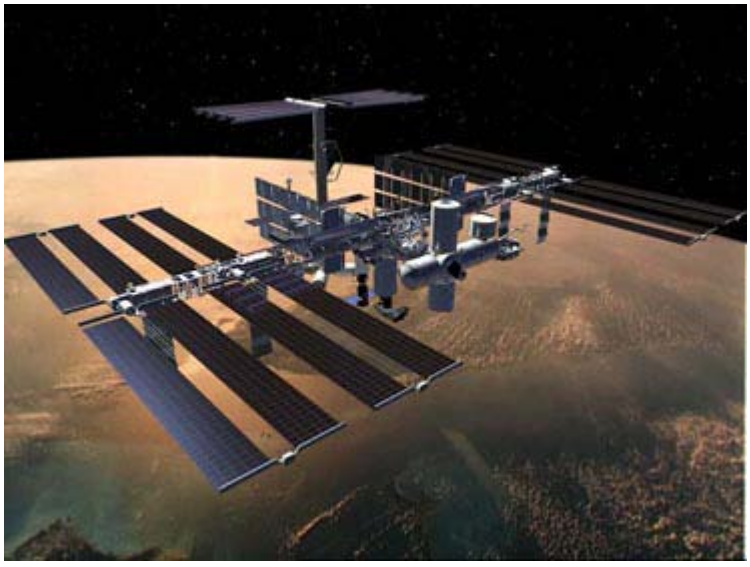
ISS

The Problem

When completed in 2002, the International Space Station (ISS) will be the largest man made object ever placed in low earth orbit. NASA has determined that the expected number of on-orbit impacts is related to the exposed area of a spacecraft and its mission time. Therefore, the 10 year design life and the tremendous vehicle size of the ISS, combine to create a challenging engineering problem for the team at the HITF.



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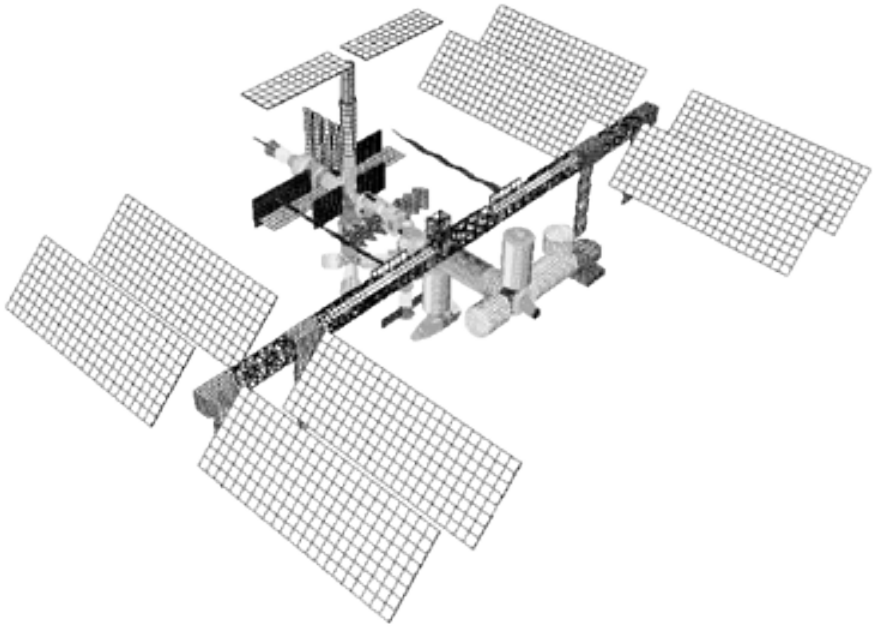
Finite Element Model

The HITF has created a 3D finite element model of the ISS which categorizes each different shield configuration used on the outer surfaces of the spacecraft. The model serves as input to the overall threat assessment. The shield properties contained in the model include thickness, material density, and spacing. The model is shown with radiators, solar arrays and trusses in place. The solar array & radiator elements are typically left out of risk assessments, while the trusses are left in for shadowing purposes (the trusses stand in the way of other more critical elements from being struck).



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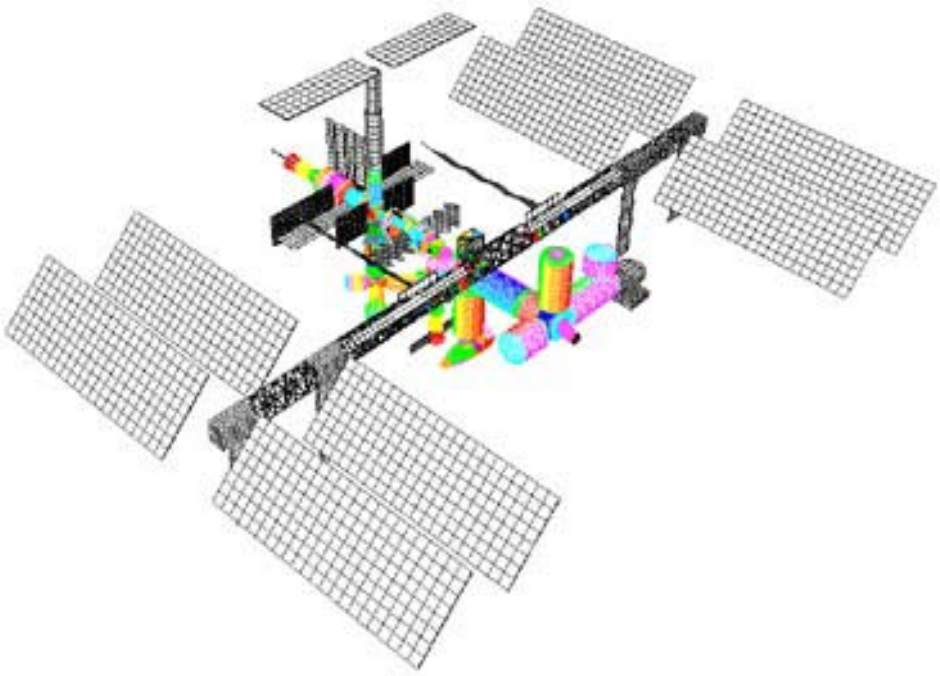
Assessment Parameters

Shield penetration risk is a function of many parameters. The Bumper code contains the current NASA meteoroid and orbital debris engineering model. This information is combined with the 3D ISS finite element model in order to determine the expected impacting particle size distribution, approach direction, and total quantity of surface impacts. Finally, the program computes the number of penetrating impacts based on the shield ballistic limit equations defined in the model.

Here is the QuickTime VR movie of the ISS at this stage of the analysis.



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The Results

The image shows the relative impact threat to different parts of the ISS. Red areas the most likely to be hit, while blue areas are the least. The picture illustrates the shadowing effects that the various ISS modules have on each other.