

Shipping Simulation

Summary

The problem that I am trying to solve is to find out the percent filled a vessel should be (C) as well as its maximum wait time (W) and which combination yields the maximum profit. The vessels vary in the amount, capacity, speed, and cost, but I will only be testing one type of vessel at a time.

To solve this problem, I set up a simulation of each vessel type and tried a range of “W” and “C” values and for each simulation I would find the median profit¹. I then was able to put these profits in a table and see the which “W” and “C” values would yield the most profit and which areas of this chart (high or low “C” and “W” values) tended to be the best for that vessel.

I found that in general vessels with larger capacities favored larger wait times (W) and larger filled percentage (C), while smaller vessels or faster vessels favored smaller “W” and “C” values. Most vessels were largely unprofitable unless it was at its “W” and “C” sweet spot. The exceptions were the Carrier Pigeon Teams which have no cost and the Canoes which has a very cheap cost per kilometer. I think a major factor to this was how far the vessels had to travel, because they would find the oldest shipment, which could be anywhere and would go there. If instead they found the nearest shipment profits would increase, but this is outside the purpose of the project.

Findings

To get my data I made a class called Simulation.java that includes important variables like my agenda and queue. This class also has a method called stats that actually runs the simulation and returns important statistics such as average profit, average filled (C), average wait (W), average duration, and average distance. The stats method takes four arguments: amount of vessels, which type of vessel, C, W. When it runs the method, it returns the statistics. The statistics are stored in an array of the Statistics class that I made. From there I made another method called csv that calls the stats method of Simulation, and gets the statistics and then writes the data to a comma separated values file to be read and analyzed later, which you will see below.

The following tables below display the average profit

100 Canoes

Canoe	Filled Percent (C)									
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
Wait Time (W)	50	-770	1910	2170	2814	2050	2050	3264	2376	3071
	100	2184	2179	3037	1999	2276	1930	2500	2612	1154
	150	2148	1543	2170	2132	3569	1817	2547	2167	2843
	200	2009	1219	1994	2140	2913	2915	2695	2350	3140
	250	2910	3265	2000	2007	2490	3100	2922	3150	2470
	300	2440	2187	1988	2140	2580	3528	3251	3134	1766
	350	2180	2147	2150	2123	1213	3314	3253	3200	3120
	400	3546	2409	2180	2187	3426	3190	3165	3740	3460
	450	2891	2350	2479	2576	2057	2570	3550	3272	3928
	500	2187	1729	2283	2532	3050	3264	3047	3164	2554

The canoes favored a larger wait time and filled percent than I had expected. I would have thought since they are so cheap to operate, that departing sooner would be better, but the reason that they departed later was because there are so many of them (100) compared to other vessels. Since there were so many ships they could keep up with the shipments being made but benefited from being more full. The range from (.6 - .9) C values are fairly similar, so as long as they were more than half full it was more profitable.

10 Yachts

Yacht	Percent Filled (C)																	
	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	
2	-8.47E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.23E+06	-8.47E+06	-8.48E+06	-9.98E+06	-9.98E+06	-9.98E+06	-8.47E+06	-9.98E+06	-9.98E+06	-9.98E+06	
4	-8.47E+06	-9.98E+06	-9.98E+06	-9.98E+06	-8.48E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-7.83E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	
6	-8.48E+06	-8.47E+06	-8.45E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-8.48E+06	-9.98E+06	-8.48E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-1.00E+07	-9.98E+06	
8	-9.98E+06	-9.99E+06	-9.98E+06	-8.47E+06	-8.48E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-1.00E+07	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	
10	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	-8.47E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	
12	-9.98E+06	-9.98E+06	-9.98E+06	-8.47E+06	-9.98E+06	-8.47E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.99E+06	-9.99E+06	-1.13E+07	-9.99E+06	-9.99E+06	-9.23E+06	-9.99E+06	
14	-9.98E+06	-9.98E+06	-8.46E+06	-9.99E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-8.47E+06	-9.99E+06	-9.99E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	
16	-9.98E+06	-8.48E+06	-8.47E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	-1.08E+07	-1.00E+07	-9.99E+06	-1.08E+07	
18	-8.47E+06	-8.47E+06	-9.98E+06	-9.98E+06	-9.98E+06	-8.48E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.99E+06	-1.08E+07	-1.00E+07	-1.08E+07	-9.98E+06	-9.98E+06	-9.98E+06	-1.08E+07	
20	-8.47E+06	-9.98E+06	-9.23E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	-9.99E+06	-1.00E+07	-1.08E+07	-9.99E+06	-9.99E+06	-1.13E+07	-1.08E+07	-9.98E+06	-9.98E+06	-1.08E+07	
22	-9.99E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	-8.47E+06	-1.08E+07	-9.99E+06	-9.99E+06	-9.98E+06	-9.98E+06	-1.08E+07	-1.13E+07	-1.13E+07	
24	-9.98E+06	-8.47E+06	-9.98E+06	-9.99E+06	-8.47E+06	-9.99E+06	-8.48E+06	-9.99E+06	-9.99E+06	-1.00E+07	-9.99E+06	-1.13E+07	-9.99E+06	-1.08E+07	-1.13E+07	-9.99E+06	-1.13E+07	
26	-8.45E+06	-8.47E+06	-8.47E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.99E+06	-9.99E+06	-9.99E+06	-9.99E+06	-1.00E+07	-1.13E+07	-1.08E+07	-1.08E+07	-9.98E+06	-1.08E+07	
28	-8.47E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-1.08E+07	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	-1.08E+07	-1.08E+07	-1.08E+07	-1.08E+07	-9.99E+06	-1.20E+07	-1.08E+07	
30	-8.47E+06	-8.47E+06	-9.99E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.99E+06	-9.99E+06	-1.08E+07	-9.99E+06	-1.13E+07	-1.08E+07	-1.13E+07	
32	-8.48E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.99E+06	-9.99E+06	-9.98E+06	-9.99E+06	-9.99E+06	-9.98E+06	-1.00E+07	-1.13E+07	-1.13E+07	-1.08E+07	-9.99E+06	
34	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.99E+06	-9.98E+06	-8.48E+06	-9.99E+06	-9.99E+06	-1.08E+07	-1.13E+07	-1.00E+07	-1.20E+07	-1.08E+07	-1.08E+07	-1.08E+07	-1.13E+07	
36	-8.48E+06	-8.47E+06	-9.98E+06	-1.08E+07	-8.47E+06	-9.98E+06	-9.98E+06	-8.47E+06	-9.98E+06	-1.13E+07	-9.98E+06	-1.13E+07	-1.00E+07	-1.13E+07	-1.13E+07	-1.10E+07	-1.13E+07	
38	-8.47E+06	-9.98E+06	-8.47E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-1.13E+07	-1.13E+07	-1.13E+07	-1.08E+07	-1.20E+07	
40	-9.99E+06	-8.47E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	-9.99E+06	-1.13E+07	-1.13E+07	-9.99E+06	-1.13E+07	-1.00E+07	-1.13E+07	-9.99E+06	-1.13E+07	-9.99E+06	
42	-9.99E+06	-8.47E+06	-9.99E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.99E+06	-9.98E+06	-9.98E+06	-1.00E+07	-9.99E+06	-9.99E+06	-1.13E+07	-1.08E+07	-1.13E+07	-1.00E+07	-1.13E+07	
44	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-1.08E+07	-9.98E+06	-1.00E+07	-1.08E+07	-1.13E+07	-1.13E+07	-1.13E+07	-1.13E+07	-1.13E+07	-1.13E+07	
46	-9.98E+06	-9.98E+06	-8.48E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.99E+06	-9.99E+06	-1.13E+07	-1.13E+07	-1.13E+07	-9.98E+06	-1.08E+07	-1.08E+07	-1.13E+07	-1.13E+07	-1.13E+07	
48	-9.98E+06	-9.98E+06	-8.48E+06	-9.99E+06	-1.08E+07	-9.98E+06	-9.99E+06	-9.99E+06	-9.98E+06	-1.08E+07	-1.13E+07	-1.08E+07	-9.99E+06	-1.13E+07	-1.13E+07	-1.20E+07	-1.20E+07	
50	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-1.00E+07	-1.08E+07	-1.08E+07	-9.99E+06	-9.99E+06	-1.13E+07	-1.20E+07	-1.08E+07	-1.20E+07	-1.20E+07	
52	-9.98E+06	-9.98E+06	-9.98E+06	-8.47E+06	-9.99E+06	-9.98E+06	-9.99E+06	-9.99E+06	-1.13E+07	-1.13E+07	-1.13E+07	-9.98E+06	-1.13E+07	-1.13E+07	-1.13E+07	-1.13E+07	-1.20E+07	
54	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.98E+06	-1.08E+07	-1.08E+07	-1.08E+07	-1.20E+07	-9.99E+06	-1.13E+07	-9.99E+06	-1.20E+07	
56	-9.98E+06	-9.98E+06	-9.98E+06	-9.99E+06	-9.99E+06	-9.99E+06	-9.98E+06	-1.08E+07	-1.08E+07	-9.98E+06	-1.13E+07	-1.13E+07	-1.13E+07	-1.08E+07	-1.08E+07	-1.13E+07	-1.20E+07	
58	-8.47E+06	-9.99E+06	-9.98E+06	-9.98E+06	-8.47E+06	-1.08E+07	-9.99E+06	-1.08E+07	-1.08E+07	-1.13E+07	-9.99E+06	-1.08E+07	-1.08E+07	-1.20E+07	-9.98E+06	-1.08E+07	-1.13E+07	

The yachts favored a lower wait time and filled percent. This is mostly due to the yachts speed and low capacity. Since there weren't many yachts (10), it was best if they departed almost immediately after they received the first oldest shipment, and any other shipments going to the same place, but not hanging around and waiting too long.

20 Galleons

Galleon		Filled Percent (C)									
		0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95
Wait Time (W)	1000	-\$586,700.00	-\$569,490.00	-\$493,651.00	-\$551,999.00	-\$536,905.00	-\$529,459.00	-\$509,102.00	-\$464,630.00	-\$585,120.00	-\$523,009.00
	2000	-\$470,570.00	-\$476,605.00	-\$417,242.00	-\$403,178.00	-\$453,059.00	-\$350,010.00	-\$475,766.00	-\$474,351.00	-\$446,025.00	-\$281,094.00
	3000	-\$321,461.00	-\$340,894.00	-\$252,480.00	-\$466,709.00	-\$394,370.00	-\$306,284.00	-\$416,445.00	-\$350,608.00	-\$353,479.00	-\$352,854.00
	4000	-\$432,984.00	-\$454,900.00	-\$467,205.00	-\$458,259.00	-\$459,433.00	-\$324,416.00	-\$443,545.00	-\$285,296.00	-\$434,929.00	-\$444,566.00
	5000	-\$329,061.00	-\$334,474.00	-\$301,348.00	-\$311,524.00	-\$360,555.00	-\$275,326.00	-\$221,335.00	-\$183,034.00	-\$251,240.00	-\$167,219.00
	6000	-\$280,130.00	-\$274,345.00	-\$330,468.00	-\$397,960.00	-\$207,928.00	-\$386,950.00	-\$325,539.00	-\$290,164.00	-\$224,975.00	-\$394,786.00
	7000	-\$284,625.00	-\$273,635.00	-\$268,765.00	-\$307,456.00	-\$232,030.00	-\$195,059.00	-\$240,425.00	-\$294,188.00	-\$301,107.00	-\$172,908.00
	8000	-\$311,961.00	-\$233,298.00	-\$215,648.00	-\$268,770.00	-\$333,424.00	-\$274,391.00	-\$236,245.00	-\$208,536.00	-\$354,040.00	-\$214,865.00
	9000	-\$257,228.00	-\$281,188.00	-\$225,968.00	-\$395,690.00	-\$264,400.00	-\$302,908.00	-\$379,510.00	-\$327,756.00	-\$199,916.00	-\$632,577.00
	10000	-\$237,978.00	-\$276,425.00	-\$270,236.00	-\$262,895.00	-\$230,495.00	-\$214,761.00	-\$375,500.00	-\$188,363.00	-\$224,455.00	-\$454,460.00
	11000	-\$340,356.00	-\$340,548.00	-\$269,335.00	-\$321,136.00	-\$294,821.00	-\$165,718.00	-\$222,755.00	-\$222,230.00	-\$220,235.00	-\$147,026.00
	12000	-\$279,955.00	-\$229,148.00	-\$360,555.00	-\$258,915.00	-\$382,530.00	-\$164,873.00	-\$300,318.00	-\$253,736.00	-\$223,925.00	-\$278,524.00
	13000	-\$260,726.00	-\$270,805.00	-\$225,089.00	-\$239,411.00	-\$253,380.00	-\$242,325.00	-\$196,158.00	-\$209,796.00	-\$180,248.00	-\$170,028.00
	14000	-\$239,199.00	-\$270,741.00	-\$404,920.00	-\$274,088.00	-\$296,608.00	-\$276,801.00	-\$379,920.00	-\$294,334.00	-\$136,343.00	-\$283,273.00

The galleons favored a larger wait time and filled percent because the galleons have a large capacity and slow speed. The most important thing for the galleon was waiting long enough at a port for more shipments.

15 Barges

Barge		Fill Percent (C)						
		0.3	0.4	0.5	0.6	0.7	0.8	0.9
Wait Time (W)	4000	-4463190	-5890780	-7579602	-4840960	-5987420	-5978540	-4964495
	6000	-3106499	-5404404	-2891268	-3993520	-9441373	-4849025	-3820380
	8000	-4867820	-4779120	42520	-3131911	-2242660	-2288980	1287139
	10000	-3827141	-4776220	-3952456	-6399550	-1205694	-1241880	-1138430
	12000	-4720685	-5117158	-4735430	-3690721	-576310	-4894885	135320
	14000	-3834829	-5760104	-2338394	-1800360	1155530	4385616	321210

Barges also benefit from large wait times and larger filled percent because they have large capacities and slow speeds. Unlike the galleon though, the barge could actually make some profit but only if it waited an extremely long time. The simulation duration was 15,000 while the most profit was found if it waited 14,000. The reason for this is that barges have very large capacities so it took a long time to get close to even get large C values. Considering that a shipment is (1 – 1,000kg) and the barge holds 1,000,000kg. If the average shipment is 500kg and there are 10 ports, but a shipment has a very low chance to go to the moon, so it has about a 1/9 chance to make a shipment going to the same location that the barge is going to, then it should take $((1,000,000 / 500) * 9) = 18,000$. So it is not surprising to see profits around 14,000 because that's about when the barges could get close to being full.

10 Freighters

Freighter		Filled Percent (C)								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Wait Time (W)	1000	-8239831	-5981600	-7784612	-8238371	-7717630	-5990140	-7737790	-7065400	-7719570
	2000	-5297915	-7713412	-5994220	-8229781	-9462033	-8210381	-9467043	-6318545	-5977200
	3000	-7613230	-7712000	-7542975	-8056700	-5525038	-5992790	-6000870	-3664455	-3450285
	4000	-9927820	-2267030	-4872160	-9065273	-5274990	-5434508	-5372088	-8889255	-4235576
	5000	-5374908	-2672217	-5554654	-5871570	-5225815	-9438443	-3711175	-4806810	-4176850
	6000	-4138631	-1279680	-5316004	317985	-5388103	-2560545	-7428350	254010	-3349760
	7000	-2994679	-686890	-3267950	-2740160	-5372604	-357190	-6933560	1483439	-4844220
	8000	-3377906	-3816946	-2995858	540370	175490	2618822	1635039	-3020878	-5408558
	9000	-2879518	-4731400	-1813629	1073500	691090	-5177818	2078079	-2960848	3521852

The freighters benefit from large W and C values because of their large capacities and slow speeds. Since it has such a large capacity, in order for the higher C values to matter it would have to wait about $(2,000,000 / 500) * 9 = 36,000$ which is a very long time, and that is why the C values appear to have little to no difference at these wait times.

Around 8000-9000 I assume that the vessel is about 25-50% full, because $8000 / 36000 = \frac{1}{4}$.

It should have $((2,000,000/4) * 1000) = \$5,000,000$ to $((2,000,000/2) * 1000) = \$10,000,000$ in shipments and then subtract the operating costs and multiply them by the average distance a ship goes²

$(5988 * 1000) = 5,988,000$.

$5,000,000 - 5,988,000 = -988,000$

$10,000,000 - 5,988,000 = 4,012,000$

So the range of profits I would expect at 8000 is $(-988,000 \text{ to } 4,012,000)$ which seems to be correct.

5 Airplanes

Airplane		Filled Percent (C)							
		0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Wait Time (W)	1000	-59966010.00	-107550546.00	-77525726.00	-41855765.00	-107694706.00	-49983500.00	-42213877.00	-49500020.00
	2000	-49884080.00	-53675608.00	-49500010.00	-53634558.00	-42317457.00	-53605618.00	-49500030.00	-45884718.00
	3000	-49879035.00	-42146150.00	-42348707.00	-41856995.00	-33573525.00	-59990970.00	-49785770.00	-49500090.00
	4000	-56289206.00	-49833360.00	-42092190.00	-49593530.00	-42051876.00	-60062980.00	-45790523.00	-49912790.00
	5000	-49657060.00	-49500010.00	-45927883.00	-45802313.00	-31393917.00	-59747670.00	-45886123.00	-77884137.00
	6000	-49500010.00	-42191932.00	-38756849.00	-49755150.00	-45911333.00	-42069647.00	-56163086.00	-51754949.00
	7000	-38877964.00	-42261297.00	-38911899.00	-31372507.00	-31318947.00	-31256434.00	-58013383.00	-42187215.00
	8000	-42169495.00	-35675398.00	-41945017.00	-41904545.00	-38882175.00	-35828955.00	-38758280.00	-53632828.00
	9000	-45877743.00	-38961289.00	-42203577.00	-38750040.00	-49694770.00	-56263959.00	-54777640.00	-52833368.00

Airplanes are interesting because they have large capacity, which leads me to think they should wait around for a while, but they also have fast speeds which leads me to think they should leave quickly like the yacht, as well as the low number (5) of them. But they also have large operating cost. Essentially,

High W&C: capacity and operating cost

Low W&C: speed and low number

Because of these qualities it seems to favor fairly high wait times, but not high filled percent, around low to middle C values. I think the reason that C values aren't higher is mostly due to the low number as well as the capacity isn't *that* high. It's the third largest of the vessels, but at the same time their capacity is nothing compared to the barge and freighter's capacity.

30 Carrier Pigeon Teams

Carrier Pigeon Team	Filled Percent (C)																		
	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	
Wait Time (W)	200	9310	9460	9260	9280	8880	9200	9230	9290	9240	8940	9330	9240	9210	9360	9140	9420	9435	9575
	400	9420	9190	9320	9420	9360	9270	9320	9190	9310	9170	9270	8960	8900	9200	9310	9460	9540	9670
	600	9360	9320	9360	9285	9440	9310	9450	9390	9420	9215	9370	9320	9260	9350	9540	9400	9620	9730
	800	9345	9410	9280	9400	9410	9410	9190	9570	9410	9365	9420	9360	9490	9380	9040	9535	9610	9670
	1000	9310	9370	9255	9270	9420	9280	9190	9330	9525	9240	9360	9320	9360	9410	9490	9540	9640	9710
	1200	9540	9450	9250	9150	9260	9400	9340	9370	9260	9370	9350	9360	9320	9360	9360	9540	9650	9750
	1400	9500	8460	9360	9460	9420	9390	9460	9345	9050	9335	9340	9380	9340	9470	9550	9560	9620	9770
	1600	9510	9380	9340	9285	9310	9350	9300	9440	9380	9510	9330	9400	9370	9420	9550	9560	9650	9800
	1800	9320	9435	9330	9450	9340	9370	9315	9400	9405	9310	9460	9295	9230	9515	9510	9610	9700	9720
	2000	9490	9190	9490	9430	9410	9260	9440	9320	9440	9170	9430	9420	9350	9490	9550	9540	9630	9700

The carrier pigeon teams make the most on average if they wait longer for their capacities to get more full. They don't have an operating cost so there is no incentive to hurry shipments, rather wait until it gets more full will yield the highest profit on average.

10 Rockets

Rocket		Filled Percent (C)								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Wait Time (W)	100	-564937751.00	-599974050.00	-565674515.00	-599991270.00	-601000000.00	-600000000.00	-599997880.00	-599996840.00	-565667745.00
	200	-499996175.00	-564957636.00	-564936966.00	-599994150.00	-538478171.00	-601000000.00	-564947421.00	-600998220.00	-564939311.00
	300	-499985090.00	-551710736.00	-564946141.00	-564927841.00	-538482831.00	-599960950.00	-564958011.00	-780247979.00	-564907341.00
	400	-499986860.00	-499985080.00	-499960940.00	-564955336.00	-499955870.00	-499970530.00	-565641645.00	-599991230.00	-538475616.00
	500	-499900010.00	-499983605.00	-538480431.00	-564912771.00	-565625515.00	-499951875.00	-600978320.00	-538453096.00	-565616835.00
	600	-499975950.00	-499989120.00	-499977860.00	-538471561.00	-499955265.00	-564920941.00	-600459940.00	-564882526.00	-499964915.00
	700	-499900030.00	-499976610.00	-499965210.00	-499954750.00	-564927906.00	-564934761.00	-499920265.00	-538465191.00	-499949820.00
	800	-424253899.00	-499967330.00	-499951470.00	-564883171.00	-499900170.00	-538455301.00	-564904391.00	-564913506.00	-538429626.00
	900	-499900050.00	-499964530.00	-499900080.00	-499954630.00	-499931210.00	-519201595.00	-499925140.00	-538443041.00	-780157019.00
	1000	-499900080.00	-499973045.00	-499968700.00	-499900020.00	-499945240.00	-564911571.00	-499926635.00	-564879271.00	-499900020.00

The rockets favored a quicker departure time and smaller filled percent because they are so fast and their capacity isn't that much, so they load the oldest shipment and any other shipments going to the same place and probably get around half full and then go. Their operating cost is so expensive that they could never make a profit but they make the most when they wait for shipments but they don't need to be that full.

Proof of Results

To see if my results were at equilibrium I ran various tests at 5000, 10,000 and 15,000 time until the simulation would stop. The first test I ran was the carrier pigeons and their profit. The correlation of data was all the same (favoring high C and W values) as well as the averages being within a few 100 of each other. I can confidently say that it yielded the same results at each of the three scenarios.

The second test I ran was the canoes and the average distances they were going, so that I could test multiple variables. The average distances were all very similar in each scenario, so I can conclude that the simulation has reached equilibrium³.

Test 1:

Carrier		Filled Percent (C)																		Profit		
Pigeons		0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95			
	200	8690	8680	8830	9105	8840	8965	8930	8820	8940	8880	8830	8880	8960	9095	9170	9235	9350	9560			
	400	9125	8855	8910	8925	8980	9040	8910	8870	9120	9015	8875	9160	9160	9125	9140	9325	9480	9600			
	600	8955	8805	9050	9030	9015	8818	8940	9060	8980	8930	9110	9150	9360	9280	9320	9370	9580	9660			
	800	8790	9065	9080	8970	9170	8930	8960	9110	9270	9055	9060	9170	9130	9210	9230	9335	9520	9570	Simulation		
	1000	9090	8920	9080	9130	8905	9080	8860	8980	8920	9080	9180	8980	9130	9280	9300	9365	9535	9540	Time: 5,000;		
	1200	9080	8830	9015	8790	9030	8970	9220	9125	8975	9210	9135	9220	9190	9330	9300	9430	9520	9600	Avg: 9140		
	1400	9085	9070	9050	8880	8800	8930	9080	9180	9070	9080	9230	9050	9210	9180	9210	9430	9530	9730			
	1600	9005	9135	8830	9100	9085	8960	9070	9170	9195	9120	9105	9310	9360	9235	9360	9470	9635	9710			
	1800	8680	8955	9050	9175	9090	9260	9010	9180	9030	8995	9135	9190	9340	9210	9410	9490	9570	9710			
	2000	9020	9080	8785	8970	8890	9030	8980	9000	9200	9270	9170	9250	9380	9270	9350	9350	9600	9710			
	200	8990	9430	9220	9195	9120	9260	9180	9310	9090	9165	9160	9140	9130	9230	9290	9250	9390	9200			
	400	9360	8735	9350	9170	9270	9120	9100	9035	8980	9210	9100	9240	9190	9250	9370	9420	9560	9660			
	600	9220	9315	9260	9210	9155	9310	9180	9180	9200	9190	9170	9260	9280	9400	9430	9410	9600	9690			
	800	9330	9155	9350	9290	9280	9310	9235	9120	9220	9115	9330	9300	9290	9275	9440	9550	9580	9700	Simulation		
	1000	9260	9360	9320	9280	9170	9280	9170	9280	9240	9190	9260	9300	9390	9300	9390	9470	9580	9700	Time: 10,000;		
	1200	9180	8950	9360	9360	9080	9270	9250	9140	9290	9240	9210	9310	9380	9380	9480	9570	9700	9690	Avg: 9315		
	1400	9305	9350	9260	9145	9250	9270	9220	9280	9230	9250	9210	9260	9420	9350	9460	9480	9690	9710			
	1600	9210	9190	9240	9300	9320	9160	9100	9270	9380	9230	9260	9225	9280	9370	9530	9580	9585	9745			
	1800	9165	9360	9280	9270	9340	9360	9380	9000	9330	9290	9405	9320	9430	9400	9470	9570	9640	9750			
	2000	9280	9395	9330	9290	9070	9355	9270	9295	9210	9300	9400	9420	9490	9550	9540	9610	9740	9740			
	200	9120	9420	9340	9420	9360	9130	9290	9320	9310	9320	9220	9290	9260	9300	9320	9310	9530	9600			
	400	9390	9120	9345	9360	9320	9370	9280	9255	9420	9210	9240	9300	9180	9370	9370	9480	9530	9590	9730		
	600	9460	9400	9360	9360	9310	9300	9260	9400	9300	9150	9260	9320	9320	9050	9430	9485	9550	9740			
	800	9430	9310	9340	9345	9340	9330	9090	9240	9240	9410	9210	9395	9510	9365	9430	9350	9680	9740			
	1000	9430	9390	9230	9500	9380	9340	9375	9320	9370	9310	9365	9300	9380	9440	9435	9610	9630	9710	Simulation		
	1200	9430	9300	9460	9350	9030	9350	9425	9380	9220	9380	9340	9460	9410	9460	9460	9590	9660	9730	Time: 15,000;		
	1400	9240	9360	9480	9390	9190	9340	9260	9370	9450	9380	9400	9440	9380	9460	9480	9590	9680	9780	Avg: 9409		
	1600	9310	9530	9470	9420	9360	9500	9370	9420	9240	9450	9495	9450	9470	9530	9610	9660	9770	9770			
	1800	9440	9510	9480	9380	9390	9410	9420	9360	9400	9420	9360	9280	9460	9470	9555	9580	9710	9730			
	2000	9430	9460	9430	9460	9440	9310	9420	9380	9430	9480	9380	9550	9460	9490	9550	9550	9650	9790			

Test 2:

Canoes		Filled Percent (C)									Distance
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
	50	3606	3606	5000	4236	4236	4236	5000	4236	4243	Simulation Time: 5,000; Avg: 4709
	100	4243	4243	5000	5000	5000	4243	5000	4243	5000	
	150	5000	4243	4243	5000	3606	5000	5000	5000	5000	
	200	4243	4236	5000	3162	5000	4243	5000	5000	3606	
	250	5000	5385	4243	4236	4243	5000	4243	5000	5000	
	300	4243	5657	5000	5000	5000	4243	5000	5650	5000	
	350	5000	4236	4236	5000	5000	5000	5000	5000	5385	
	400	4243	5000	5000	4236	4243	5000	5000	5000	5657	
	450	5000	5000	5000	5000	5000	5000	5000	3162	5000	
	500	5000	4243	4243	5000	5000	5000	5000	5657	5193	
	50	5000	5000	5000	5000	4243	5193	5000	5000	5000	Simulation Time: 10,000; Avg: 4867
	100	4243	4243	5650	5657	4243	5000	4243	4243	5650	
	150	5000	3162	5000	5000	4243	5000	5000	4243	5385	
	200	5000	4236	5385	5657	5000	5000	5000	5000	5385	
	250	4243	5000	5000	4236	5000	4236	5000	5385	4243	
	300	4236	5000	3606	5000	5000	5000	5000	6000	5000	
	350	5000	3153	5000	5650	4236	5000	5650	5000	5385	
	400	5000	5000	5000	5650	4243	5000	5385	5000	5385	
	450	5650	5000	5000	4243	5000	5650	5000	5000	5000	
	500	4243	3606	4243	5000	5000	5000	3162	5385	5650	
	50	5650	2236	4243	5000	5000	5000	5000	7804	5000	Simulation Time: 15,000; Avg: 4849
	100	4243	5000	5000	3606	5000	5000	5000	5000	4243	
	150	3606	5000	5000	5000	6010	5650	5000	2828	5000	
	200	5000	5000	3606	4243	5000	4243	5000	5000	5000	
	250	5385	5000	5000	6000	4243	5000	6010	5385	5650	
	300	4236	3162	5000	4236	5000	5657	6000	5000	5000	
	350	5000	4243	5000	4243	5000	4236	5650	3162	6000	
	400	3153	2000	4243	5000	5000	5000	5657	5000	5000	
	450	5385	5385	5000	5000	5385	6010	5000	5000	6000	
	500	5000	5000	5000	5000	1414	5385	5000	5657	5000	

Summary of Findings

Most vessels benefited from larger C values for larger average profits, which makes sense, unless they were fast (yacht, airplane, rocket). All the vessels besides the yacht benefited from larger wait times (W) as well. The larger the capacity of the vessel the longer it had to wait, because the shipments were small compared to its capacity.

1. The reason I used median instead of a mean is because whenever a trip to the moon happened it would be so unprofitable that it caused outliers and would skew the data, and although this would happen in each simulation the median is a better representation of the average.
2. The average distance between each port was used so I could calculate the average cost of each vessel in a trip. This way I could figure out if the numbers I was getting were reasonable. I found it by running the simulation and getting the distances that the vessel went and then averaging them.
3. The relationship between C & W values and the average distance that a vessel goes does not exist in the long run and furthermore does not matter, so I did not color code the numbers in that table.