willing to rough it out and chalk their way into the Indian Administration.

Many distinguished bureaucrats who have done well in the services include foreign secretary of India, Ms Choklia Iyer, an Indian Foreign Services (IFS) officer and the first woman to occupy the post in the year 2000 as well as Ms Kiran Bedi, IPS, the super cop who mooted the concept of prison reform in Delhi's Tihar Jail. Ms Vijayalakshmi Bidari was the topper of the Civil services exams in the year 2001. Dr P C Alexander and Mr. T N Seshan are other well-known IAS officers who rose to positions of prominence.

Civil servants not only rely on their intellectual ability but also on their people skills to be able to deal with situations. A lot of media attention adds enormous pressure to the day to day work of a civil servant.

With rampant corruption in India, civil servants have to bring with them a lot of personal integrity to get through their job.

I would speculate that my sense of awe and my respect for the District Collectors are more than justified.

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NEWS | Mission to Mars… abort?

Kanna Rajan Quits NASA

Kanna Rajan has quit NASA and has joined the Monterey Bay Aquarium Research Institute as Principal Researcher for Autonomy. The Sandpaper 2.0 team had the opportunity to speak with Dr Rajan about his decision as well as some of his prior experiences and about what lies ahead.

Why did you decide to leave NASA?

NASA is going thru some major upheaval currently. Early 2004 President Bush tasked the agency to return a wo/man on the moon by 2020 to build and ensure a sustained presence on the lunar surface in preparation to go to Mars by 2040. This is, in effect, the first time in 30 years that the agency was destination driven rather than looking around for a way to justify its large $16 Billion budget in trying fiscal times.

With very large tasks at hand, in a tight fiscal climate with two wars (Iraq and Afghanistan) to support and with a looming federal deficit, NASA will more than likely not be able to achieve some of these goals under tremendous budgetary pressure.

To cut a long story short, it seems to me, that in this climate any kind of basic research that NASA used to be doing (far less something like Autonomous Systems [my area of interest]) is going to get the short end of the stick. After a decade of service it seemed to me, I had run out of steam in having to depend on the whims of Congress to fund basic research like what I do, which was being cut across the board anyway.

How is the "Mission to Mars" program proceeding? What repercussions does this have for the broader society?

The robotic missions to Mars are going well. Spirit and Opportunity continue to (after 1.5 years in very hostile conditions) perform well doing excellent science and returning copious amounts of data. Future Mars missions might be in some jeopardy given the tight budgetary conditions. The next rover mission to Mars, the Mars Science Laboratory (MSL) in particular is discussing ways to alleviate the financial strain with a potential 2 year postponement of launch (from 2009) by stretching out its monies. Beyond that period it is difficult to predict what the conditions will be like for future robotic missions.

For that matter, the President's vision to go to Mars also appears to suffer from this monetary strain. While the implication of current designs for the CEV are to make ensure it enables a future human-rated Mars mission, the agency is clearly not even thinking of that eventuality at this stage and simply focusing on getting the CEV off the ground by the 2010 dateline. While this is doable, there is widespread disappointment that the agency is squandering

its money in trying to do something that has been done before and perhaps even repeat the mistakes of the past in the process. Further, the new direction has come with large layoffs in the very able contractor workforce at the agency and is now eating into the civil service (or tenured) personnel. Imminent Reductions in Force (RIF's) of civil service employees at the 3 research centers (Ames in California, Glenn in Ohio and Langley in Virginia) do not bode well not just for the people involved but for the long term health of the agency and its fundamental and applied research areas. The impact to flight centers (Johnson in Houston, Goddard in Maryland and Kennedy in Florida) have been somewhat less; however even the Jet Propulsion Laboratory (JPL) where I had an office while working on MER, has had severe impact with a 600 person contractor layoff and a more recently announced 7% layoff from its own employees.

So while the intent has been to focus on getting back to the moon, the process of doing has appears to be very self-destructive and it is not clear whether the manned Mars mission will survive the loss of talent.

What were your key learnings during your time at NASA?

Fundamentally, that one has to take risks to make an impact. By nature if you're doing something that doesn't bother (or more aptly 'piss off') someone that means you're not making an impact. The objective function for me all this time was to have the agency do business in a radically new way, using (in my case) advanced AI based technologies. I am satisfied I've made that impact and I have the necessary proof of that in terms of the paradigm shift in mission operations I've seen over my tenure not to mention the two medals (the agency is pretty stingy in awarding individual awards; getting one is difficult in of itself).

Second, it pays to work with smart people and to work in small tight teams with small(er) budgets to accomplish complex tasks. The overhead of communicating and ensuring that there is a consistent message within a team that is under severe stress is simply untenable without a shared understanding that comes only when everyone's not on the same page. Smaller budgets also mean one is more creative in approaching problems and under tighter constraints to deliver a usable end product not subject to laxity because of undue confidence in being able to throw money at a problem. While this is counter to the prevailing trend in industry, this approach has done wonders for me.

Third, doing something innovative implies a sound mix of theory and practice, which tend to drive one another. Finding interesting practical problems to solve drive interesting research problems that leads to further innovative research as a multiplicative factor. More importantly it ensures that what we as researchers and scientists do, is always exciting and on the cutting edge. Principle's like these have what made NASA Ames the premier research laboratory in Artificial Intelligence and Robotics.

Looking ahead, what will you be focusing on?

Focusing my attention on the Oceans instead of in Space.

My aim is to build intelligent underwater robots that will be able to adaptively orient themselves to solve major puzzles in science on how the Oceans actually work. To date, Oceanography still works the way Darwin did it more than a 100 years ago. The Ocean scientist wants to observe a specific phenomena and builds or uses a science platform (like a tethered Remotely Operated Vehicle (ROV), an "Autonomous" Underwater Vehicle (AUV), floats, moorings and sledges) to troll the water world in search of natures secrets in the biological, chemical and physical domains. In the process s/he is able to get point data, which might be able to show how a specific phenomena in a specific region (say the Monterey Bay) unfolds itself to human understanding. But this in no way provides a larger understanding of large-scale phenomena with potentially global spatio-temporal scales. As a result there is a lot of

scientific conjecture in how basic processes like nutrient flow in the mid-water column, or the flow of Iron and Nitrates from human impact in the littoral areas, or the impact on the oceans of large scale carbon-dioxide in the atmosphere due to emissions on land, are really well understood. So for instance, there is some consensus that CO2 emissions from the dawn of the Industrial age have resulted in a net increase in the pH (more acidic) of the oceans. However, what does it mean in terms of how the biological, chemical processes have changed over time? And what does it mean for the future of the planet?

What are the challenges in the science & technology arenas in the US given the rise of Asian powers?

Fundamentally, the US is (and will continue to be) lagging behind in generating more science and engineering graduates who will be in a position to make future advances in Physics, Chemistry and the Biological sciences. This coupled with the fact that fundamental research in science and technology is barely being recognized by this administration as well as Congress implies that the US is guaranteed to drop in terms of advances in this critical area. With increased restrictions on incoming foreign students post 9/11, it is already compounding the problems above only making things worse.

There was a time in the recent past, when the US could assume that foreign students would pore into US universities and stay to contribute to the economy here. However with all of the above (and other) issues which aren't coming to the top of the stack of our lawmakers, it is clear that not only Asian (and perhaps European) universities are attracting very good talent, many of them expatriates who are returning to their home countries armed with the knowledge, discipline and a deep understanding of where the state of the art in science and technology is, it is quite clear that non-US universities are only going to become dominant at the cost of those in the US. This will have a direct and quite near term impact to their own economies.

This is not a hypothetical scenario; we're seeing increased science/technology funding in European research laboratories with increased and innovative research especially in the biological sciences, including those dealing with Stem Cell research as well as pharmaceuticals where they've already had a traditional hold in advanced research. We're also seeing the old "Asian tigers" like Korea increasingly flexing its muscles in this arena make huge multi-billion dollar investments in doing big science. Japan is once again the home of the worlds fastest super-computer used for Atmospheric modeling and China is increasingly attracting high-powered academics from top US universities like MIT, Cornell, Princeton back to their own universities.

The fundamental problem has less to do with dollar amounts funded (although that is critical); the issue rests with the vision of what the place of the United States is, in this world which isn't solely based on how big a nuclear powered Navy it has or the number of smart weapons and soldiers it can deploy in the far reaches of the world.

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The Monterey Bay Aquarium Research Institute (MBARI)

Founded in 1987 by David Packard, the mission of MBARI is:

"to achieve and maintain a position as a world center for advanced research and education in ocean science and technology, and to do so through the development of better instruments, systems, and methods for scientific research in the deep waters of the ocean. MBARI emphasizes the peer relationship between engineers and scientists as a basic principle of its operation. All of the activities of MBARI must be characterized by excellence, innovation, and vision. For more information, please visit: http://www.mbari.org/