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# Appendix C

## Air Emissions Calculations



Table C-1. Surface Ship Air Emissions—No Action Alternative

Training Exercise	Scenario	Type Training	Number of Events	Program Totals	Nomenclature	Ship/Boat Type	Emissions												Greenhouse Gas Emissions (tons per year)																		
							Emissions >12 nm Offshore - US Territory (lbs)				Emissions 3-12 nm Offshore (lbs)				Emissions >12 nm Offshore - Outside US Territory (lbs)				CO	CO <sub>2</sub>	NO <sub>x</sub>	CH <sub>4</sub>	CO <sub>2</sub> e														
							CO	NO <sub>x</sub>	HC	SO <sub>x</sub>	PM	CO	NO <sub>x</sub>	HC	SO <sub>x</sub>	PM	CO	NO <sub>x</sub>						HC	SO <sub>x</sub>	PM											
Hours	Power (%)	Range (mi)	Percent	Percent	Range (mi)	Percent	Percent	Percent	Hours	PH <sub>10</sub>	CO	NO <sub>x</sub>	HC	SO <sub>x</sub>	PM	CO	NO <sub>x</sub>	HC	SO <sub>x</sub>	PM	CO	NO <sub>x</sub>	HC	SO <sub>x</sub>	PM												
1	AG Control Maneuvers		0																																		
2	A-A Missiles		0																																		
3	S-A Gummy Exercise		17																																		
4	S-A Missiles		4																																		
5	S-S GUMEX		4																																		
6	A-S BOMBEX		0																																		
7	SINKEX		2																																		
8	MPA ASW TRACKEX		32																																		
9	EERIEER ASW		0																																		
10	Surface Ship ASW TRACKEX		24																																		
11	Sub-ASW Trackex		64																																		
12	Elec Combat		0																																		
13	Miss Countermeasures		60																																		
14	Land Demolition Training		0																																		
15	Insertion/Extraction		0																																		
16	NSW Training		36																																		
17	HARNEX		70																																		
18	ISR		0																																		
19	UAV		0																																		
<b>Total Emissions within US Territory</b>												13.33	3.07	0.12	0.96	0.08	0.16	2.48	1.48	0.22	0.39	0.08	137.31	85.14	12.35	22.46	4.63	141.11	162.92	0.0039	0.0039	0.0039	151.82				
<b>Total Emissions outside US Territory</b>												3.00	4.35	0.34	0.95	0.16																					

Notes: 1 - Ship nomenclature highlighted in yellow identifies no specific AG Emissions data for that vessel.



Table C-3. Surface Ship Air Emissions—Alternative 2

Training Exercise	Scenario	Type Training	Number of Events	Program Totals	Nomenclature	Ship/Boat Type	Emissions													Greenhouse Gas Emissions (tons per year)																			
							Emissions 0.3 nm Offshore (lbs)				Emissions 1-12 nm Offshore - US Territory (lbs)				Emissions 12 nm Offshore - Outside US Territory (lbs)				CO	CO <sub>2</sub>	NO <sub>x</sub>	CH <sub>4</sub>	CO <sub>2e</sub>																
							CO	NO <sub>x</sub>	HC	SO <sub>x</sub>	PM	CO	NO <sub>x</sub>	HC	SO <sub>x</sub>	PM	CO	NO <sub>x</sub>						HC	SO <sub>x</sub>	PM													
<b>Total Emissions US Territory</b>																			1.38	8.34	0.99	2.66	0.54	10.05	6.67	6.48	0.96	2.28	0.48	172.29	118.91	16.80	29.76	6.18	141.71	153.24	0.0039	0.0039	154.54
<b>Total Emissions within US Territory</b>																			0.67	4.48	0.86	2.28	0.48	6.67	6.48	0.96	2.28	0.48	172.29	118.91	16.80	29.76	6.18	141.71	153.24	0.0039	0.0039	154.54	

Notes: 1. Ship nomenclature highlighted in yellow signifies no specific AC Emissions data for that vessel.

Table C-4 Aircraft Air Emissions—No Action Alternative

Scenario	Type Training	No. Aircraft	No. Flights	No. Passengers	No. Cargo	No. Fuel	No. Engines	No. Engines	Emissions										Greenhouse Gas Emissions (t/yr)									
									Emissions Indicators, lbs/100 lbs fuel					Emissions 3.12 mi Offshore (lbs)					Emissions 3.12 mi Offshore—US Territory (lbs)					Emissions 12 mi Offshore—Outside US Territory (lbs)				
Emissions Factors (lb/hr)		Emissions 3.12 mi Offshore (lbs)		Emissions 3.12 mi Offshore—US Territory (lbs)		Emissions 3.12 mi Offshore—Outside US Territory (lbs)		CO2		NOx		HC		SOx		PM		CO		CH4		N2O		CO2e				
1	FA-18E/F	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15			
2	EA-18G	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20			
3	S-3B	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30			
4	C-130	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30			
5	S-3B	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30			
6	AS-BOMBEX	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24			
7	SMXEX	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			
8	FA-18E/F	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15			
9	MPA ASW TRACKEX	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200			
10	EERIEER ROW	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10			
11	Surfex SWP ASW TRACKEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
12	Electric Control Exercise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
13	Min Courtesmeasures	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10			
14	Lead Distribution Training	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
15	Investigation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
17	HARDEX	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724	2724			
18	SR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
19	UNV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Totals		7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056	7056			



Table C-6. Aircraft AT Emissions—Alternative 2

Scenario	Aircraft	Type	Engine Model	Fuel Flow (gph)	Emissions Indexes, lbs/1,000 lbs fuel			Emission Factors (gph)			Emissions >12 m Offshore—Outside US Territory										Emissions >12 m Offshore—Within US Territory																			
					CO <sub>2</sub>			CO			PM <sub>2.5</sub>			CO			NO <sub>x</sub>			PM			CO <sub>2</sub>			NO <sub>x</sub>			PM			CO <sub>2</sub>			NO <sub>x</sub>			PM		
					CO <sub>2</sub>	CO	PM <sub>2.5</sub>	CO	NO <sub>x</sub>	PM <sub>2.5</sub>	CO	NO <sub>x</sub>	PM <sub>2.5</sub>	CO	NO <sub>x</sub>	PM	CO	NO <sub>x</sub>	PM	CO	NO <sub>x</sub>	PM	CO	NO <sub>x</sub>	PM	CO	NO <sub>x</sub>	PM	CO	NO <sub>x</sub>	PM	CO	NO <sub>x</sub>	PM						
1	FA-18E/F	15	FA-18E/F	400	1.58	0.89	0.12	6.31	0.97	3.24	48.16	0.02	3.06	0.021	0.026	0.020	0.02	3.06	0.021	0.026	0.020	0.02	3.06	0.021	0.026	0.020	0.02	3.06	0.021	0.026	0.020	0.02	3.06	0.021	0.026	0.020				
2	A-188SEX	96	E190	20	18.0	1.39	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
3	S-3A/BSEX	40	E175	30	120.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
4	S-3A/BSEX	4	E175	30	120.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
5	S-3A/BSEX	4	E175	30	120.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
6	S-3A/BSEX	30	P-3	1.0	30.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
7	S-3A/BSEX	4	E-2	18.0	84.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
8	MPAS/AT-602SEX	210	P-3	6.0	120.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
9	BERGESS/ASV	12	P-3	6.0	120.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
10	Surveillance/ASV TRACKEX	12	P-3	6.0	120.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
11	Surveillance/ASV TRACKEX	12	P-3	6.0	120.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
12	Electronic Combat Exercise	28	P-3	1.5	42.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
13	New Curriculum	12	SH-60B	2.0	24.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
14	Land/Deckboard Training	15	C-130	1.5	75.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
15	Instructional	27	C-130	1.5	75.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
16	NSW Training	27	C-130	1.5	75.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
17	HARSEX	3000	EA-6B	1.5	45.00	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
18	SR	100	P-3	6.0	120.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
19	JAW	12	Super Eagle	6.0	72.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
20		100	Global Hawk	6.0	60.0	0.89	0.76	0.60	5.98	2.30	1.34	20.09	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020	0.07	3.06	0.021	0.026	0.020			
Total		1177																																						

Total Emissions within US Territory: CO<sub>2</sub> 149,395; CO 0.23; NO<sub>x</sub> 0.20; PM 2.81; Greenhouse Gas Emissions (Pans per year) 335.90; GHG 11,213,602.3









Table C-10. Ground Vehicle Emissions - No Action Alternative

Scenario	Type Training		Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)						Emissions (lbs)						
	Days						CO	NOx	HC	SOx	PM10	CO	NOx	HC	SOx	PM			
1	Training Exercises		None																
		Air Combat Maneuvers	None																
2		A-A Missiles	None																
3		S-A Gunnery Exercise	None																
4		S-A Missiles	None																
5		S-S GUNEX	None																
6		A-S BOMBEX	None																
7		SINKEX	None																
8		ASW TRACKEX - MPA	None																
9		EER-IEER	None																
10		Surface Ship ASW TRACKEX	None																
11		Sub ASW TRACKEX	None																
12		Elec Combat	None																
13		Mine Countermeasures Training	None																
14		Land Demolition Training	102 Pickup Trucks	12	1.0	8	0.30	0.03	0.02	0.00	0.00	2980.86	249.60	156.04	2.74	8.92			
15		Insertion/Extraction	None																
16		NSW Training	None																
17		HARMEX	None																
18		ISR	None																
19		UAV	None																
Total							Total Ground Vehicle Emissions, tons						1.49043095 0.124799 0.078018 0.001371 0.004458						

Table C-11. Ground Vehicle Emissions - Alternative 1

Scenario	Type Training		Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)						Emissions (lbs)																							
	Training Exercises							CO	NOx	HC	SOx	PM10	CO	NOx	HC	SOx	PM																				
1	Air Combat Maneuvers			None																																	
2	A-A Missiles			None																																	
3	S-A Gunnery Exercise			None																																	
4	S-A Missiles			None																																	
5	S-S GUNEX			None																																	
6	A-S BOMBEX			None																																	
7	SINKEK			None																																	
8	ASW TRACKEX - MPA			None																																	
9	EER-IEER			None																																	
10	Surface Ship ASW TRACKEX			None																																	
11	Sub ASW TRACKEX			None																																	
12	Elec Combat			None																																	
13	Mine Countermeasures Training			None																																	
14	Land Demolition Training		110	Pickup Trucks	13	1.0	8	0.30	0.03	0.02	0.00	0.00	3482.54	291.61	182.30	3.20	10.42																				
15	Insertion/Extraction			None																																	
16	NSW Training			None																																	
17	HARMEX			None																																	
18	ISR			None																																	
19	UAV			None																																	
<b>Total</b>								<b>Total Ground Vehicle Emissions, tons</b>																													
								1.74127146						0.145803						0.091149						0.001602						0.006208					

**Table C-12. Ground Vehicle Emissions - Alternative 2**

Scenario	Type Training		Days	Ground Vehicles	Number	Engine Load	Hours per day	Emissions Factors (lb/hr)				Emissions (lbs)						
	Exercises							CO	NOx	HC	SOx	PM10	CO	Nox	HC	Sox	PM	
1	Air Combat Maneuvers			None														
2	A-A Missiles			None														
3	S-A Gunnery Exercise			None														
4	S-A Missiles			None														
5	S-S GUNEX			None														
6	A-S BOMBEX			None														
7	SINKEX			None														
8	ASW TRACKEX - MPA			None														
9	EER-IEER			None														
10	Surface Ship ASW TRACKEX			None														
11	Sub ASW TRACKEX			None														
12	Elec Combat			None														
13	Mine Countermeasures Training			None														
14	Land Demolition Training		110	Pickup Trucks	13	1.0	8	0.30	0.03	0.02	0.00	0.00	3482.54	291.61	182.30	3.20	10.42	
15	Insertion/Extraction			None														
16	NSW Training			None														
17	HARMEX			None														
18	ISR			None														
19	UAV			None														
<b>Total</b>								<b>Total Ground Vehicle Emissions, tons</b>										
								1.74127146 0.145803 0.091149 0.001602 0.006208										

Table C-13. Total Emissions within 3 nm of Shore

No Action Alternative	CO	NOx	HC	SOx	PM10	PM2.5
Aircraft–Operations	0.93	1.74	0.11	0.09	0.95	0.94
Surface Ships	1.33	3.07	0.12	0.56	0.08	0.08
Ordnance	0.92	0.06	0.00	0.00	0.09	0.09
Ground Vehicles	1.49	0.12	0.08	0.00	0.00	0.00
<b>Total</b>	<b>4.67</b>	<b>5.00</b>	<b>0.31</b>	<b>0.66</b>	<b>1.13</b>	<b>1.12</b>
<b>Alternative 1</b>						
Aircraft–Operations	1.02	1.86	0.12	0.10	1.03	1.02
Surface Ships	1.38	1.85	0.13	0.38	0.06	0.06
Ordnance	1.29	0.07	0.00	0.00	0.10	0.10
Ground Vehicles	1.74	0.15	0.09	0.00	0.01	0.01
<b>Total</b>	<b>5.43</b>	<b>3.93</b>	<b>0.34</b>	<b>0.48</b>	<b>1.19</b>	<b>1.18</b>
<b>Alternative 2</b>						
Aircraft–Operations	1.03	1.90	0.12	0.10	1.04	1.03
Surface Ships	1.38	1.85	0.13	0.38	0.06	0.06
Ordnance	1.60	0.10	0.00	0.00	0.12	0.12
Ground Vehicles	1.74	0.15	0.09	0.00	0.01	0.01
<b>Total</b>	<b>5.76</b>	<b>3.99</b>	<b>0.34</b>	<b>0.48</b>	<b>1.23</b>	<b>1.22</b>
<b>Increases over Baseline</b>						
Alternative 1	0.76	-1.07	0.02	-0.18	0.06	0.06
Alternative 2	1.09	-1.00	0.03	-0.18	0.10	0.10
<b>Major Source Threshold</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<i>Alternative 1 Above?</i>	NO	NO	NO	NO	NO	NO
<i>Alternative 2 Above?</i>	NO	NO	NO	NO	NO	NO

Table C-14. Total Emissions within U.S. Territory

No Action Alternative	CO	NOx	HC	SOx	PM10	PM2.5
Aircraft–Operations	1.35	3.68	0.21	0.19	1.87	1.85
Surface Ships	3.80	4.55	0.34	0.95	0.16	0.16
Ordnance	0.92	0.06	0.00	0.00	0.09	0.09
Ground Vehicles	1.49	0.12	0.08	0.00	0.00	0.00
<b>Total</b>	<b>7.57</b>	<b>8.41</b>	<b>0.63</b>	<b>1.14</b>	<b>2.12</b>	<b>2.10</b>
<b>Alternative 1</b>						
Aircraft–Operations	1.46	3.85	0.22	0.20	1.96	1.94
Surface Ships	4.06	3.45	0.36	0.80	0.15	0.15
Ordnance	1.29	0.07	0.00	0.00	0.10	0.10
Ground Vehicles	1.74	0.15	0.09	0.00	0.01	0.01
<b>Total</b>	<b>8.55</b>	<b>7.52</b>	<b>0.67</b>	<b>1.00</b>	<b>2.22</b>	<b>2.20</b>
<b>Alternative 2</b>						
Aircraft–Operations	1.49	3.95	0.23	0.20	2.01	1.99
Surface Ships	10.05	8.34	0.99	2.66	0.54	0.53
Ordnance	1.60	0.10	0.00	0.00	0.12	0.12
Ground Vehicles	1.74	0.15	0.09	0.00	0.01	0.01
<b>Total</b>	<b>14.89</b>	<b>12.53</b>	<b>1.31</b>	<b>2.86</b>	<b>2.67</b>	<b>2.65</b>
<b>Increases over Baseline</b>						
Alternative 1	0.98	-0.89	0.04	-0.14	0.10	0.10
Alternative 2	7.32	4.12	0.68	1.72	0.55	0.55
<b>Major Source Threshold</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>
<i>Alternative 1 Above?</i>	NO	NO	NO	NO	NO	NO
<i>Alternative 2 Above?</i>	NO	NO	NO	NO	NO	NO

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