GLOSSARY

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A-1	US Navy designation for first generation Polaris SLBM.
A-2	US Navy designation for second generation Polaris SLBM.
A-3	US Navy designation for third generation Polaris SLBM.
AAM	Air-to-Air Missile.
ABC	Atomic, Biological and Chemical. Also American Broadcasting Company.
ABM	Anti-Ballistic Missile. An interceptor of ballistic missiles.
ACM	Advanced Cruise Missile.
AEC	Atomic Energy Commission, predecessor to the DOE (US).
AFSATCOM	Air Force SATellite COMmunication system (US).
ALCM	Air-Launched Cruise Missile.
ARCTICSATCOM	ARCTIC SATellite COMmunication System (US).
ARPA	Advanced Research Projects Agency.
AS-1	A CIS ASM.
AS-3	A CIS ALCM.
AS-4	A CIS ASM.
AS-6	A CIS ASM.
AS-15	A CIS ALCM.
AS-16	A CIS ASM.
ASLP	Air-Sol Longue Portee (Air-to-Surface Long-range Missile -- French).
ASM	Air-to-Surface Missile.
ASMP	Air-Sol Moyenne Portee (Air-to-Surface Medium-range Missile -- French).
ASROC	Anti-Submarine ROCket, fired from surface ships (US).
ASW	Anti-Submarine Warfare.
ATBM	Anti-Tactical Ballistic Missile -- also called Anti-Tactical Missile (ATM).
ATM	Anti-Tactical Missile -- also called Anti-Tactical Ballistic missile (ATBM).
AWE	Atomic Weapons Establishment (Britain).
AW&ST	*Aviation Week & Space Technology.*
B-1	A US heavy, long-range bomber.
B-2	Newest US heavy, long-range bomber.
B-52	A US heavy, long-range bomber.
BASIC	British American Security Information Council.
BBC	British Broadcasting Company.
Backfire	A CIS medium-range bomber.
Bear-H	A CIS strategic bomber.
Blackjack	Newest CIS strategic bomber.
BNL	Banca Nationale de Lavoro (Italy's largest state-owned bank involved with illegal loans to Iraq).
Bus	The Post Boost Control System (PBCS) to which the warheads are attached, and from which they are dispensed.
C-3	US Navy designation for the Poseidon SLBM.
C-4	US Navy designation for the Trident-1 SLBM.

C^3I	Command, Control, Communication and Intelligence.
CBO	Congressional Budget Office (US).
CEP	Circular Error Probable -- the miss distance of a nuclear delivery vehicle.
CFE	Conventional Forces in Europe.
Chevaline	A British MARV for its Polaris missile.
CIA	Central Intelligence Agency (US).
CIS	Commonwealth of Independent States (11 of the 15 former Soviet republics).
CND	Campaign for Nuclear Disarmament (Britain).
CPO	Chief Petty Officer.
CRS	Congressional Research Service (US).
CSCE	Conference on Security and Cooperation in Europe (52 members including all 16 members of NATO as well as other western and eastern European countries along with former Soviet republics).
CSS-2	A Chinese INF missile.
CSS-3	A Chinese ICBM.
CSS-4	A Chinese ICBM.
CSS-N-3	A Chinese SLBM.
D-5	US Navy designation for the Trident-2 SLBM.
DARPA	Defense Advanced Research Projects Agency, now ARPA (US).
DASO	Demonstration And Shakedown Operations for submarines.
DOD	Department of Defense (US).
DOE	Department Of Energy (US).
DSCS	Defense Satellite Communication System (US).
E-6A	The new TACAMO aircraft, a Boeing 707 derivative (US).
EC	European Community (12 members: Austria, Belgium, Britain, Finland, France, Denmark, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, and Sweden).
EEI	Enhanced Electrical Isolation. The same as ENDS.
EHF	Extreme High Frequency.
EIS	Environmental Impact Statement.
ELF	Extreme Low Frequency.
EMP	Electro-Magnetic Pulse.
ENDS	Enhanced Nuclear Detonation Safety
ESGN	Electrostatically Supported Gyro Navigator.
ES&H	Environmental, Safety and Health.
EXPO	EXtended-range POseidon.
FBM	Fleet Ballistic Missile.
FLTSATCOM	FLeeT SATellite COMmunication system (US).
FROG-7	A CIS SRBM.
FRP	Fire Resistant Pits.
FY	Fiscal Year (US). Financial Year (Britain).
GAO	General Accounting Office (US Congress).
GATT	General Agreement on Trade and Tariffs.
GE	General Electric.
GLCM	Ground-Launched Cruise Missile, a former US INF weapon.
GNP	Gross National Product.

GPS	Global Positioning System.
HAC	House Appropriations Committee (US).
HASC	House Armed Services Committee (US).
HC	House of Commons (British).
Hertz	One cycle per second.
HMS	His/Her Majesty's Ship (British).
HMX	A base for more conventional high explosives. (Non-IHE explosives)
Hz	Hertz
IAEA	International Atomic Energy Agency (A UN agency).
ICBM	Inter-Continental Ballistic Missile.
IRBM	Intermediate-Range Ballistic Missile.
IHE	Insensitive High Explosive.
IMF	International Monetary Fund.
INF	Intermediate-range Nuclear Force.
IOC	Initial Operational Capability
IRBM	Intermediate-Range Ballistic Missile, an INF weapon.
kiloton	Nuclear yield equal to 1,000 tons of conventional explosives.
knot	One nautical mile per hour (1.1516 statute miles per hour).
kt	kiloton.
Lance	A US land-based SRNF missile.
LANL	Los Alamos National Laboratory (US).
LF	Low Frequency.
LIC	Low Intensity Conflict.
LLNL	Lawrence Livermore National Laboratory (US).
LMSC	Lockheed Missiles and Space Company.
Loran-C	A semi-worldwide land-based navigation system.
M-4	New French SLBM.
Mark-3	Reentry vehicle used in the 40-kiloton MIRV for US Poseidon missiles.
Mark-4	Reentry vehicle used in the 100-kiloton MIRV for Trident missiles.
Mark-5	Reentry vehicle used in the 475-kiloton MIRV for US Trident-2 missiles.
Mark-12A	Reentry vehicle used in the 335-kiloton MIRV for US Minuteman-3 missiles.
Mark-21	Reentry vehicle used in the 330-kiloton MIRV for US MX missiles.
Mark-500	A MARV designed for US Trident-1 missiles.
MARV	MAneuvering Reentry Vehicle.
Midgetman	A US small ICBM never deployed.
MILSTAR	MILitary Strategic and TActical Relay satellite (US).
Minuteman-2	A US ICBM.
Minuteman-3	A US ICBM.
MIRV	Multiple Independently-targeted Reentry Vehicles.
MP	Member of Parliament (Britain)
MRBM	Medium-Range Ballistic Missile.
MRV	Multiple Reentry Vehicle (not independently- targeted).
mt	megaton.
MX	A US ICBM.
N/A	Not Available.
NASA	National Aeronautics and Space Administration (US).
NATO	North Atlantic Treaty Organization (16 members: Belgium, Britain, Canada, Denmark, France, Germany, Greece, Iceland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Turkey, and the United States).

Nautical mile	One minute of one degree arc distance at the equator, 1.1516 statute miles, or 1.853 kilometers..
NAVSTAR	NAVigation System Timing And Ranging, a GPS satellite (US).
NOAA	National Oceanic and Atmospheric Administration (US).
Nodong-1	A North Korean SRBM. Also called a Scud-C.
NPA	New Peoples' Army (Philippines).
NPT	Nuclear NonProliferation Treaty.
NSF	National Science Foundation (US).
NTS	Nevada Test Site (US).
OMB	Office of Management and Budget (White House).
Omega	A worldwide land-based navigation system.
OPS	One Point Safety.
OT	Operational Test.
OTA	Office of Technology Assessment (US Congress).
PAL	Permissive Action Links, a safety device for nuclear warheads.
PBCS	Post-Boost Control System, the section of the missile to which the warheads are attached, and from which they are dispensed. Also called the "bus."
PCB	Polychlorinated biphenyl.
PCDS	Pacific Campaign for Disarmament & Security.
Pershing-1A	A former US SRINF missile, once used by West Germany.
Pershing-2	A former US land-based INF missile.
PLRC	Pacific Life Research Center.
PLYWD	Precision Low-Yield Weapons Design.
Polaris	A US SLBM (the A-3 version is still operational in Britain). Also the submarine carrying those SLBMs.
Poseidon	A US SLBM. Also the submarine carrying those SLBMs.
PRC	Peoples Republic of China.
PWR	Pressurized Water Reactor.
R&D	Research and Development.
RDT&E	Research, Development, Testing and Evaluation.
RAF	Royal Air Force (Britain).
RN	Royal Navy (Britain)
RNAD	Royal Navy Armament Depot (Britain).
SAC	Senate Appropriations Committee (US).
SALT	Strategic Arms Limitation Talks.
SASC	Senate Armed Services Committee (US).
SCOOP	SSBN Continuity Of Operations Program (US).
SH-08	A CIS ABM.
SH-11	A CIS ABM.
SIG	Stellar Inertial Guidance.
SINS	Ship Inertial Navigation System.
SJMN	San Jose (CA) *Mercury News*.
SLBM	Submarine-Launched Ballistic Missile.
SLCM	Sea-Launched Cruise Missile.
SNDV	Strategic Nuclear Delivery Vehicle.
SRAM-2	US Follow-on Short-Range Attack Missile, now cancelled.
SRAM-A	Short-Range Attack Missile currently deployed (US).

SRAM-T	Tactical version of the SRAM-2, now cancelled.
SRB	Special Reentry Body.
SRBM	Short-Range Ballistic Missile, a SRNF weapon.
SRINF	Short-Range INF.
SRNF	Short-Range Nuclear Force.
SRS	Savannah River Site (US).
SS-1C	A CIS SRBM.
SS-4	A former USSR land-based INF missile.
SS-11	A CIS ICBM.
SS-12	A former USSR land-based SRINF missile.
SS-13	A CIS ICBM.
SS-17	A CIS ICBM.
SS-18	A CIS ICBM.
SS-19	A CIS ICBM.
SS-20	A former USSR land-based INF missile.
SS-21	A CIS SRBM.
SS-23	A former USSR land-based SRINF missile.
SS-24	A CIS ICBM.
SS-25	A CIS ICBM.
SSBN	Ship, Submersible, Ballistic-missile, Nuclear-powered. Designation for a nuclear-powered ballistic-missile-launching submarine.
SSC-1B	A CIS GLCM.
SSM	Surface-to-Surface Missile.
SS-N-3	A CIS SLCM.
SS-N-5	A CIS SLBM.
SS-N-6	A CIS SLBM.
SS-N-7	A CIS SSM.
SS-N-8	A CIS SLBM.
SS-N-9	A CIS SSM.
SS-N-12	A CIS SSM.
SS-N-14	A CIS ASW Missile.
SS-N-15	A CIS ASW Missile.
SS-N-17	A CIS SLBM.
SS-N-18	A CIS SLBM.
SS-N-19	A CIS SLCM.
SS-N-20	A CIS SLBM.
SS-N-21	A CIS SLCM.
SS-N-22	A CIS SSM.
SS-N-23	A CIS SLBM.
START	STrategic Arms Reduction Talks.
StratCom	Strategic Command (Formerly the Strategic Air Command -- US).
Strategic	Pertaining to nuclear weapons, those inter-continental missiles and bombers designed for a thermonuclear war between the superpowers.
SUBROC	SUBmarine ROCket, fired from one submarine at another submarine (US).
SUW-N-1	A CIS ASW Missile.
SWERVE	Sandia Winged Energetic Reentry Vehicle Experiment (US).
SWS	Strategic Weapons System. Refers directly to the production, support and operation of missiles and warheads. Other operations such as training, submarine facilities, and submarine refit are non-SWS.

TACAMO	TAke Charge And Move Out, a US airplane for communicating with submarines.
Tactical	Regarding nuclear weapons, those designed to be used in battlefield or theater operations.
TASM	Tactical Air to Surface Missile.
TATB	An insensitive high explosive. (IHE)
TDG	Technology and Development Group (an Iraqi front company near London).
Tomahawk	Another name for the US GLCM and SLCM.
Transit	An early US navigation satellite.
Trident	Type of SSBN (US & Britain).
Trident-1	A US SLBM.
Trident-2	Newest US SLBM. Also to be leased to Britain.
ULMS	Underwater Long-range Missile System.
UN	United Nations.
US	United States.
USS	United States Ship.
USSR	Union of Soviet Socialist Republics.
UTC	United Technologies Corporation (US).
VLF	Very Low Frequency.
VSEL	Vickers Shipbuilding and Engineering Ltd (Britain).
V/STOL	Vertical/Short Take-Off and Land aircraft.
W-69	40-kiloton hydrogen bomb used in the US Mark-3 MIRV.
W-76	100-kiloton hydrogen bomb used in the US Mark-4 MIRV.
W-78	335-kiloton hydrogen bomb used in the US Mark-12A MIRV.
W-87	330-kiloton hydrogen bomb used in the US Mark-21 MIRV.
W-88	475-kiloton hydrogen bomb used in the US Mark-5 MIRVs.
WEU	Western European Union (9 members: Belgium, Britain, France, Germany, Italy, Luxembourg, Netherlands, Portugal, and Spain).
w/h	Warhead
yield	The explosive energy of a nuclear bomb.

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GAO/IMTEC-93-13 -- *Mission-Critical Systems: Defense Attempting To Address Major Software Challenges*, US General Accounting Office report, December 1992.

GAO/OCG-93-13TR --*Energy Issues*, US General Accounting Office report, December 1992.

GAO/NSIAD-92-282 -- *Strategic Defense Initiative: Some Claims Overstated for Early Flight Tests of Interceptors*, US General Accounting Office report, September 1992.

GAO/NSIAD-93-84 -- *Theater Missile Defense Program: Funding and Personnel Requirements Are Not Fully Defined*, US General Accounting Office report, December 1992.

GAO/NSIAD-93-229 -- *Ballistic Missile Defense: Evolution and Current Issues*, US General Accounting Office report, July 1993.

GAO/RCED-93-10 -- *Nuclear Security: Improving Correction of Security Deficiencies as DOE's Weapons Facilities*, US General Accounting Office report, November 1992.

GAO/RCED-93-154 -- *Nuclear Nonproliferation: Japan's Shipment of Plutonium Raises Concerns About Reprocessing*, US General Accounting Office report, June 1993.

GAO/RCED-94-9 -- *Nuclear Weapons: Safety, Technical, and Manpower Issues Slow DOE's Disassembly Efforts*, US General Accounting Office report, October 1993.

HAC/MILCON-94 -- *Military Construction Appropriations for 1994*, transcript of hearings before a subcommittee of the House Appropriations Committee.

Hall/CBO-1993 -- Raymond J. Hall, *Total Quantities and Costs of Major Weapons Systems Procured, 1974-1994* (Congressional Budget Office, 24 May 1993).

Hersch, Seymour M.; "On The Nuclear Edge," *The NewYorker*, 29 March 1993.

New London (CT) Day, 19 February 1993.

Nuclear Free Scotland, periodical of Scottish CND, (15 Barrland Street, Glasgow G41 1HQ, Scotland), various issues.

Pacific News Bulletin, periodical of the Nuclear Free and Independent Pacific Movement (P.O. Box 489, Petersham, NSW 2049, Australia), various issues.

Pacific Research, periodical of the Peace Research Centre (Australian National University, Canberra, Australia), various issues.

Positive Alternatives, periodical of the Center for Economic Conversion (122 View Street, Mountain View, CA 94041-1344), various issues.

Rethinking the Trident Force, a Congressional Budget ice Study, July 1993.

Safety of Trident, The; published by Scottish CND (15 Barrland Street, Glasgow G41 1HQ, Scotland).

Space News, 26 April 1993, p. 10

Swomley, John M.; "Are We Headed Toward Another Korean War?," *Fellowship*, March/April 1994, pp. 24 & 25.

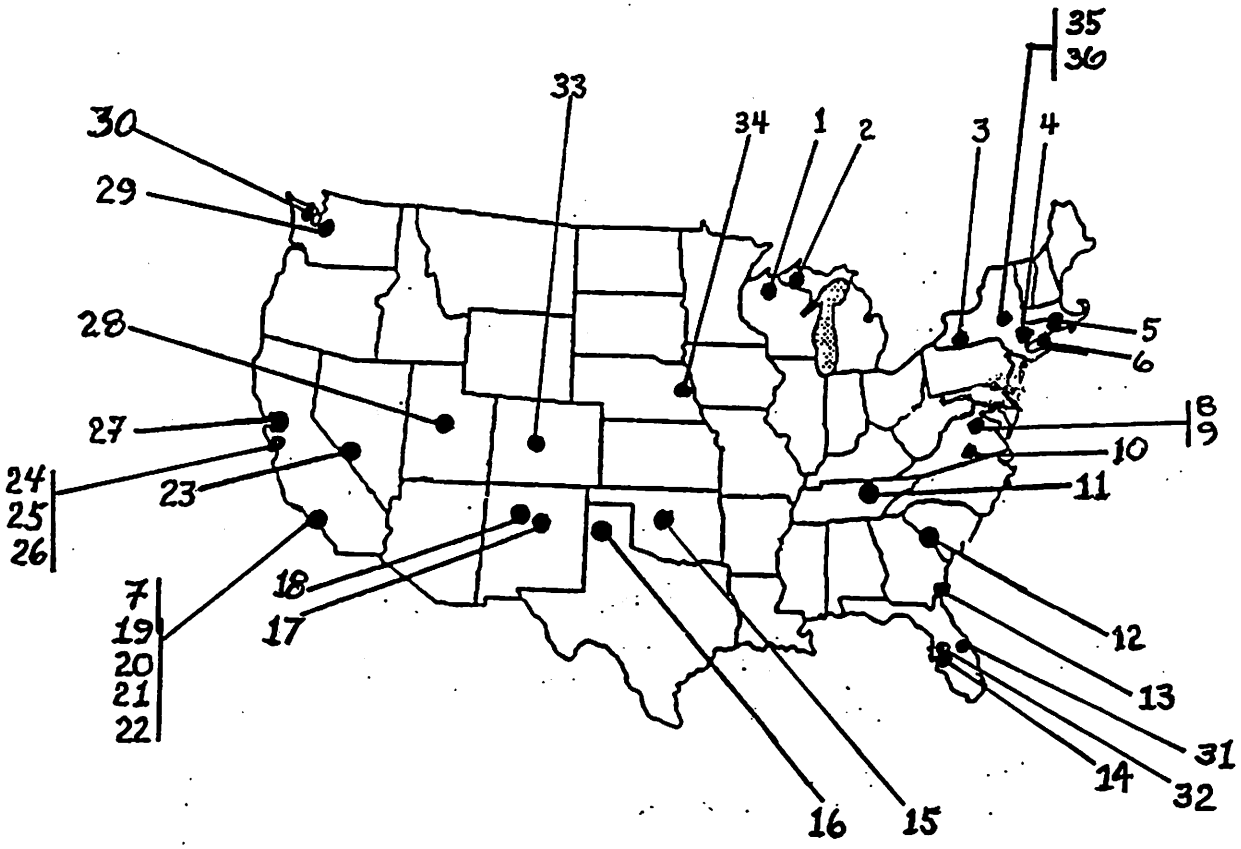
Tsuchida, Atsushi; "The Nuclear Arming of Japan," Global Securities Study No.18 of the Nuclear Age Peace Foundation (1187 Coast Village Rd, Suite 123, Santa Barbara, CA 93108-2794), February 1994.

APPENDICES

A

APPENDIX A

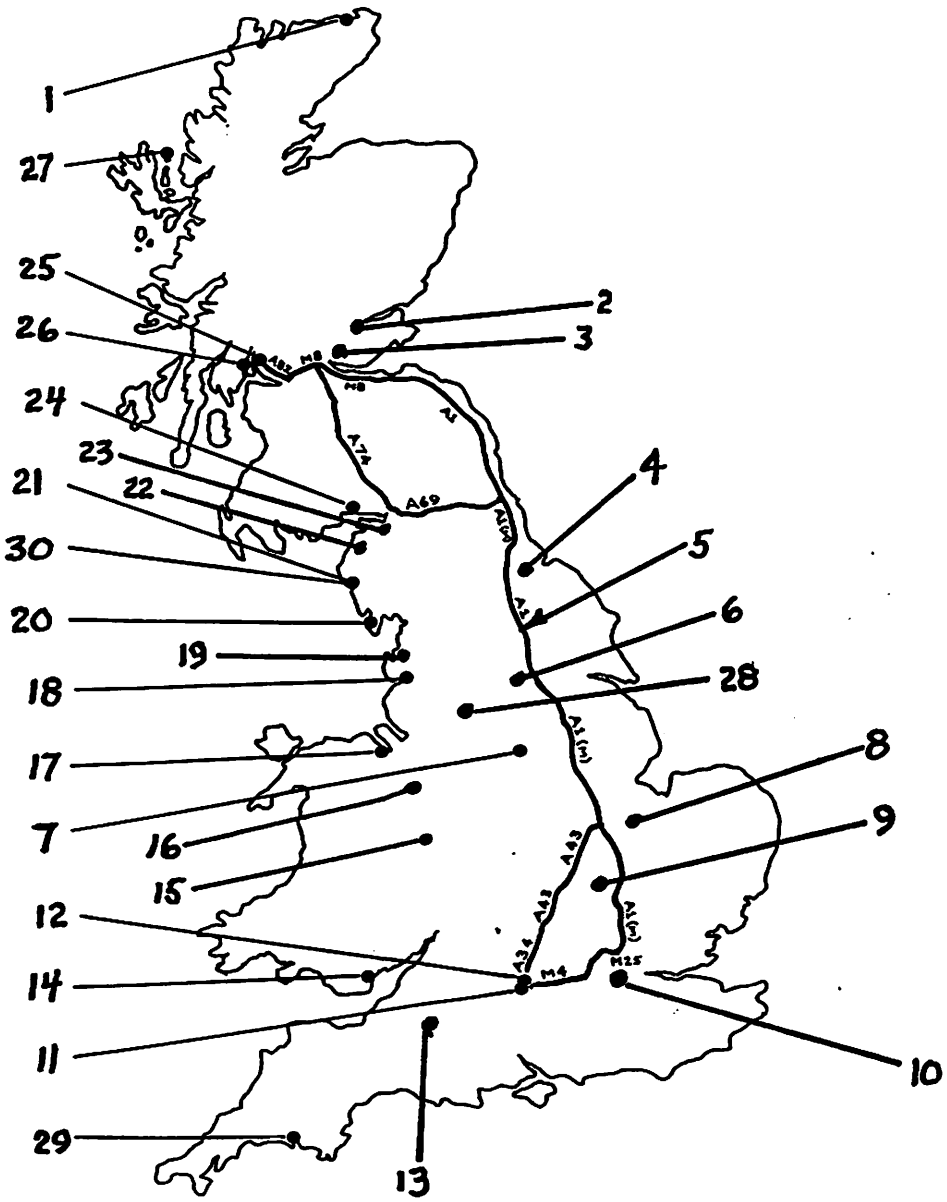
MAP OF US TRIDENT ACTIVITIES



1 Clam Lake (WI)
Extreme Low Frequency (ELF) transmitter.
2 Sawyer Air Force Base (MI)
Extreme Low Frequency (ELF) transmitter.
3 Sperry Systems Management (Great Neck, NY).
Submarine navigation system.
4 Lockheed Martin (Pittsfield, MA).
Submarine fire control system.
5 Charles Stark Draper Laboratory, Inc. (Cambridge, MA).
Missile guidance package.
6 General Dynamics, Electric Boat Div. (Groton, CT)
Submarine prime contractor.
7 Hughes Aircraft Company (El Segundo, CA)
Missile guidance electronics.
8 Pentagon (Arlington, VA)
US National Military Command Center.
9 White House (Washington, D.C.)
Commander-in-Chief of US Armed Forces.
10 Atlantic Research Corporation (Gainsville, VA)
Missile post-boost gas generators.
11 Y-12 Plant (Oak Ridge, TN) DOE -- Managed by Lockheed Martin Energy & Environment.
Provides uranium warhead components and lithium for SRS reactor.
12 Savannah River Site (SRS) (Aiken, SC) DOE -- Mgd by Westinghouse Savannah River Co.
Tritium production.
13 Sub-Base Kings Bay (GA)
East coast Trident base.
14 Honeywell, Inc. (Clearwater, FL)
Manufactures missile guidance components.
15 Tinker Air Force Base (OK)
TACAMO E-6A base.
16 Pantex (Panhandle, TX) DOE -- Managed by Mason & Hanger.
Assembly and disassembly of nuclear weapons.
17 Sandia National Laboratory (Los Alamos, NM) -- Mgd by Lockheed Martin Energy & Env.
DOE Nuclear bomb design and recycling.
18 Los Alamos National Laboratory (LANL) (Los Alamos, NM)
DOE Nuclear bomb design. Univ. of Calif. administers.
19 Ford Aerospace and Communications (Newport Beach, CA).
Missile integrated post-boost valves.
20 Northrop Corporation (Annaheim, CA).
Missile checkout equipment.
21 Rockwell International (Annaheim/ Seal Beach, CA)
Submarine inertial navigation system, NAVSTAR
Satellites, Submarine sonar acoustic processing systems.
22 Interstate Electronics Corporation (Annaheim, CA).
Submarine instrumentation.
23 Nevada Test Site (NV)
DOE Nuclear bomb testing.
24 Lockheed Martin Missiles & Space (Sunnyvale, CA)
Missile prime contractor. MILSTAR, NAVSTAR, and BMD contractor.
25 United Technologies Corp., Chemical Systems Div. (San
Jose, CA) Missile third-stage motor.
26 Westinghouse Marine Division (Sunnyvale, CA)
Submarine missile-launching system (launch tubes).
27 Lawrence Livermore National Laboratory (LLNL)(Livermore,CA)
DOE Nuclear bomb design. Univ. of Calif. administers.
28 Morton Thiokol Inc. & Hercules Aerospace Div. (Magna, UT)
Missile first- and second-stage motors.
29 Boeing, Co. (Seattle, WA)
Manufactures TACAMO E-6A aircraft.
30 Sub-Base Bangor (WA)
West coast Trident base.
31 Cape Canaveral (FL)
Launch site for NAVSTAR satellites
32 Pinellas Plant (Largo, FL) DOE -- Managed by Lockheed Martin Energy & Environment.
Makes neutron generators for hydrogen bombs.
33 Falcon Air Force Base (Colorado Springs, CO)
Master control station for NAVSTAR satellites.
34 Strategic Command (near Omaha, NE)
Command and Control of all US nuclear weapons.
35 Lockheed Martin (West Melton, NY)
Submarine propulsion system.
36 Knolls Atomic Power Lab (Schnectedy, NY) DOE-- Mgd by Lockheed Martin Energy & Env
Nuclear propulsion crew training.

APPENDIX B

MAP OF BRITISH TRIDENT ACTIVITIES



1 Dounreay.
Prototype Trident nuclear reactor -- test & training site.

2 Pitreavie Castle
Royal Navy Very Low Frequency (VLF) transmitter.

3 Rosyth Dockyard
To preform Trident submarine overhaul.

4 Albermarle (near Newcastle)
High-security overnight stopover for warhead convoys.

5 Motorways
Main warhead convoy routes, Burghfield-to-Coulport.

6 Forest Moor
Royal Navy communications receiver station.

7 Rolls Royce, Derby
Submarine nuclear reactor and fuel rods.

8 RAF Wittering (near Peterborough).
High-security overnight stopover for warhead convoys.

9 Rugby
Very Low Frequency (VLF) transmitter.

10 Northwood (London).
Joint Maritime Headquarters -- command of submarines.

11 AWE Burghfield (near Reading) -- Managed by Hunting Brae.*
Final assembly point for British nuclear weapons.

12 AWE Aldermaston -- Managed by Hunting Brae.*
Warhead nuclear component manufacture.

13 Bath (Foxhill).
Submarine design -- engineering dev. & constr. support.

14 AWE Cardiff -- Managed by Hunting Brae.*
Warhead casing and component factory.

15 Criggion.
Very Low Frequency (VLF) transmitter.

16 Swynnerton (near Stafford)
High-security overnight stopover for warhead convoys.

17 Capenhurst.
Uranium enrichment plant.

18 Springfields.
Nuclear processing -- uranium hexaflouride for warheads and reactor fuel.

19 Inskip.
Low Frequency (LF) transmitter.

20 VSEL-Vickers (Barrow-in-Furness)
Submarine contractor.

21 Sellafield (formerly Windscale).
Nuclear re-processing plant -- plutonium for warheads.

22 Ampthorn
Low Frequency (LF) transmitter.

23 Longtown (near Carlisle).
High-security overnight stopover for warhead convoys.

24 Chapel cross.
4 Magnox nuclear processing reactors -- plutonium & tritium for warheads.

25 Clyde Sub-Base Faslane (Gare Loch on Clyde)
Submarine base for Trident.

26 RNAD Coulport (Long Loch on Clyde).
Warhead storage.

27 Rona.
Sonar range.

28 Ferranti-Thompson (Cheadle Heath)
Sonar equipment for Trident submarines.

29 Devonport Dockyard
To perform Trident submarine maintenance. Fuel and defuel submarine reactors.

30 Calder Hall
4 Magnox nuclear processing reactors -- plutonium for warheads.

*Hunting Brae is a consortium of three contractors: Hunting Engineering a weapons manufacturer), Brown & Root (an American company), and AEA Technology (formerly the UK Atomic Energy Authority which was responsible for development of nuclear energy).

APPENDIX C

ESTIMATED TOTAL COST OF US 18-SUB TRIDENT SYSTEM THROUGH THE YEAR 2032 (In then-year US dollars)

Following is a cost breakdown for the complete US Trident program -- from inception to 2032. It includes backfitting Trident-1 missiles into Poseidon submarines along with estimated support and operation costs for those submarines (not for the missiles). Although the total cost seems astronomical, it is the best compilation possible from public sources. Even so, it may be conservative. The support and operation costs for Trident-1 missiles associated with Poseidon submarines is not included. In some cases, DOE expenses and government-furnished equipment are known to be excluded, and in others it is not known whether such expenses and equipment are excluded or not. So even this huge total may be too low.

Cost of backfitting 12 Poseidon submarines with Trident-1 missiles. [a]	+$ 3.6 billion
Operating and support cost for 12 backfitted Poseidon submarines, 1979-1999. Operation and support cost for missiles is not included. [b]	+$ 7.7 billion
Cost of first 8 Trident submarines, associated Trident-1 missiles, and the base at Bangor, Washington. [a] [c]	+$ 16.9 billion
Strategic Weapons System (SWS) research and development (R&D). 28 development Trident-2 missiles. 615 production Trident-2 missiles for 19-submarine fleet. Operation and support costs for SWS subsystems. Convert 8 Trident-1 submarines to Trident-2 capability. Construct Strategic Weapons Facility at Kings Bay, Georgia. Trident-2 portion of Strategic Weapons Facility at Bangor, Washington. [d]	+$ 99.3 billion
Less cost of missiles plus spares and qualification/training launches for 19th sub. 28 missiles at $26.8 million each, plus $1.0 billion operation & support costs for 28 missiles. [e]	-$ 1.8 billion
Cost of delaying until 2003 the backfit of Trident-2 missiles into the first 8 Trident submarines. [My estimate]	+$ 1.0 billion
R&D to incorporate Trident-2 capability in Trident submarines. [d]	+$ 0.1 billion

[MORE]

Cost to build 10 Trident-2 submarines. Nos. 9 through 18 [f]	+$ 11.6 billion
Military construction of non-SWS facilities and related construction activities at Kings Bay: Trident Training Facility, Trident Refit Facility, Submarine Base. [d]	+$ 1.0 billion
Submarine-related and other non-SWS equipment required for the Trident Training Facility, the Trident Refit Facility, and the Submarine Base at Kings Bay. [d]	+$ 0.8 billion
Estimated operating and support costs for 19 Trident submarines. Includes cost of submarine personnel, operations, and maintenance through the year 2032. [d]	+$ 31.0 billion
Less estimated operating and support cost of the 19th submarine. [My estimate]	-$ 1.0 billion
TOTAL TRIDENT COST THROUGH THE YEAR 2032	========== $170.2 billion

SOURCES:

a. CRS-IB73001, *Trident Program*, Congressional Research Service Issue Brief by Jonathan E. Medalia, Foreign Affairs and National Defense Division, updated 22 March 1991, p. 11.

b. My estimate based on GAO/NSIAD-89-40, *Navy Strategic Forces: Trident-2 Proceding Toward Deployment*, US General Accounting Office report, November 1988, p. 31.

c. Does not include DOE costs for nuclear warheads and reactor fuel. Cost of reactor fuel appears to be approximately $51 million per submarine in 1992 dollars (comparing submarine costs on pp. 11 & 12 of CRS-IB73001).

d. GAO/NSIAD-89-40, op. cit., p. 31.

e. Based on CRS-IB73001, op. cit., p. 15 for missile costs, and extrapolating from GAO/NSIAD-89-40, op. cit., p. 31 for operation and support costs. Cost of nuclear warheads furnished by DOE are not included.

f. Calculated from figures given in GAO/NSIAD-89-40, op. cit., p. 31; CRS-IB73001, op. cit., p. 12; and *Department of Defense Authorization for Appropriations for Fiscal Years 1992 and 1993*, transcript of hearings before the Senate Armed Services Committee, Part 2, 1991, p. 164.

APPENDIX D

ESTIMATED TOTAL COST OF BRITISH 4-SUB TRIDENT SYSTEM THROUGH THE YEAR 2032 (Billions of British pounds at 1991-1992 prices)

Following is the estimated complete cost of the British four-submarine Trident system over its 30-year lifetime. It includes the official British government estimate which adds up to 10.518 billion pounds, along with the Greenpeace UK addendum which shows the true price at 33.085 billion pounds.

GOVERNMENT ESTIMATE:	
Submarines (less SWS equipment). [a]	3.810
SWS Equipment. [a]	1.168
SWS Missiles. [a]	0.988
Tactical Weapons System. [a]	0.890
Shore Construction. [a]	1.188
Rosyth Works and Functional Machinery. [a]	0.137
Warhead, Miscellaneous and Unallocated Contingency. [a]	2.337
TOTAL GOVERNMENT COST ESTIMATE (10.676 billion at 1993 prices)	10.518 billion
GREENPEACE UK ADDENDUM:	
Development of PWR-2 submarine nuclear propulsion plant. [b]	0.535
30-year running costs for 4 boats. [b]	11.415
12 refits of the 4-boat fleet at 158 million pounds each. [b]	1.896
Decommissioning costs. [b]	0.077
VLF communications improvements. [b]	0.033
Construction at Faslane Works. [b]	0.397
Clyde Submarine Base externals (roads and services). [b]	0.003
Construction at Coulport Works. [b]	0.001
Construction at Rosyth Works. [b]	0.285
Construction at Works elsewhere. [b]	0.002
Aldermaston Works (warheads, etc.). [b]	1.431
Trident's share of AWE running cost over 30-year life. [b]	6.492
TOTAL GREENPEACE UK ADDENDUM	22.567 billion
TOTAL COST OF TRIDENT PROGRAM	33.085 billion

Sources:

a. HC-337 of Session 1991-92, *Progress of the Trident Programme, The*, Fifth Report of the Defense Committee, House of Commons, 11 March 1992, p. 25.

b. *The Rising Cost of Trident*, Nuclear Free Seas Campaign Report from Greenpeace UK, April 1992, p. 2; and *The True Cost of Trident*, Report from Greenpeace UK, April 1992, p. 5.

APPENDIX E

RESOURCE AND RESEARCH NETWORK FOR RESISTING TRIDENT

Ainslie, John

c/o Scottish CND
15 Barrland Street
Glasgow G41 1QH, Scotland
(0141) 423-1222 (Voice)
(0141) 423-1231 (FAX)

Background: Administrator of Scottish CND.
Expertise: British Trident submarine.

Babst, Dean

4489 Juneberry Court
Concord, Calif. 94521 USA
(510) 682-6321

Background: Director of accidental nuclear war projectof the Nuclear Age Peace Foundation.
Expertise: Accidental and unauthorized use of nuclear weapons, and nuclear weapons accidents.

Bartells, Wolfgang

In der Schard 8
D-5500 Trier-Zewen, GERMANY
(0651) 86711 or 40046

Background: Television journalist with specialization on public information about military bases.
Expertise: German military bases and using journalism for public education.

Chamberlain, Nigel

Glovers Cottage, Lazonby
Penrith, Cumbria, CA10 1AJ ENGLAND
(01768) 898641

Background: Nukewatch UK coordinator.
Expertise: Nuclear weapons convoys in Britain.

Harine, Kathy, PhD.

2227 "N" Street, #101
Sacramento, California 95186
(916) 448-6746

Background: Doctorate in mathematics and former Lockheed scientist.
Expertise: Nuclear weapons consultant.

McHugh, Declan

c/o Campaign for Nuclear Disarmament
162 Holloway Road
London, N7 8DQ ENGLAND

Background: Editor of "Trust and Verify" for Verification Technology Information Center.
Expertise: British nuclear weapons and treaty verification technology.

Milner, Glen

3227 NE 198th Pl.
Seattle, Washington 98115 USA
(206) 365-7865

Background: Since 1986 an extensive researcher on safety and transportation of weapons by rail. largely through Freedom of Information Act releases.
Expertise: Safety hazards associated with shipment of nuclear weapons and rocket motors by rail.

Peden, William,

Campaign for nuclear Disarmament
162 Holloway Street
London, N7 8DQ ENGLAND
(0171) 700-2393 (Voice)
(0171) 700-2357 (FAX)

Background: Researcher for Greenpeace UK and Campaign for Nuclear Disarmament.
Expertise: British nuclear weapons.

Shannon, Jack

262 Jones Road
Saratoga Springs, NY 12866 USA

Background Former submarine reactor designer and manager of safety at Knolls Laboratory. Forced out because of an "unacceptable" safety report.
Expertise: Submarine nuclear reactors and their safety.

Smith, Bob

Brandywine Peace Community
P.O. Box 81
Swarthmore, Pennsylvania 19081 USA

Background: Researcher for over ten years on the military contracting activities of General Electric and Martin Marietta.

Expertise: Martin Marietta's contribution to the Trident program both in the US and Britain.

Stuart-Whistler, Bill

620 South Orange Street
Media, Pennsylvania 19063-4012, USA
(215) 565-7806

Background: Former radar engineer for General Electric. Resigned because of GE's military involvement.

Expertise: Radar and electronic sensors.

Urfer, Bonnie

P.O. Box 2658
Madison, Wisconsin 63701-2658 USA
(608) 767-3023

Background: Nukewatch USA coordinator.

Expertise: Transportation of nuclear weapons/materials on US highways.

Willis, Patti

Pacific Campaign for Disarmament and Security
Chickadee Lane Farm
Denman Island, B.C.
V0R 1T0 CANADA
(604) 335-0351

Background: Research Coordinator for Pacific Campaign for Disarmament and Security. Publishesperiodic "Information Update."

Expertise: Militarism in the Pacific area and its effect on indigenous people.

Plesch, Daniel P.

British American Security Information Council
Carrara House
20 Embankment Place
London, WC2N 6NN ENGLAND
(0171) 925-0862 (Voice)
(0171) 925-0861 (FAX)

Background: Director of BASIC. Publishes periodic short "BASIC Reports" for updates on current events and negotiations. Also publishes periodic comprehensive papers on specific subjects.

Expertise: Weapons in Britain and Europe, particularly nuclear weapons. Treaty negotiation status and details.

APPENDIX F

PUBLICATIONS TO HELP THE NETWORK
FOR RESISTING TRIDENT

BASIC Reports
British American Security Information Council
Carrara House
20 Embankment Place
London WC2N 6NN ENGLAND
(071) 925-0862 (Voice)
(071) 925-0861 (FAX)
or
1900 "L" Street, NW; Suite 401-2
Washington, D.C. 20036, USA
(202) 785-1266 (Voice)
(202) 387-6298 (FAX)

Campaign
Campaign for Nuclear Disarmament
162 Holloway Road
London N7 8DQ ENGLAND
(071) 700-2393

Damocles in Brief (English language)
Center for Documentation and Research on Peace and Conflicts
B.P. 1027
69201 Lyon Cedex 01, France
(33) 78 36 93 03 (Voice)
(33) 78 36 36 83 (FAX)

From Trident To Life Newsletter
c/o CALC
340 Mead Road
Decatur, Georgia 30030 USA

Heddwch Action News
CND Cymru (Wales)
c/o Peace Shop
56 Mackintosh Place, Roath
Cardiff, CF2 4RQ WALES
(0222) 489260

Nuclear Free Local Authorities Bulletin
National Steering Committee
The Planning & Environmental Health Department
Town Hall
Manchester M60 2LA, ENGLAND

Nuclear Free Scotland
Scottish CND
15 Barrland Street
Glasgow, G41 1QH, SCOTLAND
(041) 423-1222 (Voice)
(041) 423-1231 (FAX)

Nukewatch Pathfinder
P.O. Box 2658
Madison, Wisconsin 53701-2658 USA
(608) 767-3023

Nukewatch Newsletter
c/o Nigel Chamberlain
Glover's Cottage, Laxonby
Penrith CA10 1AJ, England

Peace Work
A New England Peace and Social Justice Newsletter
American Friends Service Committee
2161 Massachusetts Avenue
Cambridge, MA 02104 USA
(617) 661-2832

Positive Alternatives
The Center for Economic Conversion
222 View Street, Suite C
Mountain View, California 94041 USA
(415) 968-8798

Space and Security News
5115 South A1A Highway
Melbourne Beach, Florida 32951 USA
(407) 952-0600

APPENDIX G

THE START TREATIES

Two landmark events took place during 1992 which set the stage for significant reductions in strategic nuclear weapons -- i.e. cuts in intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs), and long-range bombers. A joint understanding between the US and Russia regarding a START-2 Treaty (the so-called Bush-Yeltsin Agreement) was signed on 17 June 1992, and the START-1 Treaty was ratified by the US Senate on 1 October 1992. Although the terms and status of these two treaties are vaguely understood, a working knowledge by the general public seems to be lacking.

A. START-1

The first Strategic Arms Reduction Talks (START-1, or sometimes simply START) Treaty was signed by US President George Bush and Soviet President Mikhail Gorbachev on 31 July 1991. But on 25 December 1991 the Soviet Union ceased to exist. Soviet strategic nuclear weapons were then located in four of the successor states -- Russia, Ukraine, Kazakhstan, and Belarus.

On 23 May 1992 these four states, now members of the Commonwealth of Independent States (CIS), signed an agreement with the US in which all five become parties to the SALT-1 Treaty. That protocol provides that:

-- the four new CIS states will decide among themselves how to implement their responsibilities under START-1.

-- Ukraine, Kazakhstan, and Belarus committed themselves to joining the Nuclear Nonproliferation Treaty (NPT) as non-nuclear states. This means they will give up their nuclear weapons.

-- Russia remains a nuclear state party to the NPT.

1. Terms of the START-1 Treaty.

After the legislatures of all five parties ratify START-1 and instruments of ratification are exchanged, the treaty will go into effect. Reductions must then be completed in three phases over a period of seven years. The treaty is of 15 years duration unless abrogated earlier, and may be renewed in five year increments.

In general, START-1 covers "deployed" strategic nuclear delivery vehicles (SNDVs) and warheads. It does not mandate destruction. SNDVs and warheads can be removed from deployment by removing the launchers. The basic START-1 limits are:

1600 SNDVs which carry no more than

6000 "accountable" nuclear warheads, of which only 4900 can be on ballistic missiles.

1540 maximum on heavy ICBMs (SS-18s).

1100 maximum on mobile ICBMs.

A major obstacle during negotiations was how to count nuclear sea-launched cruise missiles (SLCMs), which the US insists are tactical weapons, not long-range strategic weapons. This was solved by a political statement (a gentlemen's agreement) that

neither country will build more than 880. The US only planned on 750 anyway. But this agreement is separate from START and does not count against the SNDV and warhead ceilings.

Another stumbling block was how to count warheads on bombers. This led to a formula for "accountable" nuclear warheads. Each bomber carrying only gravity bombs or short-range attack missiles (SRAMs) will be counted as one SNDV with only one warhead, regardless of the number of bombs and SRAMs it can carry. For bombers carrying air-launched cruise missiles (ALCMs), the first 150 of such US bombers are counted as carrying only ten warheads each, although they can carry twenty. The first 210 of such Soviet bombers are counted as having eight warheads each, although they can carry up to twelve. Above these numbers (150 and 210) the actual number of warheads on each bomber are counted. So, although there are only 6000 "accountable" warheads allowed under START, the actual number of strategic warheads could be as follows:

	US	USSR
On SLBMs	3456	1872
On ICBMs	1444	3028
Bombs/SRAMs	2720	960
ALCMs	1860	1300
Total W/Hs on 1600 SNDVs	9480	7160
Total W/Hs with 880 SLCMs	10360	8040

2. Status of the START-1 Treaty.

By a vote of 93-6 the US Senate on 1 October 1992 ratified the START-1 Treaty. Kazakhstan had already ratified START-1 and Russia followed suit on 4 November 1992. Belarus ratified on 2 February 1993. Although Ukraine started removing its missiles and warheads earlier, it completed the ratification process for START-1 in December 1994. START-1 is now in effect and dismantling to comply with its limits must be completed by the end of 2001.

B. START-2

During the 17 June 1992 Washington Summit, Presidents Bush and Yeltsin signed a Memorandum of Joint Understanding, commonly called the Bush-Yeltsin Agreement. The Joint Understanding agreed to cut strategic warheads considerably below START-1 ceilings -- to between 3,000 and 3,500 on each side by 2003. (Russia plans 3,000 and the US 3,500). Deployed Trident warheads allowed will be halved from the possible 3,456 to 1,728.

The START-2 Treaty was signed by Presidents Bush and Yeltsin on 3 January 1993. It codified the Joint Understanding and may not enter into force before START-1, but shall remain in force as long as START-1. All of the START-1 provisions apply except as specifically modified by START-2. Like START-1, START-2 limits only deployment of SNDVs and warheads -- it does not restrict the stockpile -- except for the SS-18 heavy ICBM.

1. Terms of the START-2 Treaty.

The concept of "accountable" warheads has been removed by START-2. SLCMs, however, are still not covered. START-2 is to be implemented in two phases.

a. Phase-1 Reductions. The first phase is completion of START-1 reductions seven years after that treaty enters into force. Only the US and Russia are parties to START-2 because Ukraine, Kazakhstan, and Belarus will have disposed of their strategic weapons by the end of this phase. The START-1 reductions for this phase have been further modified by START-2:

1600 SNDVs (same as START-1)

3800-4250 "actual" warheads (rather than 6000 "accountable"); with sub-ceilings of:

2160 maximum SLBM warheads (new limit).

1200 maximum MIRVed ICBMs (new limit).

650 maximum on heavy ICBMs (rather than 1540).

1100 maximum on mobile ICBMs (same as START-1).

b. Phase-2 Reductions. Phase 2 is the completion of START-2 reductions by 2003 -- or by the end of the year 2000 if the US can help Russia finance elimination of its strategic weapons. The final limits are:

1600 SNDVs (same as Phase-1/START-1)

3000-3500 "actual" warheads; with sub-ceilings of:

1700-1750 maximum SLBM warheads (may be MIRVed).

1100 maximum mobile ICBM warheads (same as Phase-1/START-1).

Zero MIRVed ICBM warheads (only one warhead allowed on each ICBM).

Zero heavy ICBM warheads (SS-18s entirely eliminated).

c. Warhead Downloading Rules. The number of warheads that can be taken off of a missile to meet treaty requirements is limited. Only two types of missiles for both countries, in addition to the US Minuteman-3 ICBM and the Russian SS-N-18 SLBM, may be downloaded by up to four warheads each. There is no limit on the aggregate number of warheads downloaded as long as no more than four come from each missile.

An exception to this rule was made so that Russia would not have to build new missiles. Since each SS-19 carries six warheads, five would have to be downloaded to make it a single-warhead (non-MIRVed) missile. Therefore, a maximum of 105 SS-19s can substituted for one of the two missile types specified for downloading. Each ICBM may only be deployed in its existing silo.

Under these downloading rules, all US Minuteman-3 ICBMs (now three MIRVs each), all Russian SS-17 ICBMs (now four MIRVs each), and 105 Russian SS-19 ICBMs may be downloaded to single-warhead missiles. The new Russian SS-25 is already a single-warhead ICBM.

If the SS-18 weren't eliminated as a heavy ICBM, nine of its ten MIRVs would have to be downloaded to become a single-warhead missile. That exceeds the downloading rule so it would have been eliminated anyway. By that same token, the US MX ICBM and

RECORD OF REVISIONS

R