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SSRMS Case Study

The Space Station Remote Manipulator System (SSRMS), sometimes called Canadarm2, is a robotic system that had a rather difficult birth because of some errors in problem specification.

The SSRMS was originally intended to service any location in an envelope surrounding the entire core of the International Space Station. The original plan was to attach the robot to something similar to a railway car that would run on tracks on the outside of the station.

However, the station's exterior was so quickly covered by a variety of obstructions - all of which were essential to the workings of the station - that there was no clear path left down which to run the rails. So engineers at NASA conceived of an alternative: the robot, they thought, could be made to walk - end over end - a little like an inchworm, and attach itself to strategically located hubs on the station's exterior, which would provide structural stability, power, and data transfer.

For this to work, the robot would have to be symmetric about its length; that is, since its wrist could be a shoulder and its shoulder could be a wrist, as it "walked" down the length of the station core, the robot's wrist and shoulder would have to be structurally and functionally equivalent.

So NASA specified that, for instance, the motors in the wrist and in the shoulder had to be the same.

The contractors for the SSRMS, MDA (used to be Spar Aerospace, in Brampton, Ontario), received the requirements specification, but didn't understand them. Typically, and especially in space applications, the wrists of robots are much smaller and lighter than the shoulders, but this was not the case for SSRMS - and NASA had *not* informed MDA about the need to have the SSRMS walk end-over-end.

The resulting confusing took over two months to resolve. During this time, a number of designs and cardboard mockups were developed, none of which were satisfactory - *because the designers didn't really know what the problem was*.

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