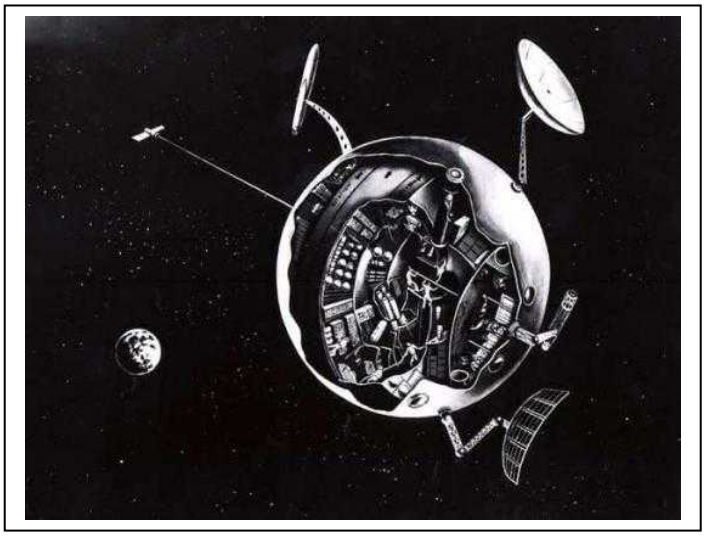

The Star Wars 'Death Star' not with withstanding, another possibility for Crew Cabin and space station designs is the spherical module. The above drawing is from an old NASA brochure in 1959.

The *Destiny* Laboratory Module on the International Space Station is 8.5 meters long, and has an outside radius of 2.1 meters. In the problems below, neglect the thickness of the walls when finding dimensions and volumes.

Problem 1 – What is the maximum number of spheres that you can stack inside the cylindrical volume of the *Destiny* module with the same radius as *Destiny?*

Problem 2 – What is the volume of the *Destiny* module to the nearest cubic meter?

Problem 3 – What is the total volume of the inscribed spheres?

Problem 4 – What is the 'wasted' volume, in cubic meters and percentage, of the cylinder if the crew is restricted to the spherical volumes?

Problem 1 – What is the maximum number of spheres that you can stack inside the cylindrical volume of the Destiny module with the same radius as *Destiny*?

Answer: Radius = 2.1 meters and Diameter = 4.2 meters so you can place **2 spheres** inside the same cylindrical volume. (2 x 4.2 = 8.4 meters which is < 8.5 meters the total length)

Problem 2 – What is the volume of the Destiny module to the nearest cubic meter?

Answer: $V = \pi r^2 h = 3.141 \times (2.1)^2 (8.5) =$ **118 cubic meters**.

Problem 3 – What is the total volume of the inscribed spheres?

Answer: $V = 4/3\ \pi\ (2.1)^3 = 38.8$ meters^3. Total = 2 x 38.8 = **77.6 meters^3**

Problem 4 – What is the 'wasted' volume, in cubic meters, of the cylinder if the crew is restricted to the Spherical volumes?

118 meters^3 - 77.6 meters^3 = **40 cubic meters**.

You loose about 100%(40/118) = **34%** of the cylindrical volume using two inscribed spheres.