The BRL-CAD Benchmark Test

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This document describes the BRL-CAD Benchmark Test Methodology, and the Ray-Tracing Figure of Merit (RTFM) used to judge the computational performance of different computer systems.

The core of the test is the **rt** ray-tracing program. The results for each processor are determined by running a benchmark test of the RT ray-tracing program on each of the sample databases provided. The **rt** program requires a binary database for input ("db/xxx.g"), and produces a binary image as output ("bench/xxx.pix"), along with a log file ("bench/xxx.log"). Each run will produce a 512x512x24 bit color shaded image in a "bench/xxx.pix" file, and a run log in "bench/xxx.log". Reference copies of the images are provided as "pix/xxx.pix" and "pix/xxx.log". The sample databases provided are processed in order of increasing difficulty, and each produces a colorful image. In each picture there are two light sources; the primary source is located near the center of the model (the white ball), and the secondary light source is located at the "eye" position.

1. The Benchmark Models

moss.g -- This is a simple model, containing a yellow torus, a green ellipsoid, a bluish cube, a pink truncated (distorted) cone, all sitting on a blue plate. Note the shadowing, and "specular splash".

world.g -- The same model as moss.g, but with various rendering features enabled. The model is enclosed in a hollow cloud sphere. The plate is a mirror, the egg is crystal, the box has a debugging texture map applied.

star.g -- A familiar sight to Star Trek fans; a low-detail exterior of the ship "Enterprise". The hull is white, with some other structures in other colors. The small red object in the foreground is the shuttlecraft Galileo, to scale.

bldg391.g -- An exploded view of a two-story imaginary computer site, including various walls, red stairways, green disk drives, etc. The lower floor is a mirror, the upper floor is glass.

2. MACHINE INDEPENDENCE

To make the benchmark distribution machine independent, the databases are provided in an ASCII format in the "db" directory, and ascii-to-binary converters are provided in the "conv" directory. The setup command "**cake benchmark**" (see the document *Installing the BRL-CAD Package*) will automatically compile and run the converters.

If you are running this benchmark on a non-UNIX machine that has difficulty writing binary streams, change the "-o file.pix" flag to "-O file.a_pix" and RT will write an ASCII form directly. For more discussion, consult the doc/pix.5 and conv/asc2pix.1 manual pages.

The reference images are distributed in binary BRL-CAD format. Earlier releases distributed the reference images in the portable ASCII form, and then converted them to the binary form. This consumed a significant amount of extra storage on UNIX machines, so this practice was discontinued. It is assumed that anyone attempting to benchmark a system that can not read pure binary files will at least have access to a UNIX system. That UNIX system can be used to convert the reference images to the portable ASCII form with the tool, and then those images may be sent to the machine under test.

Information about modifying the benchmark to run on a particular system may be found in the document *Installing the BRL-CAD Package*. For a detailed explanation of various hardware specific modifications necessary to take advantage of parallel processing, see the document *Workstations, Networking, Distributed Graphics, and Parallel Processing*. Implementations for several different types of hardware in use at BRL are included.

If you encounter difficulty with running the benchmark, you might wish to build the full BRL-CAD package, to take advantage of the image tools in determining the nature of the problem. For example, one system suffered from a compiler bug that made TGC solids vanish, while another system had difficulties with the light visibility calculations.

3. OBTAINING CORRECT RESULTS

The benchmark timings are not considered valid unless the correct results are given. Make sure that the answers match the reference files to within plus-or-minus one in each color (see pixdiff(1)). Slight variations in the calculated pixels are generally attributable to variations in floating point precision. You may wish to compare the execution times and log file remarks from your tests (in the "bench/xxx.log" files) with the VAX-11/780 (with hardware FPA) times which are given in the "pix/xxx.log" files. The reference images are also located in the "pix/" directory.

For example, if you are running the benchmark on a Cray XMP, the world.pix and bldg391.pix images will have a single byte in the blue channel off by 1, out in the cloud background. This is not to be considered an error.

4. BENCHMARK IMAGE DISPLAY

If you have a suitable framebuffer, you may wish to display the images generated by the benchmark, and compare them to the reference images. This section assumes that you have successfully compiled the full set of BRL-CAD software, not just the benchmark portion. Programs for dealing with images are in the "util" directory. To display a **pix**(5) file on a framebuffer, set environment variable FB_FILE (see **brlcad**(1) for details), and run **pix-fb**. Note that by leaving FB_FILE unset, your default display will be used.

```
cd bench
pix-fb moss.pix
```

If the images computed on your machine do not match the reference images, the program "util/pixdiff" will compute a pix file that will highlight the differences for you, and report a summary of bytes equal, off-by-1, and off-by-many, e.g.,

```
pixdiff moss.pix ../pix/moss.pix | pix-fb
```

For a display of the relative magnitude of the differences at each pixel, use "util/bwdiff" instead, e.g.,

```
bwdiff moss.pix ../pix/moss.pix | pix-fb
```

or

```
bwdiff moss.pix ../pix/moss.pix | \
bwmod -s 128 -m 4 -a 128 | pix-fb
```

and for statistics on the differences, use

```
bwdiff moss.pix ../pix/moss.pix | pixstat
```

5. THE COMPETITION

Here is the list of systems that have been tested so far, with as much information about the configuration as could be obtained. Some systems have a great many options for small things that can affect performance, such as memory interleaving.

System Name	Configuration
alliant	Alliant FX/8 (8 CEs, 9 IPs, 64 Mbytes), Concentrix 3.0
amsaa-seer	Gould PN 9080, w/MACCs, UTX 2.0, 4x4Mb mem boards
ardec-3	Pyramid 90Mx, Dual-CPU, OSx 2.5, 16 Mbytes
bob.brl.mil	Cray-2, SN 2009, 4.3ns clock
brl-patton	Cray X-MP/48, SN213, COS V115BF2, 8.5ns clock
brl-spark	Gould PN 9050, no MACC, UTX 2.0, 2x4Mb mem boards
brl-sws2	Convex C120, 16 Mbytes, Convex Unix 6.2.32.2
brl-vector	Alliant FX/80 (8 ACEs, 6 IPs, 32 Mbytes), Concentrix
brl-venom	Alliant FX/8 (8 CEs, 6 IPs, 32 Mbytes), Concentrix
brl-vgr	VAX 780, FPA, 4.3 BSD
brl-virus	Sun-3/50, 15 Mhz clock, 12 Mhz 68881, Sun UNIX 3.2
brl-vista	SGI 3030, w/FP chip, UNIX release 3.5
brl-vmb	Gould PN 9080, no MACCs, UTX 2.0, 12x1Mb mem boards
brl-vhs	Silicon Graphics 4D/60T, 12.5 Mhz clock 8MB memory
brl-voyage	Silicon Graphics 4D/120, 16.7 Mhz clock 16 MB memory
brl-taylor	Silicon Graphics 4D/220, 25 Mhz clock 16 MB memory
c1east	Convex C1 XP (2 IOPs, 4 Multibus, 64 Mbytes), S/W 6.0.1.12
elxsi-gnu	Elxsi 6420, BSD 4.2 16 MB
elxsi-gnuy	Elxsi 6420, Sys Vr2, 16MB
elxsi-m1	Elxsi 6410, BSD 4.2 16 MB
hep	Denelcor HEP, 4 PEMs
indigo	SGI Iris 3030, FPA, GL2-W3.5
mseries	MIPS Mseries, Release 0.6, UMIPS 2.1, 16 MB of R2350 RAM. R2000 CPU rev 5.0, R2010 FP rev 2.0
multiflow	Multiflow Trace 7/200 (PRELIMINARY)
snm2	Cray 1-M, SN2, UNICOS 2.0
tek4132	Tektronix 4132, 32082 fpp, UTek 2.3
utah-gr	VAX 785, FPA, 4.3 BSD
utah-cs	VAX 8600, FPA, 4.3 BSD
violet	VaxStationII GPX, Ultrix 1.2
vortac	Sun-3/160, 16.67 Mhz clock, 12 Mhz 68881, Sun 3.2

6. BENCHMARK RESULTS

In the tradition of Dongarra, the Rays/sec figure is considered the "RT Figure of Merit" (RTFM). Note that the RTFM can only be compared between different runs on the *same* database; it is not meaningful to compare RTFM numbers between different databases. The Rays/sec number for a multi-processor machine is for "aggregate CPU cluster seconds", rather than rays/total CPU seconds (which remains fairly constant on good parallel machines). Worthy finalists to date are listed below. Entries are omitted for tests in which correct results were not obtained.

The statistics are recorded in an easily understood format, with all results for a particular configuration listed on a single line. The numbers reported are the rays/sec (RTFM) figure. Entries denoted with a dagger ("†") produced incorrect results. Entries denoted with a dash ("-") were not available and should be considered differently than those entries with a dagger. Generally the results are not available because time constraints prevented running the complete set of databases.

7. RELEASE 1.20 STATISTICS (12-Feb-1987)

A/*	H/W	Moss	World	Star	Bldg	Mean	S/W Notes
Rays	tek4132	80.5	44.0	33.9	31.4	?	UTek 2.3
*vgr	tek4132	0.72	0.69	0.62	0.62	?	
Rays	violet	107.7	57.3	44.7	44.1	?	Ultrix 1.2

A/*	H/W	Moss	World	Star	Bldg	Mean	S/W Notes
*vgr	violet	0.96	0.90	0.81	0.87	?	
Rays *vgr	violet violet	119.0 1.06	63.0 0.99	50.0 0.91	46.3 0.91	? ?	Ultrix 1.2, w/fast_sqrt
Rays *vgr	vgr vgr	112.1 1.0	63.6 1.0	55.0 1.0	50.7 1.0	? 1.0	BSD 4.3
Rays *vgr	indigo indigo	115.9 1.03	85.3 1.34	† †	101.8 2.01	? ?	GL2-W3.5
Rays *vgr	vista vista	116.4 1.04	86.0 1.35	† †	102.3 2.02	? ?	SGI UNIX 3.5
Rays *vgr	virus virus	127.3 1.14	69.9 1.10	57.0 1.04	52.4 1.03	? ?	Sun UNIX 3.2
Rays *vgr	vortac vortac	148.2 1.32	81.0 1.27	65.8 1.20	60.7 1.20	? ?	Sun UNIX 3.2
Rays *vgr	utah-gr utah-gr	191.8 1.71	105.8 1.66	89.9 1.64	86.5 1.71	? ?	4.3 BSD
Rays *vgr	ardec-3 ardec-3	- -	68.4 1.08	57.2 1.04	- -	? ?	OSx 2.5
Rays *vgr	elxsim1 elxsim1	380.5 3.39	232.2 3.65	204.8 3.72	189.3 3.73	? ?	BSD 4.2
Rays *vgr	spark spark	413.4 3.69	232.0 3.65	213.8 3.89	211.9 4.18	? ?	UTX 2.0
Rays *vgr	vmb vmb	413.9 3.69	233.4 3.67	210.6 3.83	212.6 4.19	? ?	UTX 2.0
Rays *vgr	c1east c1east	454.8 4.06	252.4 3.97	205.6 3.74	192.3 3.80	? ?	Convex UNIX 6.0.1.12, vanilla cc
Rays *vgr	seer seer	460.7 4.11	263.2 4.14	246.8 4.49	241.0 4.75	? ?	UTX 2.0
Rays *vgr	venom venom	492.9 4.40	228.0 3.58	180.0 3.27	157.1 3.10	? ?	Concentrix 2.0
Rays *vgr	elxgnu elxgnu	520.6 4.64	315.4 4.96	264.4 4.81	242.0 4.77	? ?	BSD 4.2
Rays *vgr	utah-cs utah-cs	521.1 4.64	292.1 4.59	237.4 4.32	216.2 4.27	? ?	BSD 4.3
Rays *vgr	c1east c1east	521.6 4.66	285.3 4.49	230.5 4.20	215.1 4.24	? ?	Convex UNIX 6.0.1.12, vc -O1 (scalar)
Rays *vgr	c1east c1east	527.7 4.71	287.4 4.52	228.7 4.16	210.0 4.14	? ?	Convex UNIX 6.0.1.12, vc -O2 (vector)
Rays *vgr	elxgnuy elxgnuy	644.7 5.75	349.3 5.49	264.6 4.81	242.1 4.77	? ?	System Vr2
Rays *vgr	mflow mflow	845.2 7.54	439.5 6.91	313.1 5.69	338.9 6.68	? ?	(preliminary)
Rays *vgr	venom venom	904.9 8.07	424.6 6.68	349.3 6.35	312.6 6.17	? ?	Concentrix 2.0, 2 CEs, no vectors
Rays *vgr	venom venom	1375.5 12.27	650.0 10.22	523.4 9.52	459.9 9.07	? ?	Concentrix 2.0, 3 CEs, no vectors
Rays *vgr	venom venom	1813.5 16.17	845.5 13.29	686.0 12.47	600.7 11.85	? ?	Concentrix 2.0, 4 CEs, no vectors
Rays *vgr	venom venom	2364.1 21.08	1104.4 17.36	870.2 15.82	775.9 15.3	? ?	Concentrix 2.0, 5 CEs, no vectors

A/*	H/W	Moss	World	Star	Bldg	Mean	S/W Notes
Rays	snm2	2492.9	-	-	-	?	Unicos 2.0,
*vgr	snm2	22.24	-	-	-	?	no vectors, no optim
Rays	hep	2502.0	-	-	-	?	1 PEM, npsw=10
*vgr	hep	22.32	-	-	-	?	
Rays	venom	2811.4	1319.0	1051.6	918.0	?	Concentrix 2.0,
*vgr	venom	25.08	20.74	19.12	18.1	?	6 CEs, no vectors
Rays	venom	3248.8	1533.0	1232.3	1065.9	?	Concentrix 2.0,
*vgr	venom	28.98	24.10	22.41	21.02	?	7 CEs, no vectors
Rays	patton	3453.3	1514.3	1271.2	1027.3	?	COS V115BF2
*vgr	patton	30.81	23.81	23.11	20.26	?	1 CPU, no vectors
Rays	venom	3677.3	1724.2	1375.4	1208.4	?	Concentrix 2.0,
*vgr	venom	32.80	27.11	25.01	23.83	?	8 CEs, no vectors
Rays	alliant	3972.9	1840.0	1457.2	1266.4	?	Concentrix 3.0,
*vgr	alliant	35.44	28.93	26.49	24.98	?	8 CEs, no vectors
Rays	hep	4055.9	-	-	-	?	1 PEM, npsw=40
*vgr	hep	36.18	-	-	-	?	
Rays	patton	6856.6	-	2522.2	-	?	COS V115BF2
*vgr	patton	61.16	-	45.86	-	?	2 CPUs, no vectors
Rays	patton	10205.1	-	3749.9	-	?	COS V115BF2
*vgr	patton	91.04	-	68.18	-	?	3 CPUs, no vectors
Rays	patton	13320.2	-	4955.6	-	?	COS V115BF2
*vgr	patton	118.82	-	90.10	-	?	4 CPUs, no vectors

8. RELEASE 2.3 STATISTICS (2-Nov-1987)

A/*	H/W	Moss	World	Star	Bldg	Mean	S/W Notes
Rays	vgr	118.8	64.9	36.5	34.2	?	BSD 4.3
*vgr	vgr	1.0	1.0	1.0	1.0	1.0	
Rays	vmb	375.4	218.6	186.4	196.2	?	UTX 2.0
*vgr	vmb	3.16	3.37	5.11	5.74	?	
Rays	venom	468.2	221.7	166.1	144.9	?	Concentrix 3.0,
*vgr	venom	3.94	3.42	4.55	4.24	?	1 CE, no vectors
Rays	sws2	471.9	258.4	202.5	186.4	?	Convex Unix 6.2.32.2
*vgr	sws2	3.97	3.98	5.55	5.45	?	vanilla cc -O
Rays	vector	656.6	301.6	221.1	195.0	?	Concentrix 3.0,
*vgr	vector	5.53	4.65	6.06	5.70	?	1 ACE, no vectors
Rays	venom	827.3	424.0	327.1	287.9	?	Concentrix 3.0,
*vgr	venom	6.96	6.53	8.96	8.42	?	2 CEs, no vectors
Rays	vhs	958.3	545.6	447.0	414.1	?	-O2 optimization
*vgr	vhs	8.07	9.41	12.25	12.11	?	
Rays	mseries	988.3	603.5	515.6	491.6	?	
*vgr	mseries	8.32	9.29	14.13	14.37	?	
Rays	vector	1280.9	596.8	436.7	389.2	?	Concentrix 3.0,
*vgr	vector	10.78	9.19	11.96	11.38	?	2 ACEs, no vectors
Rays	venom	1288.7	630.6	486.4	428.0	?	Concentrix 3.0,
*vgr	venom	10.85	9.72	13.33	12.51	?	3 CEs, no vectors
Rays	venom	1732.9	853.2	645.4	560.1	?	Concentrix 3.0,
*vgr	venom	14.59	13.15	17.68	16.38	?	4 CEs, no vectors
Rays	bob	1856.7	801.9	574.1	500.3	?	1 CPU, UNICOS 3.0,

A/*	H/W	Moss	World	Star	Bldg	Mean	S/W Notes
*vgr	bob	15.63	12.36	15.73	15.62	?	CC -O
Rays *vgr	vector vector	1952.1 16.43	881.7 13.58	647.6 17.74	578.8 16.92	? ?	Concentrix 3.0, 3 ACEs, no vectors
Rays *vgr	venom venom	2158.4 18.17	1031.3 15.89	797.3 21.84	703.1 20.56	? ?	Concentrix 3.0, 5 CEs, no vectors
Rays *vgr	bob bob	2346.1 19.75	1127.4 17.37	751.0 20.57	677.2 19.80	? ?	1 CPU UNICOS 4.0 CC -O
Rays *vgr	bob bob	2423.5 20.40	1045.7 16.11	719.3 19.71	609.4 17.82	? ?	1 CPU, UNICOS 3.0, VCC -O
Rays *vgr	vector vector	2546.2 21.43	1170.0 18.03	867.2 23.76	758.7 22.18	? ?	Concentrix 3.0, 4 ACEs, no vectors
Rays *vgr	venom venom	2633.7 22.17	1232.7 18.99	943.4 25.85	839.5 24.55	? ?	Concentrix 3.0, 6 CEs, no vectors
Rays *vgr	venom venom	2769.4 23.31	1393.3 21.47	1098.1 30.08	971.6 28.41	? ?	Concentrix 3.0, 7 CEs, no vectors
Rays *vgr	vector vector	3131.2 26.36	1453.8 22.40	1065.8 29.20	945.4 27.64	? ?	Concentrix 3.0, 5 ACEs, no vectors
Rays *vgr	venom venom	3368.7 28.36	1605.3 24.73	1231.3 33.73	1095.11 32.02	? ?	Concentrix 3.0, 8 CEs, no vectors
Rays *vgr	patton patton	3456.5 29.10	1691.8 26.07	1169.0 32.03	1043.6 30.51	? ?	1 CPU, UNICOS 2.1 no vectors
Rays *vgr	vector vector	3686.4 31.03	1688.6 26.02	1259.1 34.49	1129.0 33.01	? ?	Concentrix 3.0, 6 ACEs, no vectors
Rays *vgr	vector vector	4140.3 34.85	1953.0 30.09	1463.3 40.09	1299.7 38.00	? ?	Concentrix 3.0, 7 ACEs, no vectors
Rays *vgr	bob bob	4641.7 39.07	2243.4 34.57	1498.2 41.05	1358.1 39.71	? ?	2 CPUs, UNICOS 4.0 CC -O
Rays *vgr	vector vector	4712.2 39.66	2226.3 34.30	1649.0 45.18	1469.7 42.97	? ?	Concentrix 3.0, 8 ACEs, no vectors
Rays *vgr	bob bob	6884.9 57.95	3422.4 52.73	2267.7 62.13	2034.3 59.48	? ?	3 CPUs, UNICOS 4.0 CC -O
Rays *vgr	bob bob	9477.1 79.77	4484.7 69.10	2947.0 80.76	2832.9 82.83	? ?	4 CPUs, UNICOS 4.0 CC -O

9. RELEASE 3.0 STATISTICS (10-Oct-1988)

A/*	H/W	Moss	World	Star	Bldg	Mean	S/W Notes
Abs *vgr	vgr vgr	138.85 1.00	67.15 1.00	54.48 1.00	49.11 1.00	77.39 1.00	BSD 4.3 w/FPA
Abs *vgr	sdm sdm	163.56 1.17	76.98 1.14	59.79 1.09	52.51 1.06	88.21 1.11	SunOS 3.4 w/68881
Abs *vgr	ardec-3 ardec-3	417.95 3.01	212.43 3.16	177.01 3.24	160.73 3.27	242.03 3.17	9820, OSx 4.1 -P 1
Abs *vgr	spark spark	443.84 3.19	216.92 3.23	190.42 3.49	192.82 3.92	261.00 3.37	UTX 2.0 no MACC
Abs *vgr	vmb vmb	482.28 3.47	226.33 3.37	191.52 3.51	193.04 3.93	273.29 3.57	UTX 2.0 no MACC
Abs *vgr	sws2 sws2	546.23 3.93	255.45 3.80	183.10 3.36	163.85 3.33	287.15 3.60	Convex 6.2.32.2 /bin/cc

A/*	H/W	Moss	World	Star	Bldg	Mean	S/W Notes
Abs	sun4	767.7	373.7	315.5	284.5	435.6	Unix 3.5
*vgr	sun4	5.52	5.56	5.79	5.79	5.62	-O2 optim
Abs	video	940.33	469.30	399.21	367.64	544.12	UNIX 2.0
*vgr	video	6.77	6.98	7.32	7.48	7.13	-O2
Abs	vhs	954.81	471.90	409.78	392.55	557.26	IRix 3.1
*vgr	vhs	6.87	7.02	7.52	7.99	7.45	Parallel, -P1
Abs	bob	2602.68	1078.25	712.39	642.42	1258.93	UNICOS 4.0, /bin/cc
*vgr	bob	21.22	18.17	15.39	13.98	17.19	-P 1
Abs	vector	3811.68	1469.80	1060.50	921.21	1815.79	Alliant 3.0
*vgr	vector	27.45	21.88	19.46	18.75	21.88	-P 5
Abs	vector	4515.09	1751.94	1266.49	1090.85	2156.09	Alliant 3.0
*vgr	vector	32.51	26.08	23.24	22.21	26.01	-P 6
Abs	patton	4550.67	1920.15	1298.61	1153.02	2230.61	UNICOS 3.0, /bin/cc
*vgr	patton	37.10	32.36	28.05	25.09	30.65	-P 1
Abs	vector	5130.74	2004.49	1438.97	1261.36	2458.89	Alliant 3.0
*vgr	vector	36.95	29.85	26.41	25.68	29.72	-P 7
Abs	bob	5186.24	2132.17	1409.10	1273.72	2500.30	UNICOS 4.0, /bin/cc
*vgr	bob	42.28	35.93	30.44	27.71	34.09	-P 2
Abs	vector	5813.76	2260.61	1638.31	1422.82	2783.87	Alliant 3.0
*vgr	vector	41.87	33.66	30.07	28.97	33.64	-P 8
Abs	bob	7934.12	3392.98	2119.11	1929.74	3843.98	UNICOS 4.0, /bin/cc
*vgr	bob	64.69	57.18	45.78	41.99	52.41	-P 3
Abs	patton	8898.79	3782.55	2559.48	2292.13	4383.23	UNICOS 3.0, /bin/cc
*vgr	patton	72.56	63.75	55.30	49.88	60.37	-P 2
Abs	bob	10734.52	4436.61	2883.53	2617.47	5168.03	UNICOS 4.0, /bin/cc
*vgr	bob	87.52	74.77	62.30	56.96	70.38	-P 4
Abs	patton	13078.79	5631.95	3832.88	3416.90	6490.13	UNICOS 3.0, /bin/cc
*vgr	patton	106.64	94.92	82.81	74.36	89.68	-P 3
Abs	patton	17157.78	7437.55	5073.58	4531.25	8550.04	UNICOS 3.0, /bin/cc
*vgr	patton	139.90	125.35	109.62	98.61	118.37	-P 4

10. RELEASE 3.3 STATISTICS

A/*	H/W	Moss	World	Star	Bldg	M35	Mean	P
Abs	vgr	121.89	54.47	45.17	40.35	49.02	62.18	1
*vgr	vgr	1.00	1.00	1.00	1.00	1.00	1.00	
Abs	spark	435.69	208.59	176.76	177.69	174.67	234.68	1
*vgr	spark	3.53	3.61	4.17	4.29	3.40	3.80	
Abs	vhs	973.11	475.00	384.62	351.12	343.44	505.45	1
*vgr	vhs	7.56	8.72	8.51	8.70	7.00	8.09	
Abs	voyage	1969.57	1001.21	862.77	809.61	786.11	1085.85	2
*vgr	voyage	15.31	18.38	19.10	20.06	16.03	17.77	
Abs	taylor	2446.98	1076.24	912.03	837.56	799.58	1214.47	1
*vgr	taylor	19.02	19.75	20.19	20.75	16.31	19.20	
Abs	viper	3255.73	1368.96	1102.71	1039.37	1008.15	1554.98	8
*vgr	viper	25.30	25.13	24.41	25.75	20.56	24.23	
Abs	vector	3956.86	1625.23	1234.03	1137.36	1121.41	1814.97	8
*vgr	vector	30.75	29.83	27.31	28.18	22.87	27.78	
Abs	taylor	4730.05	2225.56	1742.09	1590.57	1551.78	2368.01	2
*vgr	taylor	36.76	40.85	38.56	39.41	31.65	37.44	
Abs	patton	16028.8	7289.7	4827.9	4392.5	20829.2	53368.1	4
*vgr	patton	124.6	133.83	106.88	108.85	106.23	116.07	

11. ADDITIONAL STATISTICS

It would be greatly appreciated if you would return to BRL any statistics that you gather, including: which BRL CAD release was used, the manufacturer of the machine, hardware model name/number, OS/compiler software version numbers, presence or absence of floating point hardware, and the local name (preferably InterNet or UUCP) of the specific machine used.