

I departed Redlands Municipal (KREI) approximately 9:15p.m.

At the time of departure, I calculated (based on my log of tach times and fuel consumption for the 60+ hours I've owned and operated it) the Mooney had in excess of 14 gallons of fuel on board (approximately 14.4). Both fuel gauges showed in excess of 36 pounds of fuel (I believe the fuel gauges on that Mooney are marked with "ticks" at Empty, 36 pounds, 72 pounds, 108 pounds, and 156 pounds ("F" for "full"), and the needles were between 36 and 72, showing at least a quarter tank each). (Those fuel gauges never read full even when the tanks were filled to overflowing, but otherwise seemed accurate.)

I was flying to Burbank (KBUR), at 4,500', an approximately 25-30 minute flight.

I was not operating on a flight plan, but I did call up for VFR flight following. I wasn't able to contact SoCal TRACON from the ground, and the frequency (I believe on 127.25) was busy, but I picked them up somewhere over the vicinity of San Bernardino Airport (KSBD) (it was past 9pm, the tower was closed).

I don't remember exactly when I began to descend, but it would have been about 7 minutes out, to allow time to get down to traffic pattern altitude comfortably. SoCal Approach had me altitude restricted to 3,000'.

When TRACON switched me to tower, I was over the Rose Bowl visual reporting point (VPLRB), about 10nm out from KBUR. Burbank tower canceled my altitude restriction and directed me to enter left traffic for runway 15. I began my descent and turned to the south a bit to clear the low mountains east of the airport.

About a minute and a half later, I experienced the engine failure; I was probably at about 2,500' MSL (approx. 1,800' AGL). It wasn't immediately clear to me what was going on, I still saw manifold pressure and fuel pressure (in the green arc on the gauge) and my RPMs were about 1500. (I usually descend at 1950 rpm and a manifold pressure of about 17-18" to shed speed and make sure to avoid the placarded 2000-2350 range where continuous operation is to be avoided, due to harmonic vibration (Lycoming IO-360-A1A, Hartzell HC-C2YK-1BF/F7666A-2).) The prop was quite loud and I believed the engine was still running, just not making much if any power (my initial report to Burbank

Tower was that I *thought* I'd lost the engine).

I'm not clear as to the exact sequence of each of these steps, but I: pitched for best glide; activated the electric fuel pump; switched tanks; tried different throttle, mixture, and propeller control positions; ran through the Mooney's engine restart procedure (retarding throttle), etc. (to no avail); and made a "mayday" call to Burbank Tower (though listening to LiveATC recordings, the "mayday" part was cut off) and advised my engine was without power. (I had all of the checklists in ForeFlight, having personally copied them from the owner's manual.)

I switched back to the moving map display of ForeFlight where I always have the Glide Advisor turned on (I'd read an article recommending that as a best practice, to save precious seconds in the event of an emergency like this), saw that the airport was not within gliding distance, and began looking for a possible place to land. We were over a densely populated urban area and the major thoroughfares (highways, etc) were full of cars — headlights and brake lights visible. With no better option within glide range that I could see, I settled on the darkest side street I could see. I remained in positive control of the airplane until the crash, and I believe — the last couple of seconds are a bit of a blur — that, in turning to avoid an apartment building I stalled the left wing and caused the aircraft to spin 180° to the ground (from approximately 15' AGL) (alternately, it's possible impacting the tree with the left wing caused the aircraft to spin).

The last time I fueled the aircraft was at El Monte (KEMT) on 9/16/2017. The tach time then was 1528.72. It took on 34.7 gallons from the fuel truck (10.3 gph average since the last fueling, in which it had flown KAVQ->KSMO, then KSMO->KEMT), filled to "overflowing." I supervised the refueling and actually stepped away from a conversation (I had flown into El Monte for a group lunch with other area pilots) to ensure the truck driver continued filling until no gaps were visible below the tops of the tanks, as is my custom. (The Mooney wet wing is wider and shallower than most tanks, and what would be a slight gap in another aircraft is, from experience, a gallon or more down in an M20.)

(Prior to refueling at El Monte, I fueled the aircraft at Marana Regional (KAVQ), on 9/15/2017, at tach time 1525.05. The aircraft had just had avionics work done by Tucson

Aeroservices, who logged the aircraft out at 1525.1. It took on 30.3 gallons (9.0 gph), and had flown KSMO->KAVQ. Fueling was done by a fuel truck and a Tucson Aero employee; I again supervised and ensured the fuel was "overflowing." Prior to departing for Marana, I had topped the aircraft off at Santa Monica, but didn't log the specifics. (I had had new tires installed at Bill's Air Center and had taxied around the airport environment and if I recall did a loop around the pattern.) Prior to that, I filled up at Santa Monica from the Atlantic fuel truck, 1520.79 hours tach time, 25.4 gallons, 7/23/2017 (10.2 gph), after flying Chino (KCNO) -> KSMO, then KSMO->KIZA VFR and returning IFR. Prior to that, I filled up at Chino (Flying Tigers truck, I supervised the fueling), 7/21/2017, 33.2 gallons, tach time 1518.30, 9.5 gph (Corona (KAJO) -> Chino (KCNO); Chino -> Santa Monica; Santa Monica -> Torrance (KTOA) and back; then Santa Monica -> Chino). Prior to that I filled up at Corona on 7/15/2017, 1515.41 tachometer time, 37.2 gallons (9.4 gph), after flying St. George (KSGU) to Santa Monica (IFR), then Santa Monica -> Burbank -> Santa Monica, then Santa Monica -> Corona. Prior to that I filled up at St. George (KSGU) on 7/12/2017, after flying Santa Monica to Santa Barbara (KSBA) (IFR) then Santa Barbara to St. George (IFR). 39.2 gallons, 10.0 gph, tach time 1511.47.)

I tracked this information carefully based on advice from one of my private pilot CFIs, who told me aircraft fuel gauges only have to be accurate when they're empty (which I've since learned is not the case, but the adage stuck with me), and to always plan based on measured consumption - monitoring length of flight and calculating gallons per hour based on gallons pumped in to fully fuel the plane. I took that average and added a gallon per hour, to 10.5 gph (everyone talks about the Mooney being a "9-10 gph" plane, so that number seemed conservative based on observed fuel consumption). Ever since my first flights in the then-new-to-me aircraft, I've always landed with significantly in excess of an hour of fuel remaining (greater than 12 gallons on board), and typically refuel well before that point (my average (mean/median) refueling point is 30.7/33.2 gallons, with 21.3/18.8 remaining in the tank.

Ordinarily, I would have refueled the plane at Redlands, but I had a passenger who needed to return to Burbank before the Atlantic FBO closed at 10:00 p.m. We had been attending a fraternity function at the University of Redlands, which culminated in a short ceremony at 9:00

p.m.; we left immediately afterwards via a ride sharing service. At one point I offered to send my passenger home via Uber or Lyft at my expense from the Santa Monica airport (where there was no arrival deadline), but he demurred. I calculated the fuel on board and was sure I had enough to make the roughly thirty minute trip to Burbank plus a more than 45 minute reserve (approximately 9 gallons remaining, using the what I believed to be conservative 10.5 gph). (According to ForeFlight, our actual time in flight from KREI to a point 5 miles away from Burbank was 27 minutes.) I knew I would be landing at Burbank with minutes to spare before Atlantic closed, and that I would be landing with a few minutes more than required night VFR reserves, so I called ahead on the Burbank Atlantic ASRI frequency 131.6 (while using the SL30's monitor function to stay on with SoCal Approach), to request they not put the 100LL fuel truck away. They told me they'd "leave the lights on" for me.

Instead, I am informed by Elliott Simpson of the NTSB that the tanks appeared to both be dry. I do not understand how that is possible. Even if I miscalculated fuel on board (and I should have had more than enough to reach KBUR with more than the required reserve), I did not experience an "engine out" at any prior point in the flight, and as I understand it the fuel-injected IO-360-A1A installed in the Mooney would not immediately restart if a tank had been run dry, that it would take several (20?) seconds or so for air in the lines to clear before the engine could be restarted. I asked the NTSB to check for leaks, especially from the fuel sump drains under the wings and the fuel selector valve; the right tank valve stuck open at least once before (at Heber City, Utah, where Dave Shaby helped me quickly get it unstuck - he'd recently experienced the same thing on his Cirrus SR22). The fuel selector valve also sticks sometimes and doesn't fully return to the "off" (closed) position, and at night I may not have caught it if it didn't seat properly, which may explain how both tanks were empty.

From the refueling at El Monte to the scene of the accident, the Mooney flew 4.23 hours tach time. I have flown more than that or been very close to that several times, across a variety of flights (10-12,000' cross-countries and short hops at low cruise altitudes, 3500-4500), always with adequate fuel on board (52 gallons usable in the Mooney tanks): from Midland Texas to Tucson Arizona (4.50 hours tach time, took on 35 gallons); from

Santa Monica to Heber City, Utah (4.57 tach hours, took on 38.3 gallons; Santa Monica to Santa Barbara (IFR) and then on to St. George, Utah (IFR departure, canceled in the air once out of the coastal marine layer) (3.91 hours tach, 39.2 gallons); St. George to Santa Monica, Santa Monica to Burbank and back to Santa Monica, and then Santa Monica to Corona (3.94 hours tach, 37.2 gallons); Corona to Chino, Chino to Santa Monica, Santa Monica to Torrance and back to Santa Monica, and Santa Monica to Chino (3.49 hours tach, 33.2 gallons).

Since this happened I've been exploring ways to prevent it from ever happening again. An ATP and CFI pilot with 2600 hours in a short-body Mooney suggested a per-tank fuel logging system that I am adopting immediately - I have booked time with Louie DuBois III (DuBois Aviation), an accomplished instructor who owns (and learned to fly in) a Mooney M20B, an aircraft also equipped with only "tach" time. We're also going to go over this flight, for his suggestions regarding what I could have done better. Generally, I am going to be less exact, and more conservative, in fuel calculations, and fly only with significantly larger reserves.

I've attached the log I kept of tach time and fuel consumption, and the ForeFlight Track Logs information for those flights which had complete records.

After discussing this accident with an experienced Mooney instructor (who thought the fuel consumption numbers seemed low), I also cross-referenced my log with ForeFlight Track Log data (where such data existed and was complete for a flight - though some flights apparently didn't start recording until the plane was at the runup area, "missing" approximately 6-7 minutes of engine running time, at or near idle, while taxiing from the Justice / Barker hangars on the lower south ramp at KSMO), to see how they correlate. I've now learned there's a significant spread between "total time" (including taxing) and tach time, but also between flight time (which ForeFlight begins once the aircraft reaches a certain speed) and tach time, which makes me wonder, now, how accurate and reliable the tachometer in N34BE actually was. (I was planning to have Tucson Aeroservice redo both panels to make them more modern with a standardized "six-pack" instrument layout, and to install a JPI EDM 900 certified engine monitor with fuel monitoring capabilities, including a totalizer, to replace and supplement the 51-year-old instruments the

plane shipped with.)

In short, I will never rely on a single source of information again. I plan to be extremely conservative with fuel reserves, and my new personal minima are 1.5 hours for VFR flight, and 2 hours (instead of the 45 minutes in FAR 91.167) for IFR flight. I will conduct my preflights with more vigilance and am going to be revising my checklists (which are based on the 51-year-old Mooney owner's manual and almost certainly can stand to be improved), including adding a check to ensure each fuel drain has stopped draining fuel entirely. I will not allow passenger or other pressures to create a state of "get-there-itis." Finally, I have already commenced further training and look forward to being an even more cautious and safety-oriented pilot.

Tach					ForeFlight Track Log									Offset vs. Tach	
Date	Start	End	Origin	Dest.	Fuel	Tach Time	GPH	Flight Hours	Min	FT	Total Hours	Min	TT	Flight	Total
5/20/2017		1468.75	0A7	24A	41.21										
5/20/2017	1468.75	1470.63	24A	KIOB	18.2	1.88	9.7	1	46	1.77	2	21	2.35	0.94	1.25
5/21/2017	1470.63	1473.57	KIOB	KSUS	30.7	2.94	10.4	2	50	2.83	3	0	3	0.96	1.02
5/22/2017	1473.57	1477.34	KSUS	KFTW	43.8	3.77	11.6	3	37	3.62	4	4	4.07	0.96	1.08
5/22/2017	1477.34	1479.90	KFTW	KMAF	19.8	2.56	7.7								
5/23/2017	1479.90	1484.40	KMAF	KTUS	35	4.50	7.8								
5/23/2017	1484.40	1488.34	KTUS	KSMO	35.8	3.94	9.1								
5/29/2017	1488.34	1489.11	KSMO	KSMO		0.77		0	33	0.55	0	49	0.82	0.71	1.06
6/1/2017	1489.11	1489.99	KSMO	KCNO		0.88		0	41	0.68	1	13	1.22	0.77	1.39
6/1/2017	1489.99	1490.55	KCNO	KSMO		0.56		0	23	0.38	0	51	0.85	0.68	1.52
7.2.2017	1490.55	1495.12	KSMO	36U	38.3	4.57	8.4								
7.5.2017	1495.12	1497.29	36U	KSGU	19.7	2.17	9.1								
7.5.2017	1497.29	1499.94	KSGU	KSMO	24.6	2.65	9.3	2	32	2.53	2	49	2.82	0.95	1.06
7.7.2017	1499.94	1501.22	KSMO	KSMO		1.28									
7/8/17	1501.22	1502.91	KSMO	KLGB	34.4	1.69	11.6								
7/8/17	1502.91	1503.30	KLGB	KSMO		0.39		0	18	0.3	0	39	0.65	0.77	1.67
7/9/17	1503.30	1504.94	KSMO	KLPC	22.34	1.64	11.0								
7/9/17	1504.94	1506.52	KLPC	KSMO		1.58		1	30	1.5	1	53	1.88	0.95	1.19
7.10.2017	1506.52	1506.81	KSMO	KBUR		0.29									
7.10.2017	1506.81	1507.04	KBUR	KSMO		0.23		0	8.5	0.14	0	24	0.4	0.61	1.74
7.11.2017	1507.04	1507.32	KSMO	KBUR		0.28		0	12	0.2	0	28	0.47	0.71	1.68
7.11.2017	1507.32	1507.56	KBUR	KSMO	?	0.24		0	10	0.17	0	28	0.47	0.71	1.96
7.12.2017	1507.56	1508.62	KSMO	KSBA		1.06									
7.12.2017	1508.62	1511.47	KSBA	KSGU	39.2	2.85	10.0	3	3	3.05	2	44	2.73	1.07	0.96
7.12.2017	1511.47	1514.16	KSGU	KSMO		2.69									
7.13.2017	1514.16	1514.81	KSMO	KSMO		0.65		0	18.8	0.31	0	69	1.15	0.48	1.77
7.15.2017	1514.81	1515.41	KSMO	KAJO	37.2	0.60	9.4	0	26	0.43	0	41	0.68	0.72	1.13
7.15.2017	1515.41	1516.17	KAJO	KSMO		0.76		0	30.8	0.51	0	97	1.62	0.67	2.13
7.17.2017	1516.17	1516.89	KSMO	KSMO		0.72		0	36	0.6	0	58	0.97	0.83	1.35
7.21.2017	1516.89	1517.76	KSMO	KSMO		0.87		0	46	0.77	1	10	1.17	0.89	1.34
7.22.2017	1517.76	1518.30	KSMO	KCNO	33.2	0.54	11.5	0	28	0.47	0	54	0.9	0.87	1.67
7.22.2017	1518.30	1518.85	KCNO	KSMO		0.55									
7.23.2017	1518.85	1519.76	KSMO	KIZA		0.91									
7.23.2017	1519.76	1520.79	KIZA	KSMO	25.4	1.03	10.2								
8.3.2017	1520.79	1520.84				0.05									

8.3.2017	1520.84	1521.69	KSMO	KSMO		0.85		0	47	0.78	1	14	1.23	0.92	1.45	
8.5.2017	1521.69	1525.05	KSMO	KAVQ	30.3	3.36	9.0									
9.15.2017	1525.05	1528.00	KAVQ	KSMO		2.95		2	49	2.82	3	22	3.37	0.96	1.14	IFR, 8000 to PSPish then 10000
9.16.2017	1528.00	1528.41	KSMO	KEMT	34.7	0.41	10.3									
9.16.2017	1528.41	1528.72	KEMT	KSMO		0.31		0	15	0.25	0	38	0.63	0.81	2.03	
9.17.2017	1528.72	1530.23	KSMO	KSMO		1.51		0	81	1.35	0	117	1.95	0.89	1.29	To/from KOKB.
9.19.2017	1530.23	1531.24	KSMO	KSMO		1.01										To/From KCNO, night landing practice 1 @ CNO 1 @ SMO
9.22.2017	1531.24	1532.64	KSMO			1.40										SMO/BUR/REI, REI ...