PART 4

RECORDERS

List of Chapters

PART 4

CHAPTER 1 — PILOT'S DISPLAY RECORDER

Contents

Introduction

1. A Telford 1007/5 pilot's display recorder may be fitted to the Strike Sight PDU to record pictures of the display and the view ahead of the aircraft. The recorder contains up to 50 feet of standard 16 mm film and operates at 16 frames per second at an exposure time of ·004 second, giving approximately 2 minutes of filming time. The whole display is not recorded on each frame, as the CRT takes 30 milliseconds to write the display and each film frame is taken in 4 milliseconds; the display therefore appears to flash as the film is projected.

Description

2. The recorder is attached to its mounting bracket on the rear of the PDU by two studs and spring loaded catches. An adjustable lens assembly, at the top of the recorder body, is covered by a hinged mirror which must be raised when the recorder is to be used; the view ahead of the aircraft and the PDU images are reflected by the mirror and photographed through the lens. The recorder body is divided into a film compartment and an operating mechanism compartment.

3. *Lens.* A one inch focal length f1·9 lens, focused at infinity, is fitted. A manually adjustable iris permits settings down to f16. The camera field of view is 22° in elevation and 16° azimuth.

4. *Film Compartment.* The film is fed from a feed spindle through a tension arm, a guide block, a spring-loaded pressure plate and a guide-way to a take-up spindle. The pressure plate holds the film in the optical plane against an aperture plate. A spring-loaded arm, positioned against the film feed spool, is directly connected to a film contents indicator which is seen through a window in the recorder case.

5. *Operating Mechanism.* A governed DC motor drives the film take-up spindle, two shutters, and the film claw movement via an escapement mechanism activated by a DC solenoid. An event marker, controlled by a solenoid energised when the release indicator light illuminates, causes a flag to appear in the film aperture.

Controls and Indicators

6. The controls and indicators include a CAMERA MASTER switch and a CAMERA OPERATE button in the rear cockpit, and a film contents indicator which has three lines denoting F (full), half-full, and E (empty), on the recorder case. Associated controls are the pilot's ATTACK SELECTOR, firing

trigger, accept bar and reject button. There is also a time delay device which stops the recorder, if it is still running, 10 seconds after the last operation of either the CAMERA OPERATE button or the accept bar.

Power Supplies

7. 28V DC supplies from the main DC busbar via a Strike Sight fuse are required for operation of the recorder.

Management

8. *Pre-Flight.* Check the recorder for security, check that the film contents indicator reads F, and that the lead to the recorder connector is fully home.

9. *In-Flight.* When recording is required, raise the mirror and set the lens aperture. Set the attack switches as required. Turn up the PDU brilliance to ensure that the display is recorded. Select the CAMERA MASTER switch to ON. Press either the CAMERA OPERATE button or the accept bar to start the recorder, which then runs for 10 seconds unless the reject button is pressed or a weapon release pulse is generated first. (In the case of attacks in which the accept bar is held until weapon release, eg, dive toss, ADSL, the accept bar restarts the camera before the release pulse stops it and a further 10-second rundown commences.) The recorder may also be stopped by returning the CAMERA MASTER to OFF. An over-run of approximately two frames occurs as the recorder stops running. The event marker solenoid operates to mark film taken when the release indicator light is illuminated.

PART 4

CHAPTER 2 — WEAPON SYSTEM PERFORMANCE RECORDER

(Completely revised by AL4)

Contents

Illustrations

Introduction

1. The weapon system performance recorder (WSPR) records weapon system behaviour during flight using data from the Strike Sight C & RC and radio altimeter. Parameters and event marks are recorded as traces on photographic paper giving a minimum of 16 minutes actual recording time, less allowances for calibration. A radio tone release circuit facilitates matching with records from instrumented weapon ranges. During recording, the WSPR receives 28V DC only; during calibration, 200V 400 Hz 1ϕ AC is also used to produce reference voltages to drive C & RC servos.

Components

2. The WSPR consists of a recorder unit in the radio bay, a switching adapter unit adjacent to the C & RC in the aircraft nose, and a control panel in the rear cockpit. Signal flow is shown in Fig 1.

3. *Recorder Unit.* The recorder unit contains a trace recorder comprising five recording elements, three event marker circuits, a 2-speed drive motor, a cassette containing 50 feet of recording paper, switching circuits, a time sharing system, and calibration circuits.

4. *Switching Adapter Unit.* The switching adapter unit processes signals from the C & RC during recording phases and feeds signals back to the C & RC during calibration.

5. *Control Panel.* The pilot's ATTACK SELECTOR switch dictates the parameters recorded (Table 1); a REJECT selection stops the recorder motor. All other controls are on the control panel (Fig 2):

a. An AUTO/OFF/MANUAL toggle switch effects automatic or manual control of the UHF tone release facility.

b. A RECORD/OFF/CALIBRATE toggle switch (spring-loaded to OFF) starts the recorder motor for a recording or calibration sequence.

c. A RECORD green light flashes at 1 Hz when the recorder motor is running.

Normal Operation

6. *Recording of Parameters.* Six traces are recorded simultaneously by directing five light beams on to the paper (one beam is time-shared to produce two traces) via five mirrors which are integral parts of the recording elements. Orientation of the mirrors, and therefore displacement of the traces, is controlled by the elements according to the values of the parameters being recorded. When RECORD is selected momentarily, recording starts at slow speed (except in DSL modes when the motor runs at fast speed throughout) until the 3-second warning signal is generated, when fast speed is selected automatically.

7. *Recording of Event Marks.* An event mark is produced whilst RECORD is physically selected, any particular series of traces being marked by selecting RECORD a number of times. A REJECT selection by the pilot does not record an event mark, but can be identified because the recording stops. A time-base, recorded on an event trace, shows timing at 0·5-second intervals. The following events, depending on the mode, are recorded by stopping one of two further event traces:

a. The accept signal.

b. The 3-second warning signal.

c. The pull-out signal.

d. The release signal.

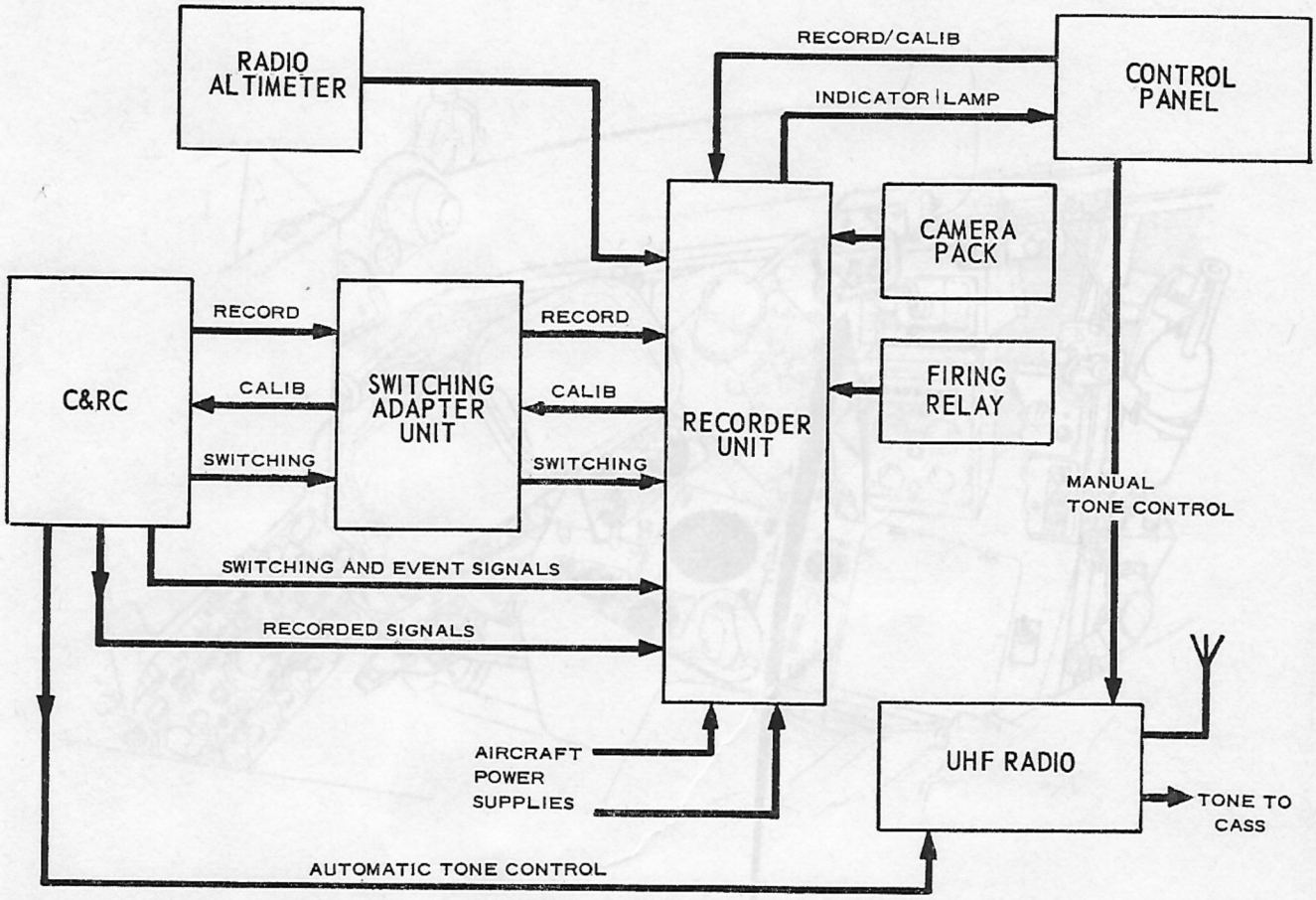
e. Camera pulses.

8. *Calibration.* Thirty seconds after momentarily selecting CALIBRATE, the recorder runs at fast speed for 4 seconds, then at slow speed for 30 seconds before stopping automatically. Throughout this 64-second period and a further 30 seconds, C & RC outputs are abnormal, Strike Sight displays are meaningless and Blue Parrot locks are broken; these units may be assumed to be operating normally 30 seconds after the RECORD light ceases flashing. During the 94-second calibration period, preferably completed immediately before and after an attack sequence, test traces of all parameters normally recorded in the selected mode are produced with known inputs. These traces are used when producing graphs showing trace displacement versus parameter for the particular combination of aircraft and C & RC, and thus the value of any recorded parameter can subsequently be deduced accurately.

9. *Tone Release.* When MANUAL is selected at least 10 seconds before weapon release in manual or timed release attacks, a 1 kHz tone is immediately transmitted on the selected range UHF frequency. In laydown or vari-toss attacks, the release signal from the timer interrupts the tone for 25 seconds, less the time on the pre-release timer, the tone then continuing until OFF is selected. In a manual attack, the tone is interrupted only for the duration of the release signal and is then transmitted until OFF is selected. When AUTO is selected for automatic attacks, the C & RC automatically starts the tone when the pull-out signal is generated, and stops it when the release signal is generated or REJECT is selected. In all types of attack OFF should be re-selected shortly after weapon release.

Abnormal Operation

10. If, with a serviceable filament (press-to-test), the RECORD light does not flash when RECORD is selected or 30 seconds after CALIBRATE is selected, or if it stops flashing before a sequence is complete, the WSPR is inoperative and cannot be rectified in flight.



4—2 Fig 1 WSPR Signal Flow

Table 1 — Parameters Recorded in Various Modes of the C & RC

Serial No	*Parameter*	*Toss Modes*	*Dive Toss Modes*	*DSL and Laydown Modes*
1	Angle between aircraft velocity vector and horizontal	Yes	Yes	Yes
2	Closing speed between aircraft and target	Yes	Yes	Yes
3	Horizontal component of range	Yes	Yes	Yes
4	Height above burst	Yes	No	No
5	Aircraft velocity normal to the sightline	No	Yes	No
6	Longitudinal accelerometer output — after generation of pull-out signal by C & RC	Yes	Yes	No
7	Vertical accelerometer output	Yes	Yes	Yes
8	Radio altimeter output throughout run	No	No	Yes
9	Radio altimeter output before generation of pull-out signal	Yes	Yes	No

4—2 Fig 2 WSPR Controls and Indicators

PART 4

CHAPTER 3 — SOUND RECORDER

(Completely revised by AL2)

Contents

DESCRIPTION AND OPERATION

Introduction

1. A sound recorder on the right wall of the navigator's cockpit containing a cassette of twin-track magnetic tape has a control panel on its outer face and operates from the aircraft 28 volt DC power supply.

Tape Recorder

2. The tape recorder contains a record head, tape rollers and a tape drive motor. The tape is driven at a recording speed of $1\frac{7}{8}$ inches per second and at fast speed when winding or rewinding; the motor stops automatically before the tape runs out from either spool. Previously recorded material is obliterated when new material is recorded as selected on the navigator's centralised audio selector system (CASS).

3. A release handle at the front of the recorder allows the recorder body to be withdrawn from its case. When withdrawn, the body is supported by a hinged bar which also forms a lock for the release handle in the closed position.

Cassettes

4. A mechanical interlock prevents removal of the cassette from the recorder unless the function switch (para 5 a.) is selected OFF. Three types of cassette are available:

Cassette Type	*Recording Time Per Track*	*Maximum Indicator Reading Per Track*
C60	30 minutes	880 digits
C90	45 minutes	1320 (999 + 321) digits
C120	60 minutes	1760 (999 + 761) digits

Controls and Indicator

5. *Recorder Control Panel.* The recorder control panel (Fig 1) has two switches and a tape position indicator.

a. *Function Switch.* The 4-position, function toggle switch is labelled OFF, ON, REWIND and FAST WIND.

(1) *OFF.* With OFF selected, power is disconnected and the cassette housing mechanical interlock (para 4) is withdrawn.

(2) *ON.* With ON selected, power is applied to the tape drive motor for a few seconds to advance the tape leader beyond the record head and so eliminate the possibility of losing a part of a subsequent recording. The motor is then ready to run when activated by a CONTinuous RUNNING selection or by the voice operated switch (para 6).

(3) *REWIND.* With REWIND selected, the motor operates at fast speed to rewind the tape onto the feed spool.

(4) *FAST WIND.* With FAST WIND selected, the motor drives the tape at fast speed from feed spool to take-up spool.

b. *Mode Switch.* A 2-position, RECORD/REPLAY rotary switch provides for selection of the required mode of operation. The REPLAY mode is deleted.

c. *Tape Position Indicator.* The tape position indicator is a 3-digit veeder counter; beyond 999 the counters revert to 000 and recommence counting. Releasing the cassette in its housing returns the indicator to 000 regardless of the actual amount of tape on the feed spool.

6. *CONTinuous RUNNING/VOICE CONTROL Switch.* A 2-position switch labelled CONT RUNNING/VOICE CONTROL is on the cockpit wall to the left of the recorder housing.

a. *CONT RUNNING.* When CONT RUNNING is selected, recording is continuous following selections of ON and RECORD.

b. *VOICE CONTROL.* When VOICE CONTROL is selected in addition to ON and RECORD, a voice operated switch inside the recorder activates the tape drive motor only when audible signals are received from the CASS, stopping the motor approximately seven seconds after audible signals cease. Very weak or short duration signals may be insufficient to activate the voice switch which may be overridden by selecting CONT RUNNING.

MANAGEMENT

Normal Operation

7. *Cassette Loading.* Before loading or changing a cassette, check the function switch is OFF. Depress the locking handle and withdraw the recorder from its outer case. Hinge the recorder down at the tray stops. Insert the cassette over the cassette spool drivers ensuring that the back of the cassette first engages against the spring-loaded lever. Select ON and REWIND until the motor stops automatically. Reselect OFF and momentarily release the cassette to return the indicator digits to 000. Relock the recorder unit back in its casing.

8. *Pre-Flight Testing.*

a. Press the I/C button on the CASS.

b. Select VOICE CONTROL, RECORD and ON and speak into the microphone for several seconds. Check that the tape indicator continues to operate for a few seconds after speech ceases.

c. Select REWIND until the counters indicate 004, then select OFF.

9. *In-Flight Recording.* To record audible signals:

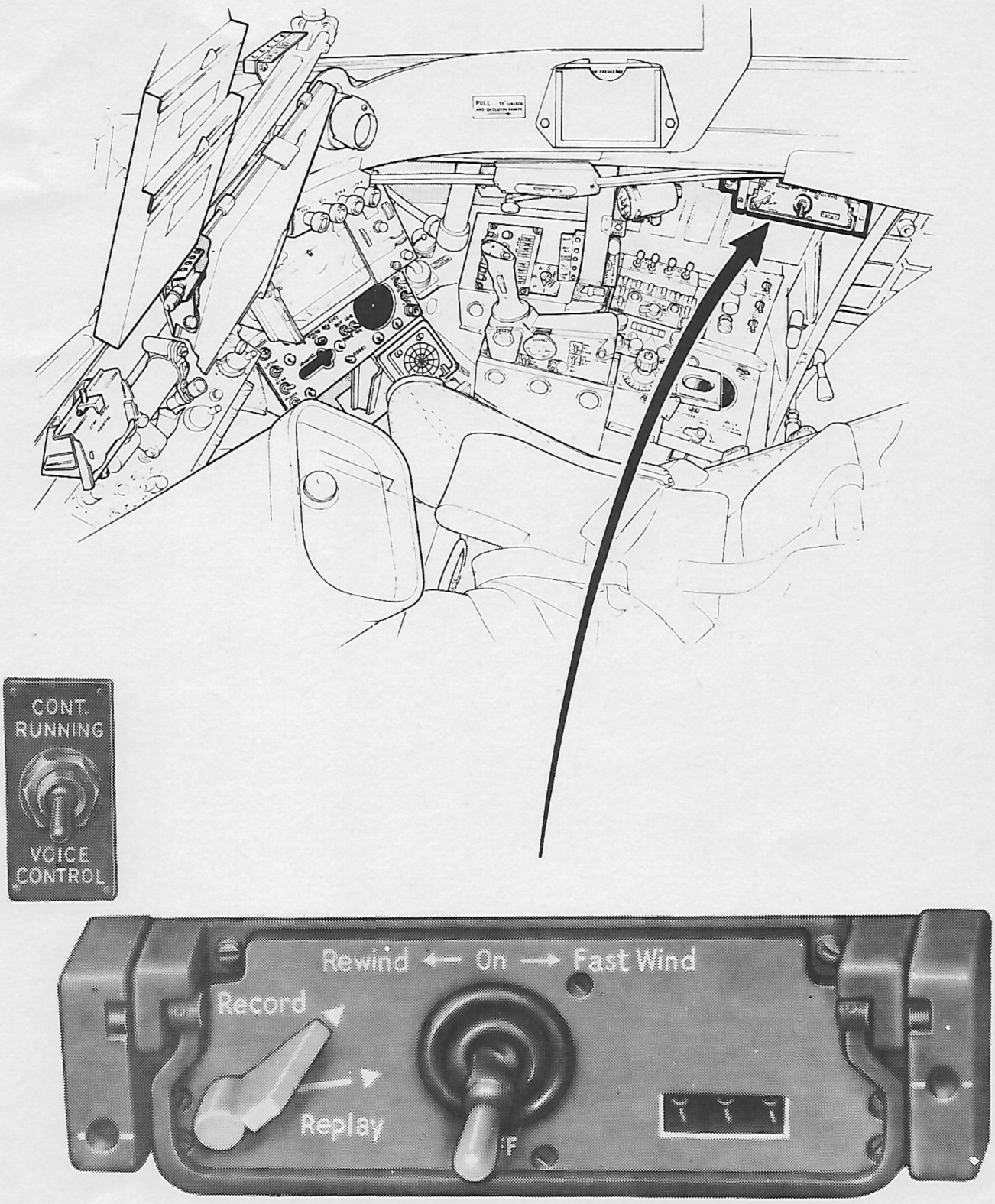
a. Depress the appropriate CASS button and check that RECORD remains selected.

b. Select CONT RUNNING / VOICE CONTROL as required.

c. Select ON.

Abnormal Operation

10. If the 28 volt DC supply fails, the recorder is inoperative and should be switched OFF. If the tape counters stop, at readings other than approximately 321, 761 or 880 (para 4) when RECORD, CONT RUNNING and ON are selected, withdraw the recorder from its casing and check if the tape is being driven. If it is, repeat checks 8a and 8b above to check operation of the voice operated switch. If the motor is running but the counters are not, the recorder is usable but tape position indication is lost.



4—3 Fig 1 Sound Recorder, Controls and Indicator

PART 4

CHAPTER 4—VIDEO TAPE RECORDER

(All text revised at AL9)

Contents

Introduction

1. A video tape recorder (VTR) can record video signals from a Martel TV missile after launch post-mod 5351 or, post-mod 5350, from a Pavespike target designator pod during the tracking mode; aircrew intercom from the CASS is simultaneously recorded. Signals are recorded on standard ¾ inch video tape in a cassette providing a maximum recording time of 20 or 30 minutes.

Components

2. *Recorder.* One of two mechanically similar recorders may be fitted in the radio bay, either employing 625 lines/frame, 50 fields/second for recording Martel signals, or 525 lines/frame, 60 fields/second for recording Pavespike signals.

3. *Controls and Indicators.* A panel above the bearing indicator of the radar warning receiver in the rear cockpit (Fig 1) contains:

a. *VTR Power Switch.* A VTR ON/OFF switch controls the 28V DC normal supply to the VTR.

b. *VTR STANDBY Light.* A yellow VTR STANDBY light with press-to-test and rotate-to-dim facilities comes on when a cassette containing unexposed tape is correctly loaded into a recorder supplied with 28V DC *and* recording is *not* taking place.

c. *End of Tape/Record Button.* A green light in the double-pole EOT/RECORD button is continuously lit during recording or flashes when the end of the tape has been reached. The light also flashes, with aircraft power and unexposed tape available, whilst the button is pressed during ground or in-flight non-effective testing of the recording process. In both cases, a flashing light goes out when the button is released from a depressed state.

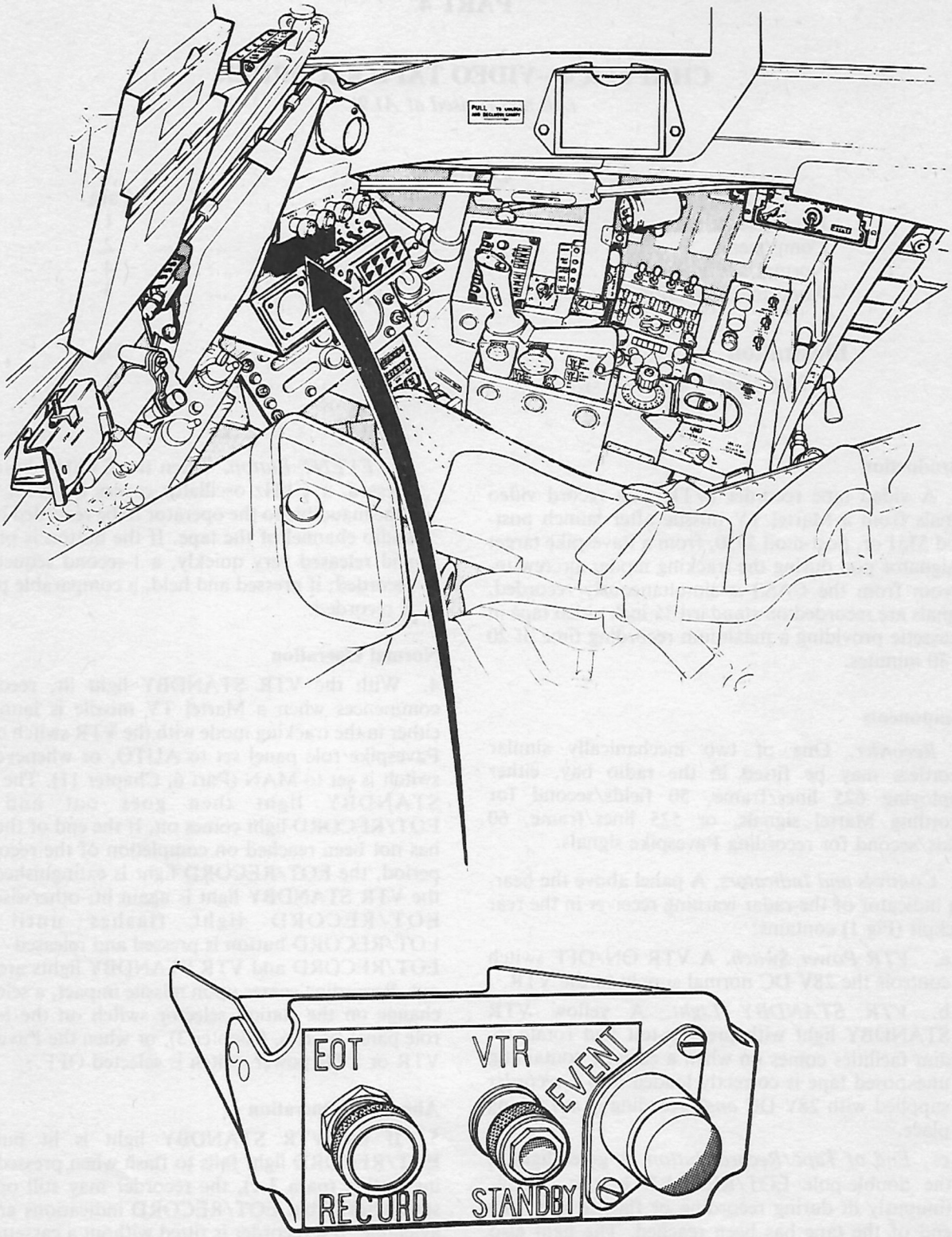
d. *EVENT Button.* When the EVENT button is pressed, a 1 kHz oscillator causes an event mark tone inaudible to the operator to be recorded on the audio channel of the tape. If the button is pressed and released very quickly, a 1-second sequence is recorded; if pressed and held, a comparable period is recorded.

Normal Operation

4. With the VTR STANDBY light lit, recording commences when a Martel TV missile is launched, either in the tracking mode with the VTR switch on the Pavespike role panel set to AUTO, or whenever the switch is set to MAN (Part 6, Chapter 11). The VTR STANDBY light then goes out and the EOT/RECORD light comes on. If the end of the tape has not been reached on completion of the recording period, the EOT/RECORD light is extinguished and the VTR STANDBY light is again lit; otherwise, the EOT/RECORD light flashes until the EOT/RECORD button is pressed and released—both EOT/RECORD and VTR STANDBY lights are then out. Recording ceases upon missile impact, a selection change on the station selector switch on the Martel role panel (Part 6, Chapter 3), or when the Pavespike VTR or VTR power switch is selected OFF.

Abnormal Operation

5. If the VTR STANDBY light is lit but the EOT/RECORD light fails to flash when pressed during testing (para 3 c), the recorder may still operate satisfactorily but EOT/RECORD indications are not available. If a recorder is fitted without a cassette, the EOT/RECORD light starts flashing each time power is connected, but may be cancelled by pressing the EOT/RECORD button; if the VTR switch on the Pavespike role panel is at MAN and the VTR power switch is ON, recording starts immediately after inserting a new cassette.



4—4 Fig 1 VTR Control Panel