NWIC Space Center’s 2017 First Nations Launch Achievements

On April 18, 2017, we were on two airplanes to Milwaukee, Wisconsin by 6:30 am for a long flight. There were 12 students, 3 mentors, 2 toddlers and 1 infant that composed the Northwest Indian College Space Center’s two rocket teams. Four separate tribes were represented as were multiple programs of study.

The Challenges

Tribal Division: Student teams will launch a dual deployment high-power that is designed and constructed to maintain a stable flight with a minimum (0) “X” Roll Axis, “Y” Pitch Axis and “Z” Yaw Axis.

American Indian Science and Engineering Society (AISES) Division: Student teams will design and construct a high-power rocket which will be able to provide an Active Drag System (ADS). The ADS must be integrated into the rocket. The challenge is to use an ADS to attain an altitude of exactly 75% of the non-deployed drag system’s apogee of at least 3000ft above ground level with the same rocket flown on the same motor. Each team must be able to fully prepare their rocket for flight within one hour of the first flight recovery.

Assessment

The Rocket Competition will be judged by these separate parts:

I. Design Reports *(written)* (30% of total score)
   a. Preliminary Design Report (PDR)(15%)
   b. Critical Design Report (CDR) (15%)
II. Flight Readiness Presentation (*oral*) (15%)
III. Readiness Review (*day before launch*) (10%)
IV. Flight Performance (*best flight data used*) (30%)
   a. Performance of Instrument-Data Collection (10%)
   b. Predicted Apogee(10%)
   c. Successful Flight Mission (10%)
V. Post-Flight Performance Report (FR) (*written*) (15%)

The teams worked days, evening, and Saturdays and Sundays from October 2016 through the launch day on April 21, 2017.

Results

So, how'd we do?

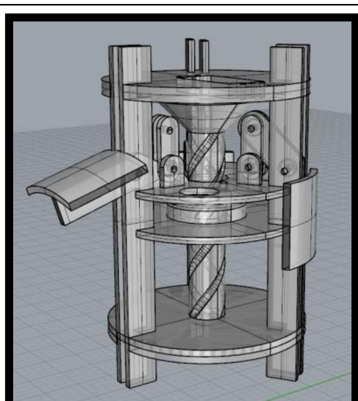
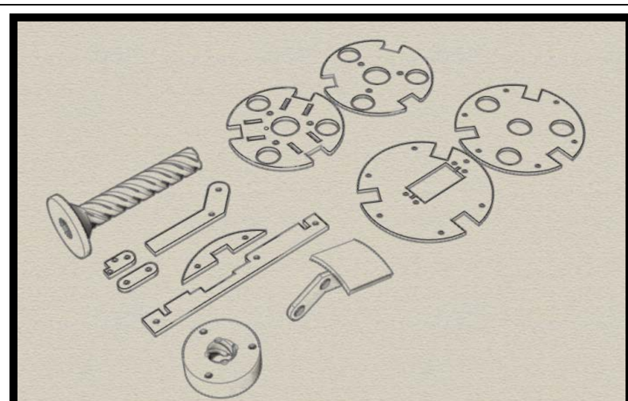
AISES Team with rocket *Braker Braker*

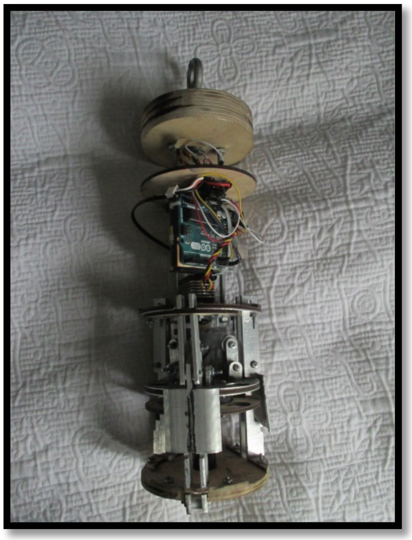
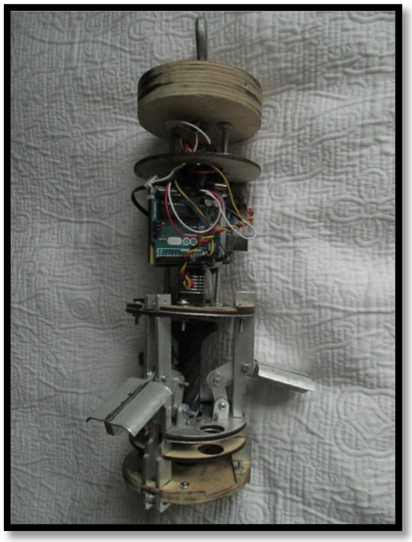
Mikale, Allen, Tamara, Melvin, Christian, Matilda

NWIC—AISES **1st Place**

FIRST NATIONS LAUNCH – AISES COMPETITION

Northwest Indian College	74.30	1st Place
University of California – Los Angeles	60.72	2nd Place
Chief Dull Knife College	57.60	3rd Place
Colorado School of Mines	44.34	
Northern Arizona University	29.36	

	
3D CAD brake system model	Brake system mechanical components

	
Brakes Closed	Brakes Open
Brake System	

The team designed an airbrake system that was milled from aluminum on our CNC mill and with plywood that was shaped with our laser cutter. It was activated by a 3-axis accelerometer with the brakes servo-controlled by an Arduino micro-controller.

Did the air brakes work? Not having video evidence (cameras didn't work) to verify the functioning/non-function of the air brakes left us with examining the two flights' altimeter readings. *Braker Braker* flew to an altitude of 3,099 feet during the first flight and then flew to an altitude of 1,916.4 feet during the second flight. The 75% of the initial altitude target was 2,324.25 feet. The 1,916.4 feet represents 62% of the 3,099 altitude achieved during the first flight. Given this evidence, we feel that we can say with confidence that the braking system worked.

Tribal Team with rocket *Straight Arrow*

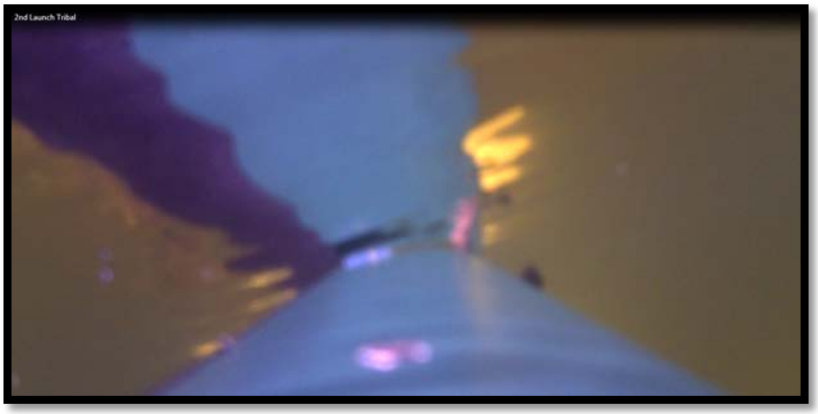
Kiaya, Lavine, Raven, Lisa, Renae, Mariah
NWIC - Tribal **1st Place**

FIRST NATIONS LAUNCH – TRIBAL COMPETITION

Northwest Indian College	75.42	1st Place
Leech Lake Tribal Community	60.76	2nd Place
College of Menominee Nation	58.00	3rd Place
Fort Peck Community College	53.33	
Comanche Nation College	50.98	
Fond du Lac Tribal Community College	50.85	
Southwest Indian Polytechnic Institute	50.43	
Little Big Horn College	47.77	
Turtle Mountain Community College	45.60	
Utah State University – Eastern Blanding	38.78	

We analyzed the video from the first flight and it showed that the rocket rolled nine complete counter clockwise revolutions (67 rpm) during the eight seconds from lift off to apogee. This was a completely unexpected result as we had carefully constructed the rocket and placed its multiple components to eliminate roll. We are attempting to understand the physics behind this. One hypothesis is that the turbulence generated by the camera bays produced a very symmetrical flow that impinged the fins in such a manner that caused the rocket to roll about its longitudinal axis.

	Launch 1 Recovery
	Launch 2 Recovery Landed in water



Launch 2 Recovery
Underwater

The team added 5mm roll control foils to each of the three fins. The foils were installed on the incorrect side fins which resulted in increased roll. The increased roll, in addition to the extra surface drag contributed by the foils, decreased the rocket’s altitude and its velocity. The roll increased from 67 rpm to 120 rpm.

Whereas we didn’t dampen the roll, we did prove that we could affect the roll with the roll control foils. Furthermore, the increased roll coupled with the increased drag from the roll control foils all contributed to the decrease in the second flight’s altitude.

Over all our teams performed very well! We accomplished many of our goals and we learned a considerable amount. And, we had fun!!

We are now planning for our next adventures which include next year’s First Nations Launch and next year’s NASA University Student Launch Initiative. Bottom line, a lot of hard work, thinking and fun ahead!