UH–60A Airloads Program (1984–1994)

Summary

The UH–60A Airloads Program was carried out by NASA Ames Research Center and the U.S. Army Aeroflightdynamics Directorate from 1984 to 1994, when flight testing was completed. This note provides a summary of the flight test data that were obtained.

Discussion

In the mid-1980s, NASA Ames Research Center devised an elaborate plan to extensively test seven or more modern rotors and develop a data base that would include flight test data, wind tunnel data, model-scale data, and fuselage shake test data for these helicopters and their rotors (Watts and Cross 1986). The first helicopter selected under this plan was the UH–60A. A contract was let with Sikorsky Aircraft in 1985 for the construction of a set of test hardware that included one blade with 242 pressure transducers and a second blade instrumented with strain gauges and accelerometers. Model-scale testing of this rotor system was accomplished under separate U.S. Army programs (Lorber et al. 1989, Lorber 1991).

The instrumented rotor blades were delivered to NASA Ames Research Center at the end of 1988. However, the integration of the extensive suite of rotor instrumentation and the hub-mounted Rotating Data Acquisition System (RDAS) became the critical element in the test program. Tests of early versions of the RDAS system in 1991 and 1992 were unsuccessful. The third RDAS system was demonstrated successfully at the end of 1992 and flight testing was scheduled to start in the summer of 1993.

On May 14, 1993 the UH–60A Airloads Program was cancelled by NASA Ames Research Center because of budget shortfalls. However, funding was in place to allow testing through the end of the fiscal year, September 30, 1993. Flights 82 to 85 were flown prior to the end of September, and NASA reprogrammed funds to allow testing to continue through the end of February 1994 when Flight 116 was completed. The flight test program has been described by Kufeld et al. (1994). A catalog of the test flights is listed here.

Table 1. – Summary of UH–60A Airloads Program flights; continued.

Flt	Flight Objective	Data Acquired
82	Low Airspeed Calibration	Ground paced, 30 mph rwd to 70 mph fwd; Nr sweep on ground
83	High Airspeed Calibration	Air-paced level flight, 80-160 kts; Nr sweep, 1 in. stick inputs on ground
84	Steady & Maneuvering Airloads[a]	Level flight, 20 kts to Vh (127 kts) at C_{W}/s=0.09; accel./decel., hover to 50 kts

Table 1. – Summary of UH–60A Airloads Program flights; continued.

Flt	Flight Objective	Data Acquired
85	Steady & Maneuvering Airloads[a]	Level flight, 20 kts to Vh (138 kts), steady turns at C_W/s=0.08; roll reversals
88	Steady & Maneuvering Airloads[a]	Level flight, 15 kts to Vh (122 kts), steady turns at C_W/s=0.10; heading changes; decel.
89	Steady & Maneuvering Airloads[a]	Level flight, 20 kts to Vh (109 kts), turns at C_W/s=0.11; roll rev; pull-ups; pushovers
90	Steady & Maneuvering Airloads[a]	Level flight, 20 kts to Vh (90 kts), turns at C_W/s=0.12 and 0.13; climbs
91	Ground Measured Acoustics	Level flight, 60-143 kts; ascents, descents, 6°-12° glide slope
92	Ground Measured Acoustics	Turns, 60 and 80 kts; heading changes, 15°-90°; ascents, descents, 6-12°
93	Ground Measured Acoustics	Level flight, 60-143 kts; ascents, descents, 6°-12°
94	Ground Measured Acoustics	Hover pedal turns, 250 ft AGL; ascents, descents, 3°-12°; climbs
95	Ground Measured Acoustics	Ascents and descents, 3°-12°; level flight, 100 kts
96	Ground Measured Acoustics	Constant radius turns, 60 kts, 1000, 1400, 1800 ft radii; low airspeed calibration
97	Ground Measured Acoustics	Terminal area traffic turns, 30°-90° heading changes, 60 kts
98	Ground Measured Acoustics	Constant radius turns, 60 kts, 1000, 1400, 1800 ft radii; low airspeed calibration
99	Ground Measured Acoustics	Terminal area traffic turns, 30°-90° heading changes, 60 kts
100	Airborne Measured Acoustics	Formation flight with YO-3A data acquisition aircraft, descents, 300-600 fpm
101	Airborne Measured Acoustics	Formation flight with YO-3A data acquisition aircraft, descents, 400-900 fpm
102	Airborne Measured Acoustics	Formation flight with YO-3A data acquisition aircraft, descents, 400-900 fpm
103	Airborne Measured Acoustics	Formation flight with YO-3A data acquisition aircraft, descents, 300-400 fpm

Table 1. – Summary of UH–60A Airloads Program flights; concluded.

Flt	Flight Objective	Data Acquired
105	Flight Dynamics[a]	Frequency sweep control inputs (long., lat., col., ped.), 70 kts
106	Flight Dynamics[a]	Turbulent air gust response, 80 and 120 kts
107	Flight Dynamics[a]	Frequency sweeps control inputs (long., lat., col., ped.), 35 kts
108	Flight Dynamics[a]	Frequency sweep (lat.) and 2-3-1-1 control inputs (long., lat., col., ped.), 35 & 70 kts
110	Maneuvers[a]	Level flight, hover to 139 kts at C_W/s=0.08; dives; turns; roll rev. pull-ups; pushovers
111	Flight Dynamics[a]	Frequency sweeps control inputs (long., lat., col., ped.), hover
112	Flight Dynamics[a]	Frequency sweep and 2-3-1-1 control inputs (long., lat., col., ped.), hover
113	Airborne Measured Acoustics	YO-3A data acquisition aircraft, descents, 200-900 fpm; collective sweep on ground
114	Airborne Measured Acoustics	YO-3A data acquisition aircraft, descents, 200-1000 fpm; collective sweep on ground
115	Maneuvers[a]	Autorotations; climbs; turns; Nr sweeps, hover, 80, 120 kts
116	Maneuvers[a]	Wind-up turns; dives; Nr sweeps, 30 kts; accel., hover to 50 kts

[a]Aircraft longitudinal c.g. held constant by using movable ballast cart to offset fuel used.

References

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