CANYON SPACE TEAM

CST Newsletter Editor
Bruce E. Watson
P.O. Box 70
Kahlotus, WA 99335-0070

Phone: 509-282-3341
Email: secretary@canyonspaceteam.org

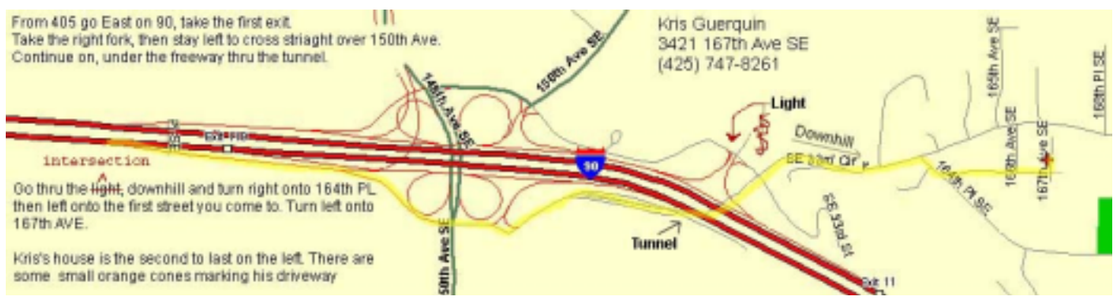
http://www.canyonspaceteam.org

The primary goal of the Canyon Space Team is to support low cost, private, human access to space (sub-orbital, semi-ballistic flight) including research and development.

President	Rich Harman 2211 172nd PL SE, Bothell, WA 98012	425-922-7761
Vice President	Kim Powell 3483 Best Lane, Bellingham, WA 98226	360-592-1152
Treasurer	Rich Collingwood 41512 SE 131st Street, North Bend, WA 98045	
Secretary	Bruce E. Watson P.O. Box 70, Kahlotus, WA 99335	509-282-3341

May 2001 General Meeting

Place: Kris Guerquin's home
Date: Sunday June 10, 2001
Time: Noon



Directions on how to get to Kris Guerquin's house

Canyon Space Team

CST Newsletter

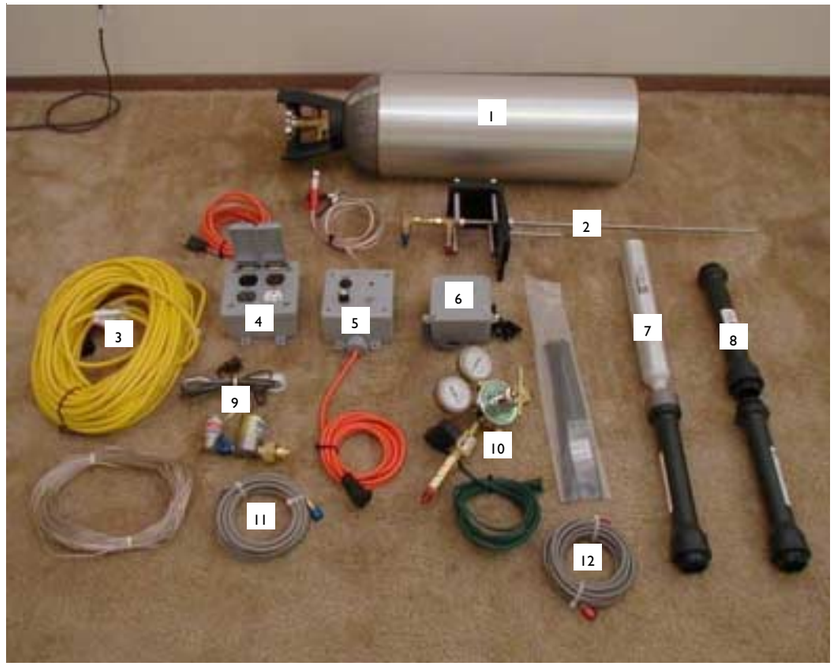
Volume 1, Issue 2 June, 2001

CST Progress:

- HyperTEK rocket engine and launcher arrives.
- Rich Harman builds and tests a cold gas thruster

Inside this issue:

HyperTEK Rocket Arrives



(1) N2O Storage tank, (2) Fill stem assembly, (3) Control cable, (4) Launch pad junction box, (5) Launch control box, (6), (7) N2O Tank, (8) Fuel grain, (9) N2O and GOX solenoid assemblies, (10) Gas regulator, (11) N2O Hose, (12) GOX Hose

The HyperTEK hybrid rocket engine and launch system arrived just prior to the last meeting. This rocket engine system

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Treasurer's Report

Rich Collingwood

Treasurer's report as of 5/31/01:

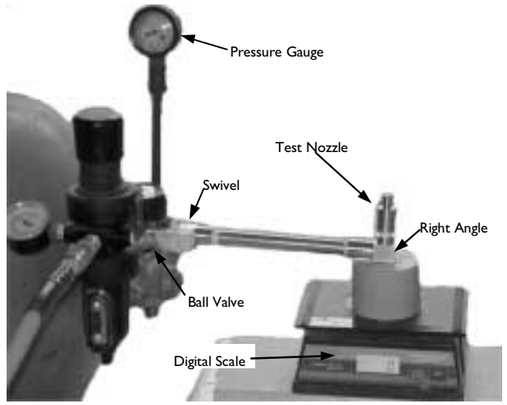
Checking Balance:	$383.34
Savings Balance:	$000.11

The only activity since the last newsletter is an outgoing check #1045 dated 5/15/01 to The Secretary of State to renew the Non-profit Corp. for $65.00.

Cold Gas Thruster Test Set UP

By Rich Harman

The test setup consisted of a ball valve mounted directly to the compressor pressure regulator for the lowest possible losses. Following the valve is a swivel to which is attached a length of pipe and finally a right angle adapter. The right angle was machined so that on the bottom there is a small bump that is exactly in line with the nozzle throat axis. Onto the right angle is screwed the thrust chamber. Under the right angle is the gram scale, which was zeroed with the thruster setup resting on it. I was initially concerned the friction from the swivel may affect readings but the scale always returned to zero after thrust was applied. Whatever friction exists from the swivel is beyond our ability to measure.



Thruster Construction

By Rich Harman

I only had the time to make one thruster. The throat diameter is .108", the nozzle exit is .282" for an expansion ratio of 6.8. Nozzle half angle is roughly 18 deg. First the throat was drilled then the nozzle machined. Next was the drilling and tapping for the 1/4 NPT right angle.

I noticed that the tapped hole was not centered on the nozzle throat so I re-chucked the chamber and dial indicated it to center. Using an end mill and a rotary table I machined down inside the chamber so that the nozzle throat length was reduced to approximately .7 mm, creating a symmetrical entrance to the throat which measures around 1/4" diameter x 5/16" deep.

Close up of test thruster attached to test set up.

I would like to next make a pair of thrust chambers identical in every respect with the exception that one will have no nozzle. Perhaps the expansion ratio will be optimized for 75 psi so that we might see an efficiency drop both above and below the target operating pressure.

Looking down the throat of the test thruster.

Side view of the test thruster attached to the right angle adapter.

Thruster Test Results

By Rich Harman

Thrust measurements were taken by opening the valve fully and then adjusting the regulator to the desired pressure. Readings were noted only after the regulator pressure stabilized. Measurements were repeatable to within 2 grams.

Cold gas thrust chamber being tested.

At pressures below 75 psi the nozzle contributes nothing to thrust. It is only with the higher pressures that we start to see an increase in thrust due to the nozzle. Since this thrust chamber was designed for 100 psi the lower pressure runs were greatly over expanded.

Pressure (psi)	Scale (grams)
25	76
50	191
65	258
75	311
90	380
100	424
125	557*
145	655*

*The higher pressure data is not reliable because the source pressure dropped to quickly to get a good reading. The actual values should be higher.

Pressure (psi)	Scale (grams)	Percentage	Thrust (grams)
25	76	73	104
50	191	92	208
65	258	96	270
75	311	100	312
90	380	102	374
100	424	102	416
125	557	107	520
145	655	109	603

This table shows the supply pressure, measured thrust in grams, the percentage (efficiency) of thrust we would expect to get by multiplying the throat area times the pressure, shown on the right.

HyperTEK Rocket Arrives

(Continued from page 1)

will be used for testing the Sub-Scale Super Sonic Vehicle (S4V). President Rich Harman will first use the HyperTEK with a rocket he is building to get his certification in order to later support the testing of the S4V.

The rocket is mounted on the fueler/launcher, with the launch stem going up through the fuel grain and sealing in the injector bell. This launch stem consists of two coaxial tubes, one of which fills the oxidizer tank with N2O, the other for providing gaseous oxygen (GOX) into the combustion chamber for ignition. A piece of ignition wire is introduced into the fuel grain the same way, and attached to an ignition transformer. The rocket is then tied down to the fueler/launcher with a tie-wrap strap.

From the launch controller the fill solenoid is activated and the N2O starts to fill the oxidizer tank. When the liquid N2O reaches the top of the vent tube the N2O vents through a hole in the side of the rocket. The vent plume is visible and indicates the tank is full; the fill solenoid is then turned off. At ignition the GOX solenoid and transformer are turned on. When the transformer is activated it causes the ignition wire to arc across the bare end which ignites the wire in the presence of the GOX, quickly lighting the fuel grain. The exhaust burns through the tie-wrap strap that secures the rocket on the launch pad. When the strap burns through, the pressure of the oxidizer open the Kline Valve, and the N2O flows into the combustion chamber, immediately bringing the motor to full thrust.