FLIGHT TESTS FOR PATRIOT ADVANCED CAPABILITY (PAC)-3

** The matrix below is a summary of the major flight tests in the Army's Patriot Advanced Capability (PAC)-3 terminal phase theater missile defense system. The PAC-3 has made an intercept 20 times out of 27 attempts during testing. The latest flight test was held on July 18, 2007, and included a successful intercept. According to the Director of Operational Test & Evaluation's FY 07 report, "Patriot met the PAC-3 Operational Requirements Document system effectiveness and defended area Key Performance Parameter requirements for some tactical ballistic missiles, but failed to meet these requirements for other tactical ballistic missile threats. Patriot demonstrated mixed performance against cruise missiles and aircraft. Performance against anti-radiation missiles, air-to-surface missiles, and unmanned aerial vehicles is uncertain due to insufficient data on Patriot interceptor lethality against these three classes of threats."**

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Flight Test Number	Date	Intercept?	Notes
DT-1	Sept. 29, 1997	n/a	First control test missile (CTM) – no seeker or target
DT-2	Dec. 15, 1997	n/a	Second CTM; extended range
Seeker characterization flight	March 15, 1997	Yes	Risk mitigation flight; intercept of short-range TBM with submunition payload
DT-3	Sept. 16, 1999	Yes	Intercept of short-range TBM with bulk chemical warhead
DT-5	Feb. 5, 2000	Yes	Intercept of short-range TBM with low-magnitude helix maneuver using 8 km remote launch
DT-7	July 22, 2000	Yes	Intercept of low-altitude cruise missile
EOR-A	July 28, 2000	Yes	Intercept of low-altitude cruise missile
DT-6	Oct. 14, 2000	Yes (PAC-3); No (PAC-2 engaged the target but didn't kill it)	A multiple simultaneous engagement was attempted in DT-6. A PAC-3 intercepted and killed a tactical ballistic missile (with submunitions), while a PAC-2 engaged but did not destroy a subscale drone target simulating an aircraft. The PAC-2's failure to kill the target was due to a hardware anomaly apparently unrelated to multiple simultaneous engagement test objective.
DT-8	March 31, 2001	Yes (1 PAC-3, 1 PAC-2)	This test was the first multiple simultaneous engagement of multiple TBM targets in the test program. This was the most complex flight test the program had undergone up to that date: five

			missiles (two targets and three interceptors) were all airborne at the same time. Two PAC-3s engaged a Hera modified ballistic re-entry vehicle that had a simulated unitary warhead. Both PAC-3 missiles were fired from the same Patriot launcher and were spaced several seconds apart. The first PAC-3 hit its target, causing the second PAC-3 to self-destruct. A PAC-2 missile simultaneously engaged a Patriot-As-A-Target (PAAT).
DT-9	July 9, 2001	Yes (1 PAC-3); No (1 PAC-3)	Problems with the communications bus that links the communications between the missile's guidance processing units and seeker caused the miss. One of two fired PAC-3s hit a remotely piloted F-4 Phantom aircraft emitting radar-jamming signals at long range and low altitude, while the second PAC-3 missed its ballistic missile target. The goal was to see if the PAC-3 could function in an electronic countermeasures environment.
DT-10	Oct. 19, 2001	Yes (1 PAC-3, 1 PAC-2)	A PAC-3 intercepted a BQM-74 cruise missile flying at a low altitude, while a PAC-2 intercepted the Raytheon MQM-107, which is a low-altitude sub-scale aircraft target. The microprocessor that caused the communications problem and consequent failure in DT-9 was taken out of the PAC-3 system. This test marked the end of the EMD phase for the PAC-3.
OT-1	Feb. 16, 2002	Yes (1 PAC-2); No (1 PAC-2 and 1 PAC-3)	One PAC-3 was fired vs. a drone simulating a cruise missile; two PAC-2s fired vs. two targets (full-scale QF-4 Phantom jet drone and a subscale drone aircraft). The only missile to hit its target was the PAC-2 aimed at the drone. The other PAC-2 missed due to an electrical arc in the radar, which lasted less than a second just before the planned intercept but managed to delay critical target information. The PAC-3 missed because an error in the ground computer caused it to provide the interceptor missile with inaccurate target location information, said Army Col. Tom Newberry.
OT-2	March 21, 2002	Yes (1 PAC-3 and 1 PAC-2);	Two PAC-3s were fired vs. a Hera BM simulating a Scud; 1 hit its target, the other failed to launch. One PAC-2 hit an MQM-107 drone aircraft.

		No (1 PAC-3)	
OT-3	April 25, 2002	No (2 PAC-3's)	This test was initially reported as a partial success: it was at first thought that one PAC-3 destroyed another Patriot which was simulating a ballistic missile target, while the other PAC-3, which was to intercept a Storm II ballistic missile target (composed of a Minuteman II second-stage booster and a Pershing II reentry vehicle), failed to launch. However, after studying the data collected, it was announced that the PAC-3 only hit its target and did not destroy it; thus, the test could not be counted as a successful intercept.
OT-4	May 30, 2002	Yes (1 PAC-3); No (1 PAC-3)	This final operational test was supposed to showcase the "ripple firing" doctrine, in which two PAC-3s are launched against one target – a two-stage ballistic missile. One PAC-3 intercepted the target, while the other PAC-3 failed to launch. MDA decided to delay moving PAC-3 into low-rate initial production (it originally was to start in September 2002). Because of the many problems that surfaced in operational testing, follow-on operational testing will be required.
OT-5	March 4, 2004	Yes	Two PAC-3s were ripple-fired at and intercepted a PAAT, a legacy Patriot that was modified to simulate flight characteristics of a Scud short-range ballistic missile. Soldiers of the 3/6 and 3/43 Air Defense Artillery battalions from Ft. Bliss, Texas, were involved in the test, which was held at White Sands Missile Range in New Mexico. Also exercised were the Patriot's improved missile segment software and the PAC-3 missile seeker's operation with a domestic source Traveling Wave Tube (the high-powered amplifier for the Patriot's Ka-band radar).
PAC-3 CRI-1 (DT/OT-11)	Sept. 2, 2004	Yes and yes	Two PAC-3s were ripple-fired at a PAAT, while at the same time a PAC-3 was launched against a Raytheon MQM-107 subscale drone aircraft simulating a cruise missile threat. The Army reported that the dual engagement was successful. According to Lockheed Martin's vice president for the PAC-3, Steve Graham, "This was our fifth successful 'ripple-fire' of

			PAC-3 missiles against TBMs, both in flight testing and in combat." Also tested were cost-reduction technologies which were developed especially for the PAC-3, including an Advanced Master Frequency Generator (AMFG), Multi-Band Radio, Frequency Data Link (MRFDL) and a Simplified Inertial Measurement Unit (SIMU).
PAC-3 CRI-2 (DT/OT-12)	Nov. 18, 2004	Yes and yes	This test used four PAC-3s in a ripple fire mode from separate launchers to intercept two target missiles. Once the intercepts were completed, the excess PAC-3s self-destructed as planned. The target missiles were a Patriot-as-a-Target and a Storm maneuverable tactical target vehicle. Not reported was whether an intercept meant the destruction of a target or simply an engagement. Used during the test was the Post Deployment Software Build (PBD)-6, which was to track and engage the target missiles; no word on whether it suffered from the same ghost tracks problems that bedeviled Patriot batteries during the 2003 Iraq war. According to Col. John Vaughn, Army Lower Tier Air and Missile Defense project manager, this test's completion signifies that they "have wrapped up the near-term PAC-3 flight test program to successfully demonstrate the cut-in of cost reduction hardware."
Missile Segment Enhancement (MSE)	Late 2006	N/A	The MSE is the latest version of the PAC-3. The Army may decide in 2007 whether to move the MSE into low-rate initial production. The MSE is hoped to fly twice as far as the PAC-3, thanks to enhanced rocket motor and fins, and should cover a range that is 50 percent larger than that of the PAC-3. Plus, the MSE is supposed to include a data downlink which should provide tactical telemetry information that could help assess whether an engagement actually occurred.
PAC-2 GEM: 2-1	June 14, 2005	Yes	Two GEM interceptors were fired, per tactical firing doctrine, at an aerodynamic TBM target. The 1st GEM damaged the target. The target self-destructed before the 2nd GEM could complete an intercept.
PAC-3: 2-2	Sept. 8, 2005	Yes	Two PAC-3 interceptors were launched against a PAAT (Patriot as a Target), a legacy Patriot

			that was modified to simulate flight characteristics of a Scud short-range ballistic missile. Following standard firing doctrine, when the first PAC-3 made an intercept, the second one self-destructed. Also tested was some new software of the Patriot and ground-system software changes.
PAC-3: 2-3	Nov. 11, 2005	No	During this test, PAC-3 missiles were supposed to intercept a short-range aerodynamic target. The firing unit sent two PAC-3s after the target, then received a false launch failure indication and sent a 3rd PAC-3 out. The 3 PAC-3s were launched from separate launching stations; all three did not intercept the target.
PAC-2 GEM: P6-2; ATM-46	Nov. 17, 2005	No	In this test, while the Patriot firing unit managed to share data with the MDA Block 04 Command, Control, Battle Management, and Communication (C2BMC) via Link-16, a GEM interceptor failed to intercept its target.
PAC-3 (P6-4)	Aug. 31, 2006	Yes	Two PAC-3s were ripple-fired at a modified Patriot-as-a-Target (PAAT) Tactical Ballistic Missile. The target was successfully intercepted. This test was a repeat of the Nov. 11, 2005, test in order to carry out the mission that it could not.
PAC-3 CRI: P6L-3	Oct. 23, 2006	Yes	Two PAC-3 Cost Reduction Initiative (CRI) missiles were launched at a Patriot-as-a-Target (PAAT) simulating a ballistic missile target. One CRI intercepted the target and the other intentionally destroyed itself.
PAC-2 GEM: P6L-2	October 2006	Yes	Two GEMs were launched at a target. The first GEM intercepted it.
PAC-2 GEM-T: PDB-6 LUT flight test P6L-1	November 2006	Yes	A low radar cross section cruise missile target was intercepted with a GEM-T.
PAC-3 MSE Flight Test 7-1	May 23, 2007	N/A	A MSE control test missile was fired at a simulated target. This was the first flight test of the MSE missile. During this test, the actuator battery lost voltage, which, according to DOT&E, "led to lateral accelerations exceeding design limits. This caused missile structural failure approximately three seconds after launch."
PAC-3 CRI: 14-1	July 18, 2007	Yes	A PAC-3 CRI missile was fired at and intercepted a subscale aircraft target that had electronic countermeasures.
PAC-3: 16-2	1QFY07	TBD	

PAC-3: 16-3	2QFY07	TBD	
PAC-2 GEM: P6X-2	1QFY08	TBD	
PAC-3: P6X-2	1QFY08	TBD	
PAC-3: 14-2	?	TBD	
PAC-3: 7-2	?	TBD	
PAC-3: 7-3	?	TBD	

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