N91-18131

LUNAR SURFACE VEHICLE MODEL COMPETITION

GEORGIA INSTITUTE OF TECHNOLOGY

During Fall and Winter quarters, Georgia Tech's School of Mechanical Engineering students designed machines and devices related to Lunar Base construction tasks. These include joint projects with Textile Engineering students and are listed here by project title.

Fall Quarter (32 students):

- Lunar Environment Simulator via Drop Tower Technology
- Lunar Rated Fasteners
- Lunar Habitat Shelter
- Design of a Lunar Surface Trenching Machine
- Lunar Support System
- Lunar Worksite Illumination (Daytime)

Winter Quarter (45 students):

- Lunar Regolith Bagging System
- Sunlight Diffusing Tent for Lunar Worksite
- Service Apparatus for Lunar Launch Vehicles
- Lunar Communication/Power Cables and Teleoperated Deployment Machine
- Lunar Regolith Bag Collection and Emplacement Device
- Soil Stabilization Mat for Lunar Launch/Landing Site
- Lunar Rated Fastening Systems for Robotic Implementation
- Lunar Surface Cable/Conduit and Automated Deployment System
- Lunar Regolith Bagging System
- Lunar Rated Fasteners and Fastening Systems

A special topics team of five Spring quarter students designed and constructed a remotely controlled crane implement for the SKITTER model that has been on exhibit at Atlanta's science and technology museum, SCITREK.

LUNAR SURFACE VEHICLE MODEL

Five other teams of Spring quarter students (51) designed entries for the "Lunar Surface Vehicle Model" competition that was held on May 31, 1990. These remotely controlled vehicles, each loaded a given payload, transported it over an obstacle course, unloaded it, and returned to the starting point. Their report titles are:

Lunar Surface Vehicle Model - Team Mars
Lunar Surface Vehicle Model - Team Mercury
Lunar Surface Vehicle Model - Team Neptune
Lunar Surface Vehicle Model - Team Pluto
Lunar Surface Vehicle Model - Team Venus

The general rules of the judging and events along with the points distribution are outlined in the following sections and Table 1. In terms of lessons learned about system design methodology and project management, this competition proved to be extraordinarily effective. The event was covered by both the local and national news media. The crane implement model and the winning vehicle are to be exhibited at the NASA/USRA Summer Conference.

LUNAR SURFACE VEHICLE MODEL COMPETITION

General Rules

Remote Control. By radio, infrared sound, etc.

Mobility. 6 identical wheels, all-wheel drive, 3 axle centers, 3 wheels on each side, same trace, axle-to-axle centers greater than 1.5 times wheel diameter.

Power. Direct current, 50 V maximum, self-contained.

Speed. 5.0 km/hour maximum (level paved surface).

Size. Width 0.5 m maximum; Height 0.5 m maximum; Length 1.0 m maximum.

Turning. 3.0-m-diameter circle, (wall-to-wall), (level paved surface).

Drawbar Pull. Static force to abe measured at axle height on centerline of vehicle, (level dry sand).

Ownership. Complete system is the property of Georgia Tech.

Cost. Less than $1,000 fair market value; $500 maximum available from NASA/University Advanced Design Program.

Payload. Mass: 0.5 kg ± 5%; Material: Aluminum; Size: Largest overall dimension 15 cm maximum; Passive.

Demonstration. Start vehicle at least 1.0 m from payload, drive to payload, load payload on vehicle within vehicle's length and width, transport payload over obstacle course, unload payload and return vehicle to starting point. 10 minute time limit. 3:00 Thursday, May 31, 1990 on the Ga. Tech. Campus.

Slope. Uphill and downhill in dry sand, 10%, 20%, and 30%. Sidehill in dry sand, 10%, 20%, and 30%.

Judged.
- Innovation in structure, power transmission, control, kinematics
- "Lunar" appearance
- Quality of workmanship
- Safety

Obstacle Course Events

1. Place the payload and vehicle at their designated places.
2. Start the timer.
3. Drive the vehicle to the payload.
4. Load the payload.
5. Set the pull scale at axle level.
6. Connect the vehicle to the pull scale.
7. Measure the drawbar pull capacity in sand.
8. Disconnect the vehicle.
9. Drive through the .5 m by .5 m opening.
10. Stop against the barricade for the length check.
11. Drive close to curb.
12. Stop momentarily.
13. Turn around a full circle between curbs.
14. Drive through the speed trap.
15. Turn around the pylon.
16. Drive through the speed trap.
17. Drive up, down and sidehill on the 10% slope sand.
18. Drive up, down and sidehill on the 20% slope sand.
19. Drive up, down and sidehill on the 30% slope sand.
20. Drive along the route to the unloading point.
21. Unload the payload.
22. Drive along the route to the starting point.
23. Stop the timer.

Table 1. Competition Points Accumulation

Category/ Criteria		Place or Award				
		1st	2nd	3rd	4th	5th
Judging: Innovation	Structure	200	100	50	0	0
	Power Transmission	400	200	100	0	0
	Control System	400	350	300	200	100
	Kinematics	200	150	100	50	0
Judging: Aesthetics	"Lunar" Appearance	300	200	100	0	0
	Workmanship	300	200	100	0	0
Judging: Safety	Very Safe	300				
	Reasonably Safe		200			
	Unsafe			0		
System Cost:	Less than $400	500				
	Less than $500		400			
	Less than $600			300		
	Less than $800				100	
	Less than $1000					0
Speed: (Fastest = 1st)		400	300	200	100	0
Size: (Smallest = 1st)	Width	200	100	0	0	0
	Height	200	100	0	0	0
	Length	200	100	0	0	0
	Volume (WHL)	500	400	200	0	0
Turning Radius: (Least = 1st)		300	200	100	0	0
Drawbar Pull: (Greatest = 1st)		800	500	300	200	0
Weight:	Lightest (W_1)	1200				
	$\leq 1.05\ W_1$		1000			
	$\leq 1.20\ W_1$			800		
	$\leq 1.50\ W_1$				600	
	$\leq 2.0\ W_1$					400
Time Over Course: (Least = 1st)		700	600	500	200	0
Slope:	30%	500				
	20%		300			
	10%			100		
Sidehill:	30%	500				
	20%		300			
	10%			100		