

## Fluttering to Success

Tumbling, tumbling, tumbling, my final aspiration crashes into the gymnasium floor, concluding the last flight of my Science Olympiad career. Heart dropping to the pit of my stomach, I trudge to my broken helicopter, dishearteningly examining the possible causes of the force imbalance resulting in disaster. After the competition I carry the shattered remains of my helicopter down to my basement and place it with the rest of my models over the years. I pick up the first helicopter I built—a crude prototype modeled after Penaud’s coaxial rotor design, constructed using wooden dowels and a garbage bag—thinking back to a night three years ago, when my whole experience first started.

My work light flickers as another hour passes; I have yet to make any notable progress on my first helicopter assignment. I dab another globule of thick wood glue onto a wooden beam and press a smaller cross onto it. After holding it tight for a count of 30, I tenderly release my grip, praying it holds. Comparing my efforts to an online picture of Penaud’s helicopter, I let out a soft sigh since mine bears little resemblance. As time slips away, I hurriedly tape garbage bags to cover my makeshift, two-bladed rotors, attempting to mimic airfoils.

A timid sophomore trying to avoid notice, I walk into the Science Olympiad room the following day, head down, and hands in my pockets. Our engineering coach, Alec, however, comes right over and demands that I launch my helicopter. Mumbling with self-doubt, I wind an Office Max rubber band and attach it onto the paper clip hook, hoping it contains sufficient energy to turn the rotors. My breath held, knees trembling, hands shaking, I let go of my

helicopter . . . and it falls out of the air, pieces dropping off in a hailstorm of balsa. Dreading Alec's disappointment, I sit down wiping my sweaty hands on my shorts, examining my broken helicopter, avoiding eye contact, and wishing I didn't exist anymore. Alec, giving me another chance, simply hands me a pile of papers as thick as my math textbook. I flip through it and encounter cross-section diagrams, aerodynamic equations, and other designs that escape my understanding; at this time I realized how much knowledge I would need for success in this event.

After a week of researching, reading, and building, I changed my newest model from a ten-gram hulk to a nimble four-gram machine. However, I again walk in timidly, still trying to hide. Winding and attaching the special competition rubber band Alec bought onto my helicopter, I brace the rotors against my finger and anxiously let it go. The rotors flutter as the helicopter wobbly jerks into the air. Hovering and twisting at eye level, the helicopter threatens to smash into the walls, but it remains airborne momentarily, falling after 13 long seconds. I look toward Alec, our head coach, Mr. T, and various upperclassmen, hoping to see signs of approval from them. With a curt nod, Alec writes down three more links instructing me to keep researching. I use the new information to tweak the efficiency of the rotors, increase the lift/weight ratio, and find materials to optimize performance.

On the fifth flight, Mr. T walks in to observe. The helicopter rises slowly to the ceiling, resting against it for 35 seconds before spiraling down. Not sure how to interact with Mr. T, I stand awkwardly holding my helicopter, he comes over, pats me on the shoulder, and exclaims, "Look at you! This'll win you something at State this weekend!" My mouth slightly agape, I realize that I had focused so much on the research behind building my helicopter, I had lost track of the fact that I needed it for a competition.

Nervous about the competition, my stomach somersaults like a restless goldfish in an undersized bowl. Overwhelmed by the size of the University of Wisconsin--Madison, I stumble through the morning, often asking Mr. T or upperclassmen for directions. Finally, with Alec's assistance I make it to the Shell for the helicopter event. Nerves undermining my confidence, an attempt to communicate with the judge comes out only as small squeaks. As practiced, I wind the rubber band to 500 turns and cautiously attach it to the rotors. I prop the rotors against my fingers. Blood pounding against my ears, head spinning, I find my perception of time slowing as my whole world focuses on the helicopter. Hands shaking, I let it go. The rotors start spinning rapidly, lifting the helicopter to the roof of the Shell, where it hangs for 55 seconds! After receiving gold for my helicopter, I feel my confidence soar. I display my helicopter for my teammates, thanking each for his or her support; Alec embraces me and tells me, "It was all you."

I return to Science Olympiad at the beginning of my junior year. With the experience from the previous season, and confidence brimming from my victory, I enter the Science Olympiad room head held high, ready to provide leadership to the new freshmen in the club. Showing off my helicopter at the first meeting, I am lulled by all the praise from the freshmen. Seeing it succeed makes me believe I had figured out everything, but Alec approaches me and suggests that I try using different types of rubber band, but even with his prodding, I refuse to research more.

A year later I walk into the competition with a swagger, boasting a helicopter identical to the one I had last year. Using the same techniques, I launch my helicopter with a small toss. With a jerk, the helicopter rises into the air; it bumps against the ceiling and rests against it for 53 seconds. I sit in the auditorium during the award ceremony, fully expecting to medal for my

helicopter. As the judges call out the top scores, I sit relaxed waiting for them to call my name for gold; however, they never do. Sitting on the bus, I get the full score report from Mr. T. Eight other teams scored higher—the first place team got double my score.

Realizing I let overconfidence divert my focus, I vowed to work harder and improve. At the start of my senior season, I immediately follow Alec's suggestions, researching different rubber types and wood-bending techniques.

A soft hiss punctures the silence as a stream of water vapor shoots away from the heated wood, burning my fingers in the process. I force back a cry of pain as I continue to run the wood across the light bulb, forging it into a new feather-like and curved design. This time I attach the two rotors next to each other, in a Chinook, duel-rotor style, which yields a three-time score bonus in competition.

Eager to test out my newest helicopter, I quickly wind up the two rubber bands—one per rotor—and attach each to the frame. Hoping that the torques match and generate equal forces, I let the helicopter go. The two rotors start to spin with disrotatory motion; however, differing angular velocities cause an imbalance in forces resulting in a crash. My overconfidence crashes concurrently as this flight restores my humility. I stand motionless, mouth open, unable to comprehend that my structure just failed. I realize that I do not know everything, and that more knowledge and research always lie ahead.

Sitting in front of the flickering light, I carve a wooden jig to which I attach my rotors. I hypothesized that with a jig, I'd create more balanced and equal rotors. I soak the wood in hot water, fit it into the curved jig, and apply heat after it rests snugly within. I remove the rotors

carefully and attach them onto the helicopter. With my mom's help, I wind the rubber bands and let the helicopter go in my living room. The twin rotors now manage to flutter up a bit higher and longer. My excitement soars as I succeeded through methodical research. I bring the helicopter in the next day; prior to its flight, a group of freshmen gathers around, inquiring about the helicopter's mechanics. Happily explaining the process, I demonstrate how each part works in order to produce lift. I smile as I give out, instead of receive, advice and instruction.

At home, I start researching Alec's idea: testing different sized rubber bands. Online I find a design for a test stand—a single rotor attachment point with a weight on the bottom—for static testing of individual parts. After constructing the test stand I place it onto a scale, and using an old rotor I test two different types of rubber band, one slightly thinner than the other, to see which produces the most lift. Releasing the rotor, I time how long one rotor maintains sufficient lift for my helicopter. The thinner rubber band sustained lift for 1:20 on the test stand, and the thicker for 1:04. Taking these data down, I proceed to use the thin rubber band to test with different rotor types—changing the pitch and width of the rotors slightly to increase productivity. Following this process, I turn the simple guess-and-check method into a methodical scientific approach.

This time our rival's hometown hosted the state competition. Sitting on the bus, looking out the window, flipping absent-mindedly through a textbook, I feel the pre-competition jitters start to creep up on me. The bus pulls into the parking lot and our team trudges out of the bus, many still trying to shake off sleep. Snapping myself awake, stifling my nerves, forcing myself into action, I grab my projects and herd my teammates inside, directing them to our homeroom. I

help the coach hand out schedules and guide my younger teammates to their respective events, keeping them calm and focused.

The morning speeds by, and soon the clock strikes eleven—time for my helicopter flight. Stomach fluttering like my helicopter, I quickly stride over to the location of the helicopter event. I barely notice the people surrounding me as I check in. Weight: 3.53 grams. Rubber width: 1/8<sup>th</sup>. Rubber weight: 1.25 grams each. Rotor diameter: 34.5 cm. I attach each rotor onto the frame of the helicopter with practiced experience. I wind each rubber band to 400 winds, attach it to the metal hooks, and prop up the rotors against my finger. I let it go. The whole room holds a collective breath. My heart pounding up to my throat, my lungs seemingly forgetting how to inhale, I force my eyes away from the helicopter and sit down. Ninety-seven seconds later the helicopter returns to the ground, fluttering to a rest. The entire room, full of students and coaches from around the state, lets out a collective sigh of relief and starts applauding my engineering accomplishment.

At the award ceremony, I proudly walk up to stage, accepting the gold medal, a symbol of my dedication in this event over the past three years. As the judges announce the team awards, I nervously wait, hoping for a chance at nationals in my final year. “In second place, with 57 points, Menominee Senior High School.”

My heart stops. The bright lights fade as warm tears of joy creep out of my eyes. “In first place, with 54 points, Madison West High School.” I charge up to the podium, my team allowing me to claim the State Title Trophy.

Having earned a national berth with our state victory, I immediately return to improving my designs. Using a maple seed as inspiration I mold the rotors in a more curved shape, wider in the middle, allowing the rotors to “capture” more air as each spins the fastest on the outside. Frequently re-visiting the test stand, I push the effective time of the rotors up to 1:50, a score which when compared with other victorious state scores places me in medaling position at nationals.

Weeks later, our team walks off the airplane at the University of Central Florida, the host of the 2012 national competition. Two successful events later, I find myself standing in their grand basketball stadium, with a ceiling 80 feet high. I look around to my fellow competitors and their different designs. Before I could go to discuss different designs with them, the judges call me up for my flight. Winding the rubber bands with a calm, experienced hand, I prop the rotors against my fingers. I let my helicopter go. The helicopter tips up, one rotor spinning, the other not, and dives to the ground. I briefly catch a glance at the rotor before it rose up after the dive. The rubber band had knotted against the hook, initially preventing the rotor from turning. Upon working itself out, the helicopter rose to the top of the gym, hanging like Tantalus’s apple above me, mocking me for my mistake. One-hundred twenty-four seconds later the helicopter returns to me. One more attempt for success. I wind up two new rubber bands, attach them to the hooks, prop the rotors against my fingers. I let it go.

Tumbling, tumbling, tumbling, my final aspiration crashes into the gymnasium floor, concluding the last flight of my career. The new rubber bands, I notice, differ in length by no more than two millimeters, a difference that escaped me when I picked them up, a difference that cost me a national medal.

Sitting in my basement holding onto the crushed remains of my failed helicopter, I reflect on each of the previous models I've made. As I compared the Penaud style helicopter I first made with my latest, it dawns on me that I, as a student and scientist, have evolved as much as my helicopters have. I realized that even though my final attempt ended in disappointment, I still walked away from that event with more knowledge and confidence; that despite the success I achieved, I always had to keep learning, and there isn't an end; and that in engineering, the smallest details count. Ultimately, the medals and awards I received for this event paled in comparison to the information I gained. Immersing myself in engineering in high school taught me to approach science with a passion, to thirst for knowledge and to spread it. This year, helicopter building returned as a middle school event. While holding coaching sessions to teach middle schoolers, I see a bit of myself in each and every one of them—timid, but eager to learn more. I finally realize the love of science I gained means more than anything else. Although the future remains unclear, I intend to approach it with the same determination as I did with my helicopter.