

Date: 11/31/21

Location: Argonia, KS (Distant Thunder 2021)

Rocket: *Mach Wave II Stage*

Motors: Aerotech K1100T to Aerotech J500G

Weight: 15 lbs

Weather: sun and light clouds, 6-8mph winds, 50°F

Launch: 10:34 (16:34 UTC)

Avionics:

Altimeter	Booster/Sustainer	Drogue	Main	Pyro/AUX
TeleMega S/N 6806	Sustainer (primary)	Apogee	600	Pyro A: T+5s, <20°, 1000ft AGL
EasyMini S/N 6434	Sustainer (secondary)	Apogee +1s	400	
TeleMetrum S/N 5099	Booster (primary)	Apogee	N/A	
RRC3	Booster (secondary)	Apogee +1s	N/A	AUX: T+2s, 1000ft AGL launch trigger

Pre-flight Prep: It had been 2 years since the previous flight, and not all repair work had been done after both stages crash-landed under drogue recovery on Flight 3. 3D-printed a new booster sled using ABS with battery cages for the li-po batteries. Utilized latex glove finger ejection charges instead of canisters taped over. All flight prep was completed 14 hours prior to flight including ejection charges attached, recovery folded, rivets and shear pins inserted, and motors assembled. All that remained was to arrive at the launch site and take rocket to RSO. Only issue during flight prep was a questionable startup sequence with the TeleMega in the sustainer. During some startups while horizontal (startup in Idle mode), it wouldn't exhibit normal behavior and would restart once. All startups in a vertical orientation were normal. The screw switches mounted to the slipband may need to be removed and cleaned or replaced. Nothing affected the flight, however.

At the Pad: No issues with preparations at the pad. Excess igniter wire for the second stage was a little tricky to move out of the way. TeleMetrum in the booster took some 10 minutes to achieve GPS lock. Batteries were healthy in the 40 to 50-degree temperatures and no problems with the 90-minute idle time on the pad, as there were complications with other rockets at the away pads.

Flight: K1100T is an awesome motor, even at the great distance of the away cell. Some tilt observed from the ground, but J500G lit without issue. The booster was visible the whole way down, but the sustainer wasn't spotted again after burning. Incoming telemetry from the

sustainer made it look as though the main failed to deploy (few packets and no decent rate slowdown reported).

Recovery: Booster landed just off of Dixon Road under main. Sustainer was also visible from 90th with the main parachute deployed after all, so perfect flight all around.

Comments from the field:

1. Only point of stress was that someone else would turn on a TeleMetrum device transmitting on the same frequency as one of my 2 transmitters. I'll look into creating my own frequencies so this isn't a concern in the future.
2. Doing every bit of prep at home was excellent. For complex flights such as this, I will continue to do that in the future when possible.
3. A tripod mount for holding 2 antenna and other ground station elements would be helpful.

Flight Data:

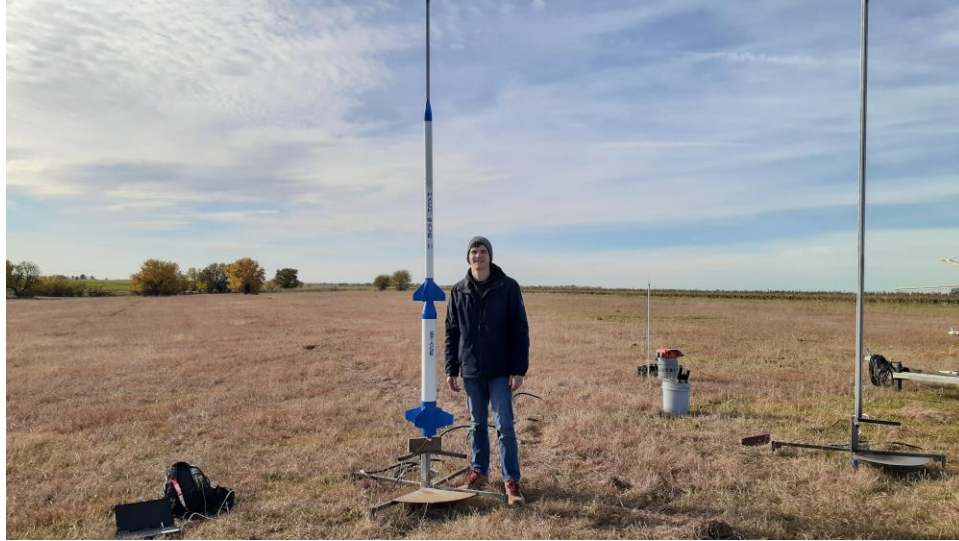
Altimeter	Max Height (ft)	Max GPS Height (ft)	Max Speed (ft/s)	Max Boost Accel (G)	Ascent Time (s)	Touchdown speed (ft/s)
TeleMega S/N 6806	11784	11903	1207	21.05	25.1	41
EasyMini S/N 6436	11849		686	12.49	27.1	40
TeleMetrum S/N 5099	4044	3947	730	24.44	14.1	31
RRC3	4033		794		14.5	30

Data Analysis: .

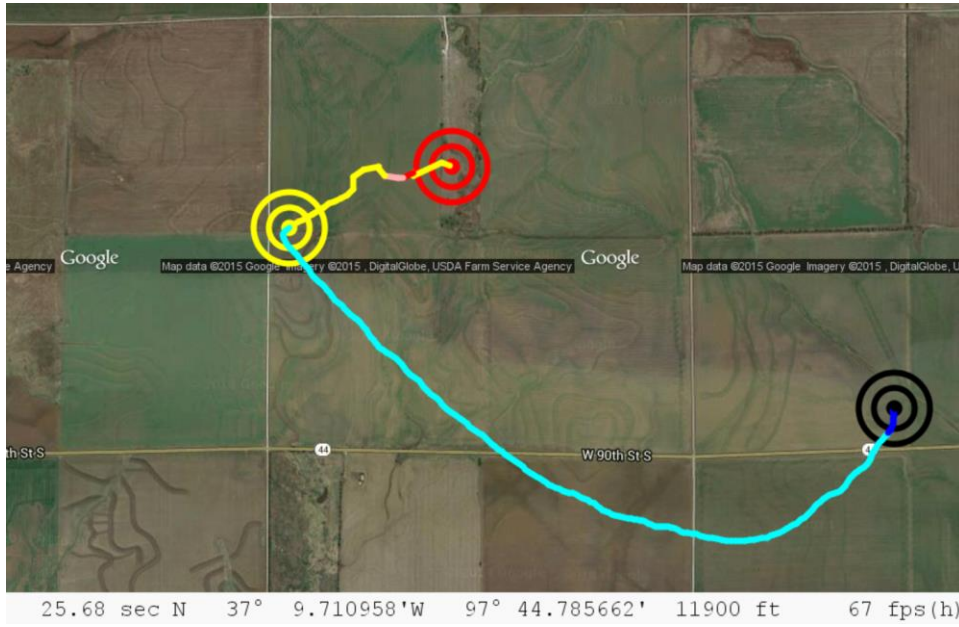
1. J500G took about 0.75 seconds to come up to pressure after receiving ignition signal.
2. Tilt at 5° during Pyro A signal. Tilt limit of 20° was reached at T+22.3s.
3. No observable jolt after K1100T burnout to indicate the separation charge was felt from the booster. Appears to be a smooth drag separation. No jolt observed in the TeleMetrum data either.

Future Actions:

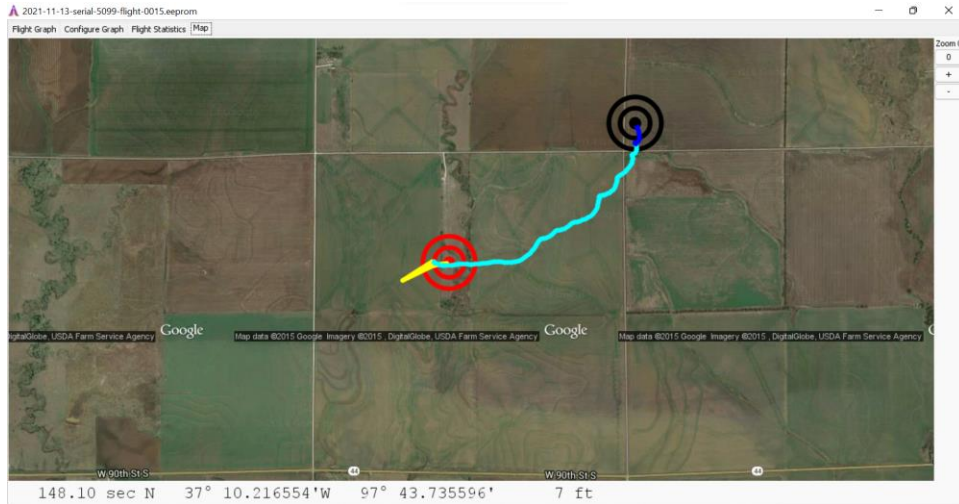
1. Create custom transmitter frequencies.
2. Install new conduit wire in sustainer.



At the pad



Sustainer GPS trace



Booster GPS Trace