[illegible]

With the professional experience and expertise of Kolm and Chilton brought to bear on the problem, in 1976 we were able to answer the most important single question about mass-drivers: Was the idea fundamentally sound and practical? Both experts were quite sure the answer was yes. Kolm suggested that we switch to an "axial" geometry for mass-drivers; in the axial case all the coils would be circular, and the drive forces could be higher. Both men were sure that my old calculations on bucket-acceleration were far too conservative; in their estimation we could achieve accelerations of several hundred gravities, shortening the length of the mass-driver accelerators.

In late 1976 and early 1977 I was able to devote a great deal of time to mass-driver research, under the best possible circumstances. I was on sabbatical leave from Princeton, and had accepted an invitation kindly extended by M. I. T. to become the Hunsaker Professor of Aerospace for that year. It was a great opportunity for close cooperation with Henry Kolm, and we worked together throughout the year, our locations at M. I. T. being only a block apart.

My main effort was on mass-driver theory. In completing the articles from the 1976 NASA study I worked out the optimization of masses, and so learned how best to design a mass-driver in order to get the highest performance with the lowest possible weight.

During the first semester of 1977, at the invitation of

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[illegible] Kolm and I designed an [illegible] driver almost as long as a [illegible] sony is appropriate for another reason: that is [illegible] not to be the hardest to bring [illegible] tion of it is of great quantities of [illegible] construction budget until months later, so in January 1977 we enlisted the unpaid volunteer help of a number of students,* and of a young post-doc, Bill Wheaton. Our materials were from the scrap-pile in Kolm's laboratory, supplemented by odds and ends like copper plumbing pipe, the brushes from an automobile starter motor, and capacitors of the kind photographers use in their flash-guns.

By early May the model was done, and we demonstrated it at the last of the seminars. Then it was brought to Princeton, and for the next several months traveled quite a bit. At Princeton it became the star performer at a large conference, and was photographed in action by several television crews. Then it was shipped to California, and climaxed the final briefing of a 1977 NASA study on space-manufacturing, at the Ames Research Center. From there it traveled to Los Angeles, and performed (flawlessly) before an audience of a thousand people, invited by Governor Jerry Brown to a celebration of "California in the Aerospace Age," on the day before the first free flight of the space-shuttle orbiter.

In the model, the bucket accelerated from zero to eighty miles an hour in a tenth of a second. Significantly, the acceleration in that first model was already higher than my