

Civil Air Patrol



Advanced Rocketry

Gary A. Dahlke, Lt Col, CAP
Director, Aerospace Education
Florida Wing
Rocketry Coordinator
CAP National Staff

CITIZENS SERVING COMMUNITIES



Why "Advanced" Rocketry?

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Two examples of advanced rocketry projects—quite possible through the mentorship of motivated, competent, and experienced AEOs.

CAP's advanced rocketry program can put cadets on a path to undertaking projects such as these.



STEM

- Middle & High School: NAR/AIA Team America Rocketry Challenge
- College
 - NASA Student Launch
 - ESRA Spaceport America Cup
 - SEDS University Student Rocketry Competition
 - Senior Design Projects



Highlights of "*Stage IV*"

- Introduction to Composite Propellant
- Dynamics and Forces of Advanced Propulsion
- Advanced Construction Techniques
- Suggested Mid-Power Kits/Manufacturers
- Criteria for Completion
 - understand concepts (test)
 - demonstrate competence (flight)

(handbook will cover all of the above-mentioned items)



Rocketry Categories

- Low Power: D and below (CAP Rocketry Stages 2 & 3)
- Mid Power: E-G (CAP Rocketry Stage 4)
- High Power: H and above (CAP Rocketry Stage 5)

Note that the CAP advanced rocketry program only permits cadets age 14-17 to fly rockets on H & I motors under supervision as part of Stage 5. Once cadets turn 18, NAR* considers them adults and will then lift the adult supervision restriction as well as allow them to certify on more powerful motors if they so choose.



Impulse (Power) Classifications

Class	Impulse Range (Ns)	Class	Impulse Range (Ns)
¼ A	0.3125+ to 0.625	H	160+ to 320
½ A	0.625+ to 1.25	I	320+ to 640
A	1.25+ to 2.5	J	640+ to 1280
B	2.5+ to 5.0	K	1280+ to 2560
C	5.0+ to 10.0	L	2560+ to 5120
D	10.0+ to 20.0	M	5120+ to 10240
E	20.0+ to 40.0	N	10240+ to 20480
F	40.0+ to 80.0	O	20480+ to 40960
G	80.0+ to 160.0		

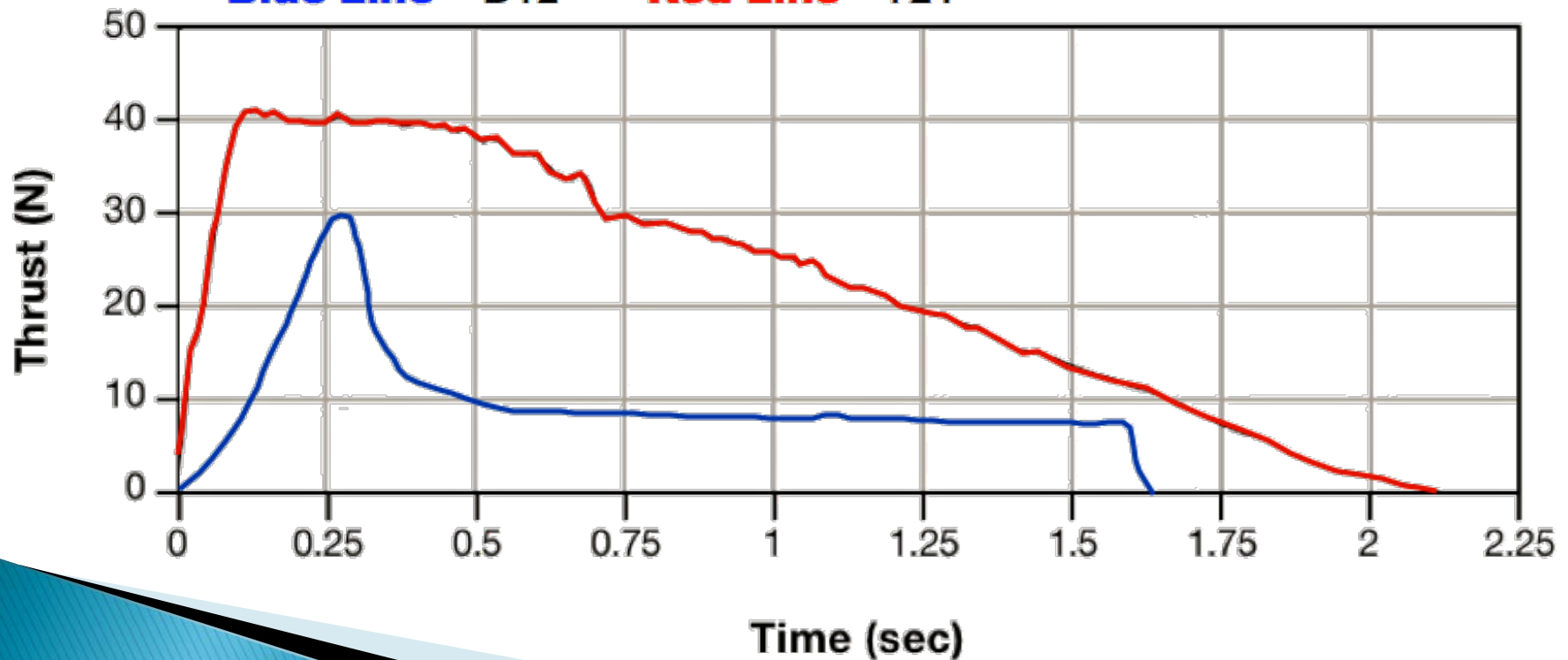
Stage IV

Propellant and Power Comparison



Blue Line = D12

Red Line = F24





Highlights of "Stage V"

- Introduction to High Power Rocketry (HPR)
- Introduction to Reloadable Motor Systems (RMS)
- High-Power Rocketry Safety Code
- Criteria for Completion (which will result in NAR Jr.

Level 1 High Power Certification)

- understand concepts (test)
- demonstrate competence (flight)

(handbook will cover all of the above-mentioned items)



Stage V

Intro To Reloadable Motor Systems (RMS)

Aerotech RMS

Reloadable Motor Parts

Motor Casing





Stage V

Intro To Reloadable Motor Systems (RMS)

CTI Pro29 Reloadable Motor Parts

Propellant Reload



Reusable Aluminum Casing

Motor "Closure"

Propellant Igniter

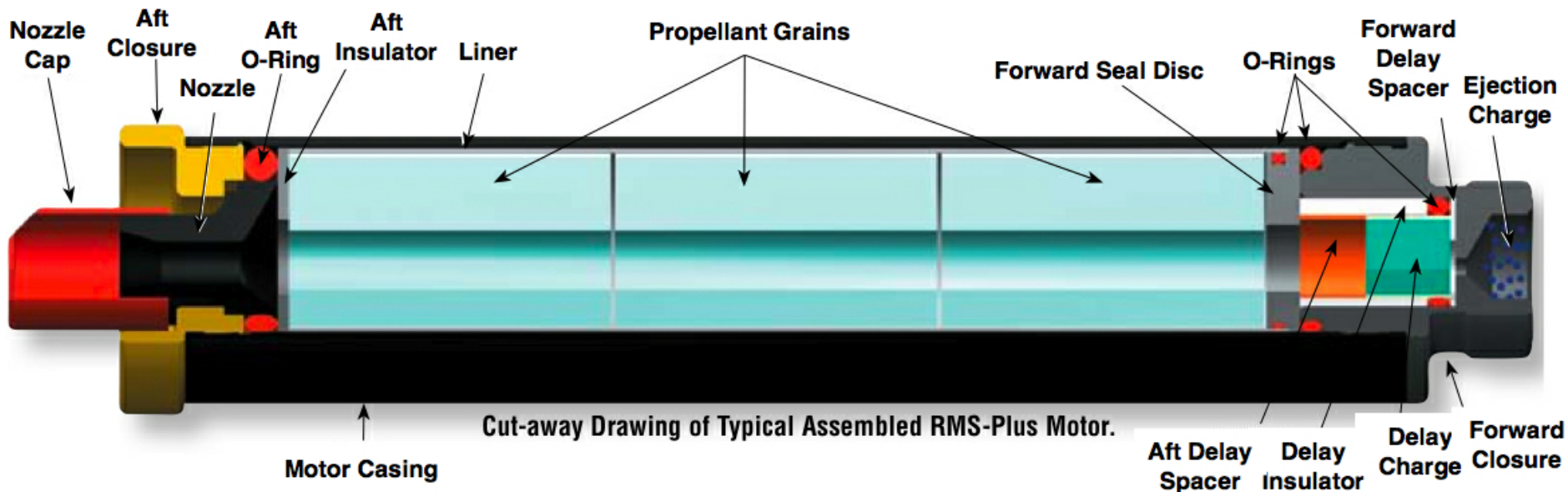


Stage V

Intro To Reloadable Motor Systems (RMS)

Aerotech RMS:

Cutaway of All the Parts Put Together...



Costs

- ▶ ~~\$55~~ \$28 Rocket
- ▶ \$15 Mid Power Motor
- ▶ \$20 High Power Motor
- ▶ \$25 NAR Membership

▶ ~~\$115~~ \$88 TOTAL

Notes:

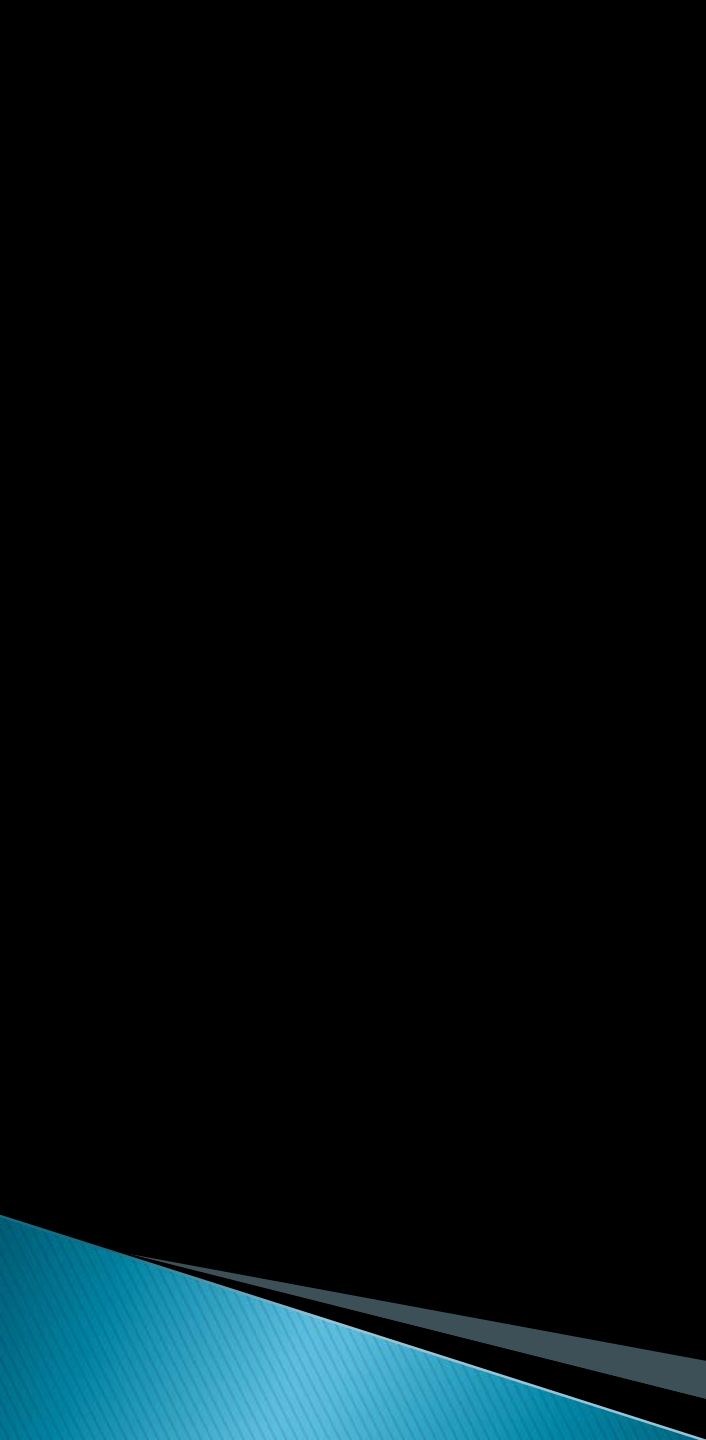
A squadron could share in the cost of purchasing a single reusable motor casing for use by all cadets.

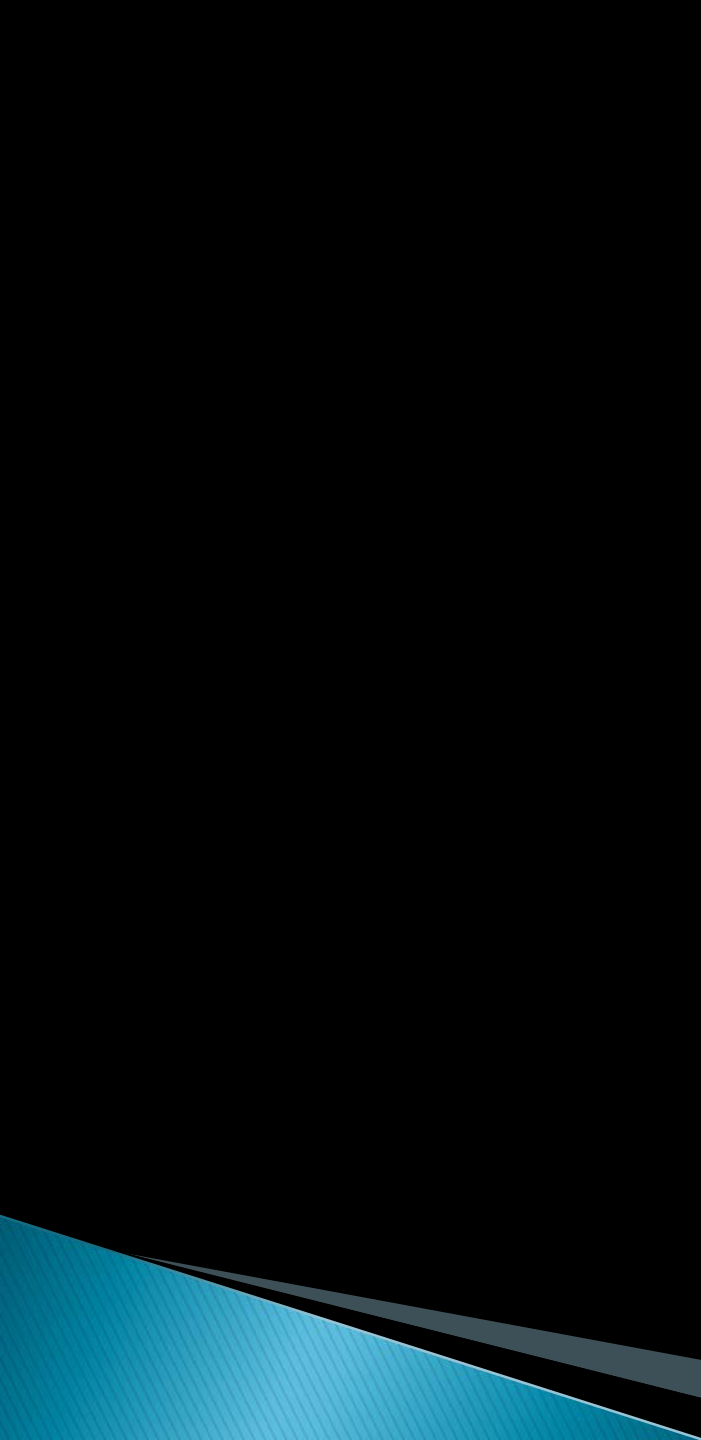
An additional cost would be the annual membership in a local HPR club which can vary between \$10 and \$40.

Advanced rocketry
project undertaken by
cadets from the 267th
Composite Sq
(Titusville/Cocoa FL)

Rocket exceeded Mach
1 and was successfully
recovered











Competitions

- ▶ Team America Rocketry Challenge (TARC)
www.nar.org
- ▶ NASA Student Launch (HS & College Levels)
www.nasa.gov

Useful Internet Links

- ▶ National Association of Rocketry
www.nar.org
 - ▶ Tripoli Rocketry Association
www.tripoli.org
 - ▶ Rocketry Information
www.flyrockets.com
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