

CRASH PROTECTED RECORDERS' TRANSFORMATION THROUGHOUT HISTORY

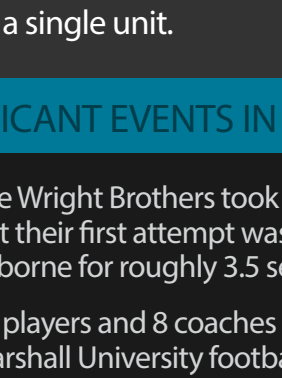
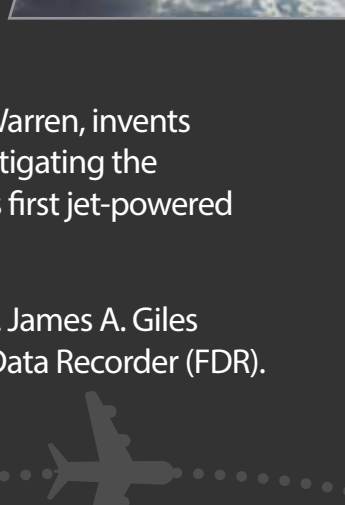
+ ANSWERING THE SKY'S UNSOLVED MYSTERIES FROM THE GROUND

Let's take a look at the transformation of this technology throughout history, and how Curtiss-Wright has stayed on top of these changes over time.



- 1930**
Crash recorder (aka flight data recorder) technology starts being used in various forms.
- 1954**
Australian scientist, Dr. David Warren, invents the first "Black Box" while investigating the mysterious crash of the world's first jet-powered commercial aircraft.
- 1955**
Professor William A. Penny and Mr. James A. Giles develop the first magnetic Flight Data Recorder (FDR).
- 1957**
Penny + Giles fit the first FDR with magnetic recording on stainless steel wiring.
- 1957**
P + G invented the first aircraft accident date recorder based on magnetic recording.
- 1960s**
Penny + Giles' "Black Box" innovations spread to numerous aircrafts and led to rapid growth in the industry.
- 1963**
UK Ministry of Aviation notices the "Black Box" technology and mandates that all civil carriers be equipped with one.

Penny + Giles is nicely positioned to provide sensors and recorders for this movement.
- 1970**
Penny + Giles starts to manufacture its FDRs differently and adds stainless steel taping, which yields 12 tracks and 25-hour recycling. We also see an increased push of FDRs in civil aircraft.
- 1986**
Penny + Giles becomes the first to combine Cockpit Voice Recorders (CVRs) and FDRs into a single unit.
- 1994**
Penny + Giles is the first to receive approval for solid state combined voice and flight data recorders.
- 2001**
Penny + Giles increases CVR and FDR recording capacity in a smaller, lighter and more robust design.
- 2002**
Curtiss-Wright acquires Penny + Giles and combined, the two companies have 60+ years of extensive knowledge in FDRs.



SIGNIFICANT EVENTS IN AVIATION

The Wright Brothers took flight in 1903, but their first attempt was only airborne for roughly 3.5 seconds.

35 players and 8 coaches with the Marshall University football team died in a plane crash in 1970.

Under violent weather and wind, a Delta flight was brought down short of the runway and killed 137 people in 1985. After the tragedy, NASA and the FAA did research for seven years for more effective equipment: on-board forward-looking radar windshear detectors.

August 12, 1985, Japan Airlines' Boeing 747 crashed into Mt. Ogura and is still considered the deadliest crash with more than 500 casualties.

In 2012, US air carriers reported 27 plane crashes out of 9,269,200 departures resulting in zero fatalities.

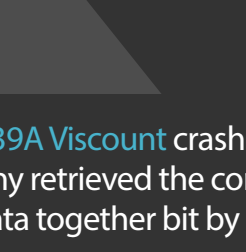
THE FUTURE

Curtiss-Wright predicts we will continue to see crash protected recorders getting smaller and lighter, increasing data storage, extending the length of voice recordings and incorporating image recordings. However, eventually products will be used to show real-time activity through satellites with less sophisticated physical units only being used as redundant back-up.

Although crash protected recorders are orange for easy retrieval within wreckage sites, the term "Black Box" was coined due to the cryptic functionality of the CPRs that retrieved details of a crash.

80% OF PLANE CRASHES OCCUR EITHER IN THE FIRST 3 MINUTES OR LAST 8 MINUTES OF A FLIGHT.

THE FIRST KNOWN COMMERCIAL AIRPLANE CRASH TOOK PLACE ON DECEMBER 14, 1920 IN LONDON.



In Germany's 6th worse plane crash, the Vickers 739A Viscount crashed onto the Nürnberg-München highway in 1968. Mr. Perry retrieved the company's split-in-half recorder and pieced all the data together bit by bit.

TESTING

CRASH PROTECTED RECORDERS UNDERGO EXTENSIVE TESTING

- STATIC CRUSH
- LIQUID IMMERSION
- CRASH IMPACT
- FIRE PROTECTION
- PIERCING

COMMON DETECTED MOVEMENTS MEASURED ON A CRASH PROTECTED RECORDER

- ALTITUDE
- CABIN PRESSURE
- WIND SPEEDS
- COMPUTER FAILURE
- ICE DETECTION
- POSITIONS
- VIBRATION LEVELS
- ACCELERATION
- ROTOR SPEED

CRASH PROTECTED RECORDER TECHNOLOGY

- BEACON
- ENCRYPTION
- SOLID STATE MEMORY
- RECORDER CHASSIS

APPROXIMATELY 100 CURTISS-WRIGHT CRASH PROTECTED RECORDERS HAVE BEEN IN A CRASH.

100% of all Curtiss-Wright recovered crash protected recorders have successfully retrieved data from the crash.

Curtiss-Wright Avionics & Electronics has a rich history in airborne recording solutions. With proven heritage, high quality products and technical experience, Curtiss-Wright takes its crash protected recorders into different applications, environments, aircraft types and operational conditions to help determine any answers an avionic professional may need after an accident. Crash protected recorders keep a watchful eye on pilot movements as well as voice recordings within the cockpit. Today we would not see the great strides in safety nor the continued improvement of avionics technology without the assistance of crash protected recorders. We can only soar higher from here.