Gateway – Project Management Webinar

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Blue Origin Engineer, FNL Assistant

ARTEMIS STUDENT CHALLENGES
nasa.gov/stem/artemis.html

NASA Partner

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Webinar Overview

- Challenge Overview / Expectations
  - Challenge Details / Milestones
  - RockSim
  - Flysheets
  - Virtual Presentations
- Project Management
  - Scheduling
  - Budgeting
  - Procurements
  - Requirements

Challenge Overview

Challenge Overview

- Gateway Challenge is a 1-semester Introduction to Rocketry
  - A stepping-stone to the Moon and Mars Challenges
    - Need rocketry to successfully compete in engineering challenges
    - You will select and build a dual deploy rocket in Gateway
- Gateway will introduce Project Management concepts
  - Project Management (PM) is used in Moon and Mars Challenges
    - Scheduling / Budgeting
    - Procurement
    - Testing / Requirements

Challenge Overview – Kit / Motor Selection

- Gateway Challenge requires you to select 1 of 3 rocketry kits
  - Not an arbitrary selection (see Appendix A5 of Handbook)
- Gateway Challenge requires you to select 1 of 2 motors
  - For each kit - choice of 2 motors (see Appendix A1 of Handbook)
    - Each kit motor combination has different performance
- Required to use RockSim simulation software
  - Required to run simulations for all possible kit / motor combinations
    - Simulations help determine which kit you want to select
    - See Appendix D3 of Handbook for RockSim Guidance

Challenge Overview – Kit / Motor Selection

APPENDIX A-1 – First Nations Launch 2024 Motor Choices

For the 2024 First Nations Launch Challenge, the motor selections are constrained to:

Gateway Challenge Motors

Kit	Manufacturer	Size	Type	Motor
YANK Iris	Aerotech	38mm	DMS	I280, I500T
EZI 65	Aerotech	38mm	DMS	I140W, I175WS
Mystic Buzz	Aerotech	38mm	RMS	I366R, I435T

Moon Challenge Motors

APPENDIX A-5 – First Nations Launch Competition Kits

Gateway Challenge

The Gateway category must select a kit from the following list:

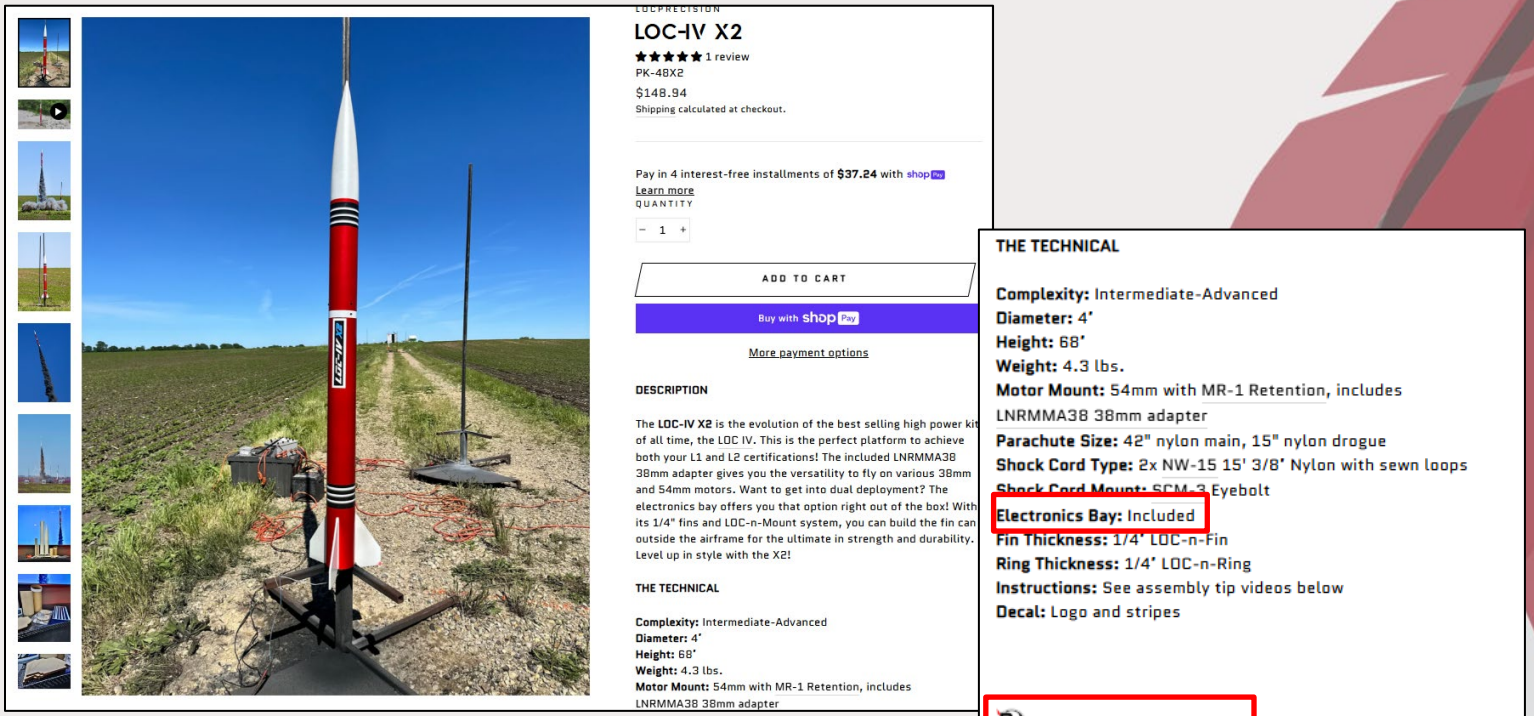
1. Loc Precision YANK Iris – 4" diameter.
    a. https://locprecision.com/collections/rockets-4-00-diameter/products/yiris4
        i. SKU: YIRIS4
    b. When ordering, remember to include the following additional components:
        i. E-bay module
        ii. 38mm motor adapter
    c. RockSim file is available on their website
    d. Motor options:
        i. Aerotech 38mm I280 DMS
        ii. Aerotech 38mm I500T DMS
2. Loc Precision - 4" diameter "EZI 65"
    a. https://locprecision.com/collections/rockets-4-00-diameter/products/ezi-65
        i. SKU: PK-64
    b. When ordering, remember to include the following additional components:
        i. E-bay module
        ii. 38mm motor adapter

*From the Gateway Competition Handbook

Challenge Overview – Kit Selection

- There are numerous kit manufacturers in Rocketry
  - For Gateway however, kits from 1 manufacturer (LOC Precision)
    - Kit Option 1 – Fantom 438 (PK-50)
    - Kit Option 2 – Patriot 4” (YPAT438)
    - Kit Option 3 – LOC-IV X2 (PK-48X2)
  - You will need to also add an Avionics Bay component:
    - In simulation – simulation files may not have avionics bay
    - In procurement – kits will have an ‘optional’ avionics bay
    - This component will turn your Kit choice into a Dual Deploy
      - Also called an Electronics Bay

Challenge Overview – Kit Selection



LOC PRECISION

LOC-IV X2

★★★★★ 1 review

PK-48X2

$148.94

Shipping calculated at checkout.

Pay in 4 interest-free installments of **$37.24** with shop Pay

Learn more

QUANTITY

− 1 +

ADD TO CART

Buy with shop Pay

More payment options

DESCRIPTION

The **LOC-IV X2** is the evolution of the best selling high power kit of all time, the LOC IV. This is the perfect platform to achieve both your L1 and L2 certifications! The included LNRMMA38 38mm adapter gives you the versatility to fly on various 38mm and 54mm motors. Want to get into dual deployment? The electronics bay offers you that option right out of the box! With its 1/4" fins and LOC-n-Mount system, you can build the fin can outside the airframe for the ultimate in strength and durability. Level up in style with the X2!

THE TECHNICAL

Complexity: Intermediate-Advanced
Diameter: 4"
Height: 68"
Weight: 4.3 lbs.
Motor Mount: 54mm with MR-1 Retention, includes LNRMMA38 38mm adapter

THE TECHNICAL

Complexity: Intermediate-Advanced
Diameter: 4"
Height: 68"
Weight: 4.3 lbs.
Motor Mount: 54mm with MR-1 Retention, includes LNRMMA38 38mm adapter
Parachute Size: 42" nylon main, 15" nylon drogue
Shock Cord Type: 2x NW-15 15' 3/8" Nylon with sewn loops
Shock Cord Mount: SCM-3 Eyebolt
Electronics Bay: Included
Fin Thickness: 1/4" LOC-n-Fin
Ring Thickness: 1/4" LOC-n-Ring
Instructions: See assembly tip videos below
Decal: Logo and stripes

LOC-IV X2 ROCKSIM FILE

From Vendor Website (last kit example)

Challenge Overview – Avionics Bay

From Vendor Website (generic example)

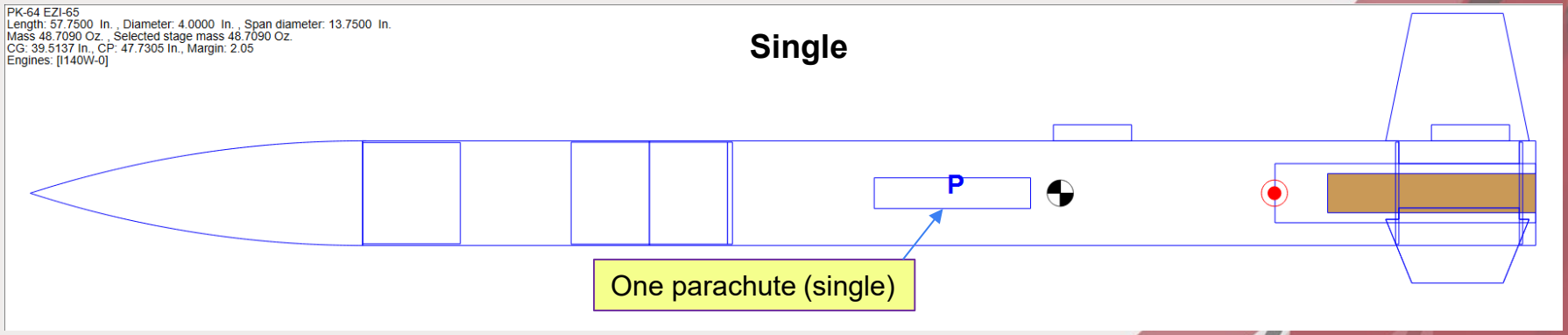
Also called ‘Electronics Bay’

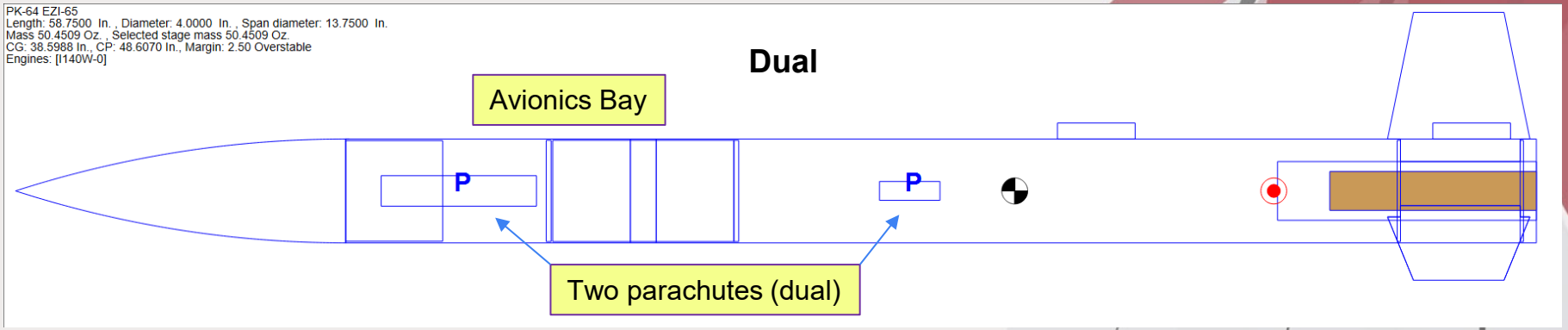
Single vs Dual Deployment

Challenge Overview – Single vs Dual

- Single vs Dual Deployment Configuration
  - Basic kits (L1) are designed with 1 parachute (single deploy)
    - Parachute uses a delay fuse to eject (no electronics needed)
  - Advanced kits (L2+) are designed with 2 parachutes (dual deploy)
    - Parachutes use electronics (altimeters) for parachute eject
      - Drogue parachute prevents drift at higher altitude
      - Main parachute slows descent for a safe landing
  - Moon / Mars always use dual deploy configuration
    - Gateway must also use dual deploy configuration
    - L2L Workshop teaches *single deploy* (do not get them confused)

Challenge Overview – Single vs Dual





Challenge Overview – Avionics Bay for Dual

- Many COTS kits you see online are **single** deploy configured
  - You can convert to dual - simply purchase the additional components
- Gateway teams (new to rocketry teams) have made this mistake and not converted to the dual deploy configuration properly
  - Make sure you understand what you need to do to accomplish this
  - Ask! We can help! Your mentor can help!
  - The Milestone Review intent is to capture potential errors

Challenge Expectations

Challenge Overview - Handbook

- Primary source of Expectations / Guidance is:
  - The Gateway Competition Handbook
- Secondary sources of information are:
  - The Advisor Handbook
  - The WSGC FNL Website
  - The Moon / Mars Handbooks (for reference)
    - Much of the same information but expectations are greater

Challenge Overview - Milestones

- In any engineering project there are Milestones
  - These are incremental points where the project should meet partial objectives before proceeding to the next Milestone

- Your Milestones are (they align with Moon Mars Milestones):
  - Preliminary Design (Jan 22) — Initial concepts / initial components
  - Critical Design (Feb 26) — Mature design / all components
  - Flight Readiness (Apr 1) — Vehicle is fully fabricated ready for flight
  - Competition Launch (Apr 29) — Competition Flight

Challenge Overview – Data Submission

- At each Milestone, you will submit:
  - RockSim File
    - Simulation of your rocket showing components and performance
  - Flysheet
    - Summary simulation performance data (component selections)

- At each Milestone, you will give a Virtual Presentation:
  - Fill out a Virtual Presentation Template
    - Allows us to give you feedback after the Presentation

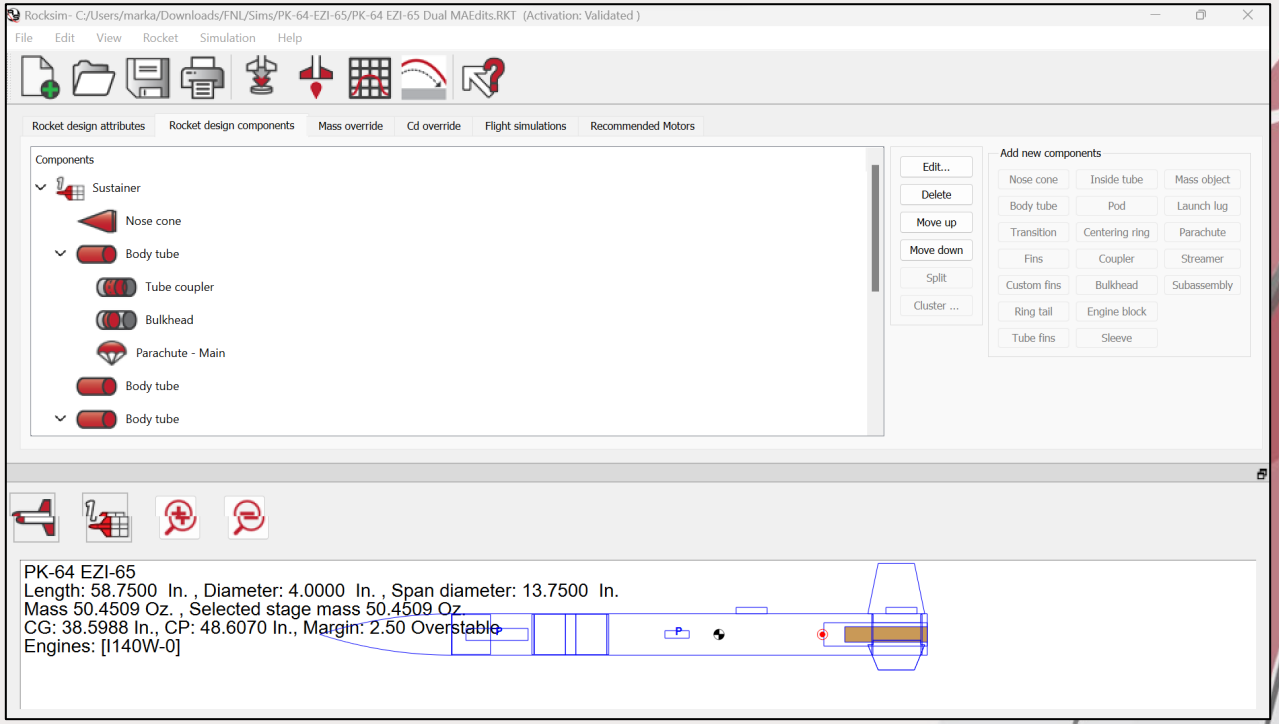
RockSim

RockSim Simulations

- Required to procure / utilize RockSim as rocket simulation software
  - Guidance how to procure RockSim in your Acceptance Letter
    - Install and use a 30-day RockSim trial in the meantime
  - Guidance how to install and tips in Appendix D-3 Handbook
  - Technical guidance in FNL RockSim Webinar Tools and Tips
  - Technical guidance in FNL Rocketry Video Series
  - RockSim support on their website at Apogee Components

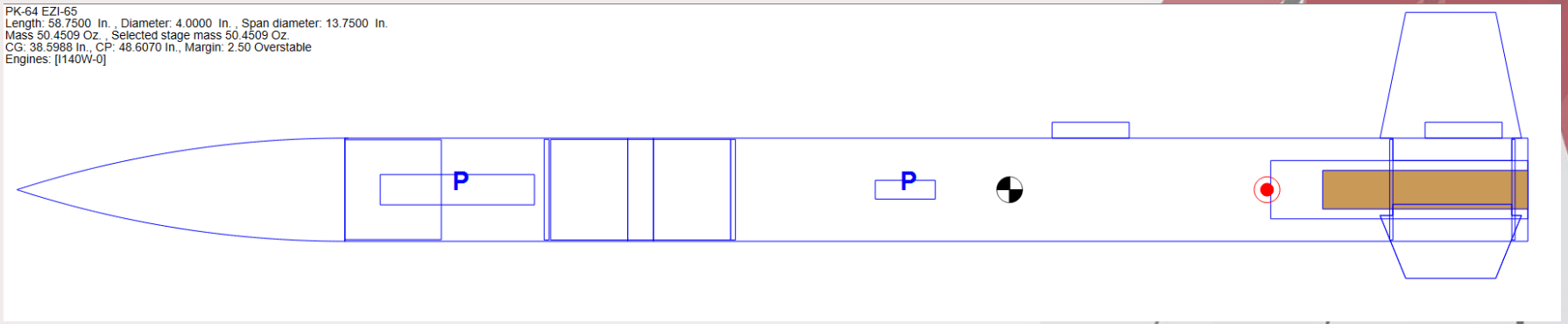
- RockSim - understand flight performance of your vehicle prior to launch
  - Modify design to achieve performance goals

RockSim Simulations



RockSim Simulations

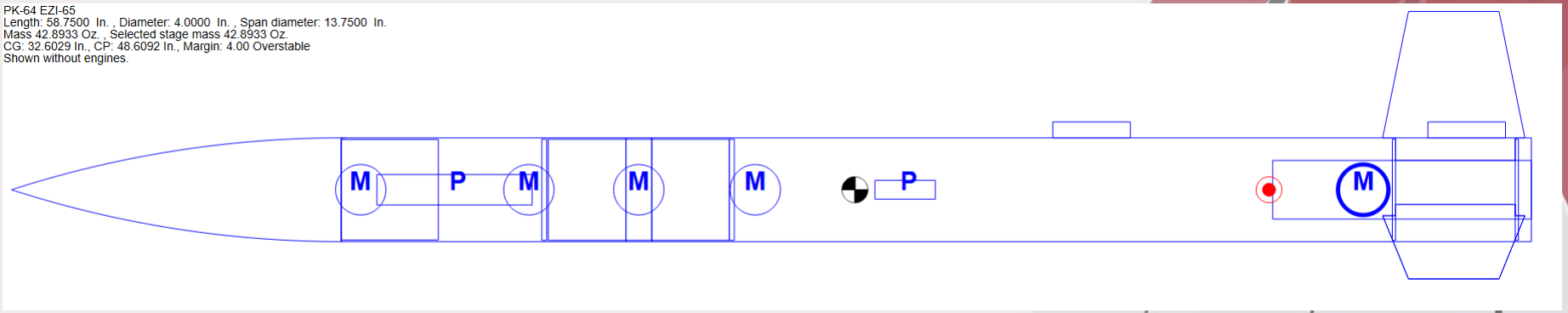
- Kit / motor selection RockSim model may be ‘empty’ at first
  - Typically download the RockSim file from vendor
  - Can add components week by week – as project progresses
    - Verify that the simulation represents what you intend to build
    - Don’t assume the downloaded file is complete / accurate



*basic file, note it is missing many components

RockSim Simulations

- Kit / motor selection RockSim model may be ‘empty’ at first
  - RockSim file will mature over time until all components are determined
    - Rocket meets performance goals (altitude, rail exit velocity, descent rate, etc.)
  - Ensure simulation accounts for all internal components that you will add
    - The TOTAL weight is very important to performance



*improved file, note it has more components (more accurate)

RockSim Simulations

LOCPRECISION

4" PATRIOT

★★★★★ 3 reviews

YPAT438

$115.16

Shipping calculated at checkout.

SELECT YOUR TRIM LEVEL

- (•) LOC CARDBOARD AIRFRAME + 1/8" BIRCH PLY FINS + 38 MMT
- ( ) PML QUANTUM AIRFRAME + .06" G-10 FIBERGLASS FINS + 38 MMT (+$34.24)

SELECT YOUR RECOVERY

- (•) LOC 36" PARACHUTE (STANDARD)
- ( ) PML 48" MULTI-PANEL DURA-CHUTE (+ $16.05)

SELECT YOUR ELECTRONICS BAY

- (•) NONE (STANDARD)
- ( ) LOC STYLE EBAY - INCLUDES DROGUE CHUTE AND EXTRA SHOCK CORD (+$53.50)

Pay in 4 interest-free installments of **$28.79** with shop Pay

Learn more

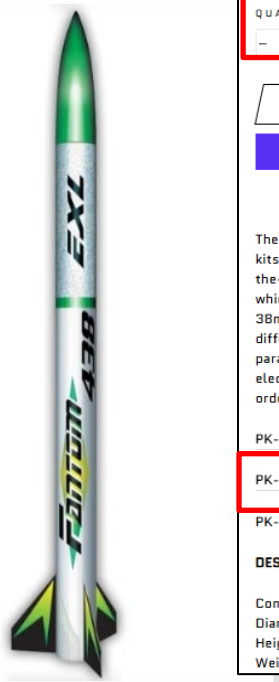
QUANTITY

− 1 +

ADD TO CART

Buy with shop Pay

More payment options



LOCPRECISION

FANTOM 438

PK-50

$123.28

Shipping calculated at checkout.

Pay in 4 interest-free installments of **$30.82** with shop Pay

Learn more

ADD E-BAY AND ALTI-PACKAGE (EXL)

No | Yes

QUANTITY

− 1 +

ADD TO CART

Buy with shop Pay

More payment options

The LOC Precision Fantom is one of the ADVANCED SERIES of kits, which include factory pre-slotted airframe and through-the-wall fin construction, Add the options for the FANTOM EXL which include an electronic "Multi Stage Deployment" kit with a 38mm motor mount. The FANTOM will accept a number of different composite motors. The EXL model includes a second parachute and shock cord set and our exclusive EB-3.9 electronics bay. The EXL is excellent for level 2 certification or order the standard kit for level 1 certification choice!

PK-51 Fantom EXL Instructions

PK-51 Fantom EXL Rocksim

PK-50 Fantom Instructions

DESCRIPTION

Complexity: Intermediate-Advanced
Diameter: 4'
Height: 47'/64" EXL
Weight: 2lbs/4.5lbs EXL

Flysheets

Flysheets

- Download Flysheet Template from WSGC Website each Milestone
  - Scoring Rubric | Wisconsin Space Grant Consortium | Carthage College
- Each Milestone requires more information to be filled out in the Flysheet
  - Little steps at first - to prevent information overload
  - Learn rocketry incrementally - there is a lot to learn
  - Allows us to see your progress by reviewing your Flysheet

Templates and Scoring Rubric

Challenge Deliverables and Templates Matrix

The overall competition scores are derived from percentages listed in Moon and Mars milestones. Education Outreach provides bonus points toward the overall scoring.

Milestone Associated Due Date	**Gateway**	**Moon**	**Mars**
Proposal October 24, 2024	N/A	Proposal Report (5%)	Proposal Report (5%) Proposal Flysheet Proposal RockSim
Preliminary Design Review (PDR) December 2, 2024	N/A	PDR Report (15%) PDR Flysheet PDR RockSim PDR Virtual PPT (5%)	PDR Report (15%) PDR Flysheet PDR RockSim PDR Virtual PPT(5%)
Critical Design Review (CDR) January 27, 2025	CDR Flysheet CDR RockSim CDR Virtual PPT Budget	CDR Report (15%) CDR Flysheet CDR RockSim CDR Virtual PPT (5%)	CDR Report (15%) CDR Flysheet CDR RockSim CDR Virtual PPT (5%)
Flight Readiness Review (FRR) March 17, 2025	FRR Flysheet FRR RockSim FRR Virtual Education Outreach Forms	FRR Report (15%) FRR Flysheet FRR RockSim FRR Virtual (5%) Education Outreach Forms (+10%)	FRR Report (15%) FRR Flysheet FRR RockSim FRR Virtual (5%) Education Outreach Forms (+10%)
Launch Weekend April 21, 2025	LW Oral PPT	LW Oral PPT (5%)	LW Oral PPT (5%)
Launch Weekend: Flight Performance April 26-27, 2025		Mission Performance (10%) Challenge Performance	Mission Performance (10%) Challenge Performance

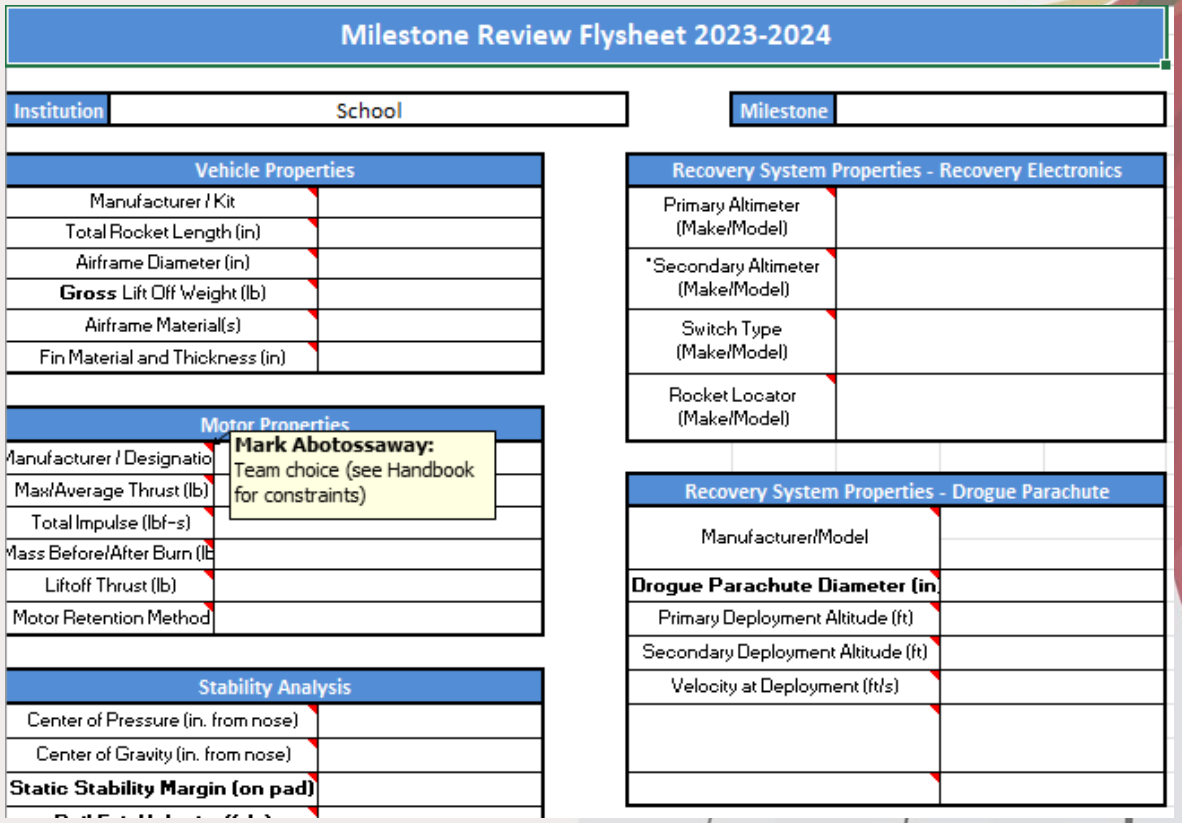
Flysheets

Each parameter (cell that is not blank) must be filled out

There is a comment (by me) in each parameter cell giving a hint how to find the data to fill it out that value

Some of this data is from:
- Team's component selection
- RockSim data
- A website

The **bold** parameters have a required value to them (see Handbook)



Milestone Review Flysheet 2023-2024

Institution	School	Milestone	

Vehicle Properties	
Manufacturer / Kit	
Total Rocket Length (in)	
Airframe Diameter (in)	
Gross Lift Off Weight (lb)	
Airframe Material(s)	
Fin Material and Thickness (in)	

Motor Properties	
Manufacturer / Designatio	
Max/Average Thrust (lb)	
Total Impulse (lbf-s)	
Mass Before/After Burn (lb	
Liftoff Thrust (lb)	
Motor Retention Method	

Mark Abotossaway:
Team choice (see Handbook for constraints)

Stability Analysis	
Center of Pressure (in. from nose)	
Center of Gravity (in. from nose)	
Static Stability Margin (on pad)	

Recovery System Properties - Recovery Electronics	
Primary Altimeter (Make/Model)	
*Secondary Altimeter (Make/Model)	
Switch Type (Make/Model)	
Rocket Locator (Make/Model)	

Recovery System Properties - Drogue Parachute	
Manufacturer/Model	
Drogue Parachute Diameter (in	
Primary Deployment Altitude (ft)	
Secondary Deployment Altitude (ft)	
Velocity at Deployment (ft/s)	

Presentations

Virtual Presentation

- At CDR and FRR you will give a Virtual Presentation of your status
  - Wait until first Milestone to begin procurements
  - Summarize your progress to date
    - Show us you have worked on simulations, researched components etc.
- Virtual Presentation can be considered practice
  - Final presentation of your teams work at Launch Weekend
- Native Engineering Professionals (along with Mark & Frank) will be your audience and give feedback at your presentations

Virtual Presentations

- Download Virtual Template from WSGC Website each Milestone
  - Scoring Rubric | Wisconsin Space Grant Consortium | Carthage College
- Each Milestone requires more information to be filled out
  - Baby steps at first, to prevent information overload
  - Allows team to learn rocketry incrementally
  - Allows us to see your progress by reviewing your Presentation

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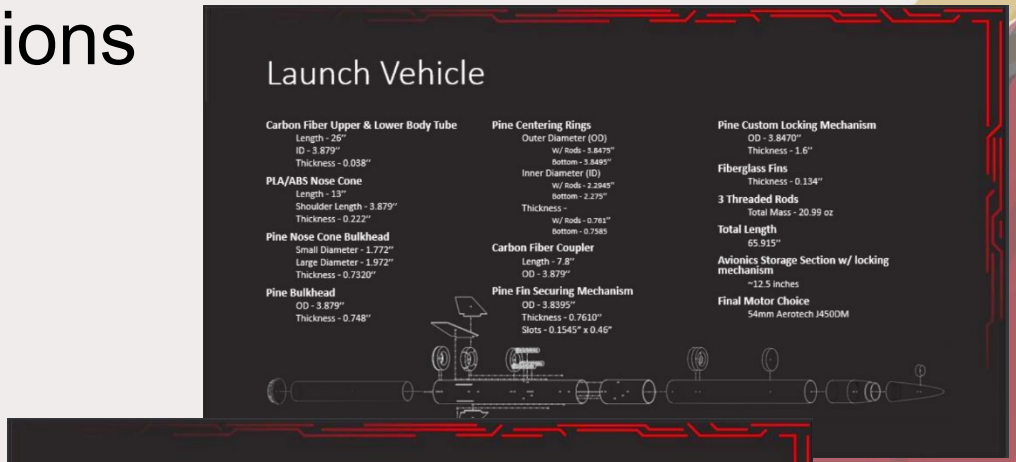
Virtual Presentations

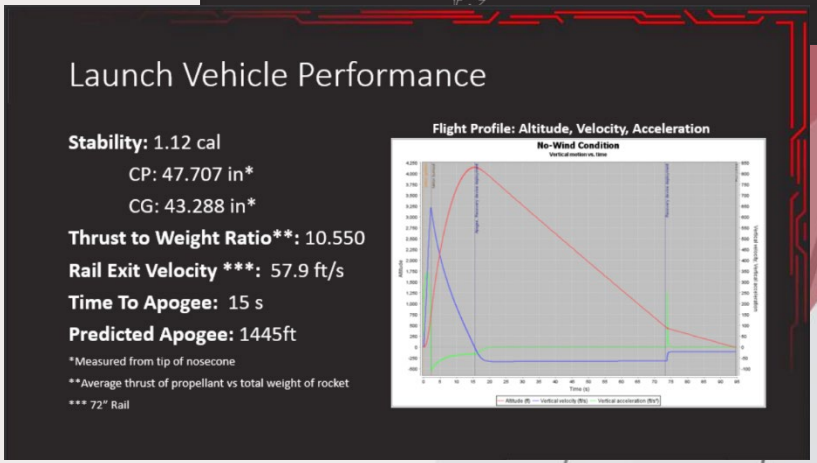
Template has about 10 slides – your present for 15 min

Fill out the content that the template slide asks for

Much of the presentation information comes from your RockSim data and your component selections

You will talk about:
- Kit / Motor you selected
- Recovery components
- Avionics components
- Test Program
- Schedule / Budget





Project Management

Project Management

- Project Management is a big part in success (or failure) of any Project
  - Project Management is
    - Scheduling
    - Budgeting
    - Procurement
    - Training
    - Simulations
    - Test Plan
    - Requirements Verification

Project Management - Scheduling

- Will need to create, update and submit a Schedule
  - It is important to have a plan (subtasks)
  - Scoring Rubric | Wisconsin Space Grant Consortium | Carthage College
- Begin with 3 Milestones for scheduling
  - CDR -> FRR -> Launch Weekend
  - Must ‘create’ intermediate goals / tasks to finish the Project
  - Milestones drive the schedule
    - Tells you what needs to be accomplished and when

Week	Date	Required Milestones
Week 1	6-Jan	KickOff
Week 2	13-Jan	
Week 3	20-Jan	
Week 4	27-Jan	CDR Document Submission
Week 5	3-Feb	CDR Presentations
Week 6	10-Feb	
Week 7	17-Feb	
Week 8	24-Feb	Intermediate Presentations
Week 9	3-Mar	
Week 10	10-Mar	
Week 11	17-Mar	FRR Document Submission
Week 12	24-Mar	FRR Presentations
Week 13	31-Mar	
Week 14	7-Apr	Intermediate Presentations
Week 15	14-Apr	
Week 16	21-Apr	Launch Weekend
Week 17	28-Apr	
Week 18	5-May	
Week 19	12-May	PLAR Documentation
Week 20	19-May	
Week 21	26-May	
Week 22	1-Jun	Announcement of Winners

Project Management - Scheduling

- Examples - Student
  - Training / Simulations / Component Selections / Procurement / Assembly

		Milestone	Student Goals	Student Goals	Student Goals	Student Goals	Student Goals
1-Jan	Week 1						
8-Jan	Week 2		Training	Simulations	Component Selections		
15-Jan	Week 3		Training	Simulations	Component Selections		
22-Jan	Week 4	PDR	Training	Simulations	Component Selections		
29-Jan	Week 5		Training	Simulations	Component Selections		
5-Feb	Week 6		Training	Simulations	Component Selections		
12-Feb	Week 7		Training	Simulations	Component Selections		
19-Feb	Week 8		Training	Simulations	Component Selections	Procurement	
26-Feb	Week 9	CDR	Training	Simulations	Component Selections	Procurement	
4-Mar	Week 10			Simulations	Component Selections	Procurement	
11-Mar	Week 11			Simulations		Procurement	
18-Mar	Week 12			Simulations		Procurement	Assembly / Fabrication
25-Mar	Week 13			Simulations		Procurement	Assembly / Fabrication
1-Apr	Week 14	FRR		Simulations		Procurement	Assembly / Fabrication
8-Apr	Week 15			Simulations			Assembly / Fabrication
15-Apr	Week 16			Simulations			Assembly / Fabrication
22-Apr	Week 17						Assembly / Fabrication
29-Apr	Week 18	Launch					

Project Management - Scheduling

- Examples - Advisor
  - Recruiting / Procurement / Resources / Travel / Meetings / Documentation

		Milestone	Advisor Objective	Advisor Objective	Advisor Objective	Advisor Objective	Advisor Objective
1-Jan	Week 1		Recruiting Students	Procure RockSim			
8-Jan	Week 2		Recruiting Students	Procure RockSim			
15-Jan	Week 3		Recruiting Students	Procure RockSim	Team Meetings		
22-Jan	Week 4	PDR	Recruiting Students	Procure RockSim	Team Meetings	Gather Resources	
29-Jan	Week 5		Recruiting Students		Team Meetings	Gather Resources	
5-Feb	Week 6		Recruiting Students		Team Meetings	Gather Resources	
12-Feb	Week 7		Recruiting Students		Team Meetings	Gather Resources	
19-Feb	Week 8		Recruiting Students		Team Meetings	Gather Resources	Assist Procurement
26-Feb	Week 9	CDR			Team Meetings	Gather Resources	Assist Procurement
4-Mar	Week 10				Team Meetings	Gather Resources	Assist Procurement
11-Mar	Week 11				Team Meetings	Gather Resources	Assist Procurement
18-Mar	Week 12				Team Meetings	Gather Resources	Assist Procurement
25-Mar	Week 13				Team Meetings	Gather Resources	Assist Procurement
1-Apr	Week 14	FRR			Team Meetings	Gather Resources	Assist Procurement
8-Apr	Week 15				Team Meetings	Gather Resources	Assist Travel
15-Apr	Week 16				Team Meetings	Gather Resources	Assist Travel
22-Apr	Week 17				Team Meetings	Gather Resources	Assist Travel
29-Apr	Week 18	Launch					Assist Travel

Project Management - Budgeting

- Will need to create, update and submit a Budget
  - It is important to have a plan (optimize your budget)
  - Scoring Rubric | Wisconsin Space Grant Consortium | Carthage College
- Split your budget among three divisions
  - Rocket parts (kit, components etc.)
  - Supplies (simulation software, PPE etc.)
  - Travel (trip to Launch Weekend)
- A budget helps us ensure you are purchasing the correct components

Project Management - Budgeting

- Example

General Budget Example							
Category	**Item**	**Manufacturer**	**Vendor**	**Qty**	**Unit Cost**	**Total Cost**	**Example**
Rocket							
	Rocket Kit	LOC Precision	LOC Precision	2	$123.29	$ 246.58	ezi-65-mini-0175 – LOC Precision / Public Missiles Ltd.
	Avionics Bay	LOC Precision	LOC Precision	2	$ 37.70	$ 75.40	Model Rocket Electronics Bays w/Switch Band - LOC Precision – LOC Pre
	Altimeter 1	Missileworks		1	$ 79.95	$ 79.95	RRC3 (missileworks.com)
	Switch 1	Missileworks		1	$ 25.00	$ 25.00	Power Switches (missileworks.com)
	Altimeter 2	Featherweight		1	$175.00	$ 175.00	Blue Raven - Featherweight Altimeters
	Switch 2	Featherweight		1	$ 25.00	$ 25.00	Av-Bay Components - Featherweight Altimeters
	GPS	Featherweight		2	$265.00	$ 530.00	Featherweight GPS Tracker (upd) (featherweightaltimeters.com)
	Parachute - Drogue	Rocketman		1	$ 50.00	$ 50.00	The Rocketman's Online Rocket Parachute Store (the-rocketman.com)
	Parachute Protector - Drogue	Rocketman		1	$ 25.00	$ 25.00	The Rocketman's Online Rocket Parachute Store (the-rocketman.com)
	Shock Cord - Drogue	Rocketman		1	$ 25.00	$ 25.00	The Rocketman's Online Rocket Parachute Store (the-rocketman.com)
	Parachute - Main	Sky Angle		1	$100.00	$ 100.00	b2 Rocketry Web Site
	Parachute Protector - Main	Sky Angle		1	$ 25.00	$ 25.00	b2 Rocketry Web Site
	Shock Cord - Main	Sky Angle		1	$ 25.00	$ 25.00	b2 Rocketry Web Site
	Miscellaneous Electronics	Wiring, Battery		1	$100.00	$ 100.00	
	Miscellaneous Recovery	Swivels, Quicklinks		1	$100.00	$ 100.00	
Build / Fabrication							
	Build Supplies	Epoxy, Tooling				$ 200.00	
	Protective Equipment	Gloves, Goggles				$ 200.00	
Travel							
	Travel					$2,000.00	
						$4,006.93	TOTAL PROJECT COST

First Nations Launch

- Tools and Tips
- Calendar
- Patch Contest
- Rocket Certification Workshop
- Application Process
- Competition Prizes
- FAQ
- Report Templates and Scorin...
- Rocket Instructional Videos/Webinars
- Awards
- About Us
- History

Templates and Scoring Rubric

Challenge Deliverables and Templates Matrix

The overall competition scores are derived from percentages listed in Moon and Mars milestones. Education Outreach provides bonus points toward the overall scoring.

Milestone Associated Due Date	**Gateway**	**Moon**	**Mars**
Proposal October 24, 2024	N/A	Proposal Report (5%)	Proposal Report (5%) Proposal Flysheet Proposal RockSim
Preliminary Design Review (PDR) December 2, 2024	N/A	PDR Report (15%) PDR Flysheet PDR RockSim PDR Virtual PPT (5%)	PDR Report (15%) PDR Flysheet PDR RockSim PDR Virtual PPT(5%)
Critical Design Review (CDR) January 27, 2025	CDR Flysheet CDR RockSim CDR Virtual PPT Budget	CDR Report (15%) CDR Flysheet CDR RockSim CDR Virtual PPT (5%)	CDR Report (15%) CDR Flysheet CDR RockSim CDR Virtual PPT (5%)
Flight Readiness Review (FRR) March 17, 2025	FRR Flysheet FRR RockSim FRR Virtual Education Outreach Forms	FRR Report (15%) FRR Flysheet FRR RockSim FRR Virtual (5%) Education Outreach Forms (+10%)	FRR Report (15%) FRR Flysheet FRR RockSim FRR Virtual (5%) Education Outreach Forms (+10%)
Launch Weekend April 21, 2025	LW Oral PPT	LW Oral PPT (5%)	LW Oral PPT (5%)
Launch Weekend: Flight Performance April 26-27, 2025		Mission Performance (10%) Challenge Performance	Mission Performance (10%) Challenge Performance

Component Selection - Tips

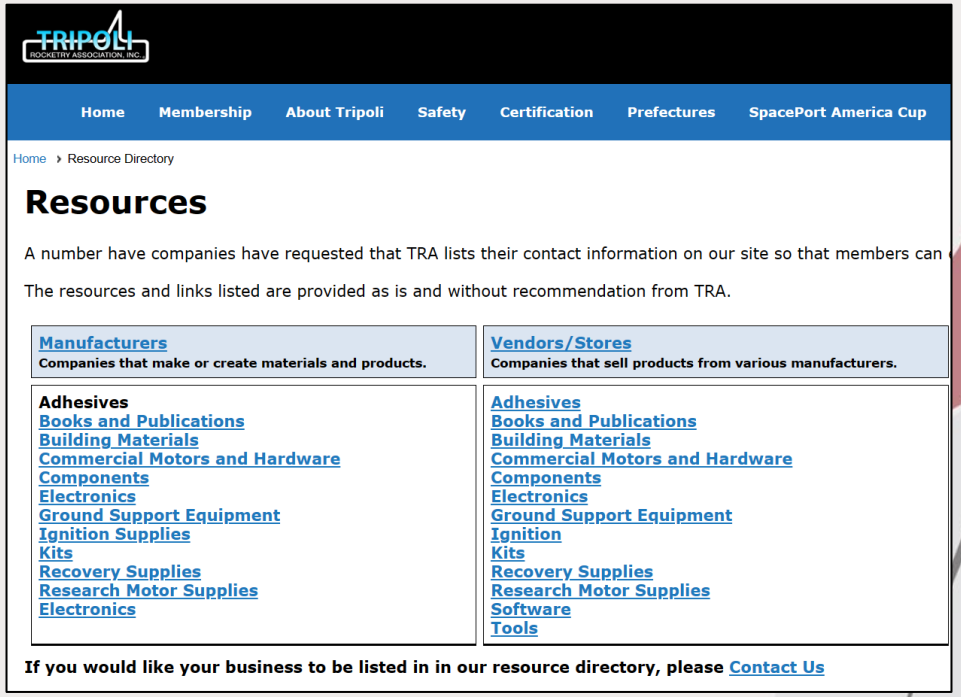
- Need to research and select components
  - For Avionics
    - Altimeters – electronic trigger to eject parachutes at proper altitudes
    - Switches – altimeters need switches that are accessible from exterior of rocket
    - GPS Tracking – electronic tracking device to help recover rocket
  - For Recovery
    - Drogue Parachute – small parachute sits in aft (booster section) for apogee descent
    - Main Parachute – large parachute sits in fwd (sustainer section) for touchdown
    - Additional hardware: Shock cords, parachute protectors, quicklinks
  - For Motor Retention
    - Retainer - component that keeps motor secure in motor tube after installation

Project Management - Procurement

Procurement References				
	Manufacturer	LOC Precision	WI	High Power Model Rocketry Supplies | Advanced Model Rocket Kits – LOC Precision / Public Missiles Ltd.
	Manufacturer	Wildman Rocketry	IL	Rocket Motors, Kits, and Supplies from Wildman Rocketry – wildmanrocketry.com
	Manufacturer	Madcow Rocketry	CA	Madcow Rocketry
	Vendor	Chris Rocketry	GA	Chris' Rocket Supplies, LLC (csrocketry.com)
	Vendor	Apogee Components	CO	Model Rockets & How-To Rocketry Information (apogeerockets.com)
	Vendor	Performance Hobbies	VA	Performance Hobbies Homepage
	Vendor	Giant Leap	OR	Giant Leap Rocketry: High Power Rocketry supplier of parts and kits – GiantLeapRocketry
	Vendor	OffWeGo Rocketry	MN	Off We Go Rocketry
	Vendor	Bay Area Rocketry	CA	Home - Bay Area Rocketry
	Electronics	Featherweight	CA	Featherweight Altimeters - Home
	Electronics	Missileworks	CO	Home (missileworks.com)
	Electronics	AltusMetrum	CO	Altus Metrum
	Electronics	Eggtimer	CA	eggtimer rocketry electronic altimeter gps tracker kit
	Recovery	Sky Angle	GA	b2 Rocketry Web Site
	Recovery	Fruity Chutes	CA	Parachute Manufacturers for Drones, UAV, Rockets, Research | Fruity Chutes
	Recovery	Rocketman	MN	The Rocketman's Online Rocket Parachute Store (the-rocketman.com)
	Motors	Motor Data		Rocket Motor Data • ThrustCurve
	Motor Hardware	Aeropack		Aero Pack – Aeropack
*reference	Motors	Aerotech Motors		AeroTech/Quest Division, RCS Rocket Motor Components, Inc (aerotechstore.com)
*reference	Motors	Cesaroni Motors		Cesaroni Technology Incorporated
Other Information				
	Tripoli Rocketry Association			Rocketry Vendors and Resources - Tripoli Rocketry Association
	National Association of Rocketry			National Association of Rocketry - NAR
	RockSim Simulations			RockSim Download & Registration : Apogee Rockets, Model Rocketry Excitement Starts Here

*this reference sheet is in the PM Template

Project Management - Procurement



TRIPOLI ROCKETRY ASSOCIATION, INC.

Home | Membership | About Tripoli | Safety | Certification | Prefectures | SpacePort America Cup

Home › Resource Directory

Resources

A number have companies have requested that TRA lists their contact information on our site so that members can

The resources and links listed are provided as is and without recommendation from TRA.

Manufacturers **Companies that make or create materials and products.**	Vendors/Stores **Companies that sell products from various manufacturers.**
Adhesives Books and Publications Building Materials Commercial Motors and Hardware Components Electronics Ground Support Equipment Ignition Supplies Kits Recovery Supplies Research Motor Supplies Electronics	Adhesives Books and Publications Building Materials Commercial Motors and Hardware Components Electronics Ground Support Equipment Ignition Kits Recovery Supplies Research Motor Supplies Software Tools

If you would like your business to be listed in in our resource directory, please Contact Us

*this resource list is on the Tripoli Rocketry Website

Requirements

Project Management - Other

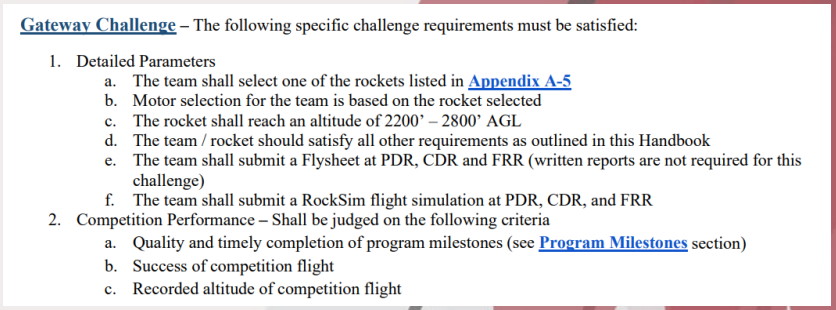
- Other Project Management items are not applicable to Gateway
  - But will be if you are in Moon / Mars Challenge
  - Get a good grasp on scheduling / budgeting / procurements
  - Testing should begin if time allows (not documented)

- Performance requirements Gateway needs to meet with their rocket
  - Performance requirements are listed in the Handbook
  - We verify these performance requirements are met:
    - In your Flysheet and RockSim

Project Management - Requirements

- Challenge Requirements
  - Rocket restricted to those on the list
  - Motor restricted to those on the list

- Altitude Requirement
  - Range of 2200 – 2800 feet
  - AGL - Above Ground Level
    - Simulation apogee goal
    - Altimeters will measure in flight



Gateway Challenge – The following specific challenge requirements must be satisfied:

1. Detailed Parameters
   a. The team shall select one of the rockets listed in **Appendix A-5**
   b. Motor selection for the team is based on the rocket selected
   c. The rocket shall reach an altitude of 2200' – 2800' AGL
   d. The team / rocket should satisfy all other requirements as outlined in this Handbook
   e. The team shall submit a Flysheet at PDR, CDR and FRR (written reports are not required for this challenge)
   f. The team shall submit a RockSim flight simulation at PDR, CDR, and FRR
2. Competition Performance – Shall be judged on the following criteria
   a. Quality and timely completion of program milestones (see **Program Milestones** section)
   b. Success of competition flight
   c. Recorded altitude of competition flight

Project Management - Requirements

- General Requirements
  - Minimum 1 altimeter (2 suggested)
  - Minimum static margin of 1
  - Minimum rail exit velocity of 52 ft/s
  - Minimum thrust-to-weight ratio of 5:1
    - Motor thrust divided by gross rocket weight
  - Final motor selection due Feb 17th

General Vehicle Requirements

1. The launch vehicle will use a commercially available solid motor propulsion system using ammonium perchlorate composite propellant (APCP) which is approved and certified by the National Association of Rocketry (NAR), and/or Tripoli Rocketry Association (TRA). Motors are provided by WSGC. Motors are limited to those listed in **Appendix A-1**.
   a. Final motor choices will be declared by the CDR milestone.
   b. Any motor change after CDR must be approved by the Tripoli Wisconsin Range Safety Officer (RSO) and will only be approved if the change is for the sole purpose of increasing the safety margin.
   c. A penalty against the team's overall score will be incurred when a motor change is made after the CDR milestone, regardless of the reason.
2. The vehicle will carry, at a minimum, one commercially available, barometric altimeter for recording the official altitude used in determining the Altitude Award winner (see '**Appendix A-4**' for awards criteria) and is to be used for electronic deployment of ejection charges.
3. Each altimeter (if redundant) will have a dedicated power supply, on an independent circuit.
4. Each altimeter (if redundant) will be armed by a dedicated mechanical arming switch, on an independent circuit, that is:
   a. Accessible from the exterior of the rocket airframe when the rocket is in the launch configuration on the launch pad.
   b. Capable of being locked in the ON position for launch (i.e., cannot be disarmed due to flight forces).
5. The launch vehicle will have a minimum static stability margin of 1.0 at the point of rail exit (to be determined by simulations). Rail exit is defined at the point where the forward rail button loses contact with the rail.
6. The launch vehicle will accelerate to a minimum velocity of 52 feet per second (fps) at rail exit (to be determined by simulations). This parameter is also known as 'rail exit velocity' or 'velocity at launch guide departure.'
7. The launch vehicle and motor will have a thrust-to-weight ratio greater than 5:1.

Project Management - Requirements

- Recovery Requirements
  - Drogue parachute
    - Selected such that the rocket descends at 45 – 65 ft/s from apogee
    - Must sit in booster section
    - Must use a backup motor ejection
  - Main parachute
    - Selected such that the rocket descends at 15 – 20 ft/s at touchdown
    - Must sit in sustainer section

Recovery System Requirements

1. The launch vehicle will utilize a standard dual deployment recovery scheme, where a drogue parachute is deployed at apogee and a main parachute is deployed at a lower altitude. Tumble or streamer recovery from apogee to main parachute deployment is also permissible, provided kinetic energy during drogue-stage descent is reasonable, as deemed by the RSO.
   a. The main parachute shall be deployed no lower than 300 feet.
   b. The apogee event may contain a delay of no more than 2 seconds past apogee.
   c. Single deployment parachute release devices (tender descender, jolly logic parachute release etc.) are not allowed.
2. The recovery system electrical circuits shall be completely independent of any payload/challenge electrical circuits.
3. All recovery electronics will be powered by commercially available batteries.
4. Descent rate after apogee (under drogue parachute) shall range between 45 – 65 feet per second.
5. Descent rate upon touchdown (under main parachute) shall range between 15 – 20 feet per second.
6. Electronics (COTS altimeters) must be used as your primary ejection events, at both apogee and main deployment.
   a. Suggest utilization of two altimeters for ejection event redundancy, but not required.
7. The motor ejection charge is the required backup (redundant) deployment at apogee.
   a. Motor ejection cannot be used as your primary (or only) ejection event.
   b. Note this requires that the drogue parachute sits in the booster section.
   c. The estimated time to apogee should be known (from simulations) to adjust the ejection charge delay fuse during motor prep.
8. An electronic tracking device (i.e., GPS) will be installed in the launch vehicle and will transmit the position of the tethered vehicle or any independent section to a ground receiver.
   a. Any rocket section or payload/challenge component, which lands untethered to the launch vehicle, will contain an active electronic tracking device.
   b. The electronic tracking device(s) will be fully functional during the official flight on launch day.

Resources

- Please reach out to the following in the suggested order:
  - Your Team Advisor (most non-technical or resource issues)
  - Your Rocketry Mentor (most technical rocketry issues)
  - WSGC FNL Admin Team
    - Rob Cannon
      - Office Hours
        - For issues that need a discussion (Advisor or Mentor cannot assist with)
      - Quick Questions / Email
        - He can direct your questions to the Tech Team as needed

Any Questions?