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CHINA'S ASCENDANCY TO NUMBER ONE POSITION IN THE REALM OF SUPERCOMPUTING: ANOTHER *'SPUTNIK MOMENT'* FOR THE US

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The rivalries among nation states can transform into a contest for assertion of elements of national power – political, economic or military. History is replete with examples of power projection by states, either to sustain or to expand their sphere of influence in the global arena. In some cases, it had brought the nations into an open conflict, while in others it had aided in maintaining the détente. A nation's desire to be recognised as a powerful entity among other nations manifests in efforts directed towards acquiring capabilities which are still elusive to its potential rivals.

During the period of the cold war, there was an ongoing contest among superpowers without any overt military confrontation. This competition became fierce and vicious, especially during early space race and nuclear armament. The national pride of the super powers was riding on the success and achievement of milestones in the field of space and nuclear armament. The American psyche was severely dented after the successful launch of Sputnik, the first artificial satellite by USSR. Its prestige suffered a further blow when Yuri Gagarin became the first human in space in the year 1961. In order to restore American pride, **President John F. Kennedy** called for the US to commit itself to achieving the goal of landing a man on the moon and returning him to earth before the end of the decade.[1] The landing of Apollo 11 on the moon on 20 July 1969 assuaged the American pride. Similarly, in the race to build up nuclear arsenal, the testing of the first atomic bomb

at Alamogordo, New Mexico was done with the dual objectives of: ending of World War II and to coerce the USSR into accepting pro American foreign policy. The US monopoly of atomic weaponry came to an end on 29th August 1949 after the detonation of its first atomic bomb by the Soviet Union at the Semipalatinsk Test Site in Kazakhstan. During 1950's, the Nuclear Arms Race became the pivot around which all the acts of superpowers against each other were undertaken. The nuclear race was further exacerbated when US tested the first Hydrogen bomb in 1952.

After the end of Cold War, it was generally believed that the unipolarity of the new world order would see ebbing away of such rivalries. However, the emergence of new players saw the development of new playing fields with different set of rules which broke the traditional hegemonies.

Lawrence Livermore National Laboratory at US symbolises the great strides the US has made in bolstering its scientific and military prowess. The laboratory shot into prominence on fruition of its assigned mission of designing the hydrogen bomb under the stewardship of Edward Teller. The successful fruition of the project was a result of innumerable simulations, collection, evaluation and assimilation of unprecedented amount of data and churning out of millions of bits and bytes into tangible results. To do this, Livermore used extraordinary computational power of powerful machines called 'Super Computers'.[2] The US has always dominated in the field of supercomputers.

In October 2010, when China unveiled to the world its Supercomputer Tianhe-1A (Milky Way), it toppled the US from the high pedestal that the High Power Computing (HPC) community had placed it on.[3] China was able to demonstrate its resolve to be able to garner its home grown expertise and engineering prowess to be at the top of the technology world. China's meteoric rise in the realm of supercomputing can be gauged by the fact that in a decade, China has developed and operationalisesd 76 supercomputers, which are in the list of the 500 fastest super computers. As a superpower, the sense of disappointment and loss of national pride experienced by the US as a result of this development was akin to the 'Sputnik Moment'. However, apart from loss of face, this also has serious ramifications for US national security. Supercomputers, showcased as

technology demonstrators, are extensively used in solving complex problems in the field of advance research. The supercomputers are used for designing weapon systems, carrying out complex processes of encoding and decoding, accurate weather forecasting, modelling climate change and developing various drugs to free mankind from scourge of many deadly diseases. The US is still not able to exorcise the ghosts of cold war era and views the race to possess the most powerful supercomputers analogous to the space race in the guise of scientific rivalry. President Obama acknowledged China's feat in his State of the Union address a few months later. He implored the scientific community to out-innovate, out-educate and out-build the rest of the world.[4]

Globally, high-performance computing technology is ubiquitously present in all the cutting edge research and development (R & D) projects. A natural corollary of being a leader in this field is having pole position in the economic and military development. Playing a second fiddle in the realm of supercomputing is tantamount to losing the edge in areas of scientific development and in the security and military fields. China's emergence as a supercomputing superpower is a result of focused, sustained and concerted efforts. The fruition of Tianhe-1A, though spectacular, had a very modest beginning. In March 1986, the Chinese under the project named '863 Project', started working on the development of advanced technologies. By the early 1990s, the state-funded Dawning Information Industry Ltd achieved some success in producing somewhat rudimentary supercomputers, a feat which went largely unnoticed in the high end technology world. In 2000, China put the pedal on the gas and established a huge supercomputer centre in

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Shanghai. This centre was followed by centres at Beijing, Shenzhen, Tianjin and Chinese National University of Defense Technology (NUDT) in Changsha.

In order to rank the 500 most powerful (non-distributed) computer systems in the world, 'TOP500' project commenced in 1993. With an aim to provide a reliable basis for ranking the super computers and for highlighting the trends in high performance computing (HPC), it releases a list twice a year. The Tianhe-1A featured at the top of the list of supercomputers for the very first time in November 2010, pushing the US 'Cray XT5 Jaguar' to second place. However, in the subsequent lists, it could not maintain its number one position. In order to regain its lost position, the Chinese came up with its new avatar 'Tianhe**-2'** which outperformed not only its predecessor but other supercomputers placed above **Tianhe-1A. It announced its arrival in the supercomputing arena with a bang, zooming past all its rivals and topping the list in June 2013.** *The* **Chinese** engineering **feat took the world by surprise as the fruition of the project was two years ahead of schedule.** The feat also marked China's return to the No. 1 position after November 2010, when Tianhe-1A was ranked as the most powerful supercomputer. The Tianhe-2 has ruled the roost by being on top of the list from June 2013 onwards for the three consecutive times. According to the 43th edition of TOP500 list published in Jun 2014, with a superlative performance of 33.86 Pflop/s (quadrillions of calculations per second) on the Linpack benchmark, Tianhe**-2' left** its rivals far behind gasping for air.

The high performance computing (HPC) has emerged as one of the most significant growth catalyst for the Research and Development (R & D) processes. In addition to fuelling breakthroughs in science, engineering and business, HPC offers cost effective and innovative tools for efficient and expeditious results through R & D processes. Two-thirds of all US based companies that use HPC unanimously agree that "increasing performance of computational models is a matter of competitive survival."'[5]

In the field of HPC, India also achieved many enviable landmarks and has carved a niche for itself in this highly exclusive, cutting edge and innovative field. In the 43th edition of TOP500 list published in Jun 2014, nine supercomputers currently in operation in India have prominently figured. The strides made in the field of supercomputing field are largely

attributable to harnessing the power of thousands of processors parallelly by using workable and efficient pieces of software. India having proven prowess in the field of software can leverage its expertise in designing more powerful and highly complex supercomputers.

The race for possessing the fastest supercomputer is likely to continue unabated. The standing in global order and prestige accrued in this domain translates into prestige in other domains as well. A number of other nations including India are likely to join the fray for world recognition of being able to design and assemble the fastest supercomputer, a feat of technological genius and a manifestation of scientific competence.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies [CAPS])

End Notes

[1] "May 25, 1961: JFK's Moon Shot Speech to Congress ",at http://www.space.com/11772-president-kennedy-historic-speech-moon-space.html, accessed on 20 Oct 14

[2] "Lawrence Livermore National Laboratory", at https://www.llnl.gov/about/history.html, accessed on 20 Oct 14

[3] "Tianhe-1A takes supercomputer crown from US", at http://www.theguardian.com/technology/2010, 28 October 2010, accessed on 20 Oct 14

[4] "A Calculating Win for China's New Supercomputer", at http://www.npr. org/ 2013/06/21/ 194230816, 21 June 2013, accessed on 20 Oct 14

[5] "The Exascale Effect: the Benefits of Supercomputing Investment for U.S. Industry", at http://www.intersect360.com/industry/reports.php?id=1, 18 October 2014, accessed on 20 Oct 14
