

REPORT ON S2P PRECISION FRAGILE PAYLOAD EVENT

Flown September 22, 2013 at “Capitol Cup 2013”, USA
Reported by the Capitol Cup Contest Director, Trip Barber

We flew S2P at the FAI World Cup competition “Capitol Cup 2013” as an Open International event. 7 competitors entered, all USA Seniors, so the event could not be reported as an official international event due to lack of non-USA participation. This event is very similar to one that has been flown in the USA for 12 years as a student rocketry competition with about 9,000 student teams entering it and flying it during that period, so there is deep experience in the USA in this type of precision-performance payload event.

The models entered in S2P were all very different in size and shape, and ranged from 300 to 750 grams in liftoff weight, including rocket motor. Motor sizes ranged from 27 to 78 N-sec. Most rockets were well-painted and colorful because there is no incentive in this event to economize on rocket weight or drag; if the rocket is heavy or draggy, just add more power to achieve the altitude target. There is no incentive to have special rocket motors that are tuned to have the maximum possible power for a class; what matters is having minimum performance variation from motor to motor.

Every flier chose a different design point in the tradeoff between rocket weight, dimensions, parachute size, and motor power in order to achieve the precision altitude target of 300 meters and duration target of 60 seconds. Each flier made adjustments in rocket weight and parachute size or configuration between each flight in order to more exactly hit the precision targets on the next flight, based on the amount by which the previous flight missed the target performance. These adjustments were informed by computer simulations and flight tests done before the competition. No competitors used onboard electronics to control the altitude of parachute deployment or to “dethermalize” the parachute to more precisely control duration in the face of weather variations such as thermals. In a larger and more highly competitive competition these strategies should be expected. These rockets can easily carry 30 grams or more of onboard electronics for these purposes, and the use of this technology will provide an advantage.

The “fragile payloads” that we used were raw eggs, which is the standard for this event in the USA. Each egg was assigned a serial number that was recorded for that competitor and each egg had its precise weight written on it, so the competitors would know where in the allowed range of weights (60 +/- 3 grams) it fell, and how much ballast weight they must add to their rocket with that egg to ensure a precise total rocket weight at liftoff. Because a rocket that goes 300 meters and returns 60 seconds after liftoff descends at a speed of 6 meters/sec, the egg payloads required significant padding for protection and the rocket construction must be sturdy. One competitor suffered an egg fracture on landing on his third and final flight and was disqualified in the event as a result. Another had a motor cato without damaging his model, and flew it again. Two competitors had to climb trees to recover their rockets on their third flights in order to achieve a score and to present an unbroken egg after the third flight in order to qualify their score.

While the rules do not specify this, the egg should be inspected prior to each flight, in connection with altimeter issue or inspection, to ensure that the correct serial-numbered egg is actually being carried in the rocket on each flight. S2P was flown as the first event of the day, so there was no opportunity for competitors to do test-flying of their rockets prior to the competition on that same day, in order to adjust its weight, launch angle, parachute, etc. to achieve a precise performance in the weather conditions of that day. This event should be flown as the first event of a day, so that competitors will be forced to rely on careful data from previous flights to make informed adjustments without the necessity of same-day flight testing.



The top 5 competitors at the Capitol Cup S2P event, with their models.

RESULTS FROM S2P PRECISION PAYLOAD AT "Capitol Cup 2013"

Name, Surname	Motor Power N-sec	Altitude 1	Duration 1	1st flight Score	Altitude 2	Duration 2	2nd flight Score	Altitude 3	Duration 3	3rd Flight Score	Total	Place
HUMPHREY, Steve	35	298	53	23	313	63	22	298	60	2	47	1
BARBER, Arthur	78	318	64	27	309	55	24	302	67	23	74	2
KIDWELL, Chris	33.6	291	64	21	266	56	46	278	65	37	104	3
BUTLER, Patrick	28.5	274	71	59	261	67	57	266	65	49	165	4
FLANIGAN, Chris	27.2	292	91	101	261	30	129	297	58	9	239	5
GUZEK, Brian	28.5	244	53	77	207	41	150	231	47	111	338	6
REYNOLDS, Tony	50	213	52	111	230	51	97	232	48	104	DQ Egg Broken	

Wind: 15 km/hr

Temperature: 20C

September 22, 2013

Contestants adjusted ballast weight, parachute size or configuration, and launch angle between flights.