummy, 1993). Edwards (1988) noted that “human carcinogenic, mutagenic, and teratogenic risks of diagnostic intensities of ultrasound are either zero or so low that they need not be considered for any examination for which there is reasonable medical indication” (p.105). However, the author noted that obstetric ultrasound be solely used with pregnant woman.

For the purpose of this study, ultrasound could be used to capture an accurate three-dimensional image of the client’s outer ear for the production of an earmold. The medians are air, epithelial tissue, cartilaginous tissue, and bone. However, according to the information compiled by Hendler, Kovach, Lockhart, Tscheschlog, Mayer, Chohan, et al. (2002) and Juhl and Crummy (1993) a conductive gel would be applied to the anatomical structure for a sharper image. Placement of the conductive gel and image transducer would be impossible within the outer ear.

Choi and Hutchins (2003) researched the propagation of ultrasound in various gases under regimented pressure levels. The researchers constructed a high pressure chamber to study the effects of pressure on ultrasonic attenuation. Choi and his colleague observed an increase of ultrasonic attenuation in air with increased pressure. Ultrasonic attenuation was contributed to both absorption and diffusion within air (Choi and Hutchins, 2003). Riley (1982) stated that ultrasonic attenuation in air is not significantly different than attenuation rate in soft tissue at 1 MHz. However, as frequencies changed attenuation rate increased (Riley, 1982).

According to Dunn (1991), the National Council on Radiation Protection and Measurements expressed exposure in terms of temperature. With increased ultrasonic amplitudes temperature increased resulting in pain and possible tissue damage (Dunn, 1991). Temkin, Smith, Shapiro, and Hynynen (1998) found that there was bone tissue

damage at exposure levels used for ultrasound surgery (1.5 MHz at 43, 57, and 72 Watts). However, the bone tissue was found to recover with time. The researchers concluded that the high intensity used for ultrasound surgery will not cause irreversible damage.

Since the outer ear is a small area receiving the ultrasound and depending on the amplitude necessary to obtain an image, ultrasound may not be an effective means by which to obtain a scanned image for the production of an earmold impression. Ultrasound presents a thermal biological hazard with increased ultrasonic amplitudes. So depending on the amplitude necessary to obtain an image of the external ear, the client may be at risk for burns due to the thermal biological hazard.

Magnetic Resonance Imaging (MRI)

The description provided by Merck (2005), was that MRI employs the use of powerful magnets and radio rays to extract a three-dimensional image of soft tissues. The reflection of radio waves and the subtle differences recorded within the waves allow the imaging system to record different tissues (Merck, 2005). Due to the use of radio waves, which were reported to be the same frequencies used by radio stations (Merck, 2005), a specialized room must be constructed. Merck (2005) provided that this type of imaging was superior to CT scans, because of the high image definition obtained.

The noninvasive properties of this medical imaging device appeared to be appropriate for developing a scanned image for the production of earmold impressions. Edwards (1988) revealed that MRI poses little biological risks. However, due to the noise exposure earplugs were given to reduce the possibility of noise induced hearing loss (Merck, 2005). Merck (2005) provided that this imaging procedure is not recommended for pregnant women, because of the release of a strong magnetic field. In addition to noise control and consumer limitations, the construction of a specialized room would not be economically feasible for small audiological practices.

Infrared

Infrared imaging uses infrared waves comprised of electromagnetic radiation (Costello, R.B., et al, 1992) to capture an image via an infrared camera. Jones, Schaefer, and Zhu (2004) discussed the use of infrared for content-based image retrieval. According to the researchers, this has been “an active research area for more than a decade” (p. 1186). Medical infrared images have been used for the retrieval of the following features: color, texture, shape, sketch, and spatial orientation (Jones, Schaefer, and Zhu, 2004). According to the research conducted by Fujimasa, Kouno, and Nakazawa (1998), infrared imaging conducted in outpatient clinics will increase with the commercial availability of infrared cameras.

Kohashi, Nakamura, Nakamura, and Miyaji (1972) developed a powder that aluminates when exposed to infrared light. The electroluminescent powder consisted of zinc-sulfur powder mixed with copper and aluminum bound with plastic resin. Kohashi and colleagues referred to the use of this powder as a “solid-state infrared image converter”. An image was subsequently derived when the electroluminescent powder was placed on the target and infrared scanning was conducted at approximately 1.2 micrometers. The researchers conducted an experimental study to determine the relationship between the electroluminescent powder thickness and image resolution. The levels of thickness ranged from 65 micrometers to 510 micrometers. Kohashi and fellow researchers concluded that with greater thickness image resolution improved. However, the authors revealed that if longer infrared wavelengths were required “the solid-state infrared image converter” would be limited.

Infrared may be a plausible means for obtaining an accurate scan of the external ear for the purpose of this study. Unlike CT, MRI, and X-ray which require specialized environments and professionals (e.g., radiologists, physician assistants), infrared does not pose the same limitations. In addition, the use of specialized environments and personnel would subsequently make the process of earmold production very expensive.

Infrared could provide an economically feasible method with commercial availability. However, the placement of the electroluminescent powder within the external ear may prove to be very difficult. The level of difficulty will increase, if equal powder thickness must be maintained within that small orifice.

Abrasive Computer Tomography via Reverse Engineering

Abrasive computer tomography apparatus “uses an abrasive method to remove the inlaid object layer by layer and to capture the cross sectional image of each layer with a CCD camera” (Chang and Chiang, 2003, p.708). Abrasive computer tomography employs the newly evolving discipline of reverse engineering. As described by Varady, Martin, and Cox (1996), reverse engineering transforms real objects into engineering models and concepts. Varady and researchers found that an important application of reverse engineering “is to generate custom fits to human surfaces” (p.2). The procedural steps involved in reverse engineering are data capture, preprocessing, segmentation and surface fitting, and computer aided device (CAD) model creation (Varady, Martin, and Cox, 1996).

Data collection phase involves a method of scanning the desired object to gather dimensional data. The preprocessing phase transports the data from the method of data collection to the segmenting software. Segmentation and surface fitting “logically divides the original point set into subsets, one for each natural surface, so that each subset contains just those points sampled from a particular natural surface” (Varady, Martin, and Cox, 1996, p. 11). There is no sequential order to the phases, the phases occur concurrently resulting in a three-dimensional image of the object via the CAD model creation.

Disadvantages to reverse engineering and the apparatuses that employ that method include calibration of the equipment, especially the data collection device (e.g., lens distortions), occlusion (e.g., shadowing effects), and limited commercial software

that allow processing and segmentation of complex objects. However, according to Chang and Chiang (2003), abrasive computer tomography overcome the limitation of capturing a processing complex objects.

Chang, Lee, and Ku (2003), used an abrasive computer tomography device to obtain sectional images of objects using Bitmap formatting. With binary segmentation and numerical schemes, boundaries of the object's dimensions were acquired. Using the method of reverse engineering, the three-dimensional image was milled using rapid prototyping technologies. Chang and fellow researcher's purpose was to use abrasive computer tomography for denture design and in-house manufacturing.

The researchers employed abrasive computer tomography to capture the target image and a computer-aided-design method to formulate a three-dimensional image. Computer numerical control machining and rapid wax prototyping were used to produce the physical denture. To manipulate the image prior to milling, Chang and colleagues employed three-dimensional touch technology. According to the authors, "the original design concept of abrasive computer tomography apparatus is to design a simple device with scanning function of commercial x-ray CT scanner" (p.31). Using a CCD camera (1.67 million pixels, Pixera Corp., USA), an image was captured. The image was then transferred to a computer for three-dimensional reconstruction. Image software employed were LabView, CopyCAT, and PowerSHAPE. After image processing, the image was sent to a four-axis computer numerical control milling machine to obtain a physical model. According to Chang and colleagues, "the computer numerical control user interface module is developed using Visual Basic (VB) language in PowerMILL environment" (p.34).

The researchers concluded that this method was advantageous for dentists. Abrasive computer tomography and rapid prototyping technologies were found to be an economical and safe. Magnetic resonance imaging, computed tomography, and x-ray were expensive methods and harmful to humans and the environment. In addition to the

bio-hazards, Chang and co-authors expressed that these medical imaging devices required well-trained personnel for operation. The authors summarized that abrasive computer tomography device could quickly capture and mill a geometrically complex object, such as dentition.

In view of the noted advantages discussed above, the theory behind abrasive computer tomography may prove to be a plausible method for obtaining accurate scans of the external ear. Imaging software downloaded into a computer used in conjunction with an infrared camera to capture the image may very well be the exact method to obtain an accurate three-dimensional image of the external ear. Ideally, that image would be sent electronically to the earmold or custom hearing aid manufactures for production of well fitted earmolds or custom hearing aid shells with no risk of harm to the client or audiologist. The audiologist would be able to use this device in the office without the needed for a specialized environment or personnel (e.g., physician).

STATEMENT OF THE PROBLEM

Currently there is no technological method which uses a medical device to scan the outer ear (i.e., pinna and external auditory canal) for the formation of an earmold. The device(s) would provide a three-dimensional computerized image of the client's outer ear for dissemination to the earmold laboratories for the production of a hearing aid or custom earmold. The medical device would make the need for an earmold impression obsolete.

The risks of bodily injury to the patient and the transmission of infectious diseases researched by Wynne, Kahn, Abel, and Allen (2000), ASHA (1994), and Overend, Hall, and Godwin (1992) would be eliminated or significantly diminished. Full benefits from the hearing aid would be afforded to the clients and not degraded by

earmold impression imperfections as noted by Killion (2003), Dillon (2001), Pirzanski, and Berge (2002), Microsonic (1998), and Macrae (1990). Similar to the device researched by Chang, Lee, and Ku (2003), biological and environmental harm would be significantly minimized. This study sought to determine the appropriate medical device which would be an alternative to the current earmold impression method described by Dillon (2001). In addition to determining the appropriate medical device, an appropriate request for proposal would be identified for continued audiological research of the determined medical device.

CHAPTER 2

REQUEST FOR PROPOSAL SELECTION

Currently there is no technological method which uses a medical device to scan the outer ear (i.e., pinna and external auditory canal) for the formation of an earmold. Therefore, a grant proposal was developed to secure funding for implementation of the research design utilizing the most appropriate medical imaging device identified. The Research Competitiveness and Industrial Ties Research Subprograms of the Board of Regents Support Fund Research and Development Program was the request for proposal selected. Selection criteria for the request for proposal were funding for university research within the state of Louisiana and funding for innovative procedures not currently practiced within the field of audiology.

The purposes defined by the Board of Regents Support Fund included “carefully defined research efforts at public and private universities in Louisiana” and “the enhancement of the quality of academic, research, and agricultural departments or units within a university”. The main objective of the Research Competitiveness and Industrial Ties Research Subprograms is to enhance fundamental research and improve the competitiveness of Louisiana Universities. Awarded grant proposals present the opportunity to enhance secondary education within Louisiana and Louisiana’s economy via the investigator’s research design. Eligibility is granted to universities and colleges

which are members of the Louisiana Association of Independent Colleges and Universities. Because this study introduces the use of reverse engineering, currently used within the field of dentistry, for the purpose of earmold production within the field of audiology fundamental research will result. In addition, Louisiana Tech University is a member of the Louisiana Association of Independent Colleges and Universities. Therefore, the purpose of this study met the criteria established by the Board of Regents Support Fund Research and Development Program.

Upon submission of the grant proposal to the Board of Regents Support Fund Research and Development Program, the appointed reviewers will determine the potential for nationally competitive status. An awarded research proposal by the Board of Regents Support Fund Research and Development Program possesses greater potential to be awarded at the federal level (e.g., National Science Foundation). This potential opportunity for federal funding, in conjunction with the requirements delineated by the Board of Regents Support Fund Research and Development Program, are advantageous for the purpose of this research.

TARGETED MARKET

As discussed in Chapter One, both hearing aid and non-hearing aid consumers would benefit from a noninvasive, alternate earmold impression method. The targeted market would include hearing aid consumers, professionals needing custom earmolds (e.g., newscasters, airline pilots, and musicians), employees needing hearing protection, and medically fragile individuals requiring ear protection (e.g., swim/bath plugs). Earmold consumers range in all ages, come from all economical backgrounds, and present a variety of health statuses (i.e., ranging from good health to medically complex

and fragile individuals). A noninvasive method would significantly reduce the health risk (e.g., ear trauma) and discomfort for consumers with medical diagnoses such as diabetes and hemophilia. The risk of ear trauma due to the current earmold impression method would be greatly minimized. With consideration to the targeted population and reviewed literature the most appropriate medical device was selected.

MEDICAL DEVICE SELECTION

Selection criteria for an appropriate medical imaging device were 1) potential to scan and measure the outer ear (i.e., pinna and external auditory canal); 2) the device would possess or be compatible with computer software that could provide a three-dimensional image; and 3) the device would present little or no biological hazards to the client or audiologist. Using the concept of abrasive computer tomography, researched by Chang, Lee, and Ku (2003) the use of an infrared camera and Materialise' Rapid Shell Modeling (RSM) imaging software to develop a three-dimensional image of the external ear was determined by this author to be the most appropriate method to replace the current earmold impression production method. Materialise' RSM software is a commercially available, three-dimensional image processing and editing software. This software imports images from scanning devices to a readable three-dimensional image. The software is compatible with Windows Operating System.

Similar to abrasive computer tomography, the use of an infrared camera in conjunction with Materialise' RSM software incorporates the discipline of reverse engineering. Varady, Martin, and Cox (1996) explained that reverse engineering transforms real objects into engineering models and concepts. Varady and researchers found that an important application of reverse engineering "is to generate custom fits to

human surfaces” (p.2). For the purpose of this study, a noninvasive earmold impression method is being investigated to obtain a custom fit to the human outer ear.

As stated in the literature review, abrasive computer tomography and rapid prototyping technologies were found to be an economical and safe alternative when compared to other medical imaging devices. As with abrasive computer tomography a CCD camera is necessary to capture the image via the integration of infrared technologies. Therefore, a commercially available infrared camera and imaging software (i.e., Materialise’ RSM software) was hypothesized to be the most appropriate equipment for the production of earmolds.

Within the literature review, x-ray was determined to be an appropriate instrument for diagnostic radiology; however, x-ray would not be an appropriate tool for the production of earmold impressions. X-ray effectively captures images of bone; however, has little effectiveness with softer tissues. Therefore, imaging of the cartilaginous portion of the ear may not provide good image quality resulting in a poor earmold impression. In addition to poor image quality of the outer ear, Suhova, Chubuchny, and Picano (2003) revealed that x-ray posed biological hazards to the clinician, clients, and the environment. Sandborg (1995) explained that x-rays are a form of radiation which can lead to cancer with exposure to high dosages. According to Juhl and Crummy (1993) the quantity of radiation absorbed by the body is more of a concern for the client than the radiation that passes through the body and is captured by the film when undergoing diagnostic x-ray. Edwards (1988) explained that the interaction of radiation from x-rays within the body is at the atomic level. Due to the

limited image quality and health risks associated with x-rays, this medical imaging device would not be appropriate for the purpose of earmold impression production.

Computed tomography poses the same biological hazards as x-ray. Image quality (e.g., resolution) was reported by Merck (2005) to be better than x-ray imaging, because of the capture of soft tissues. However, the biological hazards associated with radiation exposure supersede the purpose of this study.

Ultrasound was determined to be an inappropriate alternative due to thermal biological effects and the placement of the conductive gel and transducer. The outer ear is a small area which would receive ultrasonography. Placement of conductive gel and the image transducer would be impossible within that anatomical area.

The noninvasive properties of magnetic resonance imaging appear to be appropriate for the production of earmold impressions. Edwards (1988) revealed that MRI poses little biological risks. However, due to the noise exposure, earplugs are given to reduce the harmful effects (Merck, 2005). The placement of earplugs to reduce the harmful effects of noise exposure would impede the purpose of the device for earmold impression production. Magnetic resonance imaging would also not serve the general public at all times. Merck (2005) provided that this imaging procedure is not recommended for pregnant women, because of the release of a strong magnetic field. Pregnant women were and are fitted for hearing aids or custom-made earmolds within the profession of audiology.

Due to the disadvantages discussed in the literature review regarding the other medical imaging devices, the concept surrounding abrasive computer tomography (i.e., reverse engineering) was determined to be the best method to investigate for the

purpose of this study. Abrasive computer tomography presented properties (e.g., economical benefits, and safety) which are advantageous for the purpose of the study.

METHODS AND PROCEDURES

The request for proposal was developed with strict adherence to the required format provided by the Board of Regents Support Fund Research and Development Program (see Appendix B). The format of the grant proposal possesses the following information:

1. Cover page: Exact format is provided which should be completed in its entirety.
2. Project summary: Concise description of the project which delineates how and why the proposed project will meet the objectives of the subprogram for which it was submitted. Proposed project objectives and an outline on how the project will operate should be provided in this section. This section should not exceed 250 words.
3. Table of Contents: List of all headings and subheadings.
4. Goals and objectives: The final goal to be reached at the end of grant period. Expected major changes in research personnel and/or the program should comprise this section. This section should be no longer than one single spaced typed page.
5. Narrative and bibliography: Using the following outline, this section should not to exceed 15 single spaced typed pages with a font of 12 point or greater. The bibliography is not included in the 15 page narrative; however, the bibliography should not exceed two pages. The pages should have one inch margins and be numbered.

- a. Project rationale: Assessment for potential and plan for achieving national competitiveness. Barriers to achieving national competitiveness should be noted.
 - b. Research plan: Brief summary of the proposed project's significance, methods, and limitations to the current state of knowledge in the field. A schedule of expected activities to be implemented throughout the grant period of three years should be defined. Also performance measures should be provided so that the Board of Regents can determine the level of success which has been obtained. Submission of plans for publications and maintenance of the level of competitive research after funding will be noted.
 - c. Involvement and qualifications of investigators, faculty, and students: The role, qualifications, and salary of personnel, especially senior researchers, should be delineated.
 - d. Institutional capabilities and commitment: Level of commitment of the university to the proposed research as well as facility and equipment capabilities and availability for the research should be described.
6. Budget and budget narrative: The Board of Regents expects a decrease in the amount of support funds requested with each subsequent year of the research project, due the growth of competitiveness of the project. As the research project develops it should become competitive in obtaining federal funding.
- a. Format: The exact formatting for the proposal is provided and strict adherence should be implemented. Cost sharing and/or

monetary matching by the submitting university should be provided.

- b. Project activation and anticipated completion dates: Exact activation and completion dates will be provided to the principle investigator.
 - c. Disallowed budgetary items: The Board of Regents specifies exactly where the awarded money should not be propagated. For example, the monies awarded may not be disseminated to on-going operating costs of existing projects. In addition, the monies awarded may not be used to buy routine office equipment (e.g., fax machines), pay for equipment maintenance, and/or building renovations or construction.
 - d. Funds for principle investigators and support personnel: Salary support may be awarded to principle investigators and support personnel. However, the principle investigator's salary should not exceed 25% of their annual salary. Support personnel's contribution to the research project, their time spent to the project, and rate of pay should be clearly defined.
 - e. Equipment: Equipment may be purchased in the context of the proposed research. Equipment funding may be awarded only if the submitting institution matches or exceeds the awarded money by 25 percent.
7. Current and pending support/History of support: Forms, provided by the Board of Regents, regarding previous or current funding should be completed to its entirety.

8. Biographical sketch: Background information of all pertinent personnel should be provided. A form to use for such information is provided.
9. Proposal appendix: Essential information should be provided.
 - a. Supplemental information: General information or materials should be provided (e.g., statistical information)
 - b. Letters of support: Optional section. Letters provided by unrelated (to the research project) individuals who support the research.

Research and information obtained from the previous chapter and additional information was used to complete the grant proposal.

Appendix A is comprised of the grant developed for the Board of Regents Support Fund Research and Development Program. As stated previously, strict adherence was observed to the Guidelines for the Submission of Research Competitiveness Subprogram (RCS) Proposals. The few exceptions which were made during the grant proposal development were adjustment of left page margin of 1.6", line spacing, and formatting modifications. The margin was implemented in lieu of the one inch left margin setting recommended by the RCS Proposal submission guidelines, to remain within the Louisiana Tech University Graduate School guidelines for the submission of a dissertation. Double or triple spacing was also implemented instead of single spacing to adhere to the Louisiana Tech University Graduate School guidelines for the submission of a dissertation. Formatting modifications were made to all the required forms (i.e., cover page, project summary, budget and budget narratives, and biological sketch) to remain within the Louisiana Tech University Graduate School guidelines for the submission of a dissertation. These modifications included alteration of font style and size. Appendix B provides a copy of the Board of Regents' Request for

Proposal Guidelines for the Submission of Research Competitiveness Subprograms
Proposal which was used for Appendix A.

CHAPTER 3

DISCUSSION AND CONCLUSION

The aim of this dissertation was to determine an alternate method for producing earmold impressions for hearing aid and non hearing aid purposes using a medical, imaging device. In addition to determining the appropriate medical device, an appropriate request for proposal would be identified for continued audiological research of the determined medical device. A plausible device was determined via literature review and several consultations with biomedical engineers from Louisiana Tech University of Ruston, Louisiana Department of Biomedical Engineering and Rice University of Houston, Texas, Department of Bio-Engineering.

Medical Imaging Device Selection

Through a literature review of research the author hypothesized that reverse engineering will be the appropriate method to develop a non-invasive earmold production method. Reverse engineering is the concept behind abrasive computer tomography in which device selection was determined for this dissertation. Data collection would consist of the use of an infrared camera which would capture the exact dimensions of the external ear. Via an Intel 4 3.0 GHz or equivalent 1 GB RAM computer the infrared image would be processed into a three-dimensional image using Materialise' Rapid Shell Modeling (RSM) software. The process of reverse engineering

implementing the selected instruments would ideally make the current method of earmold impression method described by Dillon (2001) obsolete.

This alternate, innovate method is hypothesized to significantly reduced or eliminate the three issues surrounding the current method of earmold impression method described by Dillon (2001). These three issues previously discussed in Chapter One are non-standardized production method among audiologists resulting in a 50% return rate, due to poor earmold productions (Pirzanski and Berge, 2002), transmission of infectious diseases, and risk of malpractice suits for audiologists due to the potentially harmful nature of the current earmold impression method (ASHA, 1994).

Request for Proposal

Selection criteria for the request for proposal were funding for university research within the state of Louisiana and funding for innovative procedures not currently practiced within the field of audiology. Currently there is no technological method which uses a medical device to scan the outer ear (i.e., pinna and external auditory canal) for the formation of an earmold. Using the criteria the Research Competitiveness Subprogram was elected.

The main objective of the Research Competitiveness and Industrial Ties Research Subprograms is to enhance fundamental research and improve the competitiveness of Louisiana Universities. Awarded grant proposals present the opportunity to enhance secondary education within Louisiana and Louisiana's economy via the investigator's research design. Eligibility is granted to universities and colleges which are members of the Louisiana Association of Independent Colleges and Universities. Because this study introduces the use of reverse engineering currently used

within the field of dentistry for the purpose of earmold production within the field of audiology, fundamental research will result. In addition, Louisiana Tech University is a member of the Louisiana Association of Independent Colleges and Universities. Therefore, the purpose of this study met the criteria established by the Board of Regents Support Fund Research and Development Program.

For the purpose of this dissertation, the grant proposal requirements (i.e., margins, font style and size, provided forms, and headings) were modified to fulfill the Louisiana Tech University Graduate School's guidelines for preparation and submission of a dissertation. If the grant proposal was actually sent for review by the Board of Regents the document would have to be reformatted according to their guidelines.

Further Suggestions for Future Research

Several studies could be developed based on the foundation of this dissertation. With the availability of the necessary equipment one may produce an entire study comparing various distances and depths of the infrared camera from the external ear to obtain the best resolution necessary for image processing. Other imaging software may be studied and compared for the best three-dimensional image production. Survey studies may be conducted to determine audiologists' perceptions of the current earmold production method and their motivation to use an alternate, imaging device. These are only a few suggestions for future research; however, one can only assume the depth and breadth of research that can be derived from such a novel innovation.

APPENDIX A
GRANT PROPOSAL

APPENDIX A
GRANT PROPOSAL

Cover Page for Research and Development Proposals

1. R & D Subprogram: (check one) <input type="checkbox"/> Research Competitiveness Subprogram (RCS) <input type="checkbox"/> Industrial Ties Research Subprogram (ITRS)	(For Board of Regents' Use Only) Application Number:	
2. Name(s) of Submitting Institution(s) of Higher Education: (Include Branch/Campus/Other Components) Louisiana Tech University		
3. Address of Institution of Higher Education: Department of Speech, LA Tech University (Include Dept/Unit, Street Address/P.O. Box Number, City, State, Zip Code) P.O. Box 3165 Ruston, LA 71272		
4. Title of Proposed Project: Integration of Medical Technology for the Purpose of Earmold Production in the Field of Audiology		
5. Proposed Duration: (Circle # of Yrs.) 1 2 3	6. Total Funds Requested: \$50,500	7. Total Funds Requested By Year: 1st: \$29,500 2nd: \$14,500 3rd: \$6,500
8. <u>FOR RCS PROPOSALS ONLY:</u> Category In Which Proposal Is Submitted: (check one) <input type="checkbox"/> Agricultural Sciences <input type="checkbox"/> Engineering A <input type="checkbox"/> Biological Sciences <input type="checkbox"/> Mathematics <input type="checkbox"/> Computer/Information Sciences <input type="checkbox"/> Physics & Astronomy <input type="checkbox"/> Earth/Environmental Sciences <input type="checkbox"/> Social Sciences	9. <u>FOR ITRS PROPOSALS ONLY:</u> a. Using the Taxonomy in Appendix A of the RFP, list the 3 disciplines/subdisciplines which most closely reflect the subject material of this proposal: _____ b. For purposes of external evaluation, this proposal is in a : (check one) <input type="checkbox"/> scientific or engineering discipline <input type="checkbox"/> non-scientific or non-engineering discipline	
10. This Proposal Is a: (check one) <input type="checkbox"/> New Request <input type="checkbox"/> Request for Continuation of a Previously-Funded Support Fund Project		

If a CONTINUATION, provide previous contract number:					
11. Does This Proposal Contain Confidential or Proprietary Information Which Falls Into a Category Described in R.S. 44:4(16)? G YES G NO (NOTE: If YES, proposal MUST be appropriately marked.)					
By signing and submitting this proposal, the signators are certifying that: (1) the proposed research has not already been funded/is not currently being funded/has not been promised funding; (2) this proposal has been approved by an Institutional Screening Committee; and (3) the institution and the proposed project are in compliance with all applicable Federal and State laws and regulations, including, but not limited to, the required certifications set forth in: (a) <u>Grants for Research and Education in Science and Engineering</u> , NSF Grant Proposals Guide (GPG), NSF 03-2, effective 10/1/02; and (b) 45CFR 620, Subpart F (Requirements for a Drug-Free Workplace).					
Name/Title (typed) Institution (if different from #2 above)		Dept./Telephone # FAX #, e-mail		Highest Degree/Year	Signature
Principal Investigator/Project Director: Michelle L. Saltarrelli		Department of Speech 318-257-4764 318-257-4492 Mls044@latech.edu		MS	
Co-PI/PD:					
Other Investigator:					
Campus Head/Authorized Campus Representative		Dean		Authorized Fiscal Agent	
Name/Title: (typed)		Name/Title: (typed)		Name/Title: (typed)	
Signature:		Signature:		Signature:	
Date:	Telephone Number:	Date:	Telephone Number:	Date:	Telephone Number:

Project Summary

With the availability of computer technology and reverse engineering, earmold impression production using viscous material will soon be an obsolete technique. The main objective of this work is to develop a commercially available outer ear scanning medical device to replace the current method of earmold impression production, while enhancing fundamental research in the field of Audiology and competitiveness of Louisiana Tech University. This RCS proposal will focus on the research and development of a medical device used to scan the outer ear and send the information electronically to the earmold manufacturers nation wide. The current earmold production method will be discussed as well as device rationale.

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Objectives and Aims

The objective of this work is for the principal investigator to reach national competitiveness, while developing an innovative, fundamental technique to produce custom earmolds for hearing aids, hearing protection devices, and electronic devices

(e.g., cell phones) in support of Louisiana and the nation's economic development. The main objectives are to:

- Develop a medical device to scan/measure the outer ear
- Develop a three-dimensional computer model which mimics the measurements of the scanned outer ear

In order to reach the objectives the researchers will:

- Research the methods for fabrication of biological imaging
- Research the human and environmental risks involved utilizing biological imaging
- Develop preliminary testing site for device efficacy

The researchers seek funding for three years, while implementing the following annual goals:

First Project Year

Developing the medical device used to scan the outer ear for purpose of earmold production. Gathering preliminary data requiring the measurements obtained on a standardized, anatomically correct manikin. Prepare conferences and consultations with other laboratories for the exchange and collaboration for further device development.

Second Project Year

Subsequent optimization of the device design. Presenting work at national conferences and publishing journal articles regarding preliminary data.

Third Project Year

Realization of scanning device prototype. Presenting work at national conferences and publishing journal articles regarding prototype development. Acquiring

new funding to support further research and competitiveness of Louisiana Tech University in the field of audiology.

Narrative and Bibliography

Rationale of the Project Assessment of Potential for Achieving National Competitiveness

Imaging constitutes a growing research area within the field of audiology. Siemens, a globally renowned hearing aid manufacturer, announced the development of the I-Scan in 2005. The I-Scan was the first imaging device used to expedite the custom earmold or hearing aid shell process. This device removed the step of mailing the earmold impression to the hearing aid manufacturer. Audiologists place the recently produced earmold impression into the I-Scan, the I-Scan takes dimensional recordings of the earmold impression which is subsequently sent to the manufacturer for a custom hearing aid shell or earmold. Siemens' representatives were unwilling to disclose exactly what imaging device was used for the I-Scan. Although an imaging device was used to scan the earmold, earmold impression production is still necessary.

The current earmold impression method defined by Dillon (2001) involves eight steps taking approximately 15 minutes for completion. Using an epoxy material, the earmold impression material is injected via a syringe into the ear canal and the ear to provide an exact mold of the client's ear with the hardened material. The earmold is then sent to earmold and hearing aid manufacturers for the production of hearing aid shells, earmolds, and non-hearing aid products (e.g., swimmer's plugs, musician's plugs). Studies (e.g., Wynne, Kahn, Abel, and Allen, 2000; ASHA, 1994; and Ballachanda, Roeser, and Kemp, 1996) have shown the risks involved for the clients

and the audiologists with the production of earmold impressions. An impeccable impression is necessary for optimal hearing aid function (Dillon, 2001). Unfortunately, the current method of earmold impression production is a skill that still requires mastery and even with years of experience accidents can occur. The development of a new, safe method for earmold impressions could increase hearing aid and custom earmold dispensing and decrease malpractice suits. Imaging is one method that may replace the current earmold impression method.

An imaging device would need to possess scanning properties to acquire the dimensions (e.g., length, shape, width) of the client's ear for the development of an earmold. Pirzanski and Berge (2002) reported that these variances between manufactures could be minimized with an earmold impression scanning device.

The methodology of abrasive computer tomography and rapid prototyping technologies were found to be an economical and safe alternative when compared to other medical imaging devices (Chang, Lee, and Ku, 2003). Abrasive computer tomography employs a CCD camera to capture an image via the integration of its infrared technologies. Similar to abrasive computer tomography, the use of an infrared camera in conjunction with Mimics software incorporates the discipline of reverse engineering into the field of audiology. Varady, Martin, and Cox (1996) explained that reverse engineering transforms real objects into engineering models and concepts. Varady and researchers found that an important application of reverse engineering "is to generate custom fits to human surfaces" (p.2).

Using the concept of abrasive computer tomography, researched by Chang, Lee, and Ku (2003) the use of an infrared camera and Mimics imaging software to develop a

three-dimensional image of the external ear was determined by this principle investigator to be the most appropriate method to replace the current earmold impression production method. Magics software by Martialise is a commercially available, three-dimensional image processing and editing software. This software imports images from scanning devices to a readable three-dimensional image. The software is compatible with Windows 2000 or XP software.

Current Status

In September 2004, Michelle L. Saltarelli, MS, the principle investigator (PI) of the Research Competitiveness Subprogram of the Board of Regents, initiated her doctoral studies in audiology at Louisiana Tech University. As a doctoral student she has stated collaborations with audiology and biomedical engineering faculty members for the development of an innovative, imaging device for the purpose of earmold impression production.

Barriers for Achieving Competitiveness

The main barrier against the PI achieving national competitiveness is being a doctoral student. Local and state agencies traditionally fund established professionals. National funding agencies (e.g., NSF) seek strong PI investigators. Collaboration with experienced professionals within the field of audiology who have been rewarded grants will assist the PI to overcome this barrier.

Plan for Achieving National Competitiveness

The principal investigator will pursue national competitiveness through the following strategic plan:

1. Initiate interuniversity collaboration between the biomedical engineering department and Department of Speech, as well as the mechanical engineering department. Use the newly revamped Audiology Clinic of Louisiana Tech University to conduct the experimental trials.
2. Lay the foundation for collaboration between the Audiology Clinic of Louisiana Tech University and national earmold manufactures.
3. Involve faculty and graduate students to further develop their professional careers.

Research Plan

Relationship of the Study to the Present State of Knowledge. Currently there is no technological method which uses a medical device to scan the outer ear (i.e., pinna and external auditory canal) for the formation of an earmold. Earmolds and earmold impression production have been available to audiologists and hearing aid dispensers since the 1920s (Microsonic, 1998). The materials (i.e., powder and liquid solutions versus silicone materials) have evolved with time; however, the method has undergone little change. Dillon (2001) has provided a detailed explanation of the current earmold impression method.

The current earmold impression method defined by Dillon (2001) involves eight steps taking approximately 15 minutes for completion. First, the audiologist inspects the pinna and ear canal using an otoscope. A clean, clear pinna and ear canal with little to no wax are optimal for earmold impression production. Second, the audiologist inserts a canal block using an otolight. The canal block is a small piece of cotton, wool, or foam which prevents the impression material from adhering to the tympanic

membrane (i.e., eardrum). Third, the audiologist mixes the impression material using a clean surface or disposable pad and spatula. The impression material may be a mixture of powder acrylic and liquid or paste.

Fourth, using a syringe the audiologist injects the impression material in the ear canal, and concha and helix of the pinna in one continuous motion. Beginning with the ear canal the audiologist pulls the pinna up and back for a deeper syringe insertion. Once the concha is filled and the impression material is slightly overflowing, syringing is complete. The fifth step requires a 7-10 minute wait until the material is dry. This wait time varies depending on the level of humidity. Sixth, the audiologist removes the hardened impression material. The patient is instructed to open and close her jaw several times as the audiologist pulls the patient's pinna in several directions to break the bond between the impression and skin.

Seventh, using the otoscope the audiologist inspects the ear. This step ensures that no material is left behind and the skin remains intact. Eighth, the audiologist completes a visual and tactile inspection of the impression to ensure impression quality. Upon completion, the appropriate infection control methods (e.g., autoclave) are employed for sterilization of the instruments. This current method of earmold impression is not only used by hearing aid companies to produce custom hearing aids but also by manufacturers for non-acoustic purposes (e.g., swimmers' plugs and hearing protection).

According to Pirzanski and Berge (2002), the current method and quality of earmold impression production has been significantly varied among audiologists resulting in poor fits and a 50% return rate for hearing aid shell remakes. A second issue

with current earmold techniques is infection control. Devising an innovative, less invasive technique to obtain measurements for hearing aid shell production would eliminate the risk of infectious disease transmission. A third issue with current earmold impressions is the liability associated with this procedure. In a technical report submitted by the American Speech, Language, and Hearing Association in 1994 reviewed professional liability and risk management in the profession of Audiology. The findings indicated that hearing aids including the earmold impression production were the second highest cause for malpractice claims. This report supports the need for a noninvasive, innovative technique to obtain appropriate measurements for hearing aid shell productions.

Specific Aims and Research Methods and Limitations of the Study The overall goal of this research is to develop a noninvasive, innovative technique to obtain appropriate measurements for hearing aid shell or custom earmold productions. The specific aims of the proposed study are:

1. Evaluate the effectiveness of reverse engineering which incorporates infrared imaging to scan the outer ear (pinna and ear canal) of a Knowles Electronic Manikin for Auditory Research (KEMAR) in conjunction with RSM software.

The KEMAR is a research tool consisting of a head and torso which allows reproducible measurements of the head and ear canal. The development of the KEMAR was based on average male and female outer and middle ear measurements. Infrared images will be taken of the KEMAR's outer ears to test the appropriate depth of the infrared camera to capture an image with the appropriate resolution.

Involvement and Qualifications of Investigators, Other Faculty, and Students

Principle Investigator: Michelle L. Saltarrelli will be the principle investigator throughout the study. She will develop work schedules, develop the experimental design, device/study development, supervise students, and supervise experimental progress. At least 50% of her time will be devoted to the research project.

Graduate Students: Doctoral students will be involved in the progression of this study. They will be responsible for conducting the experimental studies. The graduate students will also be responsible for producing presentations/publications based on their results.

Institutional Capabilities and Commitment. The Louisiana Tech University Speech and Hearing Center is a self-sufficient clinical laboratory which possesses community networks with surrounding schools and medical clinics. The Speech and Hearing Center contributes to Louisiana's economy via the medical, outpatient clinic. The center offers the facilities and man power necessary to conduct the research study. The Speech and Hearing Center, faculty, and students are committed to the professional development which this research would provide to the profession of Audiology.

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Budget and Budget Narrative

Fiscal Year 2008-2009;

Project Year One

Title of Proposed Research: Integration of Medical Technology for the Purpose of Earmold Production in the Field of Audiology

Principal Investigator(s): Michelle L. Saltarrelli, MS

Institution(s) of Higher Education: Louisiana Tech University

	Support Fund Money Requested	Institutional Match	Private Sector/ Other Match
A. Salaries			
1. Research	\$8,000	\$8,000 in kind	\$0
2. Clerical	\$0	\$0	\$0
3. Subtotal	\$8,000	\$8,000 in kind	\$0
4. Fringe Benefits	\$0	\$0	\$0
5. Graduate Asst.	\$5,000	\$5,000 in kind	\$0
6. Student(s)	\$0	\$0	\$0
7. Subtotal A	\$13,000	\$13,000	\$0
B. Supportive Expenses			
1. Travel	\$1,000	\$0	\$0
2. Supplies	\$0	\$0	\$0
3. Consultants	\$0	\$0	\$0
4. Rentals	\$0	\$0	\$0
5. Printing	\$500	\$0	\$0
6. Equipment	\$15,000	\$7,500 cash	\$0
7. Other Expenses (Identify)	\$0	\$0	\$0
8. Subcontracts	\$0	\$0	\$0
9. Subtotal B	\$16,500	\$7,500	\$0
C. Overhead			
1. (25% of A.7)	\$3,250	\$3,250	\$0
Total Project Cost	\$29,500	\$20,500	\$0

Budget Justification, Year One: Support Requested

- A.1. \$8,000: Summer salary for secondary investigator assisting the PI.
- A.3. \$8,000: Subtotal of \$8,000 +\$0.
- A.5. \$5,000: Funding for P.I., a doctoral student.
- A.7. \$13,000: Subtotal of \$8,000 + \$5,000.
- B.1. \$1,000: Travel to national conference to report results from year one.
- B.5. \$500: Amount needed for journal publication submission.
- B.6. \$15,000: combined cost of infrared camera and Magics imaging software
- B.9. \$16,500: Subtotal of \$1,000 + \$500 + \$15,000.

Budget Justification, Year One: Institution Match

- A.1. \$8,000: Summer salary for secondary investigator assisting the PI.
- A.3. \$8,000: Subtotal of \$8,000 +\$0.
- A.5. \$5,000: Funding for P.I., a doctoral student.
- A.7. \$13,000: Subtotal of \$8,000 + \$5,000.
- B.6. \$7500: University match of 50% of equipment expenses.
- B.9. \$7500: Subtotal \$7500 + \$0.

Fiscal Year 2009-2010; Project Year Two

Title of Proposed Research: Integration of Medical Technology for the Purpose of
Earmold Production in the Field of Audiology

Principal Investigator(s): Michelle L. Saltarrelli, MS

Institution(s) of Higher Education: Louisiana Tech University

	Support Fund Money Requested	Institutional Match	Private Sector/ Other Match
A. Salaries			
1. Research	\$8,000	\$8,000 in kind	\$0
2. Clerical	\$0	\$0	\$0
3. Subtotal	\$8,000	\$8,000 in kind	\$0
4. Fringe Benefits	\$0	\$0	\$0
5. Graduate Asst.	\$5,000	\$5,000 in kind	\$0
6. Student(s)	\$0	\$0	\$0
7. Subtotal A	\$13,000	\$13,000	\$0
B. Supportive Expenses			
1. Travel	\$1,000	\$0	\$0
2. Supplies	\$0	\$0	\$0
3. Consultants	\$0	\$0	\$0
4. Rentals	\$0	\$0	\$0
5. Printing	\$500	\$0	\$0
6. Equipment	\$0	\$0	\$0
7. Other Expenses (Identify)	\$0	\$0	\$0
8. Subcontracts	\$0	\$0	\$0

9. Subtotal B	\$1,500	\$0	\$0
C. Overhead			
1. (25% of A.7)	\$3,250	\$3,250	\$0
Total Project Cost	\$14,500	\$13,000	\$0

Budget Justification, Year Two: Support Requested

- A.1. \$8,000: Summer salary for secondary investigator assisting the PI.
- A.5. \$5,000: Funding for P.I., a doctoral student.
- A.7. \$13,000: Subtotal of \$8,000 + \$5,000.
- B.1. \$1,000: Travel to national conference to report results from year two.
- B.5. \$500: Amount needed for journal publication submission.
- B.9. \$1,500: Subtotal of \$1,000 + \$500.

Budget Justification, Year Two: Institution Match

- A.1. \$8,000: Summer salary for secondary investigator assisting the PI.
- A.3. \$8,000: Subtotal of \$8,000 + \$0.
- A.5. \$5,000: Funding for P.I., a doctoral student.
- A.7. \$13,000: Subtotal of \$8,000 + \$5,000.

Fiscal Year 2010-2011; Year Three

Title of Proposed Research: Integration of Medical Technology for the Purpose of
Earmold Production in the Field of Audiology

Principal Investigator(s): Michelle L. Saltarrelli, MS

Institution(s) of Higher Education: Louisiana Tech University

	Support Fund Money Requested	Institutional Match	Private Sector/ Other Match
A. Salaries			
1. Research	\$0	\$0	\$0
2. Clerical	\$0	\$0	\$0
3. Subtotal	\$0	\$0	\$0
4. Fringe Benefits	\$0	\$0	\$0
5. Graduate Asst.	\$5,000	\$5,000 in kind	\$0

6. Student(s)	\$0	\$0	\$0
7. Subtotal A	\$5,000	\$5,000	\$0
B. Supportive Expenses			
1. Travel	\$1,000	\$0	\$0
2. Supplies	\$0	\$0	\$0
3. Consultants	\$0	\$0	\$0
4. Rentals	\$0	\$0	\$0
5. Printing	\$500	\$0	\$0
6. Equipment	\$0	\$0	\$0
7. Other Expenses (Identify)	\$0	\$0	\$0
8. Subcontracts	\$0	\$0	\$0
9. Subtotal B	\$1,500	\$0	\$0
C. Overhead			
1. (25% of A.7)	\$1,250	\$1,250	\$0
Total Project Cost	\$6,500	\$5,000	\$0

Budget Justification, Year Three: Support Requested

- A.5. \$5,000: Funding for P.I., a doctoral student.
- A.7. \$5,000: Subtotal of \$5,000 + \$0.
- B.1. \$1,000: Travel to national conference to report results from year two.
- B.5. \$500: Amount needed for journal publication submission.
- B.9. \$1,500: Subtotal of \$1,000 + \$500.

Budget Justification, Year Three: Institution Match

- A.5. \$5,000: Funding for P.I., a doctoral student.
- A.7. \$5000: Subtotal of \$5,000 + \$0.

Composite

Title of Proposed Research: Integration of Medical Technology for the Purpose of
Earmold Production in the Field of Audiology

Principal Investigator(s): Michelle L. Saltarrelli, MS

Institution(s) of Higher Education: Louisiana Tech University

	Support Fund Money Requested	Institutional Match	Private Sector/ Other Match
A. Salaries			
1. Research	\$16,000	\$16,000 in kind	\$0
2. Clerical	\$0	\$0	\$0
3. Subtotal	\$16,000	\$16,000 in kind	\$0
4. Fringe Benefits	\$0	\$0	\$0
5. Graduate Asst.	\$15,000	\$15,000 in kind	\$0
6. Student(s)	\$0	\$0	\$0
7. Subtotal A	\$31,000	\$31,000	\$0
B. Supportive Expenses			
1. Travel	\$3,000	\$0	\$0
2. Supplies	\$0	\$0	\$0
3. Consultants	\$0	\$0	\$0
4. Rentals	\$0	\$0	\$0
5. Printing	\$1,500	\$0	\$0
6. Equipment	\$15,000	\$7,500 cash	\$0
7. Other Expenses (Identify)	\$0	\$0	\$0
8. Subcontracts	\$0	\$0	\$0
9. Subtotal B	\$19,500	\$7,500	\$0
C. Overhead			
1. (25% of A.7)	\$7,750	\$7,750	\$0
Total Project Cost	\$50,500	\$38,500	\$0

Equipment

Description and Use

The equipment purchased with the rewarded funds will be an infrared camera and Materialise' Rapid Shell Modeling (RSM) software. For the purpose of this study, RSM software would be used to provide a three-dimensional scan of the external via data collected by an infrared camera.

Plan for Technical Operation and Maintenance

Michelle L. Saltarrelli and the assigned graduate student will maintain all equipment. Procedural protocols will be developed for the operation and upkeep of the equipment. The PI will also provide training to all individuals prior to use.

Justification of Need for Equipment

The equipment requested is needed to conduct this study to completeness. The infrared camera and RSM software will be used in conjunction with Louisiana Tech University Speech and Hearing Center's computers, Knowles Electronic Manikin for Auditory Research (KEMAR), and other necessary equipment to conduct the study.

Current and Pending Support

Name of Investigator: Michelle L. Saltarrelli

Status of Support: ___ Current ___ Pending ___ Submission Planned in Near Future

Project/Proposal Title:

Source of Support: None at this time

Award Amount (or Annual Rate): \$ _____ Period Covered: _____

Location of Activity:

Person-Months or % of Effort Committed to the Project: ___ Cal Yr ___ Acad ___ Summ

Status of Support: ___ Current ___ Pending ___ Submission Planned in Near Future

Project/Proposal Title:

Source of Support:

Award Amount (or Annual Rate): \$ _____ Period Covered: _____

Location of Activity:

Person-Months or % of Effort Committed to the Project: ___ Cal Yr ___ Acad ___ Summ

Biological Sketch

Identifying Information

Name: Michelle Liotta Saltarrelli

Position: Doctor of Audiology Candidate

Education

Institution and Location / Degree / Year Conferred / Field of Study

Southeastern Louisiana University, Hammond, LA / B.S. / 1998 / Speech, Language and Hearing

Southeastern Louisiana University, Hammond, LA / M.S. / 2001 / Communication Sciences and Disorders

Employment / Related Experience

2004-Present Louisiana Tech University Doctoral Assistant: Assisted professors with their hearing science research

2004-2006 Louisiana Tech Speech and Hearing Center, Ruston, LA: Provided audiological services including the production of earmold impressions under the supervision of certified audiologists.

Summer 2006 Green Clinic, Ruston, LA:

Winter 2006 The Ear, Nose, and Throat Center, Shreveport, LA: Provided diagnostic audiology services and rehabilitative audiology which includes the production of earmold impressions for hearing aid dispensing.

2006-2007 Louisiana State University Health Sciences Center Shreveport, LA: Provided diagnostic audiological services and rehabilitative audiological services.

Awards

Freshmen Honors Academic Scholarship

Sammy Genco Scholarship

Who's Who Among American Colleges and Universities

Green "S" Award

APPENDIX B

REQUEST FOR PROPOSAL

APPENDIX B
REQUEST FOR PROPOSAL
BOARD OF REGENTS SUPPORT FUND
RESEARCH AND DEVELOPMENT PROGRAM
FISCAL YEAR 2006-07

Request for Proposals, Number 2006-08

Guidelines for the Submission of
Research Competitiveness Subprogram (RCS)
Proposals
and
Industrial Ties Research Subprogram (ITRS) Proposals

(This RFP excludes the R&D Awards to Louisiana Artists and Scholars [ATLAS] Program.
The ATLAS

RFP is Number 2006-10.)

P. O. Box 3677
Baton Rouge, Louisiana
70821-3677
(225) 342-4253
www.laregents.org

(Revised 8-2006)

REQUEST FOR PROPOSALS, NUMBER 2006-08
Important Notices

1. **There will be no electronic submission of Board of Regents Support Fund proposals for the Research and Development (R & D) Program Research Competitiveness Subprogram (RCS) and Industrial Ties Research Subprogram (ITRS).** The use of the Louisiana Online Grant Administration Network (LOGAN) is an Internet/Web-based system that allows clients to conduct business electronically with the Louisiana Board of Regents (BoR). The use of LOGAN will only be used for the proposals being submitted under ATLAS.

Applicants must submit 1 original and 4 copies of the Notice of Intent and 1 original and 12 copies of the proposal by the RCS and ITRS Subprograms deadlines.

2. **Inquiries about this RFP**

In accordance with R.S. 39:1503, written and oral inquiries about this request for proposals (RFP) will be accepted until 4:30 p.m., October 1, 2006, or until 4:30 p.m. of the first working day following this date. No inquiry will be accepted--whether written or oral--after that date to ensure that all interested parties receive the same information.

3. **Suggestions for Improvements in this RFP**

The Board of Regents actively solicits constructive suggestions about ways in which this RFP can be improved. All such suggestions must be received no later than October 1 to be considered prior to the issuance of the next RFP.

4. **Board of Regents' Commitment to Reform-Based Undergraduate Education and Teacher Preparation**

At its May 22, 1997, meeting, the Board of Regents reaffirmed its commitment to the reform of undergraduate education and teacher preparation and encouraged all Support Fund program applicants to consider these priorities as they develop proposals. Further, Board staff will make all external reviewers aware of the Board's commitment to undergraduate reform and teacher preparation. Reviewers will be instructed that, when all else is equal, preference should be given to those proposals which emphasize, in a meaningful manner, reform-based undergraduate education and teacher preparation.

5. **Availability of the RFP on the Internet**

As part of the Board's ongoing effort to streamline RFPs, and to ensure that this document is as widely disseminated as possible while minimizing the number of paper copies that institutions must produce, this

RFP is available on the Internet: <http://www.laregents.org> under the main menu item, "Forms and RFPs."

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*Page 1: Board of Regents Support Fund, R & D RFP, FY 2006-07***I. GENERAL INFORMATION****A. BASIS OF AUTHORITY**

Article VII, Section 10.1 of the Louisiana Constitution established two funds in the State treasury: the Louisiana Education Quality Trust Fund (hereinafter referred to as the Trust Fund) and the Board of Regents Support Fund (hereinafter referred to as the Board of Regents Support Fund or the Support Fund). The Trust Fund was established with approximately \$550 million received from settlement of disputed oil and gas revenues generated in the so-called 8(g) stipulation of the Federal Outer Continental Shelf Lands Act. Twenty-five percent of the interest earned from investment of monies in the Trust Fund, as well as 25 percent of recurring 8(g) oil and gas revenues, will continue to be returned to the Trust Fund, until it reaches a cap of \$2 billion. Each fiscal year the remaining 75 percent of the interest earned and 75% of the recurring oil and gas revenues are placed in the Support Fund for appropriation by the Legislature.

B. PURPOSES OF THE BOARD OF REGENTS SUPPORT FUND

On an annual basis, Support Fund money is divided equally between the Board of Elementary and Secondary Education (BESE) and the Board of Regents (hereinafter referred to as the Board) for higher education. According to Article VII of the Constitution, the funds available for higher education from the Support Fund are to be utilized ". . . as that money is appropriated by the Legislature and allocated by the Board of Regents for any or all of the following higher educational purposes to enhance economic development:"

- i. the carefully defined research efforts at public and private universities in Louisiana;
- i. the endowment of chairs for eminent scholars;
- ii. the enhancement of the quality of academic, research, or agricultural departments or units within a university; and,
- iii. the recruitment of superior graduate students.

The Article further stipulates that "The monies appropriated by the Legislature and disbursed from the Support Fund shall not . . . displace, replace, or supplant other appropriated funding for higher education . . ."

Reflecting these Constitutional mandates, the Board of Regents' "Policy for Administration of Funds Received from the Board of Regents Support Fund" (hereinafter referred to as the Board's Policy for Administration), adopted in October, 1986, affirms that awards in all categories will be based on the following considerations:

1. the potential for the award to enhance the overall quality of higher education in Louisiana; and
2. the potential for the award to enhance the economic development of the State.

C. R & D PROGRAM ADMINISTRATOR; QUESTIONS ABOUT THIS RFP

Specific questions concerning this RFP and the requirements set forth herein should be directed to Mr. John Wallin, Associate Commissioner for Sponsored Programs Administration; Ms. Zenovia Simmons, R & D Program Manager; or another member of the Board of Regents Support Fund Program staff at (225) 342-4253. In compliance with R. S. 39:1503, questions will be accepted and answered until October 1, 2006 (or until 4:30 p.m. of the first working day following this date). As soon as possible after that date, all questions asked about this RFP and all answers provided in response to these questions will be

transcribed and forwarded to all institutions of higher education from which notices of intent were received. No inquiries, whether oral or written, will be accepted after the deadline date to ensure that all interested parties receive the same information.

II. TYPES OF R & D SUBPROGRAMS

The Board of Regents Support Fund R & D Program consists of three components, the Research Competitiveness Subprogram

(RCS), the Industrial Ties Research Subprogram (ITRS), and the Awards to Louisiana Artists and Scholars (ATLAS). Potential

applicants should be aware that: (1) the requirements for research proposals vary, depending upon the subprogram in which they are

submitted; and (2) several sets of criteria have been established to evaluate these proposals. (See screening and in-depth evaluation forms for research proposals in Appendix C for the criteria that will be used to evaluate proposals submitted in each subprogram.)

III. THE RESEARCH COMPETITIVENESS AND INDUSTRIAL TIES RESEARCH SUBPROGRAMS**A. OBJECTIVES****Research Competitiveness Subprogram (RCS)**

The specific objective of the RCS is to solicit research proposals designed to build and strengthen the fundamental research base and competitiveness of Louisiana's universities. The proposed research must include fundamental (basic) research contributions rather than simply the application of existing knowledge.

The RCS is a stimulus program directed only toward those researchers who are at the threshold of becoming competitive on a consistent basis in the Federal R & D marketplace and who--with some assistance from the Support Fund to implement their plans to overcome whatever barriers they have identified which have stood in their way--clearly have a strong potential for enhancing their competitive status within a limited time span. For this reason, it is unlikely that researchers and/or research groups that are already established and heavily funded (unless they are moving into a new field of research and also fit the above criteria) would be highly competitive. Junior researchers at the threshold of becoming competitive will be given priority over senior researchers who are changing research fields.

Established researchers and/or research groups that are already competitive and heavily funded are strongly encouraged to participate in research proposals submitted to the RCS in an advisory capacity, but they shall not receive funding under this subprogram. Those individuals or groups that have no previous funding records, but who wish to submit a proposal, are strongly encouraged to join with researchers/research groups who do have a history of Federal basic research funding.

Applications from Non-Tenure-Track Faculty: Because the guiding principle governing the Support Fund programs is to support activities which will have a positive long-term impact on the State's economic and educational base, when other criteria are equal, those applications from investigators who have been hired by an institution to fill a tenure-track position are regarded by reviewers in a more favorable light than applications submitted by post-docs, research staff, or instructors. For this reason, faculty who hold part-time, research, or other non-tenure track faculty positions are strongly encouraged to provide evidence of their institution's longterm interest in their research efforts.

Industrial Ties Research Subprogram (ITRS)

The specific objective of the ITRS is to fund research proposals with significant near-term potential for development and diversification of Louisiana's economic base. Accordingly, all proposals submitted in this subprogram should show evidence of involvement of the private sector. Applicants who anticipate submitting proposals in non-science or non-engineering areas should see "NOTE" at the end of this section.

The ITRS is also a stimulus program. To be funded, proposals must provide evidence that the project will: (1) involve significant private-sector or Federal funding or, at a minimum, develop a plan to greatly increase the likelihood of receiving Federal or private-sector funding in the near future; or (2) result potentially in the enhancement or establishment of a Louisiana business or industry which will attract significant revenues to the State. All faculty at Louisiana institutions of higher education, including senior researchers, who have research ideas that might promote significant near-term economic development in Louisiana are encouraged

to apply.

NOTE: In the case of proposals in non-science and non-engineering areas (e.g., tourism), private sector involvement is not necessarily a requirement, if the applicant can justify the reason for lack of involvement. The stimulus/leveraging concept is relevant, however, and non-science/non-engineering proposals must, at a minimum: (1) present a plan to leverage Support Fund monies in the manner most appropriate to the proposal; and (2) demonstrate how they will promote and/or enhance economic development in the State.

B. ELIGIBILITY CONSIDERATIONS AND REQUIREMENTS

1. **ELIGIBLE FACULTY:** Only those individuals affiliated with an eligible Louisiana institution of higher education may act as principal or co-principal investigators. **An eligible faculty member may serve as a principal or co-principal investigator on no more than one RCS and/or two ITRS grants at any one time.** Individuals who are not employed by an eligible Louisiana institution of higher education (e.g., out-of-state scholars, scientists, and/or engineers or employees of industry) may serve as consultants on applications; however, they may not be listed as principal or other investigators and must not be cited on the cover page of the proposal. Section III.A of this RFP provides more information on the type of researcher targeted in each of the Support Fund R & D subprograms.

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2. **ELIGIBLE INSTITUTIONS:** The Board's Policy for Administration stipulates that all Louisiana public institutions of higher education and those independent institutions of higher education which are members of the Louisiana Association of Independent Colleges and Universities are eligible to compete under the Support Fund R & D Program.
3. **ELIGIBLE ACTIVITIES:** The Board's Policy for Administration further stipulates that "Both basic and applied research proposals that have the potential for contributing to the State's economic development will be considered." Potential applicants should be aware, however, that R & D program funds must be used for research. For example, proposals will not be considered that are designed only to: (1) keep museums and/or laboratories open; (2) add to collections; (3) fund conferences or workshops; (4) purchase instrumentation; (5) provide services; (6) provide money to support ongoing operating costs of existing or proposed programs, entities, or projects; or (7) support literature reviews and/or develop protocols.
4. **ELIGIBLE DISCIPLINES:**
 - a. **Research Competitiveness Subprogram:** In June of 1988, the Board of Regents adopted a ten-year Strategic Plan for Higher Education's Portion of the Louisiana Education Quality Support Fund, which was subsequently updated in 1993, 1999, and 2006. Table I, which is a part of the 2006 Strategic Plan, sets forth the years in which certain disciplines are eligible to participate. Potential applicants should note that: (1) the topic of the research proposal should be used to determine eligibility, not the academic training of the potential applicants; and (2) eligible disciplines for FY 2006-07 are listed under **GROUPS I and II.**

TABLE I: ELIGIBLE DISCIPLINES*
BOARD OF REGENTS SUPPORT FUND RESEARCH COMPETITIVENESS SUBPROGRAM

GROUP I - ELIGIBLE EVERY YEAR

Biological Sciences
Computer and Information Sciences**
Earth/Environmental Sciences

GROUP II - ELIGIBLE IN FYs 2006-07, 2007-08, 2010-11, 2011-12

Agricultural Sciences
Engineering A (Chemical, Civil, Electrical, etc.)
Mathematics
Physics/Astronomy
Social Sciences

GROUP III - ELIGIBLE IN FYs 2008-09, 2009-2010, 2012-13, 2013-14

Chemistry
Health and Medical Sciences
Engineering B (Industrial, Materials, Mechanical, etc.)

*See the attached listing of those sub-disciplines which are included in these larger groupings in Appendix A.

****The frequency of eligibility for "Computer and Information Sciences" was increased in the 1993 Strategic Plan to reflect the growing importance of this discipline for the State's economic development and diversification.**

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IMPORTANT NOTICE TO ITRS APPLICANTS:

- b. **Industrial Ties Research Subprogram:** The 1999 Strategic Plan states: ". . . Prior to 1993, proposal submissions were limited to those areas deemed to be of highest priority by the Louisiana Department of Economic Development. To insure that no viable opportunity for economic development and diversification would be overlooked, submissions were invited in all research areas from FY 1992-93 to FY 1999-2000. To align the Support Fund more closely with the State's emerging economic initiatives while also targeting scarce resources for maximum effect, a modified approach will be followed..... Beginning in FY 2000-2001, ITRS proposals will be accepted each year only from the areas identified by the BoR Industrial Targets Advisory Committee... ." That list is included at the end of Appendix A.

C. MONETARY LIMITATIONS

RCS: No applicant may seek more than a total of \$200,000 over a three-year period. Applicants should be aware, however, that the average first-year RCS award for FY 2005-06 was approximately \$45,922 with first-year awards ranging from \$22,294 to \$61,680. Also, because of the intense proposal pressure in this subprogram, applicants are advised that proposals with "high-end" budgets may be reduced or not funded.

ITRS: No applicant may seek more than \$350,000 over a three-year period. The total request for the first year may not exceed \$150,000, and the total request for each successive year may not exceed \$100,000. Applicants should be aware, however, that the average first-year ITRS award for FY 2005-06 was approximately \$60,333 with first-year awards ranging from \$55,000 to \$70,000.

D. PROJECT DURATION

No applicant may seek more than three years of support under the R & D subprograms.

E. FUNDS AVAILABLE

The Revenue Estimating Conference has projected that the FY 2006-07 Support Fund budget for higher education will be \$35,650,000. Depending upon interest rates, a maximum of \$1.935 million will be available for the first year's work of successful proposals submitted in the RCS and ITRS subprograms of the R & D Program. Of this amount, \$1,350,000 has been designated for new RCS projects and \$585,000 for new ITRS projects.

F. COST SHARING, MATCHING COMMITMENTS, AND INDIRECT COST RATE

An indirect cost rate of 25% will be permitted only on salaries, wages, and fringe benefits. The Board strongly encourages the sharing of costs for the proposed project through the acquisition of funds from external agencies and institutional support.

The amount and nature of the institutional cost-sharing commitment are considered direct evidence of: (1) the institution's desire to see the project implemented; and (2) its commitment to the proposed project's ultimate success. As a result, the awarding of a grant is influenced, in some measure, by the amount and nature of the institutional commitment. Institutions should also be aware that discounts received on equipment purchases are not eligible for inclusion as a part of the institutional match.

Potential applicants and university officials should note that institutional cost-sharing commitments are not taken lightly, either by the peer review panels of out-of-state experts who evaluate proposals or by the Board which makes final funding decisions. For this reason, the Board of Regents strongly encourages institutions of higher education to make only those commitments that they can realistically meet.

Applicants and their fiscal agents should be aware that cost sharing and matching commitments of any kind (e.g., private sector, federal, institutional) which are pledged in the proposal must be honored in full if the proposal is funded at the requested level.

Depending upon consultants' recommendations, matching commitments may have to be honored in full even if the award level is reduced. Support Fund money will not be forwarded until appropriate written assurances of all matches and cost sharing promised in the proposal have been received, reviewed, and approved by the Board's staff. Further, the required signature of the fiscal agent on the proposal cover page is a certification to the Board that the fiscal agent is aware of the claimed commitment(s) and has determined said commitment(s) to be consistent with all applicable guidelines, regulations, and/or statutes. Similarly, the fiscal agent's signature, which is required on the budget page(s) of funded projects, is a certification to the Board that commitments pledged in the proposal have been honored. All matching funds must meet the same tests of allowability as Support Fund money which is expended.

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IMPORTANT NOTICE TO ALL R & D APPLICANTS

All equipment requests under the R & D program must provide, on the appropriate budget page(s), a cash match equal to or greater than 25% of the cost of the requested equipment. For RCS proposals, a 25% equipment match must be provided by the applicant's employing institution. Review panels will have authority to recommend to the Board that any R & D application requesting funds for equipment, but lacking the required equipment match, be reduced or not funded.

IMPORTANT NOTICE TO ITRS APPLICANTS

All ITRS applicants are required to have an "up front" matching commitment from the private/federal sector for at least the first year of the request. (A plan to secure subsequent year matching commitments must be addressed in the budget section of the proposal.) If all other criteria are equal, it is likely that those applicants with strong matching commitments will fare better than those lacking these commitments. Grants, awards, and "in-kind" contributions received prior to June 1, 2006, may not be applied toward any matching commitments required during the contract term.

G. INSTITUTIONAL SCREENING COMMITTEE

The Board's Policy for Administration requires that proposals be carefully screened by a campus committee to ensure that no conflict of interest exists (as defined in the "Code of Governmental Ethics," R.S. 1950, Title 42, Chapter 15, as amended) and that only the most meritorious proposals from each campus, which meet objectives and eligibility requirements as defined in this RFP, are submitted to the Board.

Appropriate signatures on the cover page of the proposal are considered a guarantee that no conflict of interest exists and that the proposal: (1) has been reviewed and approved for submission to the Board by all appropriate institutional officials who regularly are required to review proposals submitted for external review, including the submitting organization's authorized fiscal officer; (2) has met the objectives and eligibility requirements of the subprogram in which it was submitted as described in this RFP; (3) is in the format required by the Board; and (4) where appropriate, has been reviewed by officials within a particular system to ensure that the proposal does not duplicate research currently or formerly funded on a member campus.

**H. ASSESSMENT OF PROPOSALS BY
OUT-OF-STATE EXPERTS**

The Board's Policy on Administration stipulates that "(Research) proposals forwarded to the Board of Regents will undergo a merit review by out-of-state experts in the priority areas." Considerable care will be taken to ensure that these reviewers are: (1) expert researchers in their fields; (2) impartial evaluators; and (3) selected, when appropriate, from both academic and non-academic settings.

A separate review is conducted for each of the R & D subprograms; however, the review process for both subprograms usually involves at least two stages:

1. Mail and Subject-Area Reviews

Out-of-state experts familiar with the area of research review each proposal. Mail reviewers are required primarily to assess:

- (a) the extent to which a given proposal meets the criteria of the particular subprogram under which it was submitted; and
- (b)

using national standards of excellence, the quality and relative merits of the proposed research and research plan. The final

panel uses these evaluations for informational purposes when determining final rankings. (See Appendix C for sample in-depth evaluation forms.)

2. Final Panel Evaluation

A team of out-of-state experts will prepare a report which ranks all proposals included in the mail review. In arriving at its conclusions, this panel considers the objectives and guidelines for the appropriate subprogram, the scores and comments from the mail reviewers, and any additional pertinent written comments. The final panel may suggest budgetary revisions as it deems necessary and appropriate, taking into consideration the recommendations of the mail reviewers.

In the case of the Industrial Ties Research Subprogram, the final panel may also consider certain information provided by economic development experts at the Louisiana Department of Economic Development (DED). These experts will be asked:

(1) to review certain portions of each proposal included in the mail review (the project summary and the information included in section VI.B.5.a, "Rationale of Project," of this RFP); and (2) to comment on the extent to which proposals appear to have

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significant potential for the development and/or diversification of Louisiana's economy. Applicants should note that the information provided by the DED is simply another piece of information that the final panel may or may not use in arriving at its decisions. Individuals from the DED do not convene with the final panel, nor are they involved in recommending projects for funding. Even though the DED may believe a project has high potential for economic development and/or diversification, the final panel is directed to disregard that information if it believes either that the project: (1) is not scientifically meritorious and technically feasible and sound; and/or (2) does not appear to have significant potential for economic development and/or diversification.

Because of administrative and budgetary constraints placed on the Board's staff, applicants should be aware that, if an exceedingly large number of applications is received, the Board reserves the right, through a preliminary screening by out-of-state experts, to determine which proposals are eligible to participate in the mail review. In this event, these out-of-state experts will assess whether each proposal fulfills the objectives and guidelines of the subprogram under which it was submitted. (See Appendix C for sample screening forms.) Proposals which receive average screening scores in the range of 70-100 will be reviewed by mail. Proposals which receive an average screening score of less than 70 will be eliminated from the competition.

NOTE: In light of matching requirements instituted in this RFP (i.e., a 25% of cost minimum cash match for all R & D equipment requests and an "up-front" private sector and/or federal match for ITRS proposals), R & D panels will be advised that, although they may not recommend that a higher level of matching commitment be required, they may--at their discretion--recommend that a project not be funded or be funded at a reduced level based on the amount of its matching commitments.

I. FINAL SELECTION OF PROPOSALS TO BE FUNDED

After receiving recommendations of out-of-state experts, the Board of Regents decides which proposals will be funded. **The Board of Regents staff, acting on behalf of the Board, sets documentary requirements for the processing and execution of contracts on proposals approved for funding by the Board.**

J. DEBRIEFING

Copies of rating forms completed by out-of-state experts will be mailed to affected applicants after the second week of July, 2007.

K. TIMETABLE

Contingent upon Board and Legislative action, the following schedule for submission, assessment, and approval of grants through the Support Fund R & D program will apply for FY 2006-07. **If the following date(s) falls either on Saturday, Sunday, or a holiday, the deadline(s) will be extended until 4:30 P.M. of the next working weekday:**

August 2006	Request for Proposals Issued
September 11, 2006	Notices of Intent Due
October 1, 2006	Last Day that Potential Applicants May Ask Questions About the RFP
October 31, 2006	Deadline for Receipt of ITRS Proposals in the Board's Offices

November 7, 2006	Deadline for Receipt of RCS Proposals in the Board's Offices
November 2006 - March 2007	Proposals Transmitted to and Reviewed by Out-of-State Experts
March or April 2007	Reports and Recommendations of Out-of-State Experts Forwarded to Institutions of Higher Education
April or May 2007	Final Actions by the Board; Award Letters Forwarded to Institutions
May and June 2007	Contracts Negotiated and Executed
July 2007	Dissemination of Debriefing Information

L. EVALUATION OF FUNDED PROJECTS AND REPORTS REQUIRED

The Board's Policy for Administration states that: "The Board of Regents will require that institutions receiving monies from the Support Fund report periodically on the utilization of these monies. All programs supported by the Fund will be reviewed at least annually. Data and information collected for review will vary depending upon the type of activity involved, but all information necessary to assess the effectiveness of each project will be gathered. As appropriate, the services of out-of-state consultants may be utilized in the evaluation process."

Periodically, the Board of Regents will conduct a comprehensive review and evaluation of each funded project. At a minimum, annual "Progress and Financial Status" reports will be required of the principal investigator.

M. PREVIOUS SUBMISSIONS AND REQUESTS FOR CONTINUATION FUNDING

1. **REQUIREMENTS FOR PREVIOUS APPLICANTS:** Submission of a notice of intent and a research proposal in a previous funding cycle does not relieve the applicant of the requirements set forth in this RFP of submitting another notice of intent and full proposals if he/she wants the same or a similar proposal to be considered in the current funding cycle. This rule holds true regardless of whether the proposal was among those that were considered meritorious and were recommended for funding by a peer review panel. The Board always receives far more research proposals that are worthy of funding than it can fund. Additionally, the fact that a proposal was recommended for funding in a previous year is not an indication that the proposal will automatically be funded in the next funding cycle, even if another notice of intent and full proposal are submitted.
2. **REQUESTS FOR CONTINUATION FUNDING:** Except for those principal investigators whose projects are currently being funded and to whom multi-year research contracts have been awarded, all principal investigators who received funding in the past for a particular research project and who want to continue that same project or a very similar project must submit another notice of intent and full proposal in the fiscal year in which they desire continuation funding. If the continuation request is for a project which has been completed, a copy of the final report must be attached to the full proposal. If the continuation request is for a project which is ongoing, the research proposal must contain a separate section which describes progress to date.

All continuation requests must compete on a one-to-one basis with all other projects submitted for funding consideration in the year in which the continuation request is submitted. If the proposal survives the screening process, out-of-state experts participating in the review panels will be told to base their funding recommendation on their evaluations of both the new proposal and the information concerning past progress, whether it be the final report provided by the principal investigator or a progress and financial status report provided by the Support Fund R & D Program staff. In addition, applicants who have received support through the RCS in the past should note that, because the RCS targets those researchers who show strong promise of becoming competitive for federal R & D money in three years or less, any request for continuation support must include a convincing explanation as to why the investigator is not yet competitive and must demonstrate how additional support will solve this problem.

IV. PROCEDURE AND DEADLINE FOR SUBMISSION OF NOTICES OF INTENT

Before a full proposal will be accepted, the applicant must first submit an original and four copies of the completed notice of intent

form for each research proposal to be submitted. (See Appendix B for Support Fund Form 8, "Notice of Intent.") Forward all notices of intent via U. S. Mail to:

Mr. John Wallin
Associate Commissioner for Sponsored Programs
Administration Louisiana Board of Regents
P. O. Box 3677
Baton Rouge, LA 70821-3677

or

**(delivered or Federal Expressed to 1201 N. Third St.,
Suite 6-200, Baton Rouge, LA 70802)**

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This form must be in the Board of Regents' office (not simply postmarked) by 4:30 P.M., September 11, 2007. One of the primary purposes of the notice of intent is to assist the Support Fund R & D Program staff in identifying potential reviewers. Failure to provide the required information on potential reviewers, as described on page 3 of the notice of intent form, including telephone numbers (FAX numbers and e-mail addresses are strongly encouraged also), may result in return of the notice of intent for noncompliance. In this event, the full proposal for which the notice of intent was filed will not be accepted.

NOTE: All rules, regulations, and limitations in the RFP for research proposals (e.g., limitations on the maximum amount of funds that may be requested per annum, the number of proposals that may be submitted per subprogram, etc.) also hold true for notices of intent.

V. PROCEDURE AND DEADLINE FOR SUBMISSION OF PROPOSALS

Full proposals must be submitted to Mr. Wallin at the address listed previously. Research proposals must be in the Board's office (not simply postmarked) by 4:30 P.M. on the appropriate due date set forth for the particular subprogram under which the application is being submitted as listed in section "III.K. Timetable" of this RFP. If the applicant wants assurance that his proposal was received, a self-addressed, stamped post card must be included with the proposal.

If necessary, the title of the proposed research and the amount of funds requested in the notice of intent may be changed slightly when the full proposal is submitted. If the title is changed, the old title must be placed in parentheses beneath the new title in the appropriate place on the cover page. The subprogram under which the proposal is submitted, however, must be the same as that under which the notice of intent was submitted.

VI. PROPOSAL REQUIREMENTS AND FORMAT

The following requirements and format for research proposals must be followed closely. Proposals which do not adhere to these guidelines will be returned to the applicant for noncompliance and will not be considered for funding in the year of submission.

A. GENERAL REQUIREMENTS AND STIPULATIONS

NOTE: The applicant is solely responsible for any reviewer misunderstandings that occur because of pages that are missing and/or not in correct order as a result of incorrect or inadequate fastening, or because of missing/incorrect information in other parts of the proposal, including the cover page.

1. **LIMITATION ON NUMBER OF RESEARCH PROPOSALS THAT MAY BE SUBMITTED:** An applicant may submit a maximum of one research proposal in the RCS and two research proposals in the ITRS, with the applicant listed as "Principal or Co-Principal Investigator"; however, the same proposal may not be submitted under both subprograms. An applicant may be listed as "Other Investigator" on additional proposals in either subprogram.
2. **NUMBER OF COPIES REQUIRED:** An original (with original signatures and supporting material, such as pictures) and twelve (12) copies of the research proposal are required.
3. **ADDENDA SUBMITTED BEFORE OR AFTER RECEIPT OF PROPOSAL:** Proposals submitted to the Board must be complete upon submission. No addenda (e.g., letters of support) will be accepted before or after receipt of the proposal.
4. **GENERAL FORMAT STIPULATIONS:** All sections of the proposal must be typed on plain, 8-1/2" x 11" white paper, with pages numbered and 1-inch margins at the top, bottom and on each side, in type no smaller than 12 pitch. The signed original and all copies should be printed only on one side of each sheet. All copies of the proposal must be fastened

securely and in a manner that makes them easily stackable with other proposals. The use of binder clips, plastic spiral binders, printed covers, etc., is strongly discouraged. The cover page must be the first page of the application.

5. **GUIDELINES FOR IDENTIFYING, LABELING AND CERTIFYING THE CONFIDENTIAL NATURE OF INFORMATION CONTAINED IN RESEARCH PROPOSALS:** Without assuming any liability for inadvertent disclosure and except for the purposes of evaluation, the Board of Regents will limit dissemination of, or access to, information certified to be of confidential or proprietary nature which falls into a category described by R.S. 44:4(16), as long as the following conditions and assurances have been met and guidelines have been followed:

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- (1) The information to be protected must accompany the full proposal but must be separately assembled, and each page of the information to be protected must be clearly and conspicuously identified and marked as confidential. Revisions, amendments, and addenda will not be accepted after the proposal and the packet of information to be protected have been submitted to the Board.
- (2) A letter must be attached to the packet of information to be protected which:
 - i. Briefly explains and certifies the need for confidentiality;
 - ii. Contains complete identification and mailing addresses of all entities (faculty or staff members, private or public concerns) which have a right to, or ownership of, the confidential information;
 - iii. In the case of public institutions of higher education, provides assurance that this request is in accordance with the rules and regulations adopted by the institution's management board with respect to R.S. 44:4(16);
 - and iv. Is signed by all entities identified in VI.A.5.b.ii.
- (3) The packet of information and the letter described in VI.A.5.a. and VI.A.5.b. must be reviewed by the chief administrator of the applicant's university or his/her designee, and he/she must certify in writing that the information is of a confidential or proprietary nature which falls into a category described by R.S. 44:4(16). This signed certification must accompany the packet of information to be protected and must be submitted simultaneously with the proposal.

A person or entity wishing access to documents and/or records as defined previously in this section may request such access by making a specific request to the researcher(s) and any other entity having a proprietary interest. Unanimity among all entities having a proprietary interest is required prior to release of information previously deemed confidential. In cases of denial of a request for access to protected information, the only recourse is an appeal through a court of law. The Board of Regents does not assume any liability for the release of protected information when the release is ordered in accordance with State or Federal laws.

6. GUIDELINES FOR PROPOSALS INVOLVING THE USE OF HUMAN SUBJECTS OR VERTEBRATE ANIMALS

- (1) **Use of Human Subjects.** Consistent with the relevant Federal policy known as the Common Rule for Behavioral and Social Science Research (*Federal Policy for the Protection of Human Subjects*, 45 CFR 690), Board-sponsored projects involving research with human subjects must ensure that they are protected from research risks. All proposals involving the use of human subjects either must have approval from the Institutional Review Board (IRB) before an award is made, or affirm that the IRB has declared the research exempt from continued oversight. Therefore, applicants are strongly encouraged to consult with their institutional IRB during proposal planning and preparation; and prior to proposal submission.
- (2) **Use of Vertebrate Animals.** Consistent with the requirements of the Animal Welfare Act [7 U.S.C. 2131 et seq] and the regulations promulgated thereunder by the Secretary of Agriculture [9 CFR, 1.1-4.11], the Board requires that proposed projects involving the use of vertebrate animals for research or education be approved by the submitting institution's Institutional Animal Care and Use Committee (IACUC) before an award can be made. Therefore, applicants are strongly encouraged to consult with their institutional IACUC during proposal planning and preparation.

For proposals involving the use of vertebrate animals, sufficient information should be provided within the fifteen-page

narrative and bibliography (see VI.B.5), or in the proposal appendix, to enable reviewers to evaluate the choice of species, number of animals to be used, and any necessary exposure of animals to discomfort, pain, or injury. **It is no longer necessary, however, to complete the process of IACUC approval unless and until the proposal is recommended for funding.**

If the proposal is recommended for funding, a letter of approval for intended human/animal protocols by the appropriate IRB or IACUC involving experiments (i.e., surveys, etc.) with human subjects and /or animal subjects **must** be provided prior to contract execution. Also, if applicable, any changes in protocols from that contained in the original proposal should also be indicated and accompany the assurance of IRB/IACUC approval.

B. SPECIFIC REQUIREMENTS AND FORMAT

1. **COVER PAGE:** The required cover page format is enclosed in Appendix B (Form 1-R&D). Each item on the cover page must be completed. The cover page (Form 1-R&D) **MUST** appear on the top (the first page) of the application.

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2. **PROJECT SUMMARY:** The project summary may contain a maximum of 250 words and must be provided in the format supplied by the Board. (See Appendix B, Form 2.) It should be a concise description of the project, containing a clear statement of objectives and an outline indicating how the project will operate. The project summary should also explain concisely why and how the proposed project has strong potential to meet the objectives of the subprogram under which it was submitted. Project summaries for ITRS projects must also describe and assess the technology transfer potential of the proposed project.

NOTE: The project summary of proposals submitted under the ITRS must also contain a copy of the information requested in VI.B.5.a of this RFP. This information may either be incorporated into the abstract itself or copied from the proposal and stapled to the abstract. If this information is not attached as a separate document, reviewers will be instructed to assume that it is contained within the abstract itself.

3. **TABLE OF CONTENTS:** List all sections and subsections of the proposal, including appendices.
4. **GOALS AND OBJECTIVES:** The final goal to be reached by the end of the grant period, as well as annual goals for any intervening years, must be clearly specified. Major changes in research programs and/or scientific personnel that can be expected when these goals are achieved must be described. This section of the proposal must be no longer than the equivalent of one, single-spaced, typewritten page.
5. **NARRATIVE AND BIBLIOGRAPHY:** The narrative must not exceed fifteen (15) single-spaced pages with a type size of 12 point or greater. Pages must have 1-inch margins and be numbered. Reviewers are not required to read additional narrative pages. Information applicable in several places may be referenced by page and paragraph. The narrative should conform to the following outline, including all major sections and subsections. If an item does not apply to the project, include the appropriate heading followed by "Does not apply." Proposal reviewers will assign points based on the quality and specificity of each section. For multi-institutional proposals, as appropriate throughout the narrative section, explain the multi-campus agreement in the context of shared funding, resources, arrangements by which the various institutions will share the benefits of the proposed project, and/or cost savings to the State. Also provide documentation in the proposal appendix describing the exact nature of the agreement between/among the institutions involved.

NOTE: The fifteen (15) page limit identified for the narrative does not include the bibliography. The bibliography shall not exceed two (2) pages.

a. Rationale of the Project

RCS Proposals Must Include:

- i. Assessment of potential for achieving national competitiveness, including current status and identification of barriers to achieving competitiveness.
- ii. A plan for achieving national competitiveness, including the specific strategies, actions, methods, and additional resources proposed to accomplish the stated goals.
- iii. If available, critiques of proposals submitted to Federal funding agencies (or other funding sources) should be appended to the proposal if they provide information that would help Support Fund evaluators assess either: (1) the potential competitive status of the applicant, in general; or (2) the potential competitive status of the same (or a very similar) proposal, in particular. Support Fund reviewers will be instructed to give additional consideration to those applicants and proposals for which such critiques indicate a high likelihood of success, contingent upon the applicant's overcoming certain barriers (e.g., collecting preliminary data).

ITRS Proposals Must Include:

- i. A description of the relationship of the proposed research to significant near-term economic development and/or diversification in Louisiana, including: a description of the target economic sector for which the research is proposed; potential for the proposed research to remedy problems identified in this economic sector; the manner in which the results will foster economic development or diversification (e.g., the transfer of research results, private sector/industrial linkages, etc.); and the potential impact of the research if successful (e.g., the research has a broad national/international market, would create new jobs, would allow for the stabilization of an existing industry, etc.).

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- ii. A detailed description of private sector/ industrial participation in the project, including past, scheduled, and potential scheduled or potential contacts with industry or the private sector. Contributions of funds, equipment, and services by the private sector on a past, scheduled, or potential basis must also be described in detail.
- iii. Identification of an existing industry that will utilize proposal results or of a new industry that will be created as a result of the proposed research.

In the case of non-science and non-engineering disciplines (e.g., tourism), the rationale should include a description of how the proposed research will enhance/promote economic development in the State. It is understood that the impact of the proposal may be direct or subtle, depending on its focus; however, to the extent feasible, applicants should respond to the items described in this section.

NOTE: The information provided in response to this section of the RFP (VI.B.5.a) must also be provided with the abstract of all ITRS proposals, either as an integral part of the abstract itself or as an attachment.

b. Research Plan

Both RCS and ITRS Proposals Must:

- i. Briefly summarize the expected significance, methods, limitations, and relationship of the study to the present state of knowledge in the field and to comparable work in progress elsewhere.
- ii. Provide a schedule of proposed activities within the grant period of three years or less, with benchmarks indicated throughout the proposed grant period.
- iii. Performance Measures: Indicate how the Board of Regents or other entity will determine whether your project has been a success and the degree to which it has achieve its goals.

RCS Proposals Must Also:

- iv. Include plans for publications and a description of how the level of competitive research achieved during the period of the Board's grant would be maintained after financing from the Support Fund ends.

ITRS Proposals Must Also:

- iv. Include projected mechanisms to transfer results of research to economic development or diversification. Additionally, where appropriate, a technology transfer certification describing the specific actions that have been taken to protect intellectual property and license the technology must be included. The certification must also indicate any spin-off companies that have been formed as a result of the project. This certification should be provided by the technology transfer officer or other appropriate administrative officers of the institution of higher education.

c. Involvement and Qualifications of Investigators, Other Faculty, and Students

Qualifications of investigators to undertake the proposed research should be indicated. A brief statement should be included that describes the responsibilities of each person involved, the amount of time/effort each person will devote to the project, whether release time will be given and, if so, the amount, type, and duration of release time. In particular, Research Competitiveness Subprogram proposals must clearly identify the role of, and salary request for, any

senior personnel.

A description of any supportive and/or interdisciplinary expertise needed to enhance the potential success of the research, including joint research activities with other researchers or research groups at the same or other institutions, must be included.

If funds for assistantships, postdoctoral appointments, visiting faculty, etc., are requested, their roles in accomplishing objectives of the program must be clearly identified.

d. Institutional Capabilities and Commitment

Institutional capabilities and commitment with respect to the proposed research must be described, including available facilities and major items of equipment especially adapted or suited to the proposed research.

e. Bibliography

6. **BUDGET AND BUDGET NARRATIVE:** (Also see Section III.F. of the RFP relative to cost sharing commitments, matching commitments, and indirect cost rates.)

The amount of Support Fund money requested for successive years of a research project should decrease either as researchers become consistently competitive in obtaining Federal funding in the case of the Research Competitiveness Subprogram, or as they are able to secure private sector funding in the case of the Industrial Ties Research Subprogram.

a. Format

A completed budget must be submitted on forms supplied by the Board. A justification page(s) must be attached to the budget page(s) which fully explains every item for which the expenditure of Support Fund money is proposed. **A full line item explanation of institutional cost sharing and/or matching support must also be included.** The formats for the budget and budget justification pages are enclosed as Form 5-R&D in Appendix B. If multi-year funding is requested, separate budget and budget justification pages must be completed for each year of the proposed project, and a cumulative budget must also be included.

NOTE: All matching funds for which the principal investigator has received a commitment from an external source and which are cited in the text of the application, must be listed on the budget page and explained in the budget justification section. This is especially crucial for applications submitted into the ITRS, where industrial/private sector support is an important consideration for funding.

b. Project Activation Date and Anticipated Date of Completion

The project activation date is June 1, 2007, and the termination date is no later than June 30 of the year in which the principal investigator envisions the project should terminate, not to exceed a total of three years.

c. Disallowed Budgetary Items

As indicated in Section I.B of this RFP, "Purposes of the Board of Regents Support Fund," Article VII, Section 10.1, of the Louisiana Constitution stipulates that "The monies appropriated by the Legislature and disbursed from the Support Fund shall not ... displace, replace, or supplant other appropriated funding for higher education" Applicants must

make a case in their proposals for why what they are proposing does not violate this stipulation. Applicants should also be aware that the Support Fund Program staff will make the final panel of out-of-state evaluators aware of this Constitutional prohibition, as well as the current economic climate for higher education in Louisiana. The panel will then be asked to develop recommendations relative to whether providing Support Fund money for specific proposals under serious consideration would violate this constitutional stipulation. Board of Regents Support Fund money may not be used to support regular, ongoing operating costs of existing or proposed programs, entities, or projects.

The scope of the Support Fund R & D Program also does not permit: (1) purchase of office furniture or routine office equipment (e.g., Fax machines); (2) construction of facilities; (3) maintenance of equipment, whether existing or

purchased through the Support Fund; (4) routine renovation, expansion in size, or upgrading; (5) paying faculty from the submitting university to train other faculty at the same university, or faculty at other universities who are a part of an interinstitutional project; or (6) similarly, the payment of honoraria to faculty, whether they are involved in or external to the proposal, to learn how to use Support Fund-purchased equipment. These expenditures (i.e., paying honoraria to faculty) are not allowable because the faculty professional development time in question should either be provided as part of the institutional match or donated by the faculty concerned.

Support may not be requested for shortfalls or deficits in budgets, scholarships or tuition, augmentation of salaries of individuals pursuing regularly assigned duties, or unspecified contingencies. Finally, funds may not be requested for proposed centers or institutes which require Board approval prior to their establishment which has not been previously approved by the Board of Regents.

Potential applicants should note that funds may be requested for foreign travel. If the project is funded, however, permission for foreign travel must be obtained from the Division of Administration, as stipulated in the State General Travel Regulations. Discounts received for equipment purchases are not eligible as part of the institutional match.

Only under exceptional circumstances may Support Fund dollars be used to support institutional memberships to business, technical, and/or professional organizations. Individual faculty memberships to any of the above are disallowed.

All costs for telephone, faxing, e-mail, telegraph, and postage are disallowed. Costs of printing annual/progress reports to the Board of Regents are disallowed.

d. Funds for Principal Investigators and Support Personnel

Principal Investigator(s) may request partial salary support at an annual amount not to exceed 25% academic year salary plus two months' summer support. **Requests for academic year salary support are to be based on the investigator's regular compensation for the continuous period which, under the policy of the institution concerned, constitutes the basis of the investigator's salary. Summer salary requests are to be at a monthly rate not to exceed the base salary divided by the number of months for which summer salary is to be paid.**

If funds for assistantships, postdoctoral researchers, visiting faculty, etc., are requested, their roles in accomplishing objectives of the program must be clearly identified, and the budget must clearly show the percentage of time they will be involved and the rate of pay. **The principal investigator must request the Board's prior approval to compensate support personnel, including postdoctoral research associates, research technicians, and/or graduate assistants, at higher levels than those requested in the proposal and/or specified by the funding stipulations for a grant.**

Current annual or academic year salaries (FY 2006-07) for principal and co-principal investigators and support personnel requesting salary support must be stated in the proposal. Moreover, if salary support is requested, the applicants must certify that: (1) Support Fund monies will not supplant State funds; and (2) full-time employees will not, under any circumstances, receive funds in excess of 100% of their regular salaries. Institutions are encouraged to supplement this amount, if necessary, in the form of an institutional match.

No-cost extensions granted by the Board will not entitle principal or co-principal investigators to rebudget funds for additional salary support.

e. Support for Graduate Education: Graduate assistant funding requested from the Board or pledged as an institutional and/or private match must be maintained in full if a proposal is recommended for funding. If suitable graduate students are unavailable, the principal investigator must request the Board's prior approval to rebudget these funds, and may use them for the support of postdoctoral researchers, technical personnel, and/or qualified student workers only.

Support Fund money may not be requested to pay fringe benefits for graduate assistants or graduate and undergraduate student workers. However, fringe benefits for graduate and/or undergraduate students may be provided as part of an institution's match.

f. Equipment

The Support Fund R & D program is not an equipment grants program. Equipment may be requested only in the context of the particular research initiative proposed and the request must contain, at a minimum, a cash match equal to or greater than 25% of the cost of the requested equipment. (NOTE: For RCS proposals, a 25% equipment match must be provided by the applicant's employing institution.) Applicants should note that, when all else is equal, priority will be given to proposals with a match greater than the minimum. If equipment is requested, the proposal must contain: (1) a description of the equipment, as well as who would use it and in what capacity; (2) a plan for shared use, if appropriate; (3) a plan for the technical operation and maintenance of the equipment both during the award period and after Support Fund award ends; and (4) a justification of need for the equipment.

7. **CURRENT AND PENDING SUPPORT/HISTORY OF SUPPORT:** Applicants **must** complete both the "Current and Pending Support" form, as well as the "History of Support" form (Forms 3 and 7, respectively, in Appendix B). The "History of Support" form must describe, at a minimum, the last five years of support.

NOTE: Where appropriate on either or both forms, applicants must include information [including the BoRSF contract number(s)] about all previous Support Fund awards received for which he or she was either the principal investigator or a coprincipal investigator. If such awards have been received, the applicant must either declare that this is a continuation proposal or explain thoroughly why this is not a continuation proposal and why it should not be required to conform to the requirements of Section III.M.2. of this RFP.

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8. **BIOGRAPHICAL SKETCH:** Biographical sketches for all key personnel and consultants (if appropriate) are limited to two pages. It is mandatory that Form 4 in Appendix B be used to provide this information.
9. **PROPOSAL APPENDIX:** Essential material supplementary to the text of the proposal should be included in a single appendix. The appendix must be referenced in the proposal narrative, and under no circumstances may the total page count for all materials exceed 15 pages. It is inappropriate to include institutional catalogues, departmental curricula, publications, video tapes, computer diskettes, other non-print items, or general material.
 - a. **Attachments/Supplemental Information**
All general supporting materials (e.g., charts, photos) to which reference is made in the narrative section must be clearly marked and included in this section.
 - b. **Letters of Support**
Although the applicant ultimately must decide whether letters of support are needed, their addition is strongly encouraged in instances where: (1) the support of industry is required to conduct the research; and (2) an agency (other than the applicant's employing institution) or a person (other than the project personnel) will assist or collaborate in the research in some manner. Either in the letter of support or in a separate statement, the extent to which the collaborating agency and/or individual will assist or collaborate must be made clear.

Additionally, if the agency or person is to be paid from money provided by the Support Fund, the rate of pay should be included in the budget justification. Letters of support that are forwarded to the Board's office separately from the full proposal--either before or after submission--will not be attached to the proposal.

NOTE: Letters of support indicating private-sector involvement are strongly encouraged for the Industrial Ties Research Subprogram applicants.

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APPENDIX A

**TAXONOMY OF DISCIPLINES FOR THE R & D
PROGRAM and BOARD OF REGENTS INDUSTRIAL
TARGETS ADVISORY COMMITTEE TARGET AREAS
FOR ITRS**

TAXONOMY OF
DISCIPLINES
USED
IN THE
BOARD OF REGENTS SUPPORT FUND PROGRAMS

NATURAL SCIENCES - BIOLOGICAL

Agriculture

- 0101 Agricultural Economics
- 0102 Agricultural Production
- 0103 Agricultural Sciences
- 0104 Agronomy
- 0105 Animal Sciences
- 0106 Fishery Sciences
- 0107 Food Sciences
- 0108 Forestry and Related Sciences
- 0109 Horticulture
- 0110 Resource Management
- 0111 Parks and Recreation Management
- 0112 Plant Sciences
(Except Agronomy, see 0104)
- 0113 Renewable Natural Resources
- 0114 Soil Sciences
- 0115 Wildlife Management
- 0199 Agriculture - Other

Biological Sciences

- 0201 Anatomy
- 0202 Biochemistry/Biophysics
- 0203 Biology
- 0204 Biometry
- 0205 Botany
- 0206 Cell and Molecular Biology
- 0207 Ecology
- 0208 Embryology
- 0209 Entomology and Parasitology
- 0210 Genetics
- 0211 Marine Biology
- 0212 Microbiology
- 0213 Neurosciences
- 0214 Nutrition
- 0215 Pathology
- 0216 Pharmacology
- 0217 Physiology
- 0218 Radiobiology
- 0219 Toxicology
- 0220 Zoology
- 0299 Biological Sciences - Other

NATURAL SCIENCES -BIOLOGICAL (CONTINUED)

Health and Medical Sciences

- 0601 Allied Health
- 0602 Audiology and Speech Pathology
- 0603 Chiropractic
- 0604 Dental Sciences
- 0605 Environmental Health
- 0606 Epidemiology
- 0607 Health Science Administration
- 0608 Immunology
- 0609 Medical Sciences
- 0610 Nursing
- 0611 Optometry
- 0612 Osteopathic Medicine
- 0613 Pharmaceutical Sciences
- 0614 Podiatry
- 0615 Pre-Medicine
- 0616 Public Health
- 0617 Veterinary Science
- 0699 Health and Medical Sciences - Other

NATURAL SCIENCES - PHYSICAL

Chemistry

- 0301 Chemistry, General
- 0302 Analytical Chemistry
- 0303 Inorganic Chemistry
- 0304 Organic Chemistry
- 0305 Pharmaceutical Chemistry
- 0306 Physical Chemistry
- 0399 Chemistry - Other

Physics and Astronomy

- 0801 Astronomy
- 0802 Astrophysics
- 0803 Atomic/Molecular Physics
- 0804 Nuclear Physics
- 0805 Optics
- 0806 Planetary Science
- 0807 Solid State Physics
- 0899 Physics and Astronomy - Other

NATURAL SCIENCES - COMPUTATIONAL

Computer and Information Sciences

- 0401 Computer Programming
- 0402 Computer Sciences
- 0403 Data Processing
- 0404 Information Sciences
- 0405 Microcomputer Applications
- 0406 Systems Analysis
- 0499 Computer Sciences - Other

Mathematical Sciences

- 0701 Actuarial Sciences
- 0702 Applied Mathematics
- 0703 Mathematics
- 0704 Probability and Statistics
- 0799 Mathematical Sciences - Other

NATURAL SCIENCES - EARTH/ENVIRONMENTAL

Earth, Atmospheric, and Marine Sciences

- 0501 Atmospheric Sciences
- 0502 Environmental Sciences
- 0503 Geochemistry
- 0504 Geology
- 0505 Geophysics and Seismology
- 0506 Paleontology
- 0507 Meteorology
- 0508 Oceanography
- 0599 Earth, Atmospheric, and
Marine Sciences - Other
- 4403 Environmental Design
- 4405 Landscape Architecture

ENGINEERING - A

Engineering - Chemical

- 1001 Chemical Engineering
- 1002 Pulp and Paper Production
- 1003 Wood Science
- 1099 Chemical Engineering - Other

Engineering - Civil

- 1101 Architectural Engineering
- 1102 Civil Engineering
- 1103 Environmental/Sanitary Engr.
- 1199 Civil Engineering - Other

ENGINEERING - A (CONTINUED)

Engineering - Electrical and Electronics

- 1201 Computer Engineering
- 1202 Communications Engineering
- 1203 Electrical Engineering
- 1204 Electronics Engineering
- 1299 Electrical and Electronics
Engineering - Other

ENGINEERING - B

Engineering - Industrial

- 1301 Industrial Engineering
- 1302 Operations Research
- 1399 Industrial Engineering - Other

Engineering - Materials

- 1401 Ceramic Engineering
- 1402 Materials Engineering
- 1403 Materials Science
- 1404 Metallurgical Engineering
- 1499 Materials Engineering - Other

Engineering - Mechanical

- 1501 Engineering Mechanics
- 1502 Mechanical Engineering
- 1599 Mechanical Engineering - Other

Engineering - Other

- 1601 Aerospace Engineering
- 1602 Agricultural Engineering
- 1603 Biomedical Engineering
- 1604 Engineering Physics
- 1605 Engineering Science
- 1606 Geological Engineering
- 1607 Mining Engineering
- 1608 Naval Architecture and
Marine Engineering
- 1609 Nuclear Engineering
- 1610 Ocean Engineering
- 1611 Petroleum Engineering
- 1612 Systems Engineering
- 1613 Textile Engineering
- 1699 Engineering - Other

SOCIAL SCIENCES

Anthropology and Archaeology

- 1701 Anthropology
- 1702 Archaeology

Economics

- 1801 Economics
- 1802 Econometrics

Law (5102)

Political Science

- 1901 International Relations
- 1902 Political Science and Government
- 1903 Public Policy Studies
- 1999 Political Science - Other

Psychology

- 2001 Clinical Psychology
- 2002 Cognitive Psychology
- 2003 Community Psychology
- 2004 Comparative Psychology
- 2005 Counseling Psychology
- 2006 Developmental Psychology
- 2007 Experimental Psychology
- 2008 Industrial and Organizational Psychology
- 2009 Personality Psychology
- 2010 Physiological Psychology
- 2011 Psycholinguistics
- 2012 Psychometrics
- 2013 Psychopharmacology
- 2014 Quantitative Psychology
- 2015 Social Psychology
- 2099 Psychology - Other

Sociology and Social Work

- 2101 Demography
- 2102 Sociology
- 5001 Social Work

Social Sciences - Other

- 2201 Area Studies
- 2202 Criminal Justice/Criminology
- 2203 Geography
- 2204 Public Affairs and 4801 Public Administration
- 2205 Urban Studies and 4406 Urban Design
- 2299 Social Sciences - Other
- 4401 Architecture
- 4402 City and Regional Planning
- 4404 Interior Design
- 5101 Interdisciplinary Programs

SOCIAL SCIENCES (CONTINUED)

Communications

- 4501 Advertising
- 4502 Communications Research
- 4503 Journalism and Mass Communication
- 4504 Public Relations
- 4505 Radio, TV and Film
- 4506 Speech Communication
- 4599 Communications - Other

Home Economics

- 4601 Consumer Economics
- 4602 Family Relations
- 4699 Home Economics - Other

Library and Archival Sciences

- 4701 Library Science
- 4702 Archival Science

ARTS

Arts - History, Theory, and Criticism

- 2301 Art History and Criticism
- 2302 Music History, Musicology, and Theory
- 2399 Arts - History, Theory, and Criticism - Other

Arts - Performance and Studio

- 2401 Art
- 2402 Dance
- 2403 Drama/Theater Arts
- 2404 Music
- 2405 Design
- 2406 Fine Arts
- 2499 Arts - Performance and Studio - Other

Arts - Other

- 2999A Arts - Other
- 5101A Interdisciplinary Programs

HUMANITIES

English Language and Literature

- 2501 English Language and Literature
- 2502 American Language and Literature
- 2503 Creative Writing
- 2599 English Language and Literature - Other

HUMANITIES (CONTINUED)

Foreign Language and Literature

- 2601 Asiatic Languages
- 2602 Foreign Literature
- 2603 French
- 2604 Germanic Languages
- 2605 Italian
- 2606 Russian
- 2607 Semitic Languages
- 2608 Spanish
- 2699 Foreign Languages - Other

History

- 2701 American History
- 2702 European History
- 2703 History of Science
- 2799 History - Other

Philosophy

- 2801 All Philosophy Fields

Humanities - Other

- 2901 Classics
- 2902 Comparative Language and Literature
- 2903 Linguistics
- 2904 Religious Studies; 4901 Religion; and 4902 Theology
- 2999H Humanities - Other
- 5101H Interdisciplinary Programs

EDUCATION

Education - Administration

- 3001 Educational Administration
- 3002 Educational Supervision

Education - Curriculum and Instruction

- 3101 Curriculum and Instruction

Education - Early Childhood

- 3201 Early Childhood Education

Education - Elementary

- 3301 Elementary Education
- 3302 Elementary-level Teaching Fields

EDUCATION (CONTINUED)

Education - Evaluation and Research

- 3401 Educational Statistics and Research
- 3402 Educational Testing Evaluation and Measurement
- 3403 Educational Psychology
- 3404 Elementary and Secondary Research
- 3405 Higher Education Research

Education - Higher

- 3501 Educational Policy
- 3502 Higher Education

Education - Secondary

- 3601 Secondary Education
- 3602 Secondary Level Teaching Fields

Education - Special

- 3701 Education of the Gifted
- 3702 Education of the Handicapped
- 3703 Education of Special Learning Disabilities
- 3704 Remedial Education
- 3799 Other Special Education Fields

Education - Student Counseling and

- Personnel Services
- 3801 Personnel Services
- 3802 Student Counseling

Education - Other

- 3901 Adult and Continuing Education
- 3902 Bilingual/Crosscultural Education
- 3903 Educational Media
- 3904 Junior High/Middle School Education
- 3905 Pre-Elementary Education
- 3906 Social Foundations
- 3907 Teaching English as a Second Language/Foreign Language
- 3999 Other Education Fields

BUSINESS**Accounting**

- 4001 Accounting
- 4002 Taxation

Banking and Finance

- 4101 Commercial Banking
- 4102 Finance
- 4103 Investments and Securities

Business, Administration and Management

- 4201 Business Administration and Management
- 4202 Human Resource Development
- 4203 Institutional Management
- 4204 Labor/Industrial Relations
- 4205 Management Science
- 4206 Organizational Behavior
- 4207 Personnel Management
- 4299 Business Management - Other

Business - Other

- 4301 Business Economics
- 4302 International Business Management
- 4303 Management Information Systems
- 4304 Marketing and Distribution
- 4305 Marketing Management and Research
- 4399 Business Fields - Other

**BOARD OF REGENTS
INDUSTRIAL TARGETS ADVISORY COMMITTEE**

TARGET AREAS FOR ITRS

- * Medical and Biomedical
- * Micromanufacturing
- * Data and Telecommunications
- * Environmental Technologies
- * Food Technologies
- * Materials
- * Existing Principal Industries, such as petrochemicals and
agribusiness
- * Louisiana Culture and History

APPENDIX B

PROPOSAL SUBMISSION FORMS

- Form 1:** R&D Cover Page
- Form 2:** Project Summary
- Form 3:** Current and Pending Support
- Form 4:** Biographical Sketch
- Form 5:** R&D Budget
- Form 7:** History of Support
- Form 8:** Notice of Intent

COVER PAGE FOR RESEARCH AND DEVELOPMENT PROPOSALS

BOARD OF REGENTS SUPPORT FUND, FY 2006-07

1. R & D Subprogram: <input type="checkbox"/> Research Competitiveness Subprogram (RCS) (check one) <input type="checkbox"/> Industrial Ties Research Subprogram (ITRS)		(For Board of Regents' Use Only) Application Number:	
2. Name(s) of Submitting Institution(s) of Higher Education: (Include Branch/Campus/Other Components)			
3. Address of Institution of Higher Education: (Include Dept./Unit, Street Address/P.O. Box Number, City, State, Zip Code)			
4. Title of Proposed Project:			
5. Proposed Duration: (Circle # of Yrs.) 1 2 3		6. Total Funds Requested: \$	
		7. Total Funds Requested By Year: 1st: \$ 2nd: \$ 3rd: \$	
8. FOR RCS PROPOSALS ONLY: Category In Which Proposal Is Submitted: (check one) <input type="checkbox"/> Agricultural Sciences <input type="checkbox"/> Engineering A <input type="checkbox"/> Biological Sciences <input type="checkbox"/> Mathematics <input type="checkbox"/> Computer/Information Sciences <input type="checkbox"/> Physics & Astronomy <input type="checkbox"/> Earth/Environmental Sciences <input type="checkbox"/> Social Sciences		9. FOR ITRS PROPOSALS ONLY: a. Using the Taxonomy in Appendix A of the RFP, list the 3 disciplines/subdisciplines which most closely reflect the subject material of this proposal: _____ b. For purposes of external evaluation, this proposal is in a : (check one) <input type="checkbox"/> scientific or engineering discipline <input type="checkbox"/> non-scientific or non-engineering discipline	
10. This Proposal Is a: (check one) <input type="checkbox"/> New Request <input type="checkbox"/> Request for Continuation of a Previously-Funded Support Fund Project If a CONTINUATION, provide previous contract number:			
11. Does This Proposal Contain Confidential or Proprietary Information Which Falls Into a Category Described in R.S. 44:4(16)? <input type="checkbox"/> YES <input type="checkbox"/> NO (NOTE: If YES, proposal MUST be appropriately marked.) By signing and submitting this proposal, the signators are certifying that: (1) the proposed research has not already been funded/is not currently being funded/has not been promised funding; (2) this proposal has been approved by an Institutional Screening Committee; and (3) the institution and the proposed project are in compliance with all applicable Federal and State laws and regulations, including, but not limited to, the required certifications set forth in: (a) Grants for Research and Education in Science and Engineering, NSF Grant Proposals Guide (GPG), NSF 03-2, effective 10/1/02; and (b) 45CFR 620, Subpart F (Requirements for a Drug-Free Workplace).			
Name/Title (typed) Institution (if different from #2 above)		Dept./Telephone # FAX #, e-mail	Highest Degree/Year
Principal Investigator/Project Director:			Signature
Co-PI/PD:			
Other Investigator:			
Other Investigator:			
Campus Head/Authorized Campus Representative		Dean	Authorized Fiscal Agent
Name/Title: (typed)		Name/Title: (typed)	Name/Title: (typed)

Signature:

Signature:

Signature:

Date:

Telephone Number:

Date:

Telephone Number:

Date:

Telephone Number:

(Form 1-R&D, rev. 2006)

PROJECT SUMMARY

Name of Institution (Include Branch/Campus and School or Division)
Address (Include Department)
Principal Investigator(s)
Title of Project
Abstract (DO NOT EXCEED 250 WORDS)*

CURRENT AND PENDING SUPPORT
 (From ALL sources, including Board of Regents Support Fund)

The following information **MUST** be provided for each investigator and other senior personnel.
 Use additional sheets as necessary.

NAME OF INVESTIGATOR:

Status of Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future Contract Number/Proposal Title: Source of Support: Award Amount (or Annual Rate): \$ _____ Period Covered: _____ Location of Activity: Person-Months or % of Effort Committed to the Project: <input type="checkbox"/> Cal Yr <input type="checkbox"/> Acad <input type="checkbox"/> Summ
Status of Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future Contract Number/Proposal Title: Source of Support: Award Amount (or Annual Rate): \$ _____ Period Covered: _____ Location of Activity: Person-Months or % of Effort Committed to the Project: <input type="checkbox"/> Cal Yr <input type="checkbox"/> Acad <input type="checkbox"/> Summ
Status of Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future Contract Number/Proposal Title: Source of Support: Award Amount (or Annual Rate): \$ _____ Period Covered: _____ Location of Activity: Person-Months or % of Effort Committed to the Project: <input type="checkbox"/> Cal Yr <input type="checkbox"/> Acad <input type="checkbox"/> Summ
Status of Support: <input type="checkbox"/> Current <input type="checkbox"/> Pending <input type="checkbox"/> Submission Planned in Near Future Contract Number/Proposal Title: Source of Support: Award Amount (or Annual Rate): \$ _____ Period Covered: _____ Location of Activity: Person-Months or % of Effort Committed to the Project: <input type="checkbox"/> Cal Yr <input type="checkbox"/> Acad <input type="checkbox"/> Summ

Person-Months or % of Effort Committed to the Project: _____ Cal Yr _____ Acad _____ Summ

(Form 3, rev.2006)

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and consultants and collaborators. Begin with the Principal investigator/program director. Photocopy this page for each person.

NAME	POSITION TITLE
------	----------------

EDUCATION (Begin with baccalaureate or other initial professional education and include postdoctoral training.)

INSTITUTION AND LOCATION	DEGREE	YEAR CONFERRED	FIELD OF STUDY

RESEARCH AND PROFESSIONAL EXPERIENCE: Starting with present position, list, in reverse chronological order, previous relevant employment, experience, and honors.

Key personnel includes the principal investigator and any other individuals who participate in the development or execution of the project. Key personnel typically will include

all individuals with doctoral or other professional degrees, but in some projects will include individuals at the masters or baccalaureate level provided they contribute in a

substantive way to the development or execution of the project. Include present membership on any Federal Government public advisory committee. List, in reverse

chronological order, the titles, all authors, and complete references to pertinent publications during the past five years and to representative earlier publications pertinent to this

application.

DO NOT EXCEED TWO PAGES.

**BOARD OF REGENTS SUPPORT FUND
RESEARCH AND DEVELOPMENT PROGRAM, FISCAL YEAR 2006-07**

BUDGET
PROJECT YEAR (CIRCLE ONE):
1 2 3 COMPOSITE

Title _____ of _____ Proposed _____ Research: _____

Principal _____ Investigator(s): _____

Institution(s) _____ of _____ Higher _____ Education: _____

I. PROPOSED BUDGET:

	Support Fund Money Requested	Institutional Match*	Private Sector/ Other Match**
1. Research	\$ _____	\$ _____	\$ _____
2. Clerical			
3. Subtotal			
4. Fringe Benefits (% of A.3)			
5. Graduate Asst.			
6. Student(s)			
7. Subtotal A	\$ _____	\$ _____	

B. Supportive Expenses:

1. Travel	\$ _____	\$ _____
2. Supplies		
3. Consultants		
4. Rentals		
5. Printing		
6. Equipment***		
7. Other Expenses (Identify)		
a.		
b.		
8. Subcontracts		
9. Subtotal B	\$ _____	\$ _____

C. Overhead:

1. (25% of A.7)	\$ _____	\$ _____	\$ _____
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TOTAL PROJECT COST: \$ _____ \$ _____ \$ _____

*Stipulate whether in-cash or in-kind.

**The budget page(s) must reflect and the budget justification page(s) must explain any external funds that are claimed in the proposal. These funds must be itemized and their expenditure accounted for in the same manner as Support Fund money and institutional match. Refer to Section III.F of this RFP for details on ITRS matching requirements.

***A minimum 25% cash match is required for all equipment purchases using Support Fund dollars. For RCS proposals, the required equipment match must be from the applicant's employing institution. Discounts received for equipment purchases are not allowable match. as

II. BUDGET JUSTIFICATION: Attach a Budget Justification page to each budget page submitted with the proposal.

Each line item on the preceding budget page under "Support Fund Money Requested" must be itemized, fully explained, and justified. Each line item under AInstitutional Match@ and APrivate Sector/Other Match@ must also be itemized, explained, and justified.

Description of Proposed Equipment - If applicable, itemize and describe briefly the proposed equipment. Include the name, model number, and manufacturer(s).

III. FUTURE FUNDING PLAN: Attach the Future Funding Plan to the composite budget page. If having funds available after the proposed Board of Regents Support Fund award terminates is essential to the long-term success or feasibility of the project (e.g., equipment purchased with Support Fund money requires a continuing source of funds for operation and maintenance after the Support Fund award has terminated), the applicant must also provide a detailed plan for future funding of the proposed project, including the amounts needed per year for the various budget categories, and the anticipated source of these revenues.

Applicants must provide information (including LEQSF contract number) about all previous Board of Regents Support Fun awards received for which he/she was either the principal investigator or a coprincipal investigator. If such awards have been received, the applicant must either declare that this is a continuation proposal or explain thoroughly why this is not a continuation proposal and why it should not be required to conform to the requirements of this RFP.

NOTICE OF INTENT, FY 2006-2007

1. R&D Subprogram (check one) Research Competitiveness Subprogram (RCS)
 Industrial Ties Research Program (ITRS)

2. Title of Proposal

3. Name/ Title Dept/Institution/Telephone Highest Degree

Principal Investigator/ Project Director:

Co-PI/PD:

Other Investigator:

Other Investigator (Attach page, if more space needed)

4. Name(s) of Submitting Institution(s) of Higher Education:

5. Address of Institution of Higher Education

6. Total Support Funds

7. Support Funds Requested by Year:

Yr 1 \$ Yr 2 \$ Yr 3 \$ Yr 4 \$

8. Proposed Duration

9. FOR RCS NOTICES OF INTENT ONLY

Category in which proposal will be submitted: (check only one)

- Agricultural Sciences Engineering A
 Biological Sciences Mathematics
 Computer/ Information Sciences Physics & Astronomy
 Earth/Environmental Sciences Social Sciences

10. FOR ITRS NOTICES OF INTENT ONLY:

For purposes of external evaluation, this notice of intent is in a: (check one)

- Scientific or engineering discipline Non-scientific or non-engineering discipline

12. Will Proposal Contain Confidential or ProprietaryYES NO

Information Which Falls Into a Category Described in R.S. 44:4(16)? If Yes, and if any of the proprietary or confidential information is contained in the attachments to this Notice of Intent, the applicant must clearly mark—in the manner described in the current Support Fund R & D RFP—each page containing the information to be protected.

Notice of Intent

Support Fund R & D Program
Page 2 of 3

13. Using the taxonomy in Appendix A of the current Support Fund R & D RFP, identify the general field of your proposal and add as many more specific subfields within that field, as necessary, until you have identified the subfield as narrowly as you can. Numbers from the taxonomy also must be provided. This information may be used in identifying reviewers for your proposals.

14. Project Summary: (Do Not Exceed 250 words)

NOTE: Industrial Ties Research Subprogram applicants (in the Support Fund R&D Program) must also attach to this project summary a copy of the information required in VI.B.5.a of this RFP, or incorporate the information within the summary itself.

15. Provide names, titles, mailing addresses, telephone numbers, and, if possible, FAX numbers and e-mail addresses, for at least six—preferably eight—outstanding out-of-state (but not out of the continental United States) scholars in the specific field of your proposal who are qualified to evaluate your proposal and/or who can recommend other individuals who are qualified to evaluate your proposal. Notices of intent will be returned for non-compliance and not considered in the year of submission if the information required in this section of the notice of intent is not complete. Great care should be taken to identify prospective reviewers who do not have conflicts of interest with the applicant, as might occur with former research collaborators, students, or major professors. Reviewers from an institution where the applicant has taught or was a student should not be selected. In addition, although the Board cannot guarantee that certain reviewers will not be used, if the applicant believes certain individuals should not be asked to evaluate the proposal, their names, affiliations, and a brief explanation of the potential conflict must be provided. Attach additional pages as necessary to ensure that all required information is in legible form.

Name/Title (typed)

**Mailing Address
Telephone #**

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16. By signing and submitting this notice of intent, the signators are certifying that: (1) as required by R.S. 39:1498.2B (for public institutions of higher education only) (a) the proposed research is in accord with the policies and procedures promulgated by this university and its management board and (b) if the proposed research is funded, written notification of the agreement between the Contractor and the Board of Regents will be furnished to the appropriate management board; (2) no conflict of interest would exist if the individuals named above were selected to evaluate this proposal; and (3) the proposed research, if funded, will not duplicate research that has promised to be/is currently being/has been funded by any other source.

Signature(s) of Principal Investigator(s):

Date

Signature of Dean:

Date

Signature of Campus Head or Authorized Institutional Representative:

Date

(Form
8,
rev.200
6)

APPENDIX C

SAMPLE PROPOSAL EVALUATION FORMS

- Form 6.2: RCS Screening Form
- Form 6.3: RCS Mail Review Form
- Form 6.4: RCS Subject-Area Review Form
- Form 6.51: ITRS Screening Form (Science/Engineering Areas)
- Form 6.52: ITRS Screening Form (Non-Science/Non-Engineering Areas)
- Form 6.61: ITRS Mail Review Form (Science/Engineering Areas)
- Form 6.62: ITRS Mail Review Form (Non-Science/Non-Engineering Areas)

BOARD OF REGENTS SUPPORT FUND
SCREENING FORM FOR RESEARCH PROPOSALS
RESEARCH COMPETITIVENESS SUBPROGRAM, FY 2006-07

Proposal Number: _____ Principal Investigator: _____ Subject Area: _____

PLEASE NOTE: The higher the score, the more clearly the proposal satisfies the criterion under consideration.
ONLY THOSE PROPOSALS THAT RECEIVE AVERAGE SCORES OF 70 AND ABOVE WILL BE CONSIDERED FURTHER.

CRITERION I: STIMULUS TO COMPETITIVE RESEARCH (40 points)

- 1. The investigator clearly identifies barriers to achieving nationally competitive status in sponsored research. _____ of 10 points
- 2. The proposal includes a realistic plan to eliminate or reduce barriers to nationally competitive research. _____ of 10 points
- 3. The above plan will significantly improve the ability of the researcher(s) to compete nationally within three years. _____ of 20 points

CRITERION II: RELEVANCE TO FUNDAMENTAL RESEARCH (35 points)

- 1. The proposal seeks to develop fundamental knowledge, not simply apply it. _____ of 10 points
- 2. This is an important area of contemporary or future research to:
NSF ___ NIH ___ Defense ___ Energy ___ Agriculture ___ Interior ___
NOAA ___ NASA ___ Education ___ Other (name) _____ None _____ _____ of 10 points
- 3. The proposed research will provide an effective foundation on which the individual or department can build a successful program. _____ of 15 points

CRITERION III: POTENTIAL FOR SUCCESS (25 points)

- 1. The record of research accomplishments (some funding and publications) suggests strong potential for achieving a competitive status in acquiring Federal funding for fundamental research. List any participating investigators who either lack the potential to achieve national competitiveness or are already competitive: _____ of 15 points

- a. _____
- b. _____

- 2. Institutional commitment, support, and capabilities suggest high potential for success. _____ of 10 points

TOTAL POINTS: _____ of 100 points

OVERALL RECOMMENDATION CONCERNING FURTHER REVIEW OF THIS PROPOSAL (CHECK):

_____ Proposal clearly demonstrates strong potential for enhancing competitive status in the Federal & D marketplace within a three-year time span and certainly should be subjected to further in-depth review.

_____ As submitted, proposal should not be reviewed further because:

_____ It is inappropriate to the program. _____

_____ Although the research may have merit, the proposal does not assess barriers to competitive research and develop a plan to overcome them. _____

_____ The research may have some potential for enhancing competitive status; however, as
currently conceived and written, it does not appear to demonstrate strong potential for enhancing
competitive status in the Federal R & D marketplace within a three-year time span.

To the best of my knowledge, no conflict of interest is created as a result of my screening this research proposal.

Reviewer's Name: _____ Date: _____

Signature: _____

PLEASE PLACE COMMENTS ON BACK OF FORM

(rev. 2006)

Proposal Number _____ Principal Investigator _____ Subject Area _____
In-Depth Mail Review - RCS - FY 2006-07 Page 1 of 3

OUT-OF-STATE MAIL REVIEWERS' PROPOSAL EVALUATION FORM
DUE DATE:
BOARD OF REGENTS SUPPORT FUND
RESEARCH COMPETITIVENESS SUBPROGRAM (RCS)

DIRECTIONS: Review this form and the program guidelines prior to reading the proposal. The greater the number, the more clearly the proposal satisfies the criterion under consideration. Use the space provided to explain your ratings, especially on items given low ratings (e.g., 1 or 2). These comments will be particularly helpful to the expert panels who subsequently will review this application in conjunction with your evaluation. Attach additional pages as needed.

CRITERION I: POTENTIAL FOR ACHIEVING NATIONALLY COMPETITIVE STATUS AND EXISTING CAPABILITIES TO IMPLEMENT PROJECT

- | | Low | --- | High |
|--|-----|-----|-------|
| 1. The training, experience, and research accomplishments of the principal investigator(s) indicate that they are not yet nationally competitive, but may reasonably be expected to achieve nationally competitive status within the three-year period allowed.
List any investigators who either:
(a) lack the potential to achieve national competitiveness _____
or
(b) are already competitive _____ | 1 | 2 | 3 4 5 |
| 2. The likelihood and volume of federal funding for research in the field of the application is high. Identify agencies which would be interested in this area of research: (e.g., NSF) _____ | 1 | 2 | 3 4 5 |
| 3. The investigator clearly identifies barriers to achieving nationally competitive status in sponsored research. | 1 | 2 | 3 4 5 |
| 4. The proposal includes a realistic plan/strategy for eliminating or reducing barriers which will significantly improve the ability of the applicant to compete nationally by the end of the grant period. | 1 | 2 | 3 4 5 |
| 5. The institutional capabilities, commitment, and support suggest high potential for success. | 1 | 2 | 3 4 5 |
| 6. The proposed research provides an effective foundation on which the individual or department can build a successful program. | 1 | 2 | 3 4 5 |
| 7. (Answer Only If Applicable) _____
(a) The applicant is already an established investigator (as indicated in #1 above), but is moving into a new field of research in which he/she is not yet competitive; and
(b) The applicant has made a convincing case that the topic of this application is a significant departure from his/her past research and has addressed, in a meaningful manner, items 1-4 above. | 1 | 2 | 3 4 5 |
| 8. (Answer Only If Applicable) Critiques of proposals submitted to Federal funding agencies (or other funding sources) indicate a high likelihood of success, contingent upon the applicant's overcoming certain barriers (e.g., collecting preliminary data). | 1 | 2 | 3 4 5 |

Proposal Number _____ Principal Investigator _____ Subject Area _____
In-Depth Mail Review - RCS - FY 2006-07 Page 2 of 3

CRITERION II: SCIENTIFIC RIGOR OF THE PROPOSAL & ITS RELEVANCE TO FUNDAMENTAL RESEARCH

- | | | Low ----- High |
|----|--|----------------|
| 1. | The proposed research meets contemporary <u>national</u> standards of appropriateness, excellence, and innovation. | 1 2 3 4 5 |
| 2. | The proposal presents a well-conceived, technically sound, and feasible plan of research. | 1 2 3 4 5 |
| 3. | The proposal seeks to develop <u>fundamental knowledge</u> , not simply apply it. | 1 2 3 4 5 |
| 4. | There is a significant likelihood of new discoveries or fundamental advances within the field. | 1 2 3 4 5 |
| 5. | The proposed research will make a significant contribution to basic science. | 1 2 3 4 5 |
| 6. | The proposed research has a high potential for contributing to the quality or effectiveness of U.S. research. | 1 2 3 4 5 |

COMMENTS: (Attach additional pages, as needed)

Proposal Number _____ Principal Investigator _____ Subject Area _____
In-Depth Mail Review - RCS - FY 2006-07 Page 3 of 3

OVERALL RATING OF THIS PROPOSAL

POOR FAIR GOOD VERY GOOD EXCELLENT
____ _

OVERALL RECOMMENDATION TO THE SUBJECT-AREA PANEL

This proposal clearly demonstrates strong potential for enabling the principal investigator to achieve competitive status in the Federal R & D marketplace within a three-year time span and certainly should be considered further in the review process.

_____ As submitted, this proposal should not be recommended for funding

because:

_____ It is inappropriate to the program.

Although the research may have merit, the proposal does not assess barriers to competitive research and develop a plan to overcome them.

The research may have some potential for enhancing competitive status; however, as currently conceived and written, it does not appear to demonstrate strong potential for enhancing competitive status in the Federal R & D marketplace within a three-year time span.

_____ The training and experience of the principal investigator(s), as reflected in this proposal, do not suggest a high likelihood of achieving national competitiveness by the conclusion of the grant period.

ADDITIONAL COMMENTS

I agree to maintain in confidence any information, documentation and material of any kind (hereinafter referred to as "Material") included in this proposal; I further agree not to divulge, publish, file patent application on, claim ownership of, exploit or make any other use whatsoever of said "Material" without the written permission of the principal investigator. To the best of my knowledge, no conflict of interest is created as a result of my reviewing this research proposal.

Reviewer's _____ Name _____ and _____
Institution: _____ Reviewer's _____
Signature: _____ Date: _____

Proposal Number Principal Investigator
Subject-Area Panel Review - RCS - FY 2006-07
of 2

Subject Area

Page 1

SUBJECT-AREA PANEL PROPOSAL EVALUATION FORM

**BOARD OF REGENTS SUPPORT FUND
RESEARCH COMPETITIVENESS SUBPROGRAM (RCS)**

INSTRUCTIONS: The completed evaluation form should represent the consensus of the expert members of the subject-area panel and, as such, must reflect the final decisions of that panel. This form, along with other assessments, will be used by the Final Review Panel to determine whether a proposal merits funding. Review this form and the program guidelines prior to reading the proposal. The higher the score, the more clearly the proposal satisfies the criterion under consideration. Please provide comments in the appropriate places. Use additional sheets as necessary.

A. EXISTING CAPABILITIES TO IMPLEMENT PROJECT

- 1. Identification and substantiation of barriers to competitiveness of 10 points
- 2. Adequacy of institutional capabilities as base for building competitiveness of 5 points
- 3. Training, past performance, and potential of investigators of 10 points

Identify investigators listed in this proposal who are already established national competitors: (see pg. 2 of RFP)

Identify investigators listed in this proposal who lack potential to become national competitors:

B. SCIENTIFIC MERIT (Using national standards of excellence)

- 1. Technical soundness of 10 points
- 2. Likelihood of new discoveries or fundamental advances within field of 10 points
- 3. Impact on progress in this or other fields of 5 points
- 4. Contribution to basic science of 5 points
- 5. Utility or relevance of research to improved technology or society of 5 points
- 6. Potential for contribution to quality or effectiveness of U.S. research of 5 points

C. POTENTIAL FOR COMPETITIVENESS

- 1. Effectiveness of plan to overcome existing barriers of 10 points
- 2. Likelihood that funding of project will result in competitive status for Federal support of 10 points
Identify agencies: (e.g., NSF) _____
- 3. General funding prospects for this area of research by Federal agencies of 5 points
Identify agencies: (e.g., NSF) _____

D. APPROPRIATENESS OF BUDGET

- 1. Reasonable for scope of work to be performed of 4 points
- 2. Appropriate for personnel costs of 3 points
- 3. Appropriate for equipment/supply costs of 3 points

SUBTOTAL D: of 10 points

Proposal Number _____ Principal Investigator _____ Subject-Area _____
Subject-Area Panel Review - RCS - FY 2006-07 Page 2 of 2

OVERALL RATING OF PROPOSAL

POOR FAIR GOOD VERY GOOD EXCELLENT

CONSENSUS RECOMMENDATION AND COMMENTS OF THE SUBJECT-AREA PANEL

Directions: *Please summarize the conclusions of the subject-area panel with regard to this proposal. Be sure to address any differences in opinion the panel may have had with the mail reviewer(s).*

COMMENTS ON SECTION A:

COMMENTS ON SECTION B:

COMMENTS ON SECTION C:

COMMENTS ON SECTION D:

I agree to maintain in confidence any information, documentation and material of any kind (hereinafter referred to as "Material") included in this proposal; I further agree not to disclose, divulge, publish, file patent application on, claim ownership of, exploit or make any other use whatsoever of said "Material" without the written permission of the principal investigator. To the best of my knowledge, no conflict of interest is created as a result of my reviewing this research proposal.

Primary Discussant, Subject-Area

Panel: _____

Signature: _____ Date: _____

(Form 6.4, rev. 2006)

BOARD OF REGENTS SUPPORT FUND
SCREENING FORM FOR RESEARCH PROPOSALS, INDUSTRIAL TIES RESEARCH
SUBPROGRAM

FY 2006-07
Science/Engineering Target Areas

Proposal Number: _____ Principal Investigator: _____ Subject Area: _____

PLEASE NOTE: The higher the score, the more clearly the proposal satisfies the criterion under consideration. ONLY THOSE PROPOSALS THAT RECEIVE AVERAGE SCORES OF 70 AND ABOVE WILL BE CONSIDERED FURTHER.

CRITERION I: CONTRIBUTION TO ECONOMIC DEVELOPMENT (45 points)

1. At a national/international level research such as proposed is contributing or has the potential to contribute to economic development and diversification. _____ of 15 points
2. The proposal offers the strong prospect of attracting private-sector or Federal research funds from: Private Sector ___ NSF ___ NIH ___ Defense ___ Energy ___ Agriculture ___ Interior ___ NOAA ___ NASA ___ Education ___ Other (name) _____ None _____ of 15 points
3. The potential economic benefits of the research would be realized in the near term. _____ of 15 points

CRITERION II: RESEARCH INNOVATION (30 points)

1. The proposed research shows significant innovation. _____ of 15 points
2. The proposed research would advance the state of the art of science, engineering, or technology, not simply transfer existing technology. _____ of 15 points

CRITERION III: POTENTIAL FOR SUCCESS (25 points)

1. The qualifications and accomplishments of the investigators suggest high potential for success. _____ of 15 points
 2. Institutional commitment, support, and capabilities suggest high potential for success. _____ of 10 points
- TOTAL POINTS:** _____ of 100 points

OVERALL RECOMMENDATION CONCERNING FURTHER REVIEW OF THIS PROPOSAL (CHECK)

_____ Proposal clearly demonstrates strong potential for enhancing or promoting the development or diversification of Louisiana's economic base in the near future and certainly should be reviewed in-depth.

_____ As submitted, proposal should not be reviewed further because:

_____ It is inappropriate to the program.

_____ Although the research may have merit, the proposal does not offer realistic prospects for contributing to economic development and/or diversification.

_____ The research may have some potential for contributing to economic development and diversification; however, as currently conceived and written, it does not appear to demonstrate significant potential for enhancing or

promoting
the development or diversification of Louisiana's economic base in the near future.

To the best of my knowledge, no conflict of interest is created as a result of my screening this research proposal.

Reviewer's Name: _____ Date: _____

BOARD OF REGENTS SUPPORT FUND
SCREENING FORM FOR RESEARCH PROPOSALS, INDUSTRIAL TIES RESEARCH
SUBPROGRAM

FY 2006-07
Non-Science/Non-Engineering Target Areas

Proposal Number: _____ Principal Investigator: _____ Subject Area: _____

PLEASE NOTE: The higher the score, the more clearly the proposal satisfies the criterion under consideration.
ONLY THOSE PROPOSALS THAT RECEIVE AVERAGE SCORES OF 70 AND ABOVE WILL BE CONSIDERED
FURTHER.

CRITERION I: SIGNIFICANCE OF PROJECT AND CONTRIBUTION TO ECONOMIC DEVELOPMENT (35 points)

- 1. Extent to which the proposed research will have a broad positive impact on State/National academic and/or cultural resources. _____ of 15 points
- 2. Extent to which the proposed research addresses an important problem or need and represents an improvement upon, or a valid departure from, existing practice. _____ of 10 points
- 3. Value of expected contribution to economic development in Louisiana. _____ of 10 points

CRITERION II: RESEARCH INNOVATION AND ACADEMIC/INTELLECTUAL RIGOR (35 points)

- 1. Extent to which the proposed research shows significant innovation. _____ of 20 points
- 2. Extent to which the proposed research would advance the state of the art of State/National academic and/or cultural resources. _____ of 15 points

CRITERION III: POTENTIAL FOR SUCCESS (30 points)

- 1. Extent to which the qualifications and accomplishments of the investigators suggest high potential for success. _____ of 15 points
- 2. Extent to which institutional commitment, support, and capabilities suggest high potential for success. _____ of 15 points

TOTAL POINTS: _____ of 100 points

OVERALL RECOMMENDATION CONCERNING FURTHER REVIEW OF THIS PROPOSAL (CHECK)

_____ Proposal clearly demonstrates strong potential for positively impacting State/National academic and/or cultural resources and will enhance or promote economic development in Louisiana.

_____ As submitted, proposal should not be reviewed further because:

_____ It is inappropriate to the program.

_____ Although the research may have merit, the proposal, as currently written, will not have a broad, positive impact on State/National academic or cultural resources.

_____ The applicant has not made a convincing argument that the proposed research is meritorious/will make a timely contribution to its field/will enhance economic development in the State.

To the best of my knowledge, no conflict of interest is created as a result of my screening this research proposal.

Proposal Number
In-Depth Mail Review - ITRS - FY 2006-07

Principal Investigator

Subject Area

Page 1 of 3

OUT-OF-STATE MAIL REVIEWERS' PROPOSAL EVALUATION FORM

DUE DATE:

BOARD OF REGENTS SUPPORT FUND
INDUSTRIAL TIES RESEARCH SUBPROGRAM
(ITRS)

Science/Engineering Target Areas

PLEASE NOTE: This critique will be used, along with other assessments, to determine whether a proposal merits funding. The higher the score, the more clearly the proposal satisfies the criterion under consideration. Please place qualitative comments in the appropriate places. Use additional sheets as necessary.

A. RESEARCH INNOVATION AND SCIENTIFIC RIGOR (Using national standards of excellence)

- | | |
|---|--------------|
| 1. Extent to which proposal shows innovation and potential to advance the state of the art in science, engineering, or technology | of 15 points |
| 2. Extent to which the procedures and research methods are clear, appropriate and realistic within the amount of time proposed | of 10 points |
| 3. Extent to which the objectives are clearly defined and can be accomplished by the proposed approach | of 10 points |

COMMENTS:

SUBTOTAL A: of 35 points

B. CONTRIBUTION TO ECONOMIC DEVELOPMENT

- | | |
|---|-------------|
| 1. Evaluation of the expected economic impact of the proposed study in general | of 5 points |
| 2. Evaluation of the expected economic impact of the proposed study to the Louisiana economy | of 5 points |
| 3. Does the project have significant potential for:
NOTE: Answer either "a" or "b." If proposal accomplishes both "a" and "b", reduce point value for each category to four, rate all four categories, and provide comments. | |
| a. The establishment of a new business or industry | |
| I. Evaluation of the potential for commercial use of research results within the Louisiana economy | of 8 points |
| ii. Extent to which technology-based business would be interested in the project | of 8 points |
| b. The enhancement of existing business or industry | |
| I. Evaluation of the extent to which the proposed project would establish a new relationship between the researchers and one or more corporate sponsors (rather than simply reinforce--or subsidize--an existing relationship) | of 8 points |
| ii. Evaluation of the extent to which the project is part of a coherent plan for | |

Expanding university R&D activities in this area over a multi-year period

of 8 points

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4. Extent to which the principal investigator has demonstrated private-sector involvement and/or support of 4 points

COMMENTS: SUBTOTAL B: of 30 points

C. POTENTIAL FOR SUCCESS

1. Training, past performance, and potential of the investigators of 10 points

2. Extent to which institutional commitment, support, and capabilities suggest high potential for success of 10 points

3. Extent to which the personnel have been appropriately assigned to specific tasks of 5 points

COMMENTS: SUBTOTAL C: of 25 points

D. APPROPRIATENESS OF BUDGET

1. Reasonable for scope of work to be performed of 4 points

2. Appropriate for personnel costs of 3 points

3. Appropriate for equipment/supply costs of 3 points

COMMENTS: SUBTOTAL D: of 10 points

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ADDITIONAL COMMENTS:

OVERALL RATING OF PROPOSAL

Poor	Fair	Good	Very Good	Excellent
_____	_____	_____	_____	_____

I agree to maintain in confidence any information, documentation and material of any kind (hereinafter referred to as "Material") included in this proposal; I further agree not to disclose, divulge, publish, file patent application on, claim ownership of, exploit or make any other use whatsoever of said "Material" without the written permission of the principal investigator. To the best of my knowledge, no conflict of interest is created as a result of my reviewing this research proposal.

Reviewer's Name and Institution: _____

Reviewer's Signature: _____ Date: _____

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OUT-OF-STATE MAIL REVIEWERS' PROPOSAL EVALUATION FORM

DUE DATE:

BOARD OF REGENTS SUPPORT FUND
INDUSTRIAL TIES RESEARCH
SUBPROGRAM
Non-Science/Non-Engineering Target
Areas

PLEASE NOTE: This critique will be used, along with other assessments, to determine whether a proposal merits funding. The higher the score, the more clearly the proposal satisfies the criterion under consideration. Please place qualitative comments in the appropriate places. Use additional sheets as necessary.

A. RESEARCH INNOVATION AND ACADEMIC/INTELLECTUAL RIGOR (Using national standards of excellence)

- 1. Extent to which proposal demonstrates conceptual originality and clear potential to advance the quality and/or availability of Louisiana's academic and/or cultural resources of 15 points
 - 2. Extent to which the procedures and research methods are clear, appropriate and realistic within the amount of time proposed of 10 points
 - 3. Extent to which the objectives are clearly defined and can be accomplished by the proposed approach of 10 points
- COMMENTS: SUBTOTAL A: of 35 points

B. SIGNIFICANCE OF PROJECT AND CONTRIBUTION TO ECONOMIC DEVELOPMENT

- 1. Extent to which the proposed research will have a broad positive impact on State/National academic and/or cultural resources of 14 points
- 2. Extent to which the proposed research addresses an important problem or need and represents an improvement upon, or a valid departure from, existing practice of 8 points
- 3. Extent to which the project will yield products and/or outcomes that can be disseminated and/or utilized in other settings, such as information, materials, processes, or techniques of 4 points

4. Extent to which the applicant attempted to explain how the project would promote and/or

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C. POTENTIAL FOR SUCCESS

- | | |
|---|-------------|
| 1. Training, past performance, and potential of the principal investigators | of 8 points |
| 2. Extent to which institutional commitment, support, and capabilities suggest high potential for success | of 5 points |
| 3. Extent to which the personnel have been appropriately assigned to specific tasks | of 5 points |
| 4. Extent to which the applicant(s) have demonstrated a commitment to the project and a capacity to continue or build upon the project when Support Fund assistance ends | of 4 points |
| 5. Extent to which the proposal offers the strong prospect of attracting private sector and/or Federal funds or presents a plan to leverage Support Fund dollars in the manner most appropriate to the proposal. List possible sources: _____ | of 3 points |

COMMENTS:

SUBTOTAL C:

of 25 points

D. APPROPRIATENESS OF BUDGET

- | | |
|---|-------------|
| 1. Reasonable for scope of work to be performed | of 4 points |
| 2. Appropriate for personnel costs | of 3 points |
| 3. Appropriate for all other costs, especially equipment and supplies | of 3 points |

COMMENTS:

SUBTOTAL D:

of 10 points

Proposal Number _____ Principal Investigator _____ Subject
 Area
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ADDITIONAL COMMENTS:

OVERALL RATING OF PROPOSAL

Poor Fair Good Very Good Excellent

I agree to maintain in confidence any information, documentation and material of any kind (hereinafter referred to as "Material") included in this proposal; I further agree not to disclose, divulge, publish, file patent application on, claim ownership of, exploit or make any other use whatsoever of said "Material" without the written permission of the principal investigator. To the best of my knowledge, no conflict of interest is created as a result of my reviewing this research proposal.

Reviewer's Name and
 Institution: _____

Reviewer's

Signature: _____

_____ Date: _____

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rev.

2006)

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