

Joshua Young
Air Safety Investigator
AS-ERA

Date: 3/19/2026

Subject: ERA25MA106, Estimated Pitch Control Forces

Contact: Michael Lemay, Chief Air Safety Investigator, Bombardier

The airplane manufacturer was requested to calculate estimated pitch control forces at varying pitch trim settings based on ADS-B data and an aircraft performance study. They produced a memorandum which was sent to the Operations Group Chairman and a discussion took place via electronic mail, excerpts from that memorandum and discussion are below:

Assumptions and Definitions

The following assumptions and limitations are applicable:

- All conditions are Flaps 0, Gear Up.
- Estimates are based on wings level, 1 g steady state solutions.
- The airplane is out of ground effect.
- ISA conditions
- A pull force is positive and a push force is negative.
- Trim Settings correspond to a trailing edge up deflection
- Aircraft weight and C.G. : 20830 lbs and 16.85% mac

The 'Level Pitch' values are calculations for zero flight path angle. The 'Current Pitch' values were calculated at a flight path angle that yielded the requested pitch angle.

Time EST	Speed (kts)	Altitude MSL (ft)	Pitch Angle	Trim Setting	Force (lbs) for Level Pitch	Force (lbs) to Maintain Current Pitch
1806:22	174	600	13.06	5.5°	9.7	16.2
1806:25	180	750	12.22	5.5°	5.3	11.6
1806:31	182	950	12.89	5.5°	3.8	11.2
1806:34	185	1025	13.18	5.5°	1.4	9.6
1806:38	187	1350	10.96	5.5°	-0.1	5.4
1806:41	192	1450	8.86	5.5°	-4.1	-0.7
1806:43	194	1525	6.84	5.5°	-5.8	-4.9
1806:45	198	1575	5.76	5.5°	-9.3	-9.5
1806:48	204	1600	4.53	5.5°	-14.6	-16.1
1806:50	209	1625	4.23	5.5°	-19.3	-20.7
1806:54	218	1650	2.87	5.5°	-28	-30.7
1806:59	238	1625	-9.07	5.5°	-49.1	
1807:01	242	1275	-18.58	5.5°	-53.5	

Time EST	Speed (kts)	Altitude MSL (ft)	Pitch Angle	Trim Setting	Force (lbs) for Level Pitch	Force (lbs) to Maintain Current Pitch	Trim Setting	Force (lbs) for Level Pitch	Force (lbs) to Maintain Current Pitch
1806:22	174	600	13.06	5°	17.1	23.6	4.5°	24.5	31
1806:25	180	750	12.22	5°	13.1	19.4	4.5°	20.9	27.2
1806:31	182	950	12.89	5°	11.7	19.1	4.5°	19.7	27.1
1806:34	185	1025	13.18	5°	9.6	17.8	4.5°	17.8	26
1806:38	187	1350	10.96	5°	8.2	13.8	4.5°	16.6	22.1
1806:41	192	1450	8.86	5°	4.6	8	4.5°	13.4	16.7
1806:43	194	1525	6.84	5°	3.1	4	4.5°	12	12.9
1806:45	198	1575	5.76	5°	0	-0.3	4.5°	9.2	9
1806:48	204	1600	4.53	5°	-4.9	-6.3	4.5°	4.8	3.4
1806:50	209	1625	4.23	5°	-9.1	-10.5	4.5°	1.1	-0.3
1806:54	218	1650	2.87	5°	-17	-19.6	4.5°	-6	-8.6
1806:59	238	1625	-9.07	5°	-36.1		4.5°	-23.1	
1807:01	242	1275	-18.58	5°	-40.1		4.5°	-26.7	

Time EST	Speed (kts)	Altitude MSL (ft)	Pitch Angle	Trim Setting	Force (lbs) for Level Pitch	Force (lbs) to Maintain Current Pitch
1806:22	174	600	13.06	3.97°	32.4	38.8
1806:25	180	750	12.22	3.97°	29.2	35.5
1806:31	182	950	12.89	3.97°	28.1	35.6
1806:34	185	1025	13.18	3.97°	26.5	34.7
1806:38	187	1350	10.96	3.97°	25.4	31
1806:41	192	1450	8.86	3.97°	22.6	26
1806:43	194	1525	6.84	3.97°	21.4	22.3
1806:45	198	1575	5.76	3.97°	19	18.7
1806:48	204	1600	4.53	3.97°	15.2	13.8
1806:50	209	1625	4.23	3.97°	11.9	10.5
1806:54	218	1650	2.87	3.97°	5.7	3.1
1806:59	238	1625	-9.07	3.97°	-9.3	
1807:01	242	1275	-18.58	3.97°	-12.5	