Executive Summary

Design requirements for next generation hardware are in process at NASA. Anthropometry requirements are given in terms of minimum and maximum sizes for critical dimensions that hardware must accommodate. These dimensions drive vehicle design and suit design, and implicitly have an effect on crew selection and participation. At this stage in the process, stakeholders such as cockpit and suit designers were asked to provide lists of dimensions that will be critical for their design. In addition, they were asked to provide technically feasible minimum and maximum ranges for these dimensions. Using an adjusted 1988 ANSUR database to represent a future astronaut population, the accommodation ranges provided by the suit critical dimensions were calculated. This project involved participation from the Anthropometry and Biomechanics facility as well as suit designers, with suit designers providing expertise about feasible hardware dimensions and the ABF providing accommodation analysis. The initial analysis provided the suit design team with the accommodation levels associated with the critical dimensions provided early in the study. Additional outcomes will include a comparison of principal components analysis as an alternate method for anthropometric analysis.

Case Study Details

Participants included members of the Anthropometry and Biomechanics Facility (ABF): Sherry Thaxton, Karen Young, and Sudhakar Rajulu. Extra-Vehicular Activity (EVA) team members including Joe Kosmo and Dick Watson provided suit design input.

Problem Assessment

The Anthropometry and Biomechanics Facility (ABF) was contacted to provide expertise in defining anthropometry requirements for upcoming space hardware contracts. In order to provide anthropometry requirements, it is important to understand the implications in terms of hardware design. When suit designers indicated that designing suits to accommodate persons ranging from 1st percentile female to 99th percentile male in each critical dimension could cause technical and budgetary difficulties, the ABF provided information to describe the accommodation the suit team provided as feasible dimensions. This information will be taken into consideration in the definition of anthropometry requirements. Research is currently underway to compare the use of principal components analysis to the use of an entire population database. (This should be concluded in time to include in the conference presentation).

The initial analysis used a cumulative application of univariate anthropometric dimensions. A time-projected ANSUR database was compared against the dimensions successively to calculate the accommodation. Subsequent analysis (yet to be performed) will use principal component analysis to estimate accommodation. This will be considered as an alternate approach for anthropometric analysis.