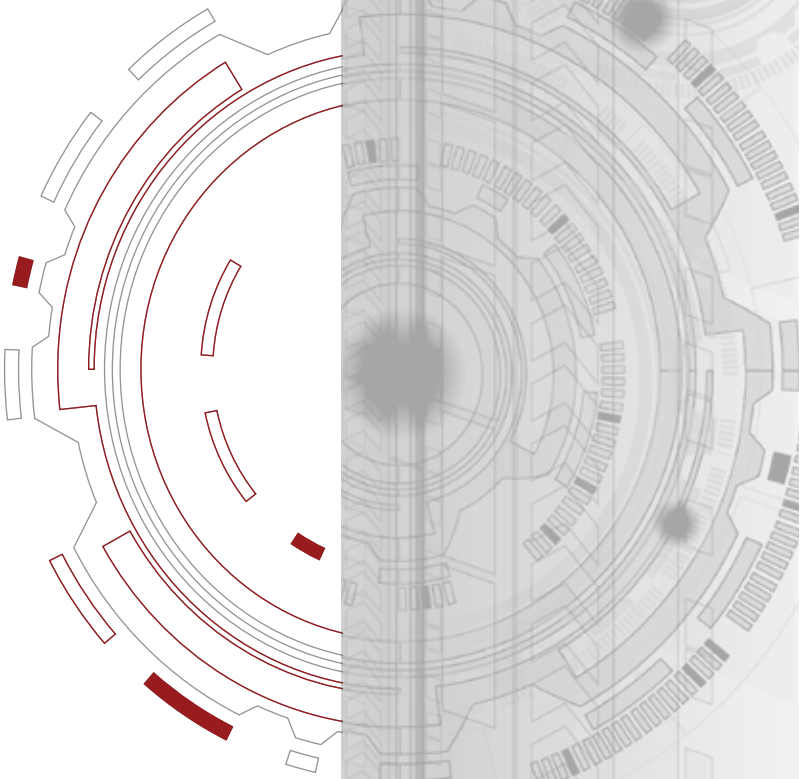
# RICHARD P. FEYNMAN CENTER FOR INNOVATION

# 2017 PROGRESS REPORT



## THE NEXT BIG IDEA

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# TRANSITIONING LOS ALAMOS' TOP INNOVATIONS

**Depends on** researchers who want to take their scientific discoveries beyond the laboratory and create technologies that can change the world. We do this by inventing, innovating, disrupting and partnering to deploy Los Alamos technology.

### Inventing

Los Alamos National Laboratory has been inventing for the past 75 years to accomplish the difficult, the unexpected and at times, what seems impossible. In 2017, Los Alamos was granted a patent on average every 4 days.

### Innovating

Los Alamos' immense contributions in leading edge science and technology research and development are directed into solving complex and forthcoming national security challenges. This year we honor the Los Alamos researchers who have exceptional and longstanding contributions to scientific discovery, innovation, and collaborations to deploy their technology.

### Disrupting

Los Alamos has a long history of disruptive innovations starting with the first nuclear weapon. This year we highlight big and small science behind the next disruptive innovations; "mosaic" vaccine for HIV, innovation in small nuclear reactor technology, software suite that pushes boundaries for modeling fluid flow and contaminant transport in fractured rock, and the development of augmented reality tools for nuclear criticality safety.

### Partnering

Los Alamos science has assisted partners big and small with their toughest challenges, this year we had four postdocs who took on a challenge to reach out to potential partners to test their technology's commercial potential.

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# THE PEOPLE POWERING INNOVATION

The Richard P. Feynman Center for Innovation is excited to announce the formation of the Innovation Honor Society. Its purpose is to honor the Los Alamos researchers who have exceptional and longstanding contributions to scientific discovery, innovation, and working with industry to deploy their technology.

The criteria for induction include overall engagement in collaboration projects, protection and deployment of intellectual property, and other innovation indicators. This involvement was used to objectively generate a weighed score threshold for induction. The inaugural class of 10 inductees are:

**Dipen Sinha** – Materials Synthesis and Integrated Devices
**Technical Focus:** Noninvasive characterization, acoustic manipulation of materials
**Primary Partner(s):** Chevron

**Bette Korber** – Theoretical Biology and Biophysics
**Technical Focus:** HIV sequencing and immunology
**Primary Partner(s):** Duke, Harvard, TomegaVax

**Cristian Pantea** - Materials Synthesis and Integrated Devices
**Technical Focus:** Ultrasonics, nonlinear acoustics, solid state physics
**Primary Partner(s):** Chevron

**Gary Grider** – High Performance Computing
**Technical Focus:** High Performance Computing, performance, memory
**Primary Partner(s):** Seagate, EMC Corporation

**Peter Hraber** – Theoretical Biology and Biophysics
**Technical Focus:** Computational immunology / evolution, statistical genetics
**Primary Partner(s):** Duke

**Stephen Judd** – Integrated Design and Assessment
**Technical Focus:** Integrated design and assessment, CubeSats
**Primary Partner(s):** Mission Sponsor

**Nicholas Dallmann** – Applied Modern Physics
**Technical Focus:** CubeSats
**Primary Partner(s):** Mission Sponsor

**Pulak Nath** – Applied Modern Physics
**Technical Focus:** Microfluidics and miniaturization
**Primary Partner(s):** STD Quick Screen, Vista Therapuetics, Divine Beauty, Pivotal Biotech, Microwave Biostimulation, CFD Research Corp, ATHENA

**Christopher Morris** – Subatomic Physics
**Technical Focus:** Muon radiography and tomography
**Primary Partner(s):** Decision Sciences, TEPCO, Toshiba

**Patrick Chain** – Biosecurity and Public Health
**Technical Focus:** Genomics, bioinformatics, molecular biology, genetics, microbial ecology and evolution
**Primary Partner(s):** University of Oklahoma, BlueDot, Viome

# RICHARD P. FEYNMAN INNOVATION PRIZE WINNER

**Bette Korber -**
**Theoretical Biology and Biophysics**

The major challenge in designing a vaccine for HIV is its extraordinarily rapid evolution, which makes HIV extremely diverse. One of Dr. Bette Korber's technical innovations, a "mosaic" vaccine, enables the design of vaccine candidates that can elicit immune responses that have the potential to be broadly effective against HIV, despite its great variability. Several of her vaccine design strategies have been tested in collaborative studies with top national and international research teams, and have shown promise in animal vaccine studies. This has led to patenting of several of her candidate vaccine designs, together with members of her team, and with external experimentalist partners who focus on vaccine delivery strategies and testing.

One of her products, an HIV vaccine that was designed to contend with global HIV diversity, was initially tested at Harvard and has made the transition into the commercial sector. Janssen, a subsidiary of Johnson and Johnson, is testing this mosaic vaccine design in a human clinical trial that is currently underway in Africa (The Imbokodo Study, a Zulu word that means "rock", and refers to women's strength), to see if it can protect people against infection. If successful, this vaccine is a possible candidate to be the first HIV vaccine to reach the market.

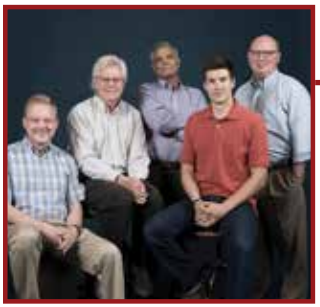
Tomegavax is using another HIV vaccine design from Dr. Korber's laboratory, to develop a vaccine delivery approach based on splicing the candidate vaccine into the genome of a cytomegalovirus, a technology developed at the University of Oregon. Oxford University is working with her on both HIV and Ebola vaccines.

## dfnWorks Team: Carl Gable, Jeffrey Hyman, Satish Karra, Nataliia Makedonska, Hari Viswanathan - Earth and Environmental Sciences Division

The dfnWorks team developed a software suite that pushes the boundaries for modeling fluid flow and contaminant transport in fractured rock. The team is collaborating with Golder Associates integrating dfnWorks with their commercial software package FracMan. FracMan is a prominent commercial software for flow and transport in fractured rock. dfnWorks is also being used by the Swedish Nuclear Fuel and Waste Management Company to model flow and radionuclide transport at their potential repository sites. The software is a part of a national, multi-lab R&D project to evaluate gas migration for the Department of Defense.

## Andrew. R. Wysong - Nuclear Criticality Safety Division

Andrew Wysong took over as the NCS Division Leader in October 2014. Under his leadership the Division has stabilized and grown to become increasingly functional and effective. Part of Andrew's vision was to not only improve technical analysis, but the implementation of safety controls as well. One project that was started to help facilitate implementation is the use of augmented reality tools in nuclear facilities to assist operators with day-to-day tasks. One example of this is the use of augmented reality tools for planning safe and efficient nuclear material movement. This technology has the potential to reduce the frequency of operator error while simultaneously increasing the production efficiency in nuclear facilities.



## Rao Dasari, Patrick McClure, David Poston, Robert Reid, Morgan Biel - CNPO, NEN-5, AET-1

This team has changed the way the lab looks at innovation for nuclear reactor technology. The estimated time from innovation to implementation of the designs could be longer than 20 years. The team has developed two new cost effective reactor designs, Megapower and Kilopower, that are readily implementable and safe, preventing many issues regarding deployment. After successful demonstration of their reactors with NASA, the group has an initiated 32 new patent filings. This creativity, promises to keep the lab at the cutting edge of reactor technologies.


## Jessica Kubicek-Sutherland

### PROBLEM

Sepsis is the third leading cause of death in the United States, occurring when the body has an extreme response to an infection. Sepsis symptoms are often confused with other diseases. Early and aggressive treatment improves chances of survival. As many as 80% of sepsis deaths could be prevented with rapid diagnosis and treatment. Current sepsis diagnostics take at least 14 hours to detect, 2 hours longer than people can survive after infected.

### SOLUTION

The Rapid Sensor Check can diagnose a sepsis infection in minutes with just a drop of blood. Detection of trace amounts of bacterial signatures directly in the blood is performed using a strategy that mimics that of our own innate immune system during an infection.

## Anand Kumar

### PROBLEM

Over 500,000 cases of Clostridium difficile (C.diff) are diagnosed each year in the United States. Following unsuccessful antibiotic treatments, many are left with only a fecal transplant as a treatment. Widespread acceptance of the fecal transplant practice is limited due to unpredictable side effects and risk of pathogen transfer as well as high out-of-pocket costs to the patient.

### SOLUTION

For C.diff patients, especially those at high risk for a recurrent infection, DiF-FiX provides a universal, safe, non-invasive treatment in the form of a pill. This is accomplished by utilizing a new platform developed at Los Alamos National Laboratory that characterizes those microbial interactions that suppress C.diff. Key cell-to-cell interactions are identified that rid the body of C.diff and prevent it from reoccurring.


## Maruti Mudunuru

### PROBLEM

Nearly 30,000 oil and gas wells are drilled every year in the United States. These wells and sites monitor temperature, gas and water content, and so much more that the data collected on a single well can exceed 27,000,000 readings. Hence, an effective data analytics software is need to condense the data into actionable information for real-time monitoring of oil & gas wells.

### SOLUTION

EDGEip provides an automated and smart sensing of leaks in near real-time by combining low-cost and energy-efficient sensors, smart computing devices, and machine learning software to reduce large volumes of sensor data to actionable information.

## Vamshi Chillara

### PROBLEM

Miniaturization, escalating healthcare costs, and chronic diseases are reshaping the medical device implant market. Implants are being placed deeper in the body where they cannot be powered by current wireless charging devices, requiring wires connected to external battery packs. Wireless energy transfer is necessary to power future implants.

### SOLUTION

The ultrasonic wireless rechargeable delivery system offers tunability, a range of 6cm into the body and a 40 percent higher efficiency. The technology is addressing deep brain neurostimulation.

## In 2017, the Feynman Center engaged in and with:

**748**
active agreements

**414**
businesses

**46**
laboratory organizations

## 2017 Intellectual Property and Licensing

**130**
patents filed

**384**
active licenses

**19**
license royalties

**92**
issued

**$1.4M**

**$500K**

## 2017 Partnerships and Agreements

**83**
collaborative research and development agreements

**99**
non-federal strategic partnerships

**21**
department of health and human services agreements

**$6M**

**$16.5M**

**$7.6M**

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