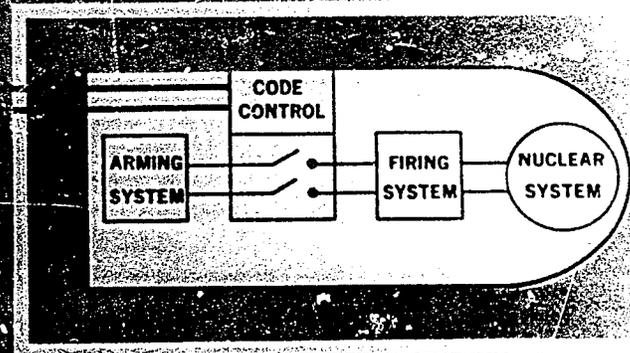
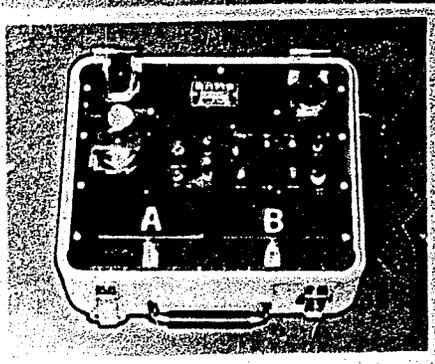
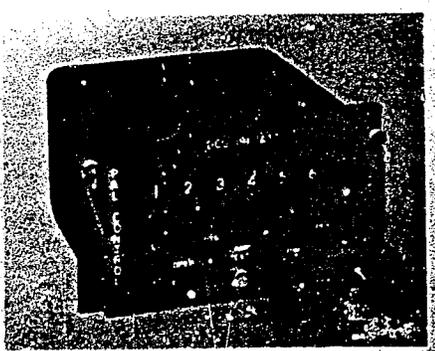


controlled numerical combination. Today, PAL devices are either combination locks or coded switches. Combination locks mechanically prevent, by a variety of means, use of the associated weapon until removed. Coded switches maintain a weapon in an electrically disenabled state until the combination is inserted (Figure 1). All PAL devices undergo unlock, recode, and verification operations. For combination locks, these are manual operations requiring no specialized equipment. Coded switches require external control equipment to perform these operations. In this section, the presently fielded PAL devices and control equipment (both ground and aircraft controllers) associated with the coded switches are described.

2.1 Hardware Elements (U)

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(U) PAL devices are utilized to delay use of a nuclear weapon by someone without knowledge of a



PERMISSIVE ACTION LINK

Figure 1. Hardware Elements (U)

2.1.1 PAL Devices (U)

(U) Table 1 shows current and planned weapons by PAL device type. These devices are discussed below.

Table 1. Current PAL-Equipped Weapons (U)

Combination Locks	CAT A	CAT B	CAT D	CAT F
W31	W50	B28-RE	B28-0-1	B61-3,-4
W33		B43-2	B61-2,-5	W84
W45-3		B57-2	(B61-6,-7,-8)	W85
W48		B61-0	W70-1,-2,-3	
W54			W79	
			(W80-0)	
			W80-1	
			(W81)	
			(W82)	
			B83	

Note: () indicates weapon in development

2.1.1.1 Combination Locks (U)

(U) Most weapons—bombs delivered by aircraft, missiles, and shells—experience a unique environment during deployment, e.g., spin, acceleration, pressure change. To provide the desired preflight handling safety, a family of ESDs evolved which close critical electrical arming lines only after the weapon experiences the desired environmental signature. In the case of ADMs, manually set in place and fired by either command or timer, there was no launch, drop, or fire environment which could be sensed by an ESD. Installation of 3-digit combination locks provided an additional safety step in the prefiring sequence (Figure 2). The 3-digit locks were redesigned by the AEC to provide 5 digits to be compatible with a 4-digit split-knowledge code management system. The Army also developed combination locks for use on several weapon systems. About half of the European stockpile is still equipped with combination locks. They are used on the W31 Nike Hercules, W45 MADM, W54 SADM, M422 (W33/8-in. AFAP) and M454 (W48/155-mm AFAP).

(U) The M422 uses an Army lock. The M83 atomic weapon locking device screws into the projectile's base; one part (the locking tube and desiccant assembly) occupies the volume into which the breech-lock-fuze assembly must be installed before firing. The M454 uses an Army lock. The M76 atomic

weapon locking device screws onto the projectile's nose, replacing the projectile's fuze (Figure 3). The W31 warhead for the Nike Hercules missile uses an Army lock. The M77 atomic weapon locking device fits onto the safing plug of the Adaption Kit (AK) (Figures 4 and 5). The W31 warhead for the Honest John missile uses an Army lock. The M81 atomic weapon locking device fits onto the safing plug of the AK (Figures 6 and 7).

(U) The W45-3 warhead for the MADM uses an AEC lock. The MC1885 padlock is installed on the warhead's J1 connector and prevents input of electrical signals to warhead circuits (Figure 8). The B54 warhead for the SADM also uses an AEC lock. The MC1948 lock-secured cover includes an MC1827 padlock (Figure 9). The cover denies unauthorized access to the arming and fuzing components.

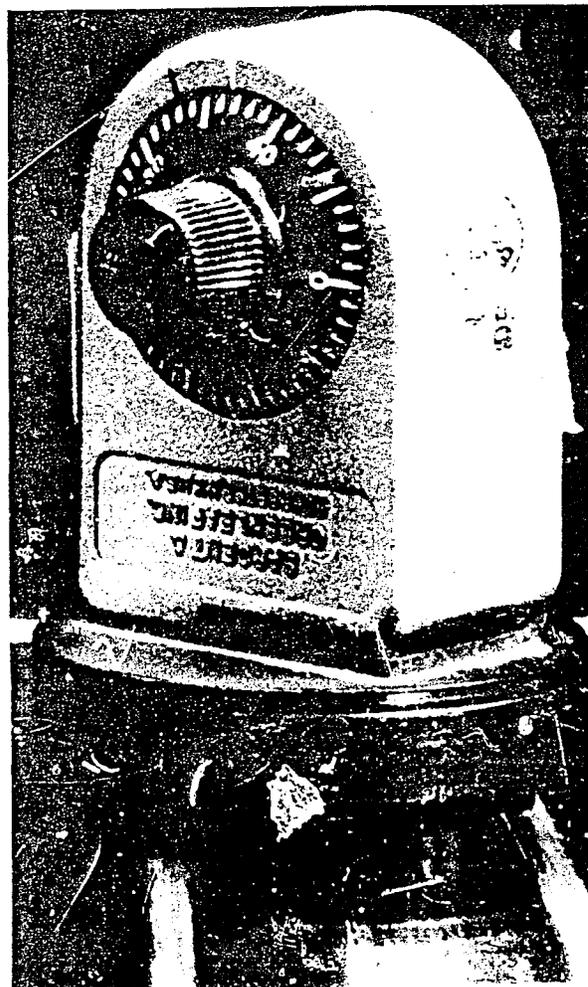


Figure 2. Combination Lock (U)

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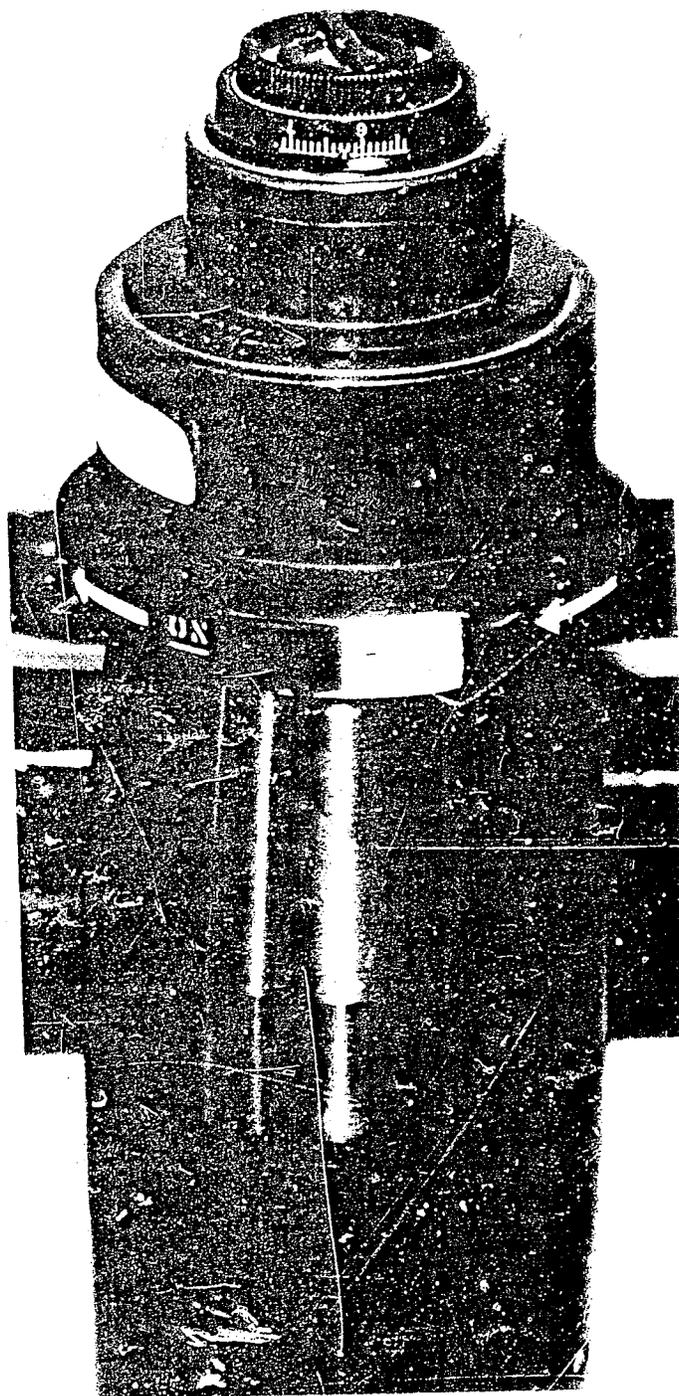


Figure 3. M20 Atomic Weapon Locking Device (1)

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Figure 4. M77 Atomic Weapon Locking Device (U)

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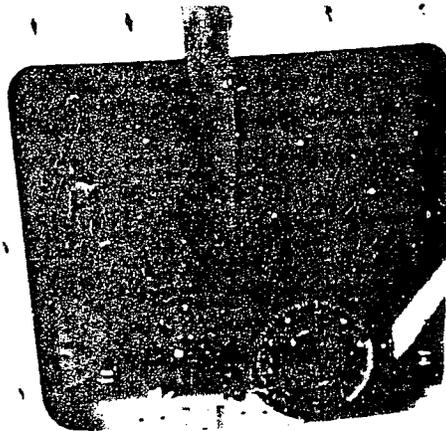


Figure 5. M77 Atomic Weapon Locking Device (U)

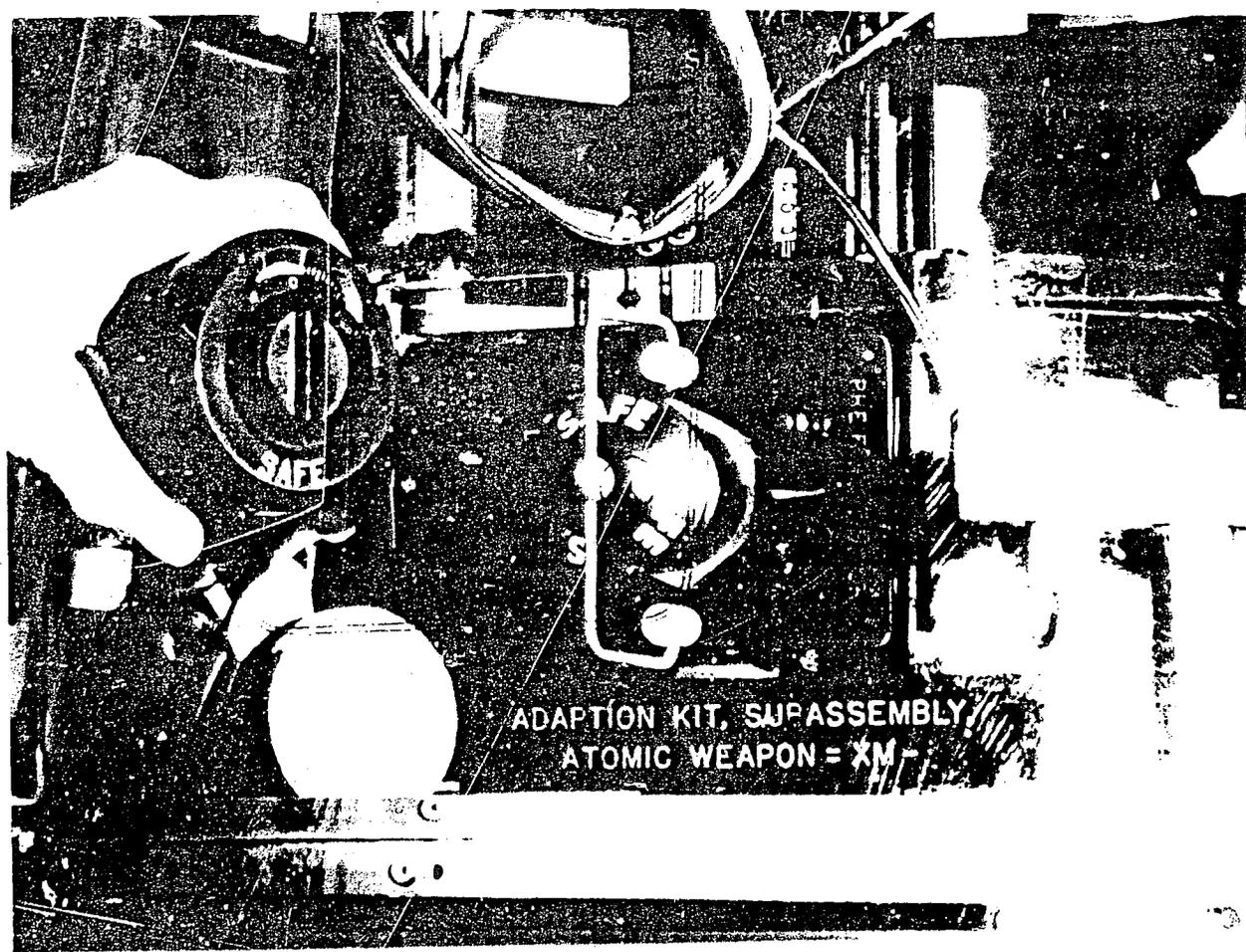


Figure 6. M81 Atomic Weapon Locking Device (U)

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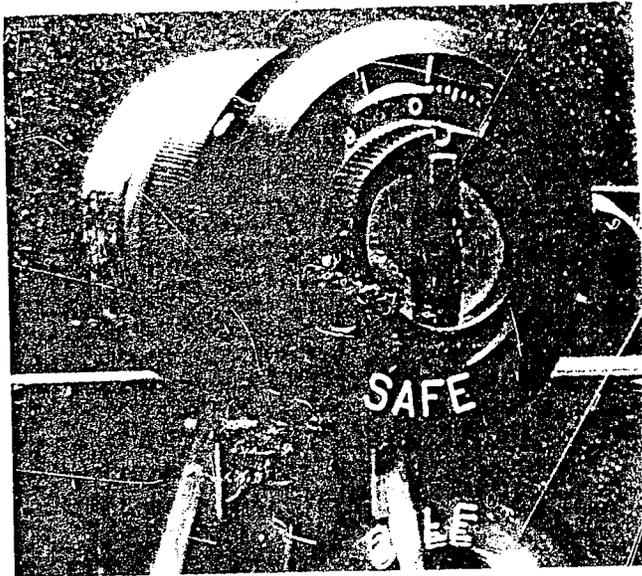
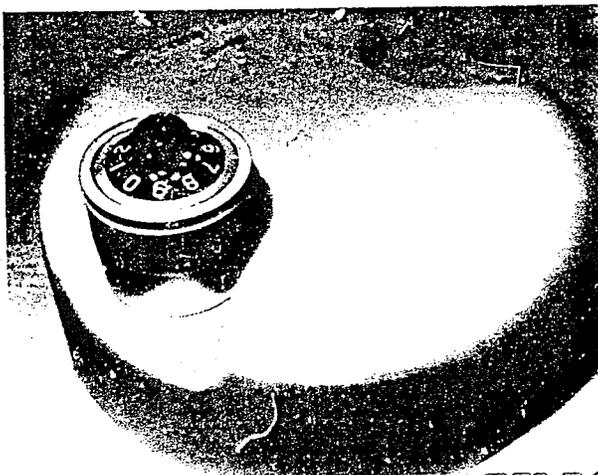


Figure 7. M-1 Atomic Weapon Locking Device (U)



a



b

Figure 8. M-1SS Padlock (U)

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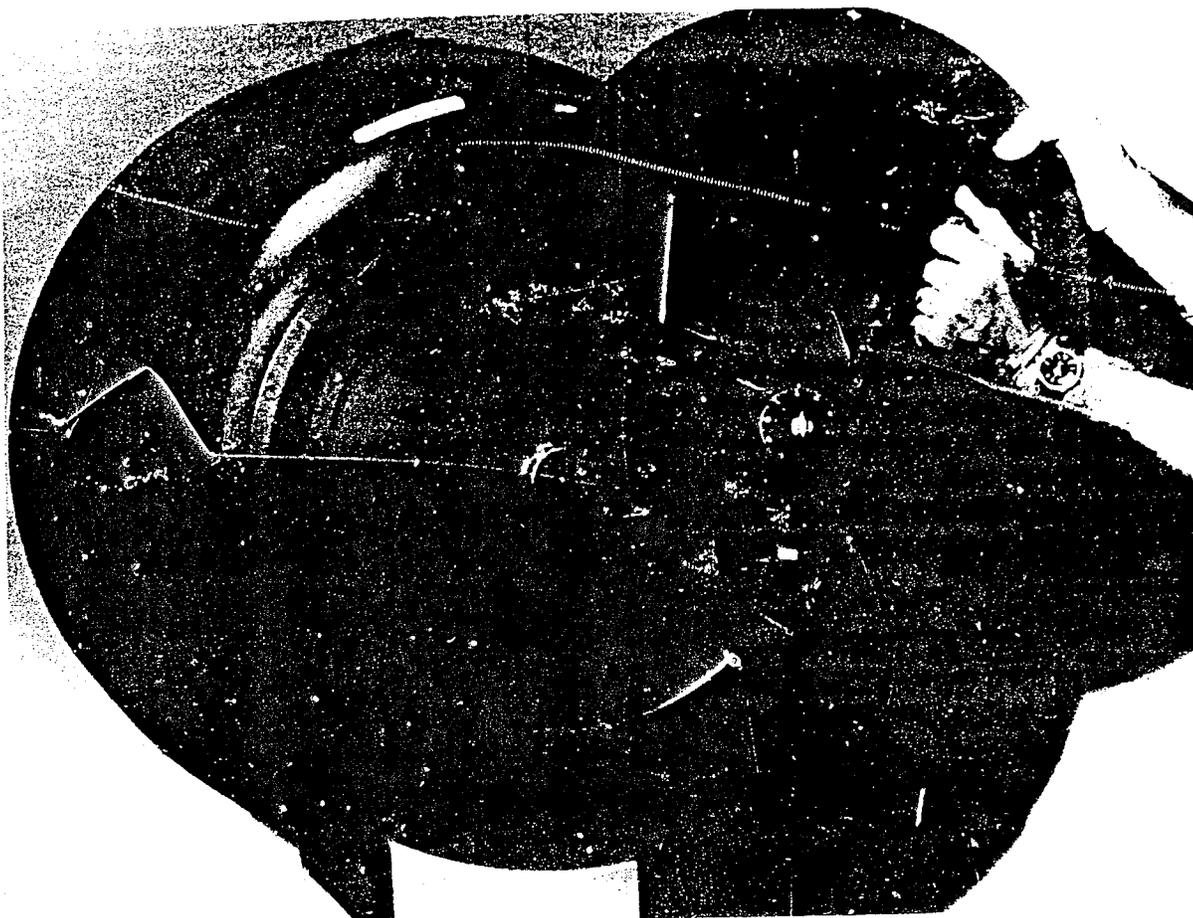


Figure 9. MC1948 Lock-Secured Cover (U)

2.1.1.2 Category A PAL (U)

(U) To provide remote control capability for weapons requiring a combination lock in lieu of an environmental sensing device, development had begun on a remotely controlled combination device prior to NSAM-160. As a result of NSAM-160, a crash effort was undertaken to complete development of this electromechanical coded switch and appropriate controllers and to install the switch to interrupt critical electrical circuits in European land-based US weapons. The switch carried the AEC nomenclature

MC1541 and was first installed on the W49 Jupiter. The Jupiter, B7, B28, W28 Mace, and W52 Sergeant with the MC1541 have been retired, but it is still operational in the W50 Pershing. The MC1541 systems, which provide a 10^4 code population, are called CAT A PAL.

(U) The CAT A PAL system (Figure 10) includes an electromechanical coded switch (MC1541), two controllers (T1500 Decoder and T1501 Recoder), a controller tester (T1502), and a power source (T436 Battery Power Supply).

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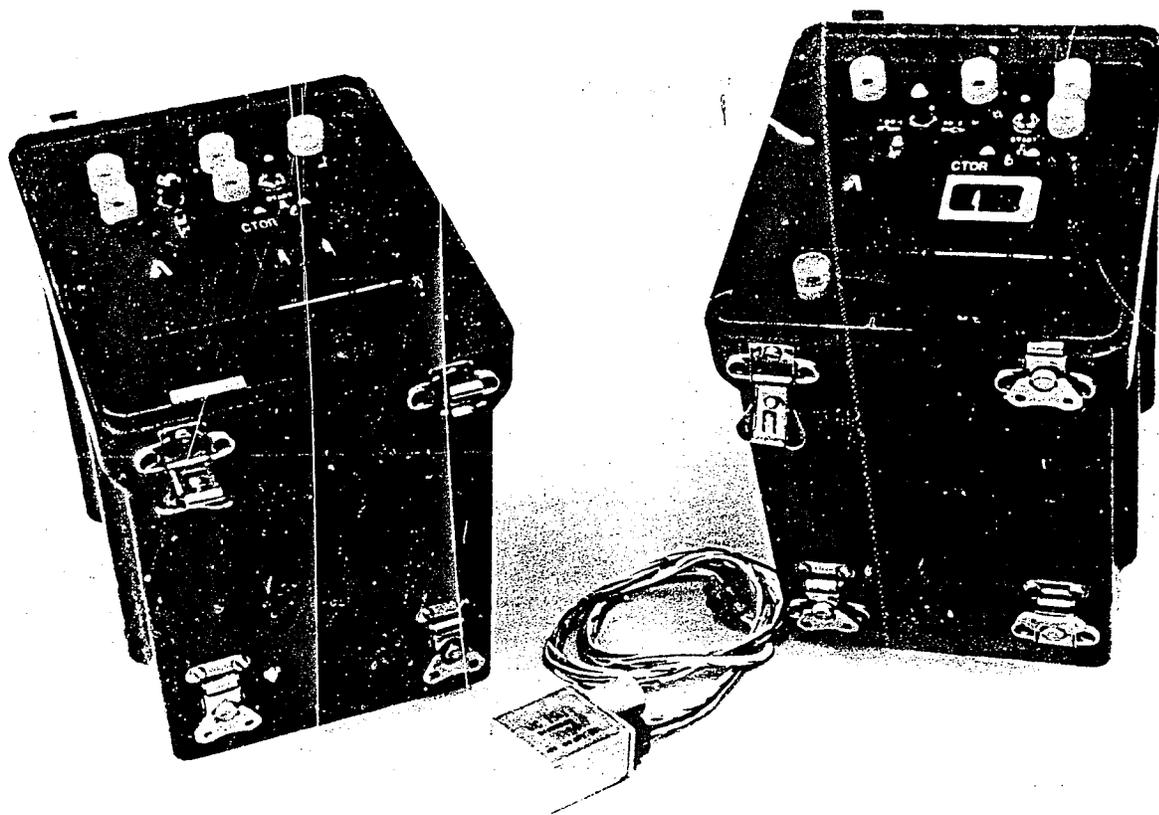


Figure 10. CAT A PAL System (U)

(U) The MC1541 weighs ~1.2 lbs, occupies a volume of ~10 cu in., and takes between 30 s and 2-1/2 min to operate. A motor-driven family of gears, cams, and cam followers operate together to provide 10^4 discrete, relative gear and cam positions. If a controller operates the motor so a proper position of the gears (code wheels) is established, the unit allows the output switches to be closed (unlock). Operating the motor to any other position of the code wheels opens the output switches (lock); thus, the MC1541 cannot be secured in the unlock mode. Two MC1541 switches were used in each weapon for reliability, although stockpile data have indicated that a single switch would have sufficed. Because of the lock system and variations in motor speed, each MC1541 must be controlled separately. Each MC1541 requires 7 control and monitor lines to the controller (14 per weapon).

(U) To change the MC1541 code information, it must first be unlocked and then a code change solenoid in the unit activated. When activated, this solenoid allows the code wheels to be driven to a new

position corresponding to the new code. With the new code inserted, the solenoid is released; this sets the new code in the unit, i.e., stores the new code. Following recode, an incorrect code must be entered to relock the MC1541.

2.1.1.3 Category B PAL (U)

(U) Because of the large number of circuits required for MC1541 operation, control from an aircraft cockpit was not practical. Therefore, the MC1707 coded switch allowing lock/unlock control and monitor with four wires was developed for the Air Force. This became CAT B PAL. The MC1707, which also provided a 10^4 code population, was installed in some B28, B43, B57, and B61 bombs. Weapons with the MC1707 can be unlocked in parallel, thus providing multiple carriage capability. In all installations, the MC1707 is used to interrupt critical warhead electrical circuits until the proper code is inserted, either by aircraft or ground control equipment.

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(U) As originally fielded, the CAT B PAL system (Figure 11) included two electromechanical coded switches (MC1707s) in each weapon, two ground controllers (T1508 Decoder and T1509 Recoder), two controller testers (T1520 and T1521 for the Decoder and Recoder, respectively), three aircraft controllers (DCU117/A and DCU121/A, combined AMAC and PAL, and the DCU116/A PAL only), and a power source (T436 Battery). CAT B was installed only in bombs which have Air Force and Navy applications (primarily Air Force).

(U) The subsequent fielding of CAT D and F PAL has resulted in requirements for back-compatibility of CAT B with newer control equipment developed for CAT D and F. Today, CAT B PAL can be operated by the T1535 Ground Decoder; the T1535, T1555, and T1563 Recoders; the T1539 Verifier; and the DCU192, 196, 201, 218, 238, and 239, as well as those controllers listed earlier.

(U) The MC1707 (Figure 12) occupies a rectangular volume of ~18 cu in., weighs ~ 2.2 lbs, and takes

~30 s to operate. It is used today in the B28-RE, B43-2, B57-2, and B61-0 bombs. Several improvements were made in the MC1707 design to overcome problems with the CAT A PAL system. The CAT B system requires 5 wires to recode, control, and monitor a weapon instead of the 14 required by CAT A. In addition, to minimize the impact on aircraft wiring, only three wires are required to control any number of switches operating in parallel, plus one wire per weapon to monitor the weapon's lock/unlock status.

(U) The CAT B system provides recode and code check capability for the stored codes without transferring the output contacts from the locked to the unlocked condition, or vice versa. Also, CAT B requires use of the stored code for a lock operation. This avoids possible accidental relock upon insertion of a wrong code after unlock. Finally, the recoders provide automated sequences of old code insertion, new code insertion, and code check operations.

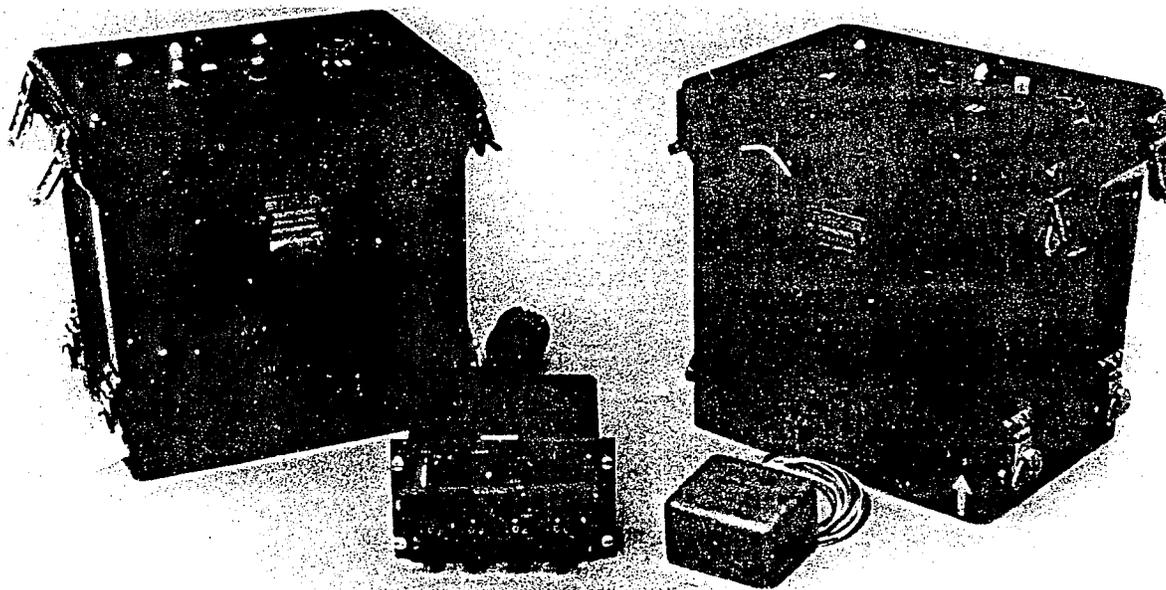


Figure 11. CAT B PAL System (U)

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Figure 12. MC1707 (U)

2.1.1.4 Multiple-Code Coded Switch (U)

(C) A desire for selective unlocking through the use of multiple codes led to the concept of a multiple-code coded switch (MCCS). In May 1971, a requirement to incorporate an MCCS into the W74 was approved as Amendment 3 to the 155 mm Howitzer Projectile Military Characteristics. Miniaturization was essential because of the small volumes of the newer systems (W74 155-mm and W75 8-in. projectiles).

The MCCS design combined some new PAL-associated features with existing and still-required characteristics. They were:

- No power required for memory storage
- Compatible with aircraft cockpit control
- Knowledge of old code required for recode

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(C) The MCCS was developed as two separate items, the MC2764, ~17 cu in. (Figure 13), and the MC2907, ~1.5 cu in. (Figure 14). Both devices provide similar capabilities and are compatible with the same control equipment. MC2764 was developed on an accelerated basis to be available on an early timescale and is used in the W70-1 Lance and B61-2 CAT D applications. MC2907, with more difficult packaging concepts but employing basically the same hybrid microcircuit technology, was developed on longer timescales and is presently used or planned in the B28-0, and -1, B61-5, -6, -7, and -8, W79, W80, W81, and B83 CAT D applications.

2.1.1.5 Multiple Code Coded Security Switch (U)

(C) The MC3641 MCCSS, sometimes called GLCM Security Unit (GSU), is ~4.36 cu in. in volume and will be used with the GLCM to provide a 12-digit

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code capability (Figure 15). It will permit numerical assurance against bypass in accordance with DOD Directive 5200.16 in several scenarios associated with unauthorized launch.

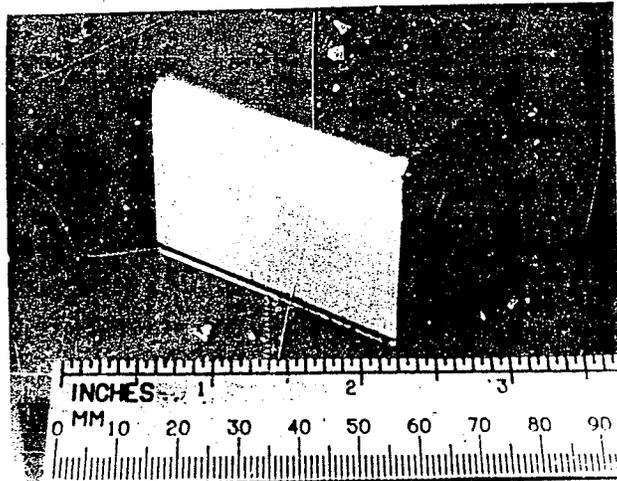


Figure 15. MC3641 (U)

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b(3) ID or serial number can be obtained upon query. Because the MCCSS is microprocessor-controlled and because of the different code length, a byte-oriented data format between the controllers and the MCCSS was chosen. The MCCSS will require new control equipment for recode and control. The T1563 Automated PAL Controller is being fielded on a timescale compatible with the GLCM for recode and APS maintenance control.



Figure 13. MC2764 (U)

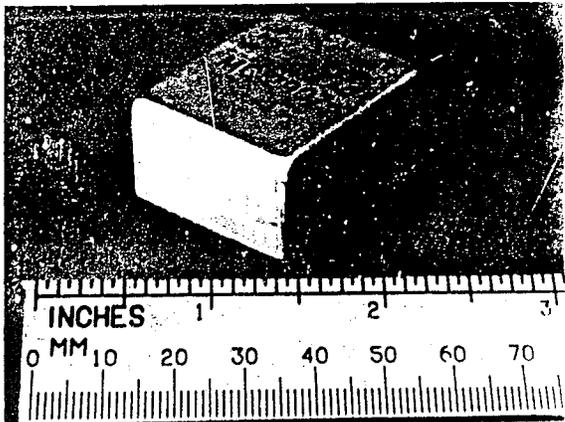


Figure 14. MC2907 (U)

2.1.1.6 Active Protection Systems (U)

2.1.2 Control Equipment (U)

(U) PAL control equipment has become very diverse and, in some cases, quite specialized. In most cases, control equipment was designed and developed by the DOE with DOE funds in response to DOD needs. Production has usually been managed by DOE and funded by DOD. There have been a few recent examples of specialized application (PII and GLCM) for which DOE specifications were provided, and design, development, and production were funded and managed by DOD. The categories of PAL control equipment are:

- Recoders (Recode and Code Check)
- Verifiers (Code Check)
- Ground Decoders (Unlock and Lock Control)
- Cockpit Decoders
- Controller Testers

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(U) The listing of Table 2 is believed to be complete. Newer controllers are back-compatible with earlier categories of PAL, except for CAT A. In most cases, older controllers have remained operational,

particularly the decoders, because they are usually available and meet original operational requirements. Individual ground control items are discussed below.

Table 2. DOE-Supplied PAL Ground Controllers (U)

Item	Function	Quantity	FI U Date	PAL Category	Military Service
T1500A	Decoder	578	3/63	A	Army
T1501A	Recoder	57	3/63	A	Army
T1502	T1500/01 Tester	274	7/63	A	Army
T1508	Decoder	340	3/64	B,B'	AF/Navy
T1509	Recoder	39	3/64	B,E'	AF/Navy
T1520	T1508 Tester	442	4/64	B,B'	AF/Navy
T1521	T1509 Tester	39	4/64	B,B'	AF/Navy
T1526**	Recoder	17	8/73	C	Army
T1527**	Decoder	33	6/73	C	Army
T1533	Decoder	192	11/73	C,D,E,F	Army
T1534	Recoder	37	12/73	C,D,E,F	Army
T1535	Decoder	182	1/75	B,D,E,F	AF/Navy
T1536	Recoder	23	2/75	B,D,E,F	AF/Navy
T1539	Verifier	12	5/75	B,C,D,E,F	AF/Navy
T1547	CAT F Adapter	118		E,F	
T1549A	Controller Tester	147	6/75	B,D,E,F	AF/Navy
T1554	Decoder	308	1/81	D,E,F	Army/Navy
T1555	Recoder/ Verifier	40	4/79	B,D,E,F	All
T1563	Recoder/Controller	130*	10/83	B,D,E,F	All
T1565	T1563 HQ EQ	2*	7/84		All

* Estimates

** No Longer Used

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2.1.2.1 T1500 Category A Decoder (U)

(U) The T1500 controller is used to unlock and lock the MC1541 coded switches (Figure 16). It drives the MC1541 motor to a position consistent with the code selected and set in the T1500, provides energy to open or close the output switches, and monitors the status of the MC1541. The T1500 weighs ~40 lbs with the T436 Power Supply attached. It controls two MC1541s simultaneously from the two independent channels and indicates when at least one of the MC1541 output switch sets closes.

2.1.2.2 T1501 Category A Recorder (U)

(U) The T1501 is similar to the T1500 decoder but has a code change capability (Figure 17). It selectively operates only one MC1541 coded switch at a time, first setting in the correct old code, then unlocking and preparing the switch for insertion of a new code. The new code is then set into the T1501 and the operation repeated, inserting the desired new code. An incorrect code must then be entered to relock the coded switch. This does not occur in an automated sequence but is done as separate operations for each of two coded switches in the weapon.

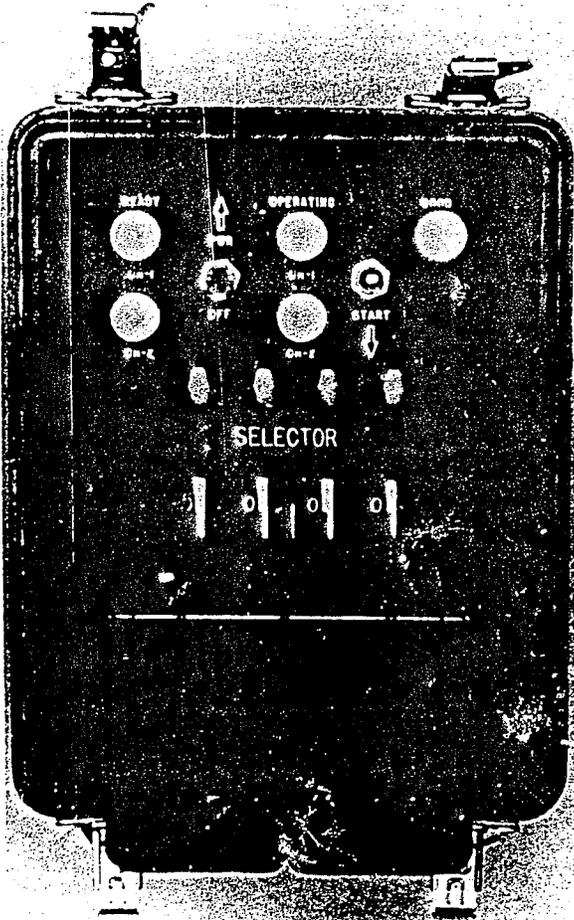


Figure 16. T1500 CAT A PAL Controller (U)

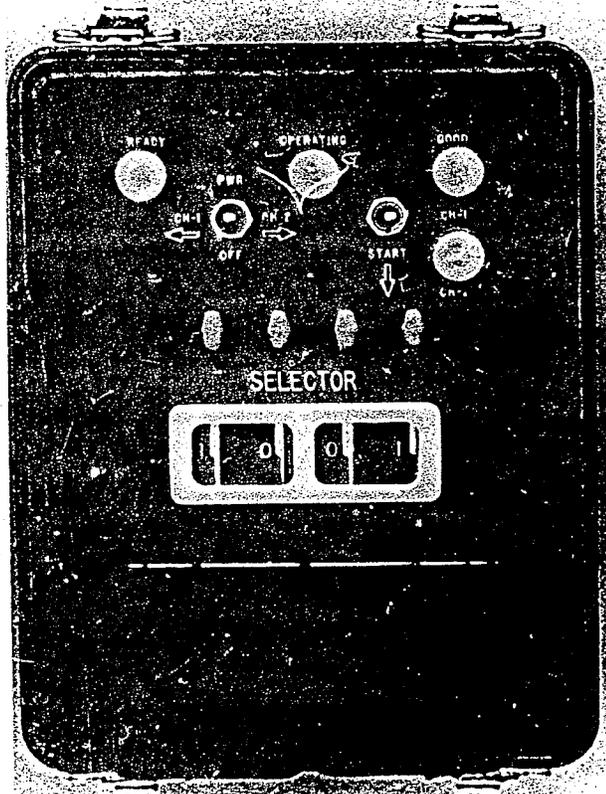


Figure 17. T1501 CAT A PAL Recorder (U)

2.1.2.3 T1502 Programmer (U)

(U) The T1502 (Figure 18) functionally tests the T1500A and T1501A. It simulates an MC1541 so that either the T1500A or T1501A may be evaluated for proper operation.

2.1.2.4 T1508 Category B, B' Decoder (U)

(U) The T1508 Controller (Figure 19) is designed to enable, code-check, or disable a weapon; if desired, it can be used to check the enable/disable condition of the weapon. The T1508 is not capable of recoding. It provides visual indications of the specific codes being utilized and of proper operations of the MC1707. Power is supplied by the T436 Power Supply which is installed in the bottom compartment prior to use.

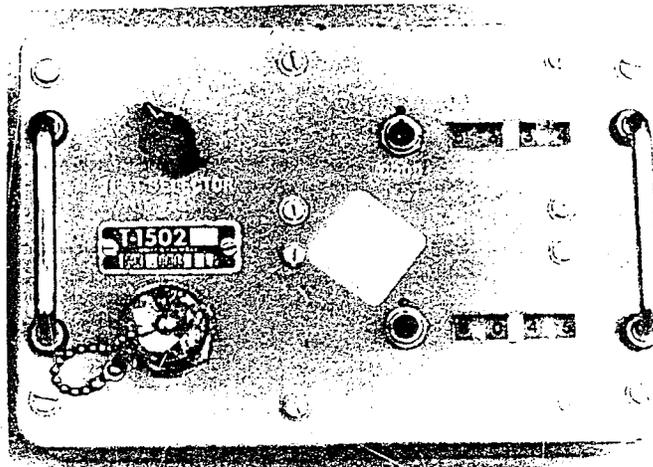


Figure 18. T1502 Programmer (U)

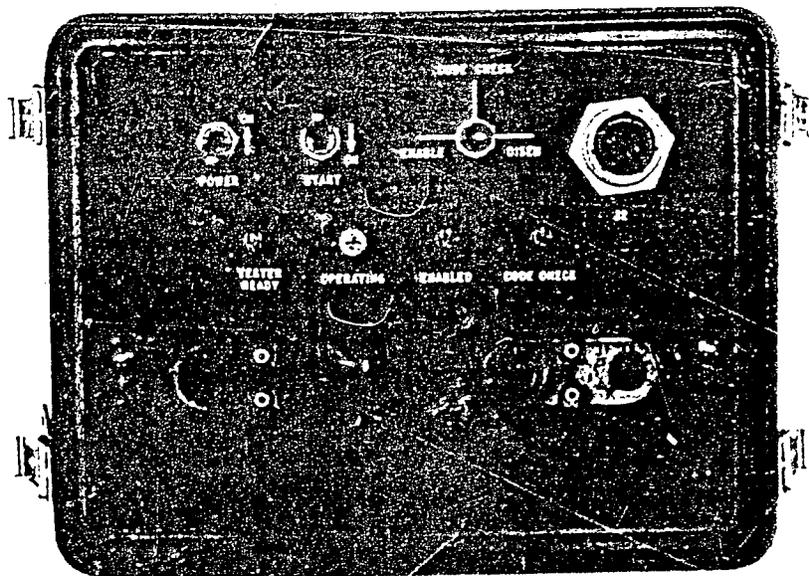


Figure 19. T1508 CAT B, B' PAL Decoder (U)

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2.1.2.5 T1509 Category B, B' Recoder (U)

(U) The T1509 (Figure 20) is a controller which code-checks and recodes the coded switches of a weapon; it is not capable of an enabling operation. The T1509 provides visual indications of the specific codes being utilized and of the proper operation of the coded switches. Power is supplied by the T436 Power Supply which is installed in the bottom compartment of the unit prior to use.

2.1.2.6 T1520 and T1521 Controller Testers (U)

(U) The T1520 (Figure 21) and T1521 (Figure 22) allow field certification of the operability of the T1508 Decoder and T1509 Recoder, respectively, by electronic simulation of the MC1707. The T1520 is also used to certify aircraft decoders. If the output of the T1508 is proper for that code, the T1520 will so indicate at the end of the operation. The T1509 and T1521 operate in a similar manner except that both an old and new code are set in the units. Power for both is supplied by the T436 Power Supply which is installed in the bottom compartment prior to use.

2.1.2.7 T1533 Army Decoder for PAL Categories C, D, and F (U)

(U) The T1533 (Figure 23) is a controller used by the Army to lock or unlock the coded switch in a weapon, or it may be used to check the locked/unlocked status of the weapon; it is not capable of a recoding operation. The T1533 was originally purchased to support the Lance system.

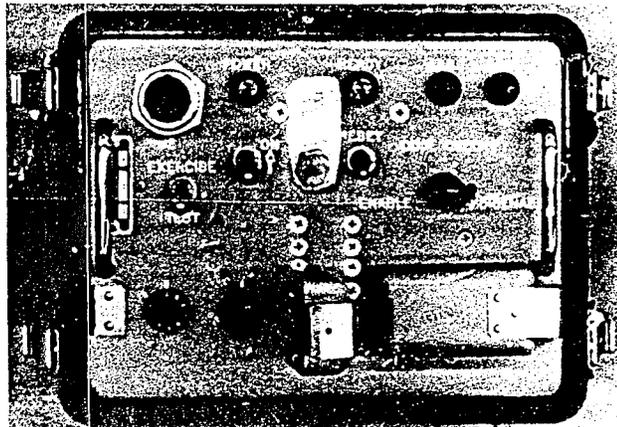


Figure 21. T1520 Controller Tester (U)

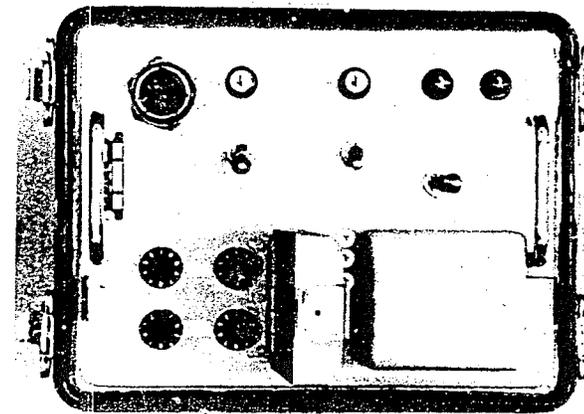


Figure 22. T1521 Controller Tester (U)

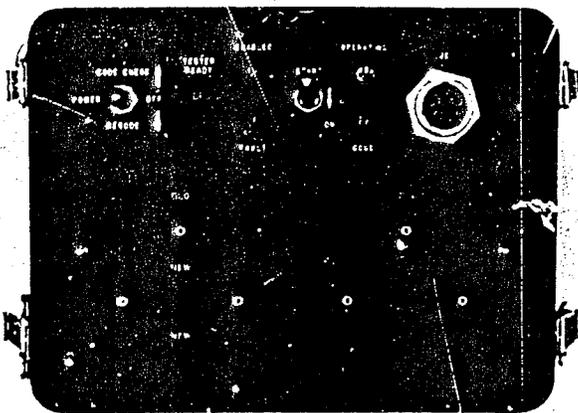


Figure 20. T1509 CAT B, B' PAL Recoder (U)

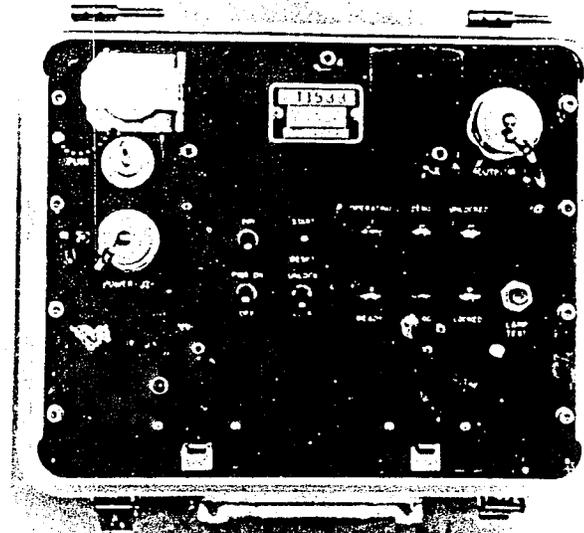


Figure 23. T1533 Army Decoder for CAT C, D, and F PALs (U)

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(U) Power is supplied to the T1533 through the CT1478 cable from a T436B Power Supply or from a tactical vehicle's battery. If tactical vehicle power is used, the T1533 will operate with the vehicle either off or operating. The T1533 automatically recognizes a coded switch system as either single code (CAT C) or multiple code (CAT D/F) and furnishes the appropriate output to the coded switch in the weapon.

2.1.2.8 T1534 Army Recoder for PAL Categories C, D, and F (U)

(U) The T1534 (Figure 24) is a controller used by the Army to recode and code-check the coded switch in a weapon; it can also be used to check the lock/unlock status of the weapon.

(U) A single-code or all-codes recode operation will always leave the weapon coded switch in the locked state. A code-check operation will not change the locked/unlocked status of the coded switch. The T1534 automatically recognizes a coded switch system as either single code or multiple code and furnishes the appropriate address to the coded switch in a weapon. Power is supplied to the T1534 through a

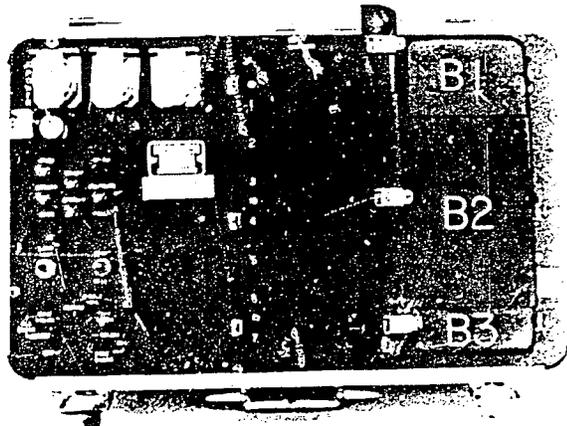


Figure 24. T1534 Army Recoder for CAT C, D, and F PALs (U)

CT1478 cable from the T436B Power Supply or from a tactical vehicle's battery. If tactical vehicle battery power is used, the engine and stabilization lockout (SLO) must not be operating. All of the necessary codes (one old and six new PAL codes) plus one new maintenance code are manually set into the T1534. After the codes are set, recoding or code-check is a single-cycle, semiautomatic operation.

2.1.2.9 T1535 Air Force/Navy Decoder for PAL Categories B, D, and F (U)

(U) The T1535 (Figure 25) is a controller designed to lock or unlock the coded switch in a weapon; it can also be used to check the locked/unlocked status of the weapon. The T1535 is not capable of a recoding operation. Power is supplied to the T1535 through a CT1478 cable from a T436B Power Supply. The T1535 will furnish the proper input for a weapon having either a single-code (CAT B) or a multiple-code (CAT D/F).

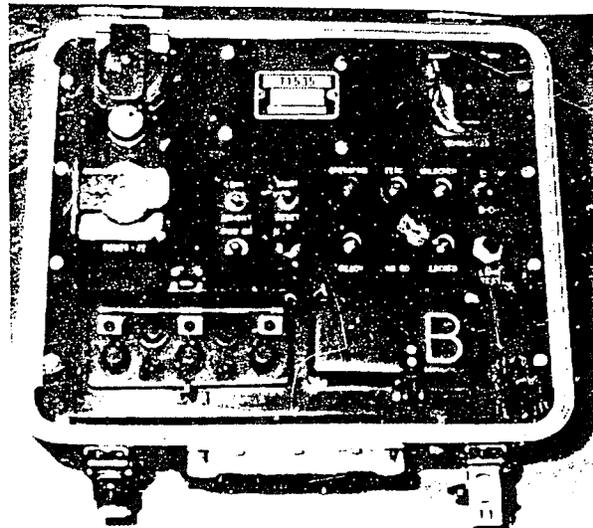


Figure 25. T1535 Air Force Decoder for CAT B, D, and F PALs (U)

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2.1.2.10 T1536 Air Force/Navy Recoder for PAL Categories B, D, and F (U)

(U) The T1536 (Figure 26) is a controller used by the Air Force and Navy to recode and code-check the coded switch in a weapon; it can also be used to check the lock/unlock status of the weapon.

(U) A single-code or all-codes recode operation will always leave the weapon coded switch in the locked state. A code-check operation will not change the locked/unlocked status of the coded switch. The T1536 automatically recognizes a coded switch system as either single code (CAT B) or multiple code (CAT D/F) and furnishes the appropriate signals to the coded switch in a weapon. Power is supplied to the T1536 through a CT1478 cable from the T436B Power Supply. All of the necessary codes (one old and six new PAL codes) plus one new maintenance code are man-

ually set into the T1536. After the codes are set, recoding or code-check is a single-cycle, semiautomatic operation.

2.1.2.11 T1539 Army/Air Force/Navy/Code Verifier for PAL Categories B, C, D, and F (U)

(U) The T1539 is a controller used in the field by the Army, Air Force, and Navy to check code values in the coded switch in CAT B, B', C, D, and F PAL weapons; it may also be used to check the locked/unlocked status of the weapon. The T1539 recognizes a coded switch system as either single code (CAT B/B'/C) or multiple code (CAT D/F) and furnishes the appropriate address to the coded switch in the weapon. Power is supplied to the T1539 through a CT1478 cable from a T436B Power Supply.

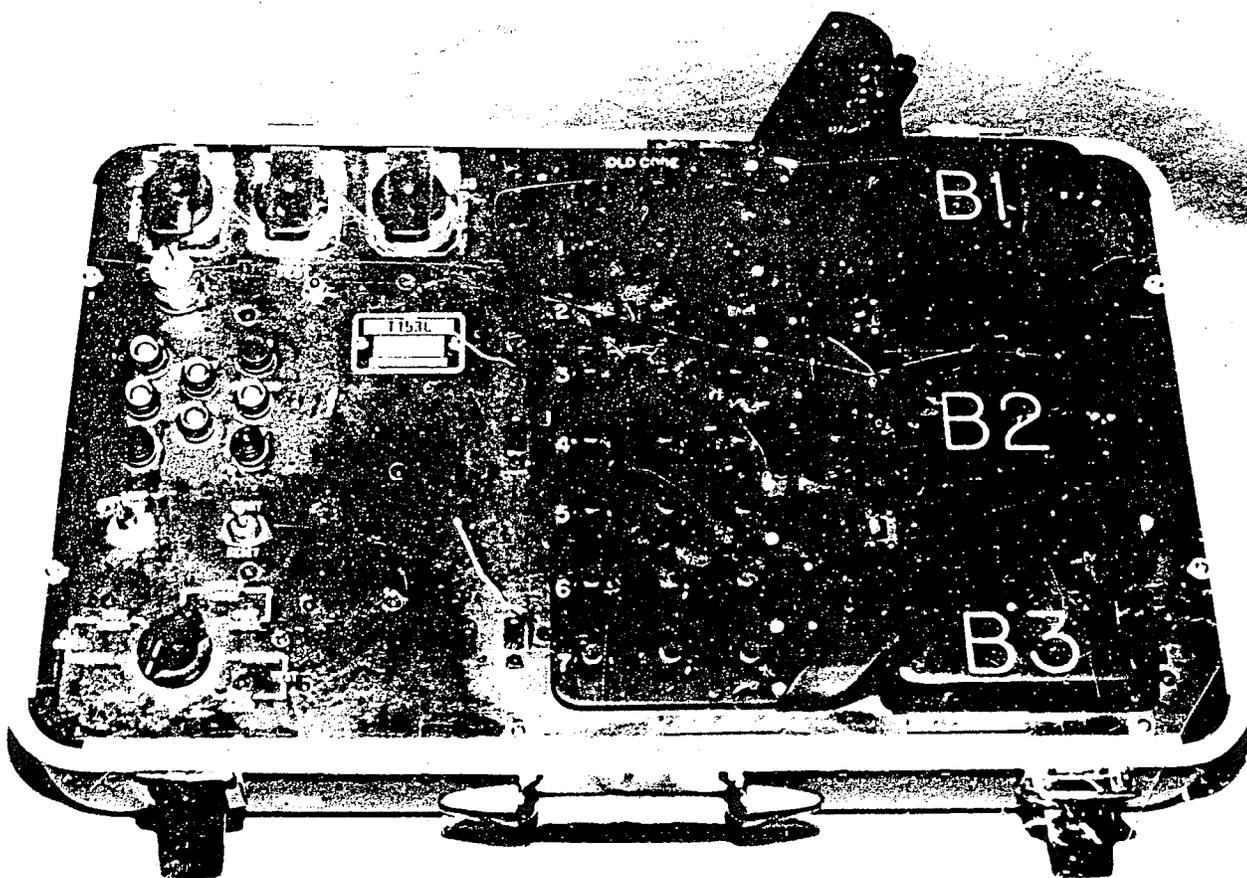


Figure 26. T1536 Air Force Recoder for CAT B, D, and F PALs (U)

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2.1.2.12 T1547 Army/Air Force/Navy Adapter for Category F PAL (U)

2.1.2.13 T1549A Air Force/Navy Programmer for PAL Categories B, D, and F (U)

(U) The T1549A performs two functions when connected to the new controllers. It performs a duration and amplitude check on the aircraft and ground controller output data and power circuits for CAT D

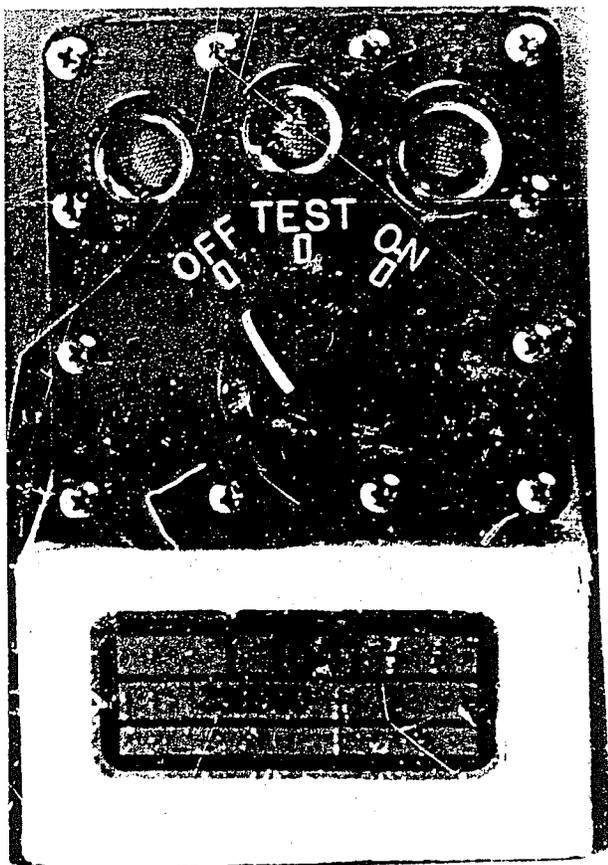


Figure 27. T1547 CAT F PAL Adapter (U)

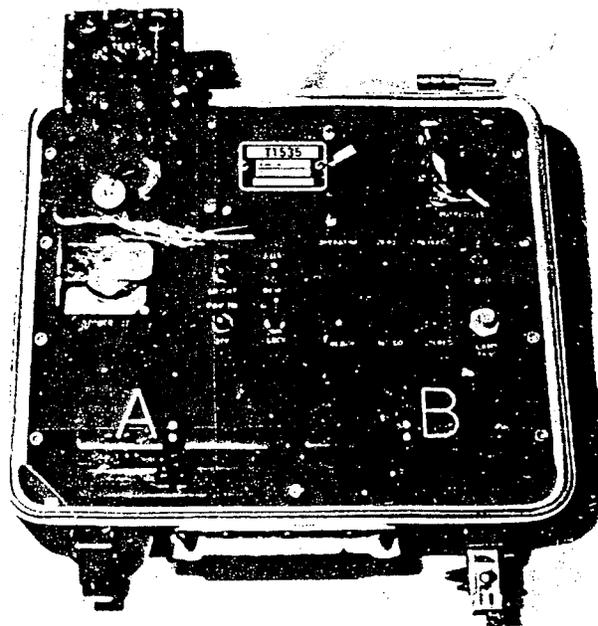


Figure 28. T1535 Decoder with T1547 Attached (U)

and F PAL systems; it also functions as a coded switch simulator for CAT B, D, and F PAL systems for training in decoding operations with the T1549A, the aircraft, and T1535 Ground Decoder.

(U) The T1549A furnishes feedback to the decoder which allows the operator to determine that an acceptable or unacceptable response has occurred. For training operations, storage of seven different codes is provided; any of these codes furnishes "off" and/or lock and unlock indications, as appropriate. The T1549A contains no control switches or monitor lamps. These responses are furnished by the controller to which the T1549A is interfaced.

Three cables are required for use with the T1549A. The CT1504 connects the T1535 Ground Decoder to the T1549A Programmer. This cable is currently used with all Air Force/Navy ground controllers. In addition, the CT1507 cable connects the T1549A to the pylon of the F4C, D, or E, and the CT1510 connects the T1549A to the F-111E aircraft pylon. No external or auxiliary power cable is required because the T1549A is powered by the ground decoder or aircraft safe power.

2.1.2.14 T1554 Army/Navy Decoder for PAL Categories D and F (U)

(U) The T1554 (Figure 29) is a controller used by the Army to lock or unlock the coded switch or to check the locked/unlocked status of the weapon. It is very similar to the T1533 except that it cannot be used to operate the single code CAT C System.

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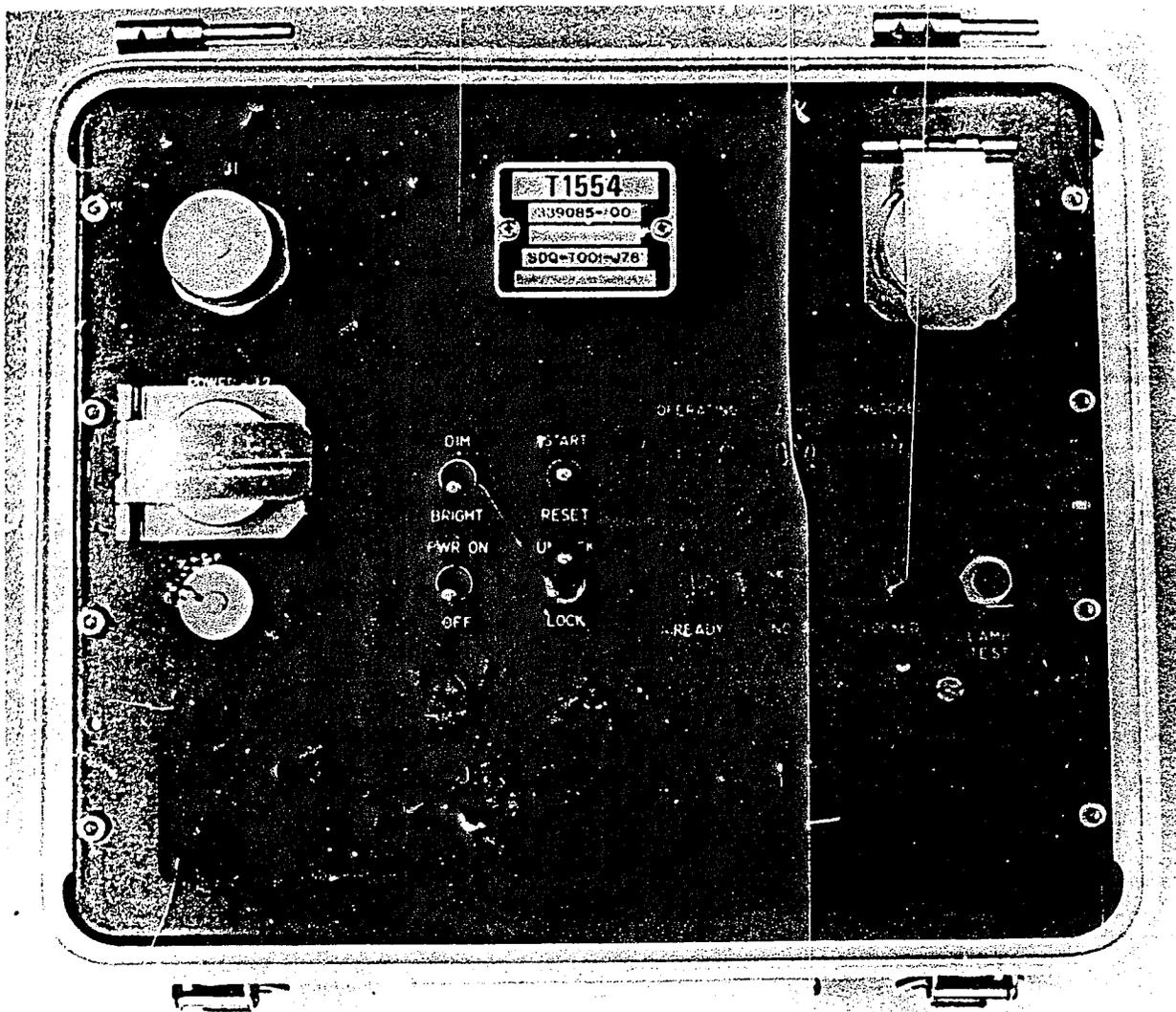


Figure 29. T1554 Army Decoder for CAT D and F PALs (U)

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(U) The T1554 is not capable of a recoding operation. Power is supplied through the CT1478 cable from a T436B Power Supply or from a tactical vehicle's battery. If tactical vehicle power is used, the T1554 will operate with the vehicle either off or operating. The decoder was originally purchased to support the W79 system.

2.1.2.15 T1555 Army/Air Force/Navy Recorder/Verifier for PAL Categories B, C, D, and F (U)

(U) The T1555 (Figure 30) is a controller that can be used by all services as either a recoder or a code verifier. The T1555 by itself is a controller used in the field to verify the code values in the coded switch in CAT B, C, D, and F weapons and may also be used to check the locked/unlocked status of the weapon. With

the T1558 plug adapter installed, the T1555 is a recoder used in the field to recode and code-check the coded switch in a weapon; it may also be used to check the lock/unlock status of the weapon. A single-code or all-codes recode operation will always leave the weapon coded switch in the locked state. A code-check operation will not change the locked/unlocked status of the coded switch. The T1555 automatically recognizes a coded switch system as either single code or multiple code and furnishes the appropriate signals to the coded switch in a weapon. Power is supplied to the T1555 through a CT1478 cable from the T436B Power Supply. All of the necessary codes (one old and six new PAL codes) plus one new maintenance code are manually set into the T1555. After the codes are set, recoding or code-check is a single-cycle, semiautomatic operation.

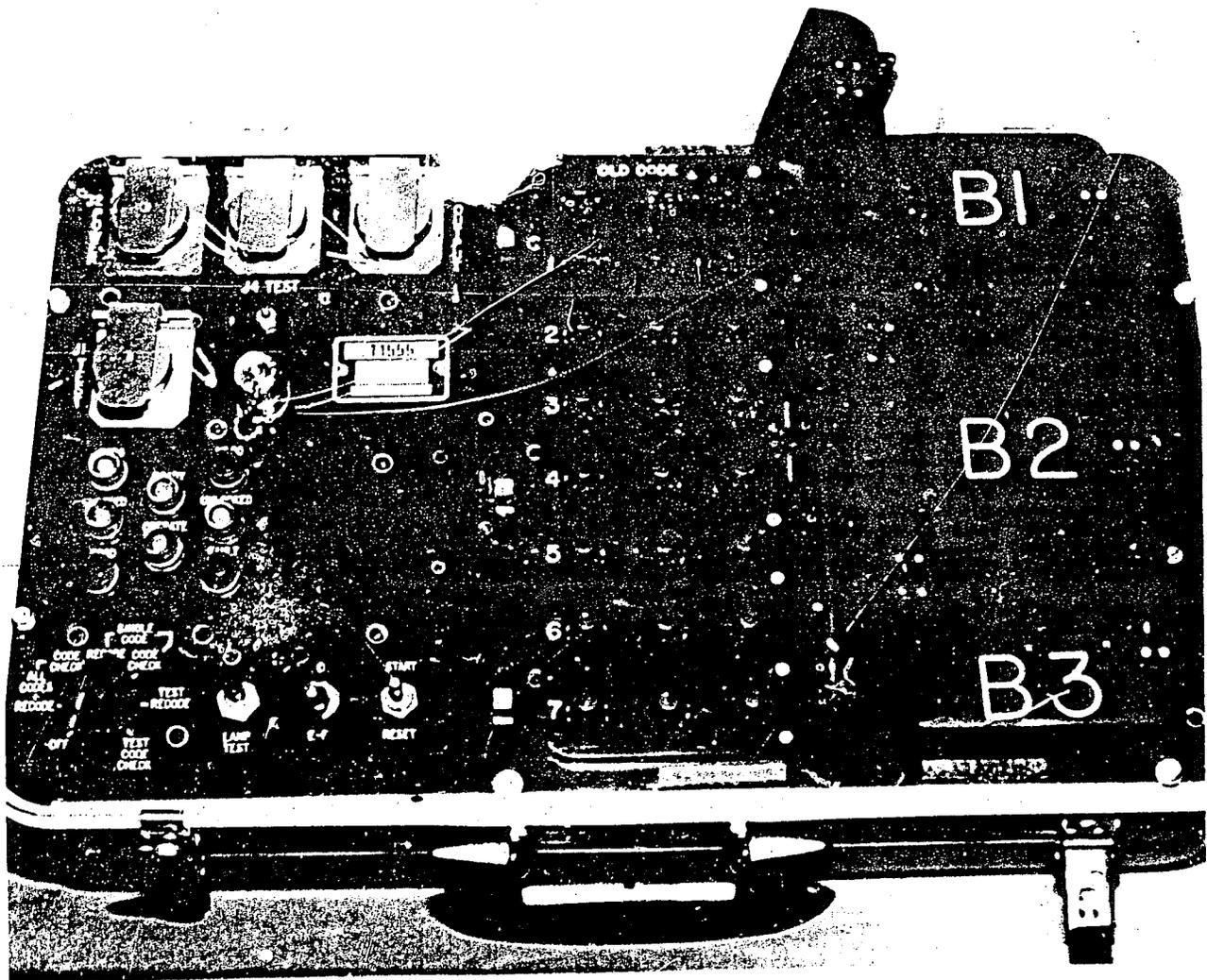


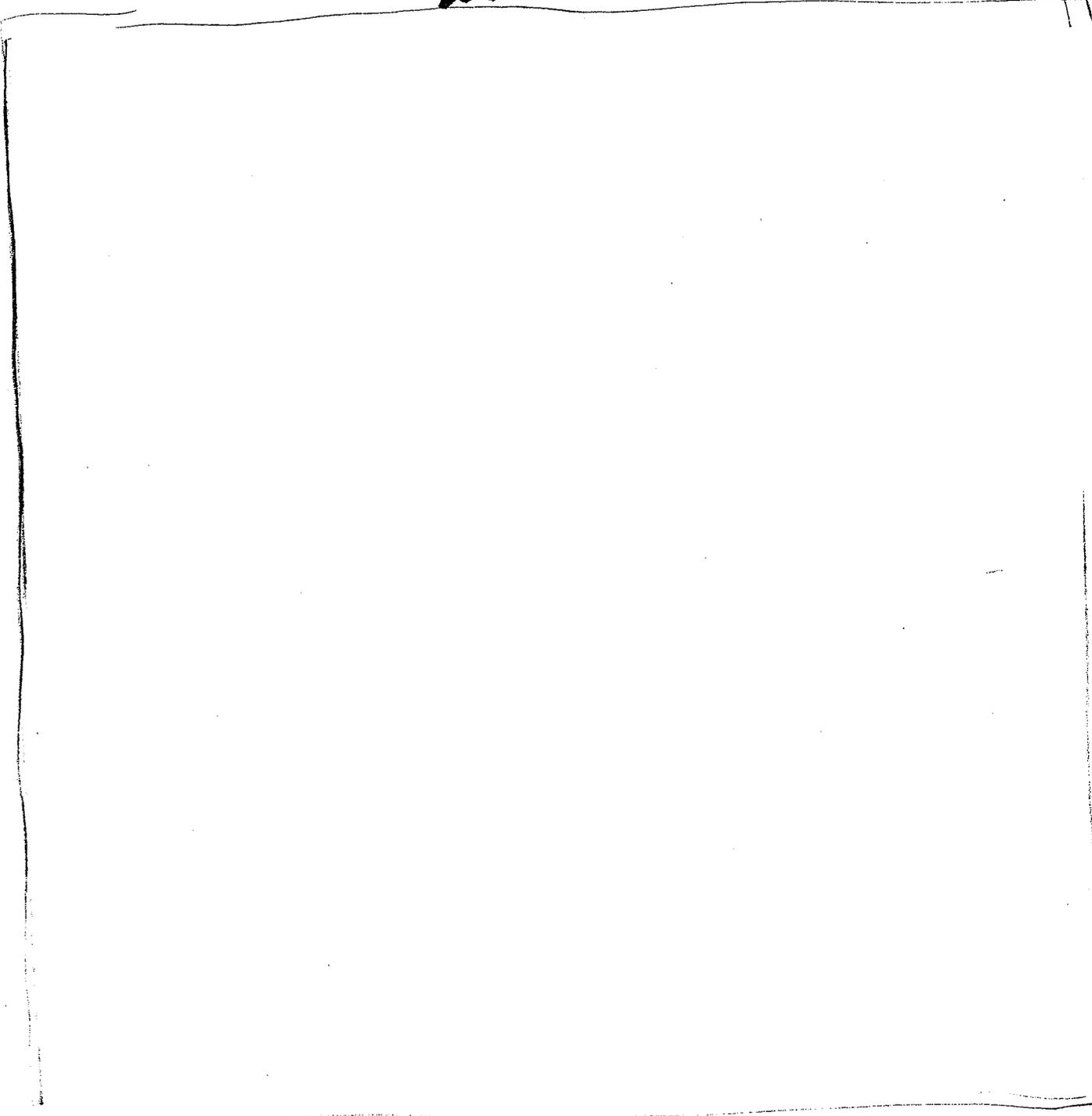
Figure 30. T1555 Recorder/Verifier for CAT B, C, D, and F PALs for Army/Navy/Airforce (U)

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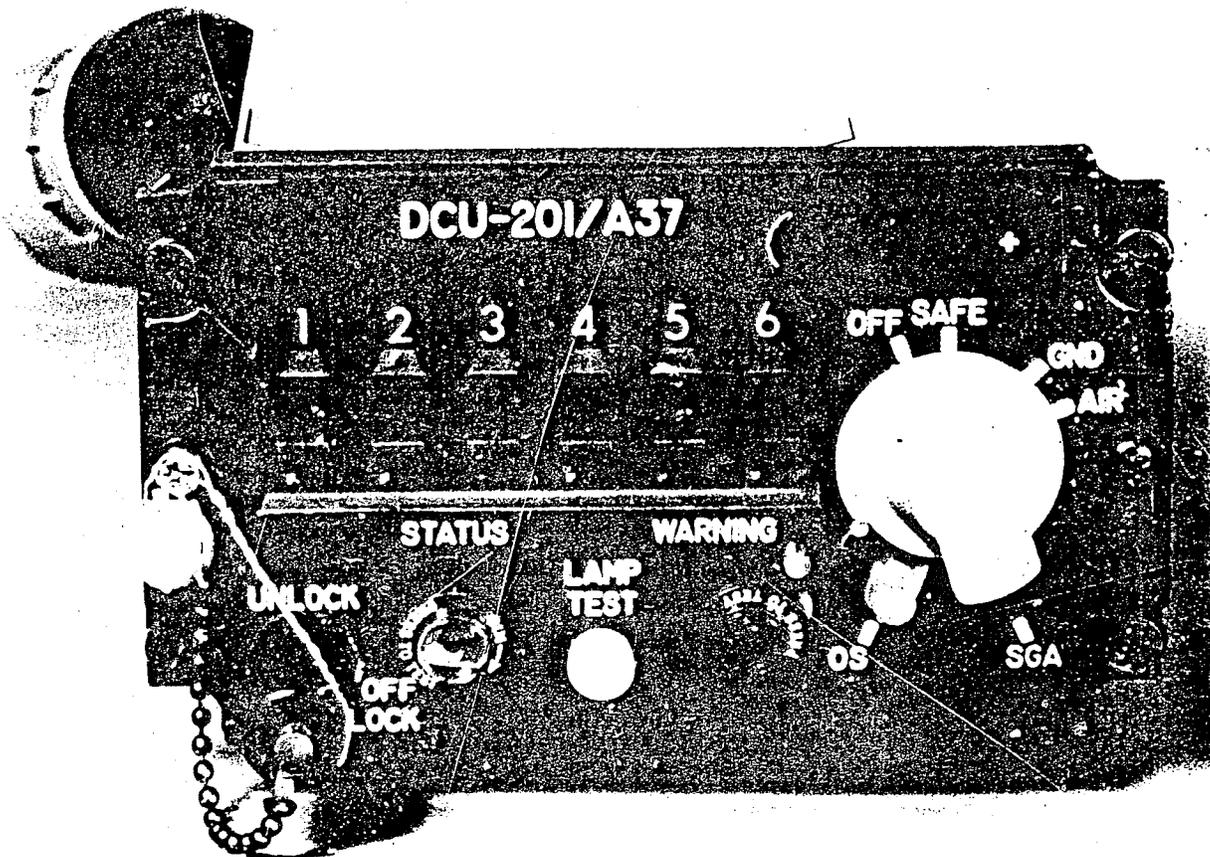
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Figure 32. Cockpit PAL Controllers (C)

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Table 3. Cockpit PAL Controllers (U)

Item	Function/Aircraft	Quantity	FPU Date	PAL Category	Military Service
DCU116/A (T1522)	PAL Only F4C,D,E/F111E	524	4/64	B	AF/NATO
DCU117/A (T1517)	PAL/AMAC F104/F100	1137	2/64	B	AF/NATO
DCU192/A	PAL Only F4C,D,E	314	6/68	B	AF/NATO
DCU121/A (T1524)	PAL/AMAC F100/F104	487	4/65	B	AF/NATO
DCU196/A37	PAL Only F4C,D,E	256	7/72	B,D,F	AF/NATO
DCU201/A	PAL/AMAC/USG F104	340	11/76	B,D,F	AF/NATO
DCU218/A	PAL/AMAC/USG F111F	111	1/78	B,D,F	AF/NATO
SWC-2	PAL/AMAC/USG MRCA Tornado	N/A	N/A	B,D,F	NATO
DCU-238	PAL/AMAC/USG/CD B52	292	7/83	B,D	USAF(SAC)
DCU-239	PAL/AMAC/USG/CD FB111A	77	4/83	B,D	USAF(SAC)

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2.1.2.16 T1563 Army/Air Force/ Navy Recoder/Controller for PAL Categories B, D, F, and Bomber Coded Switches (U)

(U) The T1563 Automated PAL Controller (APC) (Figure 31) is currently in development and is scheduled to be available to support the GLCM in October 1983. It is necessary for GLCM because the GLCM coded switch is a 12-digit device for which there is no other control equipment. The APC is also being developed in response to EUCOM and PACOM ROCs (Required Operational Capability) to provide secure data transport and storage and automated code retrieval in support of increasingly complex coding plans. Its prime function will be to recode PAL weapons and the SAC Code Enable Switch (CES). It will recode PAL weapons and CES without the operators knowing the code values (no knowledge recode) involved by using recently developed cryptographic techniques. The cryptographic system is activated electronically upon insertion of two proper individual memory phrases. The heart of the APC is a program-^{DoE} mable microprocessor which allows it to perform func-^{b(3)} tions as required.

Because of the microprocessor control, APC capability can be updated with properly authen-

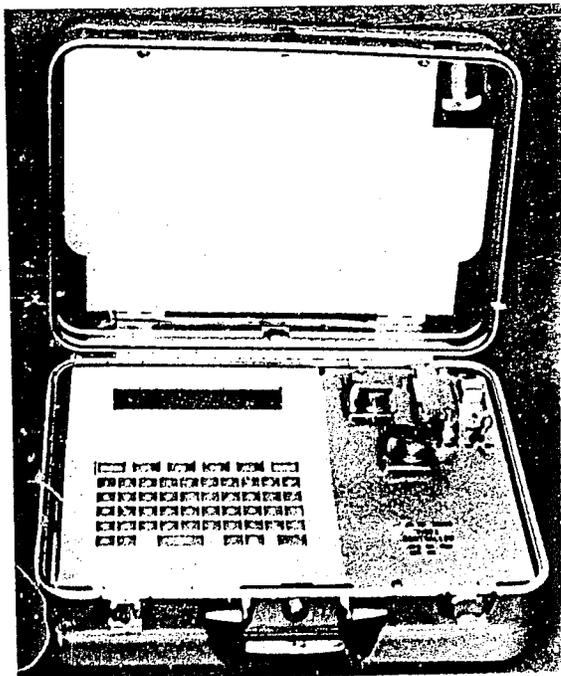


Figure 31. T1563 Recoder/Controller for CAT B, D, F, and G PALs (U)

ticated reprogramming commands after the controller is fielded.

(U) In use, encrypted combinations will be supplied by the National Security Agency (NSA) electronically stored in a Source Data Module (SDM) (an NSA-provided Programable Read Only Memory (PROM)). At a headquarters location, data from the SDM can be read into either a T1563 or a T1565 Headquarters Code Processor (see Section 4.4), where it is processed and sorted. The required data can then be transferred to Portable Data Modules (PDMs) by either the T1563 or the T1565 for transport to the recode detachments. The recode detachment personnel then load the recode data into their T1563s. The PDM is also used as a transport medium for return of the field operation monitor data when used with the T1565. The combination data are always encrypted when transported in the SDM or the PDM.

2.1.3 Cockpit Controllers (U)

(U) Table 3 lists the cockpit PAL controllers that have been fielded to date or are currently in development. Figure 32 shows representative units. To save space, the cockpit controllers are designed to very stringent panel space restrictions. PAL and Aircraft Monitor and Control (AMAC) functions are frequently combined. Because of special space and control requirements, a different controller is usually required for each aircraft (F-4, F-104, F-16, etc.). Originally, the AMAC function was simply safe/arm (ground/air) selection. Increasing concern for safety resulted in unique signal weapon switches designed not to operate on normally available (fault) voltage formats. To control these switches, Unique Signal Generator (USG) devices have been added to the cockpit controllers. In addition to PAL, AMAC and USG, some new controllers are requiring Command Disable (CD) control. Cockpit controllers are funded in a manner similar to ground controllers, with the DOE covering development costs and the DOD funding production costs for the required quantities.

2.2 PAL Code Management (U)

(S) PAL code management includes all personnel and procedures necessary to administer the PAL system.

In peacetime, code management is centered around weapon recoding. Recoding occurs for logistics purposes and to maintain code security. Recode operations are described in Section 2.2.2.

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2.2.1.5 The Structure of the Selective
Unlock Cipher System (C)

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2.2.1.6.2 PAL Release Procedures in the European Theater (U)

(U) Weapon Deployment in the European Theater—In general terms, the mission of all US and Allied forces and weapons in Europe is to

(U) "deter war by their presence and the credibility of their probable use and effectiveness in any conflict situation between Warsaw Pact and NATO forces"³⁰

(U) To this end, US nuclear weapons have been deployed to locations in EUCOM for possible use by US and NATO forces. This deployment is made possible through bilateral programs of cooperation negotiated between the host NATO countries and the US.

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(U) Weapon Employment in the European Theater—(U) In keeping with the NATO nuclear strategy of flexible response, planning for nuclear weapon employment in a European conflict encompasses options which range from massive response to very selective employment of a few weapons.

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2.2.2 Recode Operations (U)

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2.2.2.1 Concept of Recode (U)

(U) In order to maintain security, ability to change the combination required to unlock a PAL device is necessary. All PAL devices are designed to allow changing the combination after inserting the old combination. Combination locks require manual insertion of the old and new values. All electromechanical and electronic PAL devices require specialized recode equipment. (See Hardware, Section 2.1.2, for discussion of T1501, T1509, T1534, T1536, T1555, and T1563 recoders.)

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