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SRESA Newsletter

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Editors
Prabhaka V. Varde

SRESA Mission & Programmes

SRESA has outreach program as one of the important components to support mutual exchange, education, and learning. In this direction we our flag bearer event – ICRESH-2024.

SRESA has started working on development of Engineering Code, Standard and Guides in Risk and Reliability. Our First Standard on PRA is in the final stages of review.

One of the ambitious projects of SRESA is establishing IIRR – Indian Institute of Risk and Reliability – The second article provides an overview of the project.

From the President's Desk ....

In last over 10 years since it was established, SRESA has been establishing itself as one of the most vibrant and active institutions at national and international level by starting / working on outreach and events in risk & reliability and thereby working towards enhancing risk & reliability conscious culture at national level. The major activities / product of SRESA include SRESA Newsletter, SRESA's Int. Journal of Life Cycle Reliability and Safety Engineering (LRSE) published by Springer, Series of ICRESH and National conferences, organized generally every five and annually, respectively, organization of workshops, development of SRESA codes and standard program, distinguished Speaker Talk Series, etc, While ensuring smooth operationalization of the above programmes , work on new activities which are at the core of SRESA are also being envisioned and developed. One of the major visions of SRESA is establishing an Indian Institute of Risk and Reliability (IIRR). As on today it appears like a huge Vision – at times appears to be sort of impossible dream for SRESA. But the experience and the strength of SRESA is 'strong determination' that has brought SRESA to the level – where we are now and availability ~ 280 life members, each one of these, a specialist in their respective areas, and further, most important aspect - the relevance and requirement of development of risk & reliability program for accelerating national growth; we are confident that SRESA will be able to translate this dream into reality in the coming time.

Prabhakar V Varde

In this issue ....

SRESA Announces Organization of 5th ICRESH – International Conference on Reliability Safety and Hazard – 2024, in Mumbai

- Editorial

SRESA Managing Committee discussed and approved organization of ICRESH-2024 jointly with Bhabha Atomic Research Centre, Mumbai, during February 21 – 24, 2024 at DAE-Convention Centre, Mumbai. The Pre-conference Tutorial on 21st February will be one of the major features followed by the three days ICRESH spread over plenary and parallel sessions from Feb. 22 – 24, 2024. Four ICRESH events, have been organized, so far, in 2005 (Mumbai), 2010 (Mumbai), 2015(Lulea, Sweden) and 2019 (IITM, Chennai). The grand success of these events has given us an impetus to go for ICRESH-2024. ICRESH events are recognized one among the well-known events in risk & reliability in India as well as abroad. The publication of keynote talks as also manuscripts volumes by international publishers, participation of renowned academics and scientists from across Indian and abroad, high level of technological discussions and exchanges, lifetime achievement award ceremony and technical exhibition, etc. are some of the features that make ICRESH events an attraction for the participants. The major organizing features of ICRESH-2024 will be over 15 Keynote talks by renowned speakers ~ 25 Invited talks and ~ 90 contributory papers by researchers, scholars and students from India and abroad.

Indian Institute of Risk and Reliability-Concept Proposal – A SRESA Initiative

Prabhakar V. Varde
Hon. Chief Executive Officer, Indian Institute of Risk and Reliability (IRRR), President
Society and Reliability and Safety, Mumbai &
Raja Ramanna Fellow,
Bhabha Atomic Research Centre, Mumbai

1. Introduction

The India has entered into Amrit Kal era with an aspiration to be an Atmanirbhar nation with focus on 'Make in India' programs. For SRESA this translates into an inspiration to support capacity building through accelerating the development and implementation of high quality, reliability, and zero / acceptable risk target. The existing engineering education and research program essentially has quality assurance as an initial attribute and good design and operating practices towards ensuring implementation of the objective function focused on deliverables. Even though a great progress has been made, India is yet to go a long way towards tapping potential of its core values, that are based on our value systems, science & technology, tradition, literature, and philosophy. The present Indian model of design, production, operation, and environmental protection is essentially based on western material science-based approaches. While on one hand, it is for us to see that material science approach has created phenomenal engineering and scientific products & applications to make the human and society at large comfortable be it housing, healthcare, home gadgets, transportation / travel, market conditions, financial transactions and all the facilities that should make a member of public & society truly happy.

With all these available, could we realize our topmost 'dream of a happy society'. The answer is, albeit a big 'NO'. The international ranking of India on the Gross Happiness Quotient (GHQ) scale is rather low. Further, it is more interesting to note that the country which has highest GHQ is Tibet. It is quite possible that if a survey is carried out as to which country is having the highest potential for spiritual quotient and the outcome might be that again it is Tibet. Of course, Tibet cannot be compared with India when the size of economy, by considering Reserve, GDP, scientific and technological growth, Military Power, home for number of billionaires, etc., as the parameter, etc.

What does the above discussion yield? India's potential spiritual strength and value systems need to be effectively tapped, and now we can say that the India's potential is visible not only in the country but at international level. In fact, now India ranks among the top 3 or 4 nations on world stage and the accelerated growth in many sectors will make India one of the top-ranking nations leaving behind many advanced countries who were much above us in the past.

One aspect is very clear, if India follows, the western model for material progress, the result will be what Wester countries that are characterize essentially with lowest happiness quotient. But India has a profound spiritual base. Finally, it is the happiness quotient of society at large that makes the whole difference.

In sixties and later Japan's USP was 'quality' that made this nation, a great technological superpower. But the same quality consciousness coupled with the nationalistic approach through their work force reflected in their production lines and technological development that ensured Japan to be a supplier of quality product. Japan and other advanced nations who followed quality mantra, earned rich benefits in terms of finance that translated into physical comforts, nevertheless could not achieve the target of national happiness quotient. The flawed understanding that material possessions make happy society appears to be not working on perpetual scene.

Among the various energy generation sources, the nuclear industry has the highest level of demonstrated safety records. The three major accidents viz., Three Mile Island in 1978, Chernobyl in 1986 and Fukushima in 2011, provided huge learning lessons on de-risking or safety. This is because these accidents made the nuclear industry sit back and perform an introspection as to 'How these accidents could not be avoided'? The common thread was 'human error' and at higher level the 'institutional failure'. Many lessons were learnt from these accidents. It was realized that having a design & operations eco-system based on 'sound safety / risk-conscious-culture', based on scientific and rational based approach can be an effective strategy for the future. It can be argued that consciousness plays an overriding role, in fact more than cognition, as consciousness is fundamental to existence or 'being'. Therefore, Consciousness is central to R&D and academics in IIRR system. The challenge is the material science approach, as it appears till now is not able to provide adequate understanding of consciousness. Therefore,

Figure 1.0 IIRR is a SRESA Project. SRESA Logo and its basic objective - 'In search of truth ...' provides for the fundamental driving principles for IIRR.

consciousness research poses challenges, in respect of its source, its loci and how it is related to thought, attention, focus, cognitive processes, feelings, and emotions, etc. However, the traditional Indian system, requires, further focused research / studies to bring it from largely philosophical domain to scientific domain. That is, we need advanced labs for extension of material research to the realm of non-material domain. There exist observations in open literature that material science approach is inadequate to capture the understanding of consciousness – largely by asserting that it is non-material entity.

The role of consciousness has Indian spiritual system essentially based on Vedic knowledge have philosophically and scientifically defined role of consciousness not only in relation to human or more generally living being and arguably to non-living things also. In fact, western science appears to follow the dots and description of Vedic knowledge. For example, the recent Noble Prize winners research established that the world in 'not real', The rich Indian knowledge had established thousands of years ago that the world is 'mithya' (illusion). There are many scientific examples that shows that Indian science had established scientific facts, including mathematics, cosmic, healthcare, moral, ethics and value system; before the material - based research / innovation discovery.

So, if India has to excel, development of product, systems and services have to ensure the zero risk and highest reliability based on human, and the societies. The national consciousness need to be developed, keeping in view, inner development or introspection or at experiential level driven by highest spiritual practices that ensures not only highest performance but also GDP, and more important the GDH. Some of the more accepted procedures are Yoga, Meditation, Health Care (like Ayurveda, nature therapy), Understanding of nature, cosmology, mathematics and other related areas.

A new way of **Consciousness-based** education, research and development system that while dealing with engineering aspects also ensure human development underlined by Indian value system. This document proposes setting up an **Indian Institute of Risk and Reliability (IIRR)**, in India. The focus of this institute will be to performs R&D and educate, train research in development of an ecosystem that integrated hardware, software and human factor to realize products, services and systems, particularly complex systems, like nuclear plants, space systems, aviation, transport, process and industrial and further societal systems like water, housing, roads, electricity, education with higher reliability and lowest risk. Of course, the higher level implementation will follow an integrated approach where the Indian science will be explored with material science. For example, the progress in quantum physics or mechanics is slowly moving from material procedure to non-material research – where Indian system can be of immense application.

There is no doubt that engineering infrastructure and software systems have served society in an excellent manner and these systems have become integral part of day-to-day life. We also appreciate that further improvements facilitated by advanced research, software systems, new material and technology and computational techniques are required to enhance reliability of these systems. The modern technology, particularly the complex systems, like, space, aviation, defence, rail & road transport, energy process, including the recent advances in Artificial Intelligence and Machine learning systems, have also brought with it the risk / hazard potential. There is also a realization, that there is a huge scope in reducing the potential for hazard posed by the technologies. If we look at the hazard potential of our engineering systems, we look at the number of lives lost per year in infrastructure, road, rail, aviation process and chemical incidents, production systems, power generating stations, etc, there cannot be even a iota of doubt that by being a risk-conscious nation many precious lives can be saved. This underlines creation of an ecosystem of 'risk-conscious culture' be it public outreach, technology, science, education, training, development of advanced and intelligent tools and methods that are effective in increasing the throughput while moving towards zero risk target.

What we discussed, here, forms the fundamental principles and at higher level - the *'risk-reliability conscious eco-system of IIRR'*. Three factors directly support this system *Consciousness, Cognition, and Conscience-Based (C^3B or CCB) system that drives all Indian R&D and Academics.*

2. Indian Engineering Risk Scenario – A brief overview

One serious road accident in the country occurs every minute and 16 die on Indian roads every hour. Over 1,37,000 people were killed in road accidents in 2013 alone, that is more than the number of people killed in all our wars put together. 16 children die on Indian roads daily [NDTV]. 377 people die every day, equivalent to a jumbo jet crashing every day [1].

No deaths due to rail accidents in 2019, the safest year for train passengers. While railways witnessed staff deaths during the last year, there were no passenger deaths in the last 12 months, the data revealed. In 2018-2019, railways recorded 16 death and 28 deaths, in 2017-2018 and 195 deaths during 2016-2017 [2]. More than 2,500 people die and over 3,000 are injured annually in vast Mumbai's suburban network, considered the lifeline of India's business capital [3]. Since, May 2020, there have been 30 industrial accidents in India, killing at least 75 workers, according to Industrial, a global union of workers. From 2014 to 2017, 8,004 such incidents occurred in Indian workplaces killing 6,368 employees. Most such incidents took place in Delhi, Maharashtra, and Rajasthan [4]. The Aviation accidents in India since 2000 – 2020. : Total 237 fatalities in 20 years [5].

Date	Accident / Incident Description	Casualties	Survivors
2020-08-07	Air India Express Flight 1344, on 7 August 2020, (a Boeing 737-800) flying on the Dubai-Kozhikode route overshot the runway on landing at Calicut International Airport breaking into four pieces.	18	172

Date	Accident / Incident Description	Casualties	Survivors
2010-05-22	Air India Express Flight 812, on 22 May 2010, (a Boeing 737-800) flying on the Dubai-Mangalore route overshot the runway 24 on landing at Mangalore International Airport killing 158 passengers on board.	158	8
2000-07-17	Alliance Air Flight 7412 crashed in a residential estate of Patna on 17 July 2000 after the pilot lost control of the aircraft and stalled. Deaths included 55 people aboard, along with 5 on the ground.	55+5	
1999-12-24	Indian Airlines Flight 814 was hijacked by suspected terrorists on 24 December 1999 while in Indian airspace. The aircraft was flown to Kandahar, Afghanistan. *One passenger was killed by the hijackers; the other 192 aboard survived.	1*	192

2,173 killed in air crashes since 1947. In terms of fatalities, 68% of 1,057 people who died in India between 1951 and 1980 died in accidents have been attributed to pilot error, while 99% of 997 people died between 1981 and 2010 in accidents attributed to pilot error [6].

As many as 12,748 people died in 2018, which means that around 35 Indians die in a fire every day. As many as 4,290 fire-related deaths were in the 18-30 age group, followed by 3,860 in the 30-45 age group [7]. On an average, in India, every year, about 25,000 persons die due to fires and related causes. According to another estimate about Rs. 1000 crores are lost every year due to fire. Fire losses are reported both in industrial and non-industrial premises like hospitals, commercial complexes, educational institutions, assembly halls, hotels, residential buildings, etc... According to Fire Risk Survey (FRS) 2013, carried out by Pinkerton & Federation of Indian Chambers and Industry, in India, fire accounted for 8.45% of the overall ranking of risks. FRS also revealed that fires has been rated as the 5th highest risk in industry in 2013 [8]. Floods cost India Rs 4.7 lakh crore in last 6 decades [9].

Industries contribute a lot to the upliftment of poor, creation of employment, changes in socio-economic fronts, which contribute overall to the improvement of economic situation of a Country. However, the industries use raw materials from the environment, let it be chemical, oil,

IIRR

Indian Institute of Risk and Reliability

Figure 2 The proposed IIRR Logo

leather, mining, steel industries etc. which requires exploitation of natural resources causing changes in the local environment. In the later stages when the resources combine in the process the waste materials are to be discharged in large quantities into the same environment or its vicinity. This will have an impact as the waste of natural minerals together with new compounds would reach the environment for further degradation. In short, the natural materials get transformed to artificial complex compounds which are to be simplified by natural through bio-geo chemical cycles. The natural occurring microbes would rather find it difficult as many compounds are non-degradable or toxic to them or the incapability of producing suitable enzymes. This leads to the ecological imbalance and cause detrimental effect to the sustenance of environment. In the past there were several accidents minor or major in the industries or accidents due to transportation of hazardous materials or accidents due to storage facilities. All the industries must note that the accidents may be due to human factor or unsafe equipment or due to improper precautions taken, during the accidents there may be loss of life, loss of damage to the machinery which are taken care of, by the necessary insurances, but least important is given to the degradation caused to the surrounding environment. Let us take an incident of air pollution or an acid spill over the land or a nuclear blast which at one stage or the other would be damaging to the surrounding environment either air or water or land. The gaseous discharges can damage the human health or cause corrosivity to the ancient structures and modern buildings or increase in the concentration locally leading to global warming i.e., causing physical, chemical, and biological destruction. Whenever an impact assessment is made one must investigate the attributes / parameters and assess the potential damage caused by an event. Accident be it anywhere occurs often without any significant warning and the damage is beyond comprehension due to unpredictive nature and therefore unpreparedness at the level of individual, crew or organization. . For instance, a fire in an industry may spread to various units it proper preventive steps are not taken due to the apathy of the industrial managers. The fire while burning may also release some of the toxic gases into the environment which enters the eco-system causing irreparable damage to the balanced eco-system. The following major impacts may be considered in an "event" of accidents [10].

The above statics and the associated discussion, shows there are loss of human life, economic consequences that include the loss of property, and environmental consequences pose a grave situation in India. Its not that the issue is not being addressed. Governmental agencies, industrial houses

social organization contribute significantly to reduction of consequences. However, many of these measures are mostly reactive. What we need is an more proactive, scientific and risk-conscious approach to reduce the consequences.

Clearly, a movement is required at national level to reduce the risk of loss of life, property and damage to environment by employing a risk-conscious approach that works at all the level of society starting from individual, public, business houses and governmental bodies to recognize the potential benefits of risk reduction and reliability enhancement for engineering systems. A mass movement is possible only if research & development, education, training, infrastructure and public outreach forms the core of the initiative.

3. Objective & Scope

"To develop a world class Risk & Reliability Conscious R&D and Academic Center – An ecosystem for engineering technical excellence to cater to the national needs for implementation of reliability requirements, on one hand, and to effectively de-risk the society, on other."

This objective is to initiate, develop and implement consciousness-based advanced research, development, education, and training, in the area of risk and reliability engineering and management. There will be special emphasis to investigate, model and integrate human factors as a common thread running through the complete Lifecyle of engineering products, systems and services towards meeting environmental and sustainability objectives. The aim here will be to meet the a) risk and reliability conscious human-resource requirements at national level and b) collaborative and support programme for government and industry at national and international level.

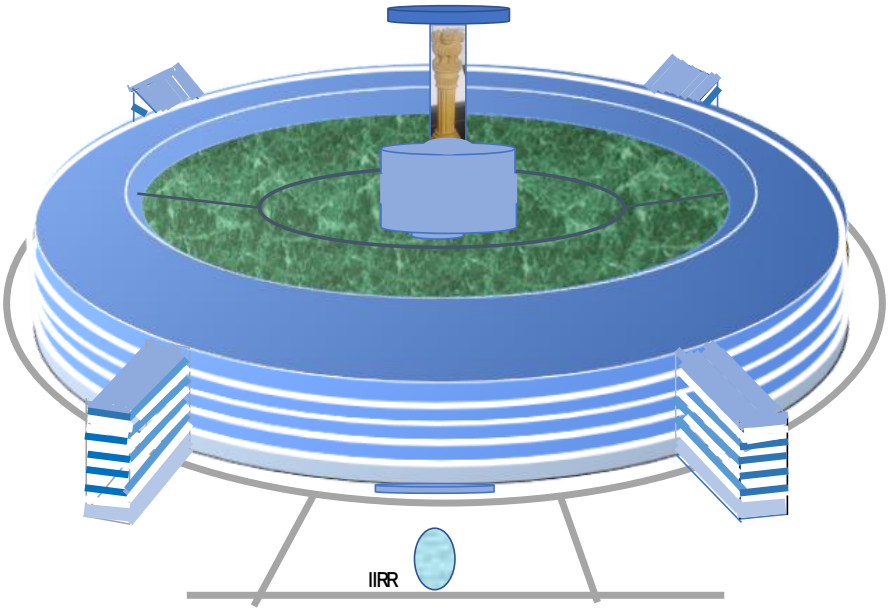

Figure 3: An artist's vision of IIRR Academic & RD Ring-Building viewed from front i.e., main building (A Wing) end.

The scope of this project is summarized as follows:

1. The complete IIRR Programme will be implemented in three phases. Even though the research and development will be at the core, the phase I and Phase II academic program will be offered on M. Tech. and Ph.D. level in the area of risk and reliability. Either as part of phase II or in next phase (Phase III) a full-fledged B.Tech. programme will be instituted.
2. Development of a national institute that facilitates research, development, education, training and national outreach programme such that it to support and promote make in India and Atmanirbhar initiatives.
3. The institute infrastructure will be developed in 100 Acre with ring-building of 350 M diameter will house, classrooms, material science labs and workshops, laboratories, testing and simulation facilities, engineering system models and prototypes, conference rooms, library, spiritual and AI center, staff rooms, services wing, etc.
4. The attempt will be to recruit faculties of imminence and repute in the area of quality, risk and reliability with sound awareness of Indian ethos and culture.
5. The selection of scholars and students will be on merit as well as ethical attributes-based systems.
6. The education in fundamental disciplines, like civil, mechanical, electrical, electronics and process instrumentation with a common thread of risk and reliability potential of these systems will form the initial two years of training. The third year onwards will be dedicated to project on application areas that might include infrastructural systems, rail and road transport, aviation, space systems, process, and chemical, external events / threats to the society at large. Modeling, Testing, validation, and simulation will form the core part of the project stages that will be in collaboration with the industries.

Keeping in view the resources, R&D & academic programme, logistic, legal and administrative / governmental requirements it has been decided to implement this project in three phases:

Phase – 1: As mentioned, this phase will be of three years starting from the hired temporary building in the identified town / city. R&D and Academic requirements will be translated into a blueprint for the complete IIRR project mainly including infrastructure, academics and R&D and funding model. Next step is approaching governmental clearances for setting up an autonomous

institute. The scope of phase I activities will include Identification of resources, like funding, hiring space for running R&D and academic programme, hiring faculties, scientists, and support staff as per the requirement adequate for different phases. Procurement of equipment for R&D and Preparing plans for Phase II is part of this phase. The objective of this phase is to announce, start specialized MTech. and Ph.D. Programme. There will be provision for Certified Courses and the organization of Annual National Conferences, Workshops, Distinguished Speaker Talks, etc. The R&D work will focus on advanced research in risk & reliability assessment and management Coordinated Research Program, Government as also private sponsored projects will be encouraged. The Major objective function apart from moving forward & establishing IIRR as National Center of Excellence, is generation of revenue such that IIRR projected requirements can be considered adequate.

Phase II: Moving to the Main Building (Wing A of the ring Building) of IIRR. The core requirements, like at Number of Faculties (~30) to run the R&D and Academic Programme, that include B.Tech. (input ~60) in core branches and interdisciplinary and administrative set-up for R&D, moving all the labs developed in phase I and setting up of new labs, Workshops, Canteens, Sport, one Hostel, Transport, etc. Setting up of Director's and deans and faculties offices will also form part of this phase. Duration of this phase is Max 10 years. The institute will have adequate annual funding for operational as well as expansion Programme.

Phase III: Director, IIRR will be the academic and administrative head of the IIRR. Five Deans, viz, Dean Academics, Dean Faculty, Dean Admin, Dean International Affairs, and Dean Innovations & technology Development. All the deans will report to Director, IIRR. This phase will focus on the development of specialized interdisciplinary labs towards making IIRR a center of excellence keeping in view the national requirements and international scenario. For example, simulator and AI complex will house all the simulators, like Nuclear Plant, Aviation, Space, Railway and Road Transport. While application on AI (machine learning / deep learning) and robotics optimization will be part of this phase. There will be a separate wing to adopt spiritual knowledge to understanding of human behavior. The quantum mechanics wing has dedicated R&D program to join the dots in Vedic sciences to have improved understanding of human towards reducing the human error in engineering systems. This is the phase when construction of the remaining three wings of the IIRR will be integrated and functional. The one-point agenda is to create a risk and reliability conscious society in India while serving as world class scholars, researchers and faculties for an accelerated growth. The faculty and research staff strength is expected to be around 400 to support the R&D and academics. Administrative staff strength will be ~ 450 while the technical staff 300 and Auxiliary / support staff strength 100 that includes helping hands, cosmetic maintenance, transport and

The IIRR project will be implemented in three phases

4. Research & Academic System for IIRR

There is a conscious consideration to establish a world class institution to effectively serve the national interest R&D and Academic must go hand in hand. Accordingly, IIRR has R&D and Academic at its core, such that both the programme complementing each other.

1. IIRR will be a Research and Academic arm of SRESA.
2. IIRR will be an autonomous institution set up on Public-Private Partnership principle and supported by Government Grant-in-Aid to support and sustain the funding requirements.
3. R&D labs will serve the national requirements and aspirations that include an effective interface with international organizations as catalyst for advanced research.
4. The academic program will have, apart from technological component, where the Indian ethos including spiritual eco-system as part of education and training.
5. CEO IIRR will have responsibility and authority to manage the development of infrastructure, to support the academics and R&D.
6. Director, IIRR and Dean Academic, Dean R&D, Dean Faculty and placement. Dean Academics and Registrar will be responsible for ensuring implementation of all the programs, including responsibility of interface area, Dean Interdisciplinary Programme will have special responsibility for acting as interface between various department for smooth running of the core area, i.e., Risk and Reliability and related disciplines in IIRR. In this phase MTech. Batch will comprise of 20 and it is expected that ~ 30 students would have registered for Ph.D. programs. A total of 15 core faculties, along with Honorary Faculties will take the IIRR Program forward.
7. The initial requirement of faculties will be created from SRESA life member pool of experts. This participation initially to a large extent will be on an honorary basis. The minimum qualifying criteria will be set for an individual member to become a faculty of IIRR. Education qualification requirement will be a Ph. D.in risk and reliability or related area, from an institute of imminence, like, IIT, NITS, BITS, HBNI, DST or a reputed university. Experience in teaching and research will also form additional criteria.
8. Official procedure for registering the institute with governmental authorities will be initiated.
9. IIRR will be set up in a phased manner. The first phase involves starting R&D and academics from a hired complex for 3 years, In the meantime campus development will be initiated. The second phase involves completion of the Main-building of the institute (part of ring building. All the Activities of IIRR will be shifted to the main building. Where there will be lecture and faculty rooms, required laboratories, The third phase will see the completion of the ring building, Auditorium, Hostels, advanced labs, such that IIRR will meet all the attributes of IIRR functional model.

4.1 Expert Services to Support IIRR R&D and Academic Programme

Since the institute does not have adequate resources during the formative stages of the project SRESA offers honorary services of pool of experts desirable to extend their honorary services to run IIREM R&D and academic Programme. Therefore, Hon Faculties are invited to kickstart the collaborative research & development and academic Programme. Based on the discussion in SRESAmc a list of faculties has been formulated. A further process of required permissions by faculties from respective department is in progress.

It is expected that the faculties have commitment to technical teaching / lecture R&D support of at least 20 hours duration a year. The IIRR will decide for the honorarium and expenses involved in visit of these faculties for contributing to IIREM Executive Committee, Hon. Secretary will send the invitation letter to the above faculties for their consent. Their participation is expected in IIREM organized courses, workshops, and participation as experts in R&D initiatives of overlapping interest. The above faculty will also be invited to be the Guide / Co-Guide the IIREM research scholar and students.

4.2 Academic Course & Syllabus

As mentioned, the IIRR, to begin with, apart from conducting Symposium, Workshops, will conduct the Certificate Course in Risk and Reliability Engineering. In next phase M.Tech. and Ph.D. Programme will be instituted. Once the infrastructure and resources are adequately made available B.Tech. Programme will also be started.

The B.Tech. programme will have Civil, Mechanical, Electrical & Electronics, Computer Science, Chemical Engineering. The maximum capacity for each disciple will be 60. Accordingly, each batch will have max. strength of 300 students.

Total B.Tech. student strength, considering 4 years B.Tech. Programme will be 1200. The academic teaching will be comprised of classroom lectures and lab / workshop/ facility experiments and studies. The syllabus for B. Tech Programme.

MTech specialization in Risk & Reliability Engineering comprised of four semesters and minimum credit of 50. Generally, it works out of total 10 courses and two labs, project work of ~ one year. Project work starts only after completion of course work. Total MTech requires four – five semesters including one year of project work. The courses available for MTech. Programme has been given in Annexure IIB.

Eligibility for Ph.D. programme is a earned MTech. degree or B.Tech. degree with two semester coursework comprising of a total of 25 credits. Generally, there are two types or courses available to MTech. and Ph.D. programme candidate, Viz Regular and Optional course work. For Ph.D. candidates the residential requirement for 1 year in the campus is mandatory. Depending on the specialization, the candidate can register for a Ph.D. under a Ph.D. Guide from the institute and a Co-guide from either institute or from any recognized institution from outside. The maximum allowed duration of a Ph.D. is five years. If the candidate requires additional time to complete his submission, then special permission is required from the Board of Study. However, if the candidate cannot submit his thesis in 6 years, then the programme stands terminated. If any specialized course is required to be taken from an outside institute, then special arrangement must be made with permission from the institute.

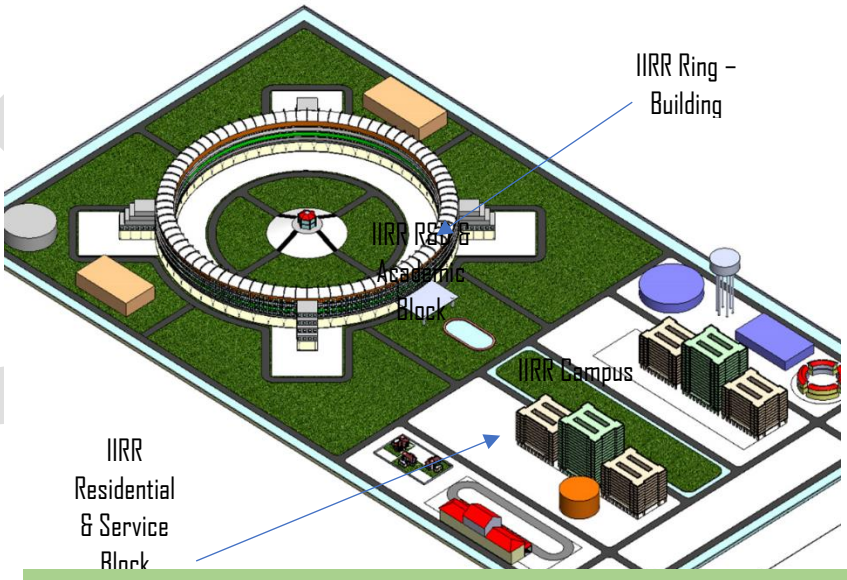

Figure 4: 3-D view of the IIRR Campus. The image shows the two major feature, IIRR R&D and Academic Block i.e. Ring-Building with Auditorium at the Center of the ring building with road access from all the four blocks shown from Main-Building (A-Block) along with two hostels , entry and exits; and the second feature is on-campus residential complex , that includes Director, Dean residents, Student Activities Center / Stadium, Lawns residential blocs, Sector Market and service area including campus electric substation, etc. (There are many assumptions made for developing the preliminary design of the campus, like the landscape is rectangular site measuring around 100 Acres. The design & construction will follow stipulated green building and campus design, e.g., use of renewable energy, waste generation and management, water conservation, standards.

4.3 Organizational Structure

The tenure of the Chief Executive Officer and Chairman will be of 5 years & can be extended by SRESA Managing Committee based requirements and in the interest of the institute. The Director, IIRR, responsible for R&D and Academics, is appointed by SRESA Managing Committee in consultation with CEO for a maximum period of five years SRESA will also appoint a. project Execution Committee

under IIRR CEO and Academic Council under Director, IIRR to support implementation and operation of Academics and R&D programme. Academic council will have few members from Project Execution Committee as also the academic council will have members from project execution committee.

Apart from overall project execution, the academic council has a responsibility to approve the programme and authorize changes in the academic programme. Academic council based on input from the Board of Studies will approve / authorize the institute academic programme, that includes new programme, new subjects and other operational and administrative policies. The academic council also consider cases regulatory in nature. The CEO and chairman, IIRR will be responsible to put institute academic, operational report to academic council. CEO and chairman will appoint a board of studies to deal with the academic activities and programme. The Board of Studies of IIRR is responsible to develop, implement the academic programme at MTech. and Ph.D. The institute will start with Mechanical, Electrical, Electronics, Software & Human Reliability & Risk, However, Artificial Intelligence Reliability and Risk Programme, Data Science Risk and Reliability Programme will form part of the core research & development. It can be further expanded or revised based on the national and societal requirements.

Each Department, as mentioned above, will be headed by a Senior and academically accomplished Faculty Member. The HOD position will have a tenure of 5 years and it will be on a rotating basis. All the faculties and the administrative staff will report to the HOD of the respective department.

5.0 IIRR Site, Development and Construction

The Major considerations keeping in view the institute academics, logistics and emphasis on self-contained features are as follows:

5.1 Policy Principles for site selection

The Policy Considerations are overriding factors that translates into stipulations and driving force for campus development as follows:

1. The estimated site area is ~ 100 Acres. Major features will be Institute Ring Building and associated academic and R&D facilities and Residential area along with public amenities, like Sport Complex, Faculty and Staff quarters, Service area and markets.
2. The site should have a water body or a plan to create a water body to cater to a) Green design and b) water requirement of the Campus.
3. The site should be selected at least 20 km from the city / town center or outskirt OR at least 10 kM from City outskirt, whichever is more.
4. The site should have access to electricity supply with adequate capacity for 5 MW loads for 24 years a day.
5. The site at relatively higher elevation provides inherent benefits for campus growth, spiritual learning and development and protection of natural ambience.
6. Connectivity with road or rail with manageable resources.
7. The site should have access to the nearby city airport.
8. The Site should not be in Seismic Zone (Seismic Zone I or II are acceptable)
9. The 1000-year return period data should not be more than Maximum Flood Level of 2.0 meters.
10. The site should not be in a socially disturbed zone.
11. The air quality data of the site should be checked and acceptable and no industry should be in 2.0 k radius from site center.
12. Preferably no road or rail line passes through or planned through the site.
13. The site should be on non-agricultural land.
14. It should be ensured that the acquired site does not have any outside claim and SRESA should have the sole claim for the site.
15. All the governmental clearance should be available for the possession of the site.

It is recognized that, in the above metrics achieving all the requirements is a challenge, hence an informed decision can be taken keeping view the environmental and health issues, resources available, socioeconomics of the areas and most important it is not violating the sustainability principles.

5.2 Development and Site Construction

Major governing considerations for site development and construction has been stipulated keeping in view the modern development and construction norms keeping in future requirements of sustainable complexes as follows:

1. The site construction will follow Green Norms for sustainable development and construction, especially provision for a) Water conservation and harvesting, b) Renewable resources for electricity, like Solar panels for catering the electricity requirements for the site, c) facility for waste treatment and reuse (zero waste policy)
2. Rule of 70:30 for ensuring adequate green cover to construction and development activities. It means 70% of the area of the site should be left for green cover to ensure the application of sustainable norms. Accordingly, not more than 30% of the site area can be utilized for construction and developmental activities.
3. Construction activities should be such that ensure minimum waste generation from the site, Principles of re-use material, etc. should be complied to. One major factor is the design should ensure use of natural lights and HVAC system that is not energy intensive.
4. The building design should follow green building standards issued by Government of India. Such that the site and building comply with the green norms.
5. The building should be designed keeping in view that academic and research ethos of the institute. The ambience should be conducive to students and faculties for research and exchange of ideas.
6. The IIRREM main building is reflection of institutes culture, ethos, and reach heritage of India on one hand the India as advanced and emerging nation.
7. The site will have two major parts a) research and academic block and b) residential block.

8. The Main Building will house the administrative offices, office of institute authorities, Director, Deans, Departmental heads and Lecture halls and Major Laboratories, Meeting rooms, Seminar rooms, Webinar rooms for distance learning and discussions; Canteens and cafeterias, a commercial / service center to meet faculty student requirements. The main building design will comply with water harvesting, waste minimization, maximize use of natural light, solar energy generation requirements, and principle of zero waste which implies re-use of wastewater and other resources.
9. The scope of site map in terms of layout of the site and location of various blocks / areas in academic and residential blocks that includes mainly main building, convention center, academic blocks service area, testing and research labs, road connectivity in academic block, location of hostels, quarters, student activity center, parking, cosmetic and landscape, estate management services for water, electricity, civil, electrical and mechanical repairs, new construction at site, etc. will be provided in the next section.
10. The layout should be designed keeping in view easy access to academic block, particularly the main building and from main building to other academic block such that walking time is minimum. Similarly, the traveling distance from residential bock to academic block also should be minimum.

5.3 Land & Infrastructure

The governing considerations are the objective of the SRESA: To create a R&D and Academic umbrella organization in India to develop cognitive, conscious and conscience empowered eco-system in general and human resource such that higher qualities attributes like inner happiness quotient can be increased by supporting technology with a value system derived from India's core strength the robust and ever sustaining 'the spiritual science' – inspired from 'Amrit Kal' initiatives.

11. To achieve the above and in line with Indian ethos the philosophy of the 'Whole world in our family' the aim is to develop a world class national institution that while meeting Indian aspirations serves and works with other countries for mutual benefits in a collaborative manner. Hence, the objective is to create a world class umbrella eco-system.
12. Human factor education will have the additional element of 'CCC-based' element that produces engineers, scientists and with value-driven approach to creation.
13. To achieve a goal of world class value-based education requires advanced scientific and engineering infrastructure and a eco-system that inspires the academic and R&D environment on perpetual mode.
14. The above requires the IIRR to have following salient features:

5.4 Location

Keeping in view the campus area requirements, availability of resources (cost or land, faculty & staff as also student's connectivity to the travel and transport and routine requirements and finally the smooth functioning of the IIRR, the following factors were worked out to setup the IIRR:

- Keeping in view the projected features and requirements, the institute will be located ~ 20 KM from a town and the campus area is 100 Acres.
- The institute will be located where following requirements are met reliably a) Reliable electricity and communication facility, b) Availability of water, c) Affordable and convenient Road, Rail and Air connectivity and d) Road connection for transfer of heavy and voluminous equipment to / from the campus.
- Adequate security / police coverage. The campus will have boundary walls protected by security posts at suitable locations including the entry and exit points.
- Availability / access to banking system.
- Access to town market within ~ 20 km for routine purchase and procurements.
- A preliminary estimate shows that a sum of approximately Rs 1900 Crores will be required to set up this institute in a phased manner.
- The institute development is targeted in three phases, temporary location in the nearest town, Main building with academic and R&D facility that fulfils adequate requirements to satisfy deliverables, and last phase completion of implementation of the master plan.

5.5 Project Development and Implementation Guidelines / Rules

5.5.1 The development rule follows the 80:20 rule, i.e., Construction will be allowed in only 20 Acres while in 80 Acres will be occupied by open gardens, lawns landmass, water bodies and other natural features.

5.5.2 Even though the IIRR complex is an integrated complex for mobility, communication and having effective presence. The campus can broadly be divided into two parts, viz., the Institute area and residential area. The institute will occupy 65% while the residential area will make up 35%.

5.5.3 The main building will be a ground+4 story building.

5.5.4 The architecture of the IIRR main building follows the Circular shape and over 70% Offices, Classrooms, Laboratories and engineering, computational facilities, like simulators, experimental labs, meeting rooms, canteens, workout areas, meditation / prayer rooms will be in the main building.

5.5.5 The Institute will cater to Industrial safety rules, particularly the laboratories, workshops and other test and experimental facilities.

5.5.6 The environmental / green norms for the development of the campus will be:

- Smart building norms
- Energy conservation: solar panels and other energy resources will be explored.
- Development for Zero waste policy that includes recycling of sewage waste.

5.6 Project Major Features

Based on the survey of some selected academic and R&D institutes following major features have been identified for IIRR campus:

5.6.1 The Campus is divided into two major areas, the Institute Campus and Residentials areas.

5.6.2 A circular / ring architecture of 350 dia is a major feature located in Institute Campus.

5.6.7 Development of land including the drainage systems, availability of water, electricity, etc., Road that include access facility, Electricity including a substation, a workshop, communication facility and security as also creating the boundary will be the part of initial development.

5.6.8 The building and layout of systems and drainages will follow water conservation.

5.6.9 The Auditorium at the centre of the institute (300 capacity) will also house technology demonstration hall, the canteen area with a capacity to serve food for 300 gathering, Meeting rooms for 20, 30, 50 and 100 people with adjoining areas for high tea and catering.

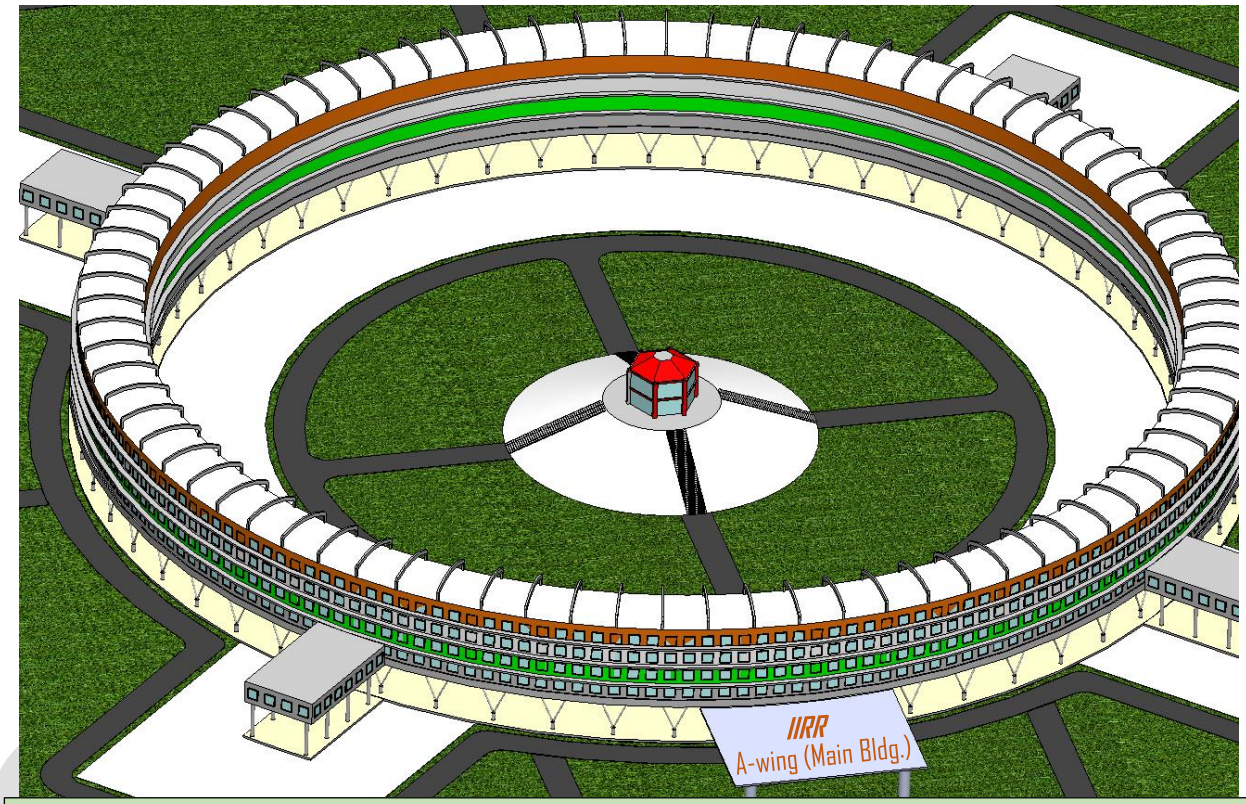

Figure 5: A 3-D architectural drawing of the main building viewed from the A-block (Main Building side. The A block with four floors with the two side wings forms part of Phase-II and the remaining three blocks are included in Phase III. At the centre of ring-building an Auditorium with a sitting capacity of ~ 300 can be see with approach roads. The auditorium will also house an technical cum-spiritual hall and exhibition centre

5.6.3 Apart from the ring building the institute will have 5 engineering buildings for hosting the core departments.

5.6.4 An auditorium with a capacity for 300 sitting along with a corridor for exhibition and meeting rooms along with the facility for presentation, discussions and adjacent catering will be provided. It will also have provision for converting the sitting area into small halls for parallel sessions for conducting parallel sessions and meetings and technical exhibitions.

5.6.5 The Main building will have room for Director and his office, meeting. The Dean, Academic, Dean Admin, Dean R&D, Dean Faculty, Dean Student Affairs along with other peripheral functions, like registrar, administration, account and other services functions.

5.6.6 The main building will have 4 lecture theatres for a sitting capacity of 70 and 10 Classrooms for academic sessions.

5.6.10 The top of the auditorium campus will host an iconic feature that reflects Indian Ethos in academic and R&D. This feature should be visible from outside of the campus.

5.6.11 The campus will have three hostels two for boys and one for girls integrated into one location. Total capacity of 300. Preferably a multi-storied design shall be employed.

5.6.12 The residential area will have following features:

A. Residential buildings of A, B, C, D, E and E1 type with a capacity of 60, 60, 60, 100 and 70 and 20. Director's quarter will be independent. A multi-story building is planned

B. The service area will be located at the interface of campus and residential area. The major services planned are:

- Water storage and management maintenance and services

- Electrical substation and services maintenance
- Transport services, that include management, parking and services
- Garbage process and sewage plant
  Security assessment and management.
- A market that caters to daily needs and other purchases

C. A playground and club house to cater to the social component for the residents.

D. Security posts for residential as well as institute interface.

5.7 Civil Design Guidance

Applicable Quality and Safety Standards shall be followed in development and construction as follows:

1.0 Highest 'Quality' standard and codal guidelines shall be followed in design, material selection and construction of the buildings, structure infrastructural and services development and implementation.

2.0 To ensure high reliability and safety in site selection, preliminary and final design, construction and commissioning, the clearance should be obtained from regulatory or equivalent review committee appointed by SRESA managing committee.

3.0 Any deviation from quality standards or codal guidelines should be recorded and a non-compliance note subjected to regulatory / review committee clearances.

4.0 The occupancy certificate should be obtained from the SRESA MC appointed review committee before regular use of the building.

5.0 Applicable codes and health and safety guidelines should be followed in the layout, design and construction of labs, workshops, and testing facilities.

6.0 Complex should also have provision for security that includes security fencing / boundary at complex level, security posts at strategic locations, provision of securities closed circuit cameras, watch towers and computerized system for routine surveillances.

5.8 IIRR complex Layout

5.8.1 Academic Block

Main Building (or A block of ring building) & Academic Blocks

- Ring building houses both R&D and academic is a f structure with two wings at corner
- The structure should have aesthetic design meeting Indian ethos and modern aesthetics
- The design should have provision for water harvesting, maximum use of natural lights and provision of plantation all through the complex
- The building should have a special room for IIRR director and his staff, 5 Deans and their staffs, Offices for Head of the Divisions 10, and 3 administrative staff halls, purchase and procurement, etc.
- The main building should have at least 10 A size Class Room, 20 B Size Class Rooms, 10 lab rooms.

5.8.2. Auditorium or Convention Centre

The design of convention center should have capacity for ~ 300 persons and a stage adequate to facilitate institute academic and cultural functions. Provision for temporary partitioning such that the available space can be converted for conducting at least 6 parallel sessions. Provision for exhibition and dining space and a regular canteen facility is also envisaged in the design. The two elevators shall be provided in the auditorium complex.

5.8.3 Academic Block

Six academic blocks one for Science (Physical and Chemical), Second for Mechanical and Civil, third for Computer Science and Artificial Intelligence and Software Engineering, fourth for Electrical and Electronics, Fifth for Human Factor Engineering and sixth for Risk and Reliability Science. Each block will be a 4 Floor Building. Each will have provision for Dept offices, HOD Room and administrative office, 20 Classrooms, 10 laboratory rooms, mostly located on ground floor due to flood loading limitations.

5.8.3 Workshops and Testing Labs

The design, total area, facility including floor bearing capacity, and foundation should be in according to the 'norms of setting up engineering institutes. Generally, all the workshops, electrical labs and testing labs shall be located in the sub-basement generally referred as the service. The service area shall have enhanced industrial safety compliance.

5.8.4 Simulation & AI and Spiritual Centre (SAS block)

Keeping in view present challenges and future requirements this block will caters to academics and R&D in an integrated facility SAS that will facilitate interdisciplinary research not only among SAS but also with quantum mechanics, physical sciences and with industries. The objective is to perform research on understanding human qualities / factor. The consciousness research will be at the core of this complex.

It is postulated that this complex will house process plants, nuclear plants, space systems, defence system, railway, and aviation simulator. These simulators will enable researchers to understand human behavior during testing times when stress levels are higher than normal. The simulation & AI complex will be one of the unique features of complex. It is considered vital that simulation and AI should be at the core.

6.0 Resource Generations

Even though the IIRR will be an autonomous body, the project implementation and subsequent operationalization will explore following options in the best interest of nation in general and stakeholders in particular:

6.1 The Central State governments in India will be approached for land and infrastructural support for the IRR, land, and other basic developments like water, electricity and campus roads and groundwork. A site location at < = 20 km from a town ship with a local water body will be preferred with other considerations like suitable distance to rail, road and airport.

6.2 For institute infrastructure development the Central Government / State government and Central Government Departments Like Department of Atomic Energy, Defense Research and Development

Organization, Department of Space, Indian Railways, Director General of Civil Aviation, Department of Telecom, Financial Institutions, and Business houses will be approached for part fundings support.

6.3 Alternatively, the project will also explore PPP (Private, Public Partnership) model.

6.4 It was discussed that an integrated model will be developed to cater to the resource requirements.

6.5 The whole project developed will be structured such that that project cost, based on a preliminary estimate for implementation, shall not exceed Rs 500 Cr.

7. Support to National Program

The support to national program has been considered at Academic, R&D and other collaborative modes at national and international level, at indicate level, as follows:

7.1 Academic Programme: IIRR is committed to the development and running of academics of national interest and growth. The objective is - Generating human resources laced with advanced knowledge on modeling, analysis, testing, simulation of engineering systems, products and services including software systems.

7.2 The R&D program will again focus on addressing the challenges faced by the industries and the society at large. Metrics will be developed in terms of requirements and the outcome of the projects. Even though the IIRR focus is primarily the industrial systems, the other sectors, like health care, pharma, or other sectors having direct impact to society and where 'risk' forms a key metrics will also be considered favorably.

7.3 To accelerate the growth collaboration program of national interest, national and international will be integral part of IIRR organizational mandate.

7. Final Remark

While working on performance objective of engineering systems, 'reliability' forms a key metrics, be at the level of design, operation, maintenance etc. while risk forms an overriding factor. Potential risk of accident and consequent fatalities, loss of property, harm to the environment are series concerns. Even though Industrial organizations are seriously following safety procedure and targets, in this globalization and competitive environment there is need of introspection and a paradigm shift to address risk and reliability metrics employing quantitative, rational and scientific based approaches. The consequences, as we come across in media systems on, sort of regular basis, a strong risk and reliability conscious culture is the need of the hour. A national center of excellence is not an option but a must. The bye laws of SRESA and the objective and aims therein provides for IIRR to serve the society at large. IIRR will have character of autonomous institution. The objective of the IIRR as an institute of academic and research excellence, is to serve by dedicatedly initiating / accelerating and run the R&D and Academic programme in the country that touches every life, employing solution-oriented approach and build a risk conscious culture. IIRR will work to meet the national aspiration of **Atmanirbhar Bharat** and Make in India initiative.

The Proposal : The proposal will be put up for 'in principle approval of IIRR. Specific items that require approval for initiation of the program are as follows:

Title of the 'Indian Institute of Risk and Reliability'. As also appoint the Chief Executive Officer, to steer, manage and implement this IDEA

Formation of Project Executive Committee and Suggestions. Approval of Faculty and adjunct faculty as per the discussion and induction of more faculties among the SRESA members. Initiate the IIRR program in phased manner: The initial phase comprised of develop conduct of Outreach programme as mentioned in item 7 of this proposal.

`Explore the feasibility of the IIRR in respect of resources, infrastructure, budgetary requirements, funding and other aspects mentioned in the proposal.

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Society for Reliability & Safety (SRESA)

(REG. NO. : F-43051 (Mumbai))

SRESA COORDINATOR, SHRI S.J. RAUT, 64-VIBHA, R. PARAMHANS MARG
OPP. CARDINAL GRACIOUS HIGH SCHOOL; BANDRA(E) MUMBAI - 400051
Web Site: www.sresa.org.in (PHONE ; +91-9892464817)

MEMBERSHIP APPLICATION FORM. MEMBERSHIP NO*.

1.	Name of applicant		Affix your stamp / passport size photograph and send a soft copy by email
2.	Qualification		
3.	Affiliation		
4.	Position held		
5.	Specialization		
6.	Official address ☐ Residential Address ☐ (Please tick the address to be used for official communication)		
7.	Brief Bio-data:		
8.	Cell phone number and email address	Email:	Cell No:
9.	Date of birth (DD/MM/YY)		
10.	PAN Number (not applicable for student)		
11.	Type of membership (Tick applicable category)	Petron (By Invitation) : Nil Honorary Member (By Invitation): Nil Life membership : Rs. 2,200/- Membership (annual) : Rs 1200/- Student membership : Rs 500/- (Please tick the applicable category)	☐ ☐ ☐ ☐ ☐
12.	Payment mode: i) Cheque ☐ ii) Demand draft ☐ iii) On-line transfer: ☐ Cheque /DD/online transfer details :.....Date: ..... Amount: ..... Name of the Bank:.....Account number.....ISFC code		
12	Signature of applicant:		

- Please send the scanned copy of the form duly signed by email to Secretary, SRESA along with a soft copy of the passport size photograph to secretary@sresa.org.in and a copy to treasurer@sresa.org.in
- SRESA account details are as follow: Money to be transferred in favour of 'Society for Reliability and Safety', SRESA Account number: 31110442604, Bank Name: State Bank of India, Branch: Anushaktinagar, Mumbai 400094, Branch Code 010124, IFS Code: SBIN0010124.
- *will be allotted by SRESA Office.

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