First Nations Launch 2024 Launch Operations Webinar

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

NASA Partner

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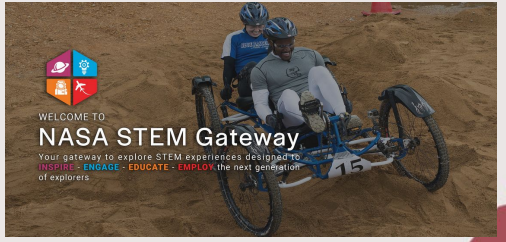
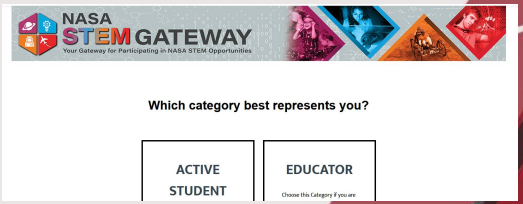
Presentation Overview

- NASA STEM Gateway Requirement
- Launch Site Overview
  - Richard Bong Recreation Area
- Pit Area Details
  - Layout / Provided / Personnel
- Tripoli Wisconsin Overview
- Launch Area Details
  - Inspections / Launch Pad prep / Launch expectations
- WSGC Updates

NASA STEM Gateway





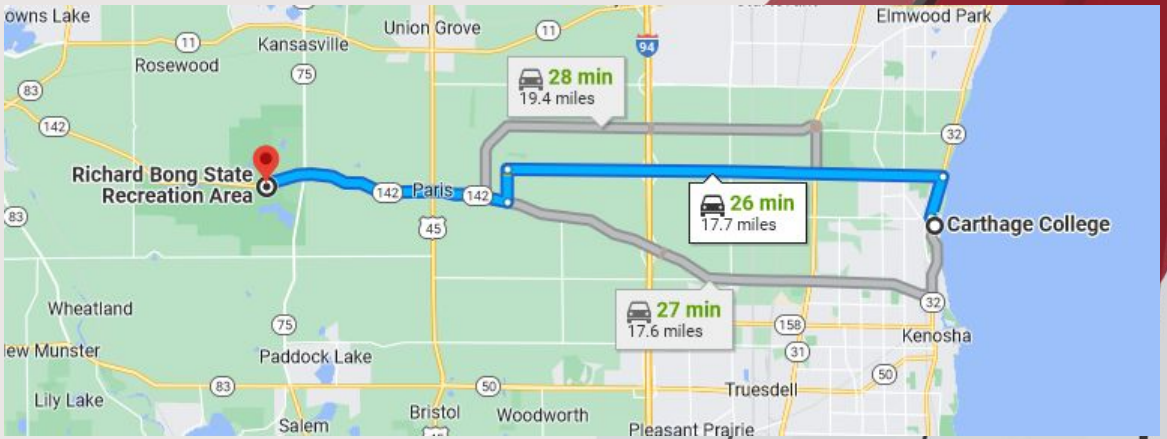
- Each participant needs to create a profile in the new system, NASA STEM GATEWAY, prior to launch weekend
  - https://stemgateway.nasa.gov/s/
  - https://stemgateway.nasa.gov/public/s/login/SelfRegister
- After individual profile has been created, NASA will link your profile to First Nations Launch

Launch Site Overview

What to expect at the Launch Site

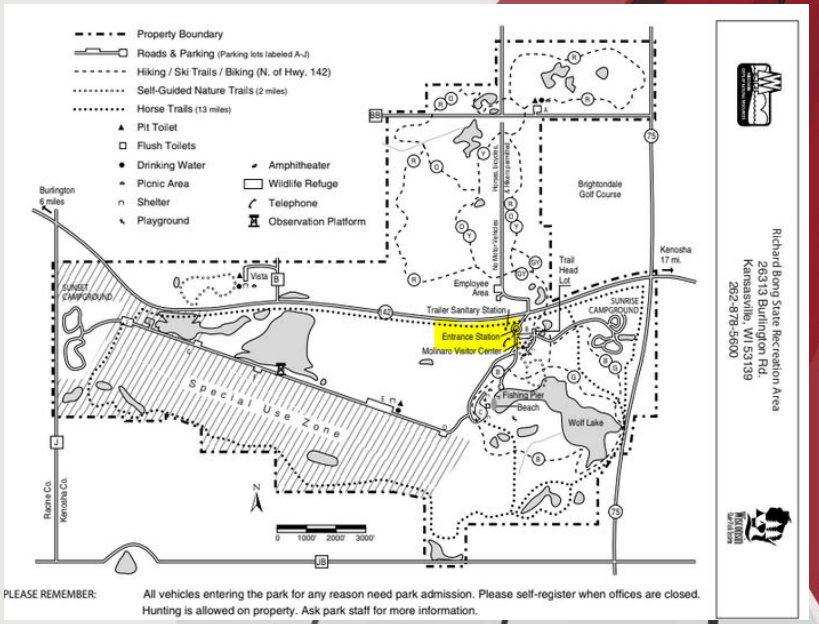
FNL Launch Site - Drive

- Richard Bong State Recreation Area
  - About 30 min drive from hotel / school
  - Fairly remote – bring everything you will need for the day
    - Rain/Sun
    - Bug Spray
    - Muddy



FNL Launch Site – Entering the Park

- First Nations Launch Parking Pass
  - Provided by Wisconsin Space Grant Consortium during registration
  - Show pass to the Park Ranger at the entrance gate if someone is on duty
  - Must be displayed on dashboard at all times
    - Department of Natural Resources will ticket vehicles that do not have a pass displayed
  - Non-Competitors
    - Pay at entrance gate
    - WI license plate (daily fee) $8.00 Fee
    - Out-of-state plates $11.00 fee



FNL Launch Site – Inside the Park

- From the entrance (green) to the launch site (yellow)
  - There will be signage and wind flags

Note the hazards when recovering rockets

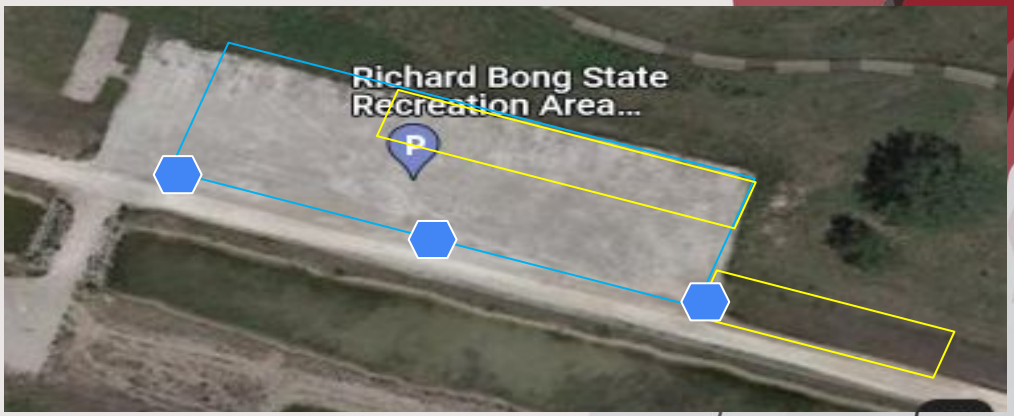
Entrance booth

Note the scale

FNL Launch Site – Rocketry Site

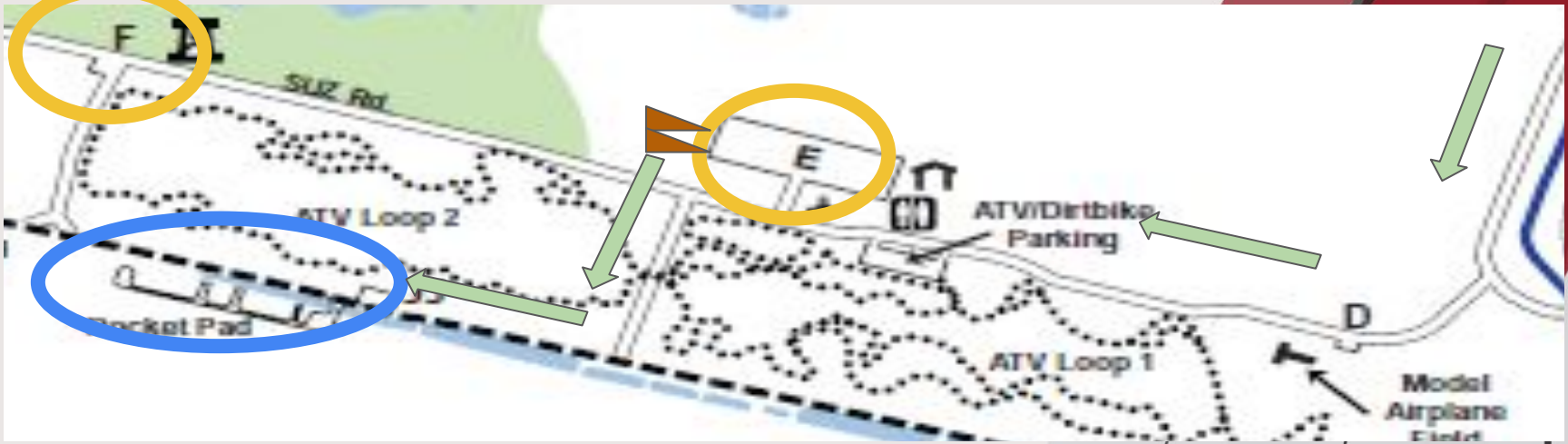
Parking

- Parking is limited –
  please park as directed by attendants
  - There will be cones – align with the cones
  - Buses will park along the road entrance (to the side) or side of parking lot
  - Parking attendants will assist your team with parking location



Parking

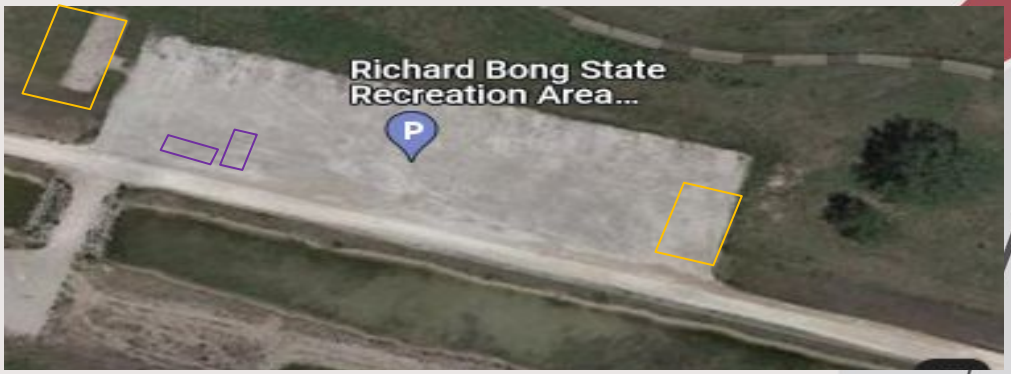
- Parking is limited – overflow parking
  - Teams limited to one (1) vehicle each, in parking lot JJ
  - Extra vehicles and guests can park in Parking Lots E or F, or alongside entrance road as space is available



Conveniences

There will be:

- bagels and coffee, snacks, lunch, and water
- port-a-johns along the back row
- a WSGC table for shirt purchases, etc.
- 20x20 canopy for shade



Pit Area Details

What to expect in the pit

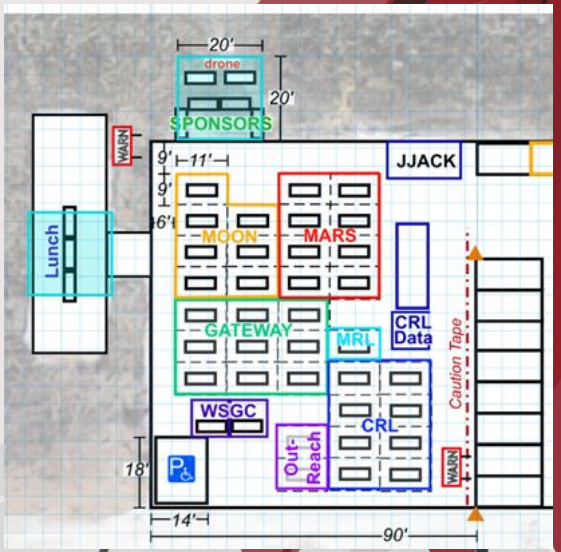
Pit Crew Support

- As the number of teams increase each year:
  - Expect Mentors in attendance to be responsible for prepping their teams
  - Will have numerous other Professionals / Alumni assisting in Pit (4 – 5)
  - Mark will manage the pit oversight
    - ALL Teams will need to get a stamp of approval from Mark prior to moving on to RSO
  - Ejection charges will be provided by Pit Crew
  - Motors will be available for teams to load

Team Prep Area (Pit Area)

- Tables arranged for teams on arrival
  - Tables will have label with team name
- Teams are grouped by competition

- Note: WSGC / TRA Wisconsin also host a statewide rocketry competition on the same day
  - There will be another set of tables / teams for the Collegiate Rocket Launch (CRL) competition
  - CRL tables will be to the right of those shown



Team Prep Area (Pit Area)

Provided to Teams on Launch Day

- Table (8-foot folding) and 4 folding chairs
  - No power source (you may bring generator if desired - needed)
  - No power or hand tools (bring what you need)
  - No room for canopies at tables
- Lunch / Water
  - Variety of Subway sandwiches and chips / drinks available
    - You will have a lunch ticket in your name badge
  - Alternative food options can be arranged
- On-Site Rocketry Vendor
  - If you need spare parts / last minute replacements

WILDMAN ROCKETRY

Provided to Teams on Launch Day

- Ejection charges (distributed by Project Assistants)
  - Assistance to wire two types of charges also provided
  - Do not transport black powder to WI
- Cellulose wadding a.k.a Dog Barf (self serve)
  - For additional recovery protection
  - A box will be available in pit area
- Motors (at RSO Inspection table)
  - Team lead or designee picks up motor at the RSO table following safety briefing
  - You must be fully assembled and ready for flight
  - Proceed to RSO table for your pre-flight inspection

FNL Personnel on Launch Day

- FNL Project Assistants will be identified by yellow vests
  - Are available for rocket prep assistance in Pit Area
  - There are 3 Project Assistants
- FNL Judges will be identified by orange vests
  - They will monitor / score your vehicle / payload prep
  - They may ask you questions – please take time to respond / explain
  - There are 8 Judges

FNL Personnel on Launch Day

- Tripoli Wisconsin will be identified by yellow vests
  - They will approve rocket for flight and get you on a launch pad
  - There will be numerous TRA Wisconsin
- WSGC Individuals will be identified by green vests
  - Non-technical questions can go to WSGC individuals
  - They will facilitate parking, lunch etc.

Launch Day – Prep Area

- Arrive – Park
  - Follow parking attendant instructions
- Find your team table
  - There will be a numbered flag at each table
- Prepare your rocket for flight (use your checklists)
  - Things to include (not an exhaustive list):
    - Program / calibrate your altimeters and tracking
    - Use fresh power sources
    - Fold parachutes and connect recovery hardware
    - Ensure sections fit together properly
- Project Assistants available for assistance

Team _____

Prelaunch Checklist

- Altimeter arming wires and switches turned to the "**OFF**" unarmed position
- Black powder charge ____ gms Main parachute?
- Verify Main parachute attached? ____ Nose Cone & ____ Payload Bay
- Insert Main Recovery Wadding (Nomex Cloth Chute protector) ____
- Black powder charge ____ gms Drogue parachute? ____
- Verify Drogue parachute attached? ____ Payload Bay & ____ Fin Section
- Insert Drogue Recovery Wadding Nomex Cloth Chute Protector)
- Obtain and install motor and install motor retention system.
- Verify static margin? CP"= _____, CG"= _____, Margin= CG"-CP"/dia"= _____
- Range Safety Officer (RSO) / Staff Review ____ If "**GO**" *then*,_____ *Initials*
- Fill out launch card > total launch weight= _____lbs and _____ozs
- Average Thrust to Weight Ratio= _____: _____ should be at least 5:1
  Example: J355 motor, 12.6lb rocket, 355/4.54/12.6= **6.2:1** (4.54 is Constant)
  _____ *Reviewers Initials, then*
- Take rocket to **LCO** *then* Launch Table. 2 students & 1 advisor at Pad for liability.
- Place rocket on launch pad. Arm altimeter(s). Ensure operational sequence.
- Install igniter *and* prepare for launch! Return checklist to staff after recovery.

Launch Day – Prep Area

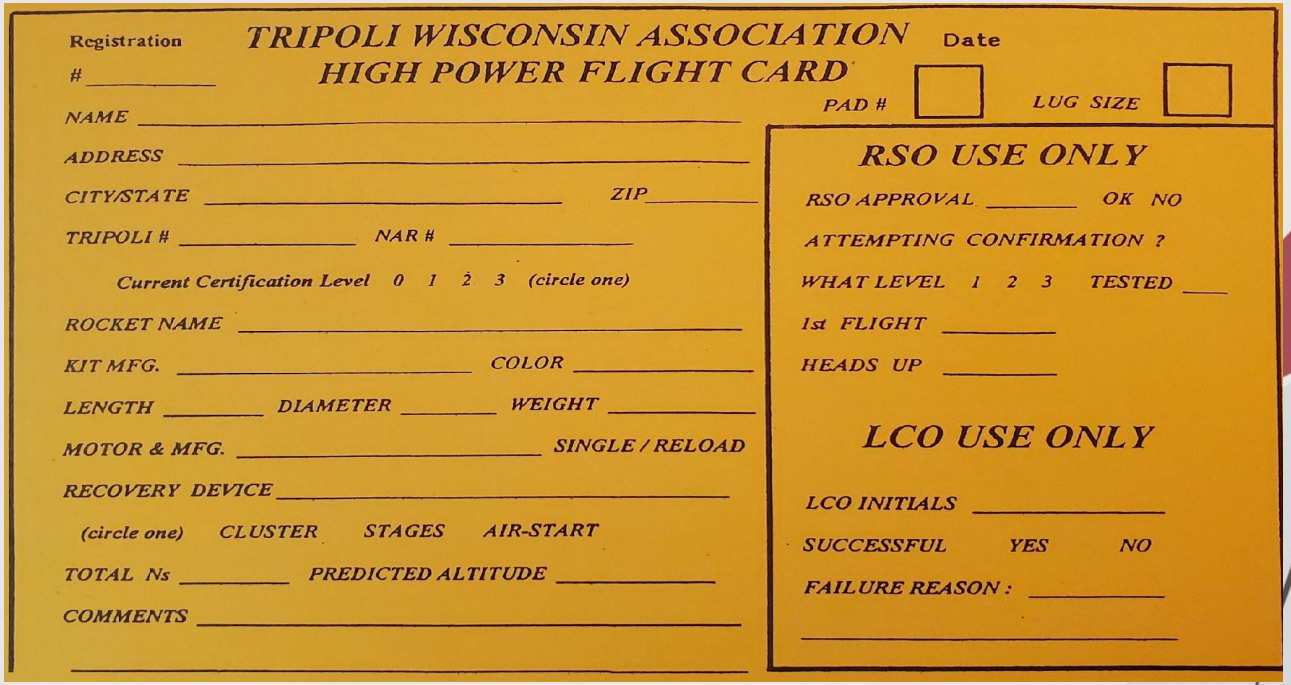
- When ready, request ejection charges from Project Assistants
  - Wait until your altimeters are programmed / ready
  - If it is your first-time handling ejection charges, ask for assistance
    - We will show you how to wire your charges safely / properly
  - Do not power on electronics after charges are installed
    - Safety requirement – electronics now remain off until on Launch Pad
- Once ejection charges are installed, complete final assembly

Launch Day – Prep Area

- Complete final assembly
  - Close and seal avionics bay
  - Ensure recovery hardware is all attached and closed (quick links etc.)
  - Pack your parachutes and shock cords
  - Close your sections together ensuring everything fits properly
- Fill out your orange Flight Card (found in your packet)
  - Get a Project Assistant to review your launch card when complete
  - Project Assistant will do a pre-inspection with you
    - One complete you will move on to RSO Inspection

Flight Card

NO ONE IS PERMITTED AT THE LAUNCH PADS
UNLESS YOU ARE A CURRENT TRA/NAR MEMBER



Registration # _____

TRIPOLI WISCONSIN ASSOCIATION
HIGH POWER FLIGHT CARD

Date

PAD # ☐ LUG SIZE ☐

NAME _____

ADDRESS _____

CITY/STATE _____ ZIP _____

TRIPOLI # _____ NAR # _____

Current Certification Level 0 1 2 3 (circle one)

ROCKET NAME _____

KIT MFG. _____ COLOR _____

LENGTH _____ DIAMETER _____ WEIGHT _____

MOTOR & MFG. _____ SINGLE / RELOAD

RECOVERY DEVICE _____

(circle one) CLUSTER STAGES AIR-START

TOTAL Ns _____ PREDICTED ALTITUDE _____

COMMENTS _____

RSO USE ONLY

RSO APPROVAL _____ OK NO

ATTEMPTING CONFIRMATION ?

WHAT LEVEL 1 2 3 TESTED ____

1st FLIGHT _____

HEADS UP _____

LCO USE ONLY

LCO INITIALS _____

SUCCESSFUL YES NO

FAILURE REASON : _____

Fill out legibly

Enter membership number

Name of Rocket

Type of motor

Tripoli Wisconsin Details

What to expect at a Tripoli Launch

Tripoli Wisconsin Association Rocket Launches

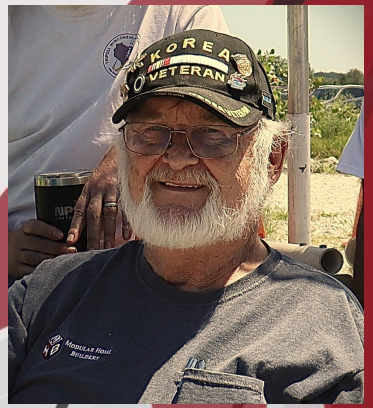
- Tripoli Wisconsin Association
  - Conducts launch operations per:
    - Per Tripoli Rocketry Association (TRA)
    - NFPA 127 rules
  - Assigns/delegates representatives to organize and run the launch
    - Range Safety Officer (RSO)
    - Launch Control Officer (LCO)
    - Launch Pad Tech (LPT)

Tripoli Wisconsin Association Rocket Launches

- Range Safety Officer
  - Minimize the risks to personnel and property
    - Model and High Power Rocket Launches
    - Handling, preparation, and launch operations
  - Inspects each rocket for flight integrity
  - Has the final call for a go or no-go launch

Tripoli Wisconsin Association Rocket Launches

- Launch Control Officer
  - Manages flight cards to coordinate each flier with a particular launch pad
  - Oversees operation of the Launch Control System
  - Follows all safety rules governing who has access to the range
    - Spectators are not allowed on the range
  - Secures/Activates FAA waivers to the assigned area parameters



Tripoli Wisconsin Association Rocket Launches

- Launch Pad Tech
  - Familiar with both launcher and launch control operations
  - Has appropriate tools available
  - Ensures all fliers follow Launch Safety Guidelines
  - Has fire suppression capability available
  - Makes sure all rockets are pointed away from the flight line and spectators while loading the rocket at the launch pad
  - Secures/Activates FAA waivers to the assigned area parameters

The Launch Crew

- Very experienced in high-power rocketry community
- Has been conducting FNL since 2009
- Hosts the WSGC Collegiate Rocket Launch annually
- Hosted Large and Dangerous Rocketships (LDRS 33) in 2014, and will host (LDRS 41) in 2023 at Richard Bong

TWA Launch Site
Richard Bong Recreational Area

- Launching at Richard Bong Recreational area since 1995
- Wisconsin Depart of Natural Resources (WDNR) have graciously supported this activity for rocketry enthusiasts and members
- Designated Model Rocketry Launch Area – former runway
- Typical April Launch
  - Average April Weather varies
    - Mean Temp: 47 °F
    - Precipitation: 1.21"
    - Wind: 11 mph
    - Visibility: 9 mi
  - Fire break - winds
    - Ponds
    - Roads

TWA Launch Site
Richard Bong Recreational Area

- TWA launch system
  - Wireless launch system
  - Dual safety arming features
- Far away launch cells (adjacent)
  - 10’ 1515 rail and 1010 rail tower
- Standard pads with 6’ rails (far right)

Walking in the Park
Richard Bong Recreational Area

- Watch your step
- Wear proper footwear - closed toe shoes
- Wear pants, long-sleeve shirts, and hats (Tick Season)
- Avoid walking and looking in the distance simultaneously
- “Stop and Look” will help you avoid tripping and possible injury

Launch Area Details

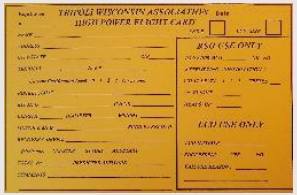
What to expect once you are ready to launch

Launch Day - Motor

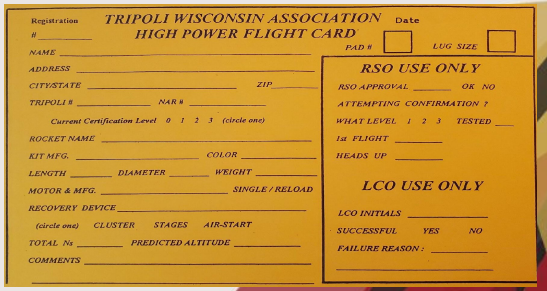
- After the Rocket Safety Meeting, send team lead or appointed representative over to RSO (Frank) to pick up motor
  - You will have prepared your motor on Friday
  - In Prep area:
    - Load the motor in your rocket and secure your retention
    - Ensure it fits properly (not loose or tight – don't force it)
    - Prepare motor igniter
      - Remove wire from the bag and straighten the wire
      - Strip at least 1-inch bare wire from the two free ends
      - Have available 4"- 5" in length of masking tape
  - Use the tape to hold the motor ignitor to the outside of your rocket airframe between the fins
    - This ensures that all rockets will have an ignitor and tape when going to the pads

Launch Area – Rocket Prep

- Starting in Prep Area, after Project Assistant approves your rocket prep
  - Proceed to RSO tent for your inspection
    - Take your TWA High Power Flight Card (filled out)
    - Take your Remove Before Flight flag for flight
    - Take your screwdriver/tool for switches
    - Take masking tape



Launch Day – RSO Inspection


TRIPOLI WISCONSIN ASSOCIATION
HIGH POWER FLIGHT CARD
Registration #
Date
PAD #
LUG SIZE
NAME
ADDRESS
CITY/STATE
ZIP
TRIPOLI #
NAR #
Current Certification Level 0 1 2 3 (circle one)
ROCKET NAME
KIT MFG.
COLOR
LENGTH
DIAMETER
WEIGHT
MOTOR & MFG.
SINGLE / RELOAD
RECOVERY DEVICE
(circle one) CLUSTER STAGES AIR-START
TOTAL Ns
PREDICTED ALTITUDE
COMMENTS
RSO USE ONLY
RSO APPROVAL OK NO
ATTEMPTING CONFIRMATION ?
WHAT LEVEL 1 2 3 TESTED
1st FLIGHT
HEADS UP
LCO USE ONLY
LCO INITIALS
SUCCESSFUL YES NO
FAILURE REASON :

- RSO will then inspect your flight ready rocket
  - RSO will ask you questions about your rocket, for example
    - CG and CP and Stability Margin
    - Altimeter settings
    - Expected altitude – time to apogee
  - RSO will examine your rocket, for example
    - Motor retention and installation
    - Fin fillets
    - Section fit
  - RSO will ask you to change / correct any issue
    - If this is the case, return to Prep Area and make corrections

Launch Day – LCO Table

- If you pass inspection - RSO will sign your orange Flight Card
- Proceed to LCO table
  - There may be a line if multiple teams are ready for flight
  - Turn in your Flight Card to LCO once at front of line
    - LCO will assign you a launch pad number
- Before proceeding to Launch Pads
  - Media will take a team photo w/rocket
    - Turn in Blue Ticket to Media after photo

Launch Day - Flight Procedures

- Launch Pad Tech will help you load on rail
- Observe your flight / Retrieve your rocket
- After you retrieve your rocket
  - Bring it back to your Prep table – Judges will need to inspect
  - Pull your altimeter data and provide a copy to a Project Assistant (via flash drive)
  - Your payload / challenge data will be submitted later

Launch Day – Launch Pads

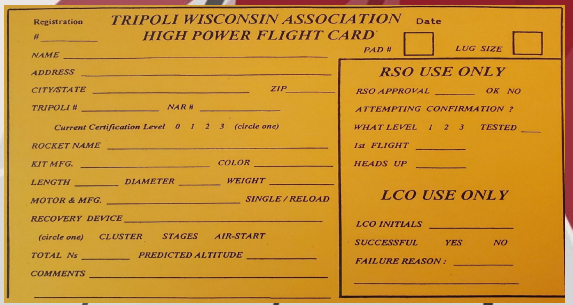
- For safety, ensure the range is open before you proceed
  - You can ask the LCO
- If range is open, proceed to assigned Launch Pad
  - Note - Only Tripoli/NAR members allowed at Launch Pads
  - Note - Max 3 people per team at Launch Pads
- Once you get to your Launch Pad
  - Launch Pad Tech will help you load your rocket on the pad
  - If you are TRA/NAR Certified Level 2
    - You may load your own rocket

Launch Pad - Rocket on Rail

- TRA Wisconsin individual available to assist with loading
- Begin by tilting the rail
  - Hold the rocket parallel to the rail
    - The rocket sits on top of rail, button down
  - Slide the bottom rail button into the rail
    - Keep the rocket parallel sliding onto rail
  - Slide the top rail button into the rail
    - DO NOT damage your rail buttons by forcing your rocket on rail
  - Return the launch pad to vertical

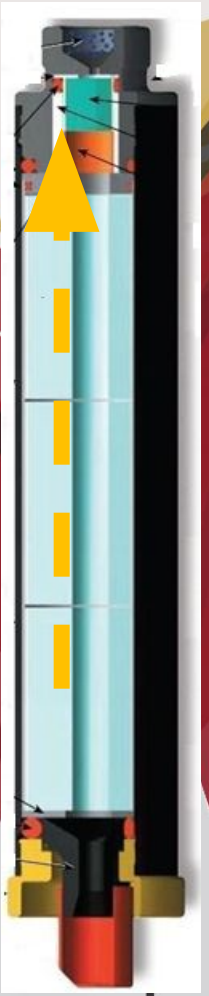
Launch Pad - Rocket on Rail

- Before you load ignitor, power on your electronics
  - Safety requirement that electronics are on prior to ignitor install
  - Safety requirement that electronics (with black powder charges connected) are not powered on until vertical on the rail
    - You may need a ladder / stool to reach your switches
      - Middle of rocket may be 6 - 8 feet in the air once its on the rail
      - You may not be able to see your switches / access holes
    - Listen for sequence of beeps to ensure your electronics systems are armed properly
      - If you can't confirm, turn off electronics and remove from rail
      - Do not disassemble rocket at pads
      - Proceed back to pit area - retrieve Flight Card from LCO
    - If confirmed, move to next step



Launch Pad - Rocket on Rail

- Next, prepare the motor ignitor
  - Remove your motor ignitor taped to side of rocket
  - Insert the wire as far as it will go into your motor
    - Insert until it stops (hits the top of the motor)
    - Kink the wire at the bottom 90 degrees
    - Tape the wire you kinked in place (using the piece of tape) to the motor retainer



Launch Pad - Rocket on Rail

- Prepare the motor ignitor (continued)
  - Find the alligator clips for your launch pad (look on the ground)
    - Ensure the circuit is not live by touching the clips together
      - A live circuit would produce sparks
    - Wrap one exposed ignitor wire around the alligator clip
      - As much contact area as possible – keeps from coming loose
    - Repeat for other ignitor wire and alligator clip
    - Ensure the two alligator clips are not (will not) contact each other, blast deflector or rail – position / tape as needed
    - Check continuity on your circuit
      - Ask TRA Wisconsin personnel for assistance
  - Your rocket is ready to go – proceed back to LCO area

Launch Pad - T-Minus 5

- LCO will announce (over PA system) that launch is about to commence
  - Stop what you are doing and pay attention – eyes on the launch pad
    - Do NOT walk any further (regardless where you are)
      - Observe the flight path of the rocket until the recovery system has deployed
    - STOP working on your rocket (if you are in Prep Area)
  - TRA will stop launch operations to ensure safety
- LCO and area safety monitors look out for incoming rockets near the launch area
  - LCO announces “heads-up” if a rocket is descending in or near spectator areas
  - If you are under a tent, make sure that you can see the rocket flight, especially during a “heads-up” notice
- **Do NOT attempt to catch a rocket**

Launch Day - Rocket Retrieval

- Post-Launch retrieval tips
  - Have a dedicated group (at least two) to retrieve the rocket
    - Not everyone – some can stay back to clean area etc.
    - You will get dirty – dress appropriately
  - Ensure your GPS system is working, and you have coordinates
    - Plan your approach
    - Do not just start walking directly
    - Drive to a better location (another road for example)
  - Be mindful of the launches still going on
    - Watch when rockets are going up or coming down – be safe

Launch Day - Rocket Retrieval

- Post-Launch retrieval tips
  - Do NOT attempt to climb trees to retrieve a rocket
  - Do NOT enter water to retrieve a rocket

  - If you are in one of these situations, ask for help
    - TRA Wisconsin has:
      - Poles to help extract rockets from trees
      - Waders / canoe to help with water extraction
    - Speak to a Project Assistant / TRA Wisconsin individual
      - Trees and water everywhere

Launch Day - Rocket Retrieval

- Post-Launch retrieval tips
  - Ensure the ejection charges have fired completely
    - Power off electronics first to move the rocket
    - Remove any charges that have not gone off
    - Assemble rocket for ease of transportation
  - Return your rocket to Prep Area
    - Judges will inspect rocket for any damage
    - Provide altimeter data to Project Assistants
      - They will give you a flash drive
  - Clean / pack your rocket for return trip home
  - Return motor casing to Project Assistants

FNL24 Drone Payload Inspections (Friday)

- In conjunction with the 3 other technical workshops / inspections
  - Motor Build, Safety Inspection, Avionics Workshop

- Mars Drones will have a demo inspection
  - Team pilots will need to bring drone ready for flight
  - Judges and Tech team may inspect and ask questions
  - Team pilot will need to fly a sequence of maneuvers to prove capability of both pilot and drone

FNL24 Drone Payloads (Saturday)

- During flight prep, there will be dedicated Drone support
  - There will be a table close to the Mars team section
- Drone ejection should be treated like parachute ejections
  - Once loaded, do not turn on electronics until on pad
- During flight – Drone pilot and spotter should locate parallel to LSO table along gravel road
  - Pilot will need to communicate status with LSO through TRA Tech for PA announcements via walkie talkie

FNL24 Drone Payloads (Saturday)

- Drone ejection electronics should eject drone at apogee
  - If we deem anything unsafe, we may ask you to turn off drone ejection
- Drone should descend on parachute from apogee
  - Pilot should verify (via camera) drone is correctly oriented and powered
  - Motors should not be on during descent
- IF drone is deemed functional (and arms extended) on descent
  - Parachute should be released at 500 feet AGL
  - This will be either programmed or triggered

FNL24 Drone Payloads (Saturday)

- IF drone is deemed non-functioning on descent
  - Let LSO know to announce HEADS UP FLIGHT
  - Do not trigger parachute release if there is any doubt
- Once drone is free of parachute (will fall another 100 feet)
  - Powered flight may begin – hover suggested (at 400 feet AGL)
  - Pilot can then fly the route to the closest landing zone (see map)
  - Do not fly over the launch range or parking / pit area
- Leave drone at landing zone until ‘Range is Open’

WSGC Updates

- Checklists have been emailed to you for upcoming launch reviews
- Come with rocket structure complete, preferably altimeter installed and pre-wired
  - Do not add charges yet
  - No rocket build workshop time this year
    - Will be split into groups to proceed through:
      - Concurrent Altimeter & Motor Workshops
      - Safety Inspection
    - Space is being coordinated at the hotels to allow for minor build time for last minute adjustments.

Any Questions?

Rocketry Vendor

- There will be a rocketry vendor on-site
- Wildman Rocketry (https://wildmanrocketry.com/)

WILDMAN ROCKETRY