A MegaTraveller Starship Design Example
--by Joe D. Fugate Sr. (from Travellers' Digest #13 and #21)

The original article from Traveller's Digest has been recognized by the MegaTraveller community for a long time as being the best-written work on designing starships—except for some small bits of errata which make the numbers fail completely. In addition, in the Traveller Q&A article in TD #21, Joe Fugate provided possible answers to this article's shortcomings. Joe also gave some additional insights provided on staterooms and accommodations in the Traveller Q&A article in TD #19. It is my intention, with Joe Fugate's permission, to piece these together, fix the numbers and make Mr. Fugate's example finally work. Where I have changed numbers and text from the originals, or added my own material, is marked by red text below.
--Don McKinney (don.mckinney@gmail.com)
Version 2.02, 3/05/08

"This starship is, well… amazing—"

"Yes, I designed it that way! It has both a meson spinal mount and a particle beam spinal mount, jump-6, maneuver-6, agility-6, and all in only 10,000 tons. Neat, huh?"

"Well, it's unusual, but I don't think it's a valid design—"

"What do you mean, 'not valid'? It just happens that if you read this rule on power output so that…"

Sound familiar? Designing a starship can be an arduous process, involving many trade-offs. If you misunderstand some of the rules, you can end up making rather bizarre designs, and even totally wrong ones.

In this "Gaming Digest", we look at how to design a starship in **MegaTraveller** using a step-by-step example. There were some discrepancies in the original printing of the *Referee's Manual* (most of these have been corrected in the second edition); these have been identified and corrected in the current **MegaTraveller** errata. For those who do not have the **MegaTraveller** errata, we have included the latest errata for craft design with this article.

You will get the most from this example by getting your *Referee's Manual* and following along.

AN EXAMPLE: THE BATTLECRUISER *REGAL*

Most of the **MegaTraveller** starship designs presented in the *Imperial Encyclopedia* are non-military vessels under 1,000 tons displacement. As an in-depth illustration of the design system, we will develop a large military starship design. For those familiar with **Traveller's** old *High Guard* design system, we have selected a *High Guard* design from *Supplement 5, Trillion Credit Squadron*—the battlecruiser *Regal*—as a particularly appropriate example. By using an old **Traveller** design, we can not only illustrate how **MegaTraveller** starship design works, but also provide insights into converting from the old system to the new one.

THE HULL SECTION

The battlecruiser *Regal* is a 75,000-ton displacement (1,012,500 kiloliter) vessel.

Starting on page 62 of the *Referee's Manual*, step 1 says we need a *hull*. We select our 75,000 UCP displacement hull from the Space Vessel Hull Table (step 4). We skipped steps 2 and 3 because they apply to small craft or small vehicles. Using a sheet of lined paper, we make our first entry as shown:

Tech Level 14 Battlecruiser Regal

Hull Section	*Power*	*Vol*	*Weight*	*Price*
UCP Disp=75,000	—	1,012,500	15,000	44,600,000

Notice we have set up four columns: power, volume, weight, and price.

Next, we go in the *Referee's Manual* to step 5, Configuration and Streamlining. The original design in *Trillion Credit Squadron* (hereafter called *TCS*) had a needle/ wedge configuration, so we select that configuration. Notice we must apply certain price and weight

modifiers for the chosen configuration. We also select streamlined, which happens to be the minimum streamlining we can get with this configuration. We now have the following on our sheet of paper:

Tech Level 14 Battlecruiser Regal

Hull Section	*Power*	*Vol*	*Weight*	*Price*
UCP Disp=75,000	——	1,012,500	15,000	44,600,000
Config=1SL	——	——	x1.0	x1.2
			15,000	53,520,000

So far, so good. We skip step 6, Planetoid Configurations, since we aren't using that configuration. We move on to step 7, Armor. We want the best armor we can get for the money and tech level, so the choice is an easy one: bonded superdense (type G):

Tech Level 14 Battlecruiser Regal

Hull Section	*Power*	*Vol*	*Weight*	*Price*
UCP Disp=75,000	———	1,012,500	15,000	44,600,000
Config=1SL	———	———	x1.0	x1.2
			15,000	53,520,000
Armor Type=G	———	———	x0.14	x1
			2,100	53,520,000

Step 8 tells us all starships need a minimum armor value of 40. We want to put a small amount of extra armor on the design since the original in *TCS* had one point of extra armor. When we get to step 9, Armor, we select the basic value of 43. Notice that this entry has a modifier of 43.6. So, according to step 10, Weight and Price, we have:

Tech Level 14 Battlecruiser Regal

Hull Section	*Power*	*Vol*	*Weight*	*Price*
UCP Disp=75,000	———	1,012,500	15,000	44,600,000
Config=1SL	———	———	x1.0	x1.2
			15,000	53,520,000
Armor Type=G	———	———	x0.14	x1
			2,100	53,520,000
Armor Rating=43			x43.6	x43.6
			91,560	2,333,472,000

We skip steps 11 and 12 since they apply only to small vehicles. Our final hull section total is:

Hull Section	*Power*	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560	2,333,472,000

Now that we've finished the hull design, it's on to the power supply section, right? Not necessarily. It is often more convenient to skip the power supply section and come back to it later, especially when designing a warship with power-hungry weapons. In fact, we're going to do all the sections through screens, and part of the control section (mainly the power-hungry environment portion) before we come back to the power supply.

This is important, so let's emphasize the concept at work here. *Don't become a slave to the rules.* The rules are organized to follow a logical sequence, and to help the novice get started. The prescribed sequence should never get in your way—and if it does, then by all means, change it.

So we'll do just that. We are skipping the power supply section for the moment, and moving on to locomotion.

THE LOCOMOTION SECTION

According to the original design specs for the *Regal* in *TCS*, we want the design to be jump-4 and maneuver-6.

Going to step 3, Jump Units Required, on page 65 of the *Referee's Manual*, we find that for jump 4 in a hull UCP size of 75,000 we need 3,750 units of jump drive:

Locomotion Section	*Power*	*Vol*	*Weight*	*Price*
Jump=4		13.5	27	3,000,000
3,750 units	0	-50,625	101,250	11,250,000,000

Note: Many of the entries in this article use this two-line format. The first line shows the "per unit" values; the second line shows the total computed values. For example, using the volume column, 13.50 times 3,750 units equals 50,625.

Note that because a jump drive *uses* volume, we subtract the jump drive volume rather than add it. Step 4, Jump Fuel Volume comes next, so we determine the jump drive fuel volume to be:

Locomotion Section	*Power*	*Vol*	*Weight*	*Price*
Jump=4		13.5	27	3,000,000
3,750 units	0	-50,625	101,250	11,250,000,000
Jump Fuel	———	x5	———	———
	———	-253,125	———	———

Next, we need to install a 6G maneuver drive. Looking at the table in step 5, Maneuver Drive, we arrive at the following for a UCP 75,000 hull:

Locomotion Section	*Power*	*Vol*	*Weight*	*Price*
Jump=4		13.5	27	3,000,000
3,750 units	0	-50,625	101,250	11,250,000,000
Jump Fuel	———	x5	———	———
	———	-253,125	———	———
Maneuver=6 (Thrusters)	70	13.5	35	700,000
12,750 units	-892,500	-172,125	446,250	8,925,000,000

Notice that a maneuver drive uses power in addition to taking volume, so we subtract both the power figure and the volume figure. We follow this method all through design.

We skip steps 6, 7, and 8 because they apply to small vehicles, and go on to step 9, Avionics. We install a tech level 14 avionics unit, giving us:

Locomotion Section	*Power*	*Vol*	*Weight*	*Price*
Jump=4		13.5	27	3,000,000
3,750 units	0	-50,625	101,250	11,250,000,000
Jump Fuel	———	x5	———	———
	———	-253,125	———	———
Maneuver=6 (Thrusters)	70	13.5	35	700,000
12,750 units	-892,500	-172,125	446,250	8,925,000,000
Avionics (NOE 180)	-0.02	-0.10	0.05	16,000

Our total for the locomotion section is thus:

Locomotion Section	*Power*	*Vol*	*Weight*	*Price*
Locomotion Total	-892,500.02	-475,875.10	547,500	20,175,016,000

Applying this to our total from the hull section gives us:

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560	2,333,472,000
Locomotion Total	-892,500.02	-475,875.10	547,500	20,175,016,000
Net Total so far…	-892,500	536,625	639,060	22,508,488,000

THE COMMUNICATIONS SECTION

Since the original *High Guard* starship design system never dealt with any communications equipment, the original *Regal* design in *TCS* does not specify what type to install. But it seems reasonable that such a military vessel would at least have a system range radio, and some type of tight-beam communications as well for private messages. Just for good measure, we'll install both laser and maser communicators.

Because this is a military vessel, let's also install redundant equipment for use as a backup in case the primaries fail: let's make it two of each kind, system range:

Communication Section	*Power*	*Vol*	*Weight*	*Price*
Radio, system range	0.010	0.020	0.010	150,000
2 units	-0.020	-0.040	0.020	300,000
Laser, system range	0.030	0.030	0.030	180,000
2 units	-0.060	-0.060	0.060	360,000
Maser, system range	0.060	0.090	0.060	250,000
2 units	-0.120	-0.180	0.120	500,000
Communication Total	-0.200	-0.280	0.200	1,160,000

Applying the communication section totals gives us:

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560	2,333,472,000
Locomotion Total	-892,500.02	-475,875.10	547,500	20,175,016,000
Communication Total	-0.200	-0.280	0.200	1,160,000
Net Total so far…	-892,500	536,625	639,060	22,509,648,000

THE SENSORS SECTION

We're in the same situation with sensors as we were with communicators: *High Guard* never explicitly covered them, so we're on our own again.

Given that the *Regal* is a warship, its sensors are its eyes, so it should have good ones, and plenty of them. We will give it all of the four basic groups: active EMS, passive EMS, densitometer, and neutrino. In addition, we'd like the *Regal* to be more difficult to spot by the enemy's passive EMS, so we'll give ourselves EM masking. And if we install an EMS jammer, we'll make the enemy's active EMS more difficult to use. Here's what we end up with:

Sensors Section	*Power*	*Vol*	*Weight*	*Price*
EM Mask	-1,010	-20,200	10,100	5,050,000,000
EMS Pas (Interstellar)	-0.20	-0.04	0.02	400,000
EMS Active (Far Orbit)	-0.30	-0.06	0.03	600,000
Densitometer (High)	-0.40	-7.00	1.50	1,500,000
Neutrino (10kW)	-0.20	-0.20	0.10	110,000
EMS Jammer (Far Orbit)	-0.60	-0.12	0.06	1,200,000
Sensors Total	-1,011.70	-20,207.42	10,101.71	5,053,810,000

Applying the sensors section to our totals gives us:

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560	2,333,472,000
Locomotion Total	-892,500.02	-475,875.10	547,500	20,175,016,000
Communication Total	-0.200	-0.280	0.200	1,160,000
Sensors Total	-1,011.70	-20,207.42	10,101.71	5,053,810,000
Net Total so far…	-893,512	516,417	649,162	27,563,458,000

THE WEAPONS SECTION

Now, to the weapons. The original *Regal* design lists these weapons:

- One type-S meson spinal mount
- Ten 100-ton particle accelerator bays (factor-9)
- Five 100-ton repulsor bays (factor-8)
- Five 50-ton fusion gun bays (factor-8)
- 100 triple missile turrets (10 batteries, factor-9)
- 100 triple beam laser turrets (10 batteries, factor-9)
- 100 triple sandcaster turrets (10 batteries, factor-9)

Looking at page 71 of the ***Referee's Manual***, we see the first step in installing weapons is to compute the available hardpoints. Taking our hull displacement of 1,010,000 kiloliters and dividing it by 1,350, we get 748 hardpoints.

The first weapon we install is the type-S meson gun:

Weapons Section	*Power*	*Vol*	*Weight*	*Price*
Meson-S (Spinal)	-300,000	-110,000	19,000	2,000,000,000

The type-S meson spinal mount takes 80 hardpoints, which leaves us with 668 hardpoints. We go on to step 7, 100-ton Bay Weaponry.

We look up particle accelerator on the table and see that a tech level 14 particle accelerator has a UCP factor of 9:

Weapons Section	*Power*	*Vol*	*Weight*	*Price*
Part Accel Bays	15,000	1,350	75	35,000,000
100-ton 10x9 (100)	-150,000	-13,500	750	350,000,000

The number in parentheses is the hardpoint cost. Each particle accelerator bay takes 10 hardpoints (see step 6, Bays), so ten bays takes 100 hardpoints, leaving 568 hardpoints available. Moving to the ten 100-ton repulsor bays:

Weapons Section	*Power*	*Vol*	*Weight*	*Price*
Repulsor Bays	2,500	1,350	60	10,000,000
100-ton 5x8 (50)	-12,500	-6,750	300	50,000,000

The repulsor bays take another 50 hardpoints, which drops us down to 518 available hardpoints. For the 50-ton fusion bays, we move on to step 8, 50-ton Bay Weaponry:

Weapons Section	*Power*	*Vol*	*Weight*	*Price*
Fusion Bays	5,000	675	35	8,000,000
50-ton 5x9 (50)	-25,000	-3,375	175	40,000,000

Subtracting the 50 hardpoints for the fusion bays, we now have 468 hardpoints left.

Next, we reach step 10, Missile Turrets (top of page 73). If we install 100 triple missile turrets, we are actually installing 300 individual missile "launchers". If we look at the table in step 10, we see that 30 units of TL 13 missile launchers gives us a factor-7. For craft profile purposes, what we have are 10 batteries of factor-7 missile turrets. See how it works? Installing the missiles we get:

Weapons Section	*Power*	*Vol*	*Weight*	*Price*
TL13 Missile Turret	1	13.5	2	750,000
10x7 (300)	-300	-1,350	600	225,000,000

Each *turret* takes 1 hardpoint (see step 9, Turrets). The 100 missile turrets thus take 100 hardpoints, leaving us with 368 unused hardpoints left. Notice the best use of hardpoints when working with turrets comes from maximizing the number of weapons installed in a turret. In this case, we have installed three missile launchers per turret. The effect is that we get two "free" weapons with no additional cost in hardpoints. Note that adding the two "free" weapons comes at no additional volume cost; each missile turret takes up 13.5 kiloliters of volume whether it has one missile launcher or three.

We move on to step 11, Laser Turrets. The *Regal* has 100 triple beam turrets—which makes the installation procedure virtually identical to those for the missile turrets. The 100 beam laser turrets also take 100 hardpoints, leaving us with 268 hardpoints.

Lastly, we install the 100 triple sandcaster turrets, taking another 100 hardpoints. We still have 168 hardpoints left, and the complete lineup of weapons looks like this:

Weapons Section	*Power*	*Vol*	*Weight*	*Price*
Meson-S (Spinal)	-300,000	-110,000	19,000	2,000,000,000
Part Accel Bays	15,000	1,350	75	35,000,000
100-ton 10x9 (100)	-150,000	-13,500	750	350,000,000
Repulsor Bays	2,500	1,350	60	10,000,000
100-ton 5x8 (50)	-12,500	-6,750	300	50,000,000
Fusion Bays	5,000	675	35	8,000,000
50-ton 5x8 (50)	-25,000	-3,375	175	40,000,000
TL13 Missile Turret	1	13.5	2	750,000
10x7 (300)	-300	-1,350	600	225,000,000
TL13 Beam Laser T	250	13.5	4	1,000,000
10x9 (300)	-75,000	-1,350	1,200	300,000,000
TL10 Sandcaster T	1	13.5	2	250,000
10x9 (300)	-300	-1,350	600	75,000,000

Even though the original design didn't mount any more weapons, it seems a real shame—even foolhardy—not to use up those hardpoints. If we can add some type of weapons system with very little cost in energy, then it seems prudent to do so. As a crewmember of the *Regal*, I'd feel better knowing the designer packed the weapon capacity of my warship to the max. Wouldn't you?

The obvious choice is more missile turrets. Each turret takes only 1 megawatt. With 168 hardpoints left, if we multiply that figure by 3 (triple missile turrets, remember), we get 504. Next, if we divide 504 by 30 (the number of TL13 missile launchers it takes to get a factor-7: see the table in step 10 again), we get 16.8, or just 16 (the .8 is not enough for us to get another battery). So we can add 16 more factor-7 missile batteries. Did you follow that? Reread it again if you did not. It's really simple if you just take it a step at a time.

Adding 16 more factor-7 missile batteries (each with 10 triple missile turrets, for a total of 30 missile launchers per battery) brings our missile battery total from 10 to 26. This also means we use 160 more turrets, and thus 160 more hardpoints, leaving only 8 hardpoints left. That's much better than 168 hardpoints left. So, after everything, we get:

Weapons Section	*Power*	*Vol*	*Weight*	*Price*
Meson-S (Spinal)	-300,000	-110,000	19,000	2,000,000,000
Part Accel Bays	15,000	1,350	75	35,000,000
100-ton 10x9 (100)	-150,000	-13c500	750	350,000,000
Repulsor Bays	2,500	1,350	60	10,000,000
100-ton 5x8 (50)	-12,500	-6,750	300	50,000,000
Fusion Bays	5,000	675	35	8,000,000
50-ton 5x8 (50)	-25,000	-3,375	175	40,000,000
TL13 Missile Turret	1	13.5	2	750,000
26x7 (780)	-780	-3,510	1,560	585,000,000
TL13 Beam Laser T	250	13.5	4	1,000,000
10x9 (300)	-75,000	-1,350	1,200	300,000,000
TL10 Sandcaster T	1	13.5	2	250,000
10x9 (300)	-300	-1,350	600	75,000,000
Weapons Total	-563,580	-139,835	23,585	3,400,000,000

Applying the weapons section to the totals:

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560	2,333,472,000
Locomotion Total	-892,500.02	-475,875.10	547,500	20,175,016,000
Communication Total	-0.200	-0.280	0.200	1,160,000
Sensors Total	-1,011.70	-20,207.42	10,101.71	5,053,810,000
Weapons Total	-563,580	-139,835	23,585	3,400,000,000
Net Total so far…	-1,457,092	376,582	672,747	30,963,458,000

THE SCREENS SECTION

The *Regal* has two screens: a factor-6 nuclear damper, and a factor-6 meson screen. Screens are listed on page 80 of the *Referee's Manual*. Nuclear dampers are in step 2; we select a factor-6 damper screen:

Screens Section	*Power*	*Vol*	*Weight*	*Price*
Nuclear Damper (6)	-15,000	-160	180	38,000,000

A meson screen (step 3) works a bit differently: power is based on the hull volume, so the larger the vessel, the more power that is required. The power requirement for a factor-6 meson screen is 0.09 megawatts per kiloliter, and the *Regal* has a volume of 1,012,500 kiloliters. So multiplying 0.09 by 1,012,500 gives us 91,125 megawatts. Installing the factor-6 meson screen gives us:

Screens Section	*Power*	*Vol*	*Weight*	*Price*
Meson Screen (6)	-91,125	-325	290	50,000,000

Our total for the screens section works out to:

Screens Section	*Power*	*Vol*	*Weight*	*Price*
Nuclear Damper (6)	-15,000	-160	180	38,000,000
Meson Screen (6)	-91,125	-325	290	50,000,000
Screen Total	-106,125	-485	470	88,000,000

Applying the totals for the screen section, we get:

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560	2,333,472,000
Locomotion Total	-892,500.02	-475,875.10	547,500	20,175,016,000
Communication Total	-0.200	-0.280	0.200	1,160,000
Sensors Total	-1,011.70	-20,207.42	10,101.71	5,053,810,000
Weapons Total	-563,580	-139,835	23,585	3,400,000,000
Screens Total	-106,125	-485	470	88,000,000
Net Total so far…	-1,563,217	376,097	673,217	31,051,458,000

THE ENVIRONMENT CONTROLS

Let's do one more part before we go back and see what we need for a power plant: the ship's environment controls (that is, its life support). For that, we need to go to the top of page 81 of the *Referee's Manual*.

Original *High Guard* never dealt with this at all, so once again, we're on our own. We'll just put in the standard: basic environ, basic life support, extended life support, grav plates, and inertial compensators. All of these are per kiloliter of ship hull, so multiplying each by the *Regal's* hull volume of 1,012,500 kiloliters, we get:

Environ Section	*Power*	*Vol*	*Weight*	*Price*
Basic Environ	-1,012.5	-5,062.5	5,062.5	10,125,000
Basic Life Sup	-1,012.5	-5,062.5	5,062.5	303,750,000
Ext Life Sup	-2,020	-3,030	3,037.5	202,500,000
Grav Plates	-50,625	-10,125	20,250	506,250,000
Inertial Comp	-20,250	-10,125	20,250	253,500,000
Environ Total	-74,925	-33,412.5	53,662.5	1,272,750,000

Here are a couple of design pointers that can help us out. First, there is no need to install basic or extended life support in the ship's fuel tanks. If you do install grav plates and/or inertial compensators, you need to install them in the *entire* hull volume. You need to install basic environment in the entire hull volume as well, including the fuel tanks. You need something to keep the fuel load at a constant temperature—plus when inspecting empty fuel tanks, lighting is a tremendous help. Grav plates and inertial compensators are "gross" items, and do not have a fine enough "focus" for installation in a specific ship location to have any real meaning. Let's look at what happens when we remove the life support from the Jump fuel space:

Environ Section	*Power*	*Vol*	*Weight*	*Price*
Basic Environ	-1,012.5	-5,062.5	5,062.5	10,125,000
Basic Life Sup	-672.08	-3,360.40	3,360.40	201,624,120.00
Ext Life Sup	-1,344.16	-2,016.24	2,016.24	134,416,080.00
Grav Plates	-50,625	-10,125	20,250	506,250,000
Inertial Comp	-20,250	-10,125	20,250	253,125,000.00
Environ Total	-73,903.74	-30,689.14	50,939.14	1,105,540,200.00

Adding in the environment controls to the rest of our totals, we get:

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560	2,333,472,000
Locomotion Total	-892,500.02	-475,875.10	547,500	20,175,016,000
Communication Total	-0.200	-0.280	0.200	1,160,000
Sensors Total	-1,011.70	-20,207.42	10,101.71	5,053,810,000
Weapons Total	-563,580	-139,835	23,585	3,400,000,000
Screens Total	-106,125	-485	470	88,000,000
Environ Total	-73,903.74	-30,689.14	50,939.14	1,105,540,200.00
Net Total so far…	-1,637,121	345,408	724,156	32,156,998,200

ESTIMATING THE CREW

It helps to estimate the one other volume intensive component of a starship ahead of time: the number of crew.

As a very rough rule of thumb, we can estimate the number of crew by figuring one crew member per 3000 kiloliters of volume. So the *Regal*, with 1,012,500 kiloliters of volume, would estimate about 338 crew members. Remember that this is *very* rough, but it does help us establish ahead of time what the crew volume requirements will likely be. With the 338 figure, if we further assume double occupancy (almost a requirement on a warship loaded with power-hungry weapons—and not that bad either, since only half the crew could be on duty at any given time), we need 169 staterooms.

Looking on page 82 of the *Referee's Manual*, step 9, Extended Accommodations, we find a standard stateroom takes 54 kiloliters. Multiplying 54 by 338 yields 9,126 kiloliters. Subtracting that volume from 332,824.7 gives us a "working volume" of 323,699 kiloliters.

THE POWER SUPPLY SECTION

Ah, at last, the power supply. We go back to page 64 of the *Referee's Manual*. We want to install a tech level 14 fusion plant. Using the net power total above, we need to design a plant that can produce about 2.5 million megawatts. From step 2, Scale Efficiency in the *Referee's Manual*, we know that any fusion power plant over 14 kiloliters in size has its power output multiplied by 3.

So working backwards from the power requirement of 1.6 million megawatts, we divide it by the scale efficiency figure of 3 to get a "raw, unimproved" output figure of 545,728. Looking at step 1, we see a TL14 plant is capable of a power output of 3 megawatts per kiloliter. To get the number of power plants we're going to need, we further divide 545,728 by 3, getting 181,910 units of power plant. We know each entry in the power plant table is for a volume of one kiloliter, we thus need 181,910 kiloliters of power plant to power the *Regal*.

Before we go too much further, we also need to consider fuel and duration needs to see how reasonable this power plant is. The 181,910 kiloliters takes over half of the working volume of 323,699 kiloliters. How much fuel tankage do we need to keep this plant running for the preferred 30 days duration? Looking at the TL14 fusion line on the table again, we see the fuel consumption is 0.005 kiloliters per hour—per kiloliter of power plant, that is.

Another thing to consider at this point: fuel purification. We already know the amount of fuel used by the jump drive, in the *Regal's* case, 253,125 kiloliters. From this and the table on page 83 (step 3, Fuel Purification Plant) we can determine at least how large a purification plant to install for the jump drive fuel:

	Power	*Vol*	*Weight*	*Price*
Fuel Purification	0.005	0.25	0.5	140
253,125 units	-1,265.63	-63,281.3	126,562.5	35,437,500

Adding this in to the rest of the totals, we get:

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0.00	1,012,500.000	91,560.000	2,333,472,000
Locomotion Total	-892,500.02	-475,875.100	547,500.000	20,175,016,000
Communication Total	-0.20	-0.280	0.200	1,160,000
Sensors Total	-1,011.70	-20,207.420	10,101.710	5,053,810,000
Weapons Total	-563,580	-139,835	23,585	3,400,000,000
Screens Total	-106,125.00	-485.000	470.000	88,000,000
Environ Total	-73,903.74	-30,689.143	50,939.143	1,105,540,200.00
Fuel Purification	-1,265.63	-63,281.300	126,562.500	35,437,500
Net Total so far…	-1,638,386	282,127	850,719	32,192,435,700

For the unknown quantity of power plant fuel, a good "trick" is to include the fuel purification volume requirement in the fuel per hour volume requirement, giving us a sort of "fuel capacity rate". From the "Fuel Consumption Modifiers to Include Fuel Purification" table (now in

the Consolidated MegaTraveller Errata), a TL14 fuel purification plant has a modifier of x1.25. We multiply the basic fuel consumption rate of 0.005 by 1.25 to get a "fuel capacity" rate of 0.00625.

So 0.00625 times 181,910 gives us 1,137 kiloliters of fuel per hour. Multiply 1,137 by 24 to get the fuel requirement for one day: 27,287; multiply that by 30 to get the fuel requirement for 30 days: 818,595 kiloliters. This, coupled with the volume of the power plant, far exceeds the 323,699 kiloliters we have. What are we to do?

Interestingly enough, this "problem" is fairly common with the new design system. With all components now using power (as they should), producing a starship design involves more trade-offs than it used to. No longer can you design a very large, very agile starship bristling with power-hungry weapons and screens. A well-balanced design is now more of a challenge, and we believe it is also more fun to work up and more realistic when finished.

There are a lot of subtle implications of the new, more detailed starship design system—more than we can possibly cover here in this article. Look for a future article on the new starship design philosophies. For now, we will discuss the most common alterations needed to an old starship design in order to update it.

High maneuver and high agility in large starships are no longer very achievable in a design if you also want a high jump number or lots of energy-hungry weapons or a multitude of screens. Let's examine the effects of this on the design of the *Regal*. The old *Regal* design in *TCS* had a 6G maneuver drive—with the new design system, the power and volume requirements of such a drive are much too large. It seems reasonable that if we drop the maneuver drive all the way from 6 down to 1, we might be in better shape. How could I guess that? Experience: do a few designs of your own and you'll get the knack of it. Here's what we would get by downsizing the maneuver capability:

Old:	*Power*	*Vol*	*Weight*	*Price*
Maneuver=6 (Thrusters)	70	13.5	35	700,000
12,750 units	-892,500	-172,125	446,250	8,925,000,000

New:	*Power*	*Vol*	*Weight*	*Price*
Maneuver=1 (Thrusters)	70	13.5	35	700,000
1,500 units	-105,000	-20,250	52,500	1,050,000,000

We have just regained 151,875 kiloliters of volume, and *reduced* our power requirements by 787,500 megawatts! We can add the 151,875 back to the 323,699 to get a new working volume of 475,574. How does all of this affect our power plant design?

Since we've reduced our power needs from 1.6 million down to 0.85 million megawatts, we divide by 3 (the scale efficiency) to find we now need a raw output of only about 283,683 megawatts. At 3 megawatts per unit of fusion plant, we need 94,561 units of power plant.

Recomputing the fuel requirements, we get: 0.00625 x 94,561 x 24 x 30 to get the fuel requirement for 30 days: 425,524.5 kiloliters—barely within our working volume!

Before we abandon the *Regal* as being unworkable, let's look at the jump drive. At TL 14, we could get by with jump-3 instead of jump-4 in a warship. Let's review how downsizing the jump capability would affect our ship:

Old:	*Power*	*Vol*	*Weight*	*Price*
Jump=4		13.5	27	3,000,000
3,750 units	0	-50,625	101,250	11,250,000,000
Jump Fuel	———	x5	———	———
	———	-253,125	———	———

New:	*Power*	*Vol*	*Weight*	*Price*
Jump=3		13.5	27	3,000,000
3,000 units	0	-40,500	81,000	9,000,000,000
Jump Fuel	———	x5	———	———
	———	-202,500	———	———

We've regained an additional 60,750 kiloliters, raising our working volume to 536,324 kiloliters; our power requirements now fit comfortably within our available volume.

So the power plant section totals are:

Power Plant Section	*Power*	*Vol*	*Weight*	*Price*
Fusion	3	1	3	200,000
Scale efficiency x 3	9			
94,561 units	851,049	-94,561	283,683	18,912,200,000

Before we apply the power plant totals to the totals so far, we update the locomotion section to now reflect a 1G maneuver drive and a jump-3 maneuver drive, as well as corrections to the environment section to remove life support from all of the fuel space, and dropping the jump fuel purification (we'll recalculate that shortly):

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560.000	2,333,472,000
Locomotion Total	-105,000.02	-263,250.100	133,500.050	10,050,016,000
Communication Total	-0.20	-0.280	0.200	1,160,000
Sensors Total	-1,011.70	-20,207.420	10,101.710	5,053,810,000
Weapons Total	-563,580	-139,835	23,585	3,400,000,000
Screens Total	-106,125.00	-485.000	470.000	88,000,000
Environ Total	-73,903.74	-30,689.143	50,939.143	1,105,540,200
Power Plant Total	851,049.00	-94,561.000	283,683.000	18,912,200,000
Net Total so far…	1,428	463,472	593,839	40,944,198,200

THE CONTROLS SECTION

We've already figured out what the environmental controls are, so it's on to the computer and control panels. For this, we first need to determine the number of control points, as specified in step 2 on page 81 of the *Referee's Manual*. Price and tech level are used for computing the CP requirements. Here are all the computations:

Hull CP:	(2,333,472,000/100,000) x 14 =	326,686.08
Pwr Plnt CP:	(18,912,200,000/100,000) x 14 =	2,647,708.00
Loco CP:	(10,050,016,000/100,000) x 14 =	1,407,002.24
Commo CP:	(1,160,000/100,000) x 14 =	162.40
Sensors CP:	(5,053,810,000/100,000) x 14 =	707,533.40
Weapons CP:	(3,400,000,000/100,000) x 14 =	476,000.00
Screens CP:	(88,000,000/100,000) x 14 =	12,320.00
Environ CP:	(1,105,540,200/100,000) x 14 =	154,775.63
Total CP:		5,732,187.75

The *Regal* needs nearly 6 million control points in control panels and computer equipment. The best computer we can install is a TL14 model-8/fib, which multiplies the CP input from our control panels by 95. To see how much CP input into the computer we need in order to get 5,732,187.75 control points out, we can divide that by the computer's multiplier of 95, giving us 60,339 CP needed as input.

We look at steps 4 and 5 on page 81 to determine our control panel mix. For starters, we know we have a big crew. A good way to provide the crew with good control input is to install several large holodisplays—in this case we'll say 10 of them. That's 15,000 CP right of the top, leaving 45,339 CP. We can cover the remaining CP with holographic linked (also sometimes called holodynamic linked) control panel units. Each of these provides 1.5 CP, so again, dividing we get: 45,339/1.5, or 30,226 control panel units. Because a starship is a "flying craft", we need to install three computers (2 backups). We also opt for electronic circuit protection, which multiplies the weight and price of all these components by 1.5. Our totals thus are:

Controls Section	*Power*	*Vol*	*Weight*	*Price*
Computer Model-8/fib	0.018	28	7	30,500,000
3 units	-0.054	-84	32	137,250,000
Large Holodisplay	0.050	2	1	500,000
10 units	-0.500	-20	15	7,500,000
Holo Link Ctl Panel	0.002	0.030	0.020	1,000
30,226 units	-60.452	-906.78	604.52	30,226,000
Controls Total	-61.006	-1,010.78	960.78	262,464,000

Which brings our net totals to:

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560	2,333,472,000
Locomotion Total	-105,000.02	-263,250.10	133,500.05	10,050,016,000
Communication Total	-0.200	-0.280	0.200	1,160,000
Sensors Total	-1,011.70	-20,207.42	10,101.71	5,053,810,000
Weapons Total	-563,580	-139,835	23,585	3,400,000,000
Screens Total	-106,125	-485	470	88,000,000
Environ Total	-73,903.74	-30,689.143	50,939.143	1,105,540,200.00
Power Plant Total	851,049	-94,561	283,683	18,912,200,000
Controls Total	-61.006	-1,010.78	960.78	262,464,000
Net Total so far…	1,367	463,472.057	593,839.103	40,944,198,200

THE ACCOMODATIONS SECTION

Here's where we get to figure out how big the crew really is. To do that, refer to page 82 of the *Referee's Manual*. For starships, start with step 7.

Here are the crew computations for the *Regal*.

Bridge:	(5,732,187.75/95)/750=80; 80 > 10, so: 10+(80/10)=	18
Engineering:	(2,647,708.00+1,407,002.24)/95)/400=	107
Maintenance:	(326,686.08+750.00)/95)/400=6; (75/6) > 6, so:	0
Gunners:	(476,000.00+12,320.00)/95)/10=514; 514 > 50, so: 50+(514/50)=	60
Flight:		0
Ship's Troops:	(75,000/1,000)x1=	75
Command:	(18+107+0+60+0+75)/6=	43
Stewards:	(43/8)+(260/50)=	10
Frozen Watch:	(18+107+0+60+0+75+43+10)=313/75=4x75=	300
Medical:	(313/120)+(300/20)=	17
	Total Crew:	329

Step 8 on page 82 describes how to determine crew segments. We divide the *Regal's* hull volume of 1,012,500 by 13,500 to get the number of crew segments, in this case: 75. Dividing the total crew of 329 by 75 yields a crew segment size of 4.

We need staterooms for the 329 members of the crew. As mentioned earlier, double occupancy is common on a military vessel, so we actually can make do with 165 staterooms. However, let's give the command element of the crew (43) their own staterooms. That leaves 286 crewmen to get double occupancy staterooms, or 143 staterooms (double occupancy), plus 43 (single occupancy), for a total of 186 staterooms.

The original *Regal* design had a complete replacement crew as a frozen watch. So, we need to add 300 low berths for the frozen watch. Here are the figures:

Accommo Section	*Power*	*Vol*	*Weight*	*Price*
Stateroom	0.003	54	4	400,000
186 units	-0.624	-11,232	832	83,200,000
Low Berth	0.001	14	1	50,000
300 units	-0.300	-4,200	300	15,000,000
Accommo Total	-0.910	-15,236	1,118	97,500,000

Our net totals are:

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560	2,333,472,000
Locomotion Total	-105,000.02	-263,250.10	133,500.05	10,050,016,000
Communication Total	-0.200	-0.280	0.200	1,160,000
Sensors Total	-1,011.70	-20,207.42	10,101.71	5,053,810,000
Weapons Total	-563,580	-139,835	23,585	3,400,000,000
Screens Total	-106,125	-485	470	88,000,000
Environ Total	-73,903.74	-30,689.143	50,939.143	1,105,540,200.00
Power Plant Total	851,049	-94,561	283,683	18,912,200,000
Controls Total	-61.006	-1,010.78	960.78	262,464,000
Accommo Total	-0.910	-15,236	1,118	97,500,000
Net Total so far…	1,366.424	447,225.277	595,917.883	41,304,162,200

THE FUEL AND MISCELLANEOUS SECTION

First, we compute 0.005 x 94,561 (volume of power plant) to get 473 kiloliters of fuel capacity needed per hour. Multiply 591 by 24 to get the fuel requirement for one day: 11,347; multiply that by 30 to get the fuel requirement for 30 days: 340,420 kiloliters. Generally, if you can get within 80% of the desired 30 days, consider that you've succeeded.

From this, we can compute the actual size of our remaining fuel space and purification equipment:

Fuel & Misc Section	*Power*	*Vol*	*Weight*	*Price*
Fuel Purification (Jump)	0.005	0.25	0.5	140
101,250 units	-506.25	-25312.5	50,625.00	14,175,000
Fuel Tankage (PwrPlnt)		-340,420		
Fuel Purification (PwrPlnt)	0.005	0.25	0.5	140
170,210 units	-851	-42,553	-85,105	-23,829,400
Fuel Scoops	———	———	———	75,937,500
Fuel Total	-1,357	-408,285	-34,480	113,941,900

We now need to consider additional rounds for the missile and sandcaster turrets. A good measure for magazine carriage is to allow for up to 24 hours of constant exchange (which is ridiculous for encounters, but provides plenty of ammunition. This will require 780 missiles and 1800 sandcasters per turn. Remember that the weight of ammunition goes towards loaded weight, but not unloaded weight.

	Vol	*Weight*	*Price*
Missiles	0.1	0.07	150,000
56,160 units	5,616	3,931.2	8,424,000,000
Sandcasters	0.1	0.05	400
129,600 units	12,960	6,480	51,860,000
Magazine Total	18,576	10,411.2	8,446,464,000

Notice we also installed fuel scoops. Our net totals are:

	Power	*Vol*	*Weight*	*Price*
Hull Section Total	0	1,012,500	91,560	2,333,472,000
Locomotion Total	-105,000.02	-263,250.10	133,500.05	10,050,016,000
Communication Total	-0.200	-0.280	0.200	1,160,000
Sensors Total	-1,011.70	-20,207.42	10,101.71	5,053,810,000
Weapons Total	-563,580	-139,835	23,585	3,400,000,000
Screens Total	-106,125	-485	470	88,000,000
Environ Total	-73,903.741	-30,689.143	50,939.143	1,105,540,200.00
Power Plant Total	851,049	-94,561	283,683	18,912,200,000
Controls Total	-61.006	-1,010.78	960.78	262,464,000
Accommo Total	-0.910	-15,236	1,118	97,500,000
Fuel Total	-1,357.3	-408,284.6	-34,480	113,941,900
Magazine Total	0	18,576	10,411.2	8,446,464,000
Net Total so far…	9.123	57,516.677	571,849.083	49,864,568,100

This leaves just one thing: cargo space. The original *Regal* specification text in *TCS* says no cargo space. We end up with 57,517 kiloliters left to the crew.

Battlecruiser, *Regal* class

CraftID: Battlecruiser, Type BC, TL14, MCr49,856.87

Hull: 67,500/1,687,500, Disp=75,000, Config=1SL, Armor=40G,
Unloaded=561,368tons, Loaded=606,112tons

Power: 9,456/12,608, Fusion=851,049Mw, Duration=30 days

Loco: 2,025/2,700, Maneuver=1G; 4,050/5,400, Jump=3; NOE=300kph,
Cruise=900kph, Top=1,200kph, Agility=0

Commo: Radio=Systemx2, Laser=Systemx2, Maser=Systemx2

Sensors: EMMask, PassiveEMS=Interstellar, ActiveEMS=FarOrbit,
Densitometer=HiPen/1km, Neutrino=10Kw, EMSJammer=FarOrbit;
ActObjScan=Rout, ActObjPin=Rout, PasObjScan=Rout, PasObjPin=Rout,
PasEngScan=Rout, PasEngPin=Rout

Off: MesonGun=S00, PartAcc=090, FusionGun=x80,

Batt	1	10	5
Bear	1	8	4

BeamLaser=x09, Missiles=x07

Batt	10	26
Bear	8	20

Def: DefDM=+7, ArmorDM=–1, MesonScrn=6, NucDamper=6,
Repulsors=x80, Sandcasters=x09

Batt	5	10
Bear	4	8

Control: Computer=8fibx3, Panel=hololinkx30,226, Special=Igholodisplayx10, Env=basic env, basic ls, ext ls, grav plts, inertial comp; Electronic Circuit Protection

Accomm: Crew=329 (75x4; Bridge=18, Engineer=107, Maint=0, Gunnery=60, Troops=75, Command=43, Steward=10, Medical=16), Frozen Watch=75x4(300), Staterooms=186, LowBerths=300

Other: Cargo=57,517kl, Fuel=408,285kl, Magazine=56,160 missiles, 129,600 sandcaster rnds; PurificationPlant(12hrs), Scoops; ObjSize=Lg, EmLevel=Mod