INTERVIEW BY ASHISH GARG

THE QUARTERLY BITSIAN: KANNA RAJAN, ('80) - NASA

A Chemistry/Chemical dual degree holder, Kanna Rajan lead the Software team for the Mars Exploration Project (MER), unarguably the most ambitious and complex mission flown by NASA to date. His work in a niche area of Artificial Intelligence was recognized in appointing him to the position. He believes his days at Pilani prepared him well for his work, especially through the extra curricular activities as CoStAAn and Election Commission Chairman. In this interview he discusses the future of space exploration, India's plans for space and the kachoris at BITS.

Tell us something about the time you spent at BITS Pilani

I joined BITS in 1980. In those days we used to have something called the 'Prep semester'. The Prep semester used to be in June, July and Aug. It was another filter after the Class 12th exam which was used to determine admission status. We had a very intense three months and at the end of it we could get to pick our dual for those who were in the dual-degree program.

In retrospect I found it interesting as it exposed us freshmen/women to Pilani gently. The Prep semester allowed us to come in, figure what we want, adjust to the environment and gave us the Pilani feeling – for instance there are things you do and certain things that you don't as BITSian. The initial shock of joining Pilani was somewhat alleviated, I must say, by a visit inside Meera Bhawan in my fresher's period when I was sent there get ragged!

I started off in Vyas which had terrible food, but it sort of improved when after I went to Malviya. Malviya was the feared Bhawan in those days because seniors who were 5 years ahead of us were busy engaging in forbidden substances. It was a different experience int eh company of some very interesting people.

In retrospect those years in Pilani were the best years of our lives. My wife continues to be amazed at how I've managed to keep my Pilani alliances alive even after all these years.

When did you come to the US and how and why did you choose to work for NASA and when?

I came to US in Aug 1986 after graduating from Pilani. I joined the University of Oklahoma at Norman for 6 months. My academic advisor sent me to the Fermi National Lab for 8 months, after which I decided to join University of Texas at Arlington (UTA).

After graduating from UTA in 1990, I worked for two years with the Artificial Intelligence group at American Airlines in nearby Ft. Worth. I left to join the Courant Institute at NYU because I wanted to work with Ernie Davis in the area of knowledge representation.

When I was at NYU, I realized that a lot of what I was doing was very theoretical. I was keen to use all this theory to solve real-world problems, which eventually led me to NASA.

Joining NASA was a serendipitous turn of events. I was looking for a job at that time. AI Magazine had a posting for a position at NASA Ames. At that time Ames was primarily a theoretical AI outfit, but was ramping up to do some spectacular applications based on years of work in the theoretical domain. I was hooked.

The funny thing about the interview itself was it was in a café in downtown Mountain View since I'd forgotten to get my green card (which I had already at that time) to get into the base.

When I joined, NASANASA researchers working on AI were mainly theorists. Fortunately the year I joined, 1995, was an interesting one because NASA agreed to fly an AI based control system on-board a spacecraft for the first time.

The agency asked us to prove it t o them that we were capable of the job of controlling a complex spacecraft by developing a prototype. I was hired to work on that project. This phase was highly successful. This system was called the Remote Agent and it still remains the only one of its kind at NASA! From an AI perspective that was good work and its flight on DS1 a significant achievement.

Credit: NASA

What is your typical day like at NASA?

NASA is a big institution with many different divisions. My group does applied research in autonomy and robotics. Its very academic; I liken it to walking into grad school. The group's charter is to essentially build the next generation of control systems for spacecraft.

Now that I lead this effort, there is a lot of administrative work to do. Apart from that there is quite some traveling to conferences. I ensure that my group at NASA Ames works closely with the NASA Jet Propulsion Laboratory (JPL) at Caltech. A day at NASA for me is fairly chaotic but exciting.

Photo credit: UT Arlington

Name: Kanna Rajan

Position: Leader, Scheduling & Planning, Mars Rover Exploration Project, NASA

Former jobs: AI Group, American Airlines; Fermi National Laboratory

Education: NYU, UT Arlington, BITS Pilani

Tell us more about the Rover project?

At any given time, the rover is doing multiple things and there are some serious energy constraints. The rover runs on solar power so we need to make sure we do not drain the battery, or we don't bump into a rock! We have limited resources, limited time and also some scientific intent behind everything that the rover does. These constraints mentioned above, could be "you cannot take a picture while you are moving because of power issues in addition to the fact that one might get blurry pictures". Also we do not want an overloading of the CPU, which runs only at 25Mhz! So in a sense there is this tension between the scientist's wanting to do as much as possible and the operations engineers want to do as little to keep the rover safe.

Our group is responsible for the MAPGEN system. For MER time and and energy are critical elements. The most crucial is battery, which is a non-linear resource. If we plan too many activities for the rover to execute, we might be draining the battery; if we plan too less then we might overcharge and top it wasting the capabilities of a rover that could have been doing a lot of science. The MAPGEN software essentially produces a sequence of activities, and then schedules these activities for the Rover.

Is there anything you learnt at Pilani that has prepared you for what you do today?

I think so. My hypothesis (which may or may not be correct) is that Pilani actually prepares you for life better than most academic institutes in India.

One of the main things I learnt at Pilani was the art of dealing with people. Academically I was always engaged but I was also very active in extra-curricular activities. I was a CoStAAn for the Department of Controls for the second APOGEE on campus. I was also the Election Commission chairman in my 3rd year. I had strong relations with people of my batch even as I was close to a batch junior.

Do you remember any funny incidents from BITS days.

One funny incident happened during my 3rd year in Vyas. On the Vyas Bhavan Cultural day I had imbibed a little too much and then kicked somebody's door open. This guy was from a rival camp in an upcoming election. Next morning, G.P. Deshpande who was the chief warden (and also Mr. Tough-Guy) called me and first thing he asked me was my GPA. Incidentally my GPA was high and he told me, "With such high GPA why are you fooling around like this?"

When we were there, BITS was a wild place. My BITS life is full of such memories and in terms of bonding with friends, it was a phenomenal experience .

Any there other people of Indian origin working on the MER project?

Not that I am aware of.

Did you ever get a chance to meet Kalpana Chawla?

No.

George Bush has announced ambitious plans involving Mars. Do you believe man (or at least the US) will colonize Mars in your lifetime?

We will get there someday for sure. We currently have the technology needed to get to Mars from a research perspective. What we don't have is a viable prototype of a system to get someone to Mars and get him back. I think within 40 to 50 years it's definitely possibility I believe that this requires more political will than anything else.

Companies are applying for licenses to take man to the edge of the atmosphere. Is this something that will become commonplace in our lifetime?

Absolutely! It will happen within the next 10 years, maybe 5. There are organizations like www.xprize.org who are trying to promote sub orbital flights with prizes of up to $10 million. I am sure that within 5-6 years we will have a commercial, non-governmental sub orbital flight.

India is planning to spend billions on their space ambitions, yet millions remain poor and starving. How can we justify investments in our space programs when the most basic needs remain unmet?

There is a long(er) term view that one has to think of, when answering such questions. Science in general always has the tendency to generate unintended (and very often beneficial) spin-offs and inventions. The personal computer (PC) as we know it today owes a lot to the work IBM did for the Apollo for example. IBM kept getting pushed to building smaller and smaller computers, which finally led to the advent of the PC. That in turn, had a very significant impact on the US economy. There is no reason to believe why why spare research will not lead to similar scientific advances in India.

However, India has to be clever enough to have a roadmap (and to articulate that roadmap) for doing space science indigenously that has a clear cut benefit to the young in Indian society (rich or poor). This in turn would spawn new industries, generate employment. Space exploration easily inspires children, so we will not lack for talent to enter the field.

India's success to date has been in launch vehicles and in putting

spacecraft into orbit. What we don't know is the quality of data they get back from these spacecraft.

India recently announced that it would fly to the moon. What do you think about that idea?

I am not sure about is the point of the mission to moon. If it is a political or a prestige issue then I don't think it's worth it. But if there is some scientific basis that can push science in India then we should go for it.

There will definitely be benefits of space research. But if people in India think that we can fly to the moon today and expect benefits tomorrow, then that scenario obviously is prone to failure. The Indian Government needs to very clearly articulate its goals in going to the moon in the short term and space exploration in general.

While you fulfill the dreams of man, you must have some of your own. What would you like to do in your lifetime?

In the long term, I want to get to a point where I can help people in the Artificial Intelligence community to push the state of the art (and practice) something I am very passionate about. Our community has some very sharp peop le, who are at the cutting edge, but the problem is that they are somewhat disconnected with real world problems. They are working on deep problems in theory and they want to get into the practical world to solve real problems. This has been a very difficult thing to do. NASA is one of the very few places were you can make this transition between the theoretic and practical worlds.

Eventually I guess I would retire to the hills of India and have a nice house ?. I am 40 and I think I have at least 10 years more of contribution in me. After that I might just become a brainless manager which maybe I already am.

Any advice for other BITSians who want to enter the realm of Space Exploration. What talents are needed? What is the career path like?

There is no specific recipe to getting into Space Exploration. My advice would be to stick with what you like. Since Pilani, for instance, I have stuck to a very narrow field of research namely planning and scheduling, and it's paid off for me. This may or may not pay off for someone else. But as long as you have the integrity to say that this is "what I am going to do because I enjoy it" I think things would work out. The most important thing is to like what you do as a career; not have to do it because of other reasons.

You really need to home in onto something and follow it. One doesn't need to be an Einstein, but one does need to focus. So going back to your question, if you want to do deep space exploration then you aim to go to JPL Caltech. If you want to do earth sciences related work, you go to NASA Goddard in Maryland. Biology is very big within NASA Ames (and most people don't realize it)! So if you want to work on AI, biology or general space science research then you come to Ames.

Lastly, tell me something about your family. Do you intend to take them to Pilani?

My wife and I have a 3-year old kid. I just got back from Madras where I was visiting my father recently.

I really want to go to Pilani sometime. The problem is that we go in winter and BITS is closed for winter vacations during the time.

During our times, there was this guy Vishwanathji, who used to sell really good kachories near the swimming pool. And I still remember the samosas and shikanji's at Blue Moon, the best I've ever had. So I'd really like to go back at the very least for the shikanjis and the kachories, not to mention if I can help BITS in any shape or form. And get my wife and kid to experience what I've been raving about all these years