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Time: 1:15 to 2:15 PM

Title: Bowstring Derailment and Arrow Nock Fracture in a Compound Hunting Bow

Abstract: An experienced archer was permanently blinded in one eye while target shooting alone with a compound hunting bow owned for four years. At near full draw, the bowstring derailed from the bow's lower cam, was captured between limb and axle, and was pulled violently downward, shearing the arrow's polymer nock and fracturing the peep sight and then striking the archer's face. An opposing analysis concluded that inadvertent nock disengagement — or a pre-existing nock crack — initiated the derailment. Physical evidence — the post-incident position of three brass bowstring rings and the fracture morphology of the sheared nock — shows the derailment occurred first, and the nock failure was a consequence (not a cause) of the derailment. The bow's hybrid-cam system used shallow string grooves of common depth for the bowstring and its power and control cables, though only the bowstring is subject to unintentional archer-induced torque and derailment. To evaluate whether this groove-depth relationship is characteristic of hybrid-cam hunting bows, baseline measurements of groove geometry, axle-to-axle length, and cam configuration were carried out across bows from multiple manufacturers. This paper documents the derailment-first evidence and comparative measurements and discusses groove depth as a design parameter bearing on this recognized hazardous failure mode.



Michael Blaise founded Precision 321 Corp. in 2022 and serves as its President and Principal Engineer. He has completed more than 900 forensic evaluations and has provided expert testimony at trial and in depositions. His forensic work encompasses investigations of damage associated with soil movement, hurricanes, floods, other storm events, fires, design or construction activities and deficiencies, moisture intrusion, plumbing and HVAC failures, environmental exposure and deterioration, product defects and failures, and mechanical failures. He also specializes in the design, analysis, and testing of mechanical components and systems, including vapor-compression and HVAC systems, thermochemical reactors, fluid-solid separators, test equipment, and data-acquisition and testing software. Blaise earned a BS in mechanical engineering from the Colorado School of Mines and is pursuing an MS in mechanical engineering at the University of Florida.



Steve Batzer, PhD, PE, is a mechanical forensic engineer who consults with clients regarding patent infringement, firearms, and the forensic analysis of accidents and product failures. He has taught at five universities, served as a commissioned officer of the U.S. Army, and has worked as a manufacturing engineer in the Michigan automotive industry. He has testified at more than 50 trials and published more than 70 peer-reviewed engineering papers. Dr. Batzer is also a member of the Society of Automotive Engineers, the American Society of Mechanical Engineers, and is a fellow of the National Academy of Forensic Engineers. He is a Vice President of the Michigan Society of Professional Engineers and encourages all engineers to be licensed. He earned his BS in mechanical engineering from Michigan Tech, an MS degree in manufacturing systems engineering from the GMI Engineering and Management Institute in Flint, Michigan, and a PhD in Mechanical Engineering, again from Michigan Tech. Dr. Batzer lives with his wife in a log cabin in the Pere Marquette forest near Fife Lake, Michigan.