

SECRET

MINISTRY OF SUPPLY

DIRECTORATE OF MATERIALS AND EXPLOSIVES RESEARCH AND DEVELOPMENT

EXPLOSIVES RESEARCH AND DEVELOPMENT ESTABLISHMENT, WALTHAM ABBEY

PROGRAMME OF RESEARCH AND DEVELOPMENT,
1955 - 56.

SUBJECT			PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRIORITY	BRANCH CONCERNED	REMARKS
	U.D.*	U.D.R.N.*	Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: ☒ A, B, C.		
PLANTS: for	2	G.D.16	Seaslug	E1A	Boost, cordite	E1A7	Development of platonised composition	E1A7A	1	S.P.R.III	
					Cordite charge for liquid expulsion	E1A12	Development of platonised composition	E1A12A	1	S.P.R.III	
	1 2 3	GW/B(a)1 G.D.16 O.R.1088	Test Vehicles When Particular Missile not Specified	E1C	Boost, plastic propellant	E1C6	Supply of filled motors	E1C6A	1	S.P.R.I	
	2 3	A.W.281 O.R.1105	Red Dean	E1D	Motor, cordite	E1D1	Development of platonised composition	E1D1A	1	S.P.R.III	
	1 3	A5061 O.R.1124	Red Shoes	E1E	Sustainer motor, plastic propellant	E1E1	Development and supply of slow burning composition	E1E1A	1	S.P.R.I	
	3	O.R.117	Magpie	E1G	Motor, cordite	E1G1	Development of platonised medium-fast compositions	E1G1A	1	S.P.R.III	
					Motor, cast double-base	E1G2	Development of charge	E1G2A	1	S.P.R.III	
							Factors affecting ballistics.	E4E1C	1	S.P.R.III	
	1	-	3.5 inch HE/AT Rocket	E4E	Development of M.7 Propellant	E4E1	Modifications to meet new U.S. requirements.	E4E1K	1	S.P.R.III	Modified to meet most recent U.S. Specifications, DOF(X)/AXCP, verbal request.
	2 3	A.W.246 O.R.1099	High Performance Aircraft Rocket (ABC)	E4K	Motor, plastic propellant	E4K1	Development of charge and supply of propellant	E4K1B	1	S.P.R.I	D.A.Arm.review date 1955
ROCKET TS: k for					Motor, cordite	E4K2	Climatic trials	E4K2A	1	S.A.S.	
					Motor, cordite	E5C1	Development of platonised compositions	E5C1A	1	S.P.R.III	
	3	-	RATO Motors	E5C	Motor, cordite	E5E1	Development of fast mesa composition	E5E1A	1	S.P.R.III	
ROCKET TS:					Motor, cordite		Development of fast mesa composition	E5E1B	1	S.P.R.I	

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	U.D.	U.D.R.N.	Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.		
KET. SUB- LPM TS: earch opment			General (Contd.)	E13A	Heat transfer (Contd.)	E13A4	Thermal conductivity of deuterium oxide (?)	E13A4M	C	S.C.E.	
							Convictional heat trans- fer from dissociated gases	E13A4N	B	S.C.E.	
					Combustion	E13A8	Effect of lead compounds on the burning of nitric esters. Combustion studies on colloidal systems simulating cord- ites	E13A8A	B	S.P.R.II	
							Combustion of liquid nitric esters. Chemical and spectrochemical studies of the combus- tion products	E13A8B	C	S.P.R.II	
							Effect of lead compounds on the combustion prod- ucts of liquid nitric esters. Chemical and spectrochemical studies	E13A8C	C	S.P.R.II	
							Reaction of nitric oxide with formaldoxime. The first stage in a synthe- tic approach to a study of propellant combustion	E13A8E	C	S.P.R.II	
							NO/fuel and NO ₂ /fuel combustion processes. A chemical and spectro- chemical study of gas reactions	E13A8F	B	S.P.R.II	New Own research
							Photoelastic studies	E13A9B	B	S.P.R.I	
					stress	E13A9					

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U.D.	U.D.R.N.		Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.		
			Plastic Propellant (Contd.)	E13B	Ignition and burning	E13B7	Effect of particle size and size distribution	E13B7A	A	S.P.R.I	
					Chemical analysis	E13B9	Development of methods	E13B9A	A	S.A.S.	
					Basic data	E13B10	Thermal diffusivity of plastic propellants	E13B10C	B	S.P.R.I	New; Own research
					Compatibility with materials	E13B12	Miscellaneous materials	E13B12A	A	S.A.S.	New
			Colloidal Propellants (Extruded)	E13C	Compositions with improved mechanical properties. Extension of temperature range	E13C3	Toughness: resistance to cracking, with reference to large webs	E13C3D	C	S.P.R.III	
					Manufacturing techniques	E13C4	Back pressure and long-parallel die techniques of extrusion	E13C4B	A	S.P.R.III	
							Segmented charges	E13C4C	C	S.P.R.III	
							High frequency heating before pressing	E13C4G	A	S.P.R.III	
							Reduction in extrusion pressure	E13C4J	B	S.P.R.III	
							Treatment of "rework"	E13C4K	C	S.P.R.III	
							Factors affecting fires on rolls	E13C4L	B	S.P.R.I S.P.R.III	
									C	S.P.R.III	

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SUBJECT			PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRIORITY	BRANCH CONCERNED	REMARKS			
	U.D.	U.D.R.N.	ITEM	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.					
ET, SUB- LM S: Search opment			Colloidal Propel- lant (Extruded) (Contd.)	E13C	Stability and climatic trials (Contd.)	E13C7	Charges for 2-inch, 3	E13C7F	A	S.A.S.				
		-inch and 5-inch rockets (current and new composi- tions).												
		Engine starter cart- ridges: Avon, Ghost, Python, Sapphire					E13C7G	A	S.A.S.					
		Engine starter cartridge No. 13					E13C7L	A	S.A.S.					
		Engine starter cartridge No. 14					E13C7M	A	S.A.S.					
		Compatibility with					E13C8	A	S.A.S.					
		materials												
			Colloidal Propel- lants (Cast Double -Base)	E13D	Manufacturing techniques	E13D3	Preparatory operations	E13D3H	C	S.P.R.III				

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U.D.	U.D.R.N.	Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.		
		Colloidal Propellants (Cast Double-Base) (Contd.)	E13D18	Investigation of new charge designs		Duplex	E13D18C	A	S.P.R.III	
						Simplex	E13D18D	A	S.P.R.III	
						Dual cone	E13D18E	C	S.P.R.III	
						Experimental 15-inch charges	E13D18F	C	S.P.R.III	
			E13D19	Process mechanics		Dilatation of new ingredients	E13D19A	C	S.P.R.III	
						Rate of solution of ingredients	E13D19B	C	S.P.R.III	
						Volume changes	E13D19C	C	S.P.R.III	
						Curing pressures	E13D19E	C	S.P.R.III	
			E13D20	Large charges		Production problems - advisory to ICI, Summerfield	E13D20A	A	S.P.R.III	
						E.M.R. - ICI Ardeer, supporting work	E13D20B	A	S.P.R.III	
			E13D22	Compatibility with materials		Miscellaneous materials	E13D22A	A	S.A.S.	

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PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRIORITY	BRANCH CONCERNED	REMARKS		
U.D.	U.D.R.N.	Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A, B, C.		
		Pressed Propellants (Contd.)	E13F	Compatibility with materials	E13F6	Miscellaneous materials	E13F6A	A	S.A.S.	
		Composite Propel- lants	E13G	Elastic type	E13G1	"Rubbery" compositions. Production; Properties	E13G1A	A	S.P.R.I	E.M.R. - Monsanto Ltd.
				Pressed and cast propellant	E13G2	Ammonium nitrate compos- itions: Alternative binders - Rubber, pitch, plastics	E13G2A	A	S.P.R.I	New; Own research in aid of G.W. generally
		Inhibitors	E13H	General require- ments	E13H1	Chemical properties of inhibiting materials	E13H1C	B	S.P.R.I	
						Physical properties of inhibiting materials	E13H1D	B	S.P.R.I	
						Adhesion to propellant	E13H1E	A	S.P.R.I	
						N.G. and plasticiser migration	E13H1F	A	S.P.R.I	
			Materials and techniques	E13H2	Screw extrusion coating	E13H2D	A	S.P.R.I		
			Development of new cellulosic deriva- tives	E13H5			Cellulose acetates, "low acetyl"	E13H5A	A	S.P.R.I
		Use of plasticisers					E13H5B	A	S.P.R.I	

SUBJECT			PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRIORITY	BRANCH CONCERNED	REMARKS
U.D.	U.D.R.N.		Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.		
D ANTS:			Cordites	E16B	Climatic trials	E16B1	Suitability of selected sulphite pulps for Service nitrocellulose	E16B1A	A	S.A.S.	
							Indian propellant WM.	E16B1B	A	S.A.S.	
D ANTS: rch ment			General	E17A	Manufacturing methods	E17A3	Moderation of double-base propellants for use in small arms	E17A3B	B	S.P.R.III	E.M.R. - I.C.I., Ardeer.
					Gunpowder	E17A5	Regularity of burning properties. Analytical work	E17A5A	C	S.A.S.	
					Ballistic behaviour	E17A6	Cordite N charges. Irregularity: Effect of processing variants	E17A6A	B	S.P.R.III S.P.R.I	
					Flash and smoke	E17A8	Improved non-blinding propellants for Naval guns	E17A8B	B	S.P.R.III	
					Stability, climatic and climatic-ballistic trials	E17A9	Compositions containing substitutes for nitro-glycerine	E17A9B	A	S.A.S.	
							Picrite propellants containing oxamide, D.B.P., D.E.G.N. and 2-N.D.P.A.	E17A9C	A	S.A.S.	
							Compositions containing mechanically nitrated cellulose	E17A9D	A	S.A.S.	
							Compositions containing	E17A9E	A	S.A.S.	

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U.D.	U.D.R.N.	Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.		
VES: Work		R.D.X.	E20B	Manufacture	E20B1	Small pilot plant with acid recirculation. Separate fume-off and modified crystalliser	E20B1C	B	S.C.E.	
				Purification	E20B2	Joint programme with D.O.F.(X) - Continuous recrystallisation from cyclohexanone	E20B2B	C	S.C.E.	
				Chemistry of manufacture	E20B3	Conditions of formation and separation of intermediate compounds	E20B3A	A	S.E.I.	
						General study of nitrolysis mechanism	E20B3B	A	S.E.I.	
		Tetryl	E20E	Stability	E20E1	Acetone-granulated tetryl	E20E1A	B	S.A.S.	
		H.M.X.	E20F	Manufacture	E20F1	Experimental manufacture of one ton	E20F1A	A	S.C.E.	
						Process research and development	E20F1B	A	S.E.I.	
						Plant design	E20F1C	A	S.C.E.	
		T.N.T.	E20G	Process development	E20G1	Investigation of 3-stage continuous process	E20G1A	B	S.C.E.	
					E20G2	Investigation of by-products and minor	E20G2A	A	S.E.I.	

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U.D.	U.D.R.N.		Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.		
			Detonators, General	E24B	Study and improve- ment of physical properties of initiating explos- ives in relation to filling and functioning	E24B1	Modification of prepara- tion and properties of lead azide	E24B1A	B	S.E.I.	
							Collaboration in produc- tion and user trials of modified forms of lead azide	E24B1B	A	S.E.I.	
			Detonators, Pricking Sensitive	E24C	Preparation of explosives and ingredients for compositions of improved compati- bility and performances	E24C1	Control of physical form of lead dinitroresorcinate and other ingrediants as required	E24C1A	B	S.E.I.	
			Chemical Stability of Initiators	E25C	Mechanism and assessment of deterioration	E25C1	Mercury fulminate	E25C1B	B	S.A.S.	
							Substitutes for composi- tions A and B.	E25C1C	B	S.A.S.	
							Initiator delay composi- tions	E25C1G	B	S.A.S.	
							Lead azide	E25C1H	B	S.A.S.	
					Climatic trials	E25C3	A.C. bomb detonators	E25C3A	B	S.A.S.	
							Correlation of chemical deterioration with effective life	E25C3B	B	S.A.S.	

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U.D.*	U.D.R.N.*	Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.		
1	MX 13	New Equipments	E30A	Standard mobile oxygen plant	E30A1	Development of prototype	E30A1A	2	S.C.E.	E.M.R. - B.O. Co.Ltd.
1	MX 14			Mobile dissolved acetylene plant	E30A2	Development of prototype	E30A2A	2	S.C.E.	E.M.R. - B.O. Co.Ltd.
		New Equipments	E31A	On-site air trans-portable oxygen plant	E31A1	Development of prototype	E31A1A	3	S.C.E.	E.M.R. - Ricardo & Co.Ltd.
				Liquid oxygen bulk storage	E31A3	Development of scheme and ancillaries	E31A3A	C	S.C.E.	
		Mobile Oxygen Plants	E33A	Research on liquid air separators	E33A1	Development of rotating still	E33A1A	A	S.C.E.	E.M.R. - Ricardo & Co. Ltd.
						Performance of packed columns - liquid air fractionation	E33A1B	A	S.C.E.	
		Propellants in General	E45A	Combustion	E45A1	Thermal ignition and combustion in the vapour phase of self-combustible compounds, e.g. hydrazine	E45A1C	C	S.P.R.II	E.M.R. - Dr. P. Gray - University of Cambridge
				Rheology	E45A4	Elongation at break at high rates of extension	E45A4A	B	S.P.R.I	
						Behaviour of colloidal and plastic propellants under high rates of compressive strain	E45A4B	B	S.P.R.I	

SUBJECT			PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRIORITY	BRANCH CONCERNED	REMARKS
UD.	U.D.R.N.	Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.			
ch ent		Propellant Ingredients (Contd.)	E45B	Picrite manufac- turing processes (Contd.)	E45B2	Studies of mechanism and kinetics in CaO- NH ₃ -CO system (a) Formation of cyanamide at the solid surface. (b) Migration into the bulk solid. (c) Decomposition of CO to C and CO ₂ on lime. (d) Thermal decomposition of NH ₃ on CaO and effect of surface contaminants (e.g. Ca. salts).	E45B2Q	A	S.E.I.		
				Nitrocellulose	E45B3	Continuous disintegration and nitration of pulp board	E45B3A	C	S.E.I.		
						Thermal degradation of nitrocellulose in solution	E45B3C	B	S.E.I.		
						Investigations on nitro- cellulose stabilisation chemistry	E45B3F	B	S.E.I.		
						Degradation measurements on nitrocellulose from cordite stability trials etc.	E45B3H	A	S.E.I.		
						Fractionation studies for characterisation of nitro- celluloses	E45B3J	A	S.E.I.		
							E45B8C	A	S.A.S.		

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Item	U.D.	U.D.R.N.	Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.		
H AND MENT: Research Development)			Sensitiveness and Detonability (Contd.)	E45D	Impact sensitive- ness (Contd.)	E45D3	Mechanism of the initia- tion of explosion in the "gap", "fragment", and "rifle bullet" tests: photographic study	E45D3H	B	S.P.R.II	
					Sensitiveness of solid explosives and propellants	E45D6	Sensitiveness of homo- geneous explosives as a function of chemical nature, particle size and voids: study of T.N.T. and picric acid in both solid and liquid phases	E45D6A	B	S.P.R.II	
							Sensitiveness of binary explosive systems based on ammonium perchlorate, as a function of the particle size of the oxidant and of voids in the system	E45D6B	B	S.P.R.II	
					Sensitiveness as a function of tem- perature	E45D7	Effect of temperature on the sensitiveness of solid and liquid explosives	E45D7B	B	S.P.R.II	
			Chemical Engineer- ing Research	E45E	Distillation	E45E7	Study of the vapour - liquid equilibria of the system nitric acid - sulphuric acid - water	E45E7A	C	S.C.E.	E.M.R. - Birmingham University
					Studies on con- tinuous reactors	E45E8	Review of knowledge and formulation for its application of practice	E45E8A	C	S.C.E.	

EXTERNAL

Ministry of Supply

D.M.X.R.D. (3)

INTERNAL
C.S.,E.R.D.E.

S.P.R.I

S.P.R.II

S.P.R.III

S.A.S.

S.C.E.

S.E.I.

S./I.S.R.G.

Mr. G.K. Adams

Dr. E. Roberts

Mr. G.W.C. Taylor

Mr. H.R. Broomhall

Mr. E. Brown

Mr. J.R.C. Duke

Mr. P.R. Freeman

Dr. L.H. Gerty

Dr. G.A. Knight

Mr. E.G. Lewis

Mr. E.A. Monro

Dr. A.W.H. Pryde

Mr. P.D. Verschoy

Mr. R.A. Wallace

Dr. T.M. Walters

Mr. H. Ziebland

Mr. H.T. Lester

Registry

Information Service

BASIC RESEARCH PRIORITIES

DEFINITIONS

- A. = Items so fully staffed that progress would not be accelerated by any increase.
- B. = Sufficient staff has been allocated to the items to ensure satisfactory progress.
- C. = Progress on this item is retarded by the lack of specialist staff.
- D. = Work to which staff is allocated when work of higher priority is held up for reasons unconnected with staff.
- E. = No staff can be made available for this item at present.
- F. = Staff are allocated for short-term jobs as the needs and priorities of the moment demand.

E5	1.2B	UNGUIDED ROCKET PROPELLANTS: UNDATED Work for Services (Contd.)	3	"LOKI" Unguided Rocket	E5J	propellant		Development of charge	E5H1B	1	S.P.R.I
			2	G.D.48/2 Long Range Rocket Flare	E5J	Motor, plastic propellant	E5J1	Development and supply of plastic propellant charge	E5J1A	1	S.P.R.I
			2	Torpedo Boost Motors	E5K	Motor, plastic propellant	E5K1	Development of charge and ignition system	E5K1A	1	S.P.R.I
			3	Boosts for Fendine Runway	E5L	Motor, plastic propellant	E5L1	Development of charge and ignition system.	E5L1A	1	S.P.R.I
								Supply of filled motors	E5L1B	1	S.P.R.I
E6	1.3	UNGUIDED ROCKET PROPELLANTS: POST DESIGN Work for Services.	1,2,3	Cordites	E6A	Climatic and cli- matic-ballistic trials	E6A2	Compositions based on sulphite pulp.	E6A2B	B	S.A.S.
								3.5-inch HE/AT rocket	E6A2C	A	S.A.S.
			3	Aircraft Rocket (Cordite Type).	E6B	Serviceability of inhibitor	E6B1	Improvement of inhibition and method of application	E6B1A	A	S.P.R.I
E13	2.1	G.W., ROCKET, TORPEDO, SUB- MARINE & LFM PROPELLANTS: Other Research and Development		General	E13A	Mechanical testing	E13A1	Mechanical properties in relation to use	E13A1K	A	S.P.R.I
								Development of new methods	E13A1P	B	S.P.R.I
						Ballistic proper- ties	E13A2	Assessment in test motors A routine service to research	E13A2A	A	S.P.R.II
						Measurement of rates of burning	E13A3	Combustion of solid binary systems based on ammonium perchlorate. Studies of the factors influencing the rates of burning of composite propellants	E13A3B	B	S.P.R.II
								Vented vessel	E13A3D	A	S.P.R.II
								Crawford "strand" burner	E13A3E	A	S.P.R.II
								Micro-rockets (solid)	E13A3F	A	S.P.R.II
								"Slab" burner	E13A3G	A	S.P.R.II
						Heat transfer	E13A4	Thermal conductivity of air constituents	E13A4A	A	S.C.E.
								Measurement of radiation and convectional heat	E13A4B	A	S.C.E.

E13 2.1

G.W., ROCKET,
TORPEDO, SUB-
MARINE & LPM
PROPPELLANTS:
Other Research
and Development
(Contd.)

(Contd.)

				of non-metals			
				Combustion equations: consecutive reaction systems. Numerical integration	E13A11B	B	S.P.
		High energy propellant systems for ballistic rockets	E13A12	Theoretical assessments and ancillary studies	E13A12A	A	S.P.
Plastic Propellant	E13B	New ingredients	E13B2	Wetting agents	E13B2B	A	S.P.
				Moderants (rate of burning)	E13B2D	A	S.P.
				Ammonium nitrate	E13B2E	A	S.P.
				Degraded butyl rubber	E13B2G	C	S.P.
				Improved catalysts (rate of burning)	E13B2H	A	S.P.
		Manufacturing techniques	E13B3	P.I.B. compositions: Processing	E13B3D	A	S.P.
				Collaboration with R.O.F., Bridgewater	E13B3E	A	S.P.
				Plastisol process - Application to propellants of plastic or similar type	E13B3F	C	S.P.
		Storage (temperature effects)	E13B4	Climatic trials and temperature cycling of filled motors	E13B4A	A	S.P.
				Effect of temperature on fatigue	E13B4E	A	S.P.

E13 2.1

G.V., ROCKET,
FORCED, SUB-
MARINE, L.B.
PROPELLANTS:
Other Research
and Development
(Contd.)

Colloidal Propel-
lant (Extruded)
(Contd.)

Stability and
climatic trials

Development aspects.
Research aspects

Effect of nature of N/C
on plateau burning rates

E13C6E

Effect of plasticisers
on platonisation

E13C6F

Slow burning compositions
containing cellulose
acetate

E13C6G

Water-insoluble plastic-
isers for cellulose
acetate

E13C6H

Alternatives to cellulose
acetate

E13C6J

Effect of nitric ester
variants

E13C6K

Effect of chemical nature
of platonising agent on
platonisation

E13C6M

Platonisation at low
rates of burning

E13C6N

Porous compositions for
igniters

E13C6Q

Ultra-high rates of
burning

E13C6R

E13C7

DGN as a substitute for
nitroglycerine

E13C7A

Compositions containing
potassium perchlorate

E13C7B

Compositions containing

E13C7D

E13 2.1

G.V., ROCKET,
TORREDO, SUB-
MARINE & LBM
PROPELLANTS:
Other Research
and Development
(Contd.)

Colloidal Propel-
lants (Cast Double
Base) (Contd.)

E13D	Ingredients	E13D8	Preparation and crystallisation of compounds for use in platonisation studies		
Chemical analysis	E13D9		Casting powder	E13D9A	B
			Finished propellant	E13D9B	B
			Casting liquids	E13D9C	B
Ballistic and mec- hancial properties	E13D11		Effect of plasticisers	E13D11A	B
			Effect of platoniser	E13D11B	B
			Effect of other ingredients	E13D11C	B
			Effect of nitrocellulose	E13D11D	A
Processing of chopped extruded powder	E13D14		Effect of ingredients	E13D14A	B
			Effect of techniques	E13D14B	B
Alternative cast- ing base	E13D15		Other methods of making base grain	E13D15B	C
Casting liquid	E13D16		Stability	E13D16C	
Restrictive con- tainers	E13D17		Methods of manufacture from cellulose acetate film	E13D17A	
			Use of extruded tubes	E13D17B	
			Centrifugal casting	E13D17C	
			Use of ethyl cellulose tubes	E13D17E	

NO.	CATEGORY	SUB-PROJECT			SUB-TITLE			Service: 1 to Basic: A,B			
		Item	U.D.	U.D.R.N.	Item	No.	Item		No.		
E13	2.1	G.W., ROCKET, TORPEDO, SUB- MARINE & LRA PROPELLANTS: Other Research and Development (Contd.)			Liquid Propellants (Contd.)	E13E7	Stability	E13E7	Isopropyl nitrate, alone and with ethyl nitrate	E13E7E	B
									Chemistry of stabilis- ation of hydrogen peroxide	E13E7H	A
						Corrosion by red fuming nitric acid	E13E8	Corrosion inhibitors: Films produced by hydro- fluoric acid	E13E8A	C	
								Storage tests in cast and welded aluminium alloy closed vessels	E13E8C	B	
					Manufacturing pro- cesses	E13E9	Hydrazine, anhydrous - Production	E13E9B	A		
							Liquid oxygen for rocket propulsion: Mobile plant; separator unit	E13E9E	B		
							Liquid oxygen for rocket propulsion: mobile plant; Engine/compressor unit	E13E9F	B		
					Pressed Propellants	E13F1	Charges	Fuel expulsion: Cool, oxygen-balanced charges	E13F1A	B	
								Rocket motor charges	E13F1B	A	
							Climatic trials	E13F3	I.C.I. charges, other than propellants	E13F3A	

SERIAL NO.	CATEGORY	SUBJECT			PROJECT		SUB-PROJECT		SUB-TITLE		Service Basic: A
		Item	U.D.*	U.D.R.N.*	Item	No.	Item	No.	Item	No.	
E13	2.1	G.W. ROCKET, TORPEDO, SUBMARINE & LPM PROPELLANTS: Other Research and Development (Contd.)			Spin-Stabilised	E13J	Development of charge	E13J1	Cordite	E13J1A	
									Cast double-base	E13J1B	
									Plastic propellant	E13J1C	
E14	1.1B	DEFENCE AND S.A. PROPELLANTS: DATE Work for Services	1 & 2	A.4513	Charges for New Equipments	E14A	Light A.A. L.70 gun	E14A5	Development of propellant and charge with D.A.P.D.E.	E14A5A	1
			1	A.2711			120 mm. gun for F.V.214	E14A11	do.	E14A11A	1
			1	A.2803			Battalion A/T gun	E14A14	do.	E14A14A	1
			2	AV.65			30 mm. Aden gun	E14A15	Granular powder for aircraft guns	E14A15A	1
			3	CR.1007/2)			Gun for Medium Tank No.2	E14A17	Development of propellant and charge with D.A.P.D.E.	E14A17A	1
			1	A.2727			New automatic rifle 7.62 mm.	E14A20	Propellant loads	E14A20A	1
			1	A.3002			183 mm. heavy tank gun	E14A21	Development of propellant and charge with D.A.P.D.E.	E14A21A	2
			1	A.2735			105 mm. (ex 20 pdr.) for Centurian	E14A22	do.	E14A22A	1
			1	A.4517			Flashless propellant for 9.2 inch and 15 inch C.A. equipments	E14A23	do.	E14A23A	4
			1	A.1142			Ancillary ammunition for 88 mm. gun	E14A24	do.	E14A24A	

SERIAL NO.	CATEGORY	SUBJECT			PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRIC
		Item	U.D.	U.D.R.N.	Item	No.	Item	No.	Item	No.	
E17	2.1	ORDNANCE AND S.A. PROPELLANTS; Other Research and Development (Contd.)			General (Contd.)	E17A	Foreign propellants	E17A12	Analysis, stability and climatic trials	E17A12A	
							Cool, non-picrite propellant	E17A13	Development of solvent type (short term solution)	E17A13A	
									Development of solvent-less type (long term solution)	E17A13B	
							Chemical analysis	E17A14	Method for new composition	E17A14A	
					Ingredients	E17B	Picrite processes	E17B1	Calcium cyanamide pilot plant		
									Final gas separation and recovery	E17B1G	
									Nitrolim to picrite Direct fusion pilot plant final development at 100 lb/hr.	E17B1J	
									Nitration pilot plant final development at 50 lb/hr., with neutralisation and re-cycling of spent liquor	E17B1K	
									Spraying pilot plant	E17B1L	
									Recovery of nitration spent acid		
									Vacuum concentration with separation of ammonium salt and improved yield of picrite	E17B1R	
					Ball Powder	E17C	Methods of manufacture	E17C1	Processing variables		

SERIAL NO.	CATEGORY	SUBJECT			PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRICE
		Item	U.D.	U.D.R.N.	Item	No.	Item	No.	Item	No.	
E21	2.1	HIGH EXPLOSIVES: Other Research and Development (Contd.)			General (Contd.)	E21A	Tetrazene	E21A3	Tetrazene: Chemistry Thermal decomposition	E21A3A	
					R.D.X.(B) and H.M.X.	E21D	Chemistry of H.M.X. formation	E21D1	Studies of the overall nitramine yield and RDX/HMX ratio from reactions of the Bachmann type	E21D1A	
E22	1.1B	FUZES AND INITIATORS: DATED Work for Services			New Equipment	E22A	30 mm. delay fuzes	E22A1	Applicability of L.D.N.R.	E22A1A	1
							Platoon A/T weapon: electric detonators	E22A3	Applicability of lead azide, R.D.1339. Collab- oration in production and confirmatory trials	E22A3A	1
					Caps, Electric (30 mm. Aden)	E22B	Study of ingredients of composition	E22B1	Applicability of lead styphnate	E22B1A	1
									Applicability of barium styphnate	E22B1B	1
									Liaison on production of lead and barium styphnates for electric cap	E22B1C	1
					Igniters and Primers, Electric for Guns and V.T. Fuzes	E22C	Studies in develop- ment of composi- tions for improved performance and compatibility	E22C1	Provision of lead styph- nate and other substances to suit A.R.D.E. develop- ment work	E22C1A	1
					Delay Compositions for Fuzes and Detonators (S.A.A., A/B Dets, and 40mm.)	E22D	Study and develop- ment of composi- tions	E22D1	Lead and barium salts for user evaluation	E22D1A	1

SERIAL NO.	CATEGORY	SUBJECT			PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRIORITY
		Item	U.D.	U.D.R.N.	Item	No.	Item	No.	Item	No.	Service 1 Basic: A, B
E21	2.1	HIGH EXPLOSIVES: Other Research and Development (Contd.)			General (Contd.)	E21A	Tetrazene	E21A3	Tetrazene: Chemistry Thermal decomposition	E21A3A	B
					R.D.X.(B) and H.M.X.	E21D	Chemistry of H.M.X. formation	E21D1	Studies of the overall nitramine yield and RDX/HMX ratio from reactions of the Bachmann type	E21D1A	A
E22	1.1B	FUZES AND INITIATORS: DATED Work for Services			New Equipment	E22A	30 mm. delay fuzes	E22A1	Applicability of L.D.N.R.	E22A1A	1
							Platoon A/T weapon: electric detonators	E22A3	Applicability of lead azide, R.D.1339. Collab- oration in production and confirmatory trials	E22A3A	1
					Caps, Electric (30 mm. Aden)	E22B	Study of ingredients of composition	E22B1	Applicability of lead styphnate	E22B1A	1
									Applicability of barium styphnate	E22B1B	1
									Liaison on production of lead and barium styphnates for electric cap	E22B1C	1
					Igniters and Primers, Electric for Guns and V.T. Fuzes	E22C	Studies in develop- ment of composi- tions for improved performance and compatibility	E22C1	Provision of lead styph- nate and other substances to suit A.R.D.E. develop- ment work	E22C1A	1
					Delay Compositions for Fuzes and Detonators (S.A.A., A/B Dets, and 40 mm.)	E22D	Study and develop- ment of composi- tions	E22D1	Lead and barium salts for user evaluation	E22D1A	1

SERIAL NO.	CATEGORY	SUBJECT			PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRIORITY
		Item	U.D.	U.D.R.M.	Item	No.	Item	No.	Item	No.	Service: 1 t Basic: A,
E25	2.1	FUZZES AND INITIATORS: Other Research and Development (Contd.)			Compatibility of Initiators and Delay Systems	E25D	With metals, plastics, sealing materials, varnishes, etc.	E25D1	Lead azides and substitutes	E25D1A	B
									Substitutes for Composition A	E25D1C	B
									Promising new compositions	E25D1F	B
									A and B1 mixtures	E25D1G	B
									Other initiators	E25D1H	B
					Sensitiveness of Initiators	E25E	Electrostatic hazards	E25E1	Spark ignition: analysis of factors determining ignitability	E25E1B	A
									Assessment of electrostatic charges formed when initiatory substances are poured	E25E1C	A
									Development of significant routine tests	E25E2	A
									Friction sensitive-	E25E3	A
									ness		
					Physical Properties of Initiators	E25G	Polymerization of	E25G3	X-ray crystallographic		

SERIAL NO.	CATEGORY	SUBJECT			PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRIORITY
		Item	U.D.	U.D.R.N.	Item	No.	Item	No.	Item	No.	Service: 1 to Basic: A,B,C
E45	2.1	<u>GENERAL RESEARCH AND DEVELOPMENT:</u> <u>Other Research and Development</u> (Contd.)			Propellants in General (Contd.)	E45A	Rheology (Contd.)	E45A4	Effect of nitrocellulose: dependence of rheological properties of colloidal propellants on type of nitrocellulose used	E45A4G	B
							Miscellaneous assessments	E45A5	Routine Cal.Val. determinations	E45A5A	A
							Manufacture of experimental compositions	E45A6	Supply of special propellants for combustion and rate of burning studies	E45A6A	B
					Propellant Ingredients	E45B	Methods of analysis	E45B1	Phthalates in cordite pastes	E45B1A	B
							Picrite manufacturing processes	E45B2	Ammonium thiocyanate provision: Direct conversion of H_2S to CS_2 .	E45B2B	C
									Indirect conversion of H_2S to CS_2 .	E45B2C	C
									Preparation of guanidine from urea Mechanism of iso-urea process	E45B2D	B
									Thermal decomposition of urea and its derivatives	E45B2F	C

SERIAL NO.	CATEGORY	SUBJECT			PROJECT		SUB-PROJECT		SUB-PROJECT SUB-TITLE		PRIORITY	
		Item	U.D.	U.D.R.N.	Item	No.	Item	No.	Item	No.	Service: 1 to 4 Basic: A,B,C.	
E45	2.1	<u>GENERAL RESEARCH AND DEVELOPMENT:</u> <u>Other Research and Development</u> (Contd.)			Propellant Ingredients (Contd.)	E45B	Stabilisers	E45B12	Stabilisers and their stabilising reactions	E45B12A	C	S.
					General Explosives and Propellant Applications	E45C	Study of crystallisation problem	E45C2	Application of electron microscope and of optical methods	E45C2G	A	S.
									Crystal size control. Crystal habit control. Polymorphism. Surface condition and deposition.	E45C2H	B	S.
							Methods of analysis	E45C3	Application of infra-red spectrophotometer	E45C3A	B	S.
					Sensitiveness and Detonability	E45D	Sensitiveness of explosives to friction and impact	E45D1	Mechanism of the initiation and growth of the detonation wave in explosives	E45D1A	C	S.
									Development of a test for the sensitiveness of explosives to friction, having no impact component.	E45D1B	B	S.
					Impact sensitiveness	E45D3			Application of the "gap" test to colloidal propellants and to explosive liquids rendered viscous by the addition of polymers	E45D3C	B	S.
									Sensitiveness of explosives to high velocity impact	E45D3E		