

The flight in N297SU began really well. We were a little delayed in taking off due to the FBO being busy and not getting us fuel in a quick enough manner as well as rain showers in the airport vicinity. We were doing the flight with the goal in mind to practice Vortex Ring State, following a navigation log for a flight plan, off airports, and other emergency procedures. The student had previously failed his stage 2 in the private lab which covers these maneuvers and we were doing a remedial flight to get him proficient on the maneuvers which he failed, which were following a navigation log and VRS. The aircraft preflight went well and nothing was spotted. We departed the airport in a normal fashion and climbed up to 7000 ft MSL over Interstate 15 southbound to follow my students navigation log. After flying his flight plan down to Kanarraville (approximately 12 miles south of the airfield) we turned around and practiced Vortex Ring State approximately 9 miles south of the airfield. We did our orbit up to 7500 and practiced both the traditional recovery (which is to lower collective and push for airspeed) and we also practiced the Vuichard Method (which is to apply lateral cyclic to the advancing side, add power pedal to keep nose straight, and raise collective). After practicing these maneuvers, we were flying back to the field over I-15 and then decided to break off and do an off airport at a common location for stage checks and one that I have been to many times.

We approached the spot and I had my student practice doing the orbits and going through the acronym AWOTFEEL (which stands for Altitude, Winds, Obstacles, Terrain, Forced Entry, Entry to the Spot, Exit from the spot, and Landing Zone). We did a high reconnaissance orbit at 500 feet AGL which we fluctuated between 500-700 feet because my student was having a hard time with altitude this particular day. We briefed AWOT and then proceeded with the low reconnaissance orbit at 300 feet AGL and again, my student was fluctuating this time between 300-500 AGL. After doing the orbits and briefing FEEL, we circled around and set up for a power check and low pass. My student had climbed back up to 500 feet AGL for this procedure. We did the first power check facing the wind (which was coming from the north around 350-010 magnetic at about 10-15kts) and we came to a stop at about 17-18" manifold pressure which was low considering we were in an OGE hover and knew it was because of the wind we had such good performance. After doing the first power check, we descended back down to 300 ft AGL for a last low pass and circled around at 300 feet to get aligned back into our spot. We came into the off airport from South to North with a headwind and did another power check once we were close to the ground to double check we had the performance. I was teaching my student how, if we didn't have the power, you can dive out while you still have altitude to the left or right since it was on the top of a hill with slopes on the sides. This last power check, we were pulling close to 20" of manifold at about 10-15 foot hover and about 30-50 feet south of the spot over a dirt road.

As we came into the spot, it is a relatively confined area with Cedar trees and a rock pit in the middle. The student went to a more sloped side and I didn't want us to touch skids with the slope so I had him come to about a 5-7 foot hover. We were able to hold a constant hover at this altitude and had 20.8-21.1" on the manifold pressure gage. For our departure, we had some trees about nose height in front of us and he began to pull power. At this point, we got the full throttle light at about 22.5" on the manifold pressure gauge and I got on the collective and lowered a little to extinguish the light. This motion brought us down to a 3- 5 ft hover and I was worried about our tail since there were trees, stumps, and a fence post behind us. I then had my student

come back to a 5 foot hover and taxi a bit forward to clear the tail for a pedal turn and to put our nose facing slightly more northeast which there was an opening in the trees for our departure from the spot. This allowed our tail to be well clear of any obstacles and a clear spot for our departure so we wouldn't have to bring in any more power. I also had the carburetor heat brought in about finger height (which was about one quarter or less on the carburetor heat) on the departure.

As we began to push forward on the cyclic, there was a big jolt in the helicopter and a left yaw. I immediately grabbed controls and I then began to think that we hit a tree or possibly another obstacle with the tail. At this point, we were already in our departure gaining speed and some altitude and it was too confined to come to a stop so I continued forward on the cyclic. The helicopter started to vibrate a lot and there was another major left yaw in the aircraft and the engine RPM began to fall quite rapidly. At this point, we began to fall. I looked at the RPM and the engine tachometer was falling more rapidly than the Rotor tach so I immediately lowered collective and rolled in throttle but the engine RPM still was falling quite rapidly even with the roll on. We never got full throttle light back and the engine was dropping quickly. Because of the loss of engine RPM, it caused the rotor RPM to fall as well. Once the low Rotor RPM horn came on, the engine RPM was close to 80% and I knew that we were committed in going down. We were having slight left yaws each time the aircraft jolted and a big left yaw right before the fall but I was able to add right pedal to counteract it. I noticed with the last left yaw the engine RPM was correlating with the yaw of the aircraft. At this point we were really close to the ground and I began a flare and leveled off the ship trying to align it enough with the steeper slope as to not hit the tail. It was at this point we had contact with the trees and I came hard aft to stop the aircraft from moving anymore forward which would have caused us to roll. In the process, I cut the tail off with the main rotor blade.

Once we were on the ground, I noticed that the engine was still running but very sporadic and off and on and it was idling lower than could be indicated on the tachometer. At this point, I pulled mixture, turned battery off, applied break. Once the blades were stopped, I pushed the distress button for spider tracks, stepped out of the aircraft and called Richard Cannon. After the phone call, I immediately went to examine the surrounding areas looking at the trees, stumps, rocks, anything I could have possibly hit with my tail to cause such abrupt shake and yaw in the helicopter. However, there was no sign of any tail strike anywhere around. I also noticed that where we started to get the yaw that there was no obstructions around other than the ground but our stinger had no evidence of a tail strike as well. I did not spin but I did have a left yaw on every jolt of the aircraft. The first indication of a problem was the big jolts of the helicopter which was followed by the power loss. All of this occurred around 1310-1312 local time. From the moment we had the jolts and vibrations to when we were down on the ground was about 10 to 15 seconds. We were at about 15-20 feet and we had a ground speed between 5-15 knots and 20 knots indicated.

It later occurred to me and made me wonder if this was something to do with how close the aircraft was to overhaul. (It was 13 hours away from Overhaul) I have also recently been informed that the aircraft had been involved with a tail strike that had happened the day previous which had caused the tail skid to be slightly bent. As I looked in the aircraft's daily log, it was not reported and the inspection was also not recorded in the aircraft's maintenance logbook. So,

because of this negligence, I was unable to know if it had the proper inspection done as outlined in the R44 Maintenance Manual Chapter 2 section 2.510.

Cedar City Weather METAR 15 minutes prior to the accident:

Air temp: 18 degrees Celsius

Dewpoint: 12 degrees Celsius (which did require us to have carburetor heat applied. It was one quarter pulled in so not full carb heat, but about a quarter applied)

Altimeter Setting: 30.09

Winds at Cedar: 130 @ 8kts

Visibility: 10SM

Scattered at 6000AGL

Broken at 8000 AGL

Broken at 9000 AGL

DA: 7200

There was also scattered rain showers that were raining lightly as reported in the METAR the previous hour.

We had the calculations of the following before takeoff:

(HLE) Highest Landing Elevation: 6500

(HLE PA) Highest landing Elevation PA: 6310

(HLE DA) Highest landing Elevation DA: 8110

(MEA) Maximum Enroute Altitude DA: 9610

(MEA) Maximum Enroute Altitude: 8000

(IGE) In Ground Effect: 9100

(OGE) Out of Ground Effect: 6200

Takeoff Weight: 2028.2 (calculated with 35 gallons on board)

MCP: 21.1

Maximum 5 min takeoff: 23.1

VNE: 103

Calculations during accident:

(HLE) Highest Landing Elevation: 6500

(HLE PA) Highest landing Elevation PA: 6630

(HLE DA) Highest landing Elevation DA: 7890

(MEA) Maximum Enroute Altitude DA: 9340

(MEA) Maximum Enroute Altitude: 8000

(IGE) In Ground Effect: 9200

(OGE) Out of Ground Effect: 7500

Takeoff Weight: 1938.2 (calculated with 20 gallons on board for a 15 GPH fuel burn)

MCP: 21.1

Maximum 5 min takeoff: 23.1

VNE: 103

NOTAMS at time of Accident:

RWY 02 RWY END ID LGT U/S. 30 SEP 20:09 2022 UNTIL 14 OCT 23:59 2022
ESTIMATED.CREATED: 30 SEP 20:09 2022

09/234 - OBST TOWER LGT (ASR 1059194) 373956.90N1130502.80W (2.2NM SSE CDC)
6176.8FT (132.9FT AGL) U/S. 27 SEP 02:46 2022 UNTIL 27 OCT 02:46 2022. CREATED: 27
SEP 02:46 2022

09/190 (A0639/22) - AD AP RDO ALTIMETER UNREL. AUTOLAND, HUD TO
TOUCHDOWN, ENHANCED FLT VISION SYSTEMS TO TOUCHDOWN, HEL OPS
REQUIRING RDO ALTIMETER DATA TO INCLUDE HOVER AUTOPILOT MODES AND
CAT A/B/PERFORMANCE CLASS TKOF AND LDG NOT AUTHORIZED EXC FOR ACFT
USING APPROVED ALTERNATIVE METHODS OF COMPLIANCE DUE TO 5G C-BAND
INTERFERENCE PLUS SEE AIRWORTHINESS DIRECTIVES 2021-23-12, 2021-23-13. 01
OCT 04:01 2022 UNTIL 01 OCT 04:01 2024. CREATED: 24 SEP 04:40 2022

09/039 - OBST TOWER LGT (ASR 1232340) 374251.50N1130442.60W (1.2NM NE CDC)
5705.1FT (100.1FT AGL) U/S. 08 SEP 12:21 2022 UNTIL 08 OCT 12:21 2022. CREATED: 08
SEP 12:21 2022

08/122 - TWY B1 HLDG PSN MARKINGS NOT STD. 15 AUG 13:31 2022 UNTIL 28 OCT
20:00 2022 ESTIMATED.CREATED: 15 AUG 13:31 2022

07/150 (A0539/22) - RWY 08/26 REDL HIGH INTST U/S. 19 JUL 19:06 2022 UNTIL 31 DEC
15:00 2022. CREATED: 19 JUL 19:06 2022

06/126 (A0383/21) - TWY B BTN TWY C AND EAST RAMP CLSD. 25 JUN 20:00 2021
UNTIL PERM. CREATED: 25
JUN 20:00 2021

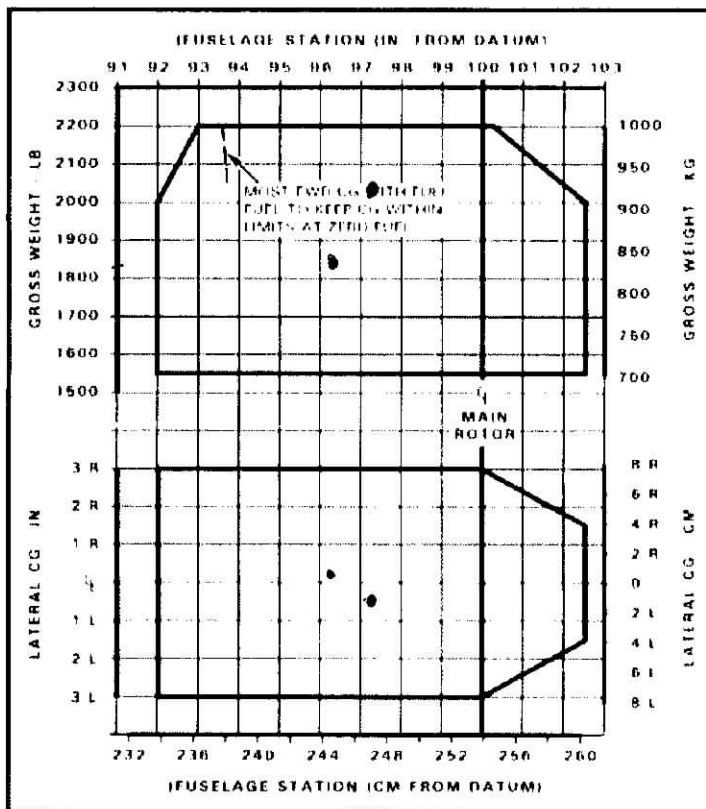
Before Take off w/ 35 gallons

R44 Cadet Weight and Balance

Weight x Arm = Moment.

Total Mom. / Total Weight = CG

Tail #	Weight	Long. Arm	Long. Mom.	Lat. Arm	Lat. Mom.
Empty Weight	1478.2	106.77	157827	-2	-295.64
Pilot	180	49.5	8910	12.2	2196
Pilot Baggage	0	44	—	11.5	—
Passenger	140	49.5	6930	-10.4	-1456
Passenger Baggage	0	44	—	-11.5	—
Right Aft Baggage Comp. and Deck	10	78	780	12.2	122
Left Aft Baggage Comp. and Deck	10	78	780	-12.2	-122
Right FWD Door	-7	49.4	—	24	—
Left FWD Door	-7	49.4	—	-24	—
Right Aft Door	-7.5	75.4	—	23	—
Left Aft Door	-7.5	75.4	—	-23	—
Zero Fuel Totals	Weight 1817.2	Long. CG 96.4	Long. Mom. 175,227.4	Lat. CG .2	Lat. Mom. 444.36
Main Tank 25 gal x 6 =	150	106	15,900	-13.5	-2025
Aux Tank 10 gal x 6 =	60	102	6120	13	780
Take Off Totals	TOW 2028.2	Long. CG 97.3	Long. Mom. 197,247.4	Lat. CG -.4	Lat. Mom. -800.64



Max Enroute Altitude (MEA) DA	9610
Highest Landing Elevation (HLE) DA	8110
Highest Landing Elevation (HLE) PA	6310
IGE	9100
OGE	6200
TOW	2028.2
Fuel On Board	2.5
Estimated Time Enroute	—

	8000		during t
+	<u>-190</u>	PA Correction	
=	7810	MEA PA	
+	<u>1800</u>	DA Correction	
=	9610	MEA DA	

During time of off airport

R44 Cadet Weight and Balance

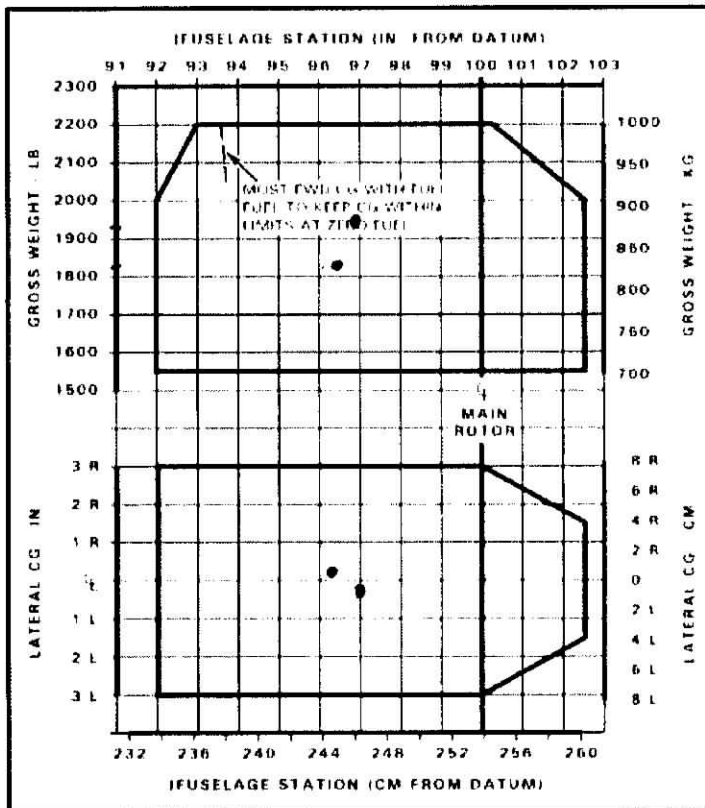
Weight x Arm = Moment.

Total Mom. / Total Weight = CG

Tail #	Weight	Long. Arm	Long. Mom.
Empty Weight	1478.2	106.77	157827.4
Pilot	180	49.5	8910
Pilot Baggage	0	44	—
Passenger	140	49.5	6930
Passenger Baggage	0	44	—
Right Aft Baggage Comp. and Deck	10	78	780
Left Aft Baggage Comp. and Deck	10	78	780
Right FWD Door	-7	49.4	
Left FWD Door	-7	49.4	
Right Aft Door	-7.5	75.4	
Left Aft Door	-7.5	75.4	
Zero Fuel Totals	Weight 1818.2	Long. CG 96.4	Long. Mom. 175,227.4
Main Tank 15 gal x 6 =	90	106	9540
Aux Tank 5 gal x 6 =	30	102	3060
Take Off Totals	TOW 1938.2	Long. CG 96.9	Long. Mom. 187,827.4

Lat. Arm	Lat. Mom.
-2	-295.64
12.2	2196
11.5	—
-10.4	-1456
-11.5	—
12.2	122
-12.2	-122
24	
-24	
23	
-23	
Lat. CG .2	Lat. Mom. 444.36
-13.5	-1215
13	390
Lat. CG -.2	Lat. Mom. -380.64

156PH
Fuel Burn



Max Enroute Altitude (MEA) DA	9390
Highest Landing Elevation (HLE) DA	7890
Highest Landing Elevation (HLE) PA	6330
IGE	9300
OGE	7,500
TOW	1938.2
Fuel On Board	1.5
Estimated Time Enroute	—

OGE: 7,500

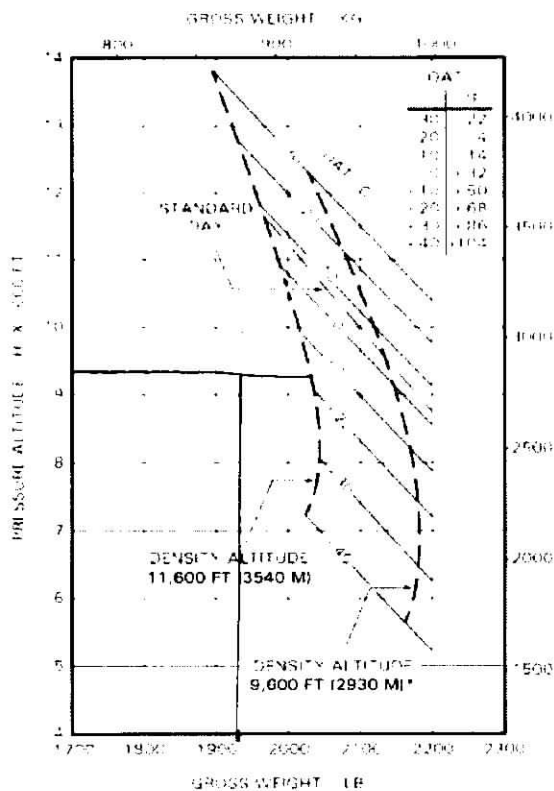
1/4 carb Heat: - 600 → 6900 OGE

School SOP: - 500 → 6400 OGE

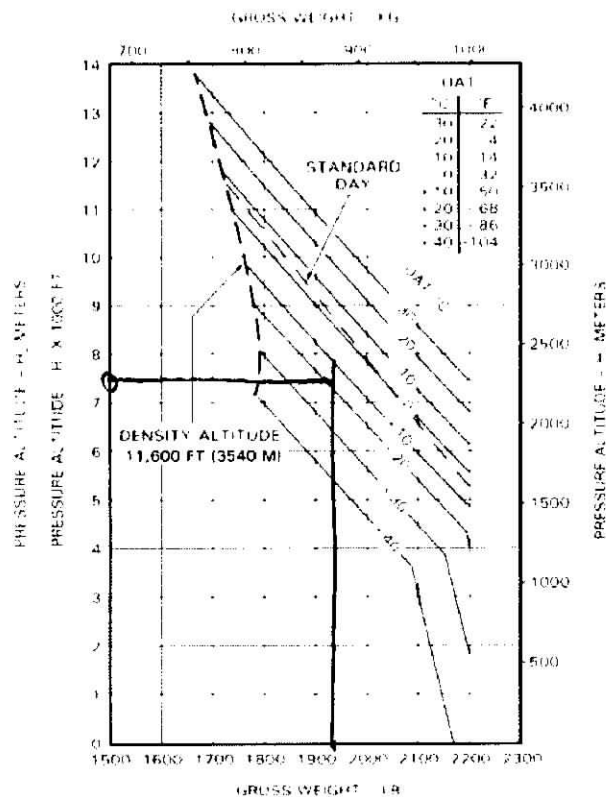
2400/4 = 600

During time of off airport

IN GROUND EFFECT AT 2 FEET SKID HEIGHT
FULL THROTTLE
ZERO WIND



OUT OF GROUND EFFECT
TAKEOFF POWER OR FULL THROTTLE
ZERO WIND



Standard Pressure at Sea Level = 29.92" Hg

Standard Temp at Sea Level = 15°C

Standard Lapse Rate = 2°C/1000'

PA Correction: $\frac{29.92}{\text{(Standard Pressure)}} - \frac{30.09}{\text{(Current Pressure)}} = \frac{-.17}{\text{PA Correction}} \times 1000 = \frac{-170}{\text{PA Correction}}$

DA Correction: $\frac{17}{\text{(Current Temp)}} - \frac{4}{\text{(Standard Temp)}} = \frac{13}{\text{DA Correction}} \times 120 = \frac{1560}{\text{DA Correction}}$

Highest altitude you'll land at
for this flight; including off
airports

$$\begin{array}{r} 6500 \\ + -170 \\ \hline = 6330 \\ + 1560 \\ \hline = 7890 \end{array}$$
 PA Correction
HLE PA
DA Correction
HLE DA

Highest altitude you'll reach
during this flight

$$\begin{array}{r} 8000 \\ + -170 \\ \hline = 7830 \\ + 1560 \\ \hline = 9390 \end{array}$$
 PA Correction
MEA PA
DA Correction
MEA DA