Earthrise

The official newsletter of the Canadian Association of Rocketry

Le bulletin officiel de l'Association canadienne de fuséonautique

Volume 9 Issue / numéro 1

Message from CAR/ Message de l'ACF — Tim Rempel

Hello fellow members of Canadian Association of Rocketry / Association canadienne de fuséonautique. It is again time for our Annual General Meeting and I invite all members of CAR/ACF, to join the Executive and the Board on February 23 at 4 PM Mountain time to review our last year and discuss any questions. As we did last year, the meeting will be hosted via Zoom videoconferencing and the login information will be emailed to each current member. If you do not receive this information, please contact me.

Please join us and help CAR/ACF continue its important work for our hobby.

Tim Rempel
CAR/ACF President

Il est temps de préparer notre Assemblée générale annuelle et j'invite tous les membres du CAR/ACF à se joindre au Comité exécutif et au Conseil le 23 février à 16 h, heure des Rocheuses pour une revue de nos activités de l'an dernier et échanger sur toutes autres questions. Comme l'an dernier, la rencontre se tiendra par vidéo conférence Zoom et les informations de connexions seront expédiées par courriel à tous les membres. Si vous ne recevez pas l'information, veuillez me contacter.

Joignez-vous à nous et aidez le CAR/ACF à continuer son important travail pour le bien-être de notre hobby.

Tim Rempel
Président CAR/ACF

Cover Photo: Mark Robert's L4 Amraam lifts off at Rage at the Gage 2019, photo by Sebastian Richard.

La fusée Amraam (niveau 4) de Mark Robert décolle pendant "Rage at the Gage 2019", photo par Sebastian Richard.

From the Editor — Bruce Aleman

Welcome to a new year and a new season of rocketry! Depending on where and when you fly, you may have survived the first launch of the year when you read this, or you may be looking forward to weather that will allow you to attend a launch. Whatever the case is, I wish you a successful season and make the usual plea that you record your builds, photograph and video your flights, and consider sharing with the rocketry community across our country via Earthrise.

The turning of the year is always a nice chance for reflection and goal setting. I know some rocketeers who are driven by the goals they set, and others who stay relaxed and simply enjoy whatever the hobby brings to them. If I could convince you to set any goals this year, it would be to take a close look at the many options available for the various products we use in this hobby. The last decade has been explosive in terms of the number of high-quality products available with decreasing costs associated. Make it a goal to see what altimeters have come out since you last purchased one, how easy is it to get set up for GPS trackers these days, how good of a job have the new owners of Estes been doing (hint, a very good job!). This hasn't really been a goal for me, it's just one way I enjoy the hobby especially during the winter. In doing so, I came across the Eggfinder Rocketry products, and ended up purchasing a Black Friday special to attempt to solder together. I can promise you there is a recent product out there somewhere that has your name on it! One other goal I set for this season was to make use of the 3D printer I have access to at work. Once I ironed out some of the details with a co-worker, I was stunned at what that unit could do. I've already printed a number of rocketry components and have more planned. The number of files available for free online is impressive if the idea of designing scares you away. Look for my 3D printed Mars Lander in a future issue of Earthrise.

One item I'd like to see in future issues of Earthrise are descriptions and materials that many of you are using in school or club programs particularly with the youth. As a classroom teacher, I have been doing a variety of rocketry programs for over a decade, and only recently shared it with anyone. I have a feeling there are good programs in place around the country, and it would be great to share what they are. If I see the success of the TARC program in the USA, and the many University high power programs springing up in North America, I'm curious what effect we could have on the future of the hobby in Canada. Please consider what you or your local club has had success with and share with the CAR/ACF community via Earthrise.

Wishing everyone a great season and clear skies!

De l'éditeur — Bruce Aleman

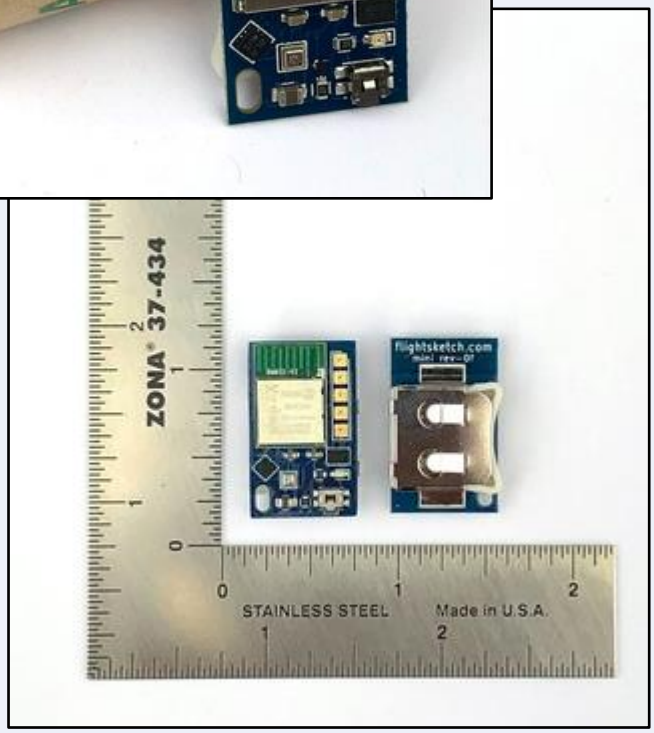
Et nous voici déjà rendu à une nouvelle année et une nouvelle saison de fuséonautique! Quand vous lirez ceci, dépendant où vous êtes et d'où vous faites vos lancements, peut-être aurez-vous déjà "survécu" au premier lancement de l'année, à moins que vous attendiez des temperatures suffisamment clémentes pour vous permettre de participer à un lancement...
Dans tous les cas, je vous souhaite une saison réussie, et je vous demande, si c'est possible: documentez vos projets, prenez des photos et des vidéos de vos vols, et pensez à partager vos expériences avec le reste du pays via Earthrise.

Le changement d'année est toujours propice à la réflexion et au choix de nouveaux objectifs. Je connais des fuséonautes qui s'engagent à fond dans des projets, et d'autres plus détendus qui cherchent simplement à prendre du bon temps en lançant des fusées. Si je pouvais vous suggérer un objectif cette année, ce serait de jeter un bon coup d'oeil à la vaste gamme de produits disponibles en fuséonautique. La dernière décennie a vu l'apparition de beaucoup de produits de qualité, souvent pour des prix plus bas que dans le passé. Informez-vous sur les altimètres disponibles depuis votre dernier achat, découvrez le monde des localisateurs GPS, et jetez un coup d'oeil sur les produits lancés par les nouveaux propriétaires de Estes (qui sont surprenamment bons!). Pour moi, ce genre de recherche est une bonne façon de me détendre pendant l'hiver. C'est comme ça que j'ai découvert les produits de Eggtimer Rocketry, et que j'ai acheté un kit en solde pour le Vendredi Fou, que j'espère réussir à assembler (en particulier du point de vue soudure). Je vous promets qu'il y a un nouveau produit quelque part sur le marché qui est exactement ce que vous cherchez! Un autre de mes buts pour cette année est d'utiliser l'imprimante 3D disponible à mon travail. Une fois que j'ai résolu avec un collègue certains des détails d'utilisation, j'ai été épaté par ce qu'on pouvait fabriquer avec un tel outil. J'ai déjà imprimé plusieurs composants de fusées et je prévois en fabriquer d'autres. Si vous êtes craintifs de concevoir vos propres pièces, vous serez surpris par le nombre de fichiers 3D disponibles gratuitement sur Internet! Dans un numéro futur de Earthrise, je présenterai mon Mars Lander imprimé en 3D...

Dans les prochains numéros de Earthrise, j'aimerais bien voir des articles portant sur les activités de fuséonautique dans le contexte scolaire ou dans les clubs, particulièrement avec les jeunes. En tant qu'éducateur, cela fait plus de dix ans que j'organise des activités de fuséonautique dans le cadre scolaire, et je n'ai commencé à partager mes expériences que tout récemment. Je pense qu'il y a de bons programmes en place à travers le pays, et il serait bon de les partager. Voyant le succès du programme TARC aux Etats-Unis, et les programmes universitaires "haute-puissance" qui apparaissent un peu partout en Amérique du Nord, je me demande quel effet notre association pourrait avoir sur la fuséonautique amateur au Canada. N'hésitez pas à partager vos réussites ou celles de votre club local avec toute la communauté CAR/ACF via Earthrise.
Je vous souhaite à tous une très bonne saison et des cieux cléments!

Product News — Bruce Aleman

FlightSketch Mini Altimeters are the newest altimeter to hit the market in the rocketry world. In a marketplace that is getting somewhat crowded, FlightSketch stands out for several reasons. Its relatively small size is exclusive, the FlightSketch Mini fits into an 18mm (BT20) coupler tube, measuring only 1” in length! The next unique feature is a seamless wireless connectivity to iOS and Android devices. While these features do exist in other units, the final advantage the FlightSketch can market is a low cost compared to similar units, coming in at $40 USD. Be aware that the altimeter is recording only, it does not have deployment capabilities, and thus is geared towards simple altitude measurement. Model fliers have a unit to love. Its size, weight and price all come in lower than competitors. Russ Parrish, the owner and designer of the FlightSketch has added other rocketry related items to his webstore, and has promised some very unique electronic products. Keep an eye on this company for more advanced flight computers and GPS units in the next year.



Upcoming Launches

Bruce Aleman

1. Fire and Ice

(Edmonton Rocketry Club):
February 29, 2020, Click for Details

2. Hanna

(Calgary Rocketry Association):
April 4, 2020, Click for Details

3. LRA Club Launch

(Lethbridge Rocketry Association):
May 9, 2020, Click for Details

4. QRC Club Launch

(Quebec Rocketry Club):
May 16-17, 2020, Click for Details

5. Rock Lake 22

(Lethbridge Rocketry Association):
June 26-28, 2020, Click for Details

6. AARM

(Edmonton Rocketry Club):
July 11-12, 2020, Click for Details

7. LRA Club Launch

(Lethbridge Rocketry Association):
August 15, 2020, Click for Details

*Launch dates and locations subject to change, check with local clubs for final details.

Build Article — Ken Mueller

The rocket is a Wildman kit called a Skunk Ace.

Included in the kit are:

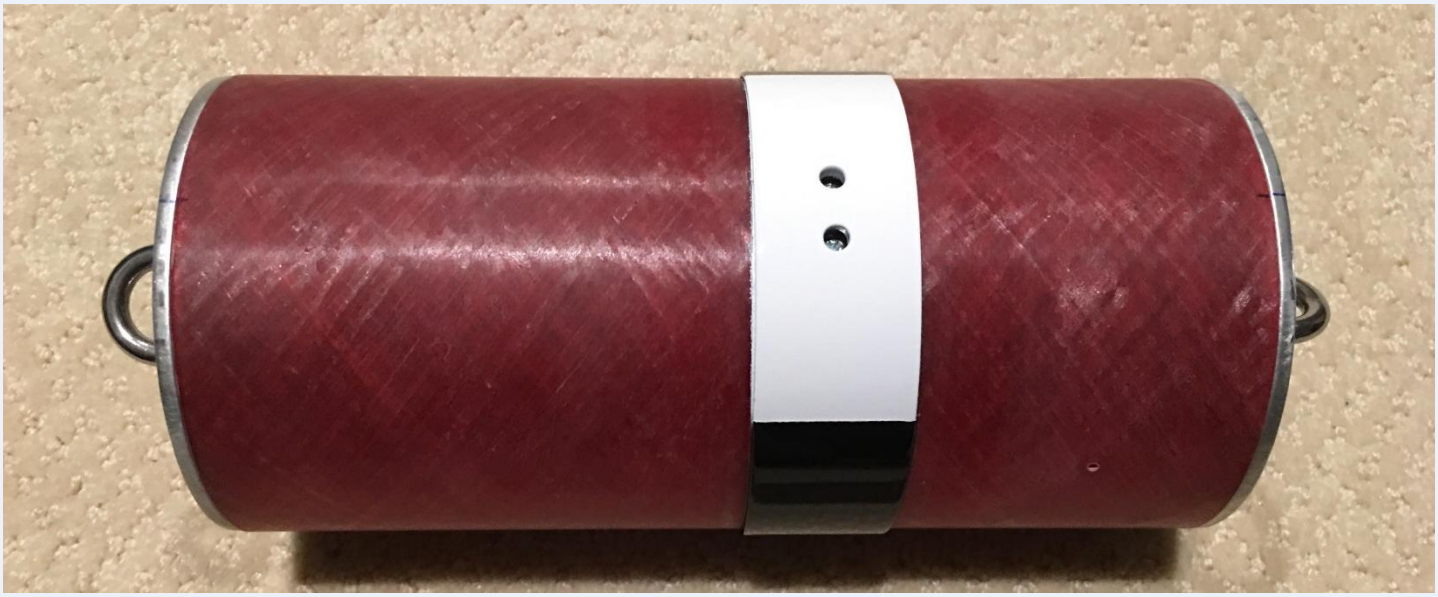
- 4 inch filament wound nose cone with aluminum tip
- 32 inch body tube that includes head end deployment
- 8 inch av bay coupler
- 1 inch switch band
- 54mm motor mount
- g10 centering rings
- aluminum av bay bulk plates

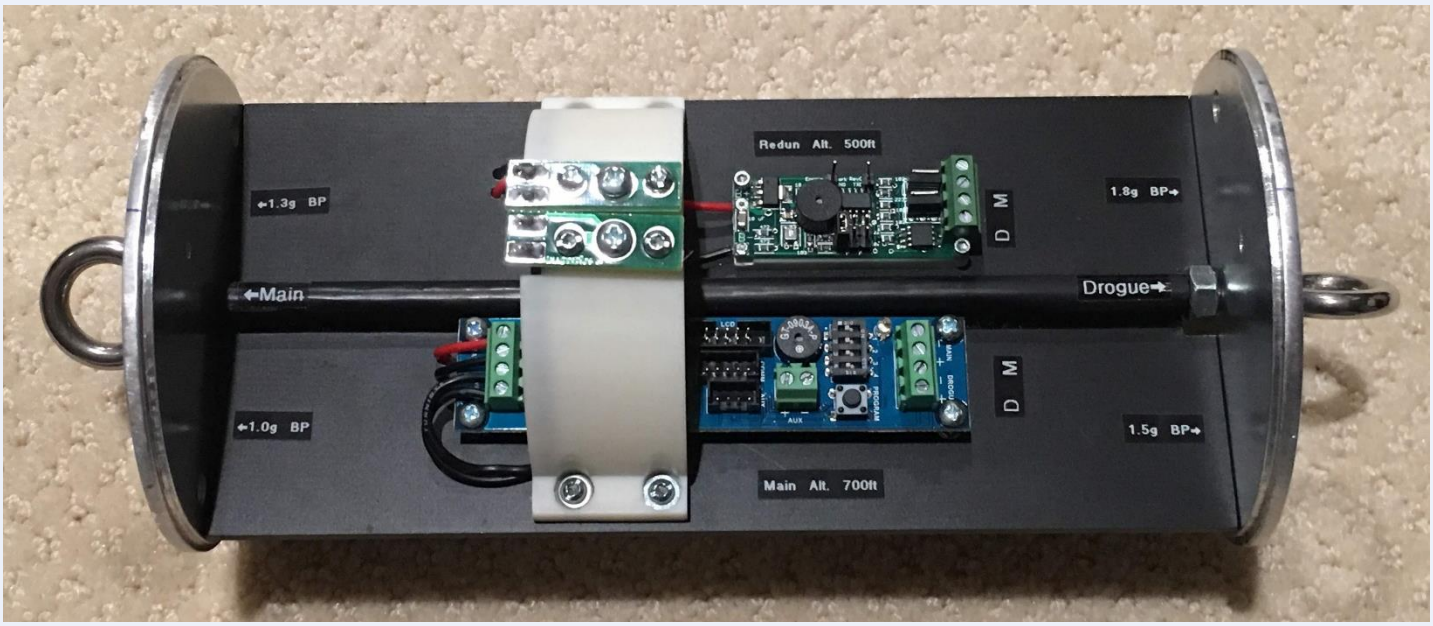
Optional motor retention:
I used a 54mm to 4 inch Aeropac Tail cone motor retainer assembly.

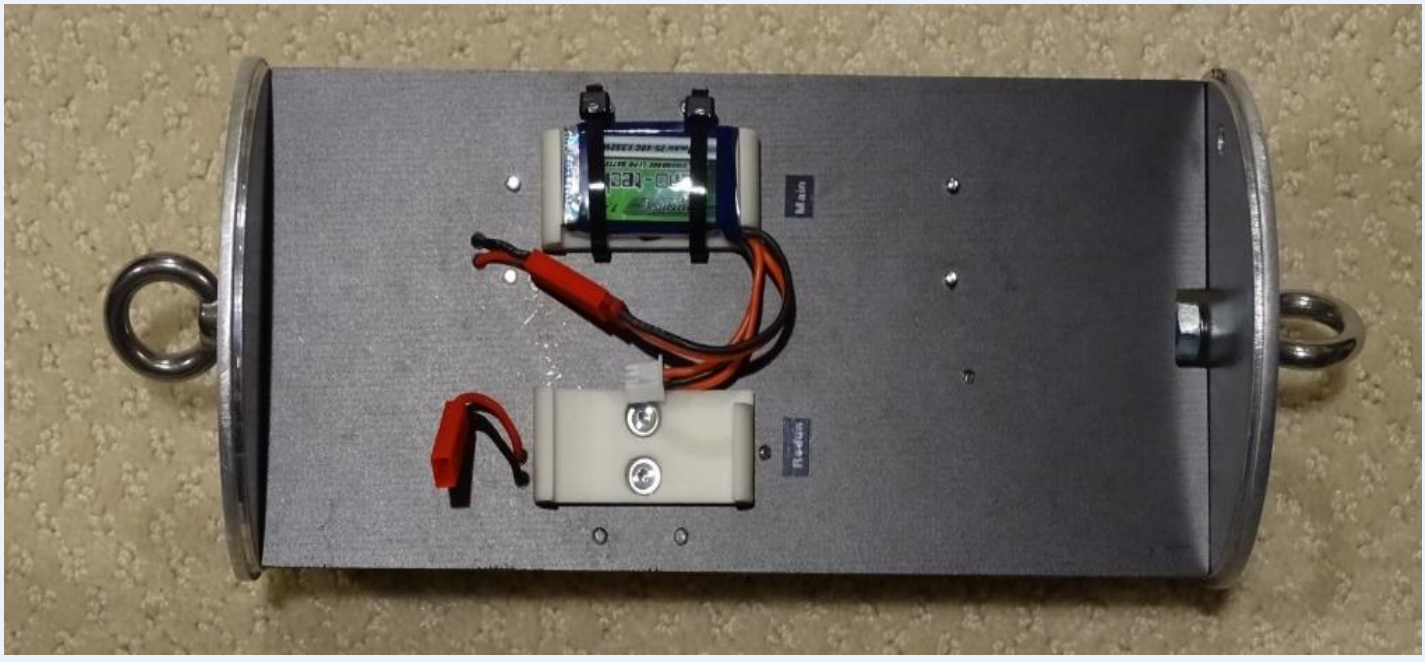
Build :
JB Weld was used to epoxy the motor mount to centering rings, fin roots to motor mount and Aeropac motor mount body. RocketPoxy was used to epoxy the outer body tube to the centering rings only because this epoxy is thick and I had some left. West system 105 Resin and 205 Hardener was mixed with chopped carbon fibers and injected with a syringe for internal fillets.

West System105 Resin and 205 Hardener along with 406 Colloidal Silica was mixed to the consistency of peanut butter and used to form the external fillets. I used a piece of 3/4 in PVC tube dipped in alcohol to form smooth fillets.

Avionics Bay:
The Av Bay uses 2 aluminum bulk plates supplied with the kit. Sled is g10 fibreglass with a fibreglass spar epoxied to the sled. I used ¼ in SS all thread rod and 2 SS eye nuts for the shock cord attachments. Altimeters are Missile Works RRC3 for the main and a Eggtimer Quark for back up if I choose to use it. I use 180 mAh 2s lipos for each altimeter. I designed the screw switch mount and battery holders and 3D printed in ABS filament.




Redun Alt. 500ft
1.8g BP→
D M
←1.3g BP
←Main
Drogue→
D M
←1.0g BP
1.5g BP→
Main Alt. 700ft


Main
Redun

Recovery:

3/8” Kevlar shock cord was used for both the body and nose cone Y- harnesses. The Y- harness Shock cord for the body section was epoxied to the motor mount using JB Weld. The rest of the recovery harness is 1/4” Kevlar, 25 ft for the drogue deploy and 15ft for the main deploy. Parachutes are a 12” Recon Drogue chute, and a 40” Recon chute for main deployment.

Ejection charges for Drogue and Main were ground tested before painting.

Painting:
Rustoleum 2x Painters Touch primer and top coat spray paints were used to paint the rocket. Decals I designed and ink jet printed on water slide decal paper. Rustoleum 2x Painters Touch Gloss Clear was used for the final Coat.

Prep, loading the rail and liftoff on the first flight of Skunk Ace. The rocket was flown at the LRA's Rock Lake 21, on a CTI J400SS.

Cette fusée est le kit “Skunk Ace” de la compagnie Wildman Rocketry.

Le kit comprend les éléments suivants:

- Un cone de 4 pouces en fibre de verre filée avec pointe en aluminium
- Un tube principal de 32 pouces prévu pour déploiement par le haut
- Un coupleur de 8 pouces pour l’électronique embarquée
- Une bande de 1 pouce pour les interrupteurs
- Un support pour moteur de 54 mm
- Des anneaux de centrage en fibre de verre G10
- Des plaques de protection en aluminium pour la baie électronique

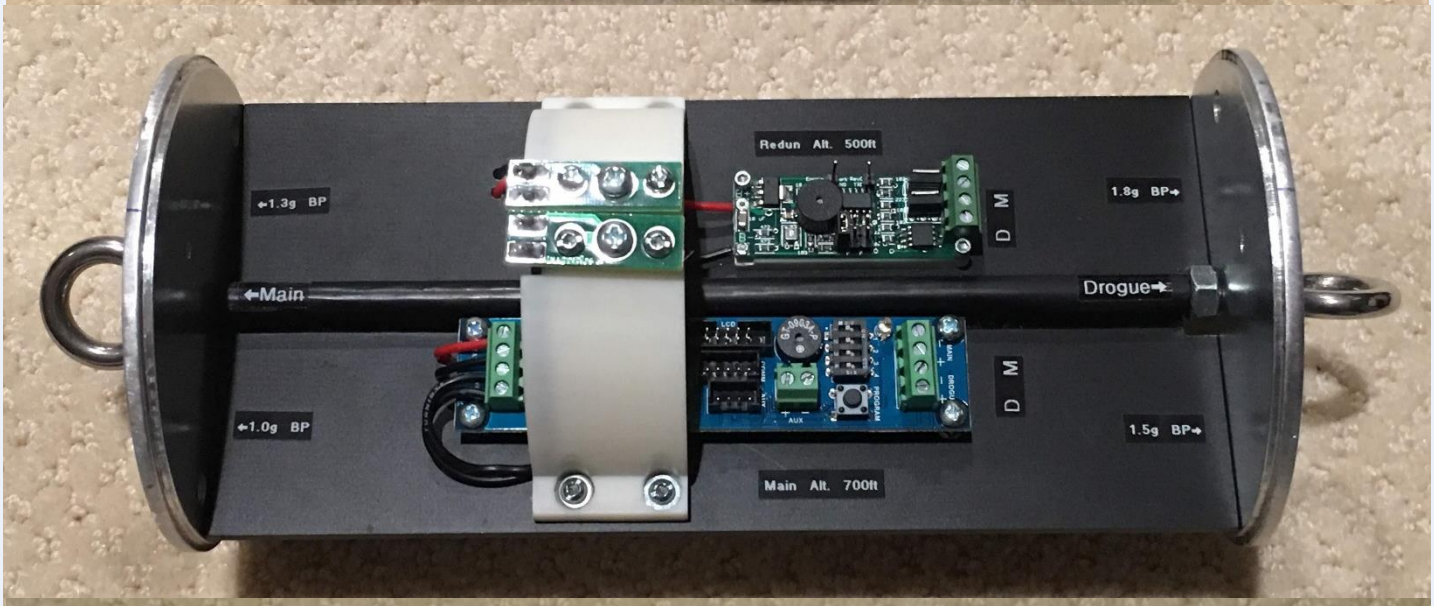
Pour sécuriser le moteur, j’ai utilisé le cone de rétention Aero Pack 54mm/4-pouces comme suggéré dans les options.

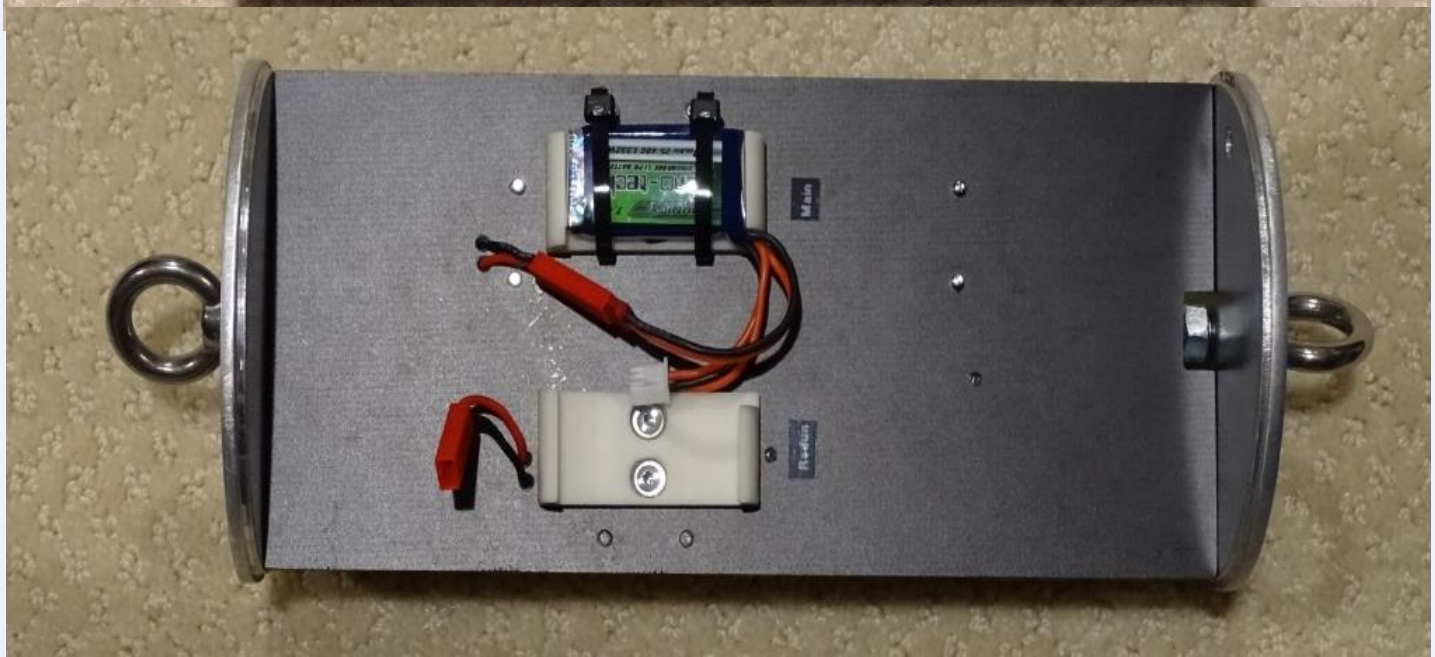
Construction :
J’ai utilisé l’époxy JB Weld pour coller le support de moteur aux anneaux de centrage, aux bases des ailerons, ainsi qu’au cone de rétention Aero Pack.
Pour coller le tube principal aux anneaux de centrage, j’ai utilisé la colle RocketPoxy, parce qu’il m’en restait et elle est plus épaisse. Pour faire les filets internes, j’ai mélangé des fibres de carbone déchiquetées avec la colle West Systems (Résine 105 et Durcisseur 205) et j’ai injecté le mélange résultant avec une seringue.

Pour les filets externes, j’ai mélangé l’époxy West System (Résine 105 et Durcisseur 105) avec leur additif “406 Silice Colloïdale”, en ajustant les proportions pour que la colle ait une consistance semblable au beurre d’arachides. Pour lisser les filets, j’ai utilisé un morceau de tuyau en PVC de 3/4 de pouce trempé dans l’alcool.

Baie pour l’électronique embarquée:
La baie utilise deux plaques de protection en aluminium qui viennent avec le kit. Le chariot de support est en fibre de verre G10, avec un soutien en fibre de verre collé au chariot à l’époxy. J’ai utilisé des tiges 1/4 de pouce filetées en acier inoxydable et deux écrous à oeil, également en acier inoxydable, pour attacher les cordons de serrage. L’altimètre principal est un Missile Works RRC3, et si j’ai besoin d’un altimètre secondaire, ce sera un Eggtimer Quark. Chaque altimètre utilise une batterie LiPo 180mAh/2S.

Pour fixer les batteries et les vis-interrupteurs, j’ai conçu des pièces sur mesure, imprimées en 3D avec du filament plastique ABS.



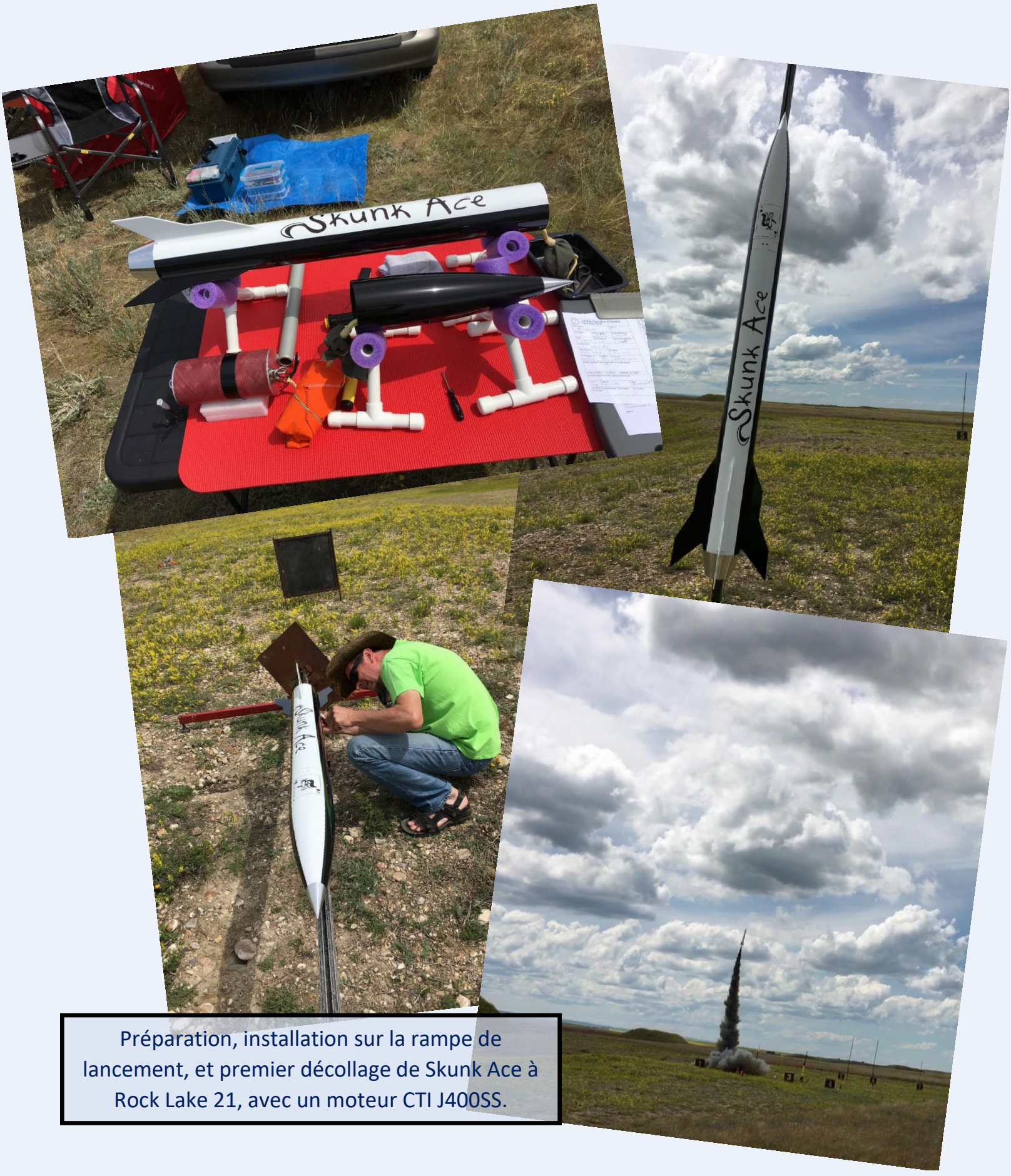


Récupération:

Pour le tube principal et le cone, j'ai fait des harnais en Y avec de la corde en Kevlar 3/8". Le harnais du tube principal est collé au support de moteur avec l'époxy JB Weld. Le reste du harnais est fait avec du Kevlar 1/4", une section de 25 pieds pour le parachute de freinage de 12 pouces de diamètre, et une section de 15 pieds pour le parachute principal de 40 pouces de diamètre.

Les systèmes d'éjection pour les deux parachutes ont été testés avant de peinturer la fusée.

Peinture:
Pour la couche d'apprêt et la couche de finition, j'ai utilisé la peinture en aérosol "Rustoleum 2x Painters Touch". J'ai dessiné les décalques et je les ai imprimé sur une imprimante à jet d'encre avec du papier à décalque. Pour finir, j'ai mis une couche de protection transparente avec Rustoleum 2x Painters Touch Gloss Clear.



Préparation, installation sur la rampe de lancement, et premier décollage de Skunk Ace à Rock Lake 21, avec un moteur CTI J400SS.

AARM (Annual Alberta Regional Meet)

Alberta Model Rocketry Competition

Saturday & Sunday, July 11 & 12, 2020

8:00 am - 5:00 pm, Morinville, Alberta

(exact location will be posted on our website closer to the date)

AARM is a model rocket competition with seven separate event categories for both adults and youth to compete in.
AARM-1 was the first ever Regional Rocket Competition held in Canada on July 11 & 12, 1970 near Morinville, Alberta. Fifty years later the Edmonton Rocketry Club is excited to celebrate the 50th anniversary of AARM!

Bring your family along and enter in our Junior and Senior model rocket competitions for a chance to win not only bragging rights but also fantastic prizes!
So dust off the body tubes, balsa, and black powder and get ready to compete!

Food and drinks will be available to purchase at the launch site. Bring a lawn chair, picnic blanket, etc. A port-a-potty will be available on site.

Dinner & Special Guests:

Dinner and guest speaker details for Saturday night will be announced closer to the date. Please check our website for updates.

Rocket & Competition Details (Youth & Adult):

Entrants of all levels and ages are welcome to participate in AARM. Models used for competition are not required to be built from scratch or custom designs, and may be as straight forward as a store bought kit. Only black powder motors such as Estes will be permitted in the competitions. Composite motors such as Aerotech or Cesaroni will not be allowed.
The Canadian Association of Rocketry (CAR) model rocketry safety code will be in effect.

Here are the event categories for the model rocket competitions:

- **A-Motor: Parachute Duration** (Fly a rocket with an A engine and parachute recovery and stay in the air the longest)
- **A-Motor: Streamer Duration** (Fly a rocket with an A engine and streamer recovery and stay in the air the longest)
- **A-Motor: Altitude** (Fly a rocket with an A engine to the highest altitude. Check our website for avionics bay requirements.)
- **B-Motor: Boost Glide Duration** (Fly a rocket with a B engine boost glider and stay in the air the longest)
- **D-Motor: Egg Loft Altitude** (Fly a rocket with a D engine and a raw egg as payload to the highest altitude. Return the egg unbroken. Check our website for avionics bay requirements.)
- **Scale:** Build, document, and fly a scale replica of an existing rocket.
- **Open Spot Landing:** Fly any rocket with an engine. Land as close as possible to a pre-designated location on the ground.

Registration Fees:

To be announced closer to the date. Please check our website for updates.

Prizes & Raffles:

Competition prizes will be awarded for the best three flights in each event category, with the exception of the Open Spot Landing, where only 1st place for Jr. And Sr. will be awarded.

For our Out-of-Town Visitors:

Bring your family along and turn this trip into a mini-vacation!
Contact us for suggestions on Edmonton's many attractions, summer events and festivals.

Contact Us:

For more competition details and rocket requirements, please go to our website:
http://www.edmontonrocketry.net/aarm-50

Email: erc@edmontonrocketry.net
Facebook Event: www.facebook.com/events/2474128609471794

Kronos E Project

David Buhler and Shane Weatherill
Pictures by Shane Weatherill, Neil Zeller, Ian Watson

Rocketry Project Celebrates 50th Anniversary of Man's First Steps on the Moon

The Kronos E project is a large, single-stage amateur rocket in the High-Power Rocketry (HPR) class. This rocket is a stand-off 1:20 scale model of the famous Saturn V rocket in the Apollo 11 flight configuration. The project was formed to celebrate the 50th Anniversary of the Apollo 11 moon landing that happened July 20, 1969. Also, not to be forgotten are the Canadian engineers and technicians that provided their aerospace experience to the Apollo program following the cancellation of the Avro Arrow program.

The Kronos E team consists of four dedicated, experienced Calgary-area flyers, Shane Weatherill, Ian Stephens, John Glasswick and David Buhler. Each team member is Level 4 certified which allows use of the largest rocket motors available in Canada (40,960 Ns).

So why Kronos E or Kronos Pente, well Ian our resident "lets find a Greek name for the project" guy simply translated Saturn V to Geek, Saturn being Kronos and E or Pente the number five. Simple.

Standing 5.5 meters tall and 50 cm in diameter, the Kronos E has four fins and 5 airframe sections, with a dry weight of 66 Kg, and when loaded with motors the weight goes to 89 Kg. Over 1500 people hours were committed to the project over a year and a half. Most Sunday mornings were spent in a garage designing, fabricating and assembling the Saturn V.

Flight configuration of this project used 5 solid propellant motors -- an N3301 and 4 air-started outboard K635 motors for a total impulse of 27,295 Ns putting this flight at an 33% O range impulse. With this configuration we expected an altitude of 2500 meters.

The five airframe sections:

1. Stage 1 Airframe - motors, fins, avionics and recovery systems;
2. Stage 2 Airframe - avionics and recovery systems;
3. Stage 3 Airframe - avionics and recovery systems;
4. Command/Service Module – avionics, tracking and recovery systems;
5. Launch Escape System – escape motor, avionics and recovery system.

For construction images head to our facebook page; https://www.facebook.com/kronospente/

A total of 9 Independent flight computers were responsible for air starting 4 outboard K motors, separation of three sections, deployment of six parachutes and ignition of the Launch Escape System motor. Six of these computers were remotely powered on and monitored by special RF switches operating in the 2.4 GHz and 900 MHz bands (Eggtimer Wifi Switch and Eggtimer TRS).

Construction was centered around a 7.5" phenolic tube core transferring the motor thrust to 12mm aircraft plywood bulkheads and ribs which formed the internal frame. The skin of the Saturn was 1.6mm thick styrene plastic held in place with special flanged screws and for added retention during flight, 3d printed "wind" strips were added at all stage sections to prevent air flowing behind the styrene skin.

The Stage 1 motor and fin section were the most complex piece to design and build. Each fin is attached to the internal frame with nylon bolts. Removable fins greatly aided in transport of the rocket and also mitigated potential landing damage as the fins were able to breakaway. The 98 mm main motor was recessed, requiring a design that could hold and transfer the 5076 N (1141 lbs) maximum thrust during lift off. The recess was required to protect the

motor casing on landing as the nozzle protruded from the motor casing by 40mm. Of note, the max thrust with all motors was 8188 N (1841 lbs).

Our inhouse pyro and fireworks guy, John made the distinctive Saturn V fairings from kraft paper making this part of the construction very light. Underneath, a 3d printed frame was created to hold the shape during flight.

We took advantage of the latest tech in manufacturing with FDM printing (Fused Deposition Modeling or 3d Printing). The Avionics bays, electronics carriers, hatch covers, LES, Capsule and fairing frame was printed with a combination of PLA and PETG plastics. Using CADD to create and model the designs against the virtual Saturn V allowed us to match complex angles and arcs in one print to match reality. The fairing frame was the most complex with two main shapes (rocket air frame and conical fairing). Second the curved Avionics Bays with integrated battery slots, matching hatch covers with built in mount points to secure the hatch.

The LES and capsule were completely 3d printed then modified to house the avionics, parachutes and motor.

Final preparation for launch began on June 26th. Various components of the rocket were transported to the launch site, an old gravel quarry near the village of Wrentham, Alberta, using three separate vehicles. Prior to the planned launch on June 29th, several tasks needed to be completed. These included multiple test flights to ensure all onboard flight computers would function as expected, a test flight of the Launch Escape System (LES), the location and setup of the launch pad, assembly of the motors, and final assembly of the Kronos E itself.

Prior to the official opening of Rock Lake, the Kronos E team performed several mid-power test flights of all flight computers utilized by the project. This was necessary, in part, because several of the devices used in the project had never been flown and had been assembled by the team members. These devices included five Featherweight Ravens, two PerfectFlite StratoLogger SL100s, five team constructed Eggtimer Wifi Switches, an Eggtimer TRS, and an FC-877. After a bit of a learning curve with the Eggtimer TRS, all devices were tested and were confirmed to be functioning as required in order to proceed with the launch of the Kronos E.

Due to the size of the Kronos E, both in terms of its physical characteristics and the motors used, CAR/ACF regulations require the launch pad be at least 500m from the range head. In order to ensure easy vehicle access for transport of the rocket, the team needed to select a new location at the Rock Lake site for the launch pad. Scouting the field prior to the launch, we found a gravel pad that had been recently dug by the landowner to test the ground composition. The pad was just out of the ballistic zone for the main pads, was easily visible from the range head, and was flat and cleared of grass – pretty much ideal for the pad setup. The Blacksky Propad 3, which was modified to better handle large project's such as the Kronos E was transported to the site and fully setup to ensure it would work as expected.

The Saturn V rocket had a unique safety feature for the astronauts – the Launch Escape System or LES. Sitting on top the crew capsule is a rocket powered tower that, in the case of an emergency, can lift the capsule away from the launch vehicle. During a normal launch, once the rocket has reached a certain altitude, the LES separates from the main rocket, leaving the capsule behind for its trip to orbit. The Kronos E was designed with a functioning LES that was planned to separate from the rocket shortly before apogee. Prior to the launch, a test flight was performed to ensure the speed and stability of the LES with no launch rail since it would not have one during the actual flight. With the Aerotech G138 Blue Thunder motor used and the Featherweight Raven and Eggtimer Wifi switch, the LES proved to be very stable and launched with enough speed to be able to safely separate from the main vehicle.

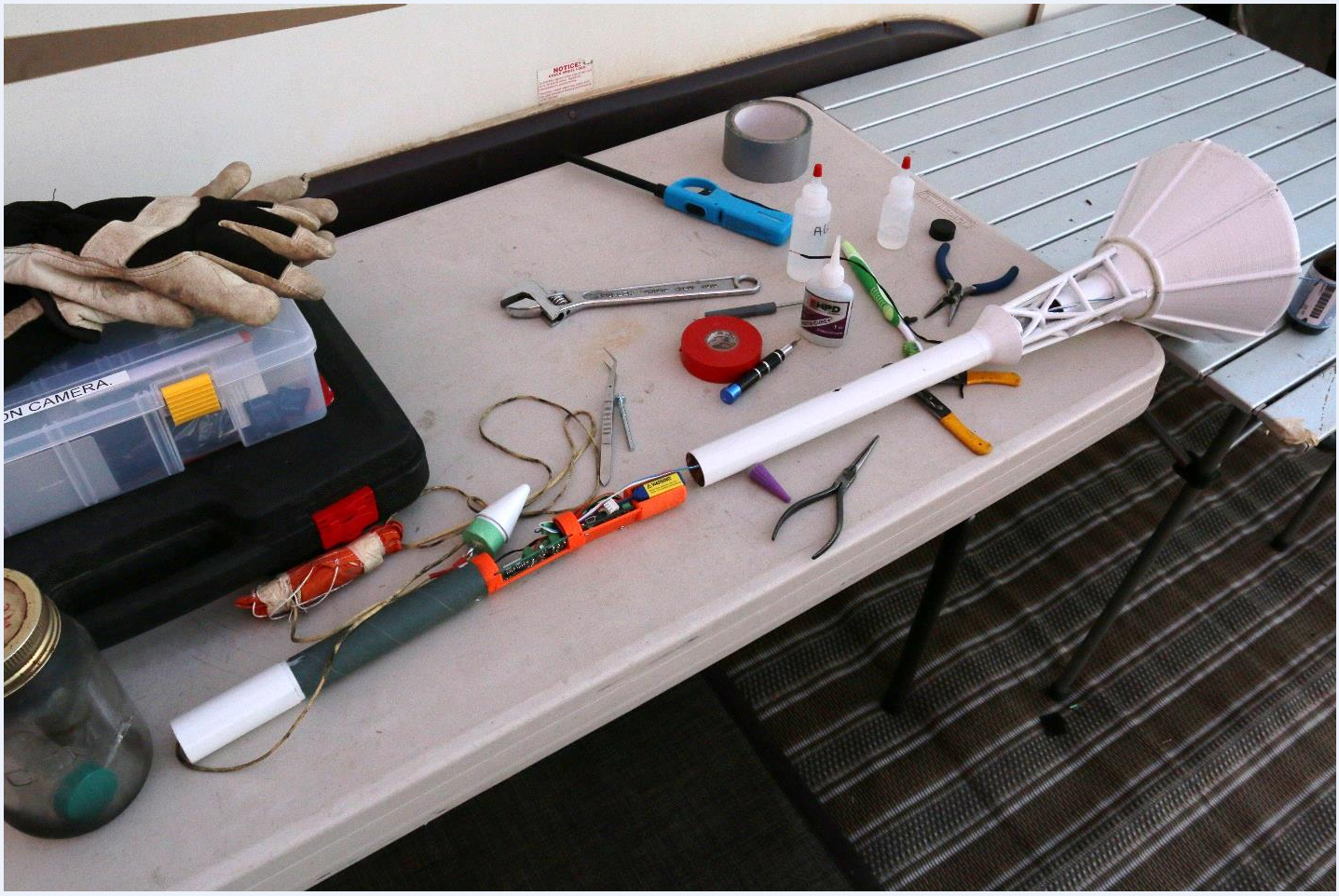


Figure 1 3d printed LES Cover and tower being prepped for recovery

Couvercle de protection LES (imprimé en 3d) et sa tour de lancement en cours de préparation pour la phase de récupération

The Kronos E utilized five motors for its main thrust – a CTI N3301 White motor and 4 air-started CTI K635 Red Lightning motors. Assembly of the K635 motors was straight forward and was similar to standard 54mm motors. The N3301, on the other hand, had a few details that made it unusual to assemble. The most unique part of the assembly was that the motor grains needed to be glued to the motor liner. In addition, the grain closest to the nozzle was different than the other gains we needed to ensure it was placed in the correct location. Details of the differences in assembly were provided in an addendum to the standard instructions, making it a bit more difficult to ensure the correct steps were followed. In the end, assembly of the N3301 was a two-person job but was completed without any problems and with sufficient time to ensure the motor was ready for flight the next day.

Figure 2 Shane and John with the completed CTI N3301

Shane et John avec le moteur CTI N3301 complètement assemblé

With the motors assembled and ready, it was time to move on to assembly of the rocket. The Kronos E was designed to break into five sections for transport and recovery. The larger sections were also modular, and access was needed to the interior for wiring and recovery harnesses. To facilitate this, the outer skin of the rocket was made of 1.6mm polystyrene plastic sheets. In order to attach the skins, all ejection charges needed to be loaded and the recovery harnesses needed to be attached. Once completed, the skins were then attached to the rocket using special flanged screws. Finally, the fins and fairings were attached to the first stage, and all seams were sealed. Assembly was done the day before launch in an open area near the range head to allow spectators to inspect the rocket.

Figure 3 Screwing down the thin Styrene skin, complete with corrugations. Vissage de l'enveloppe de styrène, avec ses décorations en relief

The morning of June 29 was clear, and the wind was calm. With the Kronos E ready to go, the sections were loaded onto two trucks and transported to the launch pad. The launch rail was attached to the pad in the lowered position and the first stage was loaded onto the rail. Each subsequent stage was then attached to form the full Kronos E rocket. Starting with the first stage, each flight computer was then powered up and continuity for each ejection charge was checked.

Figure 4 Special display and shipping cradles helped get all the parts to Lethbridge and now the pad

Supports sur mesure, pour le transport et la présentation, qui ont permis d'amener toutes les pièces à Lethbridge et ensuite au pas de tir

It was at this point a problem was detected. Not all charges were showing connected for the second stage. The team powered down the flight computers and then tested each computer in isolation, identifying the problem devices. Eventually, it became necessary to remove a section of the skin of the rocket to inspect the connectors used on some of the ejection charges. After replacing the connectors and retesting the flight computers, the problem was fixed and preparation for launch resumed with the rocket being raised to the vertical flight position.

Figure 5 Getting vertical! Two pushers with two safety lines. Transition vers la position verticale! Deux personnes pour pousser, et deux cordes d'assurance

Figure 6 John connecting the outboard motor ignitors to the ignition block

John fait les connexions des allumeurs des moteurs d'appoint au bloc terminal d'allumage

Once vertical, the flight computers could be armed so that the motors could be installed, and the staging igniters could be added. After two years of planning, building, and problem solving, the Kronos E was finally ready to soar. All flight computers were giving good values, the sky was still clear, and the wind was still low.

It had been a busy few days to get to this point, but the main igniter as finally added and the range was cleared (after a quick pause for a photo op).

Figure 7 The Team, Ian Stephens, John Glasswick, David Buhler and Shane Weatherill (l-r) L'Équipe (de gauche à droite): Ian Stephens, John Glasswick, David Buhler et Shane Weatherill

With everyone cleared back to the range head and the rocket ready to fly, the team took a couple minutes to talk to the crowd. After describing the events the Kronos E would go through so that spectators would know what to expect, and expressing appreciation for all the support we received, the countdown began.

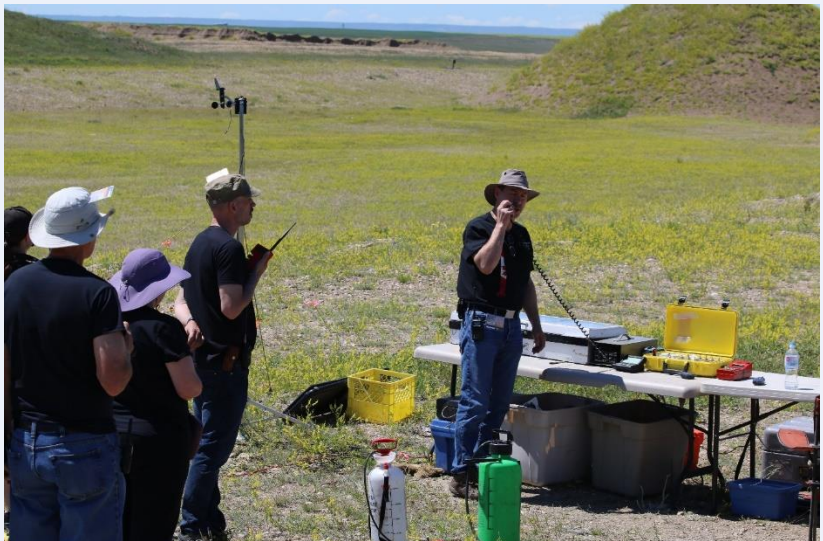
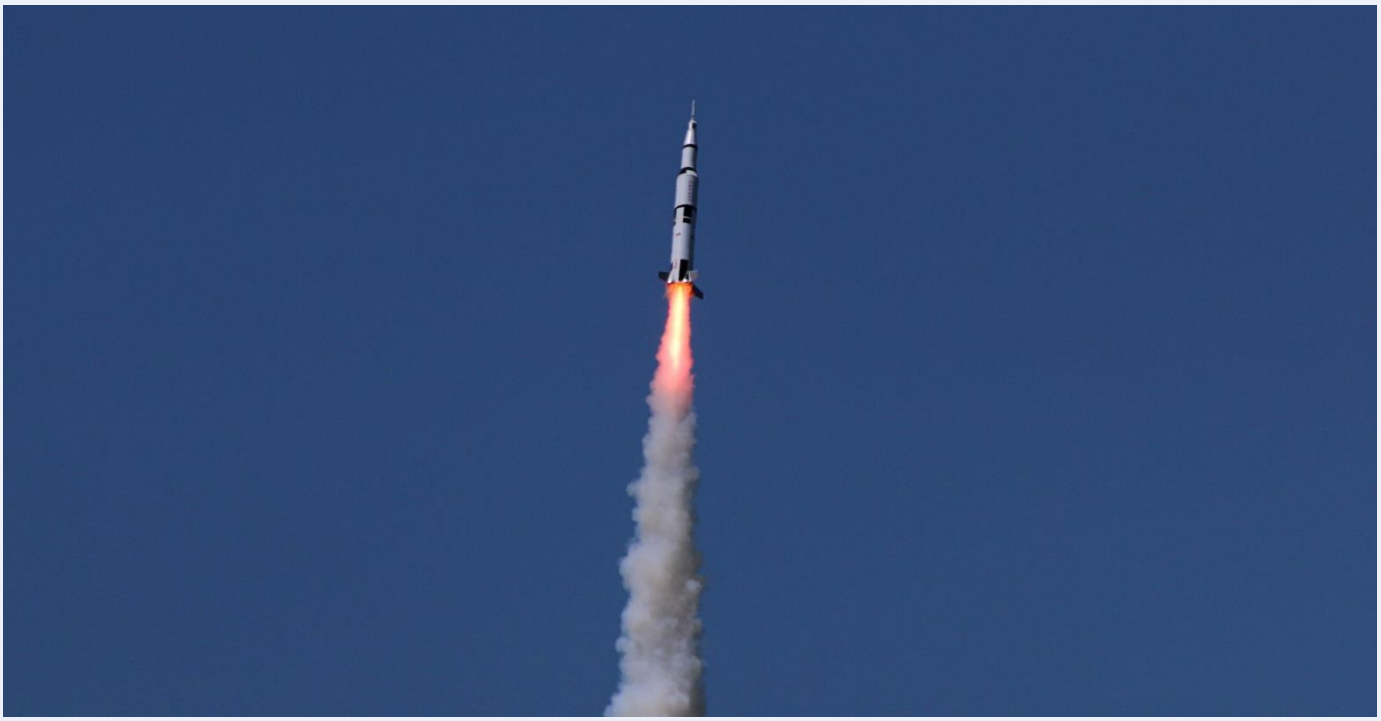


Figure 8 Ian Stephens giving the crowd a rundown of the project

Ian Stephens présente le projet à l'assistance

After a 10 second count down that echoed through out the crowd, the Launch Control Officer (LCO) pressed the button and a slight pop could be seen as the igniter lit. After what seemed like an eternity, but in reality, was only five seconds, the N3301 finally came up to pressure and the Kronos E roared into the sky. Shortly into its flight, all four K635 motors were lit by the on-board flight computers, changing the color of the flame from a bright orange to a light pink.

Figure 9 Lift off of the Kronos E! *Décollage de la fusée Kronos E!*



At approximately 1200m, the on-board flight computers began to deploy the recovery systems, and the Kronos E began its decent back to Earth. As expected, the rocket separated into five sections, but because the deployment was early, there were some issues. The two largest sections successfully deployed their parachutes and had a gentle trip back to the ground. Stage 3, the smallest of the large sections, had a parachute failure, and fell to back to the ground without a parachute. Amazingly, close inspection showed the damage received was mostly to the polystyrene skin and could be easily repaired. Finally, the Command Module and LES tumbled back to the ground and were easily located using the GPS tracking ability of the Eggtimer TRS.

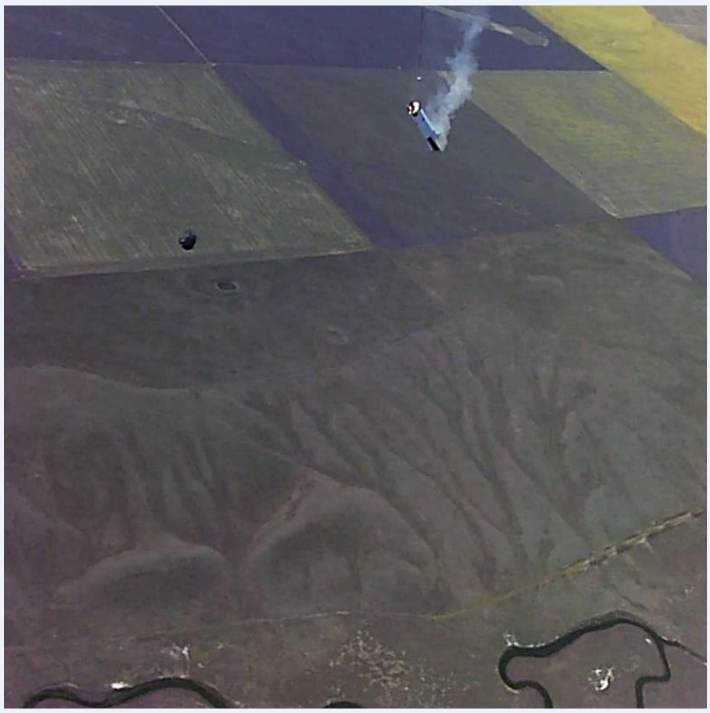


Figure 10 Booster Stage, view from Stage 2 1er étage après séparation, vu du 2e étage

The flight of the Kronos E had an unusually large spectator turnout. This presented a bit of an issue for the launch organizers and the active Range Safety Officer (RSO) in order to make sure the launch was safe. Like any other high-power rocket, the Kronos E was inspected prior to launch. Because of its size, the inspections were done piece by piece as they became ready. The crowd was also given instructions prior to launch so that everyone would be aware where they could stand and would be keeping all eyes on the rocket. CAR/ACF procedures helped make everything run smoothly and safely for everyone involved.

Another unique aspect of the Kronos E project was the large amount of media attention it received. The team was interviewed by print media, radio, and television, leading up to and after the launch. On the day of the launch, Chris Chacon of Global News in Lethbridge travelled to the Rock Lake launch site to film the launch. The active RSO did a good job of ensuring the media had the access they wanted for filming yet was always able to maintain CAR/ACF safety protocols. The team was contacted several times, by telephone, through out the day of the launch. To ensure this didn't result in a distraction for the team, the job of talking to the media was handled by one team member, Shane. This allowed the rest of the team to concentrate on preparing the rocket and solving any issues that came up.

Figure 11 Shane doing one of many interviews for the project.

Shane, dans une des entrevues sur le projet

Click to see more:

Kronos Pente Facebook Launch Video/Pictures

CLUB QUÉBÉCOIS
DE FUSÉONAUTIQUE

Philippe Alexandre Labbe's *Ta Plus Vite*, CTI K510

Chantel Rogers' successful L2 Cert rocket before and after!

Martin Garon's *Cloud Buster*

Sylvain Gagnon's *Ptérodactyl Jr*, I280 Dark Metalstorm

Sylvain Gagnon's Pac 4'' named *BigOne*, J240R (Above)

Sylvain Gagnon's *Little John*, H 295 Smoky Sam (Below)

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AARM

CELEBRATING 50 YRS

EVENTS

ALL AGES INVITED!

A-Motor:

Parachute Duration
Fly a rocket with parachute recovery, and stay in the air the longest.

Streamer Duration
Fly a rocket with streamer recovery, and stay in the air the longest.

Altitude
Fly a rocket to the highest altitude. *(check out our website for avionics bay requirements)*

B-Motor:

Boost Glide Duration
Fly a rocket with a boost glider, and stay in the air the longest.

D-Motor:

Egg Loft Altitude
Fly a rocket with a raw egg as payload to the highest altitude. Return the egg unbroken. *(check out our website for avionics bay requirements)*

Scale
Build, document, and fly a replica of an existing rocket.

Any Motor:

Open Spot Landing
Fly any rocket with an engine. Land as close as possible to a predesignated location on the ground.

JULY 11-12

2020

MODEL ROCKETRY COMPETITION

50TH ANNIVERSARY

ANNUAL ALBERTA REGIONAL MEET

Original Artwork By: Leah Nonay

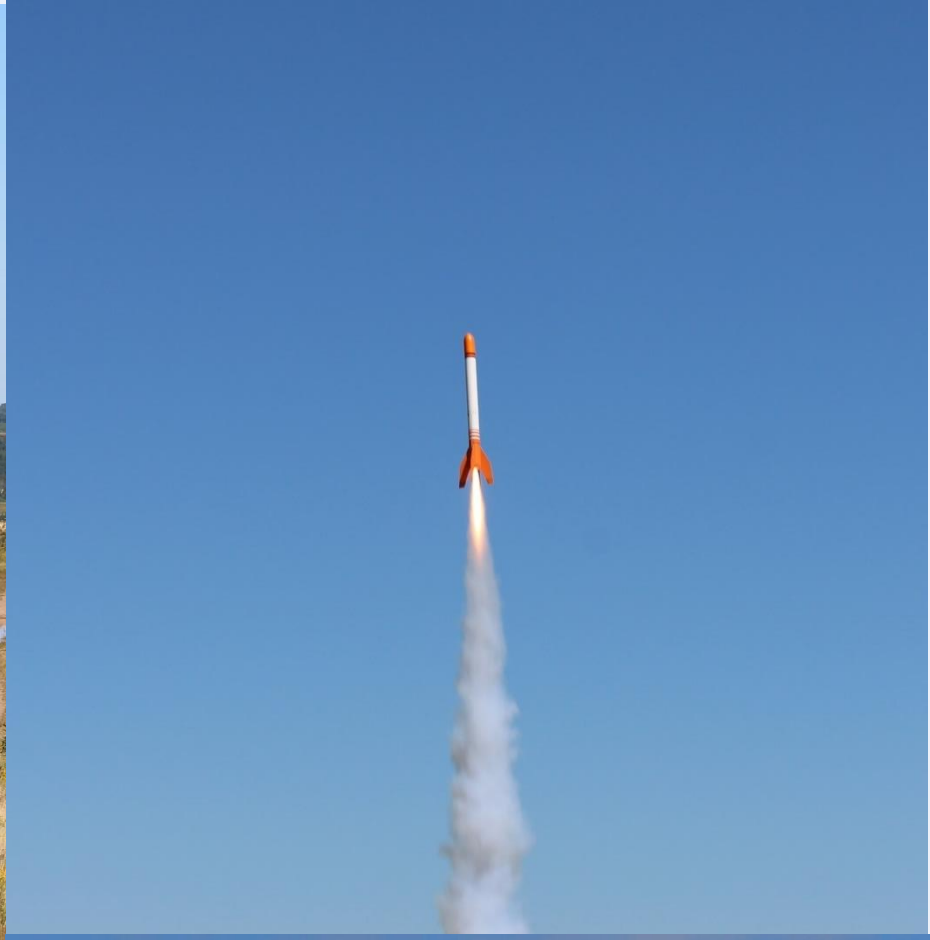
Rage at the Gage 2019 Sebastian Richard, Mario Voyer

The prep area (above), Marc Robbins discussing his L1 rocket (bottom left), and Jean Francoy getting his Patriot inspected prior to flight (bottom right)

Jean Francoy’s Patriot lifts off on an N1100.

Mark Robbins' L1 Rocket being loaded on the pad, liftoff, and flight.

Rachel Daigle arms her *Freaking Big Bertha* prior to her L3 flight (Bottom left).



Flight of the *Freaking Big Bertha*

Mark Roberts' L4 Amraam rocket on the pad and lifting off (bottom)

What is CAR/ACF?

CAR/ACF Mission

The Canadian Association of Rocketry is a world-class association of rocketeers organized for the purpose of promotion, development, education and advancement of amateur aerospace activities. The Association provides access, leadership, organization, competition, communication, protection, representation, recognition, education and scientific/technical development for its members.

CAR/ACF Vision

We, the members of the Canadian Association of Rocketry are the pathway to the future of amateur aerospace and are committed to making rocketry the foremost sport/hobby/activity in the world. This vision is accomplished through:

- A dedication to safety and responsibility
- Partnerships with its valued associates, the aerospace industry and government
- Development of programs that meet or exceed Canadian government regulatory requirements
- A process of continuous improvement
- A commitment to leadership, quality, education and scientific/technical development
- A safe, responsible and enjoyable aerospace development environment.

More about CAR/ACF

- CAR/ACF was established in 1965
- CAR/ACF is a self-supporting, non-profit organization whose sole purpose is to promote development of Amateur Aerospace as a recognized sport and worthwhile amateur activity.
- CAR/ACF is an organization open to anyone interested in legal and responsible rocketry.
- CAR/ACF is the official national body for amateur aerospace in Canada.
- CAR/ACF is a chartering organization for model rocket clubs across the country. CAR offers its' chartered clubs contest sanction and assistance in getting and keeping flying sites.
- CAR/ACF is the voice of its' membership, providing liaison and certification programs with Transport Canada, Natural Resources Canada (Explosives Regulatory Division), and other government agencies through our national headquarters in Calgary, Alberta. CAR also works with local governments, zoning boards and parks departments to promote the interests of local chartered clubs.
- CAR/ACF is the principal stakeholder representing Non-military, Non-commercial aerospace on the Transport Canada Canadian Aviation Regulatory Advisory Council (CARAC) which is responsible for maintaining and developing the Canadian Aviation Regulations (CARS).
- CAR/ACF is a Rocketry Association whose rules and regulations as formally acceptable to the Minister of Transport.

Qu'est-ce que l'ACF?

Mission de l'ACF

L'Association canadienne de fuséonautique est une association de classe mondiale organisée dans le but de promouvoir, développer, éduquer et faire progresser les activités aérospatiales amateurs. L'association fournit accès, direction, organisation, concurrence, communication, protection, représentation, reconnaissance, éducation et développement scientifique / technique à ses membres.

Vision de l'ACF

Nous, les membres de l'Association canadienne de fuséonautique, sommes la voie de l'avenir de l'aéronautique amateur et nous nous engageons à faire de la fusée le sport / loisir / activité la plus importante au monde. Cette vision est réalisée à travers:

- Un dévouement à la sécurité et à la responsabilité
- Des partenariats avec ses précieux collaborateurs, l'industrie aérospatiale et le gouvernement
- Un développement de programmes qui respectent ou dépassent les exigences réglementaires du gouvernement Canadien
- Un processus d'amélioration continue
- Un engagement envers la direction, la qualité, l'éducation et le développement scientifique / technique

En savoir plus sur l'ACF

- L'ACF fut établie en 1965.
- L'ACF est une organisation autonome à but non lucratif dont le seul objectif est de promouvoir le développement de l'aéronautique amateur en tant que sport reconnu et en tant qu'activité amateur valable.
- L'ACF est une organisation ouverte à toute personne intéressée par les fusées légales et responsables.
- L'ACF est l'organisme national officiel de l'aérospatial amateur au Canada.
- L'ACF est une organisation membre de clubs de fusées miniatures à travers le pays. L'ACF offre à ses clubs affiliés sanction et assistance pour obtenir et conserver des sites de vol.
- L'ACF est la voix de ses membres et fournit des programmes de liaison et de certification avec Transports Canada, Ressources naturelles Canada (Division de la réglementation des explosifs) et d'autres agences gouvernementales via son siège national à Calgary, en Alberta. L'ACF collabore également avec les administrations locales, les conseils de zonage et les départements des parcs pour promouvoir les intérêts des clubs à charte locaux.
- L'ACF est le principal intervenant représentant l'aérospatiale non-militaire et non-commerciale au sein du Conseil consultatif de la réglementation de l'aviation canadienne (CCRAC) de Transports Canada, qui est chargé de maintenir et d'élaborer le Règlement de l'aviation canadienne (DORS/96-433).
- L'ACF est une association de fusée dont les règles et règlements ont été officiellement acceptés par le ministère des Transports.

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Rear Photo/photo de résumé:
Sylvain Gagnon's Stretched Carbonized Aurora lifts off on a J540R at Quebec Rocketry Club October Sky launch. Photo by Yves Dufour
Décollage de la fusée "Stretched Carbonized Aurora" de Sylvain Gagnon, l'aide d'un moteur J540R, au lancement Ciel d'Octobre 2019 du Club Québécois de Fuséonautique. Photo par Yves Dufour

Earthrise Translator: Marc Chatel