NRC·CNRC

Impact research facility

Enhancing aviation safety through bird and drone impact testing

Mid-air collisions with birds and drones represent a risk for aircrafts, especially at altitudes under 10,000 feet. While aircraft certification standards include requirements to demonstrate airframe resistance to bird strikes and engine survival for bird ingestion, no such requirements exist for drones.

The NRC's drone super cannon is used for drone impact testing and research.

With over than 50 years' experience with bird impact design and testing, the National Research Council of Canada (NRC) has built its biggest cannon yet (dubbed the "drone super cannon") to address challenges resulting from the growing operation of drones and the risk of intrusion, especially in sensitive areas such as airports, military bases and government spaces.

Our impact research facility includes a number of bird guns, each for a specific application. The bird guns fire bird carcasses at rotary and fixed-wing aircraft structures. For instance, the six-inch (15.2 cm) bird gun is able to accommodate carcasses up to 2.2 pounds. The drone cannon, however, launches drones at different parts of an aircraft and its systems, such as wing leading edges, horizontal and vertical stabilizers, windshields, flaps, struts, elevators and rudders. With a barrel diameter of 17.25 inches (44 cm) and custom-made sabot, the cannon can launch quadcopters and fixed-wing drones of various sizes and types. We use the cannon for research and technology maturation projects to assess structural damage and to provide our partners with evidence-based experimental data.

High-technology characteristics

- Custom-made high-speed valve to discharge the compressed air and accelerate the projectile within the cannon
- High-speed camera to measure projectile speed prior to impact
- Up to four high-speed cameras to capture projectile footage during the impact sequence
- Self-levelling three-beam line laser to align target on test article with the centreline of drone cannon (or bird gun)
- Digital image correlation system (upon request)

The NRC's bird gun is used for testing airframe and engine resistance to bird impact and ingestion.

Impact research facility specifications

Parameter	Value
High-speed cameras	>4,000 frames per second
High-speed butterfly valve	6 in (15.2 cm) and 10 in (25.4 cm)
Accumulator pressure	Up to 150 psi (1.03 MPa)
Barrel diameter (bird gun)	3.5 in (8.9 cm), 5 in (12.7 cm) and 6 in (15.2 cm)
Barrel diameter (drone cannon)	17.25 in (43.8 cm)
Projectile speed	Up to 350 knots (180 m/s)
Sabot type	Metallic, Styrofoam-based
Projectile type	Bird carcasses and drones

Contact

Eric Lefebvre, Director, Business Development
613-949-7548
eric.lefebvre@nrc-cnrc.gc.ca

canada.ca/nrc-aerospace

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