

Reconstruction timeline of USS GREENEVILLE's Collision

Time (W)	Human Dynamics	Sensors	Fire Control Solutions	Reconstructed Reality
12:28:59	Commence tracking Sierra 12.	Gain Sierra 12: B-331.2		SSN: On C-000, S-10 kts, D-650 ft
12:30:32				SSN: Proceeds up to D-400 ft
12:31:59	Commence tracking Sierra 13.	Gain Sierra 13: B-356.8		EHIME MARU (EM): B-358, R-39,600 yds & closing, C-166, S-4 kts, AOB-S12
12:33:39				SSN: Reaches D-400 ft
12:34:40				SSN: Proceeds down to D-650 ft
12:37:56				SSN: Reaches D-650 ft
12:39:50	Commence baffle clear to the left.			SSN: Comes left to C-240
12:42:15	Drop track on Sierra 13. Sierra 13 enters starboard baffle due to change in course to 240.	Fade Sierra 13: B-359.1	Sierra 13: B-004, R-6000 yds & opening 9 yds/min, C-170, S-4 kts, AOB-S14	EM: B-359, R-35,400 yds & closing, C-166, S-4 kts, AOB-S13
12:42:34	Complete baffle clear.			SSN: Steady on C-240
12:45:00				SSN: Comes right to C-000
12:45:04				SSN: Proceeds up to D-400 ft
12:45:45	Last time held Sierra 10.	Fade Sierra 10: B-175.6 out of ATF as contact approaches port baffle	Sierra 10: B-192, R-4,000 yds & opening 152 yds/min, C-040, S-4 kts, AOB-S27	
12:47:45				SSN: Steady on C-000
12:50:00	Approximate time that Ehime Maru completes stowing anchor and increases speed to 11 kts.			
12:50:28				SSN: Reaches D-400 ft

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12:51:44				SSN: Proceeds down to D-650 ft
12:54:25				SSN: Reaches D-650 ft
12:55:30		Regain Sierra 13: B-001.9	Sierra 13: B-004, R-6,000 yds & opening 9 yds/min, C-170, S-4 kts, AOB-S14	EM: B-002, R-30,200 yds & closing, C-166, S-11 kts, AOB-S16
13:04:46				SSN: Comes right to C-020
13:06:20	Approximate time XO advises CO that ship needs to start afternoon demonstrations based upon time scheduled to be at Papa Hotel.			SSN: Steady on C-020
13:10:01		Sierra 12: B-322.9, Drwg Left	Sierra 12: B-323, R-11,000 yds & opening 242 yds/min, C-343, S-13 kts, AOB-S160	SSN: C-020, S-10 kts, D-650 ft
"		Sierra 13: B-006.9, Brg Steady	Sierra 13: B-004, R-8,000 yds & opening 60 yds/min, C-010, S-11 kts, AOB-S174	EM: B-006, R-20,600 yds & closing, C-166, S-11 kts, AOB-S20
13:14:02	Approximate time of CO's first Sonar walk-through - observed two contacts (Sierras 12 and 13) to the north and northwest.	Sierra 12: B-321.5, Drwg Left	Sierra 12: B-322, R-12,000 yds & opening 239 yds/min, C-345, S-13 kts, AOB-S157	
"		Sierra 13: B-007.5, Drwg Right	Sierra 13: B-007, R-15,000 yds & opening 30 yds/min, C-024, S-11 kts, AOB-S163	EM: B-007, R-18,000 yds & closing, C-166, S-11 kts, AOB-S21
13:15:35	Commence angles.	Sierra 13: B-007.2, Brg Steady	Sierra 13: B-007, R-15,000 yds & opening 29 yds/min, C-024, S-11 kts, AOB-S163	EM: B-007, R-16,800 yds & closing, C-166, S-11 kts, AOB-S21
"				SSN: Commences depth changes (650-150 ft) at 12-14 kts
13:17:01		Sierra 12: B-319.9, Drwg Left	Sierra 12: B-320, R-14,000 yds & opening 212 yds/min, C-343, S-14 kts, AOB-S158	
"	Fire control system solution range rate "closing" only because SSN is overtaking Sierra 13 (EM); EM believed to be on "opening" course.	Sierra 13: B-006.9, Brg Steady	Sierra 13: B-008, R-15,000 yds & closing 73 yds/min, C-024, S-11 kts, AOB-S163	EM: B-008, R-16,000 yds & closing, C-166, S-11 kts, AOB-S22

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"				SSN: Comes left to C-000
13:23:03		Sierra 12: B-318.9, Drwg Left	Sierra 12: B-318, R-15,000 yds & opening 118 yds/min, C-343, S-14 kts, AOB-S155	
"	Fire control system solution range rate "closing" only because SSN is overtaking Sierra 13 (EM); EM believed to be on "opening" course.	Sierra 13: B-010.9, Drwg Right	Sierra 13: B-011, R-15,000 yds & closing 52 yds/min, C-024, S-11 kts, AOB-S167	EM: B-013, R-11,400 yds & closing, C-166, S-11 kts, AOB-S27
13:23:10	Complete angles. Setting up for high speed maneuvers (HSMs).			EM: B-013, R-11,200 yds & closing, C-166, S-11 kts, AOB-S27
"	Approximate time XO again reminds CO of time and distance to Papa Hotel.			SSN: Proceeds up to D-400 ft, increases speed to >25 kts for high speed maneuvers
13:25:02	Commence HSMs after reaching D-400 ft and with change in course to 140.	Fade Sierra 12: B-318.8, as contact enters port baffles	Sierra 12: B-315, R-15,000 yds & opening 266 yds/min, C-343, S-14 kts, AOB-S153	SSN: Coming right to C-140
"	Fire control system solution range rate "closing" only because SSN is overtaking Sierra 13 (EM); EM believed to be on "opening" course.	Fade Sierra 13: B-007.8, out of ATF as contact approaches port baffles	Sierra 13: B-013, R-14,000 yds & closing 576 yds/min, C-024, S-11 kts, AOB-S169	EM: B-017, R-9,400 yds & closing, C-166, S-11 kts, AOB-S31
13:26:27				SSN: Steady on C-140
13:26:43				SSN: Comes left to C-340
13:28:04				SSN: Steady on C-340, S > 25 kts
13:28:17		Regain Sierra 13: B-004.6, back in ATF after steady on C-340		EM: B-015, R-7,400 yds & closing, C-166, S-11 kts, AOB-S29
13:28:57				SSN: Comes right to C-120, commences slowing to 12 kts
13:29:47		Fade Sierra 13: B-346.1, Drwg Left, out of ATF as contact approaches port baffles	Sierra 13: B-009, R-14,000 yds & opening 549 yds/min, C-024, S-11 kts, AOB-S169	SSN: Steady on C-120, S >25 kts
"				EM: B-017, R-6,000 yds & closing, C-166, S-11 kts, AOB-S31
13:30:42	Complete HSMs.			EM: B-011, R-6,000 yds & closing, C-166, S-11 kts, AOB-S25
"				SSN: Begins slowing to S-11 kts and comes left to C-340

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13:31:33		Regain Sierra 13: B-014.6, Drwg Left, back in ATF as own ship turns back to northerly course	Sierra 13: B-009, R-14,000 yds & opening 577 yds/min, C-024 S-11 kts, AOB-165	EM: B-010, R-5,400 yds & closing, C-166, S-11 kts, AOB-S24
13:31:36				SSN: Steady on C-340, S-19 kts and slowing, proceeds up to D-150 ft
13:32:03	Approximate time of CO's second Sonar walk-through.	Regain Sierra 12: B-316.6		
13:32:48	Fire control system solution range rate "closing" only because SSN is overtaking Sierra 13 (EM); EM believed to be on "opening" course.	Sierra 13: B-016.3, Drwg Right	Sierra 13: B-007, R-15,000 yds & closing 72 yds/min, C-024, S-11 kts, AOB-S163	EM: B-017, R-4,400 yds & closing, C-166, S-11 kts, AOB-S31
13:32:54	Total time steady on C-340, speed 13.5 kts or less and depth 150-170 ft is not more than 20 seconds. Total time on C-340, speed 18 kts or less and depth 150-400 ft (above Layer Depth) is 91 seconds.			SSN: Reaches D-150 ft, S-12.7 kts & slowing
13:33:03	CO orders OOD to clear baffles to course 120.	Sierra 12: B-312.5, Drwg Left	Sierra 12: B-311, R-18,000 yds & opening 26 yds/min, C-343, S-14 kts, AOB-S149	SSN: On C-340, S-13 kts, D-150 ft
"	Fire control system solution range rate "closing" only because SSN is overtaking Sierra 13 (EM); EM believed to be on "opening" course.	Sierra 13: B-017.5, Drwg Right, tracking well with SNR +9 dB	Sierra 13: B-008, R-15,000 yds & closing 23 yds/min, C-024, S-11 kts, AOB-S164	EM: B-018, R-4,200 yds & closing, C-166, S-11 kts, AOB-S32
"	Sonar Supervisor gains Sierra 14 as new contact. Sonar currently holds three contacts (Sierras 12, 13 and 14).	Gained Sierra 14: B-002.5		
13:33:07	Clearing baffles to the right.			SSN: Comes right to C-120. This will be first leg of TMA for Sierra 14.
13:34:00	Approximate time that CO explains over 1MC that the purpose of baffle clear before going to P/D is to prevent collision at P/D.			
13:34:03	Initial solution for Sierra 14 is based upon one minute of data.	Sierra 14: B-356.7, Brg Steady	Sierra 14: B-358, R-8,000 yds & closing 597 yds/min, C-195, S-12 kts, AOB-S17	
13:34:48	Sonar currently holds two contacts (Sierras 13 and 14).	Fade Sierra 12: B-316.5	Sierra 12: B-311, R-19,000 yds & opening 593 yds/min, C-343, S-14 kts, AOB-S149	

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"	Significant bearing error developing between fire control system solution and sensor bearing.	Sierra 13: B-021.5, Drwg Right	Sierra 13: B-008, R-15,000 yds & opening 303 yds/min, C-024, S-11 kts, AOB-S164	EM: B-023, R-3,200 yds & closing, C-166, S-11 kts, AOB-S37
"	Sierra 14 solution updated second time indicating that FTOW is focused on developing a good initial solution on new contact Sierra 14.	Sierra 14: B-357.5, Brg Steady	Sierra 14: B-356, R-11,000 yds & opening 402 yds/min, C-337, S-12 kts, AOB-P160	
13:35:39	Approximate time OOD orders Sonar, "Report all contacts."			SSN: Steady on C-120, D-150 ft, S-7.5 kts
13:35:48	Approximate time Sonar Supervisor reports all contacts including new contact Sierra 14. CO misses hearing report of Sierra 14 from Sonar Supervisor.	Sierra 13: B-020.5, Brg Steady	Sierra 13: B-008, R-15,000 yds & opening 452 yds/min, C-024, S-11 kts, AOB-S164	EM: B-022, R-2,800 yds & closing, C-166, S-11 kts, AOB-S36
13:35:49 - 13:36:44	CO says he has a good feel for contact picture (he believes that the two contacts held by sonar are Sierras 12 & 13 since he is unaware of new contact Sierra 14 and that Sierra 12 has faded).			
13:36:45	Approximate time CO orders ship to P/D.	Sierra 13: B-021.2, Brg Steady	Sierra 13: B-007, R-16,000 yds & opening 448 yds/min, C-024, S-11 kts, AOB-S163	EM: B-022, R-2,600 yds & closing, C-166, S-11 kts, AOB-S36
"		Sierra 14: B-356.2, Brg Steady	Sierra 14: B-352, R-10,000 yds & closing 231 yds/min, C-197, S-12 kts, AOB-P24	
13:36:58	Total time steady on C-120, S-7.5 kts, D-150 ft is 86 seconds. FTOW surprised by CO ordering ship to P/D because there is only one leg of data for Sierra 14.			SSN: Starts ascent to periscope depth; ordered depth is 60 ft
13:37:03		Sierra 13: B-020.2, Brg Steady	Sierra 13: B-007 R-16,000 yds & opening 446 yds/min, C-024. S-11 kts, AOB-S163	EM: B-022, R-2,600 yds & closing, C-166, S-11 kts, AOB-S36
13:37:18		Sierra 13: B-020.1, Brg Steady	Sierra 13: B-007 R-16,000 yds & opening 449 yds/min, C-024, S-11 kts, AOB-S163	EM: B-022, R-2,600 yds & closing, C-166, S-11 kts, AOB-S36

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13:37:48	Fire control system solution is updated to a closing solution as the submarine ascends to P/D. No report is made by the FTOW to the OOD who is on the periscope, or to the CO who is on the Conn. Updated fire control system solution is reasonable.	Sierra 13: B-020.7, Brg Steady	Sierra 13: B-021, R-4,000 yds & closing 105 yds/min, C-141, S-8 kts, AOB-S61	EM: B-021, R-2,400 yds & closing, C-166, S-11 kts, AOB-S35
"	FTOW is still focused on Sierra 14. Sierra 14 continues to draw into port baffle resulting in unreliable track of Sierra 14.	Sierra 14: B-355.7, Brg Steady	Sierra 14: B-350, R-10,000 yds & closing 221 yds/min, C-197, S-12 kts, AOB-P26	
13:38:40				SSN: At periscope depth
"		Sierra 13: B-019.8, Brg Steady	Sierra 13: B-022, R-3,000 yds & closing 115 yds/min, C-141, S-8 kts, AOB-S61	EM: B-021, R-2,200 yds & closing, C-166, S-11 kts, AOB-S35
13:39:04	Approximate time OOD reports "no close contacts" based upon three rapid 360 degree searches.	Sierra 13: B-020.6, Brg Steady	Sierra 13: B-022, R-3,000 yds & closing 110 yds/min, C-141, S-8 kts, AOB-S61	EM: B-021, R-2,000 yds & closing, C-166, S-11 kts, AOB-S35
"	Approximate time CO takes scope from OOD, begins 360 degree search and orders ship to 58 ft. Following 360 search, conducts high power sector search in the area that includes Sierras 12 and 13.	Sierra 14: B-355.6, Brg Steady	Sierra 14: B-347, R-10,000 yds & closing 197 yds/min, C-197, S-12 kts, AOB-P29	
13:39:30	CO continues periscope search.	Sierra 13: B-020.9, Brg Steady	Sierra 13: B-022, R-3,000 yds & closing 104 yds/min, C-141, S-8 kts, AOB-S61	EM: B-021, R-2,000 yds & closing, C-166, S-11 kts, AOB-S35
"				SSN: Reaches depth 58 ft.
13:39:35				SSN: Attains 57 ft (minimum depth)
13:39:46	Initiation of Emergency Deep. This completes CO's periscope search. Total time at P/D is 66 seconds. Total time at approximately 58 ft is 16 seconds.	Sierra 13: B-019.6, Drwg Left	Sierra 13: B-022, R-3,000 yds & closing 105 yds/min, C-141, S-8 kts, AOB-S62	EM: B-021, R-1,800 yds & closing, C-166, S-11 kts, AOB-S36
"				SSN: Commences Emergency Deep, departs periscope depth

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13:39:50	Approximate time CO asks for direction to Papa Hotel, ANAV responds 340.			SSN: C-121 , S-6.4 kts, D-64 ft
13:40:03		Sierra 13: B-019.4, Drwg Left	Sierra 13: B-022, R-3,000 yds & closing 95 yds/min, C-141, S-8 kts, AOB-S62	EM: B-021, R-1,800 yds & closing, C-166, S-11 kts, AOB-S35
"				SSN: C-120 , S-8.6 kts, D-79 ft
13:40:34		Sierra 14: Tracks off, then fades B-340.9		SSN: Comes left to C-340, S-12.8 kts, D-179 ft
13:41:57				SSN: Reaches 400 ft, C-038, S-13.3 kts
13:42:03	Significant bearing error developing between fire control system solution and sensor bearing due to range error in system solution.	Sierra 13: B-007.4, Drwg Left	Sierra 13: B-020, R-3,000 yds & closing 577 yds/min, C-141, S-8 kts, AOB-S59	EM: B-007, R-1000 yds & closing, C-166, S-11 kts, AOB-S21
				SSN: C-035 , S-13.2 kts, D-402 ft
13:42:25	Approximate time CO announces on 1MC expected response of ship to initiation of EMBT blow.			SSN: Initiates emergency MBT blow (Hdg 027 & swinging left at 0.3 deg/sec). Rudder amidships.
13:43:15	Approximate time SSN hull collides with EM.			SSN: Hull collides with EM (SSN Hdg 019, S-14.1 kts, Vert Vel 9.5 ft/sec).
13:43:48	Approximate time CO raises scope and observes EM astern.	Sierra 13: B-310.9, Drwg Left	Sierra 13: B-324, R-9,000 yds & opening 46 yds/min, C-240, S-99 kts, AOB-P94	EM: Astern of SSN (no track data)
13:44:49	Neither SSN nor EM reported visual sighting of any contacts after collision.	Regain Sierra 14: B-348.1	Sierra 14: B-343, R-9,000 yds & closing 79 yds/min, C-197, S-12 kts, AOB-P33	
		Note: Bearing - recorded to the nearest tenth of a degree	Note: Bearing - recorded to the nearest degree, Range - recorded to the nearest 1000 yds, Course - recorded to the nearest degree, Speed - recorded to the nearest knot	Note: Bearing - recorded to the nearest degree, Range - recorded to the nearest 200 yds, Course - recorded to the nearest degree, Speed - recorded to the nearest tenth of a knot