Indian Institute of Space Science and Technology

Declared as Deemed to be University under Section 3 of the UGC Act, 1956

An autonomous institute under Department of Space, Govt. of India

Valiamala P O, Thiruvananthapuram - 695 547, Kerala

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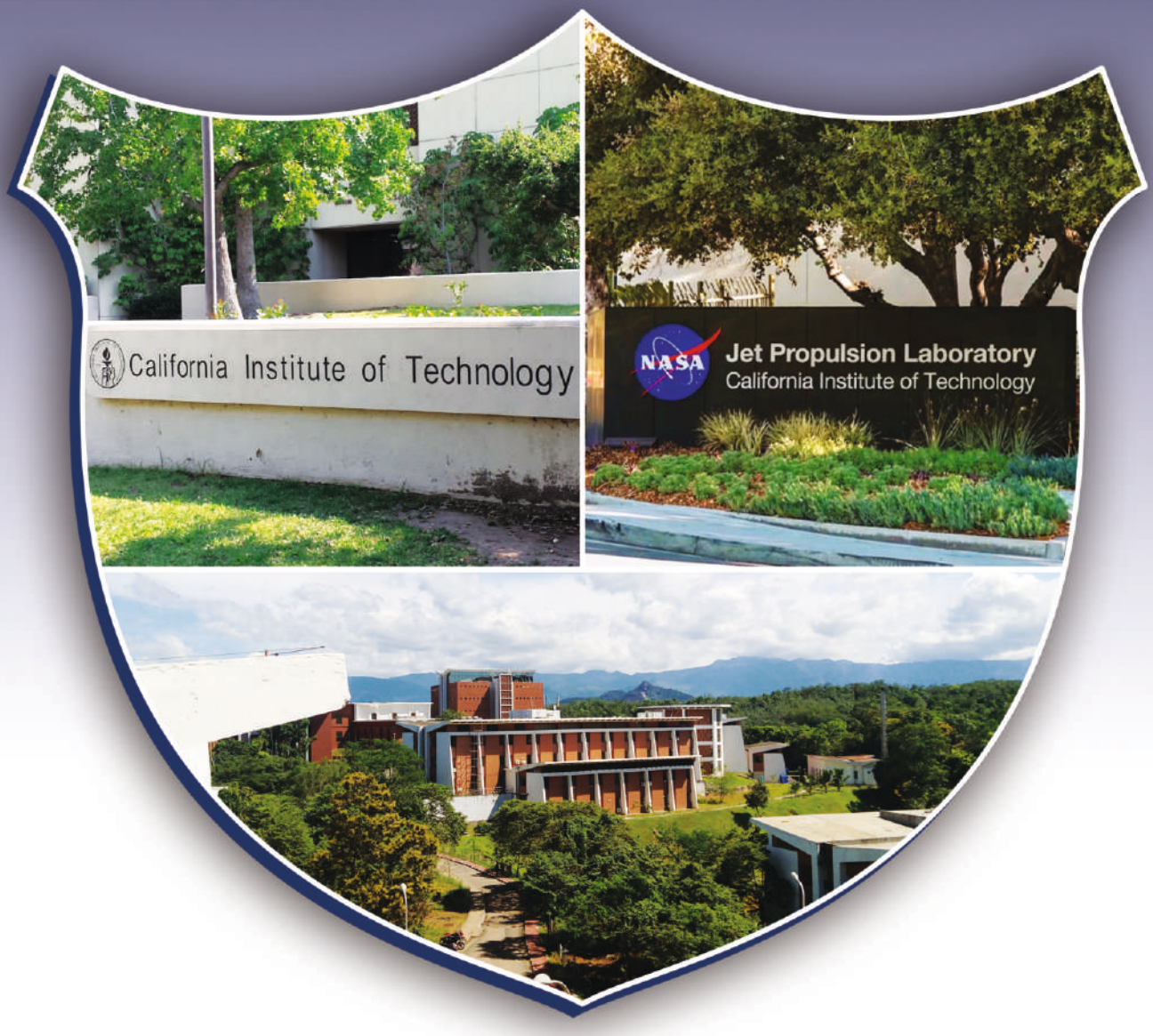

MEMOIR

10 Years of IIST - Caltech / JPL Collaboration

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Dr. B. N. Suresh

Chancellor, IIST

Message

The Collaboration between IIST and CalTech/ JPL has its genesis, way back from the middle of 2009 where initial discussions were held with Caltech/JPL, USA during a visit of delegation from IIST/ISRO officials. Subsequently, it was followed up in August 2010 by a visit of a team consisting of Prof Ravichandran and Prof. Chandy of CalTech and Dr. Virenra Sarohia of JPL. I am indeed delighted to see that these initial discussions have evolved and grown considerably in size and stature in the last ten years and the collaborations between these Institutions are on a very firm foundation.

It is certainly befitting and apt that IIST is organising a celebration on 13th September 2019 at IIST to commemorate the.'10 Years of IIST/CalTech/JPL Collaboration'. While student visits to undertake M.S. programme in CalTech under Prof Satish Dhawan Endowment has steadily expanded over the last 10 years, the number presently standing at ten including the students who are leaving this year, It is quite heartening to note that fifteen IIST undergraduate students have undertaken summer internship for two months at JPL.

The collaboration has further matured from student visits to undertake joint multi-institutional collaborative research projects such as 'AAReST' (Autonomous Assembly of a Reconfigurable Space Telescope) involving CalTech, JPL, IIST and University of Surrey and other similar projects on cutting edge space technologies. I am very hopeful that our collaborative efforts will gather further momentum and continue to benefit all participating agencies in future.

On this happy occasion, I convey my greetings and best wishes to all who are participating in the celebration programme organized by IIST to commemorate the "10years collaboration of IIST and Caltech/JPL"

Dr. David A. Tirrell
Provost, Caltech, USA

Message

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IIST Satish Dhawan Graduate Fellowship Program at Caltech

I am pleased to share the incredibly positive experience that Caltech faculty and students have had with the Satish Dhawan Graduate Fellows of the Indian Institute of Space Science and Technology (IIST) who have pursued their advanced degrees in aerospace and electrical engineering.

The IIST Satish Dhawan Graduate Fellows are in the top tier of their classes, raising the bar for their peers and contributing to the quality and reputation of Caltech. Many of the IIST aerospace students have won the prestigious Kalam Prize, awarded each year by Caltech's Graduate Aerospace Laboratories (GALCIT) to the M.S. student with the best academic performance in Space Engineering. I look forward to the upcoming expansion of the IIST Satish Dhawan Fellowship program in the area of Engineering Sciences.

I am confident that the active participation and refreshing outlook of the IIST Satish Dhawan Graduate Fellows will continue to push the intellectual boundaries of Caltech's academic programs in the future.

David A. Tirrell
Provost
Ross McCollum-William H. Corcoran Professor of Chemistry and Chemical Engineering
Carl and Shirley Larson Provostial Chair

Lt. General Larry D. James

Deputy Director, JPL, USA

Message

JPL

OFFICE OF THE DEPUTY DIRECTOR

September 5, 2019

Dr. V K Dadhwal
Director
Indian Institute of Space Science and Technology
Thiruvananthapuram – 695 547

Dear Dr. Dadhwal:

I am pleased to celebrate the success of the IIST Summer Internship Program at JPL. Over the past ten years, IIST faculty have sent their best and brightest students to participate in summer internships at JPL. The programs' multifaceted approach enriches the United States and Indian space programs.

These bright minds are contributing directly to space research and adding a fresh perspective to the process. They receive excellent hands on training and develop skills they will take back to their home institutions. This collaborative process expands the boundaries of space research beyond India.

This unique experience will help scholarship recipients create powerful bonds and navigate professional careers at the Indian Space Research Organisation (ISRO), while fostering continued collaboration between our great countries. This program promotes diversity and equal opportunities, pillars of our foundation. The future is bright and includes plans to create internship opportunities for Caltech/JPL at ISRO.

We look forward to your continued support of this incredible summer internship program and the many exciting opportunities it will create in the future years for joint space ventures between ISRO and JPL such as the NASA-ISRO Synthetic Aperture Radar (NISAR).

Larry D. James

Larry D James

Deputy Director

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Dr. V. K. Dadhwal
Director, IIST

Foreword

भारतीय अंतरिक्ष विज्ञान एवं प्रौद्योगिकी संस्थान
(यूजीसी अधिनियम 1956 की धारा-3 के अधीन मानित विश्वविद्यालय घोषित
भारत सरकार, अंतरिक्ष विभाग, वलियमला पोस्ट, तिरुवनंतपुरम 695 547 भारत

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डॉ. वी. के. डढ़वाल / Dr. V.K. Dadhwal
निदेशक / Director

Foreword

Indian and USA have very deep and diverse relations in the area of science and technology that have been sustained by large number of Indians who have studied in USA. Graduate Aerospace Laboratories of the California Institute of Technology (GALCIT) is the pioneer as well as global leader in aerospace education and research. Prof Satish Dhawan, an alumnus of Caltech was Chairman ISRO during 1972 to 1984 while he was also the Director of Indian Institute of Science (IISc), Bengaluru. While Caltech association with Indian Institute of Science (IISc) goes much earlier to late 1930s, the National Aerospace Laboratories (NAL) of India which was established in 1959 had its first three directors who were Caltech alumni: founding Director P. Nilakantan (MS 1942), director from 1959–1964; S. R. Valluri (MS 1950 PhD 1954), director from 1965–1984; and R. Narasimha (PhD 1961), director from 1984–1993.

Indian space program has another Indo-US thread in its origin. Subsequent to interactions between Indian and US scientists in International Geophysical Year (1957), US supported establishment of Thumba Equatorial Rocket Launch Station (TERLS) through training, providing equipment for telemetry and loan of Nike-Apache sounding rockets. This was instrumental in initiating rocket related activities at Thiruvananthapuram as well as establishment of Indian Space Research Organisation (ISRO) in 1969. A large number of other successful collaborative activities have since taken place between India and USA that are too numerous to be listed. A particular mention can be made of collaboration between JPL/NASA and ISRO for Chandrayan-1, recently conducted AVIRIS-NG program for hyper-spectral remote sensing and joint remote sensing mission under realization, the NISAR (NASA ISRO Synthetic Aperture RADAR), scheduled for 2022 launch.

Indian Institute of Space Science and Technology (IIST) was established by Department of Space/ISRO in 2007, with twin objective of creating specialized manpower and undertaking advanced research in niche areas of space technology, space science and space applications. It is natural for IIST to have collaborative activities with Caltech/JPL. Since early visit in 2009 to Caltech by founding Director of IIST, Dr BN Suresh and visit of Caltech/JPL delegation to IIST led by Prof. G Ravichandran, then Director GALCIT in 2010, the collaboration has blossomed into a multi-faceted sustained activity which has the commitment from participating organisations. On the occasion of 10 Years of IIST-Caltech/JPL Collaboration meeting, it is very satisfying to note the progress and share this Memoir contributed by participants in this collaboration. My best wishes for the continued growth of this collaboration and further professional growth of IIST participants and grateful acknowledgement of all Caltech/JPL faculty and staff that made this possible either directly or indirectly.

Vkdadhwal

(V K Dadhwal)
Chairman/Board of Management

September 12, 2019

Prof. A. Chandrasekar
Outstanding Professor & Dean (Academics), IIST

Evolution of the Ten year long IIST- CalTech/JPL Collaboration

Indian Institute of Space Science and Technology (IIST) was set up in September 2007 as an autonomous institution under the Department of Space, Government of India. The institute was duly recognized by University Grants Commission (UGC) in June 2008. The institute started offering three undergraduate programmes in (i) Aerospace Engineering, (ii) Avionics, and (iii) Physical Science in 2007. While PhD programme was initiated to sponsored candidates in 2008, the same was opened to non-sponsored candidates in 2010. The institute launched four Post-Graduate programmes in July 2012 which has since expanded to fifteen, presently. In 2014, the undergraduate programme with B.Tech in Physical Science was changed to a dual degree (B.Tech/M.Tech and Master of Science) programme while the B.Tech (Avionics) programme was renamed as B.Tech Electronics and Communication Engineering (Avionics) programme for students from 2014 batch.

First Visit by CalTech/JPL team to IIST

The decade long collaboration between IIST and CalTech/ JPL had its genesis, way back in the middle of 2009 where initial discussions were held with Caltech/JPL, USA during a visit of delegation from IIST/ISRO officials. Subsequently, it was followed up in August 2010 by a visit to IIST of a team consisting of Professor Guruswamy Ravichandran Professor of Aerospace and Mechanical Engineering, CalTech, Professor Kanianthra M. (Mani) Chandy, Simon Ramo Professor of Computer Science, Emeritus, CalTech and Dr Virendra Sarohia, Chief Technologist of JPL.The above visit happened just a fortnight before the institute was to move to its permanent campus on 15 August 2010.

The three member delegation from CalTech/JPL during their visit to IIST submitted a proposal that provided an opportunity for an undergraduate Aerospace Engineering student of IIST to visit CalTech and complete a M.S programme in Space Engineering in CalTech. The delegation conveyed to IIST that CalTech is agreeable to partially contribute a one-time amount that together with contribution from ISRO would form the corpus; interest from the above corpus amount would provide the necessary funding required for the total cost of a meritorious Aerospace Engineering undergraduate student of IIST to complete a 9 month M.S programme in Space Engineering in CalTech. The members of the delegation also expressed their desire that the above corpus (endowment) be named after Professor Satish Dhawan, one of their own distinguished Aerospace Engineering alumni who was also the second Chairman of ISRO. The above proposal was enthusiastically welcomed by Dr B. N. Suresh who was the (founder) and the then Director of IIST. Although all of us at IIST expected that the top meritorious student of the first batch of Aerospace Engineering undergraduate student who passed out in May 2011 would be able to avail the above opportunity, the first undergraduate student who made the cut was from the third batch of the undergraduate programme.

Professor Satish Dhawan Awardees

Mr Aditya Chapalkar, a topper of B.Tech (Aerospace Engineering) of the 2009 batch of IIST was the first student to travel to CalTech in September 2013 and complete the M.S. programme in Space Engineering in June 2014. Mr Aditya Chaplkar not only successfully completed the M.S. programme in CalTech but was also awarded Dr Abdul Kalam Prize of CalTech for the best academic performer among all graduate students. It was a great moment of pride for the entire IIST fraternity as our (Founder) and the then Chancellor was none other than Dr Abdul Kalam himself. A first IISTian availing Prof. Satish Dhawan Endowment being awarded Dr Abdul Kalam Prize; the above turned out to be a fitting tribute to the two doyens (Professor Satish Dhawan and Dr Abdul Kalam) of India's Space Programme. While IIST bore the travel expenditure, visa expenses and medical insurance of the student, CalTech supported their accommodation and incidental expenses. Mr Aditya Chaplakar returned to India in June 2014 and joined VSSC, Trivandrum as a Scientist/Engineer.

The topmost meritorious student of IIST in B.Tech Aerospace Engineering continued to proceed to CalTech and complete their M.S. in Space Engineering year after year. From the second student (of 2014 pass out B.Tech batch) undergoing M.S programme in CalTech onwards, JPL provided for an additional two months of summer internship (July and August) opportunity at JPL within the overall agreement of Prof Satish Dhawan Endowment; the above provided very valuable hands-on exposure of the research carried out at JPL to our students.

It is in the fitness of things to note that two more IISTians from Aerospace Engineering who proceeded to CalTech to complete their M.S in Space Engineering have also been awarded Dr Abdul Kalam prize (Mr Avinash Chandra in the year 2018 and Mr Padmanabha Prasanna Simha for the year 2019); a truly outstanding performance of IISTians securing three times Dr Abdul Kalam Prize in seven years. Till now, six top meritorious IIST students of Aerospace Engineering have been Prof Satish Dhawan Endowment awardees with the first girl student Ms Garima Aggarwal slated to undertake her M.S. programme in Space Engineering in September 2019.

Extending Prof Satish Dhawan Endowment to the other undergraduate programmes

Buoyed by the success of the Prof. Satish Dhawan Endowment that enabled meritorious students of Aerospace Engineering to secure Dr Abdul Kalam Prize for the best academic performer, both CalTech and ISRO agreed to extend the fellowship to include a meritorious topper of B.Tech Electronics and Communication Engineering (Avionics) to also avail the opportunity to complete M.S. programme in Electrical Engineering CalTech from the year 2017. Mr Jiljo Moncy a 2013 batch IIST student visited CalTech in September 2017 and duly completed MS programme in Electrical Engineering in CalTech in June 2018. Till now, two top meritorious IIST students of Electronics and Communication Engineering (Avionics) have been Prof Satish Dhawan Endowment awardees with the topper of ECE (Avionics) of 2019 batch slated to undertake his M.S. programme in Electrical Engineering in September 2019. The opportunity of two month of summer internship at JPL for the months of July and August is also available to the students of B.Tech (ECE) who are Prof Satish Dhawan Endowmnet awardees.

CalTech and ISRO have over the last couple of years expressed their keenness to extend Prof Satish Dhawan Endowment to the third undergraduate programme. Discussions with Government of India are at an advanced stage and it is hoped that approval for the above will happen very shortly.

Jet Propulsion Laboratory Awardees

Jet Propulsion Laboratory (JPL) have been extremely enthusiastic to provide opportunity for our undergraduate students (one in each undergraduate programme) to undertake summer internship for two months between May to July at their lab. The first three students visited JPL during May-July 2012 and the above internship opportunity has continued since then with three undergraduate students at the end of their third year getting the benefit and exposure to the research undertaken at JPL. While IIST bore the travel expenditure, visa expenses and medical insurance of the internship student, JPL supported their accommodation and incidental expenses during the internship duration. Since the summer of 2019, the JPL internship students are allowed to stay at CalTech campus for the entire duration of their internship. Till date fifteen undergraduate IIST students of third year have successfully undertaken their summer internship at JPL.

AAReST (Autonomous Assembly of a Reconfigurable Space Telescope)

Autonomous Assembly of a Reconfigurable Space Telescope (AAReST) is a multi-institutional collaborative research project involving CalTech, JPL, IIST and University of Surrey. The essential idea is to autonomously assemble small independent spacecraft, each with their own mirror, while in orbit to realize a telescope with a large, segmented primary mirror. Professor Sergio Pellegrino of CalTech, Prof. Craig Underwood of University of Surrey, Dr Priyadarshnam of IIST are the respective team leaders of AAReST. The above project has reached an advanced stage of completion and is expected to be flown shortly.

Space Solar Power

Both CalTech/JPL and IIST/ISRO have evinced keen interest in undertaking collaborative research in 'Space Solar Power', one of the dreams of our Founder Chancellor Dr Abdul Kalam. Essentially the above research project envisages effective collection of solar power in space and transmitting the above energy wirelessly to Earth through microwaves to enable uninterrupted terrestrial power availability.

Visits of CalTech/JPL delegations to IIST

Sl.No	Delegation	Date(s)	Activities/ Remarks
1	Prof G. Ravichandran, Professor, CalTech Mr.ChandyKanianthra Mani, CalTech Dr.VirendraSarohia, JPL/CalTech	Aug 2, 2010	Collaboration & Prof Satish Dhawan Endowment proposal initiated
2	Prof. Jens Kauffmann, JPL/Caltech	Jan 17, 2012	
3	Dr. Gregg Allen Vane, JPL	Jul 26, 2012	
4	Lt. Gen. (Rtd.) Larry D James, Dy.Director, JPL Dr. Leslie Livesay, Director, Engg. &Science, JPL Dr.VirendraSarohia, JPL/CalTech	Feb 24, 2014	
5	Lt. Gen. (Rtd.) Larry D James, Dy.Director, JPL Prof. Sergio Pellegrino, CalTech Dr. Jonas Zmuidzinas,CalTech Dr.VirendraSarohia, JPL/CalTech	Mar 2-3, 2015	AAReST discussions initiated
6	Lt. Gen. (Rtd.) Larry D James, Dy.Director, JPL Prof. Sergio Pellegrino, CalTech Dr. Jonas Zmuidzinas, CalTech Dr.VirendraSarohia, JPL/CalTech	Mar 28-30, 2016	
7	Lt. Gen. (Rtd.) Larry D James, Dy.Director, JPL Prof. Sergio Pellegrino, CalTech Dr.VirendraSarohia, JPL/CalTech	Jun 19, 2017	
8	Prof. Sergio Pellegrino, CalTech Dr.VirendraSarohia, JPL/CalTech	Apr 10-11, 2018	AAReST status Review
9	Prof. Sergio Pellegrino, CalTech Dr Charles Sommers, CalTech Dr.VirendraSarohia, JPL/CalTech	Dec 10-12, 2018	AAReST Project Review along with Prof Craig Underwood (Univ Surrey)
10	Prof. AdhikariRana, CalTech	Mar 3, 2019	Guest Talk in Conscientia 2019
11	Lt. Gen. (Rtd.) Larry D James, Dy.Director, JPL Dr.VirendraSarohia, JPL/CalTech	Mar 4-5, 2019	

Students list of CALTECH / JPL Programes

B.Tech Students sponsored for Caltech MS Program

Sl No	Name	Branch	Batch
1	Chapalkar Aditya Nithin	AE	2009
2	Pranav Nath	AE	2010
3	Anand Kumar	AE	2011
4	Mohit Singh Malik	AE	2012
5	Avinash Chandra	AE	2013
6	Jiljo K Moncy	AV	
7	Padmanabha Prasanna Simha	AE	2014
8	Prashant G Iyer	ECE	
9	Garima Aggarwal	AE	2015
10	Ankit Verma	ECE	

B. Tech Students sponsored for JPL Internship

Sl No	Name	Branch	Year
1	Divesh Soni	AE	(May-July 2015)
2	Suraj Kumar	AV	
3	Harshvardhan Singh	PS	
4	Avinash Chandra	AE	(May-July 2016)
5	Jiljo K Moncy	AV	
6	Netra S Pillai	PS	
7	Padmanabha Prasana Simha	AE	(May-July 2017)
8	Prashant G Iyer	ECE	
9	Hriday Dath	EP	
10	Sanjay Gorur	AE	(May-July 2018)
11	Srinika Selvam	ECE	
12	Jigyasa Nigam	EP	
13	Aalokeparno Dhar	AE	(May-July 2019)
14	Subham Saha	ECE	
15	Jureddy Chinami Sai	EP	

List of JPL Internship Students and JPL Supervisors

B.Tech in Aerospace Engineering

Students Name & Year of JPL Internship	JPL Supervisor's Name
Divesh Soni (2015)	Arturo R. Casillas
Avinash Chandra (2016)	Arturo R. Casillas
Padmanabha Prasana Simha (2017)	Arturo R. Casillas
Sanjay Gorur (2018)	Dr. Nathan.J.Strange
Aalokeparno Dhar (2019)	Armen Derkevorkian & Ali R Kolaini

B.Tech in Avionics / ECE

Students Name & Year of JPL Internship	JPL Supervisor's Name
Suraj Kumar (2015)	Berlt Kennidy
Jiljo K. Moncy (2016)	Jacek Sawonie Wipz
Prashanth Iyer (2017)	Patrik McGarey
Srinika Selvam (2018)	Nathan Strange & Nithin Arora
Subam Saha (2019)	Clayton Okino

B.Tech in Physical Science / EP

Students Name & Year of JPL Internship	JPL Supervisor's Name
Harshvardhan Singh (2015)	Dr. E. Natasha Stavros & Dr. David S. Schimel
Netra S. Pillai (2016)	Dr. E. Natasha Stavros & Dr. David S. Schimel
Hriday Dath (2017)	Dr. David S. Schimel
Jigyasa Nigam (2018)	Dr. David S. Schimel
Jureddy Chinami Sai (2019)	Dr. David S. Schimel

India Establishes Caltech Aerospace Fellowship

Article and Photo courtesy of CALTECH
Published : Wednesday, July 31, 2013 | 6:10 AM

The Indian Department of Space / Indian Space Research Organisation (ISRO) has established a fellowship at the California Institute of Technology (Caltech) in the name of Satish Dhawan (1920â€“2002), a Caltech alumnus (Eng '49, PhD '51) and a pioneer of India's space program.

The Satish Dhawan Fellowship enables one aerospace engineering graduate per year from the Indian Institute of Space Science and Technology (IIST) to study at the Graduate Aerospace Laboratories at Caltech (GALCIT), as Dhawan himself did more than 60 years ago, when GALCIT was the Guggenheim Aeronautical Laboratory. Dhawan went on to serve as the director of the Indian Institute of Science (IISc), chairman of the Indian Space Commission and the ISRO, and president of the Indian Academy of Sciences. In 1969 he was named a Caltech Distinguished Alumnus.

Chaphalkar Aaditya Nitin, an IIST graduate with a Bachelor of Technology degree in aerospace engineering, has been named the first student to receive the fellowship and will start classes at GALCIT in October.

According to GALCIT director Guruswami (Ravi) Ravichandran, the John E. Goode, Jr., Professor of Aerospace and professor of mechanical engineering, ISRO established the fellowship to create a permanent pipeline of aerospace engineering leaders who will guide India's space program into the future.

"India has a very strong domestically grown space program," explains Ravichandran. "The ISRO is hoping to maintain its momentum by training students in much the same way that Dhawan was trained when he went through GALCIT decades ago."

Satish Dhawan and colleague Anatol Roshko at a celebration of Diwali, the Hindu festival of lights, organized by Indian students on the Caltech campus in 1972.

The first three directors of what is now India's National Aerospace Laboratories were GALCIT alumniâ€"Parameswar Nilakantan (MS '42), S. R. Valluri (MS '50, PhD '54), and Roddam Narasimha (PhD '61 "The ISRO is honoring Dhawan and Caltech with this fellowship, and it is also recognizing the historical connections between engineers and scientists in the United States and India," says Ares Rosakis, Caltech's Theodore von KÃirmÃin Professor of Aeronautics and Mechanical Engineering and Otis Booth Leadership Chair, Division of Engineering and Applied Science. "It is an endorsement of GALCIT's fundamental research approach and rigorous curriculum.

"Most academic fellowships come from private philanthropy. It is extremely rare for a government institution to endow a fellowship intended for a private research institution such as Caltech," he says.

"GALCIT has had impact on aeronautics and aerospace development in the United States and abroad, not by training engineers in large numbers but by training engineering leaders," Rosakis says. "GALCIT graduates include CEOs of aerospace companies and the heads of departments at places like MIT, Georgia Tech, and the University of Illinois. If we were to create one von KÃirmÃin every half century, as well as a few aerospace CEOs, and a few Dhawans, we would be happy."

SOURCE: PASADENA NOW

Memoir

CALTECH

Chapalkar Aditya Nithin

B.Tech in Aerospace Engineering - 2009 Batch

2013
CALTECH

First thing that I felt after joining Caltech was its emphasis on science. I think it reflects in the course names also. The courses are just called as 'Fluid Mechanics' or 'Mechanics of Solids' even though Aerodynamics and Gas dynamics are taught in the course. More importance is given to understanding of various theories than to apply those theories to practical problems. The thought behind this could be that if you can understand a theory, you can apply it to any number of applications. Also, proposing a new theory has much more significance than solving just one practical problem. I still remember an example given in the Mechanics of solids class. While teaching thin plate theory, the professor explained saddle shape of 'potato chips' using the theory which felt truly amazing. Of course this can be debated if this is the right approach for an engineer, but it has worked out for Caltech so far as it is consistently in the top universities in the world.

I think this approach reflects even in the exams. Exams for different courses were of different type but all of them tried to test the fundamental knowledge. There was a mechanics of solids exam which started at 8 in the morning and answer sheet had to be submitted till 5 in the evening. All freedom was given in terms of choosing the location to give the exam (your home, classroom, library etc.) and also on use of internet. But still I could not answer all the questions satisfactorily. This shows that even though all the tools are available, finally what is being tested is your own capability.

Academics at Caltech is really tough. Completing 15 courses in a span of 9 months is really a challenge which is unchanged in GALCIT for a long long time. Every subject had 1 assignment per week that makes 5 assignments for a week. Each of these assignments used to take more than 1 day to complete. Even the exams were sometimes gruelling. I remember a day when we had mechanics of solids exam for 6 hours in the morning and had a maths exam for 3 hours in the night. When I look back after so many years, even I wonder how did I make it. But at that time, it was tough in the beginning but later on a routine was set to do the assignments and then spend remaining time on other activities. It is really important to spend some time on other activities as it is equally important to enjoy life.

Among all the courses, I felt that two courses were relatively easier Space Propulsion and Aerospace Engineering. There is a common thread to these courses that both were taken by JPL engineers. So they had a bit of application orientation which reduced the difficulty level a bit.

Honor code of Caltech was something that I was seeing for the first time. It basically states that you should not take any unfair advantage over other students. This is used in all aspects from assignments to the exams. There is nobody to continuously monitor if you are following the code but everybody follows it as the violation of it is dealt with very seriously. This builds a trust between students and helps them to collaborate. In solving the assignments, students are allowed to discuss various approaches to solve the problem but are not allowed to copy the assignment. I think this is an important aspect which enables everyone to grow.

While doing the MS, initially I had a doubt whether I belong here. Caltech selects best students from across the world and I just happen to get a fellowship. I guess this was the reason that I applied myself more than I had done before just to be on par with the other students. Also, as I was the first one to be awarded the fellowship, there was additional responsibility of doing well so as to continue this fellowship for future students. At the end of the course when I met Prof Ravichandran, I felt relieved when he said that I had done well. The very next day in GALCIT's award ceremony, receiving the Abdul Kalam Prize was a great moment not just because I got the prize but because I could live upto the expectations of the fellowship and provide a good start for future IIST students.

I still remember the day when I got a call from Prof. Chandrasekhar offering me the Satish Dhawan fellowship to pursue MS at Caltech. I was in my home after the end of the B.Tech. waiting to get a call for counselling to be placed in ISRO. This call came as a pleasant surprise. I had read about setting up of Satish Dhawan fellowship which was declared during convocation of our senior batch. But I did not expect that I would be the first one to get the fellowship. Then days just flew by in completing all the formalities. As it was the first time, everything was fresh with no precedence. So it was really tough to complete the process starting from submission of application form to finally getting the visa in a short span of time. After getting the visa I felt relieved that finally all the formalities are over and I will be going to Caltech. When my friends from IIST heard about the fellowship, they immediately congratulated me and wished me luck. But I used to tell them that I haven't got the visa yet and nothing is certain till one gets the visa. But I think their wishes as well as efforts by my family and IIST saw it through.

It was my first time travelling outside India. I felt slightly nervous but I took it as a challenge. After completing the 24 hour long journey, I was happy to see Kishore who had come all the way to the airport to pick me up. It was a really good gesture because it helps a newcomer to adjust to the surroundings. I think he has received many of the subsequent Satish Dhawan fellows and even they must have felt good by this gesture.

Orientation session at Caltech was real fun. We were formed in teams of 3-4 students and were given metro passes for the LA metro and buses. Even though the objective was to find a certain “thief team”, it was an amazing way to get introduced to the city and its public transport. In order to “find the thieves” we visited Hollywood walk of fame.

Even though the courses are demanding, other activities are essential to keep ones balance. So plenty of opportunities are given as parties to socialise and grow your circle on the campus. As there are plenty of Indian students, many of the Indian festivals were celebrated with fervour. But in order to participate in these festivals and perform, we had to squeeze time from our homework assignments which was sometimes tough. But finally when I look at it now, I feel that it was worth it. While doing all the assignments and extracurriculars, finding time to be in touch with my family was really difficult which was made even harder by being in the opposite time zone. I feel that it is something that I could have done better but I feel grateful that my family supported me throughout the course.

Caltech is not famous for its sports activities. So we decided to form a cricket team consisting of mainly Indian students but also a few from Australia, New Zealand and US. It was the 1st cricket team of Caltech. Incidentally, we even won a couple of games against other universities. Thanks to the team, I can say that I have faced an Australian bowler.

When one is in Los Angeles, it is but natural to visit Hollywood and Universal Studios. But visiting other cities like Vegas, San Francisco as well as national parks like Yosemite was an enriching experience. During one of the trip to Bryce canyon, stopping during late evening in the middle of nowhere with pitch dark and snow outside, and looking up at the milky way is a sight that I will never forget.

Virendra has been one of the strongest supports during the entire Caltech life. He has helped me out starting from the admission process till I graduated. One of his unique ways was to take me out for breakfast once a month. It was a really nice thing as we could spend good time discussing about life at Caltech along with some good food. I think it was Virendra who introduced me to Bagels. He even arranged a lunch with then ISRO chairman Dr. K. Radhakrishnan. It was indeed a great moment to discuss about life at Caltech with him in the Athenaeum which in itself is a historic place.

Even though I had gone out of India for the first time, I never felt like an outsider there. It was because of all the people there and because of all the activities that we did together. So as I have gained knowledge by studying at Caltech, I have also created a lot of memories that I will cherish forever.

Avinash Chandra

B.Tech in Aerospace Engineering - 2013 Batch

My Master of Science in Space Engineering at Caltech

I attended Master of Science in Space Engineering program at Graduate Aerospace Laboratories of California Institute of Technology (GALCIT) from September, 2017 to June, 2018. The program was a nine-month long program spread across three terms: fall, winter, and spring. A brief description of topics covered in various courses that I took during the program is as follows. The courses were taken by professors of Caltech as well as by scientists/engineers from NASA-Caltech Jet Propulsion Laboratory (JPL).

Fluid Mechanics (Ae 101 a, b, c):
Fundamentals of fluid mechanics and thermodynamics, compressible quasi 1-D flows, 1-D and 2-D unsteady flows, external incompressible flows, low-Reynolds-number flows, boundary-layer theory, hydrodynamic instability, introduction to turbulence, etc.

Mechanics of Structures and Solids (Ae 102 a, b, c):
Fundamentals of theory of elasticity, introduction to constitutive laws, static and dynamic linear elasticity, linear elastic fracture mechanics, plasticity, viscoelasticity, structural mechanics and instabilities, etc.

Mathematics (ACM 104, ACM 100 a, ACM 100 b):
Applied linear algebra, complex numbers and analyses, ordinary differential equations: initial-value problems and boundary-value problems, partial differential equations.

Aerospace Engineering (Ae 105 a, b, c):
Spacecraft subsystems and engineering, orbital mechanics, navigation, control, etc. We also worked on the student cubesat project—AAReST (Autonomous Assembly of a Reconfigurable Space Telescope)—I was part of the Attitude Determination and Control Systems team, where I worked on designing tests and setups for acceptance testing of different sensors and actuators for control systems, that were ordered from a company called CubeSpace.

Experimental Methods (Ae 104 a, b):
Fundamentals of measurement methods, instrumentation, data acquisition and processing, lab experiments to acquaint with: particle image velocimetry (PIV), schlieren and shadowgraphy techniques, and digital image correlation (DIC).

Special Topics in Experimental Fluid Dynamics (Ae 241):
Image- and laser-based diagnostics for experimental fluid mechanics: PIV, stereoscopic PIV, near-wall PIV, shadowgraphy, schlieren, background-oriented schlieren, methods for shear-stress measurement. Other topics included Doppler velocimetry, filtered Rayleigh-scattering, laser-induced fluorescence, etc.

Space Propulsion (Ae 121 a, b, c):
Fundamentals of rocket propulsion, chemical propulsion, chemical kinetics and reactive flows, modeling of combustion, overview of solid, liquid, and hybrid rocket propulsion, fundamentals of electric propulsion: ion thruster, hall thruster, etc.

Aerospace Engineering Seminar (Ae 150 a, b, c):
Seminars were given by Caltech professors, scientists/engineers from industries, as well as researchers from other universities. Seminars were about research and development in different fields of aerospace engineering. Students could also have lunch with the speaker before the seminars, thereby having an opportunity to interact personally with the speakers.

Teaching at Caltech was very pedagogical; lectures were very clear with sufficient rigour; teaching assistants provided additional help with concepts and assignments (given each week). Research and laboratory facilities at Caltech were amazing—with state-of-the-art facilities for conducting experiments in fluid mechanics, solid mechanics, and propulsion —and researches supported by various grants and scholarships.

Apart from my regular course-work, I also attended GALCIT fluid mechanics conference/Tuesday talks, GALCIT colloquiums as well as seminars presented in other departments. I also won the Dr. Abdul Kalam Prize for my performance in the program. The program was a priceless learning experience for me.

Sweet Memories of Program at Caltech

I pursued Master of Science in Space Engineering from the Graduate Aerospace Laboratories of California Institute of Technology (GALCIT) during the academic year 2017–18. While preparations for the program started from home—on-boarding processes, arrangements for renting apartment, experiences of GALCIT alumni, etc.—it turned out that I had to start my academic program itself from home: during this time, I managed to follow the topics being taken in the class with notes from my classmates and help from teaching assistants; Thibaud and Fabien, who were teaching assistants for the aerospace engineering course, had even provided me with videos of class lectures, which were so helpful to me; thank you, guys! When I got there at Caltech, I found everything so exciting and interesting. I took courses in fluid mechanics, mechanics of solids and structures, mathematics, aerospace engineering, experimental methods, space propulsion, etc. The teaching at Caltech was very pedagogical: lectures were very clear; concepts were dealt with sufficient rigour; there were teaching assistants to help with concepts and assignments; courses were well organised. We used to get assignments in almost every course each week: we had a class office-room, where all of our class sat after lectures, solving our assignments, and discussing with each other wherever we needed clarification. At home, Jiljo, my friend from IIST, and I used to cook by ourselves, taking turns each week. Every week or so, one of our classmates organised a dinner for everyone in the class and we used to play board games after that.

GALCIT used to have several interesting activities each week: we had a "Tea Time" where the entire department used to come and have snacks, while at the same time finding an opportunity to meet and interact with others in the department; then there were GALCIT fluid mechanics conference (a.k.a. "Tuesday Talk"), colloquiums, and different seminars. Our class also got to visit NASA-Caltech Jet Propulsion Laboratory, and Northrop Grumman Corporation, and view a rocket launch from the Vandenberg Air Force Base. The Caltech International Student Programs (ISP) also organised several events—Intercultural Discussion Group, visits to places, etc.—which were all so enjoyable.

Most exams at Caltech were take-home: we were required to time the exams for ourselves and submit our answers for evaluation later. Most of the time during the terms went quite engaged with academics; so when it was vacation, it sure was time to visit places around: I visited several interesting places—Grand Canyon, Las Vegas, San Diego, Austin, New York City, and places around Pasadena.

At the end of the academic year, we had an award function with awards given for the best dissertation, best teaching assistance, and so on; I won the Dr. Abdul Kalam Prize for my performance in the Master's program. The same evening, our class held an (informal) award function of our own, where we gave away to each other, awards such as the most spiritual person, future director of JPL, etc. The commencement was a very grand function, and I was very happy to have my sister and brother-in-law there.

I thank everyone so much for the wonderful memories. I thank Caltech, and especially Dr. Virendra Sarohia for the kind support and hospitality. I thank IIST for helping me avail this priceless opportunity. Thank you so much!

Jiljo K Moncy

B.Tech in Avionics - 2013 Batch

2016
CALTECH

Caltech: Epitome of High Standards

In 2017, I was bestowed with the opportunity to become the first ever Dr.Satish Dhawan fellow from the Avionics department of IIST at California Institute of Technology, Pasadena. From the day I accepted the offer, till my graduation it was as if on a thriller ride. The many days glued to the books, on the effort to crack the conundrums, still comes to me with fond memories.

Caltech community runs on the honor code, “No member of the Caltech community shall take unfair advantage of any other member of the Caltech community.” The honor code doesn't just ensure the academic integrity but also reveals the level of confidence on the individual researchers. I take great pride in being an alumnus of such a prestigious institution.

The best part of being a Caltech affiliate is that you get to be with the pioneers of the world. Dr.Victoria Kostina and Dr.Michelle Effros, eminent scientists in the field on communication, sparked my interest in information theory. Dr.P.P.Vaidynathan was a mentor to me throughout the year. It was with his guidance and support, I could polish and update my skill set in Caltech. Being the pioneer in filter banks, Dr.Vaidynathan taught me the fundamentals of multi rate systems. A commendable aspect in the life of every graduate student of Caltech is that you get to apply the classroom knowledge in real life. For instance, I was allowed to experiment with many of the latest equipmentin micro/nanotechnology by Dr.Alireza Ghaffari, of which the theory was introduced by Dr.Axel Scherer in classroom.

The diverse network of friends is a bonus in Caltech. My friends had a deep impact on me. The late night labs, challenging projects, all made me what I am today. The culture of disseminating knowledge through the discussions among friend circles, sure upholds the academic nature of the university. When these circles are made of people with diverse skill set, it adds a new flavour. The friendly arguments I had with Mr. Armian Hanelli, my classmate, during the development of PCR thermocycling system, is one of the reasons we could emerge as the only team to successfully complete the project.

To summarize, I feel that the work culture maintained in Caltech helped me not just to excel in coursework but also to enrich my technical and non-technicaltalents to be a part of the future technological developments.

Padmanabha Prasanna Simha

B.Tech in Aerospace Engineering - 2014 Batch

2017
CALTECH

Caltech M.S Academic Memoir

At GALCIT, it was mandatory for space engineering graduate students to study fluid mechanics, solid mechanics, mathematics and a course titled aerospace engineering. There was a lot of focus on the fundamentals and building up the subject once the foundation was laid out. Having focused mainly on fluid mechanics during my time at IIST, it was a refreshing change to be presented with solid mechanics from the continuum mechanics point of view. The mathematics courses offered a broad view on all the essential topics needed for an engineer. Aerospace engineering involved some orbital mechanics followed by a term of proposing a space flight project to work on. This was very similar to the aerospace vehicle design course in IIST for aerospace engineering students. The weekly assignments were draining but helped in solidifying the understanding of the subjects. At the beginning, all of us students were not excited about having to do one assignment per subject every week. But by the end of the year, we were able to appreciate the benefits of this system. It also made us manage our time in a much better fashion.

The mandatory courses were handled very well but the most memorable aspects of my academic life at Caltech come from the electives and the aerospace engineering course. Computational fluid dynamics and space propulsion were the two elective course series I took apart from the mandatory ones. The first term started with an introduction to the equations of fluid motion and relevant approximations. Then we looked at the topics from numerical methods in a general but rigorous fashion and understood how they could be applied to problems in fluid mechanics. The introduction to pseudospectral methods for fluids was very well received by all the students. The second term involved compressible flows, shock capturing and high-resolution methods. The way the subject was handled allowed us to develop our own set of skills in a manner that makes it easy to apply our knowledge of numerical methods to any situation and not just for fluid dynamics. Space propulsionstarted a recap of gas dynamics, heat transfer, combustion, electrodynamics and introductory level plasma physics. These fundamental topics were then used to analyze several different types of propulsion systems including electric propulsion during the subsequent terms. Following my coursework at Caltech I got the opportunity to work as an intern at JPL on ion thruster lifetime modeling. The best aspects of this course were the assignments which were all thought provoking. The final term project was the design and analysis of an electrothermal resistojet thruster which was an exciting problem to work on. Most of them involved writing some computer code to make use of computational methods to solve the problems. The class size for this course was very small and it allowed for the classroom to be much more interactive than any other class I have been in at Caltech.

Aerospace engineering had a course project where we had to work in teams. I worked on formation flight design and optimization for a proposed formation flying mission that carries interferometric synthetic aperture radar payloads. My team members and I were able to come up with novel methods for designing and analyzing formation flight trajectories. My IIST, B. Tech thesis project work on optimal control greatly helped me in contributing to the project at Caltech.

After graduation and during my internship at JPL, I presented a paper on low thrust trajectory optimization at the 2019 AAS-AIAA Astrodynamics Specialist Conference based on the work I had done during my B.Tech final project. The one year I spent at Caltech working on my master's degree was a very enriching experience for me and I want to take this opportunity to thank IIST, ISRO, Caltech and all the people involved in the organizationsfor setting up the Satish Dhawan fellowship.

Padmanabha Prasanna Simha PERSONAL MEMOIR

I had the opportunity to be a summer intern at JPL twice. The first time during 2017 and once again after my masters at Caltech during 2019. My first internship at JPL was also the first time I set foot outside India. It gave me an opportunity to see and experience different places in the US.

During my second time in the US as a Satish Dhawan fellow, I was able to visit even more places around the US as well as explore the city of Pasadena. My friend circle in the US greatly expanded and my classmates and I spent a lot of time together working on assignments and projects. We also made it a point to play badminton at the Caltech gym at least once a week during the term to take our minds off studies and work. It was also a great opportunity to try out different cuisines and see new places. Apart from this, I was able to interact with people from several countries and see how different or similar they are. There were several social events that used to take place at Caltech and attending all those allowed me to develop connections with people from all over the world.

This was an incredible opportunity that I was given by IIST, ISRO and Caltech. It is a unique experience where I got to interact with lots of people. I was able to learn many things that I hope I can put to good use in the future.

SpaceX Falcon 9 launch from Vandenberg Air Force Base as seen from Pasadena on October 7th 2018

Prashanth G Iyer

B.Tech in Avionics- 2014 Batch

2017
CALTECH

At the end of 9 months of academics at Caltech and 2.5 months of project at JPL, I can proudly say that I have gained a whole lot of knowledge, exposure and professionalism in this one year.

But truly to be said academic life at Caltech was not a bed of roses. I still remember the "Initial Weeks of Horror" at Caltech, where I found it difficult to accustom myself to the changes in the educational system like 10 week long terms which meant the speed with which the courses were taken was faster; courses being majorly graded on basis of regular and tough home-works instead of exams; open internet take home exams ranging from one day to one week which were guided upon by the Caltech Honor Code; practical courses which required us to sometimes spend 15-18 hours a week etc. But what kept me focused and going strong at these situations is the result that I would get if I successfully finish all these courses i.e. a Master's degree from one of the most reputed schools in the world.

But within a few months, I got adjusted to this system and slowly started enjoying the hectic academic schedule acknowledging the benefits that I was receiving for my work. The main benefit that I found was the supportive interdisciplinary environment at Caltech. Even though my specialisation was in Wireless Communication and Data Compression, I was able to take courses on Machine Learning, System Engineering and Robotics offered by different departments, which helped me improve my overall knowledge and technical skills in the field of Space Robotics which I am very passionate about.

While one course allowed me to work on system integration for a high altitude balloon launch which was a success, another course required me to get an FCC Amateur radio licence which helped me make a Ham Radio Contact with ISS Crew members. I was also able to attend a class offered by Frances Arnold who won the Nobel Prize in Chemistry in 2018. I also had the chance make connections with many JPL and Caltech professors who are world renowned experts in their field like Prof. Charles Elachi who took us a course on SAR. Having a face to face interaction with Katie Bouman, who was involved creating the first image of Black-Hole, just months after the release of the picture also was a memorable experience.

The last 2.5 months at NASA Jet Propulsion Laboratory, working in the Surface Mobility group under the Robotics and Mobility Division, gave me the opportunity to get hands on experience on the most advanced tethered rover in the world. Working with the experts in space robotics, helped me gain a lot of exposure in my field of interest which would definitely help me if I get a chance to work on this field once I join ISRO. I was also able to interact with technologists who designed the MSL rover and are currently controlling them during this short tenure at JPL.

I am extremely grateful to all the officials (IIST, Caltech and DoS) who are an active part of this program, for giving me this opportunity to complete my Masters from such a prestigious university and allowing me to make this one year of mine a life-long memorable one.

Staying in a different country, far away from my parents, my friends and specially the regular spicy food could have made me homesick but on the other hand laid the chances of meeting new people, trying new dishes, learning new cultures and exploring new places. So, I had to make a choice and I decided to make this one year of Caltech the most unforgettable year of my life, by leading my personal life with the motto: "Work Hard, Play Harder".

This year gave me the opportunity to make a global friend circle. I made friends from different parts of the World ranging from US, England, China, Italy, Australia, India and much more. I was able to learn and blend in their cultures, celebrate their festivals, try their delicacies and at the same time tell them about our majestic Indian Culture and make them eat the spicy Indian food. I am quite sure; I would have convinced at least a few of my friends to come to India at least once in their lifetime.

Staying in US gave me an opportunity to try a variety of new dishes. Since I am a foodie, I never missed a chance to try something new. I have tried all possible dishes I could find, ranging from American, Mexican, Italian, Chinese, Japanese, Thai, Mediterranean, Mongolian, Afghan etc. The only sad part for me is that I am a vegetarian, so I could not try some of famous delicacies of certain countries but none the less, I "officially" have had staple food of various countries.

This year also allowed me to explore different places in US starting from cities like Los Angeles, San Francisco, San Diego, Seattle, Las Vegas, Charlotte to places like Grand Canyon, Yosemite National Park, Sea-World, Mt. Rainier National Park etc. I was also able to take a road trip along with my parents, who came here for my commencement ceremony from San Diego to Seattle which was the most classic and remarkable route I could have thought of. Unfortunately, I was not able to explore the East Coast of US, but I assume this unfulfilled wish of mine would give me the motivation to work hard and get a chance to visit US sometime in future.

I was also able to try on adventurous activities like paragliding at the Torrey-pines Gliderpoint, San Diego; Bungee jumping from Bridge to Nowhere in Mt Baldy, California. I also got a chance to play baseball and Frisbee golf with my mentors and my friends during my project at JPL.

In short reflecting back at the last one year, I can definitely say that I have truly abided by to the motto that I set for myself.

Me paragliding at Torrey Pines

Driving towards Yosemite Falls

Memoir

JPL INTERNSHIP

Harshvardhan Singh

B.Tech in Physical Sciences - 2012 Batch

The Summer of '15

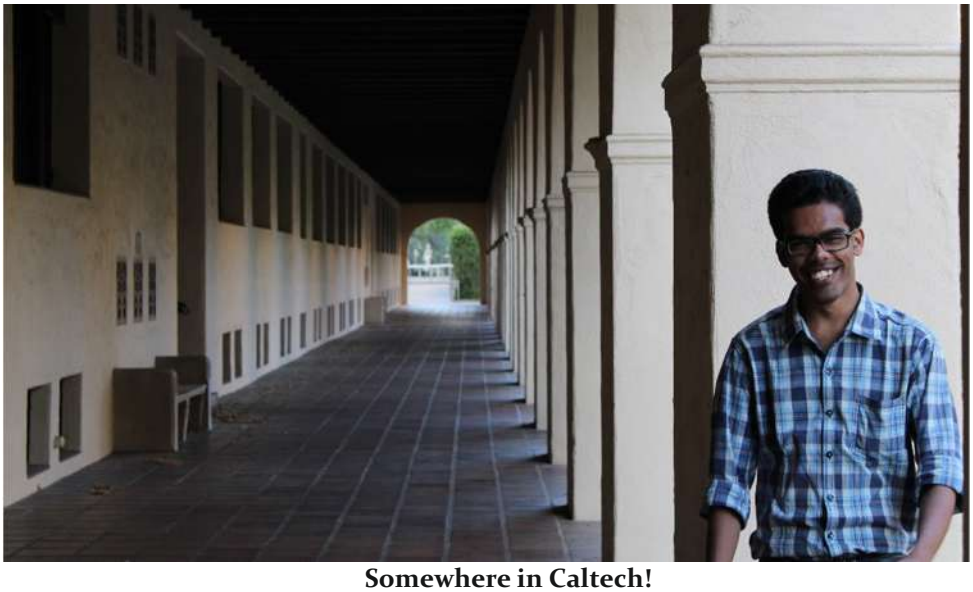
After a few hiccups in the visa processing, I finally managed to get my visa at the end of June 2015 and landed at LAX on July the 4th. Getting selected for a dream internship at JPL was something of a chimerical nature to me. Having reached LA, thanks to the efforts of the excellent faculty and administration at IIST and JPL for selecting me and doing everything to ensure smooth processing of the required paperwork, I decided to make the most of the opportunity and learn as much as I can, not only about the work culture of the premier space organisation of the world but also about culture of The US.

It was my first time in the US and in fact first time outside India. The warmth and the hospitality extended by the people from the Immigration officer to the cab driver to the neighbourhood lady who helped me find my way cannot be overstated. I wished everyone a happy July the 4th. The motley and spotless avenues of LA and Pasadena presented an Elysian vision. The warmth and hospitality seemed to permeate everywhere we went from Target to the Bank to the Social Security Office and also to Little India.

Our stay in Pasadena couldn't have been more comfortable thanks to Dr. Virendra Sarohia and his wife who made us feel home far away from home. At JPL I worked with the esteemed duo, Dr. David Schimel and Natasha Stavros on estimating carbon lost from California King Megafire using hyperspectral data. In a month at JPL, thanks to Natasha's perspicacity, I learned a lot of new concepts like Multiple End member Spectral Mixture Analysis and ways of putting to practice what I had learnt in class. But the most important thing that I learned at JPL was the rigour of a job as a scientist, being dedicated to research, working assiduously to meet tight deadlines and above all that, being kind and helpful to one's co-workers and celebrating the diversity of opinions and cultures in one's workplace.

In JPL I met people who were from all over the US and indeed all over the world, like the Sri Lankan man at the Starbucks stall who told me about his trip to India, my fellow interns, Wayana from Washington and Liev from Wisconsin who were ever so helpful to me in explaining how certain things worked in office, Hardeep, who was troubleshooter of everyone's technical and administrative conundrums and Muneo, the extremely affable gentleman who one can hang out with anywhere in the office. There is something in the air of JPL, like many ISRO centres, that provides an impetus for everyone from different backgrounds to work in unity towards realisation of a common goal.

Three years after graduation and four years after the internship, I find myself setting the reference of standard for work ethics, professionalism and moral code of conduct to what I learnt at IIST and JPL. And for that, I'll always remain grateful to my mentors at IIST and JPL.



Somewhere in Caltech!

Avinash Chandra

B.Tech in Aerospace Engineering - 2013 Batch

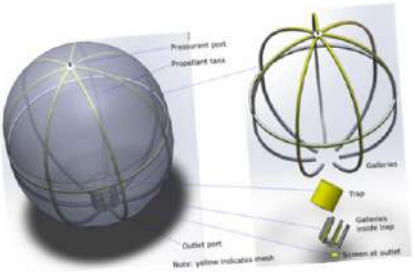
2016
JPL INTERNSHIP

Internships at Jet Propulsion Laboratory

I got two opportunities of internships at NASA-Caltech Jet Propulsion Laboratory (JPL). The first internship was during May–July, 2016, when I worked on design, manual optimisation using computational fluid dynamics, prototyping, and proof-of-concept testing of Tesla check valve. Tesla check valve was a no-moving-part leaky check valve, which had great scope for space applications, as it had longer life and increased reliability compared to conventional check valves. This ingenious invention of Nikola Tesla worked on the idea that due to the shape of the valve channels, the fluid flow took long serpentine path when the flow was in the impeded flow direction, while it took a straight path when the flow was in the unimpeded direction. Mr. Arturo R. Casillas of Chemical Propulsion Systems Group, JPL was my mentor during this internship.

The second internship was during June–August, 2018, i.e. immediately after my Master of Science program at Caltech. During this internship, I worked on two problems, both concerned with the propellants, MMH (monomethyl hydrazine) and MON-25 (mixed oxides of nitrogen with 25% by weight of nitric oxide) for temperature range of –50 to +50 . MON-25 had never been used on any earlier NASA/JPL mission, and MMH had not been used for the low temperatures mentioned here. The first problem was about conceptual design of propellant acquisition device for spacecraft propellant tanks for the given mission, to ensure gas-free propellant delivery to the propellant lines. Since MON-25 had not been used earlier, its properties required for design, which were not available in literature, were also identified and a test plan (along with estimates of cost and schedule) was formulated to determine those properties.

The second problem was concerned with fracture mechanics design of the propellant tank made of Titanium alloy, Ti-6Al-4V for stress levels of 110 ksi tensile stress. The task was to carry out a literature survey to identify properties required for fracture mechanics design of the tank (for example, stress-corrosion cracking behaviour of the metal-environment combination, properties describing fatigue-crack growth, etc.), and then to ascertain if the required properties were available in literature. Test plans were formulated for properties which were not available in literature. My mentors for this internship were Mr. Arturo R. Casillas and Mr. Jonathan R. Reh from Chemical Propulsion Systems Group, JPL; we also had discussions with subject matter experts from JPL and outside during the course of the work.



During the internships, I also attended several seminars and lab tours organised at JPL. Several social events were also organised, which were great opportunities for meeting and networking with other interns. During weekends and holidays, I could also visit various interesting places with my friends—Griffiths Observatory, California Science Centre, Universal Studios, Disneyland, Washington D. C., New York City—to name a few.

I liked the internships very much, and learnt a lot from them. The internship gave me opportunities to interact with pioneers of different fields of space sciences and technology, as well as to network with them. It gave me opportunities to pursue my passion, and get motivated from things around. I thank IIST and JPL for the wonderful internship programs. I would like to especially mention the help, support and hospitality of Dr. Virendra Sarohia and his family throughout my stay during the various programs: thank you for being so great hosts!

Jiljo K Moncy

B.Tech in Avionics - 2013 Batch

2016

JPL INTERNSHIP

A Treasured Memory

I was fortunate to be an intern at Jet Propulsion Laboratory, Pasadena,not once but twice during the summer of 2016 and 2018. It was a mere coincidence that in both the internships I was chosen to work on the same rover, 'Athena', which turned outto be a stroke of luck. During the period of my first internship, the team was experimenting with the possibilities of implementing the CAN protocol in the rover and I became a part of the evaluation team. By the time I joined the team for the second time, they had already adapted the protocol into the system and was implementing higher level protocol, CANopen and I could write the driver. The opportunity to work with the team during the initial stages and the conclusion of the project was a boon. It taught me most of the intricacies in all stages of the development cycle of a project.

A groupie with Mr. Jacek and Curiosity

I am indebted to Mr. Jacek Sawoniewicz, Mr. Neil Abcouwer and Dr. Issa Nesnas, who guided me during the internships. At times, I was amazed by the enthusiasm Mr. Jacek shared during the discussions with a novice like me. Looking back after almost a year in ISRO, I can say with confidence that it was only because of their efforts that I could excel with a steep learning curve in my current duties. I miss the work diversity and the freedom that an employee enjoys in JPL. It is unparalleled with any other organization.

It's beyond doubt that the internship experience would not have been complete without the diverse group of friends. The interactions I had with the interns of different nationalities enhanced my horizons. The experience of working as part of a team is something that I treasure the most. The camping trips, and road trips served as an ice breaker. I look forward to meeting them again someday.

A Hiking Trip at Joshua Tree National Park, California

Even with all the fun I had, there were a few challenges I had to face. The considerable number of deadlocks in my program was something that kept the midnight oil burning. It did get frustrating, but the appraisal from my mentors on fixing each bug, kept me going. Ultimately, I express my gratitude to be a part of a great research institution and for the knowledge I have gained through the internship, and hope that I was able to reciprocate my own talent and skill for the institute.

Hriday Dath

B.Tech in Physical Sciences - 2014 Batch

My Undying Gratitude

"Hello, its really nice to finally meet you", she said with a beaming smile. She was wearing a JPL tshirt with long sleeves. She kept the steaming cup of coffee she was carrying on the table. She had unkempt short and wavy blonde hair. The freckles on her face made her smile more endearing. She looked at me through her small round glasses and gave me a firm handshake. I immediately noticed that she was much taller than me.

"I'm Natasha Stavros. I'm one of the scientists working with David, your mentor. I've been sent here to receive you, introduce you to other scientists in the group and direct you during your stay in JPL.", she introduced herself. It was evident from her heavy breathing that she came running to meet me. I felt bad that she couldn't finish her morning coffee in haste to meet me. She asked me about my hometown, my family and my present accommodation facilities just to get acquainted with me. She kept looking at her phone repeatedly as if she was expecting some call or text from someone which was slightly discouraging. Later I understood that she was checking whether my desk, laptop and internet access were up for me to start working. I was annoyed with myself for judging her too soon.

The process of entering JPL for the first time was overwhelming. The orientation speech inside the auditorium was arduous to sit through because of my nerves. My heart started pounding at the sight of portraits hung on the corridors. My excitement reached its peak when I saw the NASA satellite models at entrance of the auditorium. Including me, there was five students joining JPL for summer internship in Visiting Students Program. After identity verification we were asked to sit in the waiting room to meet our respective mentors. I thought the wait to be painfully long but Natasha appeared after five minutes with a welcoming smile.

I was really nervous about meeting my mentor David Schimel. By the time I reached JPL, I had already imagined the first conversation with mentor a million times in my head. Somehow all the jitteriness suddenly vanished when I met Natasha.

"Currently Dave is out of station. I'll be your co-mentor. You can meet him next week when he'll be back", Natasha said smiling. Even though that gave my shivering mind some kind of solace, I was a little disheartened by the fact that I wont be able to meet my mentor that day.

"Don't worry. I'll personally setup a meeting for you with him next week. Until then you're in safe hands.", she said looking at my worried face. She was such a warm and lovely person. She had small talk with every single student in the room. Before I knew, we were all discussing our favorite talk show hosts and movie genres with her. I noticed that there is a tranquil quality about her that made everybody in waiting hall calm. The serenity that she brought had such a powerful effect in the room that I could feel the pressure and nervousness melting away.

"All of this, must be overwhelming for you. I certainly was, when I first came to JPL", she said looking at me.
"Yes, its quite overwhelming", I said.
"Its perfectly fine. Besides we are all here to take care of you", she replied.

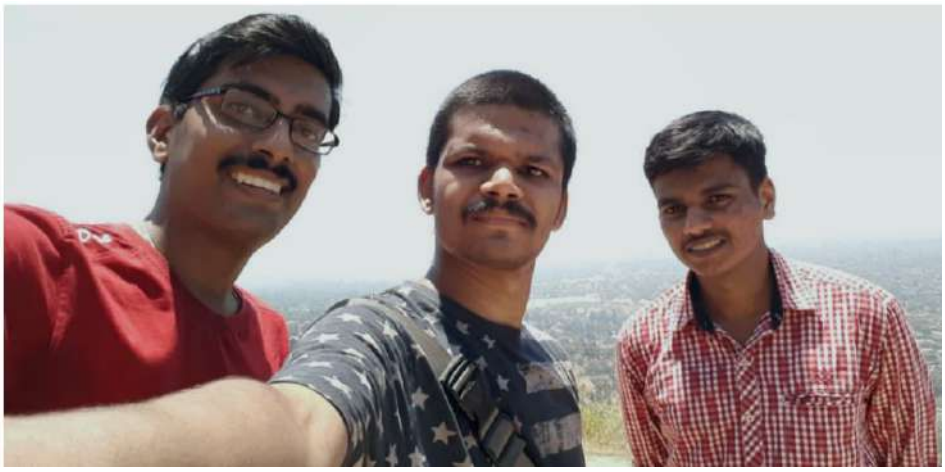
After the biometrics procedure, for which she waited very patiently, she took me to the Atmospheric Sciences building, where she showed my desk, my laptop and started briefing the work that was assigned to me. She was very patient while explaining the areas where I had difficulty in understanding. She also helped me with installing programming software that I was unfamiliar with and gave me some basic lessons how to use it. She then proceeded to introduce me to people who will be working alongside me. I met Kristen, Ryan Pavlick, David Thompson, Daniel Jenson, Genevieve, Natalie Quealy, all of whom welcomed me to their group. Genevieve's bright blue hair, which she colored that morning, was so distracting that the group

started pulling her leg. Apparently she paints her hair every week into a new color which keeps everybody on edge to see what she does next. I also met the business staff Hardy Fuller, Marisol Olvera, Muneo Miyagishima, Stephanie Blueford and Martha Farfan who made all the arrangements for my internship.

There was three things I was absolutely positive after my first interaction with Natasha and group. Firstly, I was working with a group of very cool, chic, yet warm, polite and supportive people. Secondly, they will be there to help me whenever I need them. And thirdly, I was unconditionally in love with the work I've been assigned to.

I thought this is more than anybody could wish for and felt incredibly grateful that I got such an opportunity to do my summer internship in JPL.

The following week I met David and we discussed about my internship work. I was not the least bit nervous. I felt very safe and supported in the group that the discussion felt very natural. He was very friendly. We discussed a lot of things unrelated to work and had lunch together. I realized this was a much better meeting than I could have imagined myself.



Prashant, Padmanabha and Myself hiking through Eaton Canyon Waterfalls

Prashant, Padmanabha and Myself near Statue of Liberty

He suggested different places for me to visit when I'm free during the weekends. Taking his advice I, along with my friends, went for hiking in Eaton canyon waterfalls, went for a road trip to Hollywood *Prashant, Padmanabha and Myself hiking through Eaton Canyon Waterfalls.* Boulevard, visited Los Angeles Zoo and visited Disneyland during weekends. On our way back to India we also went to see the Statue of Liberty.

Working environment in JPL completely blew me away. They were eager to meet up every week and discuss the progress of the work, and challenges faced. The problems were addressed together as a group. Nobody was piled on with responsibilities. On the contrary, the duties were executed as a collaborative effort. There was no space for hierarchy or protocol inside the group which was new to me. It was a surprisingly liberating and immensely gratifying experience.

At the end of my tenure, Natasha arranged a presentation of my work in front of some other scientists who were all well versed with the work that I've done. Everybody in the group came to support me during my presentation. Even though I stayed in Caltech only for three months, I connected with all of them like a family, so quickly that leaving JPL was heartbreaking.

My visit to JPL was thoroughly enjoyable and exciting. It was a roller-coaster adventure that I'll always cherish in my memories. I had many poignant discussions and interactions with some of the sharpest minds in the world. I learned a lot from the people that I interacted with and felt thankful for how graciously welcoming they were. I'm eternally grateful to Dr. Virendra Sarohia for his unequivocal reinforcement and for making this summer internship possible.

Sanjay Gorur

B.Tech in Aerospace Engineering - 2015 Batch

Summer of 2018, California

Fear. No, it was not fear that I felt, at first. It was a heightened consciousness of my actions, words, accent and even my own thoughts. Perhaps it was because I had to live up to being a 'certified bright kid' from India or because, for the first time in my life, I was truly a minority.

'Full short, short, medium' were the hairstyles I knew in a land where people flaunted their 'braids and cornfields'. Like everyone else, everyone wanted to be unique. This was in stark contrast to our society where we strive to fit in rather than stand out.

JPL was no different. People took pride in their jobs and this sure did give everyone a sense of belonging; a sense of belonging to a mission far reaching enough, to think about even during lunch breaks and weekends. I was part of a group which designed interplanetary missions. To think that the machine, man conceived, would reach a rock far-far away, gave a kick far greater than any other profession will or could have to offer.

Other than the intellectual stimulation JPL had to offer, cooking and fending for myself in a foreign land gave me a sense of confidence; a feeling primal in a world which is progressively softening. The diversity and sense of adventure of the people there drove me to try things like skydiving, hiking, camping and even gaming. The infrastructure, development and a general civic sense of the original first world country gave me a sense of opportunity and a preview of things to come in my own country.

I wholeheartedly thank IIST, ISRO, JPL, and so many people responsible to have made this a wonderful internship experience. The internship truly changed my outlook and vision, for me and my country.

Srinika Selvam

B.Tech in ECE - 2015 Batch

2018 JPL INTERNSHIP

Arriving in Pasadena as a complete stranger to the city, I have had one of the greatest experiences of all time. I was given the opportunity to undertake a summer internship at Jet Propulsion Laboratory (JPL) of NASA from 29th May, 2018 to 21st July, 2018. I worked on a newly emerging concept of "Report Synchronization" using a programming language called "Julia". This project was aimed at exploring various capabilities of Julia. I was guided by Dr. Nathan Strange (Group supervisor for the Mission Engineering and Planning Group) and Dr. Nitin Arora (Systems and Mission Design Engineer at the Planetary Mission Concepts Formulation Group). The goal of the project was to create a software that automatically allows mission reports to exchange information with each other with minimal human interference. The experiences of working as an intern at JPL were fascinating and the experience I got was enough to mould me as I advanced into my career. It has taught me the ability to multi-task during working hours, to be creative, to maintain professional attitude, to network with people in the field and to question inorder to fit in. The project received great appreciation from JPL colleagues as well as IIST professors. It was one of its kind. My internship has definitely given me a better understanding of my skill set. When I look back, I'm extremely honoured to have worked with scientists from a world-class laboratory. At JPL, not only that I gained technical knowledge but also was exposed to an exciting work culture and also got an insight about what it means to have a career at institutions like NASA. Lab tours, presentations, group meetings, ice-cream Wednesdays, crab feast, pizza party and dinner with group members became part of the routine. I would like to thank Dr. Virendra Sarohia for his generous help all throughout the stay. Myself, Sanjay Gorur (from Aerospace) and Jigyasa Nigam (from Engineering physics) had the privilege to interact with some of the prominent figures in the scientific industry including Lieutenant General Larry D. James (Deputy director of JPL), Tapan Mishra (former SAC, ISRO director) and Dr. B.N Suresh (Chancellor, IIST). We also found ways to take time off our routine to explore places around California. We visited places including Hollywood Boulevard, Santa Monica, Six flags, Malibu, Las Vegas, and Grand Canyon. Weekends were spent getting to know the city – people, places and culture. There was never a dull day during my stay in Pasadena. 2018 summer is a period that I will always cherish.

Jigyasa Nigam

B.Tech in Engineering Physics - 2015 Batch

Memoirs of JPL

The summer of 2018 was when I landed in Pasadena with renewed vigor and excitement to be working at the renowned Jet Propulsion Lab. As a kid with a dream of becoming a space scientist, being able to realize my fantasy of working with NASA in my capacity as an undergraduate student was more than what I had ever imagined.

Being a physics major at IIST, I was placed at the Earth Science group at JPL with a project to determine functional diversity metrics for AVIRIS data. This was an absolute learning experience, getting acquainted with remote sensing principles, ecological parameters and building my way up on this basic information to a useful particular project. From the outset, it seemed that I would be spending the two months completely immersed in books, getting a handle on this mammoth task. But then again, life is full of sweet surprises! The people showing me the way around JPL, from my mentor Dave Schimel who patiently explained the project, Ryan who guided me each step of the way and Fabian who introduced me to the exciting field of vegetation remote sensing and all the group colleagues who understood my hesitations and made themselves available to answer queries and offer advice, to my office mates- 3 postdocs from different backgrounds who included me in their daily afternoon coffee breaks and gave me company over lunch so that I never felt lonely, significantly contributed to my experiences at JPL, helping me gain a holistic perspective of the JPL culture. This warmth and conviviality implied that I spent time learning through collaboration and discussion, which made the process more enjoyable and definitely offered more insight than what I had been able to gather only through reading. To me, this was the best part of the internship, a culture which promoted learning outside of books and papers, through hands-on experience with patient and affable supervision and inspired to go beyond the routine. Certainly, the concept of honor system was motivating and definitely the RDO Fridays helped us travel around the beautiful city of Pasadena and even visit the Grand Canyon.

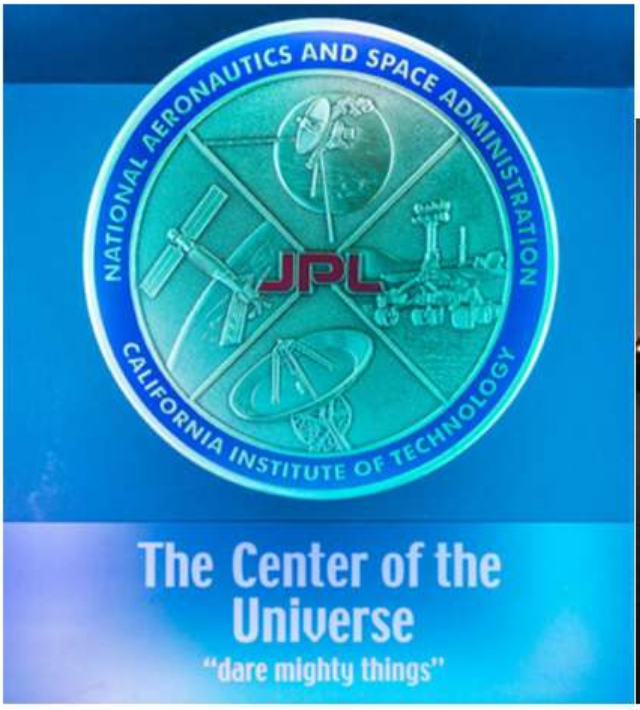
We also had the occasion of meeting Dr. Suresh and take a tour of the JPL campus with him. The opportunity to share a home with two of my colleagues, call them family, travel around and discover new places was a pleasant experience. This way I was not only involved with my group but was able to keep up with exciting work in other groups at JPL.

The experience was truly a stepping stone into the world, for not only I did I meet people from different educational backgrounds from across the globe but also pieced the jigsaw of fitting in knowledge gained through coursework to real life applications which ultimately gave me the confidence to take up anything that is thrown at me and try to find my place in the grander scheme of things.

I am exceedingly grateful to Dr. Sarohia who greeted us with a smile, the day we landed in Los Angeles and for arranging everything from thereon, including helping us set up a house to enabling our projects. This hospitality certainly meant a lot to a girl who was still struggling to find her feet in a new city!

I would like to extend my heartfelt gratitude to the Indian Institute of Space Science and Technology, the Indian Space Research Organization, the Department of Space and all organizations and individuals for making this feat possible and facilitating all procedures; to Jet Propulsion lab and Caltech for welcoming me with open arms and mind, for all resources that they extended to me, for the values that I was able to imbibe and the treasure of

This internship was a journey from roots at IIST to wings at JPL, roots- not to tie me to the ground, but to guide me to where fulfillment is found, the nourishing start, the firm foundation; wings to soar over obstacles, wings to fly free, wings to glide to the heights of the best one can be.



Aalokeparno Dhar

B.Tech in Aerospace Engineering - 2016 Batch

2019
JPL INTERNSHIP

My experiences with Caltech and JPL are memorable and everlasting one. As a foreign student in the USA, I did not feel any kind of hesitation to mingle among the people. Caltech and JPL are so welcoming and friendly that it did not take long to get adjusted with the practice, culture, and lifestyle which were unique and new to me.

JPL organized different lab visits which were quite interesting and inspiring invoking my curiosity towards Space science and engineering. Along with the work, we got the opportunity to join seminars, visit test beds like NISAR and MARS 2020 and see various exhibitions going on. Fun events and other activities organised by them took care of our social interaction. From a very small scientific community of friends in our college, my contacts now have expanded throughout the world. This internship gave me a good friend from France whom I am still in contact with. More than the learning experiences it was more about various scientific and socio culture interaction. My guide for this internship project was very friendly and helpful and introduced me to lot of researchers to whom I got chance to interact with.

We are the first batch of internship students from IIST who got accommodation in the Caltech campus itself. This gave us the opportunity to attend and experience the seminars, lectures and lots of academic and non-academic events held by Caltech just for the summer interns. The night sky observation tours fascinated me a lot, encouraging me to look up to the sky deep into the dark cosmos as space explorers. Also their effort of organizing the trips to Hollywood, Santa Monica beach helped to boost our enthusiasm at work.

Every minute I spent in Caltech and JPL will have an everlasting effect on my life's journey and will be inspiring me every day.

Jureddy Chinami Sai

B.Tech in Engineering Physics - 2016 Batch

2019
JPL INTERNSHIP

Never take a step back at something you can do...
Give it a try....
Don't know what opportunity is waiting for you
With one brave step ahead....
A journey began to thousands of miles afar
“Welcome to Our Universe” they said,
To “Dare Mighty Things”
What else does someone need as a student?
Such an inspirational environment!
Must thank destiny for letting me be a part of JPL this summer
Encouraging us with lab tours and lectures,
Summer kick-offs with free food and games
Eight weeks of learning and happiness with friendly faces everywhere
Unearthing many things in the Earth Science-Carbon cycle and Ecosystems group,
Fromamazing people all around,
With an Ocean of Patience and Treasure of Guidance.
Providing a clear sailing path to my sea of questions
In the process of predicting 'Canopy structure and Leaf traits from AVIRIS bands and LiDAR metrics'.

Many thanks to Dave, Latha, Ryan,
Marcos, Antonio, Fabian
And many others for their valuable time
Grateful to my mentor David Schimel,
for nominating me to Team-A study,
A unique opportunity I was blessed with.
Lessons learnt all worthy, priceless
Skills gained will remain forever
Forever thankful to the Govt of India and JPL
For an experience of a lifetime!

Photo Gallery

Honourable Secretary, DoS / Chairperson, IIST GC, Dr. K. Sivan is flanked by IIST's Prof. Satish Dhawan Fellowship students Mr. Padmanabha Prasanna Simha of B.Tech (Aerospace Engineering) and Shri. Prashant G Iyer B.Tech (ECE) of the 2014-2018 batch during his visit to Cal Tech, USA in October 2018

International von Kármán Wings Award

Prof. Ares Rosakis, Professor Caltech and Sri. A. S. Kiran Kumar (Former Chairman, ISRO/ IIST GC) who received the International von Kármán Wings Award on 8 November 2018 @ Caltech, USA

Photo Gallery

Prof. Sergio Pelligrino of Caltech, USA with Chancellor, IIST along with AAReST

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