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# Users' Manual

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program and documentation © 1994 by Greg Lyzenga and Doug Wade

## Preface

I originally became interested in model rocketry as a junior high school student back in the mid-60's when public interest in space-related activities was approaching a peak. In that dim and distant past when pocket calculators would have seemed about as futuristic as a Star Trek transporter beam, predicting model rocket altitude performance was a remarkably tedious chore. Sweating away with

a slide rule and pencil and paper for twenty minutes would reward one with a single-stage answer good to perhaps one and a half digits. Multi-stage calculations took almost as much patience as searching for your favorite PD model in the middle of five acres of seven-foot-high corn! My friends and I were quick to realize that computers offered a solution to this problem, but at that time, running a computer program meant for us to hitch a ride to the University of Minnesota computer center, submit a punch card deck for an overnight batch job, and then sweat out the the wait until we could get another ride back. (Often this exercise would be only to learn that the deck had a missing card!)

In later years, as computers became more capable and easy to use, I would sometimes recall these earlier experiences, and wonder whether the time was ripe for another shot at the problem. Then came 1984 and the advent of Apple Computer's Macintosh. After seeing the Mac's highly interactive and intuitive user interface, I became convinced that this was the machine many of my unfulfilled projects had been waiting for. Since my interests in rockets and computing are spare-time pursuits, it took a couple of years for me to "get my act together". I finally did though, and the result is CompuRoc, a model rocket simulator for the Macintosh. I decided to offer CompuRoc for sale in the rocketry community in the hope that it might prove a helpful tool for others who have always wanted to ask those "what if . . ." questions about rocket performance, but were inhibited by the lengthy calculations as I was.

As is the case with many products, CompuRoc is a compromise among many competing factors that would make it more or less complicated, more or less powerful, more or less accurate, etc. I decided to release CompuRoc at the point when I thought it would be of use to a majority of users, but this does not mean that its development is frozen. To the extent that we get feedback from you, the user community, we'll try to upgrade the program.

It was in this spirit that in 1993, Doug Wade and I joined forces to produce the major upgrade that is CompuRoc 2.0. The new version retains all the features of the original 1.x versions, but adds a number of enhancements that were suggested by you, the users. Those of you that have used earlier versions will note that version 2.0 now supports printing, resizable windows, supersonic drag calculations, and a number of other interface and calculation enhancements. You should also note that old CompuRoc documents created with versions 1.x are not compatible with the new 2.0 format. As a result, if you are upgrading from an earlier version, you should not leave both the new and the old versions together on your disk, or confusion and problems will ensue!

In using CompuRoc, you should keep in mind what its intended purpose is. CompuRoc is by no means a "perfect" simulator, but even if it was, the simulations it delivered could be no better than the input parameters given it. In many cases, these aren't too well known a priori. A case in point is the drag coefficient. For most rockets the drag coefficient will be poorly enough known that the absolute altitudes determined by CompuRoc will be uncertain by many meters. This is a good deal less accurate than CompuRoc's "theoretical" accuracy of  $\pm 1$  meter. Similarly, commercial model rocket engines typically vary in total impulse by several percent from unit to unit, with the resultant variance in rocket performance.

So then, what good is all that computer accuracy? The main intended purpose of CompuRoc is to allow users to pose hypothetical questions about real or imaginary scenarios, and then to quickly answer and vary them. This should give the user the ability to gain insight into the solution, and to learn "hands on" whether the result is meaningful or not in the "real world". Therefore, what CompuRoc delivers that's most useful (in our opinion) are not just raw numbers (altitudes, velocities, etc.), but an ability to easily try out and compare different scenarios and gain an intuitive "feel" for the problem.

The documentation accompanying this release contains instructions and documentation to enable you to use CompuRoc fully. In addition to documenting all of the program's features and functions, there are several examples of CompuRoc calculations. These examples only scratch the surface of what can be done in optimization, competition, and R&D projects. We'd love hear from you about projects for which you've found CompuRoc useful. In the meantime, have fun and keep 'em flying!

Greg Lyzenga

NAR #13295

Doug Wade

NAR #51002