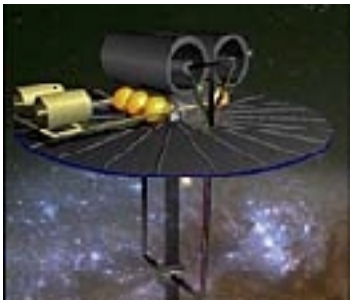

Image courtesy High Lift System

The Space Elevator Ribbon Climbing Robot Competition Rules

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DRAFT OUTLINE VERSION - NOT FOR WIDE RELEASE

I. OVERVIEW - WHY THIS CHALLENGE?

Space lies but 100 miles away - straight up. However, the current expense of getting to space - around US$10,000 per kilogram to via the Space Shuttle, keeps us from getting there as much and as often as we might.

The Space Elevator brings the cost down to a reasonable level, and gives us “access to anywhere” - the Moon, Mars, asteroids and beyond.

In October of 2002, John Young, former Gemini, Apollo, and Space Shuttle astronaut and current Associate Director (Technical) at NASA’s Johnson Space Center, issued the following statement: "In order to save the human race we must develop the technologies that will allow us to live and work on other places in the Solar System."

Young’s memo concludes that the human race is at significant risk from normal Solar System and Earth evolving events; “SINGLE PLANET SPECIES DO NOT LAST and we have no idea how much time we have.”

Though Young did not mention the Space Elevator specifically, detailed NASA-funded studies conducted by Dr. Bradley Edwards show how we can build it in the near term (years, not decades) and for a price on the order of US$10 billion - on par with other major engineering projects. See http://www.HighLiftSystems.com for more.

So, our mission is urgent. Build a “ribbon to the stars” and help guarantee the long-term future of humanity.

II. THE SPACE ELEVATOR CHALLENGE

1. Mission Profile - Build a robot to climb a thin plastic ribbon in minimum time, performing 1 five second pause on ground command, then stop automatically at the top. Score higher for using only “beamed up” vs. on-board power.

a. Inspection - verify size, weight, power, control and other parameters to satisfaction of judges.

b. Pre-Ascent - Operator places robot on base panel in position on ribbon, and activates it as needed to await Referee’s start command.

c. Start Command - When Referee gives verbal start command and begins mission timer. On hearing start command operator activates robot via non-contact method.

d. Ascend - Robot climbs ribbon.

e. Pause command - At some time during ascent phase, the Referee shall issue a verbal Pause command. On hearing Pause command, the robot operator will transmit a pause signal to robot. The Referee will issue one and only one Pause command during each mission.

i. Robot must stop and remain in place, not moving upwards or downwards, for 5 seconds.

ii. After 5 second pause robot may automatically continue ascent.

iii. The five second pause counts as part of the total mission time.

iv. Failure to perform the pause within 5 seconds of the Referee's command will result in a zero score for that Mission.

f. Stop - When the ascending robot makes physical contact with the top panel, the referee will stop the mission timer. The robot must stop automatically and remain in place, not moving upwards or downwards. The referee will record the total elapsed time for the mission.

g. Remove - the operator may then remove the robot from the ribbon at the top platform.

2. System Components

a. Ribbon - Thin polyethylene ribbon*, 30 mm (1+3/16") wide, 2 to 6 meters high, depending on limits of contest venue.

** Specifically "Red Flagging Tape" #17021, manufactured by C. H. Hanson Company. Available as Ace Hardware Store item #20905, $1.29 for 300 foot roll (as of October 2002).*

b. Base Panel - Flat 20 x 20 cm square area, with ribbon anchored securely through slot at center.

c. Top Panel - Flat 20 x 20 cm square area, with ribbon anchored securely through slot at center.

3. Climbing Robot Design Restrictions

a. Control - Robot must receive all commands from it operator via a non-contact, non-tethered method such as infrared, optical, radio or other. Once placed on the Base Panel and readied for ascent, operator may not have physical contact with robot until the end of the mission.

b. Size - At start of climb, robot must fit inside of 10 x 10 x 30 cm box. After receiving "start" command from ground control, robot may deploy and expand to any size. All parts of robot must ascend, no parts may be left on base, on ribbon or dropped at any time during mission.

c. Weight - At start of climb, entire robot must weigh 1 kilogram or less. Weight of remote control, ground power systems or other components that do not ascend are not considered as part of weight.

d. Power - Robot may be powered by any non-combustion method. Power can be provided to robot in two forms, which greatly affect scoring.

i. On-board power - robot has all power for duration of mission at start of ascent.

ii. Ground-based power - robot receives all power from a ground-based source that is NOT physically connected to robot. Ground-based power may be transmitted to robot via non coherent or coherent (laser) visible or infrared light, microwave or other controlled method.

iii. Tesla coils or other high-voltage power broadcast methods to transfer power to robot may NOT be used.

iv. Pressurized air, water or other purely physical methods of power transfer may NOT be used.

v. As missions powered by ground-based sources receive significantly higher scoring factors, ground powered robots must be fully open to inspection and testing before and after mission to satisfy judges that it contains no stored on-board power.

c. Mounting - As ribbon must remain anchored at both top and bottom platform at all times, climbing robot must mount ribbon by sliding or clamping onto it from side. Ribbon will not be removed from base or top for threading or passing through robot.

d. Starting -

e. Remote pause -

f. Automatic stop -

g. No damage to ribbon -

4. Scoring

a. Each robot may attempt three missions. Each mission will be scored separately, and the Robot's final score will be the best of the three scores.

b. Each mission will be scored as follows:

Score = T x D x C x A x P

T = Mission elapsed time in seconds

P = Power method factor;
1 if power supply carried fully on-board robot
2 if some power received from ground-based source**
10 if all power received from ground-based source**

C = Remote Control factor;
1 if successfully performed 5 second pause on command
0 if did not successfully perform 5 second pause

A = Auto stop factor;
1 if automatically stopped at top platform
0 if did not automatically stop at top platform

D = Damage factor;
1 if no damage to ribbon
0 if damage to ribbon.

** Robots that receive some or all power from ground based sources must be fully open to inspection and testing before and after mission to satisfy judges that it contains no stored on-board power. Robots intended to receive all power from ground-based sources may NOT carry devices for storing power greater than 2000 µF total. Robots in this category found to have more than 2000 µF capacity on board will be disqualified.

5. Conclusions

Question? Changes? Event planning concerns? Contact Roger Gilbertson, rgg@mondo.com

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