Proposal

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August 29, 2008

Solicitation Number: NRO 000-08-R-0314

Name and Address of Offeror: **Sarnoff Corporation**
201 Washington Road
Princeton, NJ 08540

Proposal Title: TITLE (Unclassified)

Area of Interest: ???

Proposed Duration of Effort: 9 months

Points of Contact:

	Name	Voice	Secure Voice	Facsimile	Secure Facsimile	e-mail	Secure e-mail
Management	First Last	(xxx)xxx-xxxx ext xxx	If applicable	(xxx)xxx-xxxx	If applicable	First.last @x.com	If applicab
Technical	First Last	(xxx)xxx-xxxx ext xxx	If applicable	(xxx)xxx-xxxx	If applicable	First.last @x.com	If applicab
Contracts	First Last	(xxx)xxx-xxxx ext xxx	If applicable	(xxx)xxx-xxxx	If applicable	First.last @x.com	If applicab
Security	B. Malpas	(609) 734-xxxx	(609) 734-9017	(609) 734-2330	(609) 734-9017	bmalpas@sarnoff.com	N/A

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ABSTRACT *(SHALL NOT EXCEED 1,000 CHARACTERS)*

- Provide a 1000 character or less abstract that summarizes the objective(s), technical approach and potential intelligence application(s).
- The abstract shall consist of text only. No graphics, figures or tables shall be included in the abstract.
- For proposals that are awarded a contract, the abstract will be used as a proposal summary on the project's webpage on the NRO intranet.
- The abstract should not contain any proprietary information.

Title

INTRODUCTION *(10,000 CHARACTER LIMIT)*

- Fully describe what will be done during the proposed effort and discuss why it is important to the NRO.

Remote sensing satellites equipped with cameras that make use of curved focal plane detection devices, including curved CCD's and CMOS devices, have distinct advantages over their flat detector counterparts in both geosynchronous and non-geosynchronous tracking modes. Any camera or telescope designed with curved focal plane detectors benefits universally over flat detectors by optimizing its optical system to converge an image over a preferred Petzval curvature surface established by the camera or telescope. The result of this optimization process yields a wider aperture for greater sensitivity, 75% fewer optical components due the elimination of field flattening optics, lower mass of the complete imaging system due to miniaturization and size reduction of the optical system, and greater resolution, depth of focus, and field of view of the image area through the expansion of the imaging field. In light of these fundamental improvements, additional features are enabled for orbiting satellites. In the case of the non-geosynchronous tracking satellite, curved focal plane detection optics provide real time, multi-perspective scanning abilities from a single camera device, utilizing the high speed curved imager, which in turn captures and processes 3 dimensional data taken from a rapidly shifting surface environment at the speed of light and at higher resolution, rather than in computerized post processing with conventional orbiting imaging satellites. This attribute of the high resolution curved focal plane imager renders it unique among all other imagers due to the simplification of its primary optical structure, creating a lens system that is omnivergent as well as completely solid state, with no moving parts, to achieve the multi-perspective and multi-spectral acquisition of images with a single moving camera in remote sensing mode. In such a case, the pivoting of the camera's optical axis, performed at high speed and in synchronicity with the image capturing frame rate of the curved focal plane high speed imager, runs in solid state mode with no mechanical parts as it scans over its target, sending a sequence of very high resolution, multi-perspective images directly to the receiver in real-time without the need for 3 dimensional image reconstruction. Consequently, such a remote sensing moving camera will possess a wider field of view than a flat detector camera due to its optimized curved focal plane optics, thereby transmitting additional three dimensional data sets over a larger area to the receiver in the same sequence of the scanned imaging region. This eliminates the need for additional orbiting passes of the respective region to be imaged by the satellite, making the satellite more efficient in the recording of 3D images, as well as expanding its 3 dimensional data set far beyond what an equally orbiting flat detector satellite camera could accomplish in the same time space. Furthermore, its time base for imaging in 3D will be denser in multi-dimensional detail due to the curved focal plane benefits just described, and can be enhanced to an even greater extent by coupling additional curved focal plane cameras along an axis aboard the satellite. In the case of the geosynchronous satellite utilizing a curved focal plane detector camera, the same benefits would apply as described previously, enabling these satellites to harness omnivergent imaging from a single fixed location in space, acquiring wider 3 dimensional fields of view for different imaged altitudes at higher resolutions and greater sensitivity, all in real-time, even as the satellite pivots its angle of view during a scanned sequence. Such satellites would also be able to perform real-time twin mode stereoscopic tracking over much wider fields of view and at higher resolutions for greater detailed 3D analysis of rapidly changing atmospheric phenomena or shifting land environmental activity over shorter time sequences.

Keep in Mind – Only this Introduction and Summary Chart are reviewed in Phase 1 of the evaluation process to determine whether or not this proposal will continue into Phase 2 of the evaluation process.

Title

NRO strongly advises to include and adequately address each of the subsections below in the Introduction section.

NRO expects that most projects will have merit either as being innovative or rapidly transitionable, but not necessarily both. A proposed project must have sufficient merit in either category for evaluation in Phase 2.

0.1. Overall Description

- Describe the objective(s) and performance characteristics of the proposed effort.
- Discuss the work associated with the proposed effort, e.g., algorithm development, prototyping, modeling and simulation, architecture definition, chip design, etc.
- Describe the challenges of the general technology area and the specific technology to be investigated.

The objective of this project is to create a real time remote sensing 3D imaging system capable of streaming high resolution, multi-spectral images from either a non-geosynchronous or geosynchronous satellite to an earth-based 3D display device, designed to receive and project such 3D images within seconds of retrieving the images. Such an imaging system would possess near instantaneous interactivity between ground controlers and the satellite to selectively process multiple perspective images from motion captured objects in 3D, at various scales, utilizing the new curved focal plane detection system. Such a 3D imaging system presently does not exist, and is not equipped with these abilities, although its usage has been sought in the scientific community, including the NOAA for high speed, rapidly changing weather conditions observed from space.

The stereoscopic characteristics of this 3D imaging system harnessing curved focal plane detection can take on several different forms, though yielding the same real time 3D capturing results. A tracking non-geosynchronous camera containing a curved focal plane sensor at 2K X 2K resolution will possess the beneficial feature of pivoting its central optical axis, accomplished at high speed and with no moving parts, reproducing the effect of having many cameras recording multiple points of view simultaneously over a single point source within the optical system. Furthermore, the optical system will be simplified, having a reduced number of optical components, and physicall condensed in size and mass through an optimization technique in matching to the native Petzval curvature of the chosen optical design. The speed and trajectory of the satellite will act as its stereo base, due to the fact that multiple axes will time sequentially be grouped and paired to retrieve the streaming 3D high resolution images. No such space imaging system has achieved this objective.

Another embodiment of this 3D remote sensing curved focal plane detection system is with twin satellites that remain in geosynchronous orbit near the earth's equator. In this example, the probing satellites whose imagers are curved focal plane enabled possess all the same benefits as described above, but with the added feature of locking in a preferred stereo convergence, changeable over high speed due to rapidly adjusting moving apertures and optical axes, with no mechanical moving parts, with both cameras situated several kilometers apart in space to produce sufficient 3D optical depth for orbits several hundred miles above the earth. For lower earth satellites, an extended boom could be designed into the twin camera array to capture ground based or atmospheric phenomena in real time 3D, a tool presently missing though desirable with science groups such as the NOAA, in reference to other large scale stereo imaging instruments such as those used by NASA in Project Stereo with the sun. In this instance, the cameras' curved focal plane detectors provide multiple and rapidly adjustable convergence angles as in the previous examples, introducing an imaging feature in capturing real time 3D volumetric data at high resolution for highly turbulent atmospheric phenomena, which is presently beyond the scope of current remote sensing orbiting systems.

The generalized capture and transmission of real time stereoscopic images from terrestrial sources, or from space, represents a new technology paradigm, and has only recently been demonstrated in practice, as in the case of NASA's Project Stereo. In the specialization category of simultaneous multi-axial optical imaging used in conjunction with curved focal plane technology is a new technology that can adapt previous stereo imaging algorithms that have been demonstrated for use, while also combining additional new technologies never before tested in this format. Typically, tracking satellites record their imagery from a fixed central optical axis, transmit data to a home base, where the imagery is recompiled and reconstructed three dimensionally, with no interactive earth-based control enabled instantaneously. In this new format, multiple perspective views recorded at high resolution from differing optical axes from the same camera are streamed back to earth and reassembled sequentially, without the need for computer driven 3D reconstruction. This particular step will require the introduction of a new algorithm tailored for space based real time autostereoscopic imaging with co-functional real time manipulation of the angles of the 3D camera system utilizing curved focal plane technology. A prototype system would be constructed to demonstrate and parameterized these abilities, using newly available manufacturing technologies for shuttering and aligning the curved focal plane detector and adjoining active devices and optics.

The chip design of the curved focal plane imager will be dependent upon the need for very high speed and very high resolution multi-spectral imaging, and the shortfalls of previous flat imagers will be overcome in the construction of the new chip, including radiation hardening and other factors for a space environment. Active devices already mentioned in this discussion have been recently developed and are directly suitable for use in this optical system.

Other challenges, both technological and scientific, specifically include data bandwidth expansion that addresses the wider signal signature transmitted back to earth to achieve real time 3D imaging capabilities on earth, and the necessary synchronization methodology brought into play by this new technique. Computerized simulation of the sequence of operations that this real time 3D imaging camera performs will also be supportive in this design.

0.2. Potential Impact to the NRO

- Describe how the proposed effort relates to an area of interest from paragraph 2 of the solicitation.
- Discuss the potential impact and benefit(s) to the NRO's mission.
- Discuss potential intelligence value.

The impact of such a system would be quite large since no such system exists presently. Satellite building agencies that assemble orbiting cameras with their satellites were queried on the versatility and usefulness of such a camera system capable of real time multi-optical-axial 3D imaging capture from space, either from geosynchronous or non geosynchronous satellites, and stated that it would have a major impact in these areas pertaining to space borne surveillance for any physical phenomenon being observed associated with the earth.

0.3. Innovativeness of the effort

- Indicate the technical goals and anticipated results, using appropriate metrics, of the project.
- Compare and contrast the proposed effort to the state-of-the-art.
- Provide an overview of current state of research related to the proposed effort and describe and discuss how the proposed effort presents new and innovative research.

Creation of the curved focal plane sensor would include both CCD sensors, with high fill factor (nearing or equal to 100%), and high QE, as well as CMOS sensors with equal or greater sensitivity.

0.4. Potential for rapid transition

- Describe and discuss the level of technical maturity, in terms of Technology Readiness Levels (TRL), of the proposed effort at both the beginning and end of the project.
- Discuss the need for any further development, and indicate a timeline with appropriate milestones, to achieve a fully functional demonstration of the project.

The creation and production of curved focal plane sensors, both CCD and CMOS, is achievable with present day scientific and technological knowledge. The intrinsic optical advantages of optimizing an optical system, both visible, IR, UV, or spectrographic in nature, for a curved focal plane sensor matching the Petzval curvature of the optical system has already been established. The active devices that perform the multi-optical-axial switching have recently been developed, and are presently suitable for insertion and co-operation with the described curved focal plane 3D optical system.

0.5. Uniqueness of the effort to the NRO

- Discuss the degree to which the proposed effort is uniquely applicable to the NRO
- Indicate any potential commercial or other Government agency use or development.

In researching space borne satellite camera systems currently in operation, none have the capability of producing real time multi-optical-axial, and consequently, multi-perspective views of an imaged region of the earth during the satellite's orbital tracking mode, and thereby cannot furnish real time 3D imaging of the earth's surface, or oceanic, or atmospheric phenomena as well. Continuous real time 3D imaging with real time multiple perspective views captured and observed from space and viewed as streaming 3D images sent to ground-based laboratories of such phenomena is crucial to advancing the science of those groups who design and operate such satellites.

Government agencies that could benefit from such advanced 3D imaging technology would be NASA, the NOAA, various military surveillance and reconnaissance groups, geospatial imaging companies and their government counterparts, science groups studying the magnetosphere in real time, groups studying the spread of industrial aerosols and their effect on the earth's biosphere, and groups studying other natural hazards impacting or occurring on the earth's surface.

1. TECHNICAL *(18,000 CHARACTER LIMIT)*

- Fully discuss and describe the technical background and approach for the proposed effort and indicate how the proposed objective(s) and performance characteristics will be achieved.

In order to achieve a curved focal plane 3D camera system with the features described above, applicable for real time 3D satellite tracking operations, the curved focal plane sensor design must be advanced to the point of being functional as a multi-optical axial, high resolution, and durable curved sensor, fully adapting to the benefits of being optimized optically to the camera's predetermined Petzval curvature. The initial steps in accomplishing this phase of the development will require that the optically optimized high resolution aspect of the sensor be evaluated, and thereby extended in such a way that characteristically it may perform the pivoting, multi-optically axial function that is intrinsic to its unique design. Since the active components that interact with the optical system, which by themselves are a recent and fully mature technology, transform the curved focal plane camera into a multi-axial 3D camera, such a transformation must be tested. This operation may be performed terrestrially, and does not require testing in space. The methods for creating the curved CCD's should also be executed in such a way as to render the sensor the most durable and efficient for remote sensing as needed.

1.1. Approach

- Describe the technical approach and how this approach will achieve the proposed objective(s).
- Discuss alternative approaches considered, if any, and why the selected approach is most appropriate for the identified objective(s).
- Discuss the background, theory, simulation, modeling, experimental data, or other sound engineering and scientific practices or principles that support achieving the project objective(s).

The curved focal plane 3D optical system will be imaged using the latest software tools applicable to this new design type, and after specific phases of software testing, a prototype design will be assembled and field tested. This testing will include all of the necessary parts fabricated and linked together to check performance, taking into account the fact that the pivoting of the optical axis of the 3D camera has no moving parts, and may be synchronized directly with the very high frame rate speed of the curved CCD sensor. Captured images from the camera can be collated and fed directly into the autostereoscopic display to check 3D spatial alignment for various distances from the camera base. Much of the image acquisition hardware is already available, and need not be produced with no initial foundation. Some imaging signal transmission circuitry will require some degree of refinement to fully harness these tasks, but some new circuitry designs can be used to facilitate this purpose.

1.2. Task Descriptions

- Identify and provide a description for each of the tasks and sub-tasks that represent work to be performed.
- Discuss how the identified tasks and sub-tasks interrelate with each other in terms of schedule and outcomes.
- Discuss why the identified tasks and sub-tasks are appropriate and sufficient for the identified approach.
- Indicate how accomplishment of each task relates to achieving the overall project objective(s).

The specific nature of the curved focal plane design will be done in tandem with the specialized optics and active devices employed in the design to furnish a complete demonstration of the real time multi-optical-axial switching to achieve an omnivergent path of light acquisition of the 3D space borne camera system. The tasks needed to reach this manner of 3D imaging are listed as follows:

1. Optics software that contains the most advanced toolset for design and testing of a curved focal plane optical system will be loaded on a high end PC computer system to begin the optical

configuration for this application. This software has been selected to be Code V, latest release version, running in Windows XP Pro or Windows Vista Premium Edition.

2. The most recent ultra wide view and super panoramic wide angle lens diagrams will be evaluated from a library data set associated with the software to test for previous optimizations using flat focal plane convergence, to outline mathematically their inherent limitations. Nodal points of these lenses will be reviewed to seek out center points and types of aberrations accrued from these classes of lenses.

3. From these examples, a point spread optimization function will be performed to analyze the optical variability these previous designs possess. Based on this set of results, portions of the lenses' optical prescription values will be switched to variable, creating and eliminating certain optical surfaces when the rear convergence surface is reset to a Petzval curved focal plane imaging region. This process will be repeated consecutively with different radii of curvature, and then re-optimized. It is at this point that a new wide field lens system will emerge, and its parameters will be evaluated in terms of the other lens variables, including a widening of the main lens aperture, reduction of astigmatism and coma as determined by the software's advanced point spread mapping function, nodal symmetry, and choosing different lens materials and additional optical lens components. The range of the field curvature radii will be mathematically identified and matched against the degree of curvature attainable by the method of fabrication used to make the curved focal plane sensor, either as CCD or CMOS in nature.

4. At this stage, the variable aperture device will be introduced as a new optical interface and controllable by external switching circuitry presently available. Such an active device will be selected based on its speed of switching, and the amount of light transmitted through it in its "open" mode, as well as any additional optical aberrations it may introduce into the optical system. These parameters governing its configuration may be inserted in the optics software, so that the pivoting optical axis may be honed and further optimized beyond the single axis lens design previously investigated. Several different designs of this nature will be generated, taking into account the need for reduction of weight and size of the final camera system for satellite applications. Further design changes will be made to its own configuration in combination with the new optical designs put forth, including changes to the shaping of the curved focal plane sensor to be produced.

5. Additional optical components and structures will be introduced to this set of optical designs, particularly those that work directly in conjunction with the surface features of the curved focal plane sensor itself. It is at this stage where the curved sensor fabrication methodology and the camera's curved focal plane optimized design, coupled with a pivoting optical axis, are brought together in software as a fully functional integrated 3D camera structure, to be further tested. Another round of optimization is then performed to investigate which types of curved focal plane shapes and configurations are most advantageous in terms of the requirements of the science to be performed by the satellite system. The Code V software utilities include a variety of aberration checking features, capable of addressing each stage of the progression of optical design development as described.

6. The next stage of testing of the recompiled set of optimized optical designs of the now emerging multi-optical-axis 3D camera design set is performed by a virtual environment created by the computer system operating the Code V program. In this manner, a virtual "earth", complete with terrains and other 3D topography, is introduced to the camera to create a virtual image on the curved surface of the curved focal plane sensor. In completing this test, the 3D camera's focal length, field of view, depth of focus, and aperture switching speed are checked against what the Code V software's optical testing has identified for the design. Also at this stage, several design versions of the camera can be tested together to compare results. This will help to identify which design is the most optimal. Since the proposed design allows for stereoscopic viewing, stereo

pairs of the same camera, situated from 2 virtual points above the earth's equator in a geosynchronous orbit, can be recorded and checked for stereo accuracy and proper convergence, which can be viewed on a stereoscopic, or an autostereoscopic monitor for proper stereo alignment. The stereo software to perform this task has already been written, and does not need to be adapted for this task. In the tracking non-geosynchronous mode, a virtual moving satellite can be produced within the computer system, where a series of frame sequential images can be generated by the tracking 3D curved focal plane camera system, with the camera operating in continuous optical axis pivoting mode to capture multiple perspective views as it sweeps a virtual earth. These series of captured virtual images can act as a simulation of the camera's 3D functionality, and can be checked for proper stereo convergence as the camera moves across the earth. Stereo movies of this test can also be created to record the tests, and other related phenomena can be brought into the simulation, including weather and storm tracking, ocean sea level changes, changes in earthquake faults, and dispersion of aerosols.

7. After a series of these simulations are performed, the preferred 3D characteristics of each of the 3D cameras' optical designs will be catalogued and compared to evaluate which designs are appropriate for whatever 3D mode the 3D curved focal plane camera system is performing. At this stage, the optical prescriptions of each of the designs will be sufficiently tested to create actual lenses operating together with the curved CCD's or CMOS devices that are to be fabricated in preparation for the creation of actual images.
8. The creation of new algorithms that adjust the pattern of the switching of the 3D camera's pivoting optical axis, making it function in synchronicity with the frame rate of the curved CCD, can be created with the virtual version of the 3D camera. These algorithms will in turn be testable on the stereoscopic or autostereoscopic displays as a 3D image or image sequence as described.

1.3. Technical Risk

- Identify and discuss the potential technical issues/risks, e.g., approach requires never before demonstrated fabrication technique or greater than previously demonstrated sub-component performance, etc.
- Identify and discuss appropriate mitigation techniques and plans, if any, for each identified issue and risk.

Since the optical system for the real time curved focal plane 3D imaging system is advancing the boundaries of space imaging in continuous 3D, attention must be paid to space-based hazards to properly maintain the full functionality of this design, and to protect the data it is transmitting back to earth. In this respect, any significant temperature changes or large influx of radiation occurring in space must be addressed so that all optical and electronic components maintain a careful range of equilibrium for normal operation. In the case of the real time 3D curved focal plane system, this is achievable since the fabrication and mounting of the sensors and optical components may be secured and radiation hardened to maintain performance and remain within the tested parameters as described. Since the 3D camera system containing curved focal plane technology uses much less optical glass and no moving parts, its resilience against temperature changes and the cumulative effects of radiation in space is greater than other camera systems that are larger and more dependent on moving parts.

2. MANAGEMENT *(7,000 CHARACTER LIMIT)*

2.1. Capabilities

2.1.1. Sarnoff Capabilities and Experience

- Describe the capabilities, e.g., relevant experience, previous or current R&D efforts, related Government or commercial projects, that the offeror has that uniquely support the proposed effort.

Sarnoff Corporation, which originated as RCA Laboratories, has over 30 years' experience in both government and commercial research and development. In the field of <Optoelectronics, Sarnoff has developed state-of-the-art components> under contracts funded by NRO, DARPA, NIST and other government agencies. In addition to devices and components, Sarnoff has developed and commercialized optical systems and subsystems including focal plane arrays and imagers.

Sarnoff's facilities and specific capabilities are described below.

Add Facilities and capabilities description

2.1.2. Project Management

- Describe how the effort will be managed.
- Indicate how the DII Program Office will be kept abreast of the project's progress, e.g., reports, reviews, demonstrations, visits, etc.

Sarnoff's overall goal is the [Identify goal here] <EXAMPLE: efficient, effective performance of the proposed effort to design and fabricate a voltage-tunable infrared detector that can greatly enhance spectral agility and improve persistent surveillance sensors.> To achieve this goal, Sarnoff has:

1. **Assembled a world-class team**, with experience in the relevant technologies.
2. **Developed a program plan and a specific set of objectives to be accomplished**. This plan will be used to guide and track the effort and also to provide visibility into project progress for internal Sarnoff management and the government sponsor.

The following sections describe our management approach on which we will rely for execution of this effort.

Use of Generally-Accepted Business Practices – Sarnoff was founded and continues to function on a basis of ethical performance and rigorous adherence to best practices in science and technology research and development, finance, accounting, and human relations. Common processes and procedures, coupled with the use of commercial software of recognized integrity ensure that all activities across the corporation adhere to the same high standards. Sarnoff's corporate financial system provides direct financial support projects across Sarnoff though the use of time-tested, government-approved automated cost accounting systems. Common software and processes and procedures ensure that generally accepted business practices are applied across Sarnoff to all contracts and corporate business activities.

Planning, Organizing and Managing Internal Resources – On all our contracts, Sarnoff tailors the program and project management approach to meet the specific requirements of the effort. Our approach includes:

- Rigorous planning for each task, in the context of other ongoing tasks
- Regular reviews at the contract and team levels
- Implementation of risk management procedures
- Integrating Quality Assurance procedures into daily practice.
- Communicating regularly with the NRO on progress and problems.

Project Planning – The project manager will prepare a Work Breakdown Structure (WBS) describing the tasks to be performed in this effort. This WBS will form the basis of the project plan, and will include a detailed schedule against which project resources are allocated, and budgets established, and according to which the entire project will be executed. The project plan will be reviewed with NRO staff initially, and on a regular basis thereafter. Our project manager will work with NRO to ensure that the project plan evolves with the project, and that it continues to provide an effective means of communicating the progress of the effort toward NRO goals. Our project manager will also meet weekly, or more often if necessary, with the project staff to review progress and performance.

Subcontract Management – Sarnoff communicates planning and reporting requirements of our management process to the subcontractors to ensure planning and reporting their tasks, costs and deliverables are consistent with Sarnoff and NRO requirements.

In this project, Sarnoff as team leader will ensure that its subcontractors are held to the same development and deployment discipline Sarnoff does internally. To this end, they will be required to include specific task schedule, cost and known risks along with the master plan. During the program, formal monthly reviews will be held at the location of the team member whose work is most critical at the time to the program success. Periodic telephone reviews will be held to review selected issues.

Tracking and Reporting Progress and Costs – Our project management approach includes resource scheduling to ensure that the people who have the right skills for the work are at the right place at the right time so that requirements are satisfied efficiently and in a timely manner. We track costs closely in terms of forecasts and completion estimates to make sure the work will be completed within budget.

2.2. Schedule

- Provide a schedule for the proposed effort including major milestones.
- Indicate how the schedule relates to the proposed tasks and objectives.
- Discuss why the schedule is realistic, appropriate and complete for the proposed effort.

The proposed nine-month schedule along with deliverables is shown in the Gantt chart. The tasks are described in Section 2.2 and the deliverables are listed in Section 3.6.

Add Schedule (Gantt Chart)

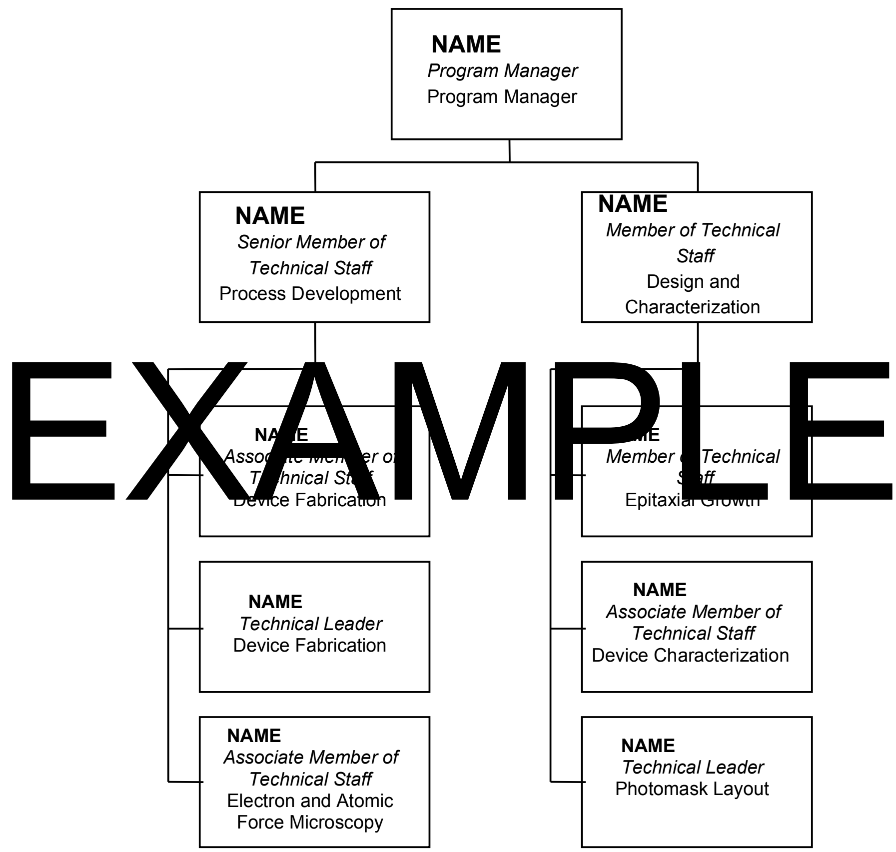
2.3. Organization

2.3.1. Team Organization

- Describe how the development team will be organized to accomplish the project objective(s) and tasks.
- Include relevant organization charts and teaming organization charts, as applicable.

One of the keys to effective task management and execution is building the correct team. The organization represented in Figure ?? depicts the Sarnoff team's proposed management structure and project leadership for the proposed effort. The proposed management team offers extensive background and experience in management of similar research and development efforts.

Sarnoff is a highly matrixed technical organization under the leadership of Dr. Donald Newsome, President and CEO. The development team, which will be assembled from several organizations within Sarnoff, has worked together in many programs in the last three years. NAME, with many years' experience managing NGA and DoD programs at Sarnoff, will be the program manager with budgetary and administrative responsibilities. The two key technical personnel are NAME and NAME, who will respectively be responsible for the device design and characterization and for the process development. Each will have technical assistance in performing their tasks. NAME will also be principal investigator and technical point of contact.



Figure??. Organizational chart for the program. Each box has the person's position and role in the program.

2.3.2. Roles and Responsibilities

- Indicate roles and responsibilities teaming organizations, e.g., consultant, or subcontract, and lead organization for each of the project tasks (from section 2.2).

2.3.3. Plan for Oversight

- Describe and discuss the plan for providing oversight and insight for individuals and teaming organizations.

2.3.4. Key Personnel

- Identify any key personnel; describe their qualifications and how those qualifications relate to the proposed effort.
- Indicate their roles and responsibilities for each of the project tasks.
- **No more than 2 individuals shall be identified as key personnel.**

Example - Dr. Winston Chan: Dr. Chan received his B.S. degree from the Massachusetts Institute of Technology in Electrical Engineering and Ph.D. from Harvard University in Applied Physics. He has 24 years of professional experience at Bell Laboratories (now Lucent), Bellcore (now Telcordia), the University of Iowa, and Sarnoff in the areas of semiconductor optoelectronic devices and optics. He is the author or co-author of 65 technical papers and has six U.S. patents with four patents pending. He will be responsible for developing the fabrication process for the gate and top contact electrodes and for device fabrication.

Add Second Key Person Name and Qualifications

2.4. Personnel, Facilities, Equipment and Information

- Identify required personnel, facilities, equipment and information and discuss their adequacy and availability for the proposed effort.

The offeror should explicitly acknowledge that no Government furnished personnel, equipment, information, material, labor or facilities are required for the effort, or that agreements with appropriate Government offices are already in place to provide any required personnel, equipment, information, material, labor or facilities.

The DII Program Office will not furnish personnel, equipment, information, material, labor or facilities for the effort.

All personnel, facilities, equipment and information (described above in Section 3) are available for execution of the proposed effort. No Government furnished personnel, equipment, information, material, labor or facilities are required for the effort.

2.5. Management/Programmatic Risk

- Identify and discuss relevant management or program issues/risks, e.g., cost, schedule, subcontractor performance, availability of data, personnel, or facilities, etc.
- Discuss appropriate mitigation techniques and plans, if any, for each identified issue and risk.

Do not address technical risk in this section of the proposal. Technical risks shall be addressed in section 2.4 (see above).

As issues arise, effective and rapid communication is essential to identifying and resolving problems before they become serious, and mechanism must be in place to report issues. Our approach is to identify and mitigate risks so that, to the greatest extent possible, we deal with them before they become problems and have strategies and plans in place to deal with them if they do occur.

Our management and technical work process confronts risks that could impede our ability to complete high-quality work on time and within budget. To ensure that we have overcome risk-related obstacles to our performance objectives, we apply a robust risk management process with proven reliability in other similar work. We recognize that projects involve risks that must be managed to avoid quality and performance impacts. We take a proactive approach to risk management by identifying potential risks to technical work, schedules, and cost performance and developing contingency plans to recover quickly from any impact on our performance.

Our development team will focus on three risk factors associated with project completion; schedule risk, cost risk, and risks associated with technology innovation. To identify the sources of risk, we examine the environment and past occurrences of similar risk events. In analyzing risks, we develop measurements for the probability of occurrence and the degree of cost, schedule, or technical impact.

Risks are categorized according to priorities and level of importance, which usually are based upon the degree of immediacy and impact. Less critical items are put on a watch list to be dealt with at a later date as conditions change. Some risks may be targeted for extended analysis to determine in more detail whether there is a potential for occurrence or impact. Risks can also be categorized based upon the acceptability of occurrence.

Mitigating risk is based upon four strategies:

- Monitoring and controlling risk factors
- Avoiding or minimizing risk by reorganizing or repositioning assets
- Responding to problems as they occur to alleviate risks by partially adjusting requirements, developing in parallel, and using a tiger team of experts capable of handling the problem
- Developing the capability to recover from risk, including the development of a new design, using a tiger team to fix the problem, or using a technical fix.

Throughout this process we coordinate closely with NRO to ensure a mutual understanding of the issues, impacts, and details and implications of mitigation approaches chosen.

2.6. Deliverables

- Identify all equipment, hardware, software, information, data, reports and/or reviews to be delivered as a result of the proposed effort.

Program deliverables are:

- Invoices and status reports to NRO
- Interim review (via teleconference)
- Final review at NRO
- Final report to NRO

Any other deliverables?????

3. PRICE *(NO CHARACTER LIMIT)*

- Indicate the price, in US dollars and provide the basis of estimate to include a breakout of the following (as applicable):
- Labor hours
- Labor dollars
- Subcontracts (who, how much, and what)
- Other costs to include a breakout of travel and materials

This basis of estimate will support how the price is complete and reasonable for the work effort and the deliverable(s) proposed and identify the amount and source of project funding (e.g., funds requested from the NRO and funds to be provided by the proposing organization, or other organizations, as cost sharing, if any).

3.1. Cost Breakdown

Need Cost sheet from Contracts

3.2. Basis of Estimate

The proposal price for the program is $400,000.

To develop the proposed firm fixed price, a cost element breakdown was prepared which includes estimated labor hours and other reasonable direct charges, overhead and general administrative allocations and profit. The cost element breakdown is based upon a build up of labor hours estimated by the program manager responsible for program execution.

The program manager uses his/her personal judgment and/or experience on similar programs to estimate the required level of expertise, the required labor mix, the required number of man-hours, and the other supporting resources necessary to execute the proposed effort. All proposed dollars are requested, as Sarnoff will not be cost sharing in this effort.

The hourly salary rates contained in the proposal for Research Scientists are developed from the actual current annual salary for specifically named individuals, factored to reflect their relative participation in the proposed program, plus an increment for salary increases during the period of performance. A normal person-month includes 168 person-hours, less vacation and holidays. The rates for technicians and model maker are company wide average rates.

The Sarnoff indirect rates for Fringe, Overhead and G&A used to develop the prices for this proposal have been reviewed by DCAA – Southern New Jersey Branch Office for other proposals and have been determined acceptable.

Included in this proposal under other direct costs are: I) the cost of subcontract for wafer turn down which is based on prior experience, ii) the cost to purchase a probe card used for testing the device in wafer form, and iii) travel to Washington, DC for a one day presentation of the final report. All travel is priced in accordance with the limitations set forth by the Joint Travel Regulations. Air/train fares are in accordance with published prices for coach accommodations for direct routes to the specific locations.

A reasonable profit commensurate with the contract and program risks was applied to the total project cost estimate to develop the proposed price for the proposal.

4. Security *(7,000 CHARACTER LIMIT)*

4.1. Classification Levels

The security classification and/or SCI compartmentation for this effort is given in the following table.

Item		Classification
1.	Overall project	Unclassified
2.	Underlying technology	Unclassified
3.	Offeror's association with the NRO	Unclassified
4.	Association of the technology/project with the NRO	Unclassified

4.2. Security Plan

- Include an organizational commitment for staffing the effort with personnel having the appropriate clearances and/or SCI accesses. In particular, obtaining TOP SECRET clearances for personnel who do not currently possess a TOP SECRET clearance can take an extended period of time. **Since the period of performance of any efforts awarded in response to this solicitation is nine (9) months, the DII program will not support requests for new TOP SECRET clearances for any personnel**. Requests for new SECRET/Collateral clearance and/or SCI access for personnel with current TOP SECRET clearance will be considered.
- Identify the Security Officer(s) for the proposed effort.
- Include security planning addressing any proposed contractors or partners.
- Identify the location(s) where any classified work will take place and identify which US Government agency holds security cognizance of the location(s). **Due to time considerations, the DII program will not support requests for accreditation of new TOP SECRET and/or SCI facilities.**
- Identify Information System(s) to be used for any classified work and identify which US Government agency holds security cognizance of the Information System(s). **Due to time considerations, the DII program will not support requests for accreditation of new TOP SECRET and/or SCI Information Systems.**
- For efforts proposed as Unclassified, the security section should indicate that the proposed effort is Unclassified and does not require a security plan.

Should this effort in the future become classified, Sarnoff Corporation (Sarnoff), Princeton, NJ, a subsidiary of SRI International, has a TOP SECRET facility clearance and safeguarding capability (CAGE Code ODKS7). The cognizant security authority is the Defense Security Service, Industrial Security Field Office, 2 Greentree Centre, Suite 120, Marlton, NJ, 08053.

Since 1989, Sarnoff has had a DIA-accredited Sensitive Compartmented Information Facility (SCIF) in the Princeton facility. It includes conference rooms, offices, a vault, an administrative area, and secure communications equipment, including an STE telephone and secure fax capability at the TS/SCI level to support any communications requirements for secure telecommunications between the Sponsor's facility and Sarnoff. Sarnoff also maintains collateral classified activities, under the National Industrial Security Program, per the National Industrial Security Operating Manual (NISPOM), January 1995.

Currently, there are employees across all technical and administrative disciplines cleared at the TOP SECRET SCI level.