THE LINEAR AND ROTATIONAL TIP VELOCITY OF A THROWN KNIFE

Facts / Conditions:

A digital movie camera filmed the event at 60 frames/second.
Distance lines perpendicular to the ground were drawn at 3 inch intervals.
The thrower stood at an 11' toe line, left foot forward, throwing with the right arm.
The thrower threw a 14" knife weighing 12 ounces.
A single spin was thrown, i.e., 1 ¼ spins as the knife must go from perpendicular at the moment of release to point first horizontal before traveling 1 full rotation to the board.
The thrower threw at a normal/comfortable speed, i.e., not soft (a lob) and not hard (maximal strength), one typically used during competition or performing in which accuracy is a consideration.
Inches/second multiplied by a constant of 0.0568 will result in miles/hour.

Results / Conclusions:

The resulting digital movie was analyzed, frame by frame, at 60 frames/second to capture the knife in two identical positions, e.g. consecutively point forward or upward.
The knife was captured in identical positions approximately 20° above horizontal.
The knife moved 90 inches in 11 frames — from and to identical positions.
The knife moved 30 inches during its first ¼ turn.
The knife moved 120" (10') from vertical release to a horizontal stick in the target, i.e., moving 1 ¼ turns.
Subtracting 10' from an 11' toe line identifies a 1' (12") overreach to release.

Linear Velocity, i.e., the speed at which the knife is moving from the hand to the target was calculated at 28 miles/hour. To wit:
Distance. 90 inches from identical points within free flight.
Time. 11 frames ÷ (60 frames/sec) = 0.1833 seconds.
Rate. The result of Distance ÷ Time = (90 inches ÷ 0.1833 sec) = 491 inches/sec.
491 inches/sec X 0.0568 = 27.9 or **28 miles/hour.**

Rotational Tip Speed, i.e., the speed at which the tip or point of the knife is rotating about the circumference of the circle created by the knife spinning in a pin-wheel fashion as it rotates toward the target was calculated at 13.6 miles/hour. To wit:
Circumference. The result of Pi X diameter = 3.14159 X 14 inches = 44 inches.
Angular velocity.
Distance. 44 inches.
Time. 11 frames ÷ (60 frames/sec) = 0.1833.
Rate. The result of Distance ÷ Time = (44 inches ÷ 0.1833 sec) = 240 inches/sec.
240 inches/sec X 0.0568 = 13.6 or **14 miles/hour.**

Thus the tip of the knife will have a **relative ground speed** that ranges between 42 miles/hour (28 mph + 14 mph) as the tip rotates forward/toward the target and 14 miles/hour (28 mph – 14 mph) as the tip rotates backward/away from the target.

Revolutions/second, i.e., the # of revolutions the tip makes during one second of flight is 5.46. To wit:
Time to rotate one revolution. 11 frames ÷ (60 frames/sec) = 0.1833 seconds/revolution
Revolutions/sec. 1 ÷ (0.1833 sec/rev) = 5.46 rev/sec.

In the authors opinion this explains why a radar gun clocked a thrown knife at "50 miles/hour." (Said individual was previously recorded at 35 miles/hour using the digital video technique described herein.) A radar gun detects the fastest motion. Thus, a linear velocity of 35 miles/hour PLUS the advancing rotational tip speed of 14 miles/hour = 49 mph; falsely interpreted as the "speed of the knife." Voila! Myth busted.

Caution and note to the reader - This analysis was done using a 14 inch 12 ounce knife thrown by The Great Throwdini under "normal" conditions and for which the question was asked, "How fast is a thrown knife?" Others claim to throw a knife at 90 miles/hour, akin to the speed of a professionally pitched baseball. Clearly we recognize the difference between "normal" tournament/accuracy style throwing and a super human effort to press the limits of how far and/or how fast a knife can be thrown. None-the-less, I invite those who make such claims to stand the scrutiny of this analysis. I'm not saying it can't be done. I'm saying, SHOW ME.

David R. Adamovich aka The Great Throwdini 1/3/06 www.knifethrower.com