The Rocket Science Behind the Martin Space Rule and Handbook

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Context 1962

Batch computing

Small signs of personal computers

1962-02-20 John Glenn

(1 year after Gagarin)

1962-04-26 Lockheed A-12

Date	Place	Event
1960	USA EUR	**ALGOL, first structured, procedural, programming language to be released.**
1960	UK	Compiler compiler, first compiler compiler is released.
1961	USA	APL programming language released by Kenneth Iverson at IBM.
1961	USA	The AN/UYK-1 (TRW-130) computer was designed with rounded edges to fit through the hatch of ballistic missile submarines, as part of the first satellite navigation system, Transit.
1961	USA	Molecular Electronic Computer, first integrated circuits general-purpose computer (build for demonstration purposes, programmed to simulate a desk calculator) was built by Texas Instruments for the US Air Force.[4]
1962	UK	**ATLAS is completed by the University of Manchester team.** This machine introduced many modern architectural concepts: spooling, interrupts, pipelining, interleaved memory, virtual memory and paging. It was the most powerful machine in the world at the time of release.
1962	USA	Work begun on the LINC, the brainchild of the M.I.T. physicist Wesley A. Clark in May 1961. It was the first functional prototype of a computer scaled down to be optimized and priced for the individual user (about $43,600 - equivalent to $368,500 in 2019). Used for the first time at the National Institutes of Mental Health in Bethesda, Maryland in 1963, many consider it to be the first personal computer, despite the big dimension of some elements, e.g. the memory rack.[5]
1962	USA	**Spacewar!, an early and highly influential computer game, is written by MIT student Steve Russell.** The game ran on a DEC PDP-1, competing players fired at each other's space ships using an early version of joystick.
1963	USA	**Mouse conceived by Douglas Engelbart**[*citation needed*] The Mouse was not to become popular until 1983 with Apple Computer's Lisa and Macintosh and not adopted by IBM until 1987 – although compatible computers such as the Amstrad PC1512 were fitted with mice before this date.

Wikipedia: https://tinyurl.com/yy5oprdh

Your *Martin Space Rule* is an instrument specifically designed to aid the student of astronautics and the skilled engineer in solving preliminary design problems that are most frequently encountered in several space flight technological areas.

The only prerequisites for the use of the *Rule* are a familiarity with the basic slide rule and a rudimentary understanding of rocketry.

Your *Martin Space Rule* was originally conceived by Michael Stoiko and subsequently developed to its present status jointly with Werner Furth. Both men are engineers at Martin's Space Systems Division.

The Authors - Selected Highlights

Michael Stoiko (1919-2010)

- WW-2 Marine aviator
- Aerospace engineer
- Authored 12 books on rocketry
- Advocated international cooperation in space
- Led the Advanced Space Vehicle team at Martin (later Lockheed Martin)
- Worked on the Gemini space program

-F. N. Rasmussen, The Baltimore Sun, 2010

Werner Furth (1930 – 2012)

- Engineer at Martin's Space Systems Division
- Worked on energy systems at Martin Marietta
- Lead author on a Martin Marietta Environmental Energy Plan

-WorldWideScience.org

The Authors - Who were they?

Michael Stoiko

Nothing can keep man from exploring space; the trend in history is unmistakenly toward interplanetary travel.

-Michael Soiko, Soviet Rocketry, 1970

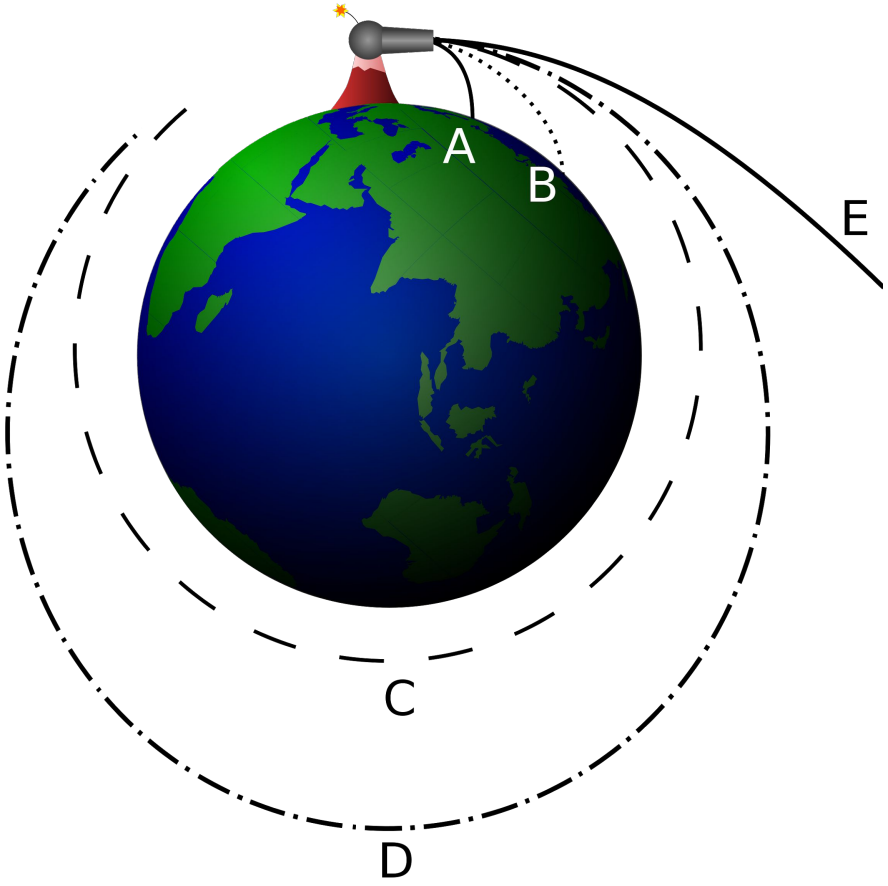
Werner Furth

A brilliant mind, coupled with a keen sense of humor, witty poems, equations on the blackboard, ink stains on his shirt, cigar ashes everywhere, his slogan of "Furth things first…." -Anne Torres, remembrance, 7/23/2012

Planets “suck”

Newton’s Cannonball

Leaving the atmosphere is expensive



https://en.wikipedia.org/wiki/Orbit

It’s All About Velocity

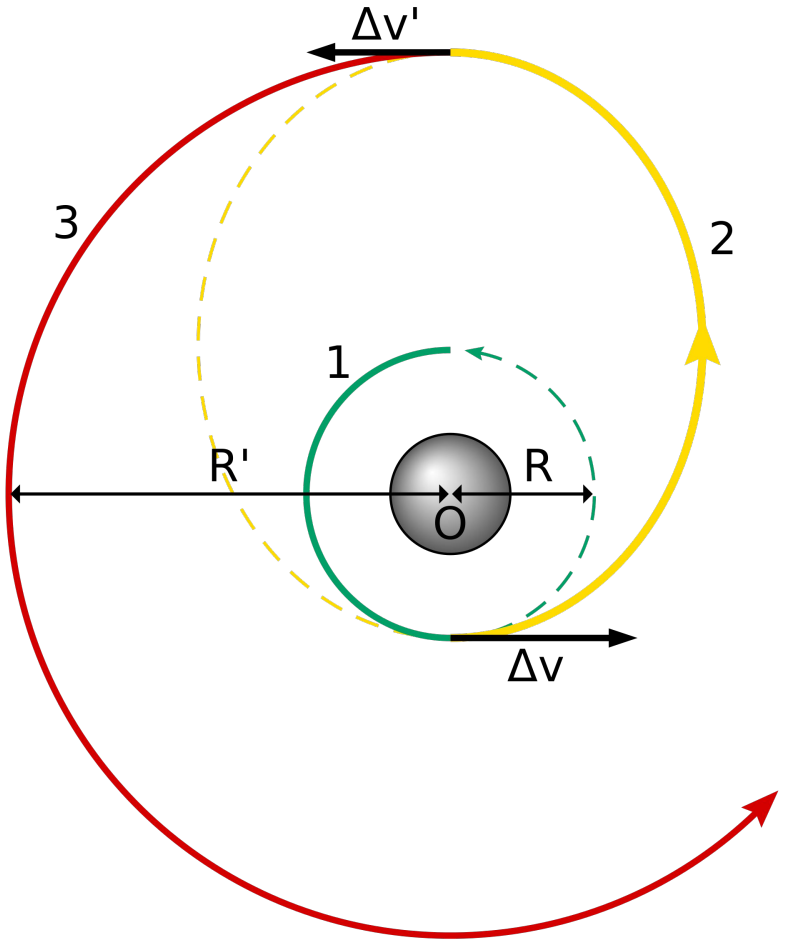
Efficiency is crucial

Sadly, no “space drives”...

Earth’s rotation can help or hurt

Earth’s orbit around the Sun can help or hurt

“Characteristic Velocity” is a total “cost” of a mission



https://en.wikipedia.org/wiki/Hohmann_transfer_orbit

Big Rockets...

Tsiolkovsky rocket equation:

$$dV = Isp\ G0\ \ln(m0 / mf)$$

Is the change in velocity from expending propellant and depends upon the efficiency of the propellant.

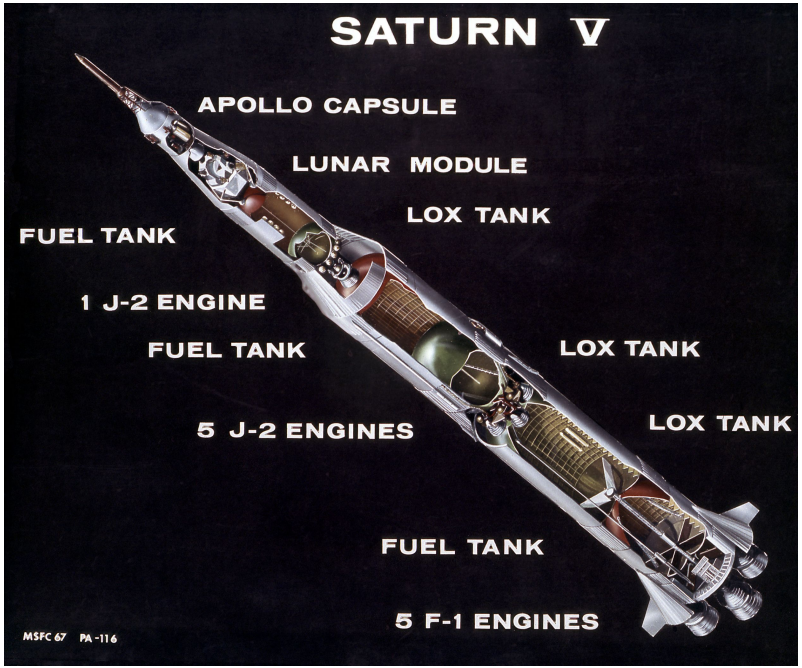
Isp is “specific impulse” efficiency

G0 is gravitational constant of ~9.8m/s^2

M0 is initial mass

Mf is final mass

- Space Shuttle SRB: 250
- Shuttle Main Engine: 450
- Nuclear Thermal: 850
- Ion Thruster: 3000
- VASIMIR: 12000



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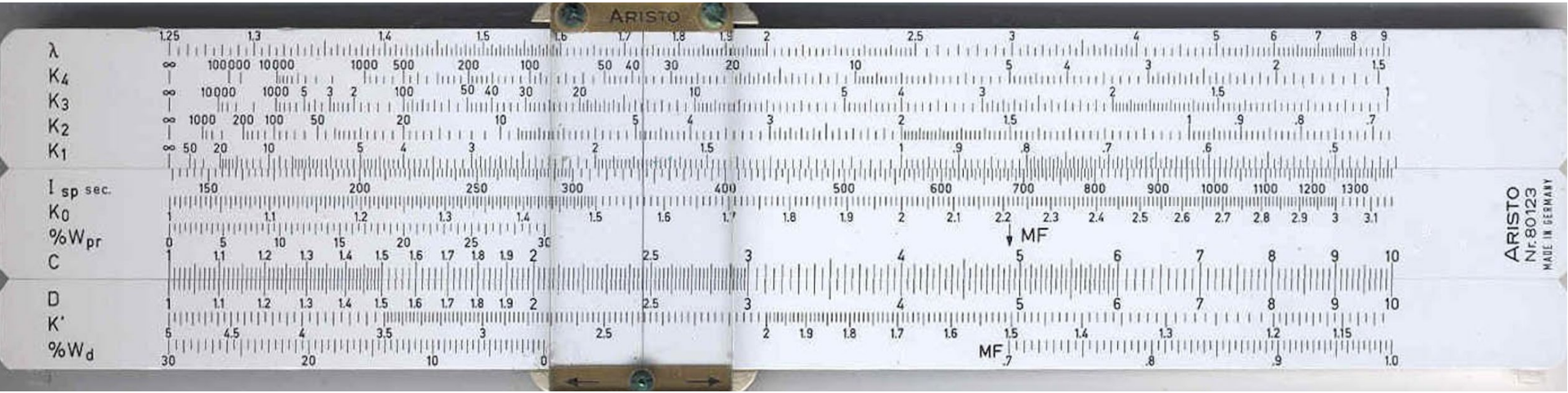
https://www.sliderulemuseum.com/Aristo/Aristo_80123_MartinSpaceRule_1962_RodLovetteCollection.jpg

The Front Scales

Conventional C and D with slide front

Mass fraction and booster design on front

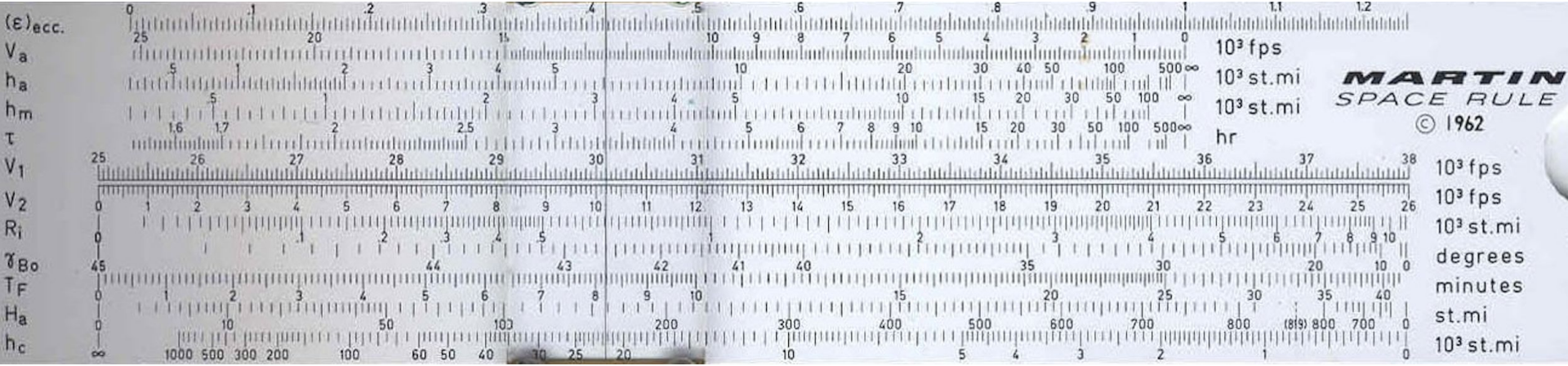
Up to four stages



The Back Scales

Earth orbit scales on back (mostly) top

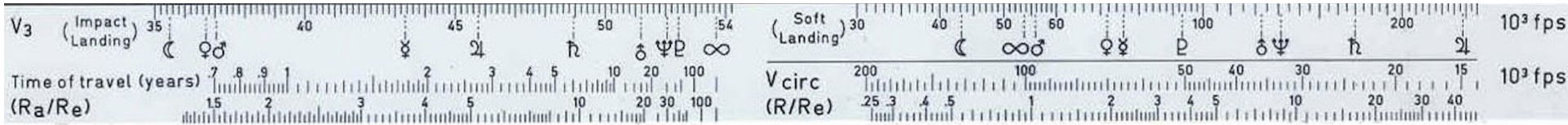
Ballistic missile “exterior ballistics” scales on back bottom



The Slide Back Scales

Interplanetary scales on the slide back

Soft and hard landings!



Gutter has useful reference information

Planet	MERCURY ☿	VENUS ♀	EARTH ⊕	MARS ♂	JUPITER ♃	SATURN ♄	URANUS ♅	NEPTUNE ♆	PLUTO ♇
Escape Vel. (fps)	13,650	33,850	36,700	16,730	200,000	119,100	69,900	76,800	34,500
Radius (st. mi)	1,550	3,846	3,963	2,060	43,480	35,800	15,790	15,545	4,300

The Handbook

1962

Tutorial format, but assumes some background

Lots of examples

CONTENTS

References About the Authors

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Questions?

https://www.ssl.berkeley.edu/~marchant/