Address by Ir Frank Chan JP - Dream beyond the sky

[Slide #2]Humanity has long been fascinated by what is up there in the sky. When the night falls and galaxies glitter afar, it is a humbling experience out there under the stars. Over time, artists, musicians and poets have created many masterpieces giving the very best of their talent and imagination. Scientists and engineers have instead chosen to explore and ascertain what is factually out there. Curiosity has driven us to gaze with space telescopes, analyse the age, mass and composition of planets and stars. We even search for extraterrestrial intelligence and probe signals from the outer space. Of all the missions we can imagine, the greatest challenge is to reach for the stars.

Venture into the Space

[Slide #3]Fifty years ago, the successful docking of two spacecrafts in 1965 marks the first operation of its kind. With *Gemini 6 and Gemini 7* each cruising at a speed of eight kilometers per second, the docking maneuver was a perfect symphony of man and machine.

[Slide #4]Four years later, Neil Armstrong became the first man who set foot on the Moon. The *Apollo 11* landed 6 kilometers away from the target landing spot. Considering a distance of 380,000 kilometers between the Earth and the Moon, the landing precision of *Apollo 11* is equivalent to hitting the bullseye of a dartboard from a few hundred meters away. Back in the 60s, it was truly a giant leap by any standard.

[Slide #5]For space mission, precision is everything. Landed on Mars in August 2012, *Curiosity* found itself 2.5 kilometers away from the target landing spot. As the Earth and the Mars are both revolving and traversing in their own orbits, the distance between the

two changes continuously, ranging from 56 to 400 million kilometers apart. Had *Curiosity* maintained the landing precision of *Apollo 11*, it could have strayed a few thousand kilometers away from its target. The achievement of *Curiosity* is phenomenal. Yet, with advancement in engineering and technology, future landing on Mars is envisaged to have a precision in the range of meters.

Mitigation of Disability

In pursuit of our dream to reach for the stars, we have overcome challenges, learned from failures and grieved over tragedies. [Slide #6]Remember the "Six Million Dollar Man" TV series in the 70s? It depicted the miraculous recovery of an astronaut, played by Steve Austin, when his space mission ended in disaster. [Slide # 7 & Video #1]

With the aid of bionics technology, he was transformed into a superman. He was equipped with visual capability better than an eagle, running speed faster than a cheetah and arm strength stronger than a bulldozer. Of course, all these are fictitious 40 years ago. At that time, prostheses were primarily structural replacement if not cosmetic, and had limited functionality.

Bionic eyes

[Slide #8]Advancement and miniaturization of instrumentation have helped enable the blind to see. Germany has developed a retinal prosthesis called "Alpha IMS" to restore optical sensation and thus visual capability. The retinal prosthesis consists of a miniature chip which carries a micro-photodiode array. The chip is 9mm^2 in size and is surgically placed behind the retina. It converts visual images into electrical signals and works like photoreceptor cells of the eye.

Although restoration of vision is still incomplete with the latest technology, patients participating in the clinical trials reported numerous beneficial experiences. They regained the capability of recognizing unknown objects, facial characteristics of people, moving objects and so on. "Alpha IMS" enables self-sustaining actions and helps improve quality of life.

Upper Limb prosthesis

[Slide #9]Advancement in biomedical engineering has also brought breakthroughs in prosthesis. The John Hopkins University has developed prosthetic limbs which directly interface with the body's nervous system. Under direct and voluntary control of the user, upper limb prosthesis mimic their phantom counterparts to the finest. They are capable to perform almost all of the movements with dexterity comparable with human arms and hands.

Take hand grasp as an example, the advanced control and sensory feedback technologies make possible the perception of pressure and force. The user can control the prosthesis to hold and grasp things like a human hand. As a matter of fact, sensation of warmth and touch can also be felt.

Lower Limb Prosthesis

[Slide #10]In 2013, Boston Marathon bombing survivor, Adrianne Haslet-Davis, lost her left foot during the attack. The loss of a limb would be devastating for anybody. For Haslet, a dance teacher by profession and an award-winning ballroom dancer, it could be the end of her way of life as she could no longer dance in a way she loved and used to. But with determination to overcome all odds and the provision of ankle-foot prosthesis developed by the MIT, Haslet has restored her way of life. [Slide #11 & Video #2]Not only has she resumed

dancing on stage in less than a year after the attack, she was honored by "Dancing with the Stars" in recognition of her passion for dance and inspiration for life. With biomechanics and microprocessors combined, the prosthesis has helped restore her normal gait, balance and pace. Last month, Haslet had once again crossed the finish line of the Boston Marathon, demonstrating to the world that she is back on track the marathon of life.

Paradigm Shift

Half a century is just a blink in human history. But in the arena of engineering and technology, we have witnessed breakthrough and paradigm shift in many fronts. [Slide #12]Fifty years ago, we studied CAM control for car engine. Today, CAM shaft is no longer needed for electric vehicles. Fifty years ago, computers were huge in size. They were meant for experts but not people in the street. They were so expensive that only institutions and major corporations could afford to buy. They worked rather slow and had little core memory in the range of kilo-Byte. Today, the computer becomes a necessity for most people. It appears in all shapes and sizes. Its closest cousin fits well in your pocket but the little guy has great memory and power. It keeps you connected with others all over the world and it performs all sorts of functions than Babbage, the father of computer, could have imagined.

The World to be

Ladies and gentlemen, half a century is indeed far too long for engineering. In the past fifty years, we have seen many ideas, imaginations and dreams coming close to reality. Given the current pace of technological advancement, fifty years from now will be way beyond our imagination.

But if I may dream, I would say: **Fifty years down the road,**

- Many people would be out of work [Slide #13]

  as robots take over most manual jobs
- Pilots, drivers and captains would become optional [Slide #14]

  as air, land and sea transport would be fully automated
- The term "Disability" would be removed from the dictionary [Slide #15]

  as body function impairment would be mitigated by bionics and prostheses
- Personal computers would no longer be needed [Slide #16]

  because it is all in the Cloud
- Many people would be found missing from the Earth [Slide #17]

  because they go elsewhere for vacations

In fifty years' time, I am not so sure if I would still be around. But just in case there is any breakthrough innovation to connect with the world up there, please do let me know if any of the dreams have ever come true.

Thank you.