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Volume XIII

PYROTECHNIC PANEL MINUTES

Nos. 518 to 579

with additional corrections to previous printed volume.

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November 1946.

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Source Pyrotechnic Panel Minutes Nos. 516 to 579, Incl. Eval. A-1

Area Reported On Great Britain Subject PYROTECHNIC RESEARCH AND DEVELOPMENT

Reference (DIRECTIVE, CORRESPONDENCE, PREVIOUS REPORT, ETC., IF APPLICABLE.)

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PYROTECHNIC PANEL

(Inter-Services Advisory Body on Pyrotechnics)

The Present Composition and address of the Panel are as follows:

Address. The Panel's Office moved on 24.6.1946 from Portland House, Tothill Street, S.W.1, to 34, De Vere Gardens, Kensington, W.8.

Telephone. Western 7266. Extension 201.

Chairman

Captain T. R. G. O'Connor, O.B.E., R.N. (Act.) (Ret'd.)(D.N.O.) to 12.3.46.
Mr. Charles Lea, M.Sc. (D.Arm.R.D.) from 4.6.46.

Vice Chairman

Gp. Capt. F. G. S. Mitchell, O.B.E., R.A.F., (D.Arm.R.D.) to 11.1.46.
Mr. C. Lea, M.Sc. (D.Arm.R.D.) from 12.1.46 to 3.6.46 then Chairman.
Mr. J. S. Dick, M.B.E., B.Sc., A.R.I.C., (C.S.A.R.) from 4.6.46.

Members

Lt. Col. C. G. Bridge, (C.E.A.D.) to 2.4.46.
W/C T. J. A. Cresswell, M.B.E., R.A.F., (C.E.A.D.) to 19.3.46.
Major W. P. Crow, (D.G. of A. (A.3)) from 22.1.46.
Mr. J. S. Dick, M.B.E., B.Sc., A.R.I.C., (C.S.A.R.) to 3.6.46 then Vice-Chairman.
Mr. E. F. Figg, F.R.I.C., (C.C.I.) from 23.8.46.
Mr. J. S. Forbes, B.Sc., A.R.I.C., (C.C.I.) to 22.8.46.
Mr. P. W. B. Harrison, M.B.E., B.Sc., Ph.D. (R.D.Arm.4) from 14.1.46.
Mr. C. Lea, M.Sc., (D.Arm.R.D.) to 11.1.46 then Vice-Chairman.
Mr. V. L. May, A.M.I. Mech.E., A.I.P.E. (C.E.A.D.) from 7.5.46.
F/Lt. K. Powell, (C.E.A.D.) from 5.3.46 to 29.10.46.
Lt. Cdr. M. P. Price, (D.N.O.) from 13.7.46.
Cdr. P. Trier, R.N. (D.N.O.) from 1.4.46.
Lt. Col. O. H. Wansbrough-Jones, O.B.E., (D.S.W.V.) to 8.1.46.

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Mr. G. B. Ashburner, (D.D.I.Arm.) to 18.7.46.
Mr. E. W. Bateman, (C.D.E.S. Porton) from 7.5.46 to 8.7.46.
Lt. Col. E. B. Beedle, M.B.E. (C.I.A.) from 16.4.46.
Mr. F. E. Gaines, (E.P.O./D.G.O.F.) from -.3.43.
Mr. J. Keith, B.Sc. (C.I.A.) to 16.4.46.
Mr. E. W. Lanfear, (C.D.E.S. Porton) from 19.7.46.
Mr. A. N. Mosses, M.Sc., Ph.D., B.Sc.(Eng), F.R.I.C., (D.Arm.R.D., R.A.E.) from 21.5.46.
Mr. B. A. Weston, (D.O.F/F.) from 1.1.46.
Mr. E. Williams, (D.D.I.Arm. - now C.I.A./Air) from 18.7.46.
Cdr. Wreford, R.N. (C.I.N.O.) from -.1.45.

Secretariat

Commander W. B. C. Ross, R.N. (Ret'd.) from 10.8.44
Mrs. E. M. Laing to 22.3.46.
Mrs. E. E. Arundel.

Minute P.P. No.	Subject
518	Soldered Blow-off Discs on Pyro Stores (Candles Smoke Red, Message - Carrying and Candles Smoke Yellow, Mk.VI N.).
519	Rustproofing, Tubes of Roman Candles.
520	Float, Smoke and Flame, A/C Nav. H.T.V. Albright and Wilson Design, filled Sodium Phosphide. Development.
521	Float, Smoke and Flame, A/C Nav. H.T.V. with Pyro filling. S.P.R.A. Type. Development.
522	Float, Smoke and Flame, A/C. Nav. H.T.V. Detachable Nose Type. Development suspended.
523	Flash Photographic, 4.5" Mk.III. Use of Pyrotechnic Bursters, Photometry.
524	Pyrotechnic Stores in Mercantile Marine. Replacement on age.
525	Cartridges and Pistols Signal 1-inch. Service Policies about retention in Use.
526	Magnesium Powders for Flares, Canadian Blown and American Atomised or milled.
527	Markers, Smoke, Yellow, Homing Aircraft. Development Trials.
528	Fire Risk with Illuminating Stores in vessels of Coastal Forces.
529	Charcoal for Rocket Compositions. Specifications.

	Subject
530	Rockets, Signal and Target Practice, filled I.C.I. Composition. Treatment of Service Lots.
531	Improved Packages for Pyrotechnic Stores for Tropical Use. Mould growth on Paints.
532	Magnesium Powder - Stability of Compositions.
533	Primed Cambric, Improvement of.
534	American Signal, Distress, Single Star, Red. M.73. British Trials of.
535	Marker, Flame, A/C, Land/Water Navn. No.1.
536	Flash Photographie, A/C, 4.5" Mk.II, III and III*. Light Characteristics.
537	Cartridges, Signal, 1½" and 1". Aluminium Cases. Designs and Production.
538	Bomb, Practice, A/C; 10 lb. Mk.IV. Flame. Leakage Test.
539	S.R.432 filling for Rockets. Development Cancelled.
540	Cartridges Signal Recognition 1½", 3-Star with Flash. Trials with G-R and other British and American Signals.
541	Fuze, Safety, for Naval Demolition. Development.
542	Candles, Smoke, Yellow or Red (Submarine) Blow-off lids, type of Sealing.
543	Rockets, Signal and Target Practice. Climatic Trials: Abolition of War Production Permits.

Minute P.P. No.	Subject
544	Delay Compositions, Research into.
545	Cartridge Signal 1-inch Red, Mark 12. Composition for Stars.
546	Cartridge 1-inch Illuminating J. Composition for Star.
547	Rocket, Line-carrying, 12 lb. for H.M. Coastguard. Introduction.
548	Rockets, Substitutes for Gunpowder Propellant.
549	Flame, Float, A/C, Nav. No.2. Mk.I. Trials.
550	Cartridge, Signal, $1\frac{1}{2}$" Brown Smoke Puff for High Altitudes. Development.
551	Secrecy of Pyro: Compositions. Degrading.
552	Improved Packages. Box. B.571.
553	Cartridge 1-inch, Illuminating J. Star Composition.
554	Float, Smoke and Flame, A/C. Nav. H.T.V. Pyro Type.
555	Float, Smoke and Flame, A/C. Nav. H.T.V. Albright & Wilson Design. Filled Sodium Phosphide.
556	Flare A/C, Target 4.5 inch. Red with Green Stars. Precoated Magnesium.
557	Secret.
558	Flashes, Photographic A/C. 4.5". Fragmentation Zones.
559	Magnesium Compositions. Boiled Linseed Oil protected. Specifications.

Minute P.P. No.	Subject
560	Thunderflashes. Improved Design.
561	Tropical Packages. Cartridge Signal 1-inch in Jungle Pack.
562	Flare, Ground, Warning. Mk.I. Red. Composition S.R. 209B approved.
563	Float, Smoke and Flame, A/C. No.2. Mk.III: Float, Flame, A/C. No.3 Mk.I. Signal Drift Night A.N. Mk.IV. (American) Comparative Trials.
564	Cartridge, Flash, Photographic. 1.75 inch. Development.
565	Marker, Smoke, Red, Air-Sea Rescue. New requirement.
566	Photometry. Theory of Photographic Flashes.
567	Signal, Distress, 1 Star, Orange Smoke, New requirement.
568	Rockets, Line-Carrying. Filled Cordite.
569	Rockets Signal 1-lb. and Target Practice. Abolition of Wartime concessions and gluing of Sockets.
570	Float, Smoke and Flame. Surface Mk.I. Development stopped.
571	Photometry. Measurement of Atmospheric Transmission of Light.
572	Rustproofing Tubes of "Roman Candle" type stores,

Minute P.P. No.	Subject
573	Cartridges Signal 1½ inch. Aluminium Cases. Rough usage in tropical packing.
574	American Pyrotechnics for Distress Signalling.
575	Magnesium and Aluminium Powders. Ignitability. Effect of Temperature.
576	German 15 c.m. Rocket. Propelled Multi-Candle Flare.
577	Rocket Measuring Cloud Height. New requirement.
578	Cartridges Signal. Aluminium Cases. 1½ and 1 inch. Development.
579	Bomb A/C Practice. Naval Requirements, for Flash, Flame, Smoke and Coloured Dye fillings.

No. P.P. 518
8.1.46
Former P.P. 350

Soldered Blow-off Lids on Pyrotechnic Stores. (Ref. 84/2)
Candles Smoke Red Message-Carrying (Experimental) (Ref. 84/1)
Candles Smoke Yellow Mark VI/N. (Ref. 148/1)

Proposed changes in designs to cure failures

NOTES BY THE PANEL

1. In P.P. 350, it is recorded that C.S.A.R.'s proposal for a change of design (C.S.A.R. Sketch R.29), to cure occasional failures at proof of Candles Smoke Yellow Mark VI, by using a "cutting projectile" in the central tube instead of the present device of a stick to push off the lid, was not proceeded with; it is supposed that all Lots of Candles on then current contracts were accepted after passing proof.

2. The same trouble of failure to push off the lid is now affecting the experimental Candles Smoke Red Message-Carrying which are being prepared for sea trials by submarine (Requisition Bridgend B.9452. 1258/20).

3. In both stores the stick sometimes fails to push off the lid and, the smoke composition having ignited, internal pressure builds up and blows out the hydrostatic mechanism in the base of the candle.

4. In correspondence between the Panel and C.E.A.D., the question of sealing the lids of such Candles and other Pyrotechnics without using any solder has been under discussion.

5. The Candles Smoke Red filled at Bridgend having failed at factory proof, by some failures to blow off the lids, these lids were all removed and resealed by the factory, with special care to avoid over-soldering in a special manner recommended by C.E.A.D.: but similar failures recurred at subsequent factory reproof and, since Bridgend is in the process of closing down, all the Candles were returned to C.E.A.D.

C.E.A.D. to Sec. P.P. on 4P/4/7 dated 16.11.45

"From a design point of view the types of seals that will meet the case are (a) by solder and (b) by cement.

A. - Solder Type

This is preferable as a water tight joint and will be better from an inspection point of view, and can be done easily by moderately skilled labour. To meet, however, the least skilled operator, it is suggested further to our previous recommendation, that the sealing disc be concentrically printed on both sides with a circle greater than the diameter of the support disc to prevent the flow of the solder beyond the boundary. Further the solder can be presented in a washer form, the outside diameter conforming with that of the recess in the adaptor.

We propose to arrange for a number of sealed adaptors of the Candle Smoke Red together with sealing disc and solder washers to be forwarded to the R.O.F. Swynnerton for trials.

B. - Cement Type

We introduced the Bostik cement seal in the Flare Identification and Flare Signal Type A. Apparatus and from a functioning point of view this was successful. It was, however, adversely commented on by C.S.A.R. from a possible "breathing" point of view. The operation from a manufacturing point of view is comparatively easy and should present no difficulties.

We do, however, point out that a rubber disc secured with Bostik XP is the basis of the seal of the Float Submarine Special Type O which is subjected to a test pressure of 200 lbs./sq. in. Special care is, however, taken to pack this Float in a water tight cylinder which would also afford protection to the seal.

It is suggested that some Candles now awaiting proof should be assembled with this type of seal by C.E.A.D. and subjected to climatic trials."

Sec. P.P. to C.E.A.D. (through D.N.O./L) dated 23.11.45. (Extracts from)

"2. Mr. May informed Sec. P.P. on 22.11.45 that C.E.A.D. had received a number of Candles Smoke Red, returned to him from Bridgend.

3. Propose that a proof be taken by C.E.A.D. to test the functioning of these re-sealed Candles, and that the remainder be held for disposal orders from F.O. (S/m) for a further Sea-Trial, except such number as C.E.A.D. may wish to keep for trials of alternative methods of sealing the blow-off discs and for investigating the alleged weakness of the lower seal on this store.

4. If, however, C.E.A.D.'s proof reproduces the failures reported by A.I.N.O. Bridgend, the Candles should be rectified by C.E.A.D. and re-tested for functioning before going for Sea Trials."

C.E.A.D. to D.A.S. on 4P/4/7 dated 24.11.45

"We have received 78 candles from R.O.F. Bridgend for rectification. It has been found necessary to remove all the solder on the adaptor by machining, and to achieve this it is necessary for the complete filling to be removed.

We have arranged with C.I.N.O. for a copy of the design issued for this contract to R.O.F. Bridgend.

We are also arranging for the replacements and rectifications on A.D.D. orders, and for proof of two candles to be carried out by I.N.O. Woolwich if this is agreeable.

We also propose in agreement with the Pyro. Panel to take six candles for experimental trials with Bostik seals.

Consigning instructions will be required."

C.E.A.D. to C.E.A.D. (T.2.) (Bridgend) dated 24.11.45

"To enable the R.O.F. to obtain practice in the soldering of the seal of the above allied stores we are

forwarding to you thirty sets of components as shown on D4(L)1002/X/6, dated 23.11.45 ("Mock-up").

These on completion are capable of being tested with the 170 lbs. per square inch external air pressure, or by an internal pressure, say 5 lbs. per square inch. In the latter case it will be necessary for arrangements to be made to the mock-up to suit the factory's testing plant."

D.N.O./L. to C.E.A.D. dated 29.11.45

"Referred, concurring in paras. 3 and 4 of Secretary P.P.'s minute dated 23.11.45.

2. The suggestion in the last paragraph of your 4P/4/7 dated 16th November, 1945, is concurred in. It is imperative that the reliability of functioning of this store should be of the highest order. It seems probable that this will be more readily obtainable by your method B. PROVIDED THAT the possible defect foreseen by C.S.A.R. can be avoided. In view of the great importance of the store and the comparatively small numbers which would be required, there should be no serious objection to each being stowed in a watertight cylinder.

3. Please reply to D.N.O.(L) through C.S.A.R., (with a copy to Secretary P.P. for information).

4. C.S.A.R. is requested to forward his comments as soon as possible to D.N.O.(L) (with a copy to Secretary P.P. for information). The position will then be reported to F.O. (S/m)., and D.N.O."

C.I.N.O. to Sec. P.P. dated 11.12.45

"With reference to A. of C.E.A.D.'s 4P/4/7 dated 16.11.45, it is suggested that the whole of the underside of the disc should be printed so as to ensure that no solder adheres to this face.

If Bostik XP cement is used for the seal, it would be desirable for the candles to be packed in a hermetically sealed cylinder to prevent "breathing"."

Remarks by the Panel

The Panel RECOMMENDS strongly that, if possible, all blow-off discs on Pyrotechnic stores, that are at present soldered in place, should be replaced by devices that do not need soldering.

2. In the Panel's opinion, it is impossible for any inspection system to control the strength of soldered seals and it is inevitable that occasional over-soldering by some operator will happen, especially when using diluted labour for large-scale production.

3. The Panel suggest that seals made with concentrically printed discs and painted over the whole under surface, as proposed by C.E.A.D. and C.I.N.O., should be deliberately over-soldered and the Candles tested to see whether this prevents correct functioning.

4. The Panel RECOMMENDS that the present situation be dealt with as follows:-

(a) Candles Smoke Red Message-Carrying Experimental

The existing batch of Candles to be so rectified by C.E.A.D. that they will pass proof and be able to go for sea trials by submarines.

If the Staff then decides that such a store is required for future production, that C.E.A.D. should work out a new design, embodying a new method of sealing the lid.

Apart from the lid and its sealing, the Panel suggests that the design of this store is too complicated and should be simplified. In its present form, it is troublesome for Filling Factories to cope with.

Remarks by the Panel (Contd.)

(b) Candles Smoke Yellow

The same type of improved lid device as may be successfully applied to the redesigned Candle Smoke Red should be applied also to a design for future production of this store.

(c) Both Smoke Candles

C.S.A.R.'s "cutting projectile" device should be tried out. Its use, in the case of these stores, might enable soldered lids to be used however much they may be over-soldered.

(d) Submerged Smoke Candles

(i) The Panel notes suggestion that the smoke vents of submerged Candles might be sealed in the same way as the Float Submarine Special Type O and that, in such case, it is desirable to supply each candle in its own watertight cylinder; and that this suggestion is approved for the present batch of Experimental Candles Smoke Red by D.N.O./L's minute of 29.11.45.

(ii) It is observed that whereas the entry of water into a Float Special Type O might have disastrous explosive results, in the case of

Remarks by the Panel (Contd.)

Smoke Candles this would not be actively dangerous but only tend to cause failure of the Candle to ignite and function correctly, because it had got wet inside.

(e) Blow-off discs in General

In addition to these two special cases of the submerged Smoke Candles, the use of soldered blow-off discs on Flares Identification and other such fire-works should be got rid of, C.E.A.D. continuing his experiments to this end.

ACTION

Forward to D.N.O. and C.E.A.D.

2. Ask D.N.O.

(a) whether there is any objection to service supplies of Candles Smoke Yellow or Red being packed in a water-tight container, not to be opened until just before loading the candle into the gun.

(b) whether any serious number of Candles Smoke Yellow Mark VI have failed to function in service and whether the nature of such failures was detected.

ACTION (Contd.)

3. Ask C.E.A.D. to note the Panel's Remarks.

D.Arm.R.D., D.G. of A., C.S.A.R., C.I.N.O., I.N.O. Woolwich, C.I.A., D.D.I.Arm., F.O. (S/m), D.A.S. and D.O.F.(F) for information.

Former P.P. 346

Rustproofing the Tubes of "Roman Candle" type Stores (Ref. 48/2)

A.D.F.F./D/Pyros. to C.E.A.D. dated 24.8.45

"Recurring trouble is experienced through faulty application and drying of anodite paint. This manifests itself by ejection of stars to varying heights and it has been proved actually to cause blind stars. This is particularly applicable where tight stars are employed.

It is suggested that a more suitable rust preventative should be found and applied at the earliest possible moment."

C.E.A.D. to A.D.F.F./D/Pyros. dated 29.8.45

"It is pointed out that "Anodite" Paint was originally introduced in signals where the centre tube was manufactured from sheet and welded and its function was to prevent rust growth caused by the oxidation of the weld.

In the case of signals where the centre tube is solid drawn, the Anodite Paint could be dispensed with and a stoved copal varnish used in lieu. This will present a harder surface which will be more satisfactory, particularly in the case of tamped stars.

Before taking any action with the above, we are discussing the matter with C.S.A.R. to fully cover both methods of manufacture of the centre tube.

We should like to point out that insufficient drying of the Anodite Paint will have a greater tendency to non-ejection of stars than to blind stars."

C.S.A.R. to C.E.A.D. on XC(2)798/1 dated 9.10.45

"(a) A probable cause of the trouble described in Minute 1 is insufficient stoving of the painted components. For satisfactory hardening of the paint, the coated components should be stoved for 45 minutes at 300°F.

(b) Akard lacquer (Messrs. Llewellyn Rylands, Birmingham) can be recommended as an alternative to "Anodite" paint. This requires stoving for 30 minutes at 300°F.

(c) Akard lacquer would be a suitable alternative to copal varnish. Coating by filling and draining should be satisfactory provided drops ("tears") are effectively removed.

A representative could attend to give advice and assistance if required."

C.E.A.D. to Sec. P.P. on 4/P/3/1 dated 17.10.45

"We note that a copy of C.S.A.R.'s minute dated 9.10.45 has been forwarded to you.

We are arranging for the manufacture and filling of eighty Signals, Emergency, 5-Star White, half to have the centre tubes internally coated with anodite paint and the other half with Akard lacquer, both stoved as suggested by C.S.A.R.

We are also arranging for the manufacture and filling of one hundred and twenty Signals, Distress, 2-Star Red, an equal number having the interior of the centre tube coated with anodite paint, Akard lacquer, and copal varnish. Ten of each of the Signals will be fired for correct functioning and for height, and the remainder will be forwarded to C.S.A.R. for climatic storage for periods of one, two and three months.

The 5-Star Signal will cover trials of the welded tube, and the 2-Star Signal for the hot drawn type."

NOTE:- Copies of correspondence were sent by Sec. P.P. to C.C.I.

C.C.I. to Sec. P.P. on 198K dated 8.11.45

"Reference your 48/2 dated 25.10.45, enclosing copies of memos. from C.E.A.D., and from C.S.A.R., to C.E.A.D., it will be appreciated that two of the materials quoted, i.e. Anodite Paint and Akard lacquer, are proprietary articles and in case it is eventually decided to specify one of these materials, it would be appreciated if arrangements could be made for 2 lb. samples of the actual material under trial to be forwarded to this Department in order that work can be put in hand with a view to drawing up a specification to control the quality of future supplies."

Sec. P.P. to C.E.A.D. dated 21.12.45 (Ref. 48/1)

"The Panel requests that Signals Distress 2-Star Red, with stoved Copal Varnish on the Centre Tubes, may be included in the trials already arranged by you with Signals Emergency 5 Star white.

The Copal Varnish should be to Specification C.S.1844."

Remarks by the Panel

It is understood that one reason why stoved Copal Varnish was not used for protecting the central tubes of "Roman Candle" type stores was that it was difficult, during the war, to provide the necessary drying stove capacity.

2. Since C.S.A.R. is now proposing varnishes which all need stoving, the Panel sees no reason why ordinary Copal Varnish should not be considered for adoption in preference to Anodite

Remarks by the Panel (Contd.)

or Akard or any other proprietary material, except that they are informed that Copal Varnish requires a longer stoving period than Akard or Anodite lacquers.

ACTION

Forward to C.S.A.R., C.E.A.D. and C.C.I.

2. Ask C.S.A.R., to forward information on the relative advantages of Copal, Anodite and Akard lacquers, as regards:-

(a) time and temperature required for stoving;

(b) physical properties of the finished films.

3. Ask C.E.A.D., and C.C.I., to note para. 2 of the Panel's remarks.

Forward to D.N.O., D.Arm.R.D., D.G. of A., C.I.N.O., C.I.A., D.D.I.Arm., D.O.F.(F) for information.

No. P.P. 520
8.1.46
Former P.P.s 162 and 354

Float, Smoke and Flame, A/C. Navigation, H.T.V. Albright & Wilson Design, filled Sodium Phosphide (Ref. 123/1)

General Armament Division R.A.E. S.6. Test Record No.300 dated 25th October, 1945

"1. Introduction

It was requested by R.D.Arm.8(c), letter references Res. Arm. 5493 and 3918 dated 8.9.45 that sample H.T.V. Sodium phosphide filled Smoke and Flame floats of a new design by Messrs. Albright & Wilson be tested for functioning in dropping trials and compared for performance with the S.P.R.A. design H.T.V. Float, Smoke and Flame.

2. Description of Store

A cross section through the store is drawn from Messrs. Albright & Wilson design 10743/4 as shown in Fig.1 (not reproduced).

A main cylindrical body, constructed from 22 s.w.g. mild steel plate, comprises a forward portion containing 3 lbs. of sodium phosphide filling and a rear buoyancy chamber which is fitted externally with four stabilising fins.

Water ingress and gas escape holes, provided around the filled portion of the body cylinder, are sheathed by an outer sleeve which terminates aft on an annular sealing ring and forward in a cored weighted ballistic nose. The outer sleeve and nose assembly is anchored to the main body cylinder by a retaining stud which passes from the main cylinder end through the core of the nose weight and by the thin weak-link diaphragm which is sweated to the retaining stud and nose weight respectively. The free end of the

retaining stud is fitted with a wing nut and transit-safety washer which are removed prior to release of the store. In operation, the impact surge of water against the thin diaphragm causes the outer soldered joint of the diaphragm to fail, thus freeing the outer sleeve assembly from the main cylinder to make the latter buoyant, and to unmask the water ingress and gas emission holes as is necessary for functioning the sodium phosphide filling to provide the desired smoke and flame.

3. Object of Trial

To investigate the functioning of the floats in release from 3,000 ft.

4. Conduct of Trial

Four floats were chute launched singly from 3,000 ft. into 30 ft. of water from a Lancaster aircraft flying at 180 m.p.h. I.A.S.

5. Results of Trial

All the stores functioned satisfactorily to give a good smoke and flame output of approximately four minutes duration. Subsequent examination of the stores after functioning was prohibited as none of the stores were recovered owing to weather conditions.

6. Conclusions

(i) Satisfactory preliminary functioning of the stores is concluded from the trial.

(ii) Observers fully familiar with the best performance of the S.P.R.A. H.T.V. Float Smoke and Flame rate the

. . . performance of the new Sodium Phosphide filled store to have been superior to that so far achieved with the former.

(iii). The ballistic profile of the store is considered to be capable of improvement as are the measures employed for ensuring the sealing and safety of the sodium phosphide filling of the store in storage and rough usage.

7. Recommendation

The design for an H.T.V. Smoke and Flame Float should, if warranted by Service requirement, be reconsidered in the light of the promise shown by the new Albright & Wilson Sodium Phosphide filled store and the experience obtained with the S.P.R.A. design; and, provided the considerations of para. (iii) in the conclusions above are catered for, it is considered that the requisite data are now available to ensure development of a fully satisfactory store."

D.N.O.(L) to Sec. P.P. on N.O. 6989/45 dated 25.6.45
(Re S.P.R.A. type)

"Re P.P. 345 Para. 4 of Action. The Naval Staff have confirmed that a terminal velocity of at least 600 f.s. is required for this Store. They are anxious that development should be pressed forward so that the store may be available for new aircraft designed for it.

2. It is important that the filling of this Float, which will be carried in large numbers, should be suitable for stowage below docks in aircraft carriers, in order to relieve the congestion of weather deck stowages. For this reason a sodium phosphide filling is not favoured though it has been accepted for certain practice bombs used in much smaller quantities.

Remarks by the Panel

Some of the difficulties inherent in getting a design of Float Smoke and Flame H.T.V. with a pyrotechnic filling are mentioned in the Panel's Remarks in P.P. 354.

2. The complete failure of the S.P.R.A. ejection type (pyro. filled) after prolonged trials is recorded in P.P. 521.

ACTION

Forward to D.Arm.R.D., C.S.A.R. and D.N.O.

2. Ask D.Arm.R.D. to forward filled bodies from 5 Albright & Wilson type Floats filled Sodium Phosphide and from 5 S.P.R.A. type Floats to C.S.A.R. for comparison of performances.

3. Ask C.S.A.R. to determine the time-intensity curves of the stores referred to in para.2 above and inform the Panel of the results.

4. Ask D.N.O. whether the Naval objection to a Sodium Phosphide filling for this store is mandatory, so that development at high priority of a C.E.A.D. or S.P.R.A. pyrotechnic-filled type must continue, in spite of the unpromising situation of these, vide P.P.s 354 and 521.

D.N.O.(L). C.E.A.D., C.N.R., C.I.N.O., D.R.A.E., and D.A.W.T., for information.

No. P.P.521
8.1.46
Former P.P.435

Float Smoke and Flame A/C. Navigation H.T.V. with Pyrotechnic filling. S.P.R.A. Type. (Ref. 120/2)

Notes by the Panel

1. The following trial reports cover the development trials up to date of Messrs. Schermuly's design: (See P.P.354. Remarks, paras. 3 and 4):-

M.A.E.E. Helensburgh Reports H/Arm/134 Nos. 1, 2 and 3 dated 20.4.45, 15.5.45 and 16.7.45.

R.A.E. Farnborough BGDS Test Records Nos.234, 256 and 268 dated 21.6.45, 19.7.45 and 17.8.45.

2. C.E.A.D.'s design D.4(L)921/X/214 has been passed by Sec. P.P. to C.S.A.R. for criticism. The Panel doubt whether a strip of primed cambric will reliably transmit ignition for so long a distance.

General Armament Division, R.A.E. S.6 Test Record No. 299 dated 17th October, 1945.

"Previous Reports:

(i)	Test Record No.	BGD.	228	dated	22.6.45 -	Stability Trials)
(ii)	"	"	234	"	21.6.45 -	Functioning ")
(iii)	"	"	256	"	19.7.45 -	" "
(iv)	"	"	268	"	17.8.54 -	" "
(v)	"	S6	292	"	20. 9.45-	" "
(vi)	"	S6	293	"	15.10.45-	Ballistic "

1. Introduction

Test Records, (i)-(iv) above, show that despite various adjustments made and put to test in many floats, generally to the original S.P.R.A. design, to obtain satisfactory and consistent functioning, the success achieved was of a very

low order. Consequently further stores, redesigned by Messrs. Schermuly for improved buoyancy and ignition, which gave promising results in buoyant static functioning trials, were subjected to the air dropping trials (Arm S.6 Test Record No.292 refers) to show that whilst buoyancy was in general maintained after impacts from 2,000 ft., 80% of the these stores failed due to faulty ignition.

A further trial of these stores, incorporating modifications to the ignition system, from heights complying with the operational requirements was requested by R.D.Arm.8.c.

2. Description of Stores

The stores under trial were identical in external appearance and generally similar in assembly to those employed in the previous trial (Arm. Test Record No.292 refers), excepting that the flash receiving ends of the Bickford fuzes were turned to face the flash from the fuze magazine, and that the burster emission discs were all of the pressed tin plate type employed with half of the stores tested in the previous trial referred to above.

3. Object of Trial

To investigate the functioning of the floats when released from 5,000 ft. and over.

4. Conduct of Trial

Twelve floats were chute launched singly into 30 ft. of water from a Lancaster aircraft flying at 180 m.p.h. I.A.S. Four floats were released from 5,000 ft., four from 10,000 ft., and four from 15,000 ft. Where possible, the floats were recevered after the trial.

5. Results of Trial:

A summary of the results obtained is given in Table 1.

Only one of the twelve stores functioned satisfactorily.

Five stores, Nos. 3, 6, 8, 10 and 12 all with noses satisfactorily separated, were recovered.

Examination showed that whereas No.3 store which functioned satisfactorily was undamaged, Nos. 6, 10 and 12 had failed owing to damage sustained at the tail ends which resulted in flooding and consequent sinking of the stores.

The damage in stores 6 and 12 was confined to severe localised indentations across the soldered body tail cone joint, but with store No.10 the tail was completely severed from the body in a manner suggestive that a considerable axial force had been applied since the retaining rivets were sheared and the rivet holes appreciably elongated aft.

The ignition of stores 6 and 12 broke down owing to wetting of the top primed cambric disc, the burster discs being consequently intact. It was observed, however, that burning of the top primed cambric disc and initial ignition of the candle of store No.10 had been satisfactory prior to the tail becoming detached.

Store No.8 was recovered with its burster disc intact and, although no visible sign of damage was evident which would explain water ingress, a considerable quantity of water contained in the central body portion could be removed only by breaking down the store.

6. Conclusions

(i) It is believed from visual observation that all the fuzes functioned satisfactorily.

(ii) That the stores not recovered sank due to non-seperation of the noses from the bodies is considered improbable having regard to the satisfactory experiences in this respect in earlier trials.

(iii) It is considered that structural damage is the primary cause of total failure. Damage of this nature might be attributed to the conjoint effects of low inherent store strength and bad impact attitude which would arise from ballistic instability. Acceptable ballistic performance is, however, given to the store from the ballistic investigations undertaken and referred to in Arm. Test Record No. S.6,293.

Alternatively it is not discounted that faulty ignition (a feature evident in all previous trials) may be responsible for structural damage and water ingress. The nature of the failures of stores Nos. 8 and 10 and inexplicable failures that have occurred in earlier trials may support the theory that an excessive ignition pressure coupled with non-rupture of the burster disc may result in structural damage or produce vacuo conditions in the interior of the store which would allow a rapid ingress of water up the tubular Bickford fuze guides to the quickmatch, or candle ignition end, where many past failures have occurred.

7. Recommendations

Trials involving upwards of 150 stores of various experimental design assemblies have ~~not~~ many been undertaken on this project with extremely poor results. The high percentage and many types of failures experienced suggest that the S.P.R.A. design is fundamentally unsound, and that past experience and the promise shown by the Albright and Wilson sodium phosphide filled H.T.V. Smoke and Flame floats in the trials (P.P.520) be co-ordinated in a redesign which will satisfy the requirements."

D.N.O. to Sec. P.P. on N.O.6989/45 dated 22.6.45

"Re P.P.354, Para.4 of Action. The Naval Staff have confirmed that a terminal velocity of at least 600 f.s. is required for this Store. They are anxious that development

should be pressed forward so that the store may be available for new aircraft designed for it.

2. It is important that the filling of this Float, which will be carried in large numbers, should be suitable for stowage below docks in aircraft carriers, in order to relieve the congestion of weather deck stowages. For this reason a sodium phosphide filling is not favoured though it has been accepted for certain practice bombs used in much smaller quantities.

3. It is therefore requested that the development of the S.P.R.A. float may be given high priority.

C.E.A.D. to Sec. P.P. dated 8.1.46

"Herewith are two prints of D4(L)1090/X/214 showing sketch of the proposed redesign for the Float Smoke and Flame H.T.V. (not reproduced). You will notice that this design dispenses with the nose pistol used on the previous model designed by Messrs. Schermuly. We have substituted the reversible diaphragm used in the L.T.V. Float since this seemed to give satisfactory results at recent trials. We have stiffened the body with a number of internal diaphragms but otherwise the construction remains substantially as shown on D4(L)921/X/214.

The total weight will be 19.3 lbs. and the calculated T.V. 750 f.p.s. The last figure should not be taken as gospel before confirmation in the wind tunnel. Providing that we employ the built up conical tail, the store should have a freeboard when filled, of 8".

Remarks by the Panel — The Panel agree with the recommendations in paragraph 7 of R.A.E's. report above. The S.P.R.A. design not only suffers from a large number of ignition failures, but also seems to be insufficiently robust to retain buoyancy after impact.

2. C.E.A.D's. new design D.4(L)1090/X/41 contains stiffening members which should reduce the probability of failure due to collapse of the float, and the elimination of the protruding nose pistol should improve the stability in flight. It is, however, by no means clear that the numerous possible sources of failure encountered in the trials of Schermuly's pattern floats have been or can be eliminated in the store on these lines.

3. The only promising development for this type of store is that of Messrs. Albright and Wilson's Sodium Phosphide filled Float reported on in P.P. 520. Unfortunately, the Navy does not like Sodium Phosphide fillings, because of the problems that arise in stowage below and possible flooding of compartments.

ACTION Forward to D.N.O.

2. Ask D.N.O. to note the above remarks in connection with P.P.520.

D.N.O.(L)., D.Arm.R.D., C.E.A.D., C.N.R., C.I.N.O., C.S.A.R., D.R.A.E. and D.A.W.T. for information.

No. P.P. 521 Appendix

S.6. Test Record No.299

Table 1

Functioning Trials of S.P.R.A., H.T.V.
Smoke and Flame Floats
Weston Period - 21.9.45.

Summary of Results

Store No.	Height (ft.)	Speed M.P.H. (I.A.S.)	Time of Burning	Remarks
1	5,000	180	-	Failed. Not seen to resurface.
2	5,000	180	-	Failed. Not seen to resurface.
3	5,000	180	4½ min.	Satisfactory. Recovered undamaged.
4	5,000	180	-	Failed. Not seen to resurface.
5	10,000	180	-	Failed. Not seen to resurface.
6	10,000	180	-	Failed. Not seen to resurface recovered, badly damaged.
7	10,000	180	-	Failed. Thought to resurface. Sank immediately.
8	10,000	180	-	Failed. Resurfaced. Sank. Recovered, undamaged.
9	15,000	180	-	Failed. Not seen to resurface.
10	15,000	180	-	Failed. Recovered. Tail torn completely off.
11	15,000	180	-	Failed. Not seen to resurface.
12	15,000	180	-	Failed. Recovered undamaged.

No. P.P. 522
8.1.46
Former P.P. 354

Float, Smoke and Flame, Aircraft Navigation, High Terminal Velocity with Pyrotechnic Filling. Detachable Nose type. (Ref. 120/1)

Secretary records receipt from D. Arm. R.D. of further reports on this subject, from which the following information is abstracted:-

B.G.D. Test Record No.154 dated 11th December, 1944

8 dummy floats with $6\frac{1}{2}$ lb. cast iron noses to Fordham Pressings design (see P.P.354 para. 15) were chute launched tail first, into 20 feet of water, five from 150 feet and three from 1,500 feet. The noses detached satisfactorily from all except No. 21 which did not surface and was not recovered. Two floats dropped from 1,500 feet suffered damage by collapsing of the buoyancy chamber but no leakage occurred. In addition, one float was concertinaed in two places near the nose.

R.A.E., conclude that the new type of nose is satisfactory, but a slight radius in the corners of the groove on the nose weight should assist in detaching it and thus reduce the force of impact on the float.

They suggest that the buoyancy chamber may not be strong enough to withstand the water pressure at the depth to which it penetrates and recommend pressure tank tests. They recommend also that the retaining bolt thread should be sufficiently free to enable the nose weight retaining plate to be screwed hard against the nose of the float to prevent the weight from tilting on impact.

B.G.D. Test Record No.219 dated 22nd May, 1945, records further trials of dummy floats fitted with Fordham (type D) noses. The nose weight weighed $6\frac{1}{2}$ lbs. and the total weight was $12\frac{1}{2}$ lbs; CG ratio = .2.

Eight were chute launched from 50 ft., five from 6,000 ft., and seven from 2,000 ft., into water 30 ft. deep.

From 50 ft., the stores did not recover from the oscillations imparted by chute launching, which seemed to be aggravated by the slip-stream turbulence between the aircraft and the water. Only four out of eight floated; the noses did not detach from three of the remainder, which were damaged by impact.

Only one store dropped from 6,000 ft., was recovered and this had suffered severe damage which was attributed to forces applied by the inverted conical cavity formed in the water. Similar effects were visible also in one of the stores dropped from 2,000 ft.; two of these sank and were not recovered. It was concluded that under reasonable impact conditions the type D Fordham nose functions satisfactorily, but strengthening of the store and ballistic investigations are recommended.

R.A.E. Test Record No. B.G.D.231 dated 20th June, 1945

Sixteen floats to D4(L)7/X/1 (see P.P.354, Remarks, para.2) were dropped into 30 ft. of water from a Lancaster flying at 180 m.p.h. Four type A (flat nose) and four type B (radiused nose) were dropped from 50 ft.; four more type B and four type C (hemispherical nose) from 1,000 ft. The latter were seen to be unstable in flight. None floated after impact. Although the screws had sheared, the noses were firmly jammed on the noses of those floats which were recovered.

Remarks by the Panel — In view of para.2 of the Remarks in P.P.435, and the disappointing results obtained in the trials described above, no further development on the above lines has been attempted.

ACTION · Forward to D.N.O.

2. Ask D.N.O. to note the above in connection with P.P.s 520 and 521.

D.N.O.(L)., D.Arm.R.D., C.E.A.D., C.N.R., C.I.N.O., C.S.A.R., D.R.A.E. and D.A.W.T., for information.

No. P.P. 523
8.1.46
Former P.P. 370

Flash, Photographic, 4.5 in., Mark III. Use of Pyrotechnic Bursters. (Ref. 46/1)

C.S.A.R. to Sec. P.P. on XC(4)1005/5/14 dated 15.12.45

"The Mark III photographic flash with C.E. burster has a low luminous efficiency measured in terms of candle-seconds per gram of flake aluminium powder in the main filling. The Mark III* photographic flash with T.N.T./A1. burster has a higher luminous efficiency which may be due either to the higher initial temperature produced by the explosive or to better ignition of the cloud of aluminium powder by the propulsion of burning aluminium particles from the explosive through it.

It was thought that the aluminium cloud could be carried further by substituting a burster of pyrotechnic composition for T.N.T./A1. For this purpose the central burster tube was filled with 1.1/8-lbs. composition S.R.801A.

In another type of flash a length of cordtex was situated in the middle of the S.R.801A in order to speed up the rate of explosion and the rate of dispersion of the burning particles through the main filling. A third type of flash had a burster of 1.7/8-lbs. gunpowder G.12.

Each of these types of flash were repeated with magnesium powder Grade VI as the main filling. If S.R.801A gave better ignition of the metal powder cloud, magnesium powder, which is more difficult to ignite than aluminium powder, might be induced to burn more efficiently.

Five flashes of each of the six types were fired. The results are set out in the Tables A and B attached. Curves drawn from the mean results are also attached.

The results may be summarised as follows:-

(1) The intensity-time curves of all the types showed a slow rise to peak intensity and a slow die away. The peaks were very broad and were reached at periods varying from 36 to 91 milliseconds after initiation.

(2) The highest peak intensity was obtained with S.R.801A, the next highest with S.R.801A and cordtex and the lowest with gunpowder.

(3) The peak intensities and the luminous outputs of aluminium powder flashes were higher than those of the corresponding flashes filled magnesium powder.

(4) The luminous output of the flashes varied with the peak intensities. That of the aluminium powder-S.R.801A flash was very high and was twice that of the Mark III* flash. It gave 10 x 10^6 candle-seconds in the first 50 milliseconds. The greater part of the light from the other types of flashes occurred after 50 milliseconds.

(5) The duration of one tenth peak intensity was about one fifth of a second for all flashes.

Flashes with burster of S.R.801A produce more light than those with H.E. bursters; and those filled aluminium powder-S.R.801A will be further examined. None of the other types are considered promising enough to justify further work with them."

C.S.A.R. to Sec. P.P. on XC(4)1005/5/15 dated 4.1.46

"Further to this Department's minute dated 15.12.45, the radii and projected surface areas of the flashes (assumed circular) produced by bursters of S.R.801A and gunpowder have now been computed from the photographs taken

with a cine-camera giving 60 frames per second. They are shown in the following table, which includes also the characteristics of the flashes, and they are there compared with the corresponding figures of the Mark III* flash.

Filling	Burster	Time to peak m. sec.	Peak (candles x 10^6)	Radius (cms)	Projected Surface area (sq. cms)	Total light (candle secs. x 10^6)	Luminous efficiency candle-sec. per gram.
Mag.VI	S.R.801A	52	141	360	405,000	17.1	5040
	S.R.801A & cordtex	64	99	380	450,000	14.4	4240
	Gunpowder	91	59	320	320,000	10.6	3120
Al.	S.R.801A	36	254	320	320,000	22.9	6600
	S.R.801A & cordtex	42	175	340	360,000	20.4	6000
	Gunpowder	42	62	320	320,000	7.1	2090
Service	Mark III*	6	368	450	635,000	9.11	2700

2. The outline of all the flashes is somewhat irregular. The Mark III* flash is the most regular in shape but the photographs show the streaks issuing from the periphery which seem to be characteristic of all flashes burst by H.E. and which may be aluminium powder that has been pelleted or compacted in the explosion. The photographs of the flashes burst by Cordtex also show this effect. The outline of the flash given by S.R.801A is, however, quite clean and free from these streaks. Most of the photographs indicate that there is a central hollow in the luminous cloud.

The characteristics quoted in the table indicate that the intensity of light from the flashes burst by S.R.801A rises at a much slower rate to the peak than that from the H.E. flashes. The photographs show that this is due to a much slower expansion of the luminous cloud. When the cloud reaches the maximum intensity it is only half the area of the H.E.-burst flashes at the same point. Yet the total output of light per gram was $2\frac{1}{2}$ times as great, the largest ever recorded for aluminium. The peak intensity was more

than two-thirds that of the H.E.-burst flashes. A burster of H.E. therefore ignites the aluminium much more quickly and produces a much larger luminous cloud, the intensity of which falls off rapidly from a peak which is somewhat higher than that produced by S.R.801A. Because of the difference in the projected area, it would seem fair to conclude that the temperature of the H.E. cloud is lower than that of the S.R.801A cloud. This greater loss of heat from the H.E. cloud might be due to the forced convection of the luminous particles through the air, or to some of the aluminium powder being compacted by the explosion, or to incompleteness of the oxidation of the aluminium. The poor results obtained with gunpowder indicate that all the aluminium powder was not ignited.

The results obtained with magnesium powder are fair, but it is suspected that some of the magnesium had compacted together and it is not considered that the best results have yet been obtained with this metal. The gunpowder bursters did not seem to ignite all the magnesium powder.

3. This examination of the results indicates that the following experiments might be carried out.

(1) To find the effect of using different sizes of burster of S.R.801A.

(2) To try aluminium-magnesium alloy which is more readily ignited than aluminium by explosives of the gunpowder type.

(3) To try to fill up the hollow shown in the photographs of the luminous clouds by using shortened burster tubes filled with aluminised H.E. and with S.R.801A."

Remarks by the Panel

Noted. The Panel assume that the projected area of the flash occupied by the burster of S.R.801A would be vulnerable to Incendiary or H.E. Ammunition, and that the relative safety of the store would be correspondingly impaired.

ACTION

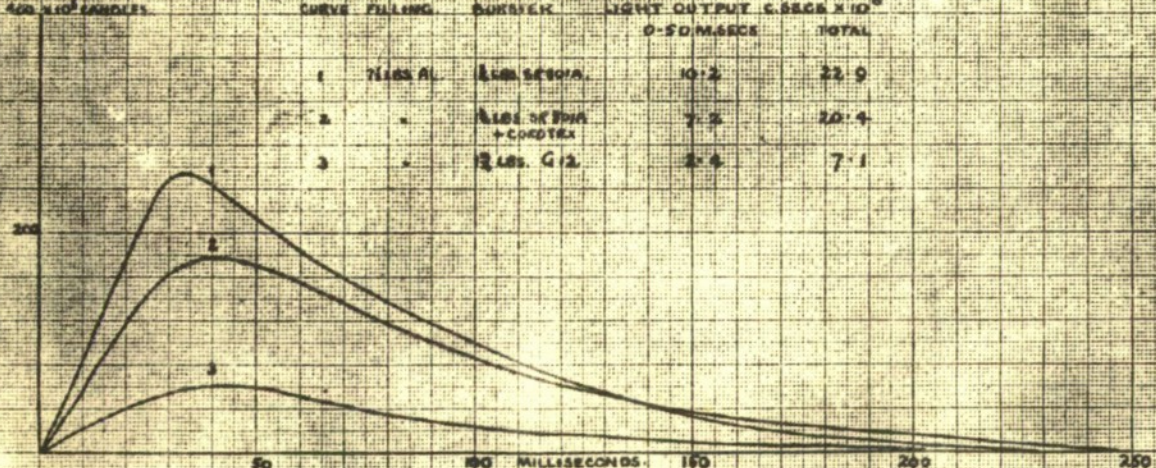
Forward to Sec. P.I.F.I. for information of the Photoflash Panel and any remarks they may wish to make. D.Arm.R.D., D.N.O., C.N.R., D.Arm.R., Sec. N.P.C.S., R.A.E. (Armt.)., R.A.E. (Photos), D.D. (Photos), (A.M.)., R.D. Photos (M.A.P.), U.S. Naval and Military Attaches, B.A.C. and B.C.S.O. Washington, A.D.S.A.E./F. (M.A.P.), C.S.A.R., C.E.A.D., C.C.I., A.D./X2. D.O.F.(F), N.R.C. Canada for information.

TABLE A

Mark III container filled 7½-lbs.
Aluminium Powder ex B. M. P.

Burster	Flash No.	Duration milliseconds					Peak Intensity million candles	Luminous output million candle secs.			Luminous efficiency candles secs. per gm. metal
		Total	At 1/10 Peak	At 3/4 Peak	To Peak	T.T 3/4 Peak		To 50 m. secs.	After 50 m. secs.	Total	
S.R.801A 1.1/8-lbs.	1	225	158	36	30	18	241	11.1	13.1	24.2	7100
	2	237	148	30	40	24	268	10.2	11.2	21.4	6250
	3	195	149	36	38	20	232	8.3	10.2	18.5	5430
	4	245	163	45	30	18	255	10.8	14.6	25.4	7470
	5	245	150	31	36	23	274	10.7	14.6	25.3	7400
	Mean	229	154	36	36	21	254	10.2	12.7	22.9	6600
S.R.801A 1.1/8-lbs.+ Central Cordtex	1	200	157	47	39	19	181	7.1	11.5	18.6	5470
	2	262	195	53	38	18	172	7.2	14.5	21.7	6400
	3	260	227	50	38	22	157	7.0	12.6	19.6	5760
	4	265	157	37	38	27	217	9.0	11.8	20.8	6130
	5	260	216	70	57	22	149	5.8	15.8	21.6	6320
	Mean	247	191	52	42	22	175	7.2	13.2	20.4	6000
Gunpowder G.12 1.7/8-lbs.	1	190	160	65	38	13	43	1.8	2.8	4.6	1360
	2	225	196	36	45	27	85	3.5	5.2	8.7	2550
	3	305	251	56	45	27	92	3.7	10.2	13.9	4100
	4	202	175	32	33	20	27	1.1	1.5	2.6	760
	5	215	186	14	45	29	62	2.2	4.0	6.2	1820
	Mean	227	193	42	42	23	62	2.4	4.7	7.1	2090

FLASH PHOTOGRAPHY 4·5 INCH MARK III.
PYROTECHNIC BURSTERS.



CURVE	FILLING	BURSTER	LIGHT OUTPUT C.SECS x 10^6 0-50 M.SECS	TOTAL
1	7½ LBS. A.	½ LBS. SEQUIN.	10·2	22·9
2	"	½ LBS. 3" DIA. + CORDTEX	7·2	20·9
3	"	½ LBS. G12.	2·4	7·1

FLASH PHOTOGRAPHIC 4·5 INCH MARK III.
PYROTECHNIC BURSTERS.

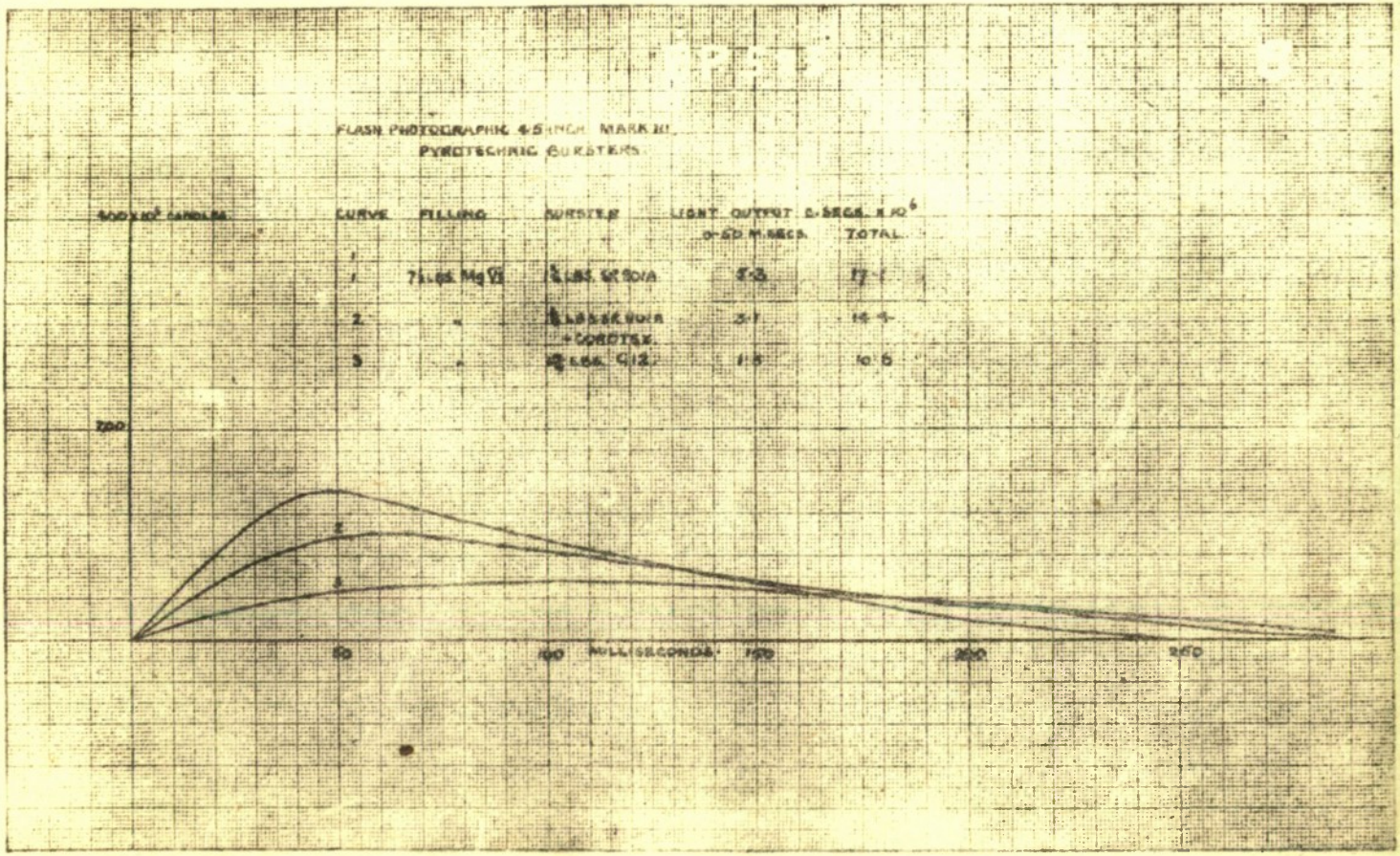


TABLE B

Mark III container filled $7\frac{1}{2}$-lbs. Magnesium Powder Grade VI

Burster	Flash No.	Duration milliseconds					Peak Intensity million candles	Luminous output million candle secs.			Luminous efficiency candle secs. per gm. metal
		Total	At 1/10 Peak	At 3/4 Peak	To Peak	To 3/4 Peak		To 50 m. secs.	After 50 m. secs.	Total	
S.R.801A 1.1/8-lbs.	1	262	220	64	58	28	137	5.2	11.6	16.8	4940
	2	203	168	43	38	20	134	5.6	7.7	13.3	3920
	3	250	196	61	58	32	150	5.4	13.0	18.4	5410
	4	253	199	61	42	23	145	5.8	12.0	17.8	5220
	5	285	246	81	65	34	138	4.8	14.7	19.5	5700
	Mean	251	206	62	52	27	141	5.3	11.8	17.1	5040
S.R.801A 1.1/8-lbs. Central Cordtex	1	220	167	51	46	23	102	3.9	12.0	15.9	4680
	2	310	253	78	68	25	95	3.1	8.4	11.5	3380
	3	325	269	140	83	25	99	2.5	12.3	14.8	4350
	4	312	260	99	60	30	102	3.6	14.7	18.3	5370
	5	280	244	84	63	34	99	2.6	9.2	11.8	3470
	Mean	289	259	90	64	28	99	3.1	11.3	14.4	4240
Gunpowder G.12 1.7/8-lbs.	1	380	349	190	178	23	66	2.3	9.9	12.2	3600
	2	415	393	202	143	71	108	1.6	18.3	19.9	5830
	3	255	242	112	83	53	32	0.7	2.0	2.7	790
	4	260	217	98	61	26	55	1.9	6.3	8.2	2400
	5	275	231	95	90	43	35	1.2	4.5	5.7	1680
	Mean	317	286	137	91	43	59	1.5	9.1	10.6	3120

No. P.P. 524
8.1.46
Former P.P. 284

Pyrotechnic Stores in Mercantile Marine: Replacement on Age. (Ref. 147/1)

Sec. P.P. to Sec. Ministry of War Transport dated 7.11.45 (Ref.147/1)

"Arising from P.P. Minute No.284, copy attached, the Panel instructs me to ask for a list of all the Pyrotechnic and Smoke Signal Stores that may be carried in the Merchant Navy, with the Designs and Specifications to which they will be made, so that age condemnation limits, suitable to the various compositions used in fillings and to the way in which the fireworks are packed and stored on board, can be reviewed in due course.

2. It appears to the Panel that the pre-war practice of scrapping fireworks that are two years old, even if they have never been removed from their original packages for "ready use" purposes, may be an unnecessary extravagance."

Director General, Ministry of War Transport, to Sec. P.P. on M.15043/45 dated 6.12.45

"In reply to your minute of the 7th November, regarding age limits for pyrotechnic stores carried by Merchant ships, (your reference 147/1) I have to inform you that provision of appliances of this nature in peace time is a matter for the shipowner concerned. Pyrotechnics such as rockets, flares etc. are therefore obtained by shipowners direct from the trade or through normal trade channels and paid for by the shipowners.

As you are probably already aware, the special war-time arrangement whereby your Ministry designed and placed contracts for pyrotechnics on behalf of this Department was cancelled a few months ago in anticipation of a reversion as soon as possible to peacetime practice.

In peace-time it is not the practice of this Department to lay down detailed specifications which must be followed by the manufacturers of pyrotechnics and the regulations regarding them are limited to a plain statement as to the type of signal to be provided. Their suitability for their intended purpose is then determined by actual test at the makers' works and where necessary, under service conditions at sea.

While, under war-time conditions, it would have been advantageous in the national interest to extend the life of pyrotechnics beyond the two years' limit for the special purpose of conserving supplies of the requisite explosives and the containers, similar considerations do not apply in peace-time. For this reason, the Ministry feel that it would be very undesirable to depart in peace-time from the pre-war practice of requiring pyrotechnics carried in merchant ships to be renewed, if not previously condemned, after a period of two years from the date of their manufacture, since experience has shown that the conditions under which they are stowed on board merchant ships, (particularly in life-boats) and the constantly changing climatic conditions which they are called on to endure, vary so much that it is frequently necessary to have them renewed within a less period than two years from the date of manufacture."

Sec. P.P. to the Director General, Ministry of War Transport dated 27.12.45

"The Panel thanks you for your answer dated 6th December, 1945, to our enquiry of 7th November, 1945, and agrees that no further action by Government Departments need apply to pyrotechnics purchased by Owners for Merchant Ships in peace time."

ACTION D.N.O., D.N.O./L., D.A.S., C.I.N.O., D.D.I.Arm., C.I.A.(A)., D.T.D. Admiralty, M.W.T. for information.

No. P.P. 525
22.1.46
Former P.P.s 514 and 514A

Cartridges and Pistols Signal 1 in. Service Policies about Future Use. (Ref. 87/3)

D.A.W.T. to D.N.O. on N.O. 9788/45 dated 8.1.45

"The decision to retain the 1 in. Pistol and Cartridges and not to adopt the Roman Candle was reached in agreement with D.N.A.O., whose responsibility this is."

D.N.O. to Sec. P.P. (through D.A.W.T. and D.N.O./L) on N.O.10321/45 dated 13.12.45

"Ref. P.P. 514, Paragraph 2 of Action.

It is confirmed that the Signal Distress 2 Star Red will continue to be used in "K" type Dinghies."

Remarks by the Panel — The Panel is informed by D.Arm.R.D., in answer to P.P. 514, Action, Paragraph 3, that the situation is as stated in P.P. 514, except that ultimate supersession of the 1 in. Cartridge and Pistol in the R.A.F. has been recommended to Air Staff. In the interests of economy, however, it is probable that the 1 in. Pistol and Cartridge will remain in service while stocks of cartridges last.

ACTION — Noted.

Forward to D.N.O., D.G. of A., D.Arm.R.D., D.A.W.T., D.N.A.O., D.S.D., C.I.N.O., C.N.R., D.A.S., C.I.A., D.D.I.Arm., C.S.A.R., C.E.A.D., E.29. O.C.O. India, B.S.A.C. Washington, A.M.R. and Sec. O.B. for information.

N.B. This minute contains confidential matter of American origin.

No. P.P. 526
19.2.46
Former P.P.s as given in notes below

Magnesium Powder for Flare Compositions. Canadian Blown Magnesium Powder and American Magnesium Powders, Atomized or Milled
(Refs. 95/1, 95/5 and 87/5)

Notes by the Panel

1. (a) British wartime experience with American Magnesium Powder Grade C, used in T.I. Flare Candles, is given in P.P.s 135, 236 and 322: and

(b) with Canadian Blown Magnesium Powder, used in T.I. Candles and Reconnaissance Flares, in P.P.s 92, 172, 203 and 403.

(c) P.P. 203 deals with the modification of Specification C.S.787 to include High Density (Blown) Powders, "Heavy" Grades 0, 3 and 5.

2. American reports on tests of the Stability of Magnesium Compositions repeatedly state that:-

"The best results are obtained with atomized Magnesium of various types and the worst with Army Grade B, Mg., with Navy 100 mesh Magnesium falling in between".

3. Investigation by the Panel of the Stability of Magnesium in Pyrotechnic Compositions was started in P.P.483, a more stable composition than the present Sodium Nitrate one being needed for the Cartridge Illuminating 1 in.J.

Stability of Magnesium Powders, (reference 95/5 and 87/5)

D.Arm.R.D. to Sec. P.P. dated 25.8.45

"In connection with the recent discussions on stability of magnesium compositions in 1" signal and illuminating cartridges, the work on tracing compositions by the "Metal and Thermite Corporation", Rahway, New Jersey, may be of interest (See N.D.R.C. - Division 8 Interim Report May 15th to June 15th, 1945). This report mentions that the Army, who hitherto used Grade B magnesium in all tracer igniters, have now changed to atomized magnesium.

The typical composition tested consists of magnesium 17%, asphaltum or calcium resinate 2%, and barium peroxide 81%. The tests were carried out at 60°C and 75% relative humidity. Dichromated atomized magnesium is found to be definitely more stable than untreated atomized magnesium, which is approximately equal in stability to dichromated magnesium - aluminium alloy (50/50). Grade B magnesium is far inferior in stability, and the improvement produced therein by the dichromate treatment, although considerable, does not bring it into the same class as the atomized material."

Extracts from report on a visit to the U.S. and Canada, October 10th to November 22nd, 1945, by Mr. J. C. Cackett (C.S.A.R.)

"4.3. Magnesium Powder (Ref. 95/1)

Considerable trouble had been experienced in obtaining specified rates of burning and intensity in flares and signals owing to the great variability in the properties of magnesium powder. The same complaint was raised at the Naval Armament Depot in connection with the manufacture of Star shell and it was understood from Dr. Harrison that he had heard likewise at Suffield Arsenal in Canada, and elsewhere. The

opinion was unanimous that owing to the varied form of the magnesium particle obtained by mechanical methods of production it was impossible to lay down rigid specifications of particle size and shape, characteristics on which the pyrotechnic properties of compositions appear to depend very intimately.

All these establishments had experimented to a greater or lesser degree with atomized magnesium powder manufactured by the Consolidated Mining and Smelting Co., Montreal, and were satisfied that this type of powder would be the solution to their problems. The uniformly shaped particles can be readily graded in size to within narrow limits and a uniform powder, not subject to segregation, results."

"5.1 Illumination

The illuminating compositions used by the Americans usually contain the following ingredients:- Magnesium powder, Aluminium powder, Barium nitrate, Paraffin wax and sometimes Sodium Oxalate.

The variability of the pyrotechnic properties of magnesium powder was a constant source of trouble; often the rates of burning of compositions varied with magnesium powder from the same drum owing to segregation of the particles. The use of atomized magnesium powder was strongly advocated. Some investigations had been made with this powder and it had given satisfactory results.

It was explained that 8 to 10 per cent aluminium powder was always mixed with the magnesium powder in order to obtain regularity of burning. The reason was not clear. Sodium oxalate was used to increase the illumination.

They used a fairly high proportion of paraffin wax in their compositions and allowed for its specific heat in calculations as they considered it to be an important factor.

Dr. Harrison was of the opinion that its heat of vaporization might have more effect. During their investigations they had found that the bulk density and particle size of all the ingredients, that is, the nitrate and $Na_2C_2O_4$ as well as the metal powders, had a considerable effect on the rate of burning of the flare. They had investigated this phenomenon very thoroughly and had determined the relationship between the physical properties and the pyrotechnic effects produced by means of the statistical analysis of the results of many experiments.

They were not aware of the increase in luminous efficiency of $Ba(NO_3)_2$ compositions when some strontium nitrate is added but they were interested and proposed to investigate it later.

It was considered that in order to get the greatest luminous efficiency from a composition it should be balanced both in regard to the chemical reactions taking place and to the physical properties of the ingredients."

Existing British Stock of Canadian Blown Magnesium (Grade O Heavy)

Sec. P.P. to A.D.X.2. dated 27.9.45, ref. 95/1

"The Pyrotechnic Panel understands that the question of disposing of stocks of Pyro. ingredients is under consideration. I am instructed to inform you that it is desired that, if practicable, any supplies of Canadian Blown Magnesium now in this country should be retained for further experimental or production uses."

A.D.X.2. to Sec. P.P. on 285/Mats/42 dated 3.10.45

"In accordance with the requests contained in your communication of 27.9.45 steps have been taken to retain for further experimental or production uses the remaining stock of Canadian Blown magnesium powder."

Note by the Panel

C.C.I. having reported that about 87 tons of this Canadian material remains in stocks, C.S.A.R. has asked A.D.X.2. to keep all of it.

Remarks by the Panel

The Panel is of the opinion that "Blown" Magnesium Powders in Pyrotechnic Compositions deteriorate much more slowly than ordinary mechanically disintegrated materials.

2. The Panel RECOMMENDS that -

(a) Pyrotechnic Compositions containing Grade O Heavy Magnesium should be used in future manufacture wherever they are already approved, e.g. Composition S.R. 571B instead of S.R. 562.

(b) C.S.A.R. should examine the possibility of replacing the compositions containing British Magnesium Powders at present approved for use in either Signal or Illuminating Pyrotechnics, by compositions containing an appropriate grade of "Blown" Magnesium Powder and should recommend the necessary modifications to the specifications, etc. as the work proceeds.

(c) Manufacture of Blown Magnesium Powders should be started in Britain. The reports from Canada show that the process has gone on in that country for a long time without serious accidents or difficulty and with satisfactory and economical production of very large quantities of the Blown Magnesium Powder.

Note by the Panel. Members of the Panel were informed that in Canada the atomized magnesium is made by allowing molten Magnesium to flow into a stream of nitrogen from a high pressure jet. The process is described in an article "Magnesium in Powder Metallurgy", by E. J. Groom, in "Light Metals", February 1938, p.p. 33 and 34, and some details of the plant at Traill, B.C. are given in P.P. 172. The process is protected by Nichols's patents U.S. 1351865, 1356780 and 2371105.

ACTION

Forward to D.N.O., D.G. of A., D.Arm.R.D., C.S.A.R., C.C.I., A.D.X.2, and B.S.A.C. to note the Panel's recommendations.

2. Ask AD/X2 to investigate the possibility of home production of Blown Magnesium Powders.

3. Ask C.S.A.R. to tell the Panel what amounts of Magnesium Grades 3 Heavy and 5 Heavy will be necessary for the proposed investigations.

4. Ask B.S.A.C. to obtain, if possible, a copy of the report on the relationship between the physical properties and the pyrotechnic effects produced, referred to at X. on page 4 above.

D.N.O./L., Sec. O.B., C.E.A.D., C.I.N.O., C.I.A., D.D.I.Arm., Sec. P.I.F.I., B.C.S.O. Washington, D.G.O.F., C.S.L.O./N.R.C., A.M.R., M.L.O. (N.Z.), U.S. Naval and Military Attaches, O.C.O. India for information.

No. P.P. 527
19.2.46
Former P.P. 415

Marker, Smoke, Yellow. For Homing Aircraft. Development Trials. (Ref. 35/3)

On N.O. 9143/44 C.S.A.R. to Sec. P.P., reference XC(4)0026/1/21 dated 1.2.46, forwards trial report from Admiralty Docket G.O.14611/44, reproduced below:

"Will you please say whether the remaining Floats should be filled and whether a design should be prepared."

TRIAL 91 - Use of Small Floats to assist Aircraft Landings in bad visibility

"The trial with Markers Yellow Smoke Mark I Modified (Manufactured at Bridgend) was carried out with a Firefly in conditions of low drifting patches of sea fog, visibility varying from $\frac{1}{2}$ to 3 miles.

2. The aircraft was directed in by R/T on a bearing of Red 160° from a distance of 6 miles, the ship steaming into wind at 15 knots, giving a windspeed over the deck of 20 knots.

3. When the aircraft was approximately $2\frac{1}{2}$ miles away the Smoke Floats were thrown over the port quarter of the ship singly at 15 second intervals, 25 smoke floats in all were used. This spaced the smoke floats at about 130 yard intervals giving a total length of 3,000 yards. It had been found in previous trials with the lighter coloured smoke that:-

(a) 50 yard intervals are too close together.

(b) A good long line is necessary for the pilot to get an accurate check on the ship's course.

4. The pilot, who was at times "popeyed" in fog banks reports:-

(a) The modified Mark I Smoke Floats with the dark yellow smoke are very much easier to see than the light yellow smoke in low visibility.

(b) The long line of smoke floats would give him more time to steady up accurately on the ship's course.

(c) The psychological effect is great. The pilot realises he is nearly home and will soon sight the carrier, and that his period of blind flying has brought him in touch correctly.

(d) In fog with a glassy sea they show the surface of the sea, and aid him in maintaining the correct height.

5. These smoke floats would be no use if used in conjunction with Type 961 Talk Down procedure. The smoke floats lie on a line directly astern, whereas the aircraft approaches up a bearing between Red 150° - Red 135°, and therefore the pilot would never sight them on his approach. They would, however, be of use were the pilot waved round again."

Remarks by the Panel — Noted.

2. With regard to paragraph 4(a) of the report of the sea trial, the Panel has not seen the reports of any trials with the "light Yellow Smoke" there mentioned.

ACTION — Forward to C.S.A.R. and D.N.O.

2. Ask C.S.A.R. to forward to C.E.A.D. information on the filling of the Markers successfully tested in this Admiralty trial.

3. Inform D.N.O. that the Panel RECOMMENDS that the remaining empty Markers should be filled for further sea trials or Service use, as necessary; and that designs be prepared by C.E.A.D.; and request that C.E.A.D. may be so instructed, if D.N.O. concurs.

C.N.R., D.N.O./L., D.Arm. R.D., C.I.N.O., D.Arm.R., C.E.A.D., D.A.C.R., D.D.I.Arm., D.O.F./F., D.A.W. and D.A.O.T. for information.

No. P.P. 528
19.2.46
Former P.P. 60

Fire Risk with Illuminating Stores in Vessels of Coastal Forces
(Ref. 79/1)

Extracts from N.O. 7719/43

C.S.A.R. to Sec. P.P. (reference 2304/43(25)) dated 13.1.45

"There is no progress to report and on account of the low priority allocated, there is little prospect of the investigation being actively pursued in the immediate future".

Minute 6

Sec. P.P. to C.S.A.R. dated 6.11.45

"Before asking D.N.O. whether it is desired that this investigation should go on, the Panel asks for your remarks about the likelihood of any success in getting Illuminating Compositions that are immune to impact of bullets, etc.

Minute 7

C.S.A.R. to Sec. P.P. (reference XC(4) 0503/11/2) dated 19.11.45

"It is thought that there is little likelihood at present of finding any illuminating composition which is proof against ignition by small arms fire".

Minute 11

D.N.O. to Sec. P.P. and C.S.A.R. dated 8.2.46

"In the light of C.S.A.R.'s remarks in Minute 7 the Naval Staff have now agreed that this investigation can be dropped."

ACTION Noted.

D.N.O., D.G. of A., D. Arm. R.D., Sec. O.B., C.I.N.O., C.I.A., D.D.I.Arm., C.S.A.R. C.E.A.D., Sec. P.I.F.I., for information.

No. P.P. 529
19.2.46
Former P.P. 335

Charcoal for Rocket Compositions. (Ref. 2/1)

Trials with Beech Charcoal made by R.O.F. Chorley

A.D.F.F./D/Pyros. to Sec. P.P. dated 25.9.45

"Samples of homogeneous Beech Charcoal, manufactured at R.O.F. Chorley under controlled conditions, were forwarded to Messrs. Brock and Schermuly.

These samples had the following characteristics:-

Sample 1	Sample 2
Size 52 Nominal	Size 120 B.S. Nominal
Carbon 78.1 - 77.9	Carbon 77.8
Ash 1.72 - 1.61	Ash 1.70
V.M. 7.4 - 5.3	V.M. 7.5

Sieving		Sieving
Retained 52 B.S.	0;0	0
Retained 120 B.S.	16.0, 16.0	0
Passed 170 B.S.	64.5, 64.5	83
Passed 240 B.S.	58.5, 56.5	70.5

BROCK

Composition was made up following the procedure put forward by C.S.A.R. being passed three times through a 40 B.S. sieve and with ingredients in the following proportions:-

Potassium Nitrate	62%
Sulphur	15%
Charcoal	23%

Sample 1

4" Column test 16.6 Secs.
16.6 "
16.4 "

Rockets were too weak
Composition adjusted.

Potassium Nitrate	67%
Sulphur	13%
Charcoal	20%

4" Column test 14.0 Secs.
13.8 "
13.8 "

Rockets were excellent.

Sample 2

4" Column test 13.6 Secs.
13.6 "
13.8 "

Rockets were excellent.

Fifty rockets of each sample were fired and it was then determined to give normal cold magazine storage conditions to the remaining rockets, taking ten for test each week to examine change in performance and also to send samples to C.S.A.R.

Again height measurement on the first batch of ten was not accurate, but on subsequent batches, heights were carefully recorded. No great "sharpening up" was observed after storage but from the stage of initial mix to final trials the Sample 2 had "sharpened" considerably as was seen from test thrust curves.

It would seem that the 4" Column burning test time limits should be reset at 13.5 secs. to 15.5 secs. and that 52 B.S. charcoal is preferable to 120 B.S. charcoal. The reasons for this last statement are as follows:-

(a) Rockets are less liable to sharpen in storage.
(b) Consolidation is more easily effected.
(c) 52 B.S. charcoal is better to handle.
(d) Charcoal can be more readily produced.

This test following others outlined in P.P. Minute 335 make it clear that satisfactory rockets can be made from either alder buckthorn or beech charcoal of a carbon content greater than 75% but that a percentage of "fines" is essential.

SCHERMULY

A sample of the same beech charcoal 52 B.S. made by Chorley was sent on to Messrs. Schermuly who made various trials and finally determined that the most suitable composition had ingredients in the following proportions:-

Potassium Nitrate	67%
Sulphur	10%
Charcoal	23%

They reported, however, that they did not like this charcoal as in their estimation it was slow and could not be made into good rockets. Mixing procedure was exactly as before, the composition being passed three times through a 40 B.S. sieve.

Firing results show great variability, heights attained being between 275 feet and 840 feet. Comparing these results with those obtained at Brocks it would appear that the different filling technique employed is the reason for such variation.

Had more care been taken in the composition adjustment at the initial stages, and selective filling carried out

under controlled conditions, results it is felt would have confirmed the findings following the tests previously outlined."

C.S.A.R. to Sec. P.P. on XC(4)8017/5/35 dated 23.1.46

"Ten rockets made from "120 B.S. Charcoal" and six made from "52 B.S. Charcoal" have been received from Messrs. Brock. Three rockets of each type were fired on the dynamometer. Those made from 52 B.S. Charcoal gave peak thrusts of 37, 31 and 38 lbs. and those from 120 B.S. Charcoal gave peak thrusts of 28, 31 and 32 lbs. The thrust time curves were normal and both types can be regarded as satisfactory, although the peak thrusts of the 52 B.S. type are a little on the high side.

Comments on Messrs. Brock's firing trials of rockets filled with the above compositions are contained in a separate minute to the Panel. Messrs. Brock now appear to be able to make satisfactory rockets with charcoal manufactured by R.O.F. Chorley, and no further work on charcoal is contemplated by this Department for the present."

C.S.A.R. to Sec. P.P. on XC(4)8017/5/34 dated 25.1.46

"A.D.F.F/D/Pyros' report has been read with interest. It is not understood why Brock failed to get good rockets with composition giving a time of 16.5 secs. in the 4-inch column test, or why Messrs. Schermuly failed to get good rockets at all. It is possible that the potassium nitrate and sulphur used by Messrs. Schermuly were coarser and they obtained a slower burning composition, as no time is quoted for the 4-inch column test and it is believed that this test is not used by Messrs. Schermuly. This matter is however of secondary importance, as Messrs. Schermuly were only used as a control and have their own sources of Charcoal from which they make satisfactory rockets. It is however evident that Messrs. Brock have succeeded in making satisfactory rockets using composition giving a time of

13.9 seconds in the 4-inch column test and containing beech charcoal made by R.O.F. Chorley. Some of these rockets have been fired on the dynanometer at Tondu, and gave satisfactory thrust time curves, although the peak thrusts were a little on the high side. These results are being reported in a separate minute to the Panel.

(In the circumstances, it is suggested that the time in the
Y (4-inch column test can be allowed to lie between 14.0 secs.
(and 18.0 secs. instead of between 16.0 secs. and 18.0 secs.
(as at present.

There is no need to lower the upper limit to 15.5 secs. as suggested by A.D.F.F./D/Pyros. because satisfactory rockets can certainly be made with slower burning compositions, and in any case rockets with too slow a performance would be rejected at proof. Fast burning compositions give rockets which will attain a greater height, but rockets filled with slower burning compositions are preferable, provided they attain the height of about 900 ft. (for the Mark III/A) required at proof. Rockets tend to sharpen on storage and it is therefore best to start with rockets which are not working at high pressures, even though their performance may not be so spectacular."

Extracts from Specification C.S. 2142.A. for Rocket Composition

"2. DESCRIPTION. The Rocket Composition must consist of a uniform and intimate mixture of the following ingredients in the proportions by weight as shown:-

	Nominal Proportions	Permissible Variation
Potassium Nitrate, Grade I or Grade II. Size 120	62 per cent	55 - 67 per cent
Sulphur, Grade I or Grade II, Size 120	15 " "	10 - 15 " "
Charcoal, Type G, Size 120 (see also para.3, below)	23 " "	23 - 30 " "

The proportions of ingredients may be adjusted, as necessary, within the limits of "permissible variation" shown above, in order to obtain a composition complying with the time-of-burning requirement given at para.5 (c) below. Such variation of proportions must be applied only as a "fine adjustment" after the required time-of-burning has been approached as closely as possible by suitable grinding of the charcoal (see para.3, below).

The composition must be free from grit, visible impurities and foreign matter.

3. INGREDIENTS. The ingredients must comply with the respective current approved C.S. specification.

In addition the charcoal must be made from beechwood and must be ground to such a state of division that the rocket composition mixed in the "nominal proportions" shown at par.2 above, will comply as nearly as practicable with the time-of-burning requirements given at para.5 (c) below.

4. MANUFACTURE

(a) The composition must be prepared by simple mixing of the ingredients and must not be milled."

"5. EXAMINATION

(c) Time of burning. The time of burning of a 4-inch column of the composition, determined as described in the Appendix, must be not less than 16.0 seconds and not greater than 18.0 seconds."

"APPENDIX

Determination of Time of Burning

Press the composition in eight equal increments, of approximately 18 grains each, under a dead load of 250 lbs. into a steel mould, open at both ends, 1 inch diameter externally, and 0.4 in. diameter internally, and $4\frac{1}{2}$ inches high, so that the length of the pressed column is not less

than 3.8 inches and not more than 4.2 inches. Measure the length of the column accurately and ignite it from one end. Determine the time of burning of the column of composition and thence calculate the corresponding time of burning of a similar column exactly 4 inches in length."

Remarks by the Panel

The situation now appears satisfactory, in so far as all firms should be able to produce satisfactory rockets from the supplies of charcoal available to them.

2. The Panel RECOMMENDS that the recently approved Specification C.S.2142A and all Specifications co-ordinated with it be amended to make the 4 inch column test 14.0 to 18.0 secs. as proposed at Y of C.S.A.R.'s minute.

3. It is observed that this Specification makes obligatory the use of Beech Charcoal only, with which the Panel concurs, in spite of the remark at X of A.D.F.F/D/Pyros' report.

ACTION

D.N.O., D.G. of A., D.Arm.R.D., C.I.N.O., C.I.A., D.D.I.Arm., C.E.A.D., D.A.S., C.C.I., D.O.F./F., I.N.O. Woolwich for information.

No. P.P. 530
19.2.46
Former P.P. 432

Rockets, Signal and Target Practice. Filled I.C.I. Composition. (Ref. 91/1)

I.N.O. Woolwich to C.I.N.O. on C.I.N.O. 4477/45 dated 28.6.45

"1. The following rockets have been received at Messrs. Brock in satisfaction of P.P. Minute No. 432.

No. of rockets	Filler	Lot No.	Date	M.U. from which received
20	C.T.B.	460	9.44	Chilmark
20	"	461	9.44	Chilmark
20	"	564	11.44	Brafferton
19	"	564	11.44	Redcastle

2. A firing took place on 21.6.45 in which 14 rockets of each batch were fired, except the batch from Redcastle of which only 13 were fired.

Dr. Skeen representing C.S.A.R. and Commander Higgins witnessed the trial.

3. Results of trial

Serial No.	Lot 461		Lot 564 B		Lot 564 R	
	Height	Time of Burning Secs.	Height	Time of Burning Secs.	Height	Time of Burning Secs.
1	950	6	800	5.2	N.O.	5.8	700	6
2	850	5.8	600	6.2	900	5.6	1000	6.2
3	750	6	950	5.4	1050	6.2	900	6
4	800	5	800	5.8	850	6	1000	5.2
5	950	5.2	750	6	950	5	800	6.6
6	800	5.8	750	6.2	900	6.6	750	6.8
7	850	5.8	1000	6.4	850	5.8	950	6
8	N.O.	5	700	6	950	6.6	800	6.2
9	700	5.2	750	6	750	6	700	6
10	700	4.8	750	5.4	900	6	850	6.8
11	750	5.4	1200	6.8	650	6.2	950	6.4
12	750	5	1000	5.4	850	6.8	900	6
13	700	5	750	6.2	750	6.4	800	6
14	650	5.2	800	6	800	6.4	-	-
Mean	785	5.37	800	5.93	850	6.1	846	6.17

The times of burning shown are the times from firing the rockets to the bursts.

The heights recorded are approximations only although measured by rake, as there was a considerable variation in the direction of flight.

The rocket with recorded height of 1200 ft. in Lot 461 has been disregarded in working out the mean height as this rocket was observed to fly towards the rake operator.

4. Several rockets were considered too sharp but there were no explosions or prematures.

5. The remaining 6 rockets of each batch have been sent to C.S.A.R. Tondu, for the attention of Dr. Maxwell."

C.S.A.R. to Sec. P.P. on C.I.N.O. 4477/45, ref. XC(4)8017/5/36 dated 7.2.46

"The following are the results of the firing on the dynamometer of 24 of the R.A.F. Rockets filled I.C.I. Composition referred to in para.2 of P.P. 432.

Serial No.	Lot No. 460 Max. Thrust	Lot No. 461 Max. Thrust	Lot No. 564 B Max. Thrust	Lot No. 564 R Max. Thrust
1	38 lbs.	35 lbs.	37 lbs.	38 lbs.
2	37 "	Blew through heading	37 "	37 "
3	40 "	40 lbs.	35 "	36 "
4	37 "	41 "	38 "	37 "
5	41 "	36 "	38 "	37 "
6	36 "	42 "	35 "	37 "

The peak thrusts are somewhat on the high side but the thrust-time curves, with the exception of the round that blew through the heading, were otherwise normal. The functioning of the 56 rounds which were fired into the air appears to have been satisfactory."

Remarks by the Panel — Since no more Rockets will be filled with I.C.I. Milled Composition, the only remaining question is the treatment of accepted Lots of such rockets in the Services. Routine annual proof in Depots should show when any Lots have deteriorated to a point at which they should be condemned.

ACTION — D.N.O., D.G. of A., D.Arm.R.D., D.A.S., C.I.N.O., C.S.A.R., I.N.O. Woolwich, C.I.A., D.D.A.I., C.C.I. for information.

No. P.P. 531
19.2.46
Former P.P. 490

Improved Packages for Pyrotechnic Stores for Tropical Use (Ref. 150/1)

Ref. P.P. 490 Part II. Mould Growth on Paints

M.G.O. India to O.C.O. India

"The following report has now been received from W.T.S.F.F., A.L.F., S.E.A.

"During the pre-monsoon period little or no growths or Fungus were seen on wooden packages, but since the monsoon started mould growths and Fungus are very much in evidence in spite of stack ventilation.

In the wetter areas (low lying) growths similar to the home grown mushroom have been noticed to grow from boxes in a matter of 48 hours.

Boxes affected by moulds definitely deteriorate much quicker and damp seems to strike through to the inside faster, also a box that has been attacked becomes increasingly difficult to dry out.

Cardboard containers (unwaxed) are very quickly affected."

Sec. P.P. to O.C.O. India, ref. 150/1, dated 25.10.45

"Your O.C.O. No. 56/4705/SC dated 19.10.45 with enclosed report by M.G.O., India.

The Panel directs me to ask whether or not the wooden packages in this report were painted."

O.C.O. India to Sec. P.P. on O.C.O. 56/4705/Sc. dated 31. 1.46

"It has been confirmed that the boxes were painted."

Remarks by the Panel — The above shows that paint is not a satisfactory protection for wood in tropical storage, and is in direct contradiction of the experience of B.A.F.S.E.A. quoted by P.P.C.O. (see P.P. 490 Pt. III Sec. 1(a)). The Panel RECOMMEND that steel packages be developed for pyrotechnics which are to be stored in tropical conditions.

Action — D.N.O., D.G. of A., D.Arm.R.D., O.C.O. India, D.A.S., C.I.N.O., D.D.I.Arm., C.I.A./A., C.S.A.R., C.E.A.D., Sec. O.B., D.T.M., Sec. I.S. Packaging Committee, Sec. Inter Departmental Packaging Co-ordinating Committee, D.A.W., D.G. of E., D.D.S.M.3., D.Arm.R., C.C.I., B.S.A.C. Washington, E.29, P.P.C.O., M.A.P., P.P.C.O. M.O.S. for information.

No. P.P. 532
5:3:46
Former P.P.s. 483 and 526

Magnesium Powder - Stability
(Ref. 95/5 and 87/5)

NOTE: P.P. 526 calls attention to the stability of Pyrotechnic Compositions made with atomized (Blown) Magnesium Powders being better than that of compositions made with ordinary ground or flaked materials.

D.Arm.R.D. to Sec. P.P. dated 25.8.45. (This minute appears also in P.P. 526)

"In connection with the recent discussions on stability of magnesium compositions in 1" signal and illuminating cartridges, the work on tracing compositions by the "Metal & Thermite Corporation", Rahway, New Jersey, may be of interest (See N.D.R.C. - Division 8 Interim Report May 15th to June 15th 1945). This Report mentions that the Army, who hitherto used Grade B magnesium in all tracer igniters, have now changed to atomized magnesium.

The typical composition tested consists of magnesium 17%, asphaltum or calcium resinate 2%, and barium peroxide 81%. The tests were carried out at 60°C and 75% relative humidity. Dichromated atomized magnesium is found to be definitely more stable than untreated atomized magnesium, which is approximately equal in stability to dichromated magnesium - Aluminium alloy (50/50). Grade B magnesium is far inferior in stability, and the improvement produced therein by the dichromate treatment, although considerable, does not bring it into the same class as the atomized material."

D.Arm.R.D. forwards to Sec. P.P., ref. 87/5, dated 17.9.45, extract from Division 8, N.D.R.C. Interim Report on Tracer Compositions June 15, 1945 to July 15, 1945

"We have continued to accumulate data on the stability of various types of magnesium in igniter compositions at 60°C, and 75% relative humidity. Our usual procedure of analysing duplicate pellets for gain in weight and metallic magnesium, the latter by hydrogen evolution, has been continued.

The best results are obtained with atomized magnesium of various types, and the worst with Army Grade B Mg, with Navy 100 mesh magnesium falling in between. In order to check our previous good results obtained with a sample of atomized Mg. from Kingsbury Ordnance Plant, we repeated the tests with a sample from Wolf Creek Ordnance Plant. With this second sample the results were even better, showing greater stability than anything tested before. In addition, we found that dichromating of Sample No. 1 atomized (Lot TC627 from KOP) improved the stability above that of untreated material. Presumably, dichromate treatment of Sample No. 2 would make this material still better. Dye treatment by the National Fireworks Process of Sample No. 1 showed a definite improvement in stability but it was not quite as good as the dichromate treatment. The atomized Grade 3 magnesium, sieved to Grade B size, was less stable than the coarser material, as would be expected. It was, however, much better than either Army Grade B Mg. untreated or dichromated and Navy 100 mesh Mg.

In all cases there was less decomposition of metal and less gain in weight of the pellets with calcium resinate as the binder than with asphaltum as binder. The curves for gain in weight show the same relative order for stability as do the loss of magnesium curves. In last month's report we had some data which showed dichromated atomized Mg. with asphaltum as a binder to have less decomposition than with calcium resinate. These data were anomalous in

that the asphaltum composition showed more metallic Mg. after 28 days than after 14 days. The curves, however, have straightened themselves out with the accumulation of further data and we now find greater stability with calcium resinate as would be expected in view of our other work.

It has come to our attention that all of the atomized Mg. used by the Army so far has been made in Canada by the Consolidated Refining and Smelting Company of British Columbia. This company has been using a nitrogen atmosphere for their atomization. It is the intention of the Army, however, to procure atomized Mg. from the Golwynne Chemical Company in this country who use a helium atmosphere for atomization. We have requested samples of the latter material so that we may compare its surveillance properties with the Canadian magnesium. It may well be that differences in the surface films will greatly affect the relative stabilities.

In an attempt to discover the reason for the large difference in stability of atomized Grade 3 and Army Grade B Mg, not all of which would seem to be accountable on the basis of particle shape, we conducted chemical analyses with the following results:

	Mg. Grade B	(Sample No. 1) Mg. Grade 3
Metallic Fe	less than 0.0005%	0.001%
Insoluble Residue	0.035	0.023
Alloyed Al as Al_2O_3	0.014	0.024
Alloyed Fe as Fe_2O_3	0.044	0.054
Manganese	0.039	0.006
Silicon	0.014	0.013
Copper	0.018	Not found
Nickel	Not found	Not found

Surprisingly enough, iron, which has a very deleterious effect on the stability of atomized Mg. even when present in very small amounts, is higher in the atomized than in the

Grade B sample. The only other major difference between the two is the presence of copper in the Grade B sample."

D.Arm.R.D. to Sec. P.P., ref. 87/5, dated 6.10.45 - Deterioration of Magnesium Star Compositions

"Herewith a note giving the latest information on the subject.

Copies have gone to Sec. P.I.F.I. and C.S.A.R."

Stability of Mg. composition Blown Magnesium Powder

"(1) N.D.R.C. Division 8 Interim Report by Metal and Thermit Corporation Rahway N.J. for period of July 15th to August 15th, 1945, (TC 18) contains the result of surveillance tests for 56 days at 60°C and 75% relative humidity on igniter pellets containing barium peroxide and magnesium powdered and treated in different ways.

The best results are obtained with atomized magnesium of various types, both surface treated and plain, and the worst with Army Grade B magnesium, with Navy 100 mesh magnesium falling in between.

Both dichromated atomized Grade 3 Mg. and dye-treated atomized Grade 3 magnesium are more stable than the plain atomized Grade 3 sample. The dye treatment by the National Fireworks Process shows good stability but it is not quite so good as the dichromate treatment.

(2) It had been noticed by High Duty Alloys Ltd.* that when die cast incendiary bomb bodies of magnesium alloy to DTD 281, chromated by the 30 minute hot bath of DTD 911, were sharply struck a glancing blow with an aluminium rod, a flash and minor explosion occurred. Steel or magnesium alloy rods produced similar results, which were not observed

*Laboratory Report No. 2445

in absence of the chromate coating. Abrasion of the surface with a rotating steel wire wheel produced sparks which ceased immediately the chromate coating had been removed.

It was known that the coating consisted largely of chromic chromate, probably intimately mixed with oxides of the basis metal, and it was assumed that the phenomenon is due to a thermit reaction of this material with the magnesium. It was found that 100 mesh powder of magnesium alloy to DTD 594 after chromating for 30 minutes in the hot bath of DTD 911, filtering and drying, would flash on striking and ignited explosively on heating unlike magnesium powder, which burns quietly in the same circumstances."

Remarks by the Panel

The Panel have already recommended in P.P. 526 that Blown Magnesium Powder be used in preference to that prepared by mechanical disintegration, on account of its more consistent pyrotechnic behaviour.

2. They are informed that various modifications to the star construction and priming in Illuminating Cartridges 1 inch are being tested in climatic trials.

3. They RECOMMEND that a composition using a suitable grade of atomized powder be developed for this illuminating cartridge, and tested in comparison with the Service composition in cartridges modified as may appear desirable from the trials mentioned in para. 2.

4. In view of the difficulty in dichromating magnesium, the poisonous properties of dichromate, and the sensitivity of the product as reported above, they do not recommend trials of the dichromate treatment at present.

Action

Forward to D.G. of A., C.S.A.R. and Sec. P.I.F.I. Committee.

2. Ask D.G. of A. and C.S.A.R. to note the recommendation in para. 3 of the Remarks.

3. Ask Sec. P.I.F.I. to inform the Panel whether the studies in progress at Oxford University, on protection of powdered magnesium by sodium fluoride and other compounds, have progressed enough for further trials on the above lines to be recommended.

D.N.O., D.Arm.R.D., C.E.A.D., C.I.N.O., C.I.A., D.D.I.Arm., D.G.O.F., C.C.I., B.C.S.O. Washington, C.S.L.O./N.R.C., A.M.R., M.L.O./ N.Z., U.S. Naval and Military Attaches, Sec. O.B. and O.C.O. India for information.

No. P.P. 533
5.3.46

Primed Cambric. Improvement of (Ref.168/1)

Notes by the Panel

1. On S.B. 11697 dated 10.4.45, D.Arm.R.D. called attention to the occasional failures of pyrotechnic stores through the primed cambric failing to be ignited by the flash from a cap or detonator. It was suggested that the existing specification, Air/499, might need amendment to ensure proper impregnation of the cambric base material, so that the ignition of the priming on one face of the primed cambric should carry on through to the other face with certainty.

2. Since then, the subject has been discussed continually by the Panel with C.I.A., C.C.I., A.D.F.F./D/Pyros. and C.S.A.R.; and the Pyrotechnic Experimental Station co-ordinating Committee, first at Bridgend and now transferred to R.O.F. Swynnerton, has been investigating all aspects of the manufacture and testing of primed cambric.

3. The aim, suggested by the Panel to those concerned, is to recommend "A material which is easier to manufacture to a higher standard of reliability and easier to handle without damage while it is being incorporated in stores". (Item 19 (a) of 52nd P.P. meeting 24.4.45).

4. Meanwhile, Birmingham University has been doing research into "The effect of Moisture and Lithographic Varnish on the Electrostatic Ignitability of various Impregnated Cambrics". (Ref. report S(X)22 dated 1.10.45).

5. At the Panel's suggestion, R.O.F. Swynnerton has sent samples of primed cambric to Birmingham University for tests similar to those recorded in the above report. The results are not yet known.

6. It was remarked by Dr. Leckie (D.O.F.(F)) at the 55th Meeting of P.E.O. Swynnerton that "German pyrotechnics

which he had seen, and the factories in Germany which he had visited, do not use primed cambric at all". (P.E.C. Minute 2/55).

Extracts from report of P.E.C. Investigations: Minute 3/56 (d) of 56th P.E.C. Meeting.

"Mr. Fox tabled a report.

He explained that this is only an interim report covering preliminary work. It is almost entirely factual and and he has made few attempts to draw conclusions, in view of the large amount of further work necessary.

Part I of the Report deals with methods of testing. It was felt that the specified method was unsatisfactory and liable to give false results. By lengthening the strip and making it narrower, variations were accentuated and the presence of "bald" patches more likely to be revealed. The rubbing of the primed strip over a wooden rod would remove any loose priming and simulate the rough usage likely to be received during filling and transport of the complete store. The results did indicate that some correlation existed between weight of priming and quickness of burning.

The apparatus for the through ignition test was produced.

In discussion on this part of the report, W/C. Cresswell pointed out that the origin of the investigation was a request by the Pyrotechnic Panel, following failures of T.I. candles, that a test for distinguishing between good and bad primed cambric should be devised, and a method of manufacturing good primed cambric developed. He considered that the through ignition test was the answer to the first of these, and was prepared to suggest to the Pyrotechnic Panel that they should recommend its adoption to the inspectorates."

"Mr. Fox suggested that this test should be used in parallel with the specification test for a time, for

comparison purposes. In reply to Mr. Forbes, he said that he did not consider the strip burning test necessary in addition to the through ignition test."

"Mr. Forbes pointed out that the minimum specified weight of 700 grains per sq. ft. appears to be a critical point and suggested that the limit should be increased.

It was agreed that detailed drawings of the "Through Ignition Test" Apparatus should be sent to the Inspectorates."

"The Chairman suggested that we recommend to the Pyrotechnic Panel that the specification for primed cambric should be amended to require the following tests:

(i) weight of priming not less than 700 gr./sq. ft.

(ii) through ignition test

(iii) existing burning test to be applied after a standardised rough usage of the strip yet to be determined.

This appeared to be generally agreed, except that Major Ryan suggested increasing the minimum weight to 720 gr./sq. ft.

Part II of the Report

Dealing with the second part of the report, Mr. Fox explained that this described the testing of primed cambric which had been prepared by various methods on the Experimental Station at Bridgend.

The variations in weight of priming observed indicated that present methods are not satisfactory, even when carried out under the best conditions. The specification test is not a criterion of the goodness of the priming. It tested the surface layer of priming rather than the impregnation,

and might therefore be very misleading. W/C. Cresswell declared that he had never heard of a sample of primed cambric which had failed at the specified test."

"The Chairman also expressed the thanks of the Meeting to Mr. Fox, and said that the next step in this work was to devise a standard rough usage test and a satisfactory method of priming cambric. He suggested recommending to C.S.A.R. that trials should be made with a coarser type of cambric or other material. W/C. Cresswell said that C.S.A.R. has a long term investigation into alternative materials in hand. It is not likely that this investigation will be completed in the near future, and they want us to proceed with the development of a method for priming the present material."

Note by the Panel

At this P.E.C. Meeting re Part II of the Report, the subject was also discussed of moisture tests of primed cambric and the relation between moisture content and ignitability. It appears to the Panel that this aspect of the matter merits further investigation, to which the results of the Birmingham University tests on electrostatic ignitability may be very relevant.

Part I of the report of the Royal Filling Factory, Swynnerton, Development Department to the 56th P.E.C. Meeting, "Primed Cambric, method of Testing" is attached as an Appendix.

Remarks by the Panel

1. As regards the testing of primed cambric, the Panel RECOMMENDS that the "Through Ignition Test", using an apparatus like that developed at Swynnerton, should be adopted by Inspectorates and put into the specification as soon as possible.

2. The Panel also RECOMMENDS that the minimum weight of finished primed cambric should be

Remarks by the Panel (Contd.)

increased from 700, as at present laid down in Specification Air/499, to 750 grains per square foot, rather than to 720 grains as suggested by D.G. of A. (Major Ryan).

3. Part II of the R.F.F. Swynnerton Development Department's report deals with improved methods of manufacturing primed cambric and the possible use of a more suitable fabric. These investigations are not yet complete and amendment to the specification, in these respects, cannot be recommended by the Panel until further reports from P.E.C. Swynnerton or C.S.A.R.

4. As regards the existing specified Proof by a burning test, the Panel agrees that this should remain in the specification for the present, in addition to the new "Through Ignition Test".

5. As regards a "rough usage" of sample strips, before they are submitted to the burning test in the Proof Clause of the specification, the Panel will wait for more evidence, from P.E.C. Swynnerton or the Inspectorates, before making further recommendations to amend the specification.

ACTION

Forward to D.N.O., D.G. of A.; D. Arm. R.D., C.I.N.O., C.I.A., D.D.I.Arm., C.S.A.R., C.E.A.D., C.C.I., Sec. P.E.C. Swynnerton and D.C.F./F.

2. Ask D.N.O., D.G. of A., D. Arm. R.D., C.I.N.O., C.I.A. and D.D.I.Arm. to note the Panel's remarks and their Recommendations in paragraphs 1 and 2 thereof.

3. Ask C.S.A.R., C.E.A.D., C.C.I., Sec. P.E.C. and D.C.F./F. to note the Panel's remarks.

A.M.R., O.C.O. India., M.L.O.(N.Z.), D.G.T.S. (South Africa) and Sec. O.B., for information.

APPENDIX

Royal Filling Factory, Swynnerton
Development Dept.

Primed Cambric — D.E. Fox
Method of Testing

Part I

It has been observed during the proof of various pyrotechnic stores over a considerable period, that many failures have been attributed to the unsatisfactory performances of primed cambric, the failure of the primed cambric to function correctly being due to the following:-

1. Failure to pick up from a flash.
or 2. Failure to burn through the cambric
or 3. Failure to impart the burning to the pressed composition.

This work was carried out in an attempt to devise a simple method of testing which would discriminate between satisfactory and unsatisfactory primed cambric.

The specification, AIR/499 (17/3/1941) requires that one square foot of the primed cambric should weigh not less than 700 grains, dusted, and not less than 540 grains, undusted.

It also requires a proof in which a strip of the primed cambric, not less than 6 inches long and 1 inch wide, is laid across the wind and ignited at one end, the time of burning must not exceed 5 seconds per 6 inches of length, or pro rata.

Trials have shown that badly primed cambric, in which care was not taken to impregnate it correctly, will pass the specified tests; and the fact that failures have occurred in stores, due to primed cambric which had complied with the specification requirements, suggests that the method of testing is not entirely satisfactory.

Preliminary trials were carried out with primed cambric manufactured on the Pyrotechnic Experimental Station, Bridgend. Two types were provided the first was carefully prepared, the priming being well scrubbed into the cambric which was afterwards well dusted. The second type was badly prepared, care not being taken to impregnate the cambric and the dusting was not carefully carried out.

The first test was a modification of the specified proof. A strip of cambric 12 inches long and $\frac{1}{2}$ inch wide was subjected to a form of rough usage in which it was drawn over a piece of $\frac{1}{2}$ inch square smooth wood twice, on each side. The strip was held in such a way as to cause the strip to form a right angle, with approximately 10 lb. load applied to the ends. After this treatment any loose powder was shaken off. It was visualised that primed cambric could be prepared by priming both sides of the cambric with a thick coating of priming with little or no impregnation, such priming would probably satisfy the specified requirements for weight and proof, but in the completed store it was possible that rough usage might remove the surface priming leaving, virtually, unprimed cambric.

The strip was mounted horizontally in a stand consisting of pairs of steel pegs approx. 1/16" apart and 1" between pairs. It was ignited at one end by means of a fuze and the burning time noted. The results were as follows:-

Table 1

Good Cambric		Bad Cambric	
1.	11.4 secs.	1.	16.0 secs.
2.	11.5 "	2.	15.4 "
3.	11.7 "	3.	18.2 "
4.	12.9 "	4.	14.9 "
5.	14.2 "	5.	40.0 went out after 40 secs.
6.	13.0 "	6.	80.0 went out halfway along strip.

Table 2

Strips not subjected to rough usage treatment

Good Cambric	Bad Cambric
1. 10.0 secs.	1. 15.2 secs.
2. 10.1 "	2. 13.4 "
3. 9.9 "	3. 15.4 "

The results suggest that the time of burning of cambric strips might be used as a method of proof, especially if a method can be devised of subjecting the strips to some form of rough usage which will be consistent.

A second test was devised to ensure that the primed cambric burned through and would ignite a second disc placed a distance away. The first disc was ignited by means of a strip of the same cambric $\frac{1}{4}$" wide placed a set distance away and ignited at one end. Trials were carried out on primed cambric manufactured by normal production at R.O. . Bridgend, which had given satisfactory results when put to a variety of uses. This cambric had been kept for a considerable period under normal magazine conditions at the Proof Yard. The weight per sq. ft. of primed cambric, the ignition strip distance from the first disc and the distance between the discs were observed. For comparison the specified proof was also carried out. The results were as follows:-

Table 3

Wt. per Sq. ft. Grn.	Ignition Strip ¼" at ins.	Pipe Flash ins.	Ignition Strip Failed	Ignited First Disc only	Ignited second disc correctly	No. Tested	Spec. Test 1" x 6" Laid flat sec.
A. 1010	2	6	-	-	10	10	
995	2	6	-	6	4	10	
881	2	6	-	-	9	9	
867	2	6	-	2	8	10	
863	2	6	-	1	8	9	4.7
823	2	6	-	-	10	10	
773	2	6	1	1	9	11	
719	2	6	3	5	5	13	
B. 1010	1½	6	-	-	9	9	3.4
998	1½	6	-	1	8	9	4.4
880	1½	6	-	-	9	9	3.5
787	1½	6	1	1	8	10	3.7
715	1½	6	3	-	6	9	3.3
653	1½	6	4	-	7	11	2.7
C. 985	2	5	-	-	8	8	3.0
906	2	5	-	-	8	8	4.8
856	2	5	-	-	8	8	4.0
760	2	5	-	-	8	8	3.0
690	2	5	5	-	8	13	4.1
653	2	5	2	3	6	11	9.4
377	2	5	7	3	4	14	63.6
D. 983	1½	5	-	-	9	9	3.4
910	1½	5	-	-	9	9	3.3
830	1½	5	-	-	9	9	4.5
723	1½	5	-	-	9	9	3.8
660	1½	5	2	1	8	11	7.5

It will be observed that in groups C & D cambric below the specified minimum weight (700 grains) failed to pass the test. It is interesting to note that in groups C & D two and one samples respectively failed the specification proof. The variation in the weights of the primed cambric illustrates the variability of primed cambric prepared by present production methods (R.O.F. Bridgend).

It is considered that this second test simulates to some extent the conditions under which primed cambric functions in most pyrotechnic stores. It will be necessary to carry out further trials to determine the optimum distances between the component samples of primed cambric - it would appear that 5 inches between discs is satisfactory and 1½ or 2 inches between the ignition strip and first disc is recommended.

No. P.P. 534
5.3.46
Former P.P. 263

N.B. This Minute contains confidential matter of American origin.

American Signal Distress 1 in., Single Star Red. M.73
British Trials With
(Ref. 101/6 & 87/3)

D. Arm. R.D. to C. S. A. R. on Res. Arm. 307/S. B. 5369 dated 17.7.45

"A number of Signals, Distress, 1", that is, the U. S. version of the Cartridge, Signal, 1", Red.Mk.1?, were handed to your representative Mr. Jones.

Will you please arrange for these cartridges to be placed on alternating climatic trial so that some estimation of their probable exposed life can be made.

The cartridges consist of a one-piece aluminium case and are rather badly sealed with a cork disc coated with a thin film of red lacquer. The finished cartridge is enclosed in a metal foil envelope sealed at the edge."

C. S. A. R. to Sec. P.P. on XC(4)7004/30/2 dated 12.2.46

"The cartridges designated Signal Distress 1", Single Star Red M.73 have been received and subjected to climatic trial.

1. Initial Examination

The cartridges are packed in individual paper bags which are waxed and lined with lead foil attached by means of a pitch adhesive. The inner surface is covered with a thin sheet of cellophane. The cartridge consist of an aluminium case 2.25" long by 1.0" diameter, which is closed by means of a lacquered cork plug. The signal itself is a pyrotechnic star pressed in a rolled paper tube lined with thin aluminium foil. The composition is as follows:

Hexachlorobenzene	6.7	per cent
Pitch	7.8	" "
Strontium nitrate	28.0	" "
Pot. perchlorate	22.5	" "
Magnesium	34.3	" "
B.L.O.	0.7	" "

The priming consists of a few grains of black powder.

The star is ejected when a primer cap ignites a gunpowder charge and attains a height of about 250 ft. The star burns for about 9½ secs. with an intensity of about 5000 cp.

2. Climatic Trial

The signals unpackaged, were subjected to an intensified trial for a period of eight weeks, and six were removed for firing at the end of every two months.

The cartridges in the sealed bags were placed in a chamber following a cycle of

2 days at 115°F.	95% R.H.
1 day cooling	100% R.H.
2 days at 115°F.	95% R.H.
1 day at 140°F.	95% R.H.
1 day cooling	100% R.H.

The results of the firing trials are shown below.

Period weeks	Time of burning of stars secs.	Mean time of burning secs.	Volatile matter %	Metallic Mg to Total Mg %	Remarks
0	9.3 9.6 9.8 9.8 9.9 9.8	9.7	-	-	All the Signals functioned well for both T.B. and brilliance. None failed to ignite.
2	9.8 9.4 9.6 9.5 9.8 9.7	9.6	-	-	
4	9.8 9.6 9.8 9.5 9.5 9.7	9.7	0.1	89	
6	9.5 9.8 10.3 9.7 9.7 9.9	9.8	0.1	88	
8	9.8 9.7 9.5 9.8 9.6 9.9	9.7	0.1	87.2	

The cartridges remained in good condition throughout the trial. All the signals functioned well and their time of burning and brilliance were not affected. The combination of waterproof wrapping and lacquered cork plugs proved therefore to be an effective seal. The signals would probably last two years in tropical conditions."

D. Arm R.D. to Sec. P.P. on S.B.5369 dated 21.2.46.

"This item was based on the British Cartridge, Signal, 1 inch, Red Mk.XIIT and was recommended for standardisation for Army Air Force use in Ordnance Committee Item 25951 dated 7th December, 1944. The following comparison with the British signal is quoted therein:-

Characteristic	MK. XII T	T.51
Ignition Delay	0.4 secs.	0.48 secs.
Burning Time	8.0 secs.	7.25 secs.
Projected Height	200 ft.	210.9 ft.
Candlepower	18,000	21,880
Burning Time (static test)	9.5 secs.	9.56 secs.
Colour ratio	0.56	0.52

Three signals were to be packed in a metal can $1\frac{1}{2}$" x $2\frac{5}{8}$" x $3\frac{5}{8}$". They were to be fired from the M.10 projector.

In Ordnance Committee Items 29893 dated 20th December, 1945, and 30053 dated 17th January, 1946, the signal is declared obsolete, since the AN M.75 Red, Two-Star Distress Signal and the AN Mk.I Mod.1 Hand Smoke Distress Signal meet existing requirements for use with emergency kits in aircraft life rafts."

Remarks by the Panel

The Panel notes that the American packing of waxed paper-lead-foil-cellophane, in an envelope of which material these cartridges are wrapped, proved effective under climatic trials, the mouths of the cartridges being sealed only with a lacquered cork disc.

2. The Panel were informed by D.Arm.R.D. that in view of the larger number of signals which can be made with a given weight of 1" cartridges, as compared with the 2 star Distress Signal, the 1" Pistol and Cartridge Red Mark XII remain an Air Staff requirement, notwithstanding the statement in P.P.525. An aluminium cartridge case will, therefore, be required for this store.

ACTION — D.N.O., D.G. of A., D.Arm.R.D., C.E.A.D., C.I.N.O., C.I.A., D.D.I.Arm., O.C.O. India, A.M.R., C.S.L.O./N.R.C., M.L.O.(N.Z.), Sec. O.B., D.A.S., E.29, I.S. Packaging Committee, D.O.F.F. (P. & P.), U.S. Naval and Military attaches D.M.S. Ottawa for information.

CONFIDENTIAL

No. P.P. 535
19.3.46
Former P.P. 493

Marker, Flame, A/C, Land/Water (Ref. 103/2)
Navigation No. 1

In A.M.C. 28021, dated 21.2.46 this requirement of the R.C.A.F. has been cancelled.

ACTION Noted.

D.Arm.R.D., D.Arm.R., D.N.O., C.N.R., D.A.W., C.E.A.D., C.I.N.O., B.S.A.C., D.M.S. Ottawa., D.R.A.E., O/C.M.A.E.E. Helensburgh, U.S. Naval and Military Attachés, for information.

No. P.P. 536
19.3.46
Former P.P. 484

CONFIDENTIAL

Flash Photographic A/C 4.5 in. Mark II. Mark III and Mark III* (Ref. 46/2)

Secretary reports receipt of A.R.D. Explosives Report No. 428/45 "A study of the characteristics of 100 Mark III and Mark III* and 100 Mark II 4.5" Photographic Flashes."

This paper gives the light characteristics of Mark III flashes, thirty-one containing U.S. aluminium, four containing aluminium made by the British Metal Powder Co. and forty Mark III* flashes containing U.S. aluminium and twenty-six containing B.M.P. aluminium.

The averages of the results and those from 100 Mark II bombs are given below.

Characteristic	Duration milliseconds					Peak intensity million candles	Luminous output million candle secs.		
	Total	At 1/10 Peak	At 3/4 Peak	To Peak	To 3/4. Peak		To 50 milli-secs.	After 50 milli-secs.	Total
Mark III with C.E. burster									
(i) U.S. aluminium									
Mean	147	46	7	8	5	243	4.18	1.11	5.29
Extreme values (	85	30	6	5	2	170	3.30	0.18	3.50
(	210	63	10	13	9	325	5.41	2.00	6.38
Standard deviation	26	9.4	1.1	1.9	1.5	36.5	0.57	0.24	0.81
(ii) B.M.P. aluminium									
Mean	159	84	7	8	6	201	3.57	1.80	5.37
Extreme values (	140	60	6	8	5	180	3.40	1.35	4.87
(	190	99	8	9	6	225	3.88	2.85	6.33
Mark III* with T.N.T./A[illegible] Burster									
(i) U.S. aluminium									
Mean	197	52	7	6	4	344	5.95	2.13	8.18
Extreme values (	155	43	5	4	2	270	4.55	0.88	6.41
(	250	82	9	8	6	420	7.18	3.10	9.80
Standard deviation	24	8.2	0.9	0.9	0.9	35.8	0.64	0.46	0.83
(ii) B.M.P. aluminium									
Mean	190	59	7	6	4	368	6.68	2.43	9.11
Extreme values (	150	44	5	5	2	272	5.00	1.43	7.07
(	260	100	9	8	5	462	8.60	4.05	12.40
Standard deviation	23	11.9	1.2	0.8	0.8	56.2	1.04	0.97	1.12
Mark II flash									
Mean	-	74	14	8	-	223	-	-	7.64
Extreme values (	-	38	6	2	-	88	-	-	4.0
(	-	111	25	17	-	395	-	-	11.5
Standard deviation	-	15.0	4.3	3.6	-	49.0	-	-	2.11

Histograms were drawn from most of the above data. The greater part did not agree closely with normal distribution curves although some of the duration data showed some tendency to do so. The possible causes of the variability of the results are discussed.

The various characteristics of the Mark III and Mark III* flashes are more reproducible than those of the Mark II flash. The Mark III flash has a shorter duration at 1/10 and at 3/4 peak than the Mark II flash but the time to peak is about the same.

The Mark III* flash containing aluminium supplied by the British Metal Powder Co. is rather better than that containing American aluminium powder.

The Mark III* flash is much superior to the Mark III flash.

Remarks by the Panel

Noted.

This report demonstrates the great variability of the light produced by photoflashes. The Panel understand, however, that rapid-cine photographs which have now been taken indicate how these variations arise and will await further reports. Meantime it considers that for record purposes the important characteristics of the Mark III* or Mark IV photoflash might be quoted as follows.

Characteristic	Duration milliseconds					Peak intensity million candles	Luminous output million candle secs.		
	Total	At 1/10 Peak	At 3/4 Peak	To Peak	To 3/4 Peak		To 50 milli-secs.	After 50 milli-secs.	Total
Average	190	59	7	6	4	368	6.68	2.43	9.11
Mean difference	17	8	0.4	0.5	0.5	52	0.89	0.57	1.34
Greatest difference	110	56	4	3	3	190	3.6	2.62	5.33

Action Forward to D.Arm.R.D., D.N.O., D.N.O./L., C.I.N.O., B.C.S.O., Washington, Sec. P.I.F.I. Committee, C.E.A.D., C.N.R., R.A.E. Arm,, R.A.E. Photos., D.D. Photos. (A.M.), and R.D. Photos. (M.A.P.) N.R.C. Ottawa, for information.

No. P.P. 537
25.3.46
Former P.P.s 505, 501 and 500

Cartridges Signal 1½ in. and 1 in. Aluminium Cases (Ref. 23/2 and 87/3)

Designs and Production

On P.P.437, the Panel asked the Ordnance Board to investigate the chamber pressure generated in Cartridges Signal 1 in. and 1½ in. The results recorded in O.B. Proc. No. 32414 were as follows:-

Cartridge Signal	Charge	Max. Pressure lbs/sq.in.	Average lbs/sq.in.
(a) 1 in. Single Star	Normal Charge (1.65 gm. G12)	230. 255, 253	246
(b) 1 in. Single Star	Increased Charge (2.25 gm.)	306, 296	301
(c) 1 in. Single Star	Increased Charge (3.25 gm.)	437, 421	429
(d) 1½ in. Single Star	Normal Charge (2 gm. G.12)	220, 225	222
(e) 1½ in. Single Star	Increased Charge (3 gm.)	356, 338	347
(f) 1½ in. Single Star	Increased Charge (4 gm.)	480, 446, 420	449

D. Arm. R.D. to Sec. P.P. on Res.Arm.5037 dated 30.11.45 (XC(4)0008/1/23)

"It will be noted from C.S.A.R's report that the impact extruded cartridge cases did not split when filled with white and brown smoke puff units, although they were not fitted with a paper liner. The cartridges were not difficult to remove from the pistol after firing.

This would appear to contradict the view held previously by Messrs. I.C.I. that the absence of a paper liner would give rise to split cases and swelling which would render the cartridge difficult to withdraw from the pistol.

Investigation has now shown the method which has been used by the Germans to produce their signal cartridge cases, and it is therefore considered that clearance of the design should await the development of a cartridge case on the lines of the German.

The German case is made in two operations, the first being an impact extruded cup with a thick base, the rim of the cartridge case being then formed by a second operation which deforms the thick base to form a rim. A fuller report on the German method will be forwarded to you in due course.

Ordnance Board Investigation No. 1771 reported in Proc. No. 32414 should be noted, as it contains information on the maximum internal pressures recorded when signal cartridges, both 1" and $1\frac{1}{2}$" types, are fired". (See above).

Note by the Panel

On 11.1.46, the Panel asked D.G.O.F. whether he could consider the installation of machinery for the impact extrusion of Aluminium Cartridge Cases in an Ordnance Factory, in view of the difficulties that reconstruction programmes in the trade are likely to impose on the development of military stores. The suggestion was also made by the Panel that suitable machinery might be obtained from Germany for this purpose.

D.G.O.F. to Sec. P.P. on D.D.S.A.A./C.S.46/6102 dated 23.1.46

"With reference to your letter 23/2 and 87/3 dated 11th January, 1946, I am prepared to offer the Panel the assistance it may require, although I would like further information concerning the scope of the project.

I have already made a claim for certain vertical and horizontal presses manufactured by the firms of Herlan and Schuler. Their particulars are as follows:-

One Schuler Vertical Toggle Press closed cam action impact at the maximum velocity of stroke. Probably over 850 tons.

Three Herlan Horizontal presses 1 off each of the following capacities:

(1) 450 ton
(2) 620 ton
(3) 1,000 ton

This equipment, if obtained, will be used for further research in the field of Impact Extrusion of Aluminium High Strength Alloys with particular reference to high pressure cartridge cases, and will be installed at the R.O.F. Radway Green.

I should like to know the type of equipment the Panel propose to supply and if the manufacture of a case with a length in excess of 4" is contemplated. If this is so the following information should be recorded. A 1,000 ton press manufactured by Herlan with a stroke of 18" to 2' is only capable of producing ten pieces per min. of length 9/10" as against 40/60 pieces with a 100 ton deep drawing press.

This leads me to enquire whether the Panel have abandoned the idea of a drawn product or whether they are prepared to undertake a programme to run in parallel with the present 20 m.m. Hispano development. This case is now being produced by the Impact Extrusion as well as by methods analogous to the production in brass. Radway Green have had considerable experience in the manufacture of the 20 m.m. Light Alloy Case by the latter method and I

would say that if the presses mentioned above are delivered from Germany they could be made available for your work as well.

I assume that the Panel will arrange the finance of any work it calls upon me to undertake".

Sec. P.P. to C.E.A.D. on D.D.S.A.A./C.S.46/6102 dated 6.2.46

"1. The Panel ask for information on the results of your recent investigations in Germany, concerning:-

(a) drawn or impact extruded signal cartridge cases.

(b) the possibility of getting suitable plant, if that here offered by D.G.O.F. is not suitable.

(c) the possibility of getting the services of German technicians.

2. The Panel consider that a design of signal cartridge case, without paper liner or base wad, should be prepared for development by D.G.O.F. and C.E.A.D. in co-operation".

C.E.A.D. to Sec. P.P. dated 15.2.46 ref. P/2/10

"In answer to your minute of 6th February on the above subject, a copy of the report on a preliminary visit by members of D.Arm.D. M.A.P. and of this Department to Messrs. Herlan (Karlsruhe) and Vereinigte Deutsche Metallwerke (Nuremburg) is attached. (Not reproduced).

We are in touch with D.G.O.F., regarding the suitability of the presses mentioned by him for impact extrusion of signal cartridge cases of the lengths likely to be required by us.

It will probably be desirable to obtain the services of a German technician in connection with this development, and the possibility of this will be explored.

Designs will be prepared in due course in co-operation with D.G.O.F."

C.E.A.D. to D.D.S.A.A. on P/2/10 dated 22.2.46

"As promised I am sending you a drawing D4(L) 968 showing the only aluminium cartridge case we have so far played with. It is made of almost pure aluminium and stands up reasonably well to our pressure requirements. You will notice that it has a compressed paper base wad similar to those used in existing brass-based rolled paper signal cartridge cases and the aluminium walls are lined internally with rolled paper.

We think these internal paper components are undesirable and should like to eliminate them. We should also much prefer a rim of more rectangular cross section giving more positive location of the cartridge in the pistol or discharger.

The case shown is only 4" long, but cases up to 8" or 10" long may be required. There will also be a requirement for a 1" calibre case on similar lines but probably only 4" long.

A drawing D4(L)967 of a typical filled cartridge is also enclosed showing the method of closing so far adopted. This consists in turning over the lip of the cartridge case through 90° onto an aluminium closing cap and sealing with a bituminous cement. It is probable, however, that if the paper liner is omitted a satisfactory tropics-proof closure will be possible with only a 30° radiused turn over, and that by this means the pressure developed in the cartridge case will be materially reduced, and risk of damage of the contents during ejection minimised.

The question of your undertaking development of aluminium signal cartridge cases was brought up at the Pyrotechnic Panel

meeting on Tuesday 19th when the need for financial cover for any development work you may be asked to undertake, was emphasised. No difficulty was anticipated in obtaining this.

When this project has been put on a basis satisfactory to you by the Pyrotechnic Panel, we should like to attend a meeting to discuss details of the new design with your technical people.

We shall have to consider early whether to adopt the existing loose anvil type of cap chamber which was, I believe, borrowed from the shot gun cartridge, or go to a fixed anvil type with, preferably, an aluminium cap which would avoid corrosion troubles due to the contact of dissimilar metals".

D.D.O.F./S.A.A. to Sec. P.P. on C.S.33/6231 dated 28.2.46

"I now await a concrete proposal for the development of the aluminium Signal Cartridge Case and a Pyrotechnic Panel requisition to cover.

I assume that when the order is placed C.E.A.D. will provide the requisite number of drawings, i.e. 15 copies".

Remarks by the Panel

The Panel RECOMMENDS that production of aluminium Signal Cartridges 1½ in. and 1 in. should be undertaken by D.G.O.F., in collaboration with C.E.A.D., using such machines as can be got from Germany.

Impact extrusion is considered preferable to solid drawing, provided the longest cartridges required can be produced by impact extrusion with such machines as may be available

2. The avoidance of paper liners or base wads is very desirable.

3. If it suits production, and gives satisfactory results as regards the firing of the caps, a fixed anvil might be embodied in the head of these cartridges.

4. The use for the shells of the percussion caps of aluminium or some other metal that will not interact with the aluminium of the case is desirable.

ACTION

Forward to D.N.O., D.G. of A., D.Arm.R.D., D.G.O.F., E.P.O., C.E.A.D., C.S.A.R. and Sec. O.B.

2. Ask D.N.O., D.G. of A., D.Arm.R.D., D.G.O.F., C.E.A.D. and C.S.A.R., to note the Panel's recommendation and remarks.

3. (a) Ask C.S.A.R. with reference to P.P. 505 and subsequent correspondence, whether he can now recommend a minimum wall thickness for impact extruded aluminium signal cartridges without paper liners, and a method of mouth closing suitable for all fillings, including smoke puffs with weakened walls.

(b) Ask E.P.O. to arrange, in collaboration with C.E.A.D., for development of 1½" and 1" Signal cartridge cases; and for the ultimate supply of 1,000 cartridges of each size for filling and firing trials. (Appendix III to P.P. 233 refers).

(c) Inspection to be arranged by consultation with C.I.N.O., C.I.A. and D.D.I.Arm., to suit the localities where this work is being done.

(d) The cost will be covered by O.B. P.P. Requisitions Nos. 7 and 8, for 1½ in. and 1 in. cartridges respectively.

D.N.O./L., C.I.N.O., C.I.A., D.O.F./S.A.A., D.D.I.Arm., D.A.S., E.29, O.C.O. India, A.M.R., B.S.A.C. Washington and M.L.O. (N.Z.), D.M.S. Ottawa for information.

No. P.P. 538
19.3.46
Former P.P. 470

Bomb, Practice, Flame, A/C., 10 lb. Mark 4. Leakage Tests. (Ref.83/2)

At the 66th P.P. Meeting on 20.11.45 (Item 11(g)), D.Arm.R.D. asked for suggestions for a test for leakage of the Sodium Phosphide-Heavy Oil filling of these bombs, before they leave the Filling Factory.

It was suggested that C.C.I. and C.S.A.R. should confer and consult with Messrs. Albright & Wilson, the filling contractors.

Extracts from C.C.I. to Sec. P.P. on S.3538/1 dated 17.12.45

"The development of a suitable test for absence of leaks in the filled bomb was discussed with Messrs. A. & W. on 14.11.45.

It was explained by Mr. Carter, works manager, A. & W. Ltd., that the normal test for such a purpose would be a pneumatic one, in which the object to be tested is connected to an air-pressure apparatus of suitable dimensions, any leakage into the object being indicated by a fall in pressure. This method, however, is only applicable where there is a reasonable air space in the object to be tested, and it appears that the present design of the 10 lb. bomb requires the body to be completely filled with sodium phosphide-oil mixture, leaving no air space at all. Consideration of this point suggested that such an arrangement might involve risk of dangerous pressure due to seasonal temperature changes or to exposure to tropical conditions. Mr. Carter was not sure about the relative coefficients of expansion of the filling and of the bomb body, but agreed to carry out a test to ascertain whether there would be a tendency for the filling to be forced past the screw threads of the closing plug under such conditions. If the result of this test should confirm the relatively greater expansion

of the filling, it would appear desirable to reconsider the design with a view to introducing an adequate air-space to allow for expansion. If this were done, each filled bomb body could be tested by the pneumatic method referred to above, before attaching the weighted nose portion.

The only alternative method of testing for leaks which appeared at all promising was the use of a detector paper of suitable sensitivity. Messrs. A. & W. Ltd. use a paper treated with 0.1 per cent solution of silver nitrate to detect the presence of phosphine. Such papers are sensitive to a concentration of one part in a million, and would probably show a positive test if exposed for an appreciable period in any part of Messrs. A. & W's. works. A less sensitive paper would probably be required for the present purpose, the paper being applied either as a band around each bomb, or placed loose in the transit box containing the bombs.

The following procedure is also suggested for trial. After filling and closing the bomb body and before attaching the nose; allow the R.D. cement to harden; clean the top of the bomb to remove traces of oil and phosphide; invert the body and stand it on a sheet of perous paper in an oven heated to (say) 60° or 70° C. Any leakage would be indicated by an oil stain on the paper. Impregnation of the paper with a phosphine detector such as silver nitrate or copper sulphate may or may not be advantageous for this test.

Trials on these lines could be put in hand at Oldbury if required, Messrs. A. & W. Ltd., having offered laboratory facilities for our use.

C.C.I. to R.D.Arm.8.C. on S.3538/1 dated 21.2.46

"With reference to your request for a suitable test to ensure absence of gas leaks in the sealing of the above bomb,

please see attached copy of a minute dated 16.2.46 from my Chemist-in-Charge at Swynnerton, describing a test as developed by A. & W. Ltd.

If you agree that the proposed test is suitable, it is suggested that a specification clause on the following lines should be adopted.

"When the filled and sealed tail portion of the bomb is submitted to the following test there must be no indication of leakage of gas or air between the interior and exterior of the bomb.

Place the filled and sealed bomb-tail in a pressure vessel fitted with a mercury manometer and apply air pressure of approximately 10 - 15 pounds per square inch. Shut off the air supply and allow the bomb to remain under this pressure for not less than 15 seconds. Observe the manometer reading carefully. Any fall in pressure during this period would indicate a major leak in the sealing of the bomb-tail.

Release the air from the pressure vessel, quickly remove the bomb-tail and immerse it immediately in paraffin (kerosene) so that the filling-plug is submerged to a depth of about half an inch. Any bubbles arising from the threads of the filling-plug and locking ring or from the soldered joint between the central plug and tail cone will indicate the presence of leaks.

Examine the joints visually to ensure the absence of gross leakage, which would not be detected by this test owing to the rapid equalisation of air pressure between interior and exterior of the bomb-tail.

Immediately after the test, thoroughly remove all paraffin from the bomb-tail by means of a dry rag.

It is understood that you propose to notify Messrs. A. & W. Ltd. and I.N.O., Birmingham, accordingly in order that the test might be put into operation forthwith."

Extracts from Chemist in Charge, Swynnerton, to C.C.I. ref. S.W.596 dated 16.2.46 referred to in C.C.I's. minute above

"3. It is possible that major leaks may not be detected by this method owing to a too rapid process of equalising of pressures. It is felt, however, that any such major leaks would not escape notice on visual examination, and in this respect it may be felt desirable to insert a clause in the specification covering visual inspection of the sealing.

4. The test in para. 2 has two distinct disadvantages:-

(a) That the paraffin may dissolve the cement. This, I am assured by A. & W. is most unlikely, since, for some time, they have used the same cement on Flame Floats which they have subjected to an almost identical leakage test with no apparent solution of the cement.

(b) After the test the cement-sealed end of the bomb must be cleaned free from paraffin by means of a dry rag. To minimise the risk at (a) above, it is recommended that a clause be inserted in the specification calling for this cleaning to be done immediately after the performance of the leakage test.

5. It is felt that A. & W. have done their best to find a speedy, routine leakage test which is at the same time reliable, and it is felt that this test will work quite

satisfactorily, particularly since presumably the test, and the subsequent cleaning of the bomb, will be done in the presence and to the satisfaction of representatives of the final inspectorate (A.I.D., C.I.A. or I.N.O.)."

Remarks by the Panel — The Panel RECOMMENDS that the filling design of these bombs should call for at least 5% air space to suit the leakage test proposed by C.C.I. and Messrs. Albright & Wilson.

They also RECOMMEND that this test should be adopted forthwith and inserted in the Specification.

Action — Forward to D.Arm.R.D. to note the Panel's recommendation.

D.N.O., C.I.N.O., C.I.A., D.D.I.Arm., C.C.I., C.S.A.R., C.N.R., C.E.A.D., Sec. Explosives and Transport Committee, E.29. D.A.S., C.D.R.2, D.O.F./F., and Sec. O.B. for information.

No. P.P. 539
2.4.46
Former P.P.'s 358 and 463

S.R. 432 Filling for Rockets. Development dropped.
(Ref. 29/4)

Sec. P.P. to D.N.O., D.G.A., D.Arm.R.D. and C.I.N.O. dated 25.2.46

"1. After the issue of P.P. 358, C.E.A.D. raised a Requisition D.D/4391/202 for 100 Rockets Illuminating 9 lb. filled S.R. 432 to design D4/L/66/GF.3 (Ref. 29/4).

2. It is now clear that S.R. 432 is not suitable as a filling for small steel rockets for firing from a hand-held pistol. (See P.P. 463, Ref. 29/4).

S.R. 432 also has the disadvantage of a very bright flame.

3. The project of using S.R. 432 in steel rockets of Schermuly type, to abolish the risk of the occasional explosion of a rocket body with a stemmed gunpowder filling, was a wartime expedient to avoid using cordite, then in short supply. (See P.P.s 187, 290 and 295, Refs. 29/4 and 97/1).

4. The Panel is informed that a large number of components are still waiting for completion of the experimental order by R.O.F. Swynnerton. Moreover, difficulty in canneluring filled rockets, as required by the design, is anticipated by that Filling Factory.

5. The Panel, therefore, recommends that this order be cancelled and all developments of S.R. 432 fillings for rockets be dropped. (Refs. 29/4 and 51/1).

6. Introduction of a steel rocket filled Cordite, to replace paper rockets filled Gunpowder, is proceeding on low priority. (See P.P. 492, Ref. 119/2)."

C.E.A.D. to Sec. P.P. Ref. P5/1 dated 1.3.46

"In view of your remarks in your corres. 29/4, 51/1 and 47/1, dated 25th February, with which we concur, we have issued instructions on DD. Reqn. 4391/202 to suspend all work pending the remarks of the other interested parties.

These will presumably be forwarded by you when they have been received.

With reference to your para. 4, we wish to point out that the modified canneluring was introduced at the express wish of C.S.A.R."

Note by Sec. P.P.

On N.O. 5570/46 dated 11.3.46 D.N.O. concurs with the cancellation of this development.

D.Arm.R.D. to Sec. P.P. on S.B. 55858 dated 20.3.46

"This directorate concurs in the recommendation in para. 5 of your minute of 25th February that the order for 100 rockets filled S.R. 432 to design D4(L)66/GF/3 be cancelled and that all development of S.R. 432 fillings for rockets be dropped."

Remarks by the Panel — Noted.

Action — Forward to D.N.O., D.G. of A., D.Arm.R.D., D.C.A.M., D.T.M., C.E.A.D., C.S.A.R., D.O.F./F., C.I.N.O., C.I.A., D.D.I.Arm. for information.

P.S. to Remarks — A design has been sealed for record, under the Nomenclature "Rocket Illuminating 9 lb. No.5 Mk.I/Air", although none have actually been made or tested. (A.I.D. Information List No.173 dated 27.3.46).

No. P.P. 540
2.4.46
SECRET

No. P.P. 541
2.4.46
Former P.P.s 356 and 425

Fuze, Safety, for Naval Demolitions. Developments.
(Ref. 89/2)

C.I.N.O. to C.S.A.R. on C.I.N.O.1471/46 dated 20.3.46.
(Copy to Sec. O.B.)

"With reference to P.P. Minute No.356, action by D.T.M., (Now D.U.W.) under para.2 has been completed with results as follows:-

(a) Service tests of I.C.I. Alkathene (Polythene) protected fuze.

Capt, H.M.S. VERNON (M) report M.3414 dated 3.7.45 showed that while this fuze had better water-proofness than existing service fuzes, it proved liable to catch fire and burn. Accordingly it has not been adopted for naval demolition work.

(b) Discussion with I.C.I. on possibility of tightening the water-proofness requirements of existing fuzes Nos. 11 and 18.

The firm was asked whether they would agree to supply these fuzes to meet the proof requirements detailed in Enclosure 1B (See Appendix). They now state that they "cannot possibly accept" the proposed clauses since fuze No.11 fails at test b(ii) as relaxed, and fuze No.18 at both test b(i) and b(ii) as relaxed.

Further approach to I.C.I. appears likely to prove fruitless.

2. It will accordingly be appreciated if C.S.A.R. can undertake the development of safety fuzes for naval demolition work.

3. Basically these fuzes should be capable of satisfying the following conditions of service:-

(a) storage for up to 4 years at temperatures varying from -30°F to 120°F and then;

(b) functioning in water at 30 lbs. per sq. in. pressure, after immersion for 15 minutes.

The specification tests must, however, be more stringent to ensure that Service requirements will be met.

4. The proof requirements of the new fuzes are the same as those submitted to I.C.I. (enclosure 1B) (See Appendix) except that it is now considered that tests b(i) and (ii) should more appropriately be as follows:-

Store both pieces of fuze for 4 weeks at 55°C. (131°F). Then hermetically seal the ends and immerse both pieces in water at 30 lb. per sq. in. for one hour. Test one piece by burning in air and the other by burning in water at 30 lb. per sq. in.

The burning of safety fuze under pressure is a novel proof test, and the rate of burning to be required and the tolerance to be allowed will both have to be determined.

5. In the present specifications I.512 and I.522A there is no check on the resistance of the fuze to abrasion and rough usage. If suitable tests can be devised, they should be included in the proof requirements of these fuzes.

6. As stated in P.P.356, the external diameters of the fuze must not exceed 0.215 inches, because anything higher will not enter the Detonator, Safety Fuze, No.80 Mk.1N.

7. Priority P2 please".

Remarks by the Panel: Noted.

ACTION: Forward to C.S.A.R.

2. Ask C.S.A.R. to send to the Panel a copy of his answer to D.U.W's. enquiry.

D.U.W., D.N.O., D.G. of A., D.Arm.R.D., C.E.A.D., C.I.N.O., C.I.A., D.D.I., Arm D.R.A.E., S.R.7, Sec. O.B. for information.

No. P.P. 541 - APPENDIX

Enclosure 1.B to C.I.N.O. 1471/46

Draft Proof Requirements for safety fuzes Nos.11 & 18

5. Proof

Proof will be selected by the Inspecting Officer at the rate of one length per lot, or alternatively one length from each package delivered by the Contractor. The length selected will be proved as follows. Any failure to function correctly will render the lot liable to rejection.

(a) Two pieces 5 feet long will each be ignited in the open by means of a safety fuzce or other approved means of ignition at one end and must each burn out to the end of the section, steadily and without unduc sparking. The rate of burning is to be from 80 to 100 seconds per yard, (for safety fuze No.11); and from 205 to 235 seeonds per yard, (for safety fuze No.18).

(b) Two pieces 5 feet long will each be formed into a coil of approximately 3 inches in diameter and the coils will be stored as follows:-

(i) one coil for 4 weeks at 60°C. (140°F.) * followed by 3 days at 70°C. (158°F.)

(ii) one coil for 4 weeks at 60°C. (140°F.) * the ends will then be hermetically sealed and the coil immersed in water at a pressure of 30 lb. per square inch for one hour.

(* Subsequently relaxed to: 55°C. (131°F.), and 3 days at 70°C. omitted).

Immediately after the expiration of the above tests each piece will be straightened and two inches will be cut off from each end; the covering must not drag when cut

with a sharp knife. One end of each length will be ignited as detailed in (a). Each section must burn evenly, and the rate of burning must not vary by more than ± 10 per cent. from the rate measured in (a).

(c) A piece one foot long will be cut into two pieces, the one four inches in length and the other eight inches. Each piece will have one end inserted into a piece of glass tubing, a distance of one inch between the ends in question being maintained. The longer piece will be ignited at the free end and must cause the ignition of the other piece.

(d) A two foot length of the unpowdered fuze is introduced, in the form of a coil, into a sterile Petri dish approximately four inches in diameter. The space between the lower dish and its cover is then filled with molton sterile paraffin wax, which has a setting point of 50°C. (122°F.) or over, taking care that the wax does not penetrate into the interior of the dish. When cold, the dish which should have been hermetically sealed by the above process, is incubated in a suitable oven for 7 days at a temperature of 30°C. (86°F.). At the end of this period no mould growth should be visible.

Note:- The mandrel on which the fuze is coiled for the purpose of the above-mentioned tests is, in all cases, to be removed from the fuze before the application of the test.

No. P.P. 542
2.4.46
Former P.P. 518

Soldered Blow-off Lids on Pyrotechnic Stores (Ref. 84/2)

Candles Smoke Yellow or Red (for Submarines) (Ref. 84/1 and 148/1)

NOTE BY THE PANEL

In P.P. 518, D.N.O. was asked:-

(a) Whether there is any objection to Service supplies of Candles Smoke Yellow or Red being packed in a water-tight container, not to be opened until just before loading the candle into the gun.

(b) Whether a serious number of Candles Smoke Yellow Mark VI have failed to function in service and whether the nature of such failures was detected.

With regard to (a), the idea was that a type of seal not depending upon solder might be acceptable for the blow-off lid, if extra protection could be given to the water-tightness of the store, up to the moment of its use, by packing it in a watertight cylinder which would be removed only just before loading the candle into the gun.

D.N.O. to Sec. P.P. on N.O. 5121/46 dated 22.3.46 (G.01194/46)

"With reference to para. 2(b) of your action no failures of candles Smoke Yellow Mark VI in service have been reported.

2. Regarding para. 2(a), the objection to service supplies of Candles Smoke Yellow and Red being packed in water-tight containers is, apart from the expense, the extra space that would be required to stow the outfit of candles or alternatively, the fewer number of candles that could be

stowed in existing spaces. In the circumstances it is not considered that the number of failures reported justifies the expense and restriction of stowage involved."

Remarks by the Panel

D.N.O's. decision means that Smoke Candles for Submarines must remain completely watertight by themselves, without the protective use of a packing cylinder. Therefore, the type of sealing for lids that was adopted for Floats Submarines Special Type O cannot be used for these Stores.

2. The Panel notes that C.E.A.D.'s experiments with both Bostik X.P. seals and improved methods of soldering the seal in candles Smoke Red are proceeding. (Ref. P/4/7 dated 16.3.46).

ACTION

Forward to C.E.A.D.

2. Ask C.E.A.D. to note D.N.O's. decision and the Panel's remarks.

D.N.O., D.Arm.R.D. D.G. of A., C.S.A.R., C.I.N.O., I.N.O. Woolwich, C.I.A., D.D.I.Arm., F.O./S.M., D.A.S., D.O.F./F. for information.

No. P.P. 543 CONFIDENTIAL
16.4.46
Former P.P.s 355, 372 and 492

Rockets Signal and Target Practice. (Ref. 64/1)

I. Climatic Trials
II. Proposed abolition of Wartime "Production Permits"

C.S.A.R. to Sec. P.P. on X.155/3/7 dated 20.3.46

"With reference to Action 2 of P.P. 355, in which the climatic trial of rockets in tape-sealed and soldered cylinders was arranged, rockets have now been subjected to 1 and 2 months C.T. on the I.S.A.T. (A) cycle. The following are the results obtained in the firing trials.

After 1 month's Climatic Trial

Type	Sealing	Months C.T.	Observation
Signal	Tape	1	Functioned correctly
"	"	1	" "
"	"	1	" "
"	"	1	" "
Signal	Soldered	1	Functioned correctly
"	"	1	" "
"	"	1	" "
"	"	1	Some stars (10) ejected at 50'. No functioning at max. height.
Target	Tape	1	Parachute ejected correctly Low 300'
"	"	1	" " "
"	"	1	" " "
"	"	1	" " "
Target	Soldered	1	Functioned correctly.
"	"	1	" "
"	"	1	Exploded on projector.
"	"	1	" "

After 2 month's Climatic Trial

Type	Sealing	Observation
Signal	Tape	Functioned correctly.
"	"	Stars ejected at 50'
"	"	Functioned correctly.
"	"	" "
"	Soldered	2 stars ejected at 50', but flight of rocket was good.
"	"	Functioned correctly.
"	"	Stars ejected at 50'. Rocket carried on to normal height.
"	"	Stars ejected at 50'. Rocket attained normal height.
Target	Taped	Exploded on projector.
"	"	" "
"	"	" "
"	"	" "
Target	Soldered	Rocket failed to attain max. altitude. Parachute ejected normally at about 500'.
"	"	Attained maximum height. Parachute not ejected.
"	"	Exploded on projector.
"	"	" "

(Note by the Panel. "Exploded" here means that the Rocket Body was blown to pieces.)

"Ejection of the contents of the head at such a low height as 50 feet means that the rocket blew through the heading. In view of the poor results obtained in the above firing trials it was decided to fire the rockets which had been subjected to three months climatic trial on the dynamometer since more information could be obtained in that way.

The following are the results of this firing.

Type	Sealing	Months C.T.	Peak Thrust	Remarks
Signal	Tape	3	33 lbs.	Thrust-time curve O.K.
"	"	3	43 "	Thrust-time curve Fair
"	"	3	54 "	Blew through heading.
"	"	3	46 "	" " "
Signal	Soldered	3	N.O.	Functioned O.K.
"	"	3	24	Thrust-time curve O.K.
"	"	3	50	Blew through heading
"	"	3	27	" " "
Rocket	Tape	3	-	Blew through heading
Target	"	"	23	Thrust-time curve O.K.
Practice	"	"	-	Blew through heading
"	"	"	-	" " "
Rocket	Soldered	3	-	Exploded
Target	"	"	-	Blew through heading
Practice	"	"	-	" " "
"	"	"	-	" " "

The behaviour of the rounds fired into the air and also those fired on the dynamometer suggests that from the point of view of preventing mal-functioning of the rockets neither type of sealing has any advantage over the other. It is unfortunate that such a miscellaneous collection of rockets were used in this trial. Each type of rocket should have been chosen from a recently manufactured batch and the two types of sealing should have been tried out on the same batch of rockets. Some rockets were made in 1940 and therefore may not have been very good when the trial was started. The following are the details of the rockets used.

A. Rockets, Signal, 1 lb. Service Mk.III in Tape Sealed Cylinders. Lot 86 made 10/40 by C.T. Brock and packed 2/44.

B. Rocket, Signal, 1 lb. Service Mk.III in Soldered Cylinders. Lot 73 made 10/40 by C.T. Brock and packed 2/44.

C. Rocket, Target, Practice, 1 lb. Mk.II in Tape-Sealed Cylinders. Lot 114 made 7/43 by C.T. Brock and packed 7/43.

D. Rocket, Target, Practice, 1 lb. Mk.II in Soldered Cylinders. Lot 326 made 7/43 by S.P.R.A. and packed 7/43.

The cylinders and rockets appeared in good condition after 3 months C.T."

Remarks by the Panel

1. It is clear that existing powder-filled paper rockets, even when packed in tin cylinders sealed by solder, will not stand up to the severity of the Standard Climatic Trial.

2. However, the Panel suggest that the small number of failures that seem to occur in service with Rockets made in peacetime and kept in magazines on board ship or on shore indicates that no special measures are needed in present circumstances.

3. The routine annual proofs carried out by Inspectorates should ensure the condemnation of any Lots or Batches that deteriorate enough to give an excessive number of explosions of the rocket body, premature functionings (blow through) before or during flight, or other failures.

4. The introduction of a non-gunpowder (cordite?) filling in steel signal and other rockets, see P.P. 492, should be the ultimate solution of these troubles.

Remarks by the Panel (Contd.)

5. As regards the wartime "Production Permits" that were embodied in designs of Rockets Signal and Target Practice, the Panel RECOMMEND the following, in addition to the reversion to Italian Twine only for binding on the sockets, as recommended in P.P. 355, and the discontinuance by Messrs. Brock of using Messrs I.C.I. Rocket Composition (P.P. 424):-

(i) Material for Sockets
Varnished blackplate to be abolished. Only tinned plate or copper to be used.

(ii) Sealing of Base for all paper Rockets.
Revert to the screwed wood plug and abolish the permitted alternative of a paper disc seal over the vent.

NOTE:- The reason for (ii) above is that Signal Rockets, especially in ships at sea, remain ready for firing by a friction tube in a machine. When the rocket is removed from the machine, (e.g. on returning to harbour), the wood plug can be replaced and the rocket kept for future use, if it is still undamaged and not wet inside.

6. Adhesive for fixing Sockets.
Suitable adhesives were recommended in P.P. 355, Remarks, Paragraph 3.

ACTION

Forward to D.N.O., D.G. of A. and D.Arm.R.D. to note the Panel's remarks and recommendations.

D.N.O./L., C.E.A.D., C.I.N.O., C.I.A., D.D.I.Arm., D.A.S., E.29, D.S.D., M. of T., D.G.C.A., C.S.A.R., C.S.P.D.E., C.P.D., D.O.F/F., A.M.R., M.L.O. (N.Z.), D.G.T.S.(S.A.), O.C.O.C.O. India, C.S.L.O. (N.R.C.) and Sec. O.B. for information.

No. P.P. 544
16.4.46
Former P.P. 516

Delay Compositions. (Ref. 16/3)

Secretary reports the receipt of A.R.D. Explosives Report No. 283/45 "Second interim report on combustible products of oxidation of nitroaromatic amines" by T. Urbanski.

Summary

This report and the previous one by the same author, A.R.D. Explosives Report No. 502/44, describe the preparation of combustible compounds formed by the oxidation with dichromate and acid of certain nitro-amines, viz. m-nitraniline, p-nitro-o-toluidine, nitro-p-phenylene diamine, 3.5-dinitrani-line and p-nitro-o-aminophenol. The amine is dissolved in sulphuric acid and after cooling a solution of sodium dichromate is stirred in. The reaction starts immediately, the product begins to precipitate and the temperature rises to about 60°C. After cooling and standing for 24 hours the precipitate is filtered off, washed and dried. The yields are good. The products are dyes which vary in colour from red to brown. The most important of these compounds is that obtained from m-nitraniline which has been designated NAP. Similar compounds can be obtained by using permanganate or chlorate as the oxidising agent.

The constitution of these compounds is considered but it is not clear whether they are anilino-quinones or whether the oxidation has proceeded further to derivatives of phenazine. Only those nitro-amines in which the para-position to the amino group is unoccupied, or is occupied by an easily oxidisable group, form a compound of the NAP type.

In order to produce substances containing fewer nitro groups and thus obtain a slower rate of burning, mixtures of o-or m-nitraniline and p-phenylene diamine or p-phenylene diamine and aniline were oxidised under similar conditions. From a mixture of m-nitraniline and p-phenylene diamine

oxidised with sodium chromate and hydrochloric acid, a quantity of a dark brown substance was isolated which has been designated NAZ. It contains after washing about 30 per cent of chromium (estimated as Cr_2O_3) and is probably a compound of chromic oxide and a dye.

2. In another report, A.R.D. Explosives Report No.585/44, the author reviews the same work and describes the preparation of other nitro-compounds, (i) by condensing certain nitramines with formaldehyde and (ii) by nitrating dyes.

(i) The compounds formed by condensation with formaldehyde have all definite melting points and are soluble in alcohol. The condensation of picramic acid and formaldehyde is described in detail. The product melts at 186°C. and ignites at 183°C.

(ii) Nitration of azo-dyes gives products which are probably mixtures having low ignition points. Of the diphenyl and triphenyl-methane dyes, auramine, malachite green, and aniline blue, give a good yield of combustible materials whose ignition points are not too low for use. The constitution of these compounds is discussed. Several azine dyes were nitrated but the ignition points of the products are low. The nitration of emeraldine gives a reddish-brown substance, soluble in acetone, which burns very readily. Nitration of methylene blue and methylene green gives the same product, a green powder, which burns readily and has a high ignition-point. The constitution of this material is discussed. Acridine yellow when nitrated gives a compound which has an ignition point of 133°C. Quinoline yellow gives a compound soluble in water; and of the sulphur dyes, primuline gives a small yield of a compound which burns readily. Indigo forms a compound, probably dinitroindigo, which has a high ignition point and burns slowly without flame.

3. Most of the compounds which are described in these papers have properties similar to those of nitro-indene polymer (NIP). They do not melt before decomposition or ignition and, mixed with potassium nitrate, provide compositions which burn rapidly at atmospheric pressure and continue to burn under reduced pressure. Thus NAP provides a composition with potassium nitrate that burns somewhat slower than NIP and continues to burn under a pressure of 6 inches of mercury. NAZ, probably because of its high content of chromium, provides a composition which burns more slowly. Its rate of burning is less affected by change of pressure. Nitrated auramine gives more satisfactory results and its rate of burning is scarcely affected by change of pressure.

4. In a further report, A.R.D. Explosives Report No. 208/45, T. Urbanski and S. Minahan describe the preparation of some complex cobalt co-ordination compounds. The general formula for these compounds is $(CoZ_2X_2)Y$, where Z represents an organic base such as methylamine or ethylene diamine, X a nitrito, nitrate or chloro group and Y a nitrite, nitrate, chloride or azide group.

Of the 17 compounds prepared and examined for burning properties and stability, the most promising was cobalt diethylene-diamino dinitro nitrite $(Co\ en_2\ (NO_2)_2)\ NO_2$, where en represents ethylene diamine. Two methods for the preparation of this salt are given and a summary of one of them follows. Cobalt nitrate and sodium nitrite are dissolved in water at 45-50°C. and a solution of glacial acetic acid in an equal volume of water is slowly added with stirring. The ethylene diamine monohydrate is next added. The mixture which is now at 70°C. is cooled in ice and after standing overnight the fine yellow crystals are filtered off and washed with alcohol and ether. The weight of product obtained is equal to that of the cobalt nitrate used and consists of a mixture of the cis and trans isomers. The trans isomer contains two molecules of water of crystallisation which is lost on drying at 105°C. The product when pure and dry is completely non-hygroscopic and does not pick up

moisture when exposed to a relative humidity of 75 per cent. The chemical stability is good. The decomposition temperature is 205°C. no gas is evolved on keeping at 100°C. for 40 hours and it is unaffected by boiling water. It is difficult to ignite and the substance when burned alone does not give sufficient "spit" to ignite A.S.A. The figure of insensitiveness is 59. It does not ignite when struck a glancing blow with a boxwood mallet on stone, hard wood and soft wood. The rate of burning is 60 seconds per inch in a 0.25-inch diameter brass tube.

The above salt still contains insufficient oxygen to oxidise it completely to carbon monoxide, water, and cobalt oxide, and an improved oxygen balance is obtained by replacement of a nitrite group by a nitrate group. The compound so formed appears to be satisfactory but has not been so thoroughly examined.

Remarks by the Panel — Noted.

It is presumed that compounds of the kind described in these reports are still being investigated by C.S.A.R. The Panel would be glad to receive any reports which are available for their application.

ACTION

1. Forward to C.S.A.R. (Fort Halstead).

2. Ask him to forward to the Panel any further details that he may have of the pyrotechnic properties of these compounds and also details of their application.

D.Arm.R.D., D.N.O., D.G. of A., C.C.I., C.E.A.D., D.C.F./F., E.P.O./D.G.O.F., Sec. P.I.F.I. and Sec. O.B. B.C.S.O. Washington for information.

No. P.P. 545.
16.4.46
Former P.P. 371

Cartridges Signal 1 in. Red Mark 12
Composition for Star
(Ref. 87/4)

Extract from C.S.A.R's trial report to Sec. P.P. on cartridges made up in aluminium cases, ref. XC(4)0008/1/32 dated 14.3.46.

"5. The Red Mk. 12 stars filled S.R. 297C were slow in igniting and did not attain full intensity until the star was at or past the apex of the trajectory (400-500 feet); The stars in consequence burned for about 2 seconds on the ground. It is recommended that consideration be given to the replacement of the composition S.R.297C, which contains grade 0 magnesium powder and which is slow in igniting, by a composition such as S.R.406 which contains grade 4 magnesium powder. Composition S.R.406 is already used in the Red Mk. 13 star and has a slightly higher intensity and faster rate of burning than S.R.297C. The use of compositions containing grade 0 magnesium powder for signal stars which have to ignite rapidly has been discontinued for other signal cartridges (viz. S.R.582 was replaced by S.R.413 for the cartridge, signal, 1½-inch, Double Star, Mk. 3)."

Remarks by the Panel

The Panel were informed by D.Arm.R.D. that for some time S.R.232 containing Grade 4 Magnesium has been used in the Cartridges Signal 1" Mark 12 as an alternative to S.R.297C. They RECOMMEND that this change, together with the details of manufacture, which have been found desirable in wartime production, e.g. roughening the surface of the priming pellet after the star has been pressed, should be shown on the design for record; but, before introducing further changes, it would appear desirable to await the introduction of the Aluminium Signal Cartridge

Remarks by the Panel (Contd.)

case (P.P. 537) and the results of trials with compositions containing atomized Magnesium powder, (P.P. 526).

ACTION

Forward to D. Arm. R.D.

2. Ask D. Arm. R.D. to note the Panel's Remarks, and if he concurs to arrange for the recommended amendments to the design.

D.N.O., D.G. of A., C.I.N.O., C.I.A., D.D.I. Arm., C.S.A.R., C.E.A.D., C.C.I. for information.

No. P.P. 546
16.4.46
Former P.P. 532

Cartridges 1 in. Illuminating J. Composition for Stars (Ref. 87/5)

Extracts from C.S.A.R.'s trial report to Sec. P.P. on cartridges made up in aluminium cases, ref. XC(4)0008/1/32 dated 14.3.46.

"3. The illuminating stars were filled with either S.R.568A or S.R.588. The stars filled S.R.568A were about 1.75 inches long and had a time of burning of about 7 seconds; the stars filled S.R.588 were about 1.25 inches long and had a time of burning of about 7 seconds. Either S.R. 568A or S.R.588 (which contains the more readily available grade 0 magnesium powder) are used in the present design of 1 inch, Illuminating, J Mk. 3 cartridge, and the approximate performance of these stars is as follows:-

Composition	Approximate length of star (inches)	Approximate time of burning (seconds)	Approximate candle-power
S.R. 568A	1.75	6.5 - 7.5	75,000
S.R. 588	(1.25 (1.5	6.5 - 7.5 8.5 - 9.5	65,000

"7. Illuminating cartridges with aluminium cases with stars filled S.R.568A (1.75 inches long) and with stars filled S.R.588 (1.5 inches long) have been supplied to D. of A.(S.A.) for comparative trials."

Remarks by the Panel: The Panel would be glad to receive information of the trials leading up to the

Remarks by the Panel (Contd.)

introduction of composition S.R.588 and a copy of the report of the comparative trial of the cartridges supplied to D. of A.(S.A.) (P.P. 483 refers). They draw attention to their recommendation in P.P. 532, Remarks, para. 3 that compositions using atomized Mg. powders should be tried.

ACTION

Forward to C.S.A.R. and D. of A. (S.A.).

2. Ask C.S.A.R. to forward the information requested on the development of composition S.R.588.

3. Ask D. of A.(S.A.) to supply a copy of the report referred to in the Remarks when available.

D.N.O., D.Arm.R.D., C.E.A.D., C.I.N.O., D.D.I.Arm., D.G.O.F., C.C.I., B.C.S.O. Washington, C.S.L.O./N.R.C., A.M.R., M.L.O./N.Z., U.S. Naval & Military Attaches, Sec. O.B. and O.C.O. India for information.

No. P.P. 547
16.4.46
Former P.P. 264

Rocket Line-carrying S.P.R.A. 12 lb. (for H.M. Coastguard)

(Ref. 29/5)
(see photograph attached)

Sec. P.P. to M.W.T. Ref. 29/5 dated 6.3.46.

"With regard to Messrs. Schermuly's Rocket Line-carrying 12 lb. Mark I for use by H.M. Coastguard, the Panel understands that this equipment may replace the old "Boxer" rocket gear and I am instructed to ask that a copy of the reports of your comparative trials with cordite rockets and the gunpowder-filled rockets may be sent to the Panel, in view of its interest in line-carrying rockets and their applications to service uses."

Report by M.W.T. (H.M. Coastguard) ref. C.G. 2090 dated 20.3.46.

"Specification is to carry a 1 inch line not less than 250 yards Range when fired at an angle of 16-20 degrees.

I. Original Trial at Newdigate 22.8.1945. Light Wind Force.

II. Three successive Shots:- rockets fell within a very small radius at 315 yards range, direct for point of aim; 1 inch Rocket line used in each case.

II. Comparative trials with cordite Rocket Type J. at Eastbourne 24.10.45.

Trials carried out in squally weather, heavy showers - wind force 427, one inch line in each case.

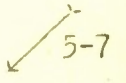
Force and Direction of wind relative to Line of Fire

Schermuly 12 lb. Rocket

1. Rocket landed 250 yards, 125 yds. drift of line to left.
   Elevation 35° (too high)

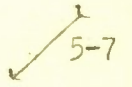


2. Rocket landed 290 yds, 55 yds. drift to left.
   Elevation 18 degrees



Boxer Rocket for comparison

2A Rocket landed 345 yds, 60 yds. drift to left.
   Elevation 25 degrees.

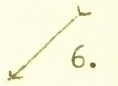




3. Rocket landed 300 yds. direct into wind no drift.
   Elevation 15 degrees.



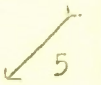
4. Rocket landed 200 yds. Bounced, Bad shot.
   Elevation 15 degrees.



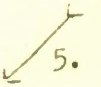
5. Rocket landed 300 yds, 40 yds. drift to left.
   Elevation 20 degrees.

Cordite Type J Rocket

Modified with 12 lb. weighted lead



1. Rocket landed 350 yds, 20 yds. drift of line to left
   Elevation 30 degrees.



2. Rocket landed 310 yds, no drift of line.
   Elevation 18 degrees



3. Rocket landed 330 yds, no drift of line.
   Elevation 20 degrees

Although the weather conditions were not heavy and no opportunity has up to date occurred for testing the conditions peculiar to a cliff edge in gale force wind, the conclusions arrived at are that Schermuly 12 lb. Rockets can be relied on to carry a 1 inch line to a range of 250 to 300 yds.

In order to release a certain number of Boxer Rockets (not now being manufactured) Schermuly 12 lb. Rockets are being supplied to 24 Intermediate L.S.A. Stations.

Interesting points of comparison between the Cordite Type "J" Rocket, Schermuly 12 lb and Boxer Rockets are:-

Cordite - has a very high initial speed and short time of flight. Takes the line rapidly to a culminating point of approx. 250 - 300 feet at about 8/10 Range and falls rapidly.

There is therefore very slight wind effect on the trajectory and drift of line due te a cross wind. There is however considerable wear and tear of line and the present Rocket Line 1 inch would not survive more than 6 to 10 shots.

There is considerable back fire on discharge; this can probably be overcome.

Schermuly and Boxer - The initial speed is gradual and the normal speed of flight is approx. 600 ft. per second. The trajectory is low - about 80-100 ft. at 2/3 yds. of range and the consequent drift of line is larger, in fact an allowance of 30 degrees to windward is necessary in a cross wind of gale force.

General conclusion is that it is very desirable to have a Rocket that will attain a range of 400 to 500 yards and it is therefore hoped that further investigations will be made in the problem before the stock of Boxer Rockets is exhausted."

Memorandum from vice Chairman P.P. dated 29.3.46

"The rocket has been designed to replace the Boxer Rocket hitherto in use by the Coastguard Service, supplies of which are no longer available. It is required to carry the Board of Trade line (Manilla, 1" circumference, 1200-lb. breaking strain) to a range of 250 yds.

The single stage steel rocket motor is filled with powder, and fitted with a hemispherical head and a short projecting tapered venturi. A greased brass cap is screwed on to the venturi to ensure watertightness in store (it was suggested that a leather washer would improve this feature). The type of hinged bridle common to other Schermuly Line-carrying Rockets is attached about the middle of the motor, and is connected by a length of steel cable covered with braided asbestos to the end of the line.

The projector consists of a steel tube mounted with an elevating quadrant on a braced tripod of tubular steel. Into the rear end of the tube screws a breech piece carrying the electrically fired cartridge, with a vent tube which extends through the venturi into the rocket motor when the rocket is loaded. The firing cartridge is provided with a short rubber-covered electric cable containing two leads, which terminates in a standard two-pin connector; this cable passes through the hinged breech closing plate, which is fastened by means of a spring catch.

An extension lead, wound on a drum with handle, is provided with a socket at the free end for the connector. The inner end is connected to a second two-pin fitting mounted on the side of the drum; this in turn can be connected to the battery box, on which is mounted a push-button firing switch.

Two rockets were fired. Each functioned correctly; extending the line to a distance of approximately 315 yards, falling a few yards off the aiming mark; a very light breeze was blowing from right to left across the range."

Remarks by the Panel

1. The Panel notes the introduction of this equipment to replace the old Boxer life-saving rocket gear.

2. They observe that the desire of H.M. Coastguard to get a range of 400/500 yards is not attained by this 12 lb. Schermuly rocket, but are of the opinion that a larger rocket could be produced to fulfil the need.

3. The future replacement of compressed gunpowder for filling rockets by some other propellant that is not liable to give dangerous explosions of the rocket body is dealt with in P.P. 548.

4. (a) The Panel understands that Rockets have been developed with Coated Cordite filling which gives a lower thrust over a longer period than the 2 inch motor employed in the Cordite Rocket concerned in this report.

(b) It is understood that C.S.A.R. will provide rockets of this Coated Cordite type for further tests by M. of T.

ACTION

Forward to M. of T. Ask M. of T. to let the Panel have copies of reports of his further trials with cordite filled or other rockets, in due course.

D.N.O., D.Arm.R.D., D.G. of A., C.E.A.D., C.S.A.R., C.P.D., C.S.P.D.E. and Sec. O.B. for information.



No. P.P. 548
16.4.46

Former P.P.s. as given in Text

Rockets, Substitution for Gunpowder of some other Propellant (Ref. 97/1)

Remarks by the Panel

The liability of gunpowder-filled rocket bodies to explode, with danger to life and limb when the bodies are made of steel and not paper, is dealt with in P.P.s 187 and 295.

2. Research into the causes of these explosions was conducted by the Ordnance Board and was stopped by O.B. Proc.U.1990 (see P.P. 290), no satisfactory explanation having been discovered.

3. At that time, it was intended to develop S.R.432 (a slowed down T.N.T.) as an alternative filling, to avoid the risk of explosions, chiefly because the use of cordite could not be contemplated owing to the supply position during the war.

4. The end of the war and some objectionable features displayed by S.R.432 rocket fillings while under trial led to this development being dropped, see P.P. 539 and O.B. Proc. U.2709.

5. Explosions of paper bodied rockets (Signal and T.P.) are also liable to occur, especially after subjection to the severe conditions of C.S.A.R.'s latest climatic storage test (see P.P. 543).

6. Although any further use of the P.A.C. or Snowflake Rockets, (Apparatus A.D. Type D.) seems unlikely, a number of the smaller sizes of Schermuly type rocket are service articles for line-carrying and illuminating purposes;

Remarks by the Panel (Contd.)

and a 12 lb. rocket has just been introduced by H.M. Coastguard as a substitute for the old Boxer type of life-saving equipment (see P.P. 547).

7. (a) The question arises whether research and development should continue with the aim of getting rid of compressed gunpowder fillings for the bodies of all signal and other pyrotechnic rockets, to avoid risks of body explosion.

(b) A low priority development of a cordite filling for a steel signal rocket is already proceeding (P.P. 492).

8. If the answer to 7(a) is yes, the question arises whether such research and development should be dealt with by the Pyrotechnic Panel.

ACTION

Forward to D.N.O., D.G. of A., D.Arm.R.D., C.S.A.R., C.S.A.R.Tondu, C.S.A.R. Woolwich, C.P.D., M. of T. and Sec. O.B. asking them for their remarks on paragraphs 6, 7 and 8 above.

No. P.P. 549
16.4.46
Former P.P. 161

Flame, Float, A/C. Nav. No. 2 Mark I. (Ref. 85/1)
(Formerly Flame, Float, A/C. Nav. Mark II)

Summary of Functioning Trials reported in M.A.E.E. Helensburgh Report No. H/ARM/47M Report No. 15 dated 9.8.45.

1. 48 Floats, 12 each made by four manufacturers, were chute-launched from a Wellington Aircraft at ground speeds of 121 knots to 166 knots from heights of 7,000 to 2,000 feet.

2. The Floats were observed from the air and from a launch, by which the bodies were recovered when possible.

Results

Although the height of release was reduced progressively from 7,000 to 3,000 feet, or in some cases 2,000 feet, for each lot of floats, not one of the floats withstood impact without showing signs of damage or leaks from which a proportion of the gas bubbled up through the water and ignited at the surface. In many cases more serious damage resulted and 7 floats failed completely, of which 6 were not seen and another was recovered from which the nose cap and filling were missing. A table is given below showing the comparative average burning times and number of failures for the floats from each manufacturer.

Float Numbers	Average Burning Time Mins.	Secs.	Number of failures
1 to 12	7	23	3
13 to 24	6	23	2
25 to 36	7	39	1
37 to 48	7	45	1

The observers in the aircraft were of the opinion that, although damage to the case produced a flickering and intermittent flame owing to the escape of gas below the surface, it would have been possible in most cases to take a drift on the flame produced. Nevertheless it cannot be said that the floats operated satisfactorily even at 2,000 feet.

Conclusions

(a) The construction of the Flame Float, Aircraft, Navigation, No. 2 Mark I is not sufficiently robust to withstand impact with the water from heights even down to 2,000 feet. The particular points of weakness being:-

(i) The nose and soldered nose joint.

(ii) The centre joint.

(b) Occasional damage to the central body of the float is to be expected owing to distortion of the tail vane on impact.

(c) The flame emitted by a damaged float cannot be relied upon with certainty for taking a drift.

Copy Minute by D.N.O. dated 20. 2.46 on G.O. 2003/46 in N.O. 5609/46

"The results of this trial are noted with interest.

2. With one exception the floats which completely failed were all released from heights considerably in excess of those used by Naval A/C.

3. Regarding para. 5 D.N.O. does not recollect having seen reports of failures due to these causes, though it is realised that such defects might not necessarily mean complete failure to function.

4. In view of 5(c) however, the urgent need for a stronger float such as the combined smoke and flame float with high T.V. is emphasised."

Memorandum Vice Chairman P.P. to Sec. P.P. dated 1.4.46.

In order to avoid these failures the following modifications were to have been tested:-

(a) A thickened centre tube in the phosphide chamber, pierced with a series of 3/8 in. diameter holes, instead of slots.

(b) Reinforcement of the base of the phosphide chamber by a ribbed steel plate, spot welded in position.

(c) Substitution of a pressed cup for the tube projecting below the phosphide chamber.

Air Staff have now decided, however, that this work shall be suspended: effort being concentrated instead on the H.T.V. Smoke and Flame Floats.

Remarks by the Panel — The Panel notes that further work to improve the reliability of existing smoke floats and flame floats will be stopped and effort concentrated on developing satisfactory H.T.V. combined Smoke and Flame Floats (see P.P.s 520, 521 and 522).

ACTION — D.N.O., D.N.O./L., D.Arm.R.D., C.E.A.D., C.N.R., C.S.A.R., D.A.W., D.R.A.E., C.I.N.O., D.D.I.Arm. for information.

No. P.P. 550 CONFIDENTIAL
16.4.46
Former P.P. 352

Cartridge Signal 1½ in. Brown Smoke Puff for use at High Altitudes (Ref. 131/1)

Minutes of a Special Meeting held on March 19th, 1946 at the Pyrotechnic Panel Office

IN ATTENDANCE:-

Mr. C. Lea	Vice Chairman P.P. (In the Chair)
Mr. A. Day	R.D. Arm. 1
Mr. G. F. Ebeling	R.D. Arm. 1(a)
Mr. W. T. Salter	R.D. Arm. 1(a)
Dr. P. W. B. Harrison	R.D. Arm. 8.c.
Mr. E. W. Sears	R.D. Arm. 14
Ft. Lt. K. Powell	C.E.A.D. D.4
Mr. H. Reynard	C.E.A.D.
Mr. Goldsmith	E.P.O./D.G.O.F.
W/Cdr. Cresswell	C.E.A.D./F.
Mr. D. F. Swift	D.C.F./F.
Mr. G. E. Hicks	Orfordness Research Station
Mr. J. S. Dick	C.S.A.R.
Dr. J. W. Skeen	C.S.A.R.
Ft. Lt. Lisowski	R.A.E.
F/O. A. H. Young	B.B.U.(R.A.F. Woodbridge)
Cdr. W. Ross, R.N.	Sec. Pyro Panel.

The Chairman informed the Meeting that the supply of reliable cartridges to O.R.S. Orfordness in time to enable high altitude bomb ballistic trials to be resumed as soon as good weather sets in is D.Arm.R.D.'s most urgent pyrotechnic requirement and all work necessary in this connection is to be given the highest possible priority.

Orfordness R.S. Report dated 25.2.46, was considered and Mr. Hicks said that in a further trial at 31,000 feet (-50°C), of 15 smoke puff cartridges, having propelling charges of 66 grains of G.12, only 3 had given puffs. Two caps had not been struck and four had been struck very lightly and had probably not fired. The remaining six had ejected the puff

unit without producing a puff; but examination of the felt wad in four of these suggested that the gunpowder may not have burnt correctly: the unit might have fallen out before, or when, the cap fired. He confirmed that when it functions correctly, the cartridge gives a puff which can be observed satisfactorily from the ground. One discharger has been fitted with 70 in.-oz. striker springs and with this, no cap failures have so far occurred.

A report by R.O.F. Swynnerton F.D.D. dated 29.1.46 on gauging and firing signal cartridge cases was then discussed. From this it appeared that while there was considerable variation in the dimensions of the cartridge heads, even those with the smallest head-space could not be relied on to fire in the discharger. Increased striker protrusion produced no improvements: but stronger striker springs (about 68 in-oz.) reduced the proportion of failures considerably: all the failures were found to be struck off-centre.

Mr. Day said that the discharger, of which about 500 have been made, had not been designed for use from high altitudes, and was believed to have been used with satisfaction at low altitudes by Coastal Command and 2nd T.A.F. The striker springs originally fitted gave a blow of 40 in-oz. which should be sufficient since he understood the service cap to require only 24 in-oz. The solenoids are unlikely to release the sears if still stronger springs are fitted.

Redesign of the discharger, to enable it to be used at 55,000-60,000 feet (which is expected to be required shortly) has not yet been called for, and will probably entail building in heating elements or the use of an electric primer: this could not be ready in less than 12 months. In the meantime, the best course would be to select the best available dischargers and fit them with 90 in-oz. springs. He stressed the importance of good maintenance with a minimum of oils. O.R.S. asked that detailed instructions might be issued, pointing out that while a warrant officer had been appointed to supervise maintenance, the work involved was considerable,

with four not very accessible dischargers in each of three aircraft. Since the aircraft must be ready at an hour's notice to take advantage of favourable weather, installation of the dischargers cannot be left until the last minute. They asked for 100% reserve and IT WAS AGREED that they should be supplied with 24 dischargers, specially gauged and passed by Goffs Oak and proofed by firing in the R.A.E. cold chamber.

In view of the fact that the head-space of the cartridge seems to make little difference, it was decided not to attempt to select cartridge cases within particular limits; and since manufacture of this cartridge case has ceased, W/Cdr. Cresswell's suggestion of an anvil with radiused edge cannot be followed up at present. C.E.A.D. confirmed, however, that this question is being considered in the design of the aluminium cartridge case, which will probably incorporate the same cap and anvil as the 20 m.m. cartridge.

F/Lt. Lisowski mentioned that in the discharger used in his tests at R.A.E. two of the six strikers failed completely to release: Mr. Salter will inspect this as soon as the present series of cold tests is complete. It was decided that difficulty in opening and closing the breech at low temperatures was not important.

Cdr. Ross suggested that the indentation produced by the striker at normal and at low temperature be compared by the Naval inspection method: R.D. Arm. 1 will contact C.I.N.O. on this subject.

The results of F/Lt. Lisowski's trials at low temperature and pressure were next considered. These had been intended to examine the effect of low pressure and low temperature, separately and together, on the reliability of the discharger, cap and propelling charge. The weight, and nature of the propelling charge and the size of the cavity in the felt washer in which it is housed had all been varied. Failures appeared to be the result of low temperature rather

than low pressure, and were reduced, with felt washers of the approved internal diameter (3/4 in.) by increasing the weight of gunpowder. Alternative propellants, S.R. 227 and S.R.346, appeared to give better results. D.G.O.F. said that S.R.227 is in good supply but S.R.346 is not: and it was AGREED that cartridges should be made for air trial with bursters of 31 grains of S.R.227, using felt washers with 5/16 in. holes.

W/Cdr. Cresswell suggested that to facilitate correct assembly, the part of the propelling charge which occupies the hole in the felt washer should be inserted as a perforated pressed pellet. It was decided that this should be discussed further at the 75th Meeting of the Panel.

Dr. Harrison drew attention to the fact that no failures to fire had been recorded in the trial with green signal cartridges; in this design the burster is tightly packed, the star fits more tightly in the cartridge and the cartridge is more firmly sealed than the brown smoke puff cartridge. O.R.S. stated that in some cartridges the puff had fallen away without breaking the paper sealing band, which remained attached to the cartridge case. After some discussion on alternative adhesives, and the use of tapes, such as Lassovic, it was AGREED that Lassovic should be used, subject to satisfactory results in a test to be done by W/Cdr. Cresswell. It was AGREED that the puff unit should be fitted more closely to the case by affixing a roll of paper ½ inch wide, just above the delay diaphragm; and that composite cylinders should be used, instead of scored cylinders, which might be responsible for prematures.

O.R.S. said that further trials would be done, with a signal pistol, on the special cartridges having delays of S.R.346, and the results would be reported to the Panel: enough evidence was not yet available to say whether this composition is reliable. Dr. Skeen pointed out that the conical cavity at the inner end of the delay had not been made in the smoke puff cartridges both white and brown, of Bridgend manufacture which he had broken down. It was mentioned that

these had been made under Naval inspection, and it was X AGREED that the Factory and Inspectorate's attention should be drawn to the fact that this feature has been shown to reduce the risk of failure.

Mr. Dick said that at extremely low pressure, a small proportion of delays filled S.R.346 might fail: and that barium peroxide tracing compositions might be more reliable. It was AGREED to discuss this suggestion further at the 75th P.P. Meeting.

After some discussion on the need for the millboard washer in the base of the smoke puff, and a suggestion by W/Cdr. Cresswell that the hole should be countersunk, it was AGREED that the washer should be retained unaltered for the present, but that countersunk washers should be sent for Dr. Skeen's inspection.

PRODUCTION. It was stated that production can commence in the Experimental Station, R.O.F. Swynnerton, at the rate of 500 per week as soon as closing and delay diaphragm are supplied and the design details arrive. It was confirmed by O.R.S. that this rate would be sufficient for the programme of ballistic trials, and E.P.C. said that the first 500 sets of diaphragms would be available by 9th April.

C.E.A.D. undertook to provide D.D.O.F. with a sketch showing the necessary alterations to the sealed design; and D.D.O.F. undertook to inform Dr. Skeen when filling is to commence, so that he can confirm that everything is in order.

The need for further special meetings on this subject will be considered when the first cartridges of the modified pattern have been tested.

Memorandum Res. Arm. 4757 from D.Arm.R.D. dated 22.3.46

"Mr. Hicks 'phoned today to give the results of the firing of cartridges from a pistol at high altitude.

As agreed at the P.P. meeting on Tuesday 19th March, he fired 23 of the last batch delivered to Orfordness from R.O.F. Swynnerton at heights between 38 and 40,000 ft., recorded air temperature, electrical thermometer -42° C, air temperature probably -47°C, (correct figure has been requested by him from Met. Office).

(i) 14 cartridges fired correctly and puffs functioned.

(ii) 1 cartridge fired correctly. Puff unit was ejected but no burst was seen.

(iii) 8 remaining cartridges - all caps fired correctly, but the gunpowder propellant charge was not ignited, and the puffs were not ejected.

Mr. Hicks stated that in one of these 8 there was evidence that the cap flash ignited the NIP delay without lighting the gunpowder, as the puff functioned after 2 seconds delay.

He agreed that this improvement is very satisfactory and discloses the extent of the discharger trouble."

Remarks by the Panel

Although it appears that misfires of percussion caps caused by faulty operation of the Dischargers are very frequent at very low temperatures, the available evidence shows that even at ground level the behaviour of the existing Dischargers is not altogether satisfactory, not only with Cartridges Brown Smoke Puff, but also with Photographic Flash Cartridges, see. P.P. 440.

2. As regards the filling of the Cartridges B.S.P.:-

(i) It seems to be clear that a gunpowder propellant is unreliable at these very low temperatures and that its replacement by S.R. 227 may cure this trouble.

Remarks by the Panel (Contd.)

(ii) It seems doubtful whether the Delay Composition S.R.346 will prove sufficiently reliable at high altitudes.

3. The Panel was informed that a sketch design, embodying the improvements to the filling that were discussed at the special meeting, has been issued by C.E.A.D. to D.O.F./F. to govern production by Swynnerton of the next batch of trial cartridges.

ACTION

Forward to D.Arm.R.D. and C.E.A.D., D.R.A.E., D.D.I.Arm., C.I.N.O., and C.I.A.

2. Ask D.Arm.R.D. to send to the Panel a copy of the report of the high altitude trials with the next batch of modified cartridges now being filled at Swynnerton.

3. Ask C.E.A.D. to send to the Panel a copy of the sketch design referred to in paragraph 3 of the Remarks above.

4. Ask D.D.O.F., D.D.I.Arm., C.I.N.O., and C.I.A., to note the importance of the conical cavity at the inner end of the delay column, (Ref. 'X' Page 5).

5. Ask D.R.A.E., to forward details of his trials at low pressure temperature on signal cartridges with various propelling charges.

D.N.O., D.N.O./L., D.G. of A., C.S.A.R., and C.C.I. for information.

No. P.P. 551
7.5.46

Secrecy of Pyrotechnic Compositions

Proposed degrading (Ref: 200/5)

C.C.I. to Sec. O.B. (Ref. No. S.2124 dated 21.3.46.)

In accordance with the ruling given in O.B. Proceedings Nos. 10577 and 10801, certain C.S. specifications for pyrotechnic compositions which were previously "SECRET" have been issued as "OPEN" specifications with an annexure in the terms shown at Enclosure 1.A.

It is thought that the need for this "semi-secret" condition of issue no longer arises, and it is proposed, subject to agreement of the Ordnance Board, to seek approval of the relevant user authorities for the deletion of this annexure from the specifications in question.

A list of the specifications and compositions concerned is attached at Enclosure 1.B.

The concurrence of the Board in this proposal would be appreciated.

Sec. O.B. to C.C.I. (Ref. No. O.B.E.714 dated 5.4.46.)

Reference Minute 1, pyrotechnics in general have been taken over by the Pyrotechnic Panel to whom it is suggested that this subject should be referred.

S.R.563, 580 and possibly some others are used in service star shell and the Board have no objection to your proposal so far as these are concerned.

C.C.I. to Sec. P.P. dated 10.4.46.

Referred, for concurrence of the Panel in the proposed deletion of the annexure referred to at minute 1 and enclosures, in respect of the compositions not already

cleared by the Ordnance Board.

Sec. P.P. to C.C.I. (Ref. 200/5 dated 16.4.46.)

The Panel concurs. This transaction will be put "on record" in a P.P. minute.

ACTION Forward to - D.N.O., D.G. of A., D.Arm.R.D., C.I.N.O., C.I.A., C.S.A.R., D.D.I. Arm., C.C.I., O.C.O. India., A.M.R., C.S.L.O., M.L.O.,(N.Z.)., D.G.T.S.(S.A.), B.S.A.C. Washington for information.

Enclosure 1A

(TYPICAL)

Contractors and others to whom Specification C.S./933F is issued are requested to ensure as far as possible that its circulation is restricted to employees of proved reliability.

This notice must be detached before the specification is circulated.

E. F. FIGG

for Chief Chemical Inspector

Enc. 1B.

Spcfn. No.	Nomenclature
C.S. 617	Composition S.R. No. 521
C.S. 619	" " " 522
C.S. 621	" " " 534
C.S. 622	" " " 536
C.S. 796	" " " 561
C.S. 797	" " " 562
C.S. 798	" " " 569
C.S. 854	" " " 568
C.S. 914	" " " 578
C.S. 922	" " " 575
C.S. 933	" " " 580
C.S. 941	" " " 568.P.
C.S. 961	" " " 568.A.
C.S. 965	" " " 565
C.S. 1138	" " " 579
C.S. 1196	" " " 563
C.S. 1297	" " " 585
C.S. 1352	" " " 588
C.S. 1377	" " " 586
C.S. 1389	" " " 591

No. P.P. 552
21.5.46
Former P.P. 494

Improved Packages for Tropical Use
Box B.571 for Flares A/C. 4 in. (Ref. 150/1)

I.N.O. Woolwich to C.I.N.O. dated 6.3.46 ref. Z.9460/4/1.
(Extracts from)

"A rough usage trial was carried out at Royal Arsenal, Woolwich, on 1.3.46 on a wood box B.571 (modified) containing two 4" reconnaissance flares each in a sealed tin cylinder.

2. Weight of box and stores ..... 112 lbs.
" " 1 flare in cylinder ..... 33 lbs.
" " box empty ..... 46 lbs.

3. Hot water test for airtightness - correct. Box side had one split about 9" long.

4. Eight hours' modified jolt and rolling end for end through two revolutions on concrete caused no damage.

Cycle 1. Drops on concrete from 18". 6 drops in each cycle on to bottom, sides and ends. Slight bulge was apparent on end of one tin cylinder.

Cycle 2. Repeat drops from 2-ft. Crack on side increased slightly. Second crack started.

Cycle 3. Repeat drop from 3-ft. Batten near lid split due to corner drop. One interior batten loose. Increased markings on cylinder end.

Cycle 4. Repeat drops from 4-ft. 6 ins. Cracks spread further. Two quick cotton catches damaged, one broken. The tin cylinders showed signs of cracking at one end. Two cork buffers on lid came loose. One final drop was made on extended handles of the box from 3'6". One handle bent. No further damage to box.

5. Hot water test for airtightness correct. The flares appeared undamaged.

6. Conclusions: The wood box and tin cylinders are considered satisfactory for Naval Service. The following comments are offered.

The wooden box just stood up to rough usage but was not in a Serviceable condition at the finish. The tin cylinders survived the trial, the end discs and the joint between the ends and side appeared to be the weakest points. The back plate on the handles was satisfactory."

Remarks by the Panel

1. Although this box appears to meet Naval requirements for stowage in magazines, if packages for such Flares are required for R.A.F., the Panel RECOMMENDS that the outer container be of steel. (See P.P. 531, Remarks by the Panel.)

2. Moreover, the Panel RECOMMENDS that in all such packages a means of making the internal cylinder watertight again, after a store is removed and replaced, be provided; this is not the case when, as here, the cylinders are sealed with a tear-off strip.

3. The Panel is informed by C.E.A.D. that stowage dimensions of Box B.571 are 34.3" long x 18.8" wide x 10.25" deep.

ACTION

Forward to D.N.O. and D.Arm.R.D. to note the Panel's Remarks and recommendation.

D.N.O./L. D.G. of A., C.E.A.D., C.I.N.O., D.A.S., D.D.I.Arm., C.I.A., C.S.A.R., Sec. I.S. Pack. Com., Sec. Interdepartmental Pack. Co-ord. Comm., D.G. of E., D.Arm.R., P.P.C.O./M.A.P., P.P.CO./M.O.S., O.C.O. India, B.S.A.C. Washington A.M.R., MLO.(N.Z.), C.S.L.O./N.R.C., A.O.C./R.A.A.F. London, for information.

P.S. Note.

On C.I.N.O. 1348/46 it was later stated by D.N.O. that this package is no longer required. Ref. Res. Arm. 6623 dated 3.6.46.

No. P.P. 553
21.5.46
Former P.P. 546

Cartridge 1 in. Illuminating J. Star Composition. (Ref. 87/5)

Extracts from report dated April, 1946, from Comdt. Small Arms School, Hythe, to D. of A.(S.A.) (Ref. A.708)

The trial of the two types of experimental illuminating signal cartridges forward by D. of A.(S.A.) was carried out at Hythe on Friday, 12th April, 1946.

Method

(a) The following signal cartridges were under trial:-

Type "A" - filled S.R.588 - 25 in number
Type "B" - filled S.R.568A - 15 in number

Service cartridges illuminating J. Mk. 3 T were used as control.

(b) Signal pistols 1" were fired by remote control from a fixed rest so as to give each illuminating star the same angle of projection. Angles of projection used were 80° and 45° set by clinometer.

(c) Illuminating stars were observed at the following points:-

(i) By day - for brightness, height and time of burning at firing point - 1,000 yds. - 1500 yds. - 2,000 yds.

(ii) By night - for brightness, time of burning, distance of observation and ease of identification of objects at firing point - 100 yards and 200 yards in front of firing point.

(d) Time of burning and functioning were recorded at the firing point.

(e) Order of merit was decided for each characteristic by allotting 3-2-1 points.

(f) Order of firing was unknown to the observers.

Results

(a) Consolidated results showing order of merit points, 3-2-1 basis are as follows:-

Trials I - II - III - IV (Day)

Cartridge	Brightness	Height (Compared)	Time of burning	Height (measured)
Service	1.925	1.65	9.5 secs	391 feet
Type "A"	2.0	2.025	9 "	422 "
Type "B"	2.075	2.325	7.5 "	422 "

Trials V - VI - VII - VIII (Night)

Cartridge	Brightness	Time of burning (compared)	Ease of Identification of objects	Distance of observation
Service	1.1	2.8	2.4	200 yds.
Type "A"	2.8	2.2	2.6	250 yds.
Type "B"	2.1	1	1	250 yds.

(b) Remarks on results are as follows:-

By day

(i) There was very little to choose between any of the types for brightness.

(ii) Both experimental types appeared to go slightly higher than the service star and both maintained a very even height. These estimates were confirmed by measured recordings.

(iii) The time of burning of Type B was definitely less than Type A or service. On several occasions the service star hit the ground still burning and caused a considerable heath fire which the spectators extinguished. This was due partly to the steep hill rising directly from the firing point and the direction of the wind.

By night

(i) Both experimental types appeared brighter than the service as they gave a much whiter light. The service was fairly yellow in comparison. The whiter light assisted in identifying objects.

(ii) Type B definitely gave a much shorter time of burning too short in fact for case of identification. Having seen an object, before it could be clearly identified, the light went out; the extra 2 seconds of burning given by the type B and the service makes a great deal of difference in this respect.

(iii) The whiter light of the experimental types increased the distance at which objects could be seen and also the stars burnt more evenly. The service star was inclined to flicker. Objects could be seen at about 200 yards with the service star and 250 yards with the experimental star.

(c) Other comments are as follows:-

(i) When comparing the various types it is appreciated that the Service cartridges were factory filled under war conditions, whilst the two experimental types were probably hand filled.

(ii) The Aluminium cartridge cases showed very little

deformation after firing. The mouth of the case averaged 1.034 ins. in diameter before firing and 1.05 ins. after firing.

(iii) The black pitch substance which was used for sealing at the mouth of the cartridge case was most unsatisfactory and not acceptable. On arrival for the trial some of it had melted and the cartridges were stuck together. In a hot climate it would melt completely. The barrels of the signal pistols after firing were caked at the muzzle and for half their length with a black deposit. This fact together with the small expansion of the mouth undoubtedly affected extraction and ejection of the empty case. With Type A the cases had to be extracted by hand and with Type B on occasions an implement had to be used to remove case. Service Cases extracted and ejected satisfactorily.

Conclusions

(i) The aluminium cartridge case is satisfactory as an alternative to the service case.

(ii) The shorter cartridge illuminating, Type A is satisfactory as an alternative to the longer service cartridge. Brightness for illuminating purposes, time of burning and height reached when fired are all satisfactory and comparable with the present signal cartridge.

(iii) Type B cartridge is not acceptable on account of too short a burning period.

(iv) The black pitch substance used in both the experimental types of cartridge is most unsatisfactory and not acceptable.

Recommendation

Type A illuminating cartridge with aluminium case can be adopted as an alternative to the present service illuminating cartridge, J. Mk.III T.

D. of A/S.A. to Sec. P.P., En. 1 270/Carts/276, dated 7.5.46.

"The War Office state that there is no service objection to the development of a cartridge on the lines of Cartridge "A" providing that:-

1. A method of sealing is produced which will be fully satisfactory in extremes of temperature and climate, and which will not cause fouling of the barrel.

2. Hand extraction is eliminated.

3. The bulk produced article can be expected to give a performance comparable to that given by the samples under trial."

C.E.A.D. to Sec. P.P. on P/2/15 dated 17.5.46.

2. It is understood that the method of sealing these experimental Cartridges was only intended for these particular trials and not for future use. If these experimental cartridges proved superior to Service Cartridges in other respects, it was intended to evolve a satisfactory method of sealing for the new type of Aluminium Cartridge case now being developed.

3. Hand extraction appears to have been caused by slight swelling of the aluminium cases after firing. This may have been accentuated by the adherence of the sealing

composition to the inside of the barrel of the signal pistol. Although no splitting of the cases occurred in these trials, previous trials with similar cartridge cases revealed this defect (C.S.A.R.'s minute XC(4) 0008/132 dated 14.3.46.)

Relevant extract from C.S.A.R.'s minute referred to above, all of which was not reproduced in P.P.'s 545 and 546.

"The A/. Cases with the illuminating star filling were all swollen for a length of about 1.0 inch near the middle, and two of the cases were split for the whole length of the case. The split cases were difficult to extract."

Remarks by the Panel

The Panel RECOMMEND that S.R. 588 should be adopted for the star in the Cartridge Illuminating 1 in. for future manufacture, until compositions using atomised Mg. Powder have been tried out.

2. The Panel notes the difference in performance between the experimental stars of composition S.R.568A in type B cartridges and the service stars, which they understand to have been made of the same composition. If the Lot Numbers of the service cartridges used in this trial at Hythe can be identified, it is suggested that a few be sent to C.S.A.R. Tondu for critical examination of the stars.

3. The Panel concurs with C.E.A.D.'s minute dated 17.5.46.

ACTION

Forward to D.G. of A., D. of A/S.A., C.I.A. and C.S.A.R.

ACTION (Contd.)

2. Ask D.G. of A. to note the Panel's recommendation.

3. Ask D. of A.(S.A.), C.I.A. and C.S.A.R. to note the Panel's remarks, paragraph 2.

D.N.C., D.Arm.R.D., C.I.N.O., D.D.I.Arm., C.E.A.D., D.G.O.F., C.C.I., B.C.S.O., Washington, C.S.L.O./M.R.C., A.M.R., M.L.O./N.Z., U.S.A., Naval and Military Attaches, Sec. O.B., O.C.O. India and Comdt. Small Arms School, for information.

No. P.P. 554
20.6.46
Former P.P.s 520, 521 and 522

Float, Smoke and Flame, A/C. Navigation, H.T.V. Pyrotechnic Type

(Ref. 120/1, 120/2, 121/1 and 123/1)

Minutes of Meeting held at Thames House on 3.5.46

Present:

Mr. Lea	... ...	D.Arm.R.D. Chairman
Dr. Mosses	... ...	R.A.E.
Mr. Harrison	... ...	R.A.E.
Mr. A. Schermuly	... ...	Messrs. S.P.R.A. Ltd.
Mr. May	... ...	C.E.A.D.
Mr. Richards	... ...	C.S.A.R. Tondu
Mr. Davies	... ...	D.Arm.R.D.

Apology for absence was received from Commander Ross (Secretary Pyrotechnic Panel.)

The Chairman outlined the purposes of the meeting which were to correlate the information already available on this store, to decide the lines on which future development will proceed, and to hand over to R.A.E. the executive control of the development up to Service Trial stage, which had previously been exercised by D.Arm.R.D.

The requirement was primarily one for the Fleet Air Arm, and to a small extent for the R.A.F. The present service type Flame Float, No.2, Mk.1, containing calcium phosphide, had been in Service throughout the war but was unsuitable for storage below decks, and the Navy required an alternative store. The problem was an urgent one in view of the use of these stores in new aircraft carriers. A large number of trials had been done already with generally disappointing results, on two main types, viz:-

(a) C.E.A.D's. design, based on the use of composition S.R.414 (P.P. file 120/1, former P.P. 522).

(b) S.P.R.A. Type (P.P. file 120/2, former P.P. 521).

Mr. Lea pointed out that dropping trials would in future be more difficult to arrange and stressed the need for full co-operation, and the embodiment if possible of the most promising features from all sources in a single type.

The requirements for this store are:-

(i) Terminal velocity - not less than 600 f.s.

(ii) Time of burning - 6 ± 1 minutes.

(iii) Dimensions - suitable for chute launching, to be fitted with L.S. carrier lugs without bands.

(iv) Height of release and speed - 1,500 to 15,000 ft. at 400 knots.

(v) Type of aircraft - all Naval aircraft; R.A.F. Lincolns and other bombers.

(vi) Weight and length - maximum length 30" and weight 16-lb, but less if possible.

(vii) Number required - the Naval requirement is for 40,000 per annum, with a further small quantity for the R.A.F.

Mr. Schermuly then described the main points of his design and exhibited a sectioned model. As in earlier models, an air-armed nose fuze operates on impact, igniting a gunpowder separating charge which breaks a soldered joint between the body and the sleeve bearing the nose weight, so that the latter falls away. The flash also ignites the delay system. The float comes to the surface in an

inverted position with the ballistic tail downwards; and the candle is fitted axially in the tail portion so that the ignition end then points upwards. The stability is improved by providing small holes in the tail cone to admit water. The delay system consists of two lengths of instantaneous fuze separated by a length of safety fuze, burning about 12 seconds, and the filling - a mixture of hexachlorethane smoke composition with magnesium powder - is contained in a standard TI bomb candle tube.

The advantages of this float over earlier models are chiefly in the shortening of the delay train, made possible by reversing the position of the candle, and the removal of the vulnerable blow-off disc from its usual position in the tail of the store.

C.S.A.R's. figures for the candle power of the Albright and Wilson S.P.R.A. and the "No.2, Mk.3" (Pyrotechnic) floats were then considered (see Tables I, II and III attached), and the Chairman pointed out that since the intensity of the S.P.R.A. float is of the same order as that of the No.2, Mk. III, increase in burning time to meet requirements should not be at the expense of intensity. Mr. Schermuly said that a longer time could be achieved by using a longer candle, made by connecting shorter lengths together, but diameter is restricted by the size of the existing moulds. Any increase in candle diameter might require the float diameter to be increased. It was mentioned that the No.3, Mk. 2 Flame Floats at present in Service do not always float upright, and after some discussion it was agreed that some degree of tilt was permissible.

Mr. Harrison asked if the bulge on the outside of the body could be eliminated, in view of the possible adverse effect on the ballistics of the store at high speeds. Mr. Schermuly said this gave increased strength and asked if the meeting could give him any guidance on the permissible size of the bulge. Mr. May stressed the need for maximum

strength in stores of this type and agreed that the modified S.P.R.A. design should show improved separation.
Mr. Schermuly gave the following dimensions of the S.P.R.A. store - length 25", CG 5 3/4" from nose. It should be possible to replace the wood block by one of metal but this would result in increased weight.

Mr. May outlined the proposed new C.E.A.D. design which was at present in the rough sketch stage only. He felt that previous types had not been sufficiently robust to withstand the stresses at impact. The new design would replace the Bickford Fuze by a pressed delay and it was also proposed to enclose the fuze system behind a sealed diaphragm. The main features of the new design would be the use of two separate candles, one for smoke and one for flame, which would be ignited together and burn simultaneously. Mr. May agreed to obtain time/intensity figures for the new system, in order that a comparison might be made with the three types of store already mentioned.

Mr. Lea summarised the points on which further clarification was needed viz:-

(a) General development of the design to increase the strength.

(b) Steps to reduce the bulge on the body and improve the ballistics.

(c) Development of a pyrotechnic composition burning for 5 to 7 minutes with the necessary intensity.

(d) Design of a suitable ignition system.

Mr. Harrison explained a design including an annular nose weight attached to the float by a ball locking device. On impact a central core is driven inwards until a channel registers with the locking balls in a sleeve attached to the

float. The balls then fall into the channel releasing the nose weight.

C.E.A.D. pointed out that the retardation of the body on impact could be less with this arrangement than with the present hydraulic ejection action of the Flame Float, No.2, Mk.1, and Mr. Harrison suggested, to ensure rapid return to the surface, the float might be made to follow a curved path under the water by slanting its lower surface.

Dr. Mosses quoted that previous failures appeared to be of two kinds ;-

(a) Failures due to damage of the body, and

(b) Failures of the ignition train.

He thought the use of an expanded material such as Onazote might reduce (a), whilst ignition failures might be overcome by the use of a sea-cell. Mr. Schermuly thought a sea-cell could be incorporated into the S.P.R.A. design without much difficulty.

The use of the three compositions (i) Sodium phosphide (ii) S.R.414 (iii) Magnesium/hexachlorethane smoke, was then discussed, and Mr. Lea pointed out that the Navy wished to avoid the use of composition (i) and are not altogether happy about (ii). C.E.A.D. questioned the stability of (iii) which is being investigated by C.S.A.R.

The following action was agreed:-

(1) Mr. Schermuly to supply R.A.E. with fifty candles burning for 6 minutes and complete with wood floats, for trials to confirm that visibility is adequate; and 24 noses complete with fittings and separation charges, for 5 below.

2. D.Arm.R.D. would request Messrs. S.P.R.A. Ltd. to manufacture these on R.D.Arm.8(c)'s requisition.

(3) C.E.A.D. to provide time/intensity figures for the proposed combined filling for comparison with those already available.

(4) C.E.A.D. to supply R.A.E. with a sketch of the hydraulic separation type design.

(5) R.A.E. to investigate the possibility of conducting firing trials at the Glen Fruin tank where it is believed that, by the use of a mortar, impact velocities up to 600 f.s. should be attainable. C.E.A.D. undertook to supply information on the technique of avoiding damage to mortar ejected stores. The object of these trials would be:-

(a) to determine the type of detachable nose giving the quickest separation.

(b) to develop a body having adequate strength to withstand the forces of impact at various attitudes of entry.

(6) D.Arm.R.D. undertook to ask Naval Air Staff:-

(a) to state the minimum distance at which visibility of this store was required. (This has been confirmed by N.A.S. as five miles at 15,000 ft.), and

(b) to arrange visibility tests with the mock-up floats.

(7) The Chairman proposed that final designs and dropping trials be deferred until the above preliminary tests have been carried out, and suggested that R.A.E. should then call a further meeting to discuss the final design."

C.S.A.R. to Sec. P.P. on XC(4)0021/2/4 dated 25/4/46

"Five Albright & Wilson type floats and five S.P.R.A. type floats were received on 16.4.46 and 1.4.46 respectively. The dimensions and weights were approximately as follows:

A & W Type Float

Cylindrical shape.
length, 20.5 inches.
Diameter, 3.6 inches.
Weight, 5 lb. 14 ozs.
5 holes (each 0.2" diam.) were spaced equi-distantly around the circumference of the float at a distance of 12.5 inches from the top and 5 similar holes at one inch from the bottom of the float. Both sets of holes were covered with adhesive tape. The float was functioned by removing the adhesive tape and dropping the float into a drum of water. Spontaneously inflammable phosphine gas was liberated immediately. The flames were approximately 1½ to 2 feet high and 9 to 12 inches wide.

S.P.R.A. Type Float

Cylindrical shape tapering off to a narrow neck.
Total length 23 inches.
Length of neck 5 inches.
Maximum diameter 4.2 inches.
Diameter of neck 1.8 inches.
Emission hole at top of neck, diameter 1 inch. The float was functioned by lighting the safety fuze provided and then dropping the float into a drum of water. The flame was that of a typical white pyrotechnic flare and was from 6 to 9 inches high and approximately 2 inches wide.

The candle-power of the flames from four of each of the two types of floats was measured at quarter minute intervals. The results obtained are shown in the attached tables, I and II."

C.S.A.R. to Sec. P.P. on XC(4)0034/1/1 dated 25.4.46.

Floats, Smoke and Flame, A/C Navigation, "No.2 Mark III". L.T.V. (see P.P. 485)

"Five floats were functioned by hitting the striker with a rod and hammer and allowed to burn whilst floating in a drum of water. One float (No.5) failed to function correctly. There was an initial delay approximately 10 secs. when bubbles of gas were observed rising to the surface of the water. This gas was not spontaneously inflammable. Within two seconds an explosion occurred, the top of the float was blown off and no flame was observed.

The results obtained with the other four floats are given in the attached table III.

Remarks by the Panel — The Panel were informed by C.S.A.R. that the luminous efficiencies of the Floats are as follows:-

Sodium Phosphide	479	candle-seconds		
S.P.R.A.			per	gram
Composition	145	"	"	"
S.R.414	967	"	"	"

Since a much larger quantity of Sodium Phosphide can be carried in a float of a given size than of Composition S.R.414, the higher luminous efficiency of the latter is more than counter-balanced in practice. The S.P.R.A. composition is not only low in specific luminous output, but, in addition, reacts on mixing and is, therefore, unsuitable for service use.

2. The Panel RECOMMEND, therefore, that for the present floats should be designed to use either S.R.414 or Sodium Phosphide. Composition S.R.414 is somewhat sensitive in manufacture and

filling and if a float were to ignite in its package, the package and stack would be contaminated by white phosphorus. While no ignitions are known to have occurred with Floats containing similar compositions (including U.S. Float Light Mks. IV and V) which have been used in the R.A.F. and F.A.A. during the war, it appears desirable to carry out a drastic rough usage trial of a float containing the composition as now proposed.

ACTION

Forward to D.Arm.R.D., C.I.N.O., D.N.O. and C.S.A.R.

2. Ask D.Arm.R.D. and C.I.N.O. to arrange special rough usage trials of Floats, Smoke and Flame, A/C., Nav. L.T.V. No.2 Mark 3 or Floats, Smoke and Flame, Surface, Mark 1, Type A. and report to the Panel.

3. Ask D.N.O. to say whether Floats filled S.R.414 will be acceptable for stowage below decks subject to satisfactory results in the above trials.

4. Ask C.S.A.R. whether he can recommend a composition based on the principle of S.P.R.A's Smoke and Flame Candle, which will have equal or better specific luminous output and be suitable for manufacture and service.

Forward to D.N.O/L., C.N.R., C.E.A.D., D.D.O.F., D.D.I.Arm., D.R.A.E., D.A.W., Messrs. S.P.R.A., Messrs. Albright & Wilson for information.

TABLE I

A. & W. Floats (see P.P. 520)

Time mins.	secs.	No. 1 Intensity candlepower	No. 2 Intensity candlepower	No. 3 Intensity candlepower	No. 4 Intensity candlepower
	0	-	-	-	-
	15	4000	4000	4400	4400
	30	3500	4000	4800	4400
	45	2500	3800	4800	4400
1	0	2600	3600	3800	4000
	15	N.R.	3200	4000	3200
	30	2700	3200	3000	4000
	45	2100	3400	3600	3200
2	0	1900	3000	3600	3000
	15	2400	N.R.	3200	2400
	30	2700	3300	3400	2400
	45	2100	3200	3200	2600
3	0	2200	2800	2400	2000
	15	1700	2400	2500	2100
	30	2100	1900	2400	1400
	45	1000	1600	1800	1600
4	0	500	700	1000	1100
	15	500	400	400	800
	30	Finished at 4 mins. 30 secs.	Finished at 4 mins. 25 secs.	Finished at 4 mins. 30 secs.	400
	45				Finished at 4 mins. 45 secs.

N.R. = Not recorded.

TABLE II

S.P.R.A. Floats (see P.P. 520)

Time mins.	secs.	No. 1 Intensity candlepower	No. 2 Intensity candlepower	No. 3 Intensity candlepower	No. 4 Intensity candlepower
	0	-	-	-	-
	15	400	320	240	260
	30	160	140	100	180
	45	N.R.	260	200	140
1	0	400	300	240	100
	15	N.R.	600	400	100
	30	400	420	320	120
	45	320	320	300	240
2	0	320	420	440	340
	15	N.R.	440	380	240
	30	560	380	320	280
	45	800	600	280	260
3	0	640	440	420	380
	15	640	600	500	260
	30	480	440	400	360
	45	480	480	400	380
4	0	640	460	320	400
	15	640	500	400	240
	30	560	480	440	400
	45	Finished at 4 mins. 40 secs.	240	400	380
5	0		200	Finished at 4 mins. 55 secs.	500
	15		140 Finished at 5 mins. 18 secs.		300 Finished at 5 mins. 20 secs.

N.R. = Not recorded.

TABLE III

Float, Smoke and Flame, A/C. Nav. No.2 Mark III (L.T.V.)
(See P.P. 485)

Time mins.	secs.	Float No. 1 Intensity candlepower	Float No. 2 Intensity candlepower	Float No. 3 Intensity candlepower	Float No. 4 Intensity candlepower
	0	–	–	–	–
		Disc blown off and flame appeared at 7 secs.	Disc blown off and flame appeared at 8 secs.	Disc blown off and flame appeared at 5 secs.	Disc blown off and flame appeared at 8 secs.
	15	340	800	N.R.	240
	30	420	680	420	500
	45	580	420	400	420
1	0	800	580	400	460
	15	900	500	220	380
	30	1100	600	60	300
	45	1100	940	N.R.	300
2	0	1700	1300	100	600
	15	2300	1700	400	800
	30	2200	2100	720	1200
	45	1000	2100	780	1400
3	0	800	1700	700	1200
	15	780	1100	600	1200
	30	800	1200	360	1100
	45	520	900	560	800
4	0	340	800	580	920
	15	460	500	800	980
	30	340	300	580	900
	45	100	200	–	900
5	0	50	40	480	900
	15	40	Finished	440	1000
	30	Finished		520	800
	45			780	600
6	0			580	400
	15			260	180
	30			140	80
	45			70	50
7	0			30	Finished
	15			Finished	

No. P.P. 555
4.6.46
Former P.P. 520

Float, Smoke and Flame, A.C. Nav. H.T.V. Albright & Wilson design, filled Sodium Phosphide (Ref. 123/1)

D.N.O. to Sec. P.P. on N.O.5377/46 dated 12.2.46

"With reference to para. 4 of the Panel's remarks in P.P. 520 the situation is that the Naval requirement is for the float to be stowed below and no relaxation of this requirement can be made.

2. On the other hand the Albright & Wilson sodium phosphide filled float shows sufficient promise for consideration to be given to its use by shore stations.

3. As regards the interim use in ships of the sodium filled float pending the full requirement. No recommendation can be made to the Naval staff until full details of the stowage dimensions of this float have been received in order that the availability of existing weather deck stowage may be reviewed.

4. It is requested therefore that the dimensions may be forwarded as soon as possible.

5. In the meantime it is desired that the Albright and Wilson float may be continued to the stage of clearance for Naval Service and that the further investigation may proceed into the design of a float to meet the full Naval requirement."

Extracts of Minutes of Meeting held at Thames House on 15.4.46

Present:-

Mr. Lea	-	D.Arm.R.D. (Chairman)
Dr. Mosses	-	R.A.E.
Mr. Topley	-	Albright & Wilson Ltd.
Cdr. Ross	-	Pyrotechnic Panel
Cdr. Hurry	-	R.D.Arm.N.
S/Ldr. Harrison	-	Air Ministry
F/Lt. Dance	-	D.Arm.R.D.
Mr. May	-	C.E.A.D.
Mr. Davies	-	D.Arm.R.D.

The Chairman outlined the new policy with regard to the development of this store which up to the service trial stage would be entirely in the hands of R.A.E., who will continue to collaborate with Messrs. Albright & Wilson.

The Air and Naval Air Staffs have been asked to state their requirements for the store, which are:-

(1) Terminal Velocity - to be not less than 600 f.s.

(2) Time of Burning - Naval Air Staff stated that six ± one minute would be satisfactory.

(3) Dimension - N.A.S. were of the opinion that the diameter was not critical provided the store could be chute launched. (Naval Air Staff agreed to check the size of chutes in use on Naval aircraft). They require L.S. carrier lugs to be fitted, but without bands. American lugs should be fitted if possible.

(4) Height of Release and Speed - the store should be capable of release from heights of 1,500 to 15,000 ft. at 400 knots.

(5) Types of Aircraft - all Naval aircraft; R.A.F. Lincolns and other bombers.

(6) Weight and Length - N.A.S. agreed that the present limits pf 16-lb. weight and 30" length were acceptable, but desire a reduction if possible. It was decided that a wooden model of the appropriate size and weight would be supplied to the navy for handling tests.

(7) Number of Stores required - The Navy have a requirement for 40,000 per annum, but the R.A.F. requirement will be for a small quantity only.

The Chairman indicated the earlier development of the store as given in P.P. Minute No. 520 and mentioned the defect in the Flame Float No.2, Mk.1 in which the intensity falls off towards the end of the burning period when high intensity is most needed.

Mr. Topley described the design of the store in its present form. He estimated the candle-power over a burning period of 4 to 6 minutes as approximately 1,500 and, owing to the purification of the phosphine by bubbling through water, as probably nearer 2,000 to 3,000.

F/Lt. Dance described an instance of a float leaking in storage owing to fracture of the soldered diaphragm. Mr. Topley thought that with a minimum drop of 1,500 ft., the force of impact would permit a thicker diaphragm.

The question of soldered joints as opposed to rubber seals was then discussed as applied to the separation of the break-away portion of the body case. Cdr. Ross thought that rubber might be unsatisfactory under tropical conditions and Cdr. Hurry mentioned that neoprene might be satisfactory.

The possibility of the use of "flip-out tails" to improve the stability was then discussed.

Dr. Mosses described the R.A.E. modified design in which the size of the nose weight had been increased and the length increased by approximately 6". It was hoped that this model would have better aero-dynamic properties owing to improved streamlining and the use of a tail. The soldered diaphragm had been brought forward in the nose to facilitate soldering.

The following modifications to the R.A.E. design were suggested:-

(a) The rubber wing at the union of the canister and nose portion to be held between two paralled conical surfaces by a cannelure on the inside of the outer wall. This would ensure a more positive pressure on the rubber ring and quicker break-away.

(b) The lips at the nose end of the cannister to be eliminated to give a flush surface.

(c) The end of the phosphide container to have a boss or collar to locate it definitely in the nose, and so prevent displacement during rough usage.

(d) The nose weight to be recessed to take the wing nut.

(e) Nose transit washer to be made more easily removable, for example by attaching to the wing nut.

(f) The amount of phosphide to be increased to give a longer burning time.

Packing

It was suggested that a package for the float be developed simultaneously, and R.A.E. agreed to do this. The store itself to be waterproof, packed two per box, the box comprising an inner metal moisture-proof container and an outer pack which permits of drainage.

R.A.E. agreed to amend the design incorporating the above points and then submit to Messrs. Albright & Wilson Ltd. for their comments.

Messrs. Albright & Wilson agreed to undertake the filling of the stores and in addition to manufacture up to 50 only of the empty store.

F/Lt. Dance confirmed that a development contract had been placed on Albright & Wilson for £1,500 expiring 1st February, 1947.

Mr. Lea asked that R.A.E. inform D.Arm.R.D. beforehand of any trials and send him reports, which should also be sent to the Pyrotechnic Panel."

Remarks by the Panel

1. The candle-power of this Float is given in P.P. 554 Table I.

2. The Panel notes that the development of this store is now in the hands of R.A.E., under D.Arm.R.D.'s direction, and Messrs. Albright & Wilson are collaborating with R.A.E. in perfecting the design.

3. The development is proceeding at present, on the understanding that the maximum dimensions

of 30" long x $4\frac{1}{2}$" diameter will not be exceeded. The float at present under consideration has a maximum length of $27\frac{1}{2}$" and diameter of 3.3/4", but until dropping trials have taken place, it cannot be guaranteed that the final store will conform with these dimensions.

ACTION — Forward to D.N.O., D.A.W., and D.R.A.E.

2. Ask D.N.O. and D.A.W. to note the information in para. 3 of the Remarks by the Panel.

3. Ask D.R.A.E. to inform D.Arm.R.D., as soon as possible, of the stowage dimensions of the finally redesigned float, and of its package. D.N.O./L., C.E.A.D., C.S.A.R., C.N.R., C.I.N.O., D.D.I.Arm., D.Arm.R.D., Messrs. S.P.R.A. and Messrs. Albright & Wilson for information.

No. P.P. 556
4.6.46
Former P.P. 419

Precoated Magnesium
Flare, A/C., Target, 4.5 in. Red with Green Stars
(Ref. 52/1 and 28/1)

Requisition No. RA2/2515 dated February 16th, 1945, placed an order on R.O.F. Bridgend, which was later transferred to Swynnerton. The requisition calls for 100 4.5 in. Target Flares Red emitting Green Stars.

"The flares should be in general conformity with D.D.(L)19743 and Spec. Air.783A, but it is desired that the filling of the candle should be modified as found necessary to comply with the proof conditions called for in the Specification, i.e. Candles to burn for a period of $2\frac{1}{2}$ - $3\frac{1}{2}$ minutes and all Stars to burn for not less than 6 seconds after any ejection."

Extracts from R.O.F. Swynnerton's Experimental Report No.5 dated 15.5.46. This reports on the technique and experience of the factory in fulfilling the above order and offers the following comments:-

Comments on Design

A. Departures from Design - None.

B. Operations unsuitable for production - None.

C. Improvements in design suggested.

It was noticed at trials that 1 star to design P.Y. No.811 failed to ignite and the following alternative amendments are suggested to design -

(1) Item 8 be amended to read washer M/B 1.74" external dia., 1.0" internal dia., 0.10" thick.

(2) 2 strands of 6 thread quickmatch are secured at their ends with moist priming, the quickmatch to be placed in criss-cross fashion across the ignition end of the star.

Development work recommended - None.

The results of proof of 20 of the candles are shown in the attached table.

Remarks by the Panel — The Panel regards these results as satisfactory and agree with R.O.F. Swynnerton that no further development work is necessary.

2. They do not think it necessary to alter the design in an attempt to avoid the occasional star failure that the report displays.

3. They note that composition S.R.2090 was used in the Flares filled on this Requisition and that no trouble was encountered from this. (See par. 5(11) of C.S.A.R's. minute in P.P. 345.)

4. They are informed that there is no present service requirement for this store.

ACTION — Forward to D.Arm.R.D., C.S.A.R., C.E.A.D., E.P.O./D.G.O.F., D.O.F./F., D.D.I. Arm. for information.

P.P. 556 - TABLE

Max. 59° Wet 49°

Results of Proof carried out by A.I.D. Swynnerton on 29th April, 1946. Barometer 29.19". Thermometer Min. 43°. Hydrometer Dry 52°

Star No.	Candle No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	T. of Burning of Star	7.30	7.00	6.40	8.80	7.70	7.90	7.34	8.51	8.84	8.12	8.14	8.24	7.90	7.64	8.16	7.69	8.74	8.25	7.28	7.96
	T. interval of ejection	49	48	49	54	50	52	53	50	49	50	50	54	52	52	51	54	49	53	48	48
2	T. of Burning of Star	7.50	6.30	6.95	7.73	7.30	8.36	8.81	8.24	8.80	8.04	8.11	8.11	8.10	7.53	7.58	7.70	8.21	7.71	8.15	8.55
	T. interval of ejection	25	24	25	21	23	17	23	23	26	26	22	22	22	22	22	22	24	23	23	26
3	T. of Burning of Star	7.46	6.10	6.75	7.39	*5.80	6.40	8.65	8.40	7.69	7.90	7.89	7.69	6.90	8.55	7.29	8.11	6.78	8.62	7.26	8.23
	T. interval of ejection	22	23	23	24	24	23	23	24	24	19	24	24	22	20	23	23	19	22	24	22
4	T. of Burning of Star	7.70	6.60	8.75	6.20	6.40	Failed	7.52	8.18	8.68	8.40	7.88	7.81	7.61	7.82	Failed to ignite	7.20	7.99	7.99	7.40	7.62
	T. interval of ejection	23	20	25	20	20	Failed	23	22	22	23	21	21	23	23	22	22	24	24	20	26
5	T. of Burning of Star	8.90	6.80	8.20	7.14	8.70	*3.05	7.55	7.50	8.59	8.16	8.07	6.64	6.85	7.60	7.49	8.80	8.10	7.23	7.85	8.26
	T. interval of ejection	25	20	23	18	21	40	22	26	25	25	25	22	19	23	23	23	20	20	24	22
6	T. of Burning of Star	7.90	*3.00	8.50	8.71	8.20	7.23	7.60	8.16	7.40	8.30	7.70	7.30	7.30	7.65	7.50	7.89	7.64	7.03	8.23	7.81
	T. interval of ejection	23	23	24	21	24	15	24	22	25	25	23	22	19	22	22	23	17	22	22	25
7	T. of Burning of Star	7.80	6.10	6.40	8.42	8.20	8.22	7.76	8.09	8.79	7.59	7.64	8.21	7.76	7.99	6.65	7.79	6.88	7.30	7.75	7.95
	T. interval of ejection	18	16	17	21	18	23	17	18	20	17	18	21	21	18	19	19	21	21	20	17
Time of Burning of Candle		3 mins. 19.9 secs.	3 mins. 8 secs.	3 mins. 24 secs.	3 mins. 20 secs.	3 mins. 19 secs.	2 mins. 59 secs.	3 mins. 17 secs.	3 mins. 21 secs.	3 mins. 25 secs.	3 mins. 22 secs.	3 mins. 15 secs.	3 mins. 16 secs.	3 mins. 9 secs.	3 mins. 15 secs.	3 mins. 14 secs.	3 mins. 23 secs.	3 mins. 2 secs.	3 mins. 17 secs.	3 mins. 15 secs.	3 mins. 25 secs.

NOTE: * = outside specification limits.

DS 82227/1

No. P.P. 557

Secret

No. P.P. 558
4.6.46

Flashes, Photographic, A/C., 4.5 in. and 6 in. Fragmentation Zones (Ref. 46/2)

C.S.A.R. to Sec. P.P. on XC(4)1005/19/1 dated 7.5.46

"Trials have been carried out in which the distribution of fragments from 4.5-inch and 6-inch photographic flashes filled with exploders of aluminised T.N.T. was measured.

The flashes were suspended horizontally 8 feet above the sand and pointing along a base line marked on the sand. On one side of the line semi-circles were drawn with radii 100, 200 and 300 feet and with the flash as centre. After a flash was fired, the fragments in each semicircular zone were collected and counted; many fragments close to the bomb were buried in the sand and no attempt was made to retrieve them. The 4.5-inch flash was fired both with and without the cast iron nose; the 6-inch flash was fired with its cast iron nose. For the purposes of this trial it was assumed that the distribution of fragments was symmetrical about the major axis of the flash bomb.

The following observations were made:-

(1) The majority of fragments were found within an area enclosed by two lines perpendicular to the base line, one 50 feet in front and one 50 feet behind the flash.

(2) Two thirds of the tinplate fragments were found within 100 feet of the flash; very few fragments were found beyond 300 feet and none beyond 330 feet.

(3) Pieces of the cast iron nose were found up to 500 feet away; most of these were to the side of the bomb.

(4) The distribution of fragments of tinplate appeared to be similar with all three types of flash; the absence of the nose of the 4.5-inch flash made little or no difference to the fragmentation of the container.

(5) The 4.5-inch flash Mark IV without cast iron nose requires a minimum safe distance of 150 yards.

(6) The 4.5-inch flash with nose requires a minimum safe distance of 400 yards.

(7) The safe distance of the 6-inch flash is similar to that for the 4.5-inch flash."

ACTION Noted.

Forward to D.N.O., D.G. of A., D.Arm.R.D., C.I.N.O., C.I.A., D.D.I.Arm., C.N.R., C.E.A.D., C.S.A.R., Sec. P.I.F.I., R.A.E., D.D. Photos (A.M.), R.D. Photos M. of S., D.O.F./F., N.R.C. Ottawa, A.M.R., O.C.O. India, M.L.O. (N.Z.), U.S. Naval and Military Attaches, A.O.C./R.A.A.F. (London), D.G.T.S. (S.A.) for information.

No. P.P. 559
4.6.46
Former P.P. 243

Magnesium Compositions protected by Boiled Linseed Oil Specification distinction for use of "precoated" or non-precoated Mg. in the same Composition. (Ref. 52/1)

Extract from C.C.I. to C.S.A.R. on X.133/18c dated 4.3.46

"1. As you are aware there are two general methods of manufacture for the above compositions:-

(a) Where the maturing operation is carried out on a mixture of coated magnesium, potassium perchlorate, barium nitrate (or Chlorate) and starch and -

(b) Where the maturing operation is carried out on the coated magnesium before admixture with the other ingredients. (Sometimes referred to as "precoating").

Method (a) may be used in all cases but method (b) is confined to manufacture of composition for certain specific stores for which it has been specifically approved. For example S.R. 472 manufactured by Method (b) may be used for filling T.I. Candles, but not for Night Marker Shell 5.5."

It would appear desirable in order to avoid confusion to treat compositions made by the two methods as two separate materials - e.g. S.R. 472 and S.R. 472M. It is thought that this would simplify the specifications of the composition and of the filled stores concerned. In addition it would reduce the possibility of composition made by Method (b) being used for purposes for which it is not approved.

The same considerations apply to S.R. 427A and S.R. 477D. It is suggested that in the case of the former, composition manufactured by Method (a) be called S.R. 427A and composition manufactured by Method (b) be called S.R. 427AM. It is believed to be unlikely that S.R.477D

will be used in the future and it is therefore suggested that no action be taken in regard to this composition.

Would you please say if you agree to the above proposals.

C.S.A.R. to C.C.I. on XC(4)2552/8/21 dated 29.3.46

"It is agreed, that it would be desirable to distinguish between compositions which contain the same ingredients, but have been mixed by different methods, and which in consequence may have different physical properties and be restricted to certain stores. This is particularly important with the compositions containing boiled linseed oil, e.g. S.R. 472 and S.R. 427A, and the proposed method of differentiation is concurred in."

C.C.I. to Sec. P.P. on X.133/18c dated 11.5.46

"A copy of correspondence with C.S.A.R. on this subject is attached. In the case of S.R. 472 and S.R. 427A, the normally mixed compositions have the same proportions of ingredients as the alternative compositions containing "precoated" magnesium. In these cases the addition of the suffix "M" has been proposed to denote the latter. In the case of S.R. 237, the alternative compositions have different proportions of ingredients and have already been allotted separate numbers, viz. S.R. 209B and S.R. 209C. No amendment is therefore necessary in this case. The only other composition containing boiled linseed oil in which "precoated" magnesium may be used is S.R. 477D. Since, however, this is not now likely to be used, it is not thought necessary to include it.

The following is a list of stores in which "precoated" magnesium can be used (Ref. P.P. Minute No. 243 etc.). The compositions manufactured by the normal method are shown together with the alternative compositions containing "precoated" magnesium, the new proposed nomenclature being adopted for the latter. It is suggested that filling specifications and drawings should quote both alternative compositions where they are applicable. It will then be clear that, in cases where an alternative composition containing precoated magnesium is not specified, the use of such a composition is prohibited. This should prevent the possibility of compositions containing "precoated" magnesium being used in stores for which they have not been specifically approved.

Store	Composition manufactured by normal method	Composition containing "precoated" magnesium
Flare A/C. Target 4.5" Mk.II Red with Green or Yellow Stars.	S.R.237	S.R.209C
Flare A/C. Target 4.5" Mk.II Green with Red or Yellow Stars.	S.R.427A	S.R.427AM
Flare A/C. Target 4.5" Mk.II Red.	S.R.237	S.R.209C
Flare A/C. Target 4.5" Mk.I Green.	S.R.427A	S.R.427AM
Candles, T.I. Bomb various, Red.	S.R.237	S.R.209B
Candles, T.I. Bomb various, Green.	S.R.472 or S.R.477D	S.R.472M
Flare Ground Warning Mk.I Red.	S.R.237	S.R.209B
This store is dealt with in P.P. 562		

Remarks by the Panel — The Panel concurs with C.C.I's. suggestion to adopt the suffix "M" to distinguish the compositions and RECOMMENDS its adoption.

2. The Panel concurs also with C.C.I's. suggestion that filling specifications and drawings should quote both alternative compositions, where applicable, and RECOMMENDS its adoption.

ACTION — Forward to D.N.O., D.G. of A., and D.Arm.R.D., asking them to note the Panel's recommendations.

C.C.I., C.S.A.R., C.E.A.D., C.I.N.O., C.I.A., D.D.I.Arm., D.G.O.F., Sec. P.I.F.I., Sec. O.B. for information.

No. P.P. 560
4.6.46
Former P.P. 511

Thunderflashes. Improved Design (Ref. 133/1)

C.E.A.D. to Sec. P.P. on P16/1 dated 24.5.46

Thunderflash, Mark 8 design D4/L/159/GF/76

"The thunderflashes sealed with (1) cold setting waterproof glue and (2) Shellac - R.D.1198 B have been rough usaged and jolted, subjected to one month's climatic trials, alternating from normal temperature to 100°F at 95% humidity and then further rough usaged and jolted.

The results were as follows:-

Cold Setting Waterproof Glue

On firing 12 thunderflashes, 9 functioned satisfactorily, 3 failing, through failure of safety fuze to take over from the match composition in 2 cases and in the other, through missing match composition. In all, 4 match compositions were missing.

The seal at the safety fuze end was in good condition and generally in better condition than at the opposite end. In 2 cases, the handles were loose. No composition had percolated through the seals.

Shellac - R.D. 1198B

On firing 12 functioned satisfactorily. One handle was loose.

In all cases, the film of R.D.1198B was brittle and was cracked, but the shellac was intact. No composition had percolated through the seals. It appears that the R.D.1198B had taken the brunt of the climatic trial, leaving the shellac comparatively unaffected.

For reasons given in our minute dated 16.11.45 (P.P.511), we suggest the cold setting waterproof glue should be the sealing medium."

Remarks by the Panel

The Panel agrees that cold setting waterproof glue should be used for the sealing of stores of this nature.

2. They are of the opinion that premature functioning and liability for the composition to leak out during rough usage have been successfully overcome in Design D4/L/159/GF/76.

3. They RECOMMEND that all future designs of Thunderflashes, Chinese Crackers and similar stores should follow these lines.

ACTION

D.N.O., D.N.O./L., D.G. of A., C.E.A.D., D.Arm.R.D., C.I.N.O., C.I.A., D.D.I.Arm., D.O.F./F., C.S.A.R., E.P.O./D.G.F.F. for information.

No. P.P. 561
4.6.46
Former P.P. 490

Tropical Packages. Cartridge Signal 1 in. in Jungle Pack

Jungle Storage and Exposure Tests
Ref. (150/1)

D. of A/S.A. on 270/Carts/175 dated 27.5.46 forwards to Sec. P.P. a copy of West African Tropical Testing Establishment (W.A.T.T.E.) Report No. 63 - Final Report on Good and Bad Jungle Storage tests of Cartridges Signal 1 in. Green Mark 12T and Red Mark 13T.

B. DESCRIPTION OF PACKAGING

The red and green cartridges were packed in separate metal ammunition boxes, type G.70, Mk.I (unsealed lid) Design D.D.(L)12919.

(Method of Packing - design D.D.(L)20243)

Each box was painted vandyke brown with vertical buff markings to denote that they were special packs for tropical climates.

Inside each box G70 were four black japanned tins (boxes No.515 Mk. 1 designs D.D.(L)20241-2 and 20397) which had metal lids, further sealed with a soldered tin sheet which completely covered the lid recess. These boxes were held secure by 3 ply-wood and cardboard packing pieces. In some cases there was a cardboard lining to the base of the metal ammunition box.

Inside each of these tins were nine tin boxes No. 437, (Designs D.D.(L)18751-2 & 3) sealed with black waterproof adhesive tape, each containing three cartridges.

The whole box G70 therefore contained 108 cartridges.

C. DESCRIPTION OF TEST CONDITIONS

(1) Duration

The total period of test was three months.

(2) Good Jungle Storage

Two boxes of each colour cartridge were placed on dunnage inside an open thatched roof hut situated amidst jungle undergrowth and under a moderate canopy of trees, at the Jungle Site near PORT HARCOURT.

(3) Bad Jungle Storage

Four boxes of each colour cartridge were placed directly on the ground in an area cleared of undergrowth, but under a moderate top canopy of trees at the Jungle Site near PORT HARCOURT. The boxes were covered with a tarpaulin which allowed little or no ventilation.

(4) Exposure Test

Since more boxes were received than were needed to carry out the Schedule of Tests requirements, an additional two boxes of each colour cartridge were placed directly on the ground fully exposed to the sun and rain in a jungle clearing.

D. METEOROLOGICAL CONDITIONS THROUGHOUT THE TESTS

The weekly averages of relative humidity at 1300 hours ranged from 75% to 98%. The weekly averages of relative humidity at 0800 hours and 1800 hours ranged from 88% to 100%.

The weekly averages of shade temperature ranged from 72.3°F to 84.6°F.

The weekly averages of daily solar maximum temperature ranged from 119°F to 132°F.

The total rainfall during the period of the test was 29.2 inches.

E. CONDITION ON ARRIVAL

All the boxes were in perfect condition.

F. CONDITION OF PACKAGING AND CARTRIDGES AFTER GOOD JUNGLE STORAGE

(1) After One Month

After one month an external examination showed that all the boxes were still in good condition.

(2) After Two Months

At the inspection after two months, heavy rusting of the lid and base of the outer boxes was observed, where paint had been removed by abrasion, and there was slight rusting on the sides in isolated spots. The hinges on the lid were slightly rusted. The stencilling was clear and legible. The string securing the fasteners of the box was in good condition.

The inner containers and cartridges were all in good condition.

(3) After Three Months

The condition of the packaging was no different from that noted after two months of test (see para. F2 above).

The cartridges were all in good condition.

G. CONDITION OF PACKAGING AND CARTRIDGES AFTER BAD JUNGLE STORAGE

1. After One Month

The packaging was still in good condition, as seen by external examination. One box of each colour cartridge was opened up, and the cartridges were found to be in good condition.

2. After Two Months

The condition of the outer boxes was the same as that of those boxes which had been on two months good jungle storage (para. F2 above).

One box of each cartridge was opened up. It was found that in both cases rain had entered the box via the unsealed lid. The inside of the base of the box was corroded, and the 3-plywood and cardboard packing pieces were saturated with water and disintegrating, and slight mould growth was found on the cardboard.

The inner metal containers (No. 515 Mk. I) were however in good condition, and the stencilling was clear and legible.

The cartridges were in good condition.

3. After Three Months

The corrosion had increased considerably and the hinges were so corroded that the boxes were difficult to open. The string securing the metal fastening clips had lost almost all

its strength. The box markings were legible after the removal of a mud spray deposit.

The one box of each colour cartridge remaining on the Exposure Test was opened up for inspection. Rain had entered both boxes, passed the unsealed lids, with the result that the inside of the outer box was heavily corroded, especially on the base, and the paint had softened.

The cardboard packing pieces had lost strength and were supporting mould growth. The 3-plywood packing pieces were saturated with water, warping, and had lost strength. They were also supporting heavy mould growth.

The inner metal containers were rusted only on the bases, where they had been in contact with the heavily corroded base of the outer box (the cardboard base lining having been omitted from these boxes.)

The cartridges were in good condition.

I. FUNCTIONAL TRIALS

From the boxes which had been on two and three months good and bad jungle storage and on exposure tests the contents of one inner metal container of each colour cartridge (27 cartridges each) were fired.

All cartridges were satisfactory, and the light emission was good.

J. SUMMARY

The method of packaging, using a solder-sealed inner metal container is very satisfactory for the storage of Signal Cartridges in a tropical climate."

Remarks by the Panel — The Panel notes the success of the "Jungle Pack".

ACTION — D.N.O., D.G. of A., D.Arm.R.D., O.C.O., India, D.A.S., C.I.N.O., C.I.A., D.D.I.Arm., C.S.A.R., C.E.A.D. Sec.O.B., D.U.W., P.P.C.O., M.O.S., Sec. I.S.P.C., M.L.O./N.Z., A.M.R., D.G.T.S., (S.A.) and C.S.L.O. N.R.C. for information.

No. P.P. 562
9.7.46
Former P.P.s 409 & 559

Flare, Ground, Warning Mark I. Rod. Composition S.R.209B. (Ref. 163/1)

C.C.I. to Sec. P.P. ref. X.133/18c dated 18.6.46.

"In my minute dated 11.5.46 which is reproduced in P.P. Minute No. 559 reference is made to the use of composition S.R.209B in place of composition S.R.209A which is at present specified. C.S.A.R. and D.Arm.R.D. have agreed that compositions S.R.209B and S.R.209C, which permit variation in the ratio of potassium perchlorate to starch in order to provide for adjustment of rate of burning, shall replace compositions S.R.209A and S.R.209 respectively in all stores for which the latter are specified. A copy of extracts from correspondence with C.S.A.R. and D.Arm.R.D. is attached."

C.C.I. to C.S.A.R. and D.Arm.R.D. ref. X.133/17 dated 9.2.46.

"Composition S.R. 209 Specification C.S.1907
" S.R. 209A (no specification issued)
" S.R. 209B Specification C.S.2028
" S.R. 209C " C.S.2081

All these compositions contain the same ingredients and are related as follows (see specifications, etc., attached (not reproduced).

In S.R.209C the proportions of magnesium, linseed oil and strontium oxalate are the same as in S.R.209, but in S.R.209C the ratio of potassium perchlorate to starch is variable (over a specified range) in order to provide for adjustment of rate of burning.

The particular proportions of potassium perchlorate and starch specified for S.R.209 are included in the "permissible

variations" of these ingredients quoted for S.R. 209C.

A similar relationship exists between S.R. 209A and S.R. 209B.

It appears therefore that Compositions S.R. 209 and S.R. 209A should be regarded as OBSOLETE and the Specification C.S. 1907 for S.R. 209 endorsed accordingly (No specification is held for S.R. 209A)"

C.S.A.R.

"Through you for concurrence or remarks."

C.S.A.R. to D.Arm.R.D. on XC(4)2552/3/9 dated 8.3.46.

"Forwarded."

"Proposed amendments are concurred in."

D.Arm.R.D. to C.C.I. on S.B.55214 dated 14.3.46.

"Formal approval to amendments herewith and copies returned."

C.C.I. to D.Arm.R.D. dated 8.4.46.

"Approval noted, thank you."

Remarks by the Panel — Noted.

ACTION — D.N.O., D.G. of A., D.Arm.R.D., C.C.I., C.S.A.R., C.E.A.D., C.I.N.O., C.I.A., D.D.I.Arm., D.G.O.F., Sec. P.1.F.1., Sec. O.B. for information.

No. P.P. 563
9.7.46
Former P.P.s as quoted

This minute contains matter of American origin.

Float, Smoke and Flame, A/C. No.2 Mark III (PPs. 485 and 554)
Float, Flame, A/C., Nav. No.3 Mark I (P.P. 149)
Signal Drift Night A.N. Mark IV (American) (P.P. 102)

Comparative Trials
(Ref. 121/1)

Comparative trials with these three navigational marks were carried out by A.S.W.D.U. and recorded in Report No. 46/7 dated 2.5.46 from which the following is extracted.

1. Method of conducting trial

(a) For visibility. These stores were dropped from 400 ft., 800 ft. and 2,000 by day and from 400 ft. and 2,000 ft. by night. Observers in the rear turret of the aircraft timed the Floats from ignition until they became invisible. These times were converted into ranges in nautical miles.

TABLE 1

Daily Average Range of Visibility. (All distances in nautical miles)

		Signal Drift Night Mk.IV			Flame Float No. 3 Mk.I			Smoke & Flame Float No.2. Mk.III		
Height	Vis.	400'	800'	2000'	400'	800'	2000'	400'	800'	2000'
Day	n.mls.									
8.1.46	6-9				4.3			5.0		
10.1.46	3-4				0.9			1.6		
17.1.46	3-6	1.0	1.4	1.5	1.2	1.6	1.6	1.2	1.9	2.1
Night										
24.1.46	7-10	3.2		6.0	3.4		4.9	4.2		6.5
Distance behind aircraft at which float lights up		.6	0.7	0.8	0.15	0.2	0.3	0.5	0.6	0.7

(b) For functioning of Float Smoke and Flame, A/C., No. 2 Mark III. The Floats were dropped from heights between 50 ft. and 5,000 ft. The percentage of failures for this Float, and for the other two types (between 400 ft. and 2,000 ft. only), is given in Table II.

With the Float Smoke and Flame No. 2 Mark III, the delay between impact and the first emission of Smoke and Flame was 12 seconds. The total time of burning averaged about six minutes.

TABLE II

Reliability of Functioning

Height	Signal Drift Night Mk. IV		Flame Float No. 3 Mk. I		Smoke & Flame Float No.2. Mk. III	
	Failed	Dropped	Failed	Dropped	Failed	Dropped
50					0	4
100					0	4
200	0	3	0	3	0	3
400	14	21	2	20	4	18
800	4	14	0	12	0	6
2000	3	8	0	9	1	10
5000					0	6
Total	21	46	2	44	5	51
Percentage of failures	46%		5%		10%	

2. Comments on Results

(a) The volume of smoke and brightness of flame appear to be of the same order for all of the stores but the average ranges show that the No. 2 Mk. III Smoke and Flame Float is superior in range of visibility by about 20% to the No. 3 Mk. I Flame Float or the American Signal Drift Night A.N. Mark IV.

(b) There were 5 failures with the No.2 Mk. III Smoke and Flame Float against 2 with the No.3 Mk. I Flame Float, but this difference does not prove to be statistically significant. Both the No.3 Mk. I Flame Floats and the No.2 Mk. III Smoke and Flame Floats are however much superior to the Mk. IV in reliability of functioning.

(c) The Naval Air/Sea Warfare Development Unit carried out dropping tests from a Firefly with Smoke and Flame Floats No.2 Mark III. When released through the flare chute at 160 - 170 knots there were only two failures out of ten. When released at 220 - 250 knots, however, four out of five floats failed after emitting smoke for 10 - 20 seconds. It is perhaps significant that of the four failures, three hung up for as much as six seconds at the mouth of the flare chute, and it is possible that some internal derangement or puncturing of the float chamber occurred. It would be desirable to investigate this point when further supplies of the Flame Float become available. The floats were not dropped in an area where they could be recovered for examination.

3. Comments on operational considerations

(a) One operational advantage of the No.2 Mk. III Smoke and Flame Float and the American Signal Drift Night Mk. IV over the No.3 Mk. I Flame Float is that neither require any preparation before using, and in this respect they are both superior to the Flame Float No.3 Mk. I. The fins of the No.2 Mk. III are more strongly constructed and less liable to damage than those of the other two stores.

(b) The duration of smoke emission is ample for wind finding with the A.P.I. wind finding attachment.

NOTE BY THE PANEL

C.S.A.R.'s tests of the candle power of Float Smoke and Flame A/C No.2 Mark III are recorded in P.P. 554, table III.

The explosion of one float, reported by C.S.A.R., has now been explained as follows.

C.S.A.R. to Sec. P.P. on XC(4)0034/1/3 dated 17.6.46.

"Further to this department's minute dated 25.4.46 on XC(4)0034/1/1 the float (No.5) which failed to function correctly has now been examined.

The soldered lid on the tail of the float had been blown off and the brass disc in the centre was still firmly attached but had a very small crack. The priming composition and a little of the main filling had burned in the explosion. The rest of the filling was unburned and remained in the float.

It is considered that the brass disc did not rupture when the priming first started to burn and that the insufficient venting and subsequent build-up of pressure gave rise to the explosion."

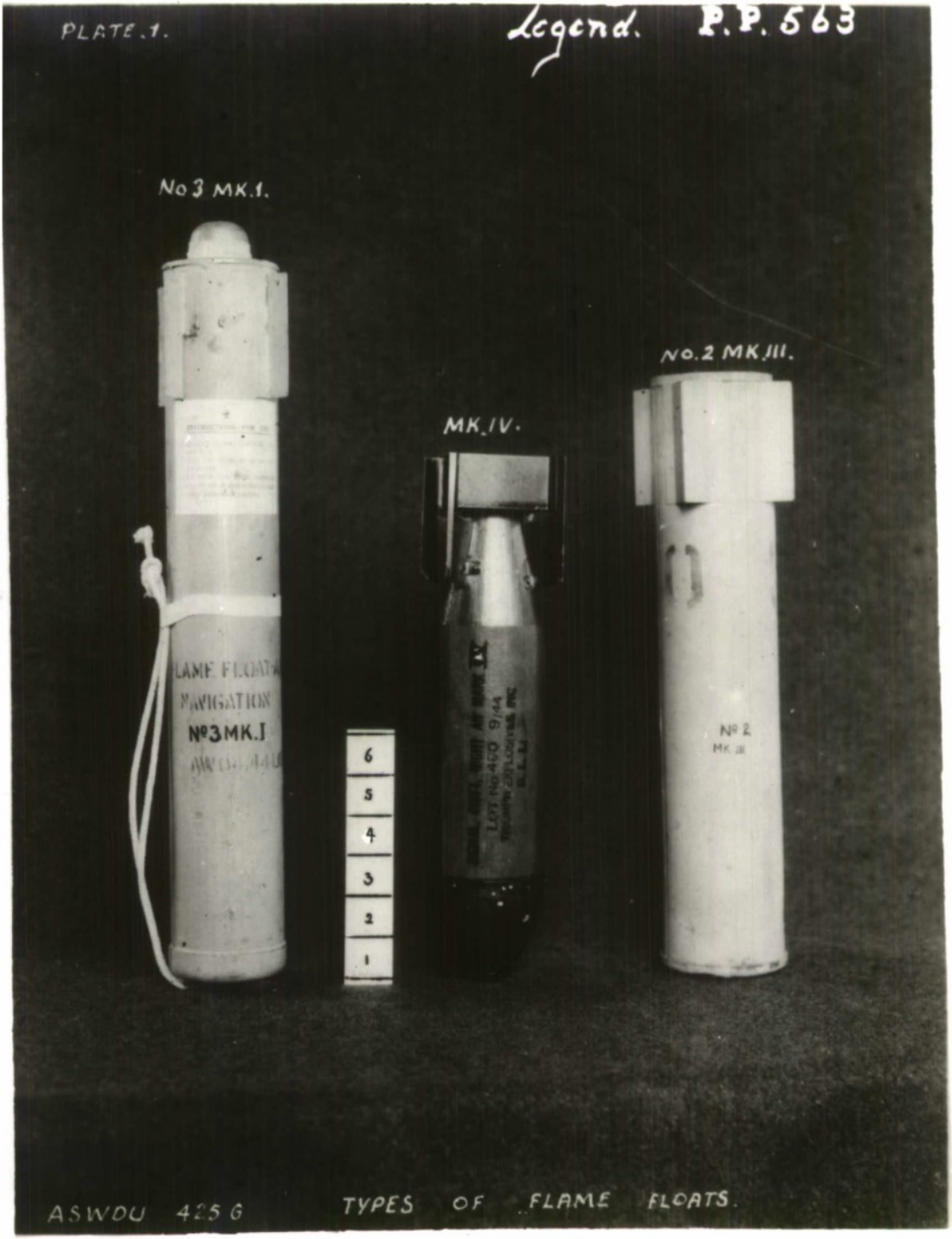
Remarks by the Panel

The Panel are informed that the American Signals Drift ("Floats Light") have now been provided with a completely waterproof packing, which enables them better to withstand storage. This may cure the high percentage of failures recorded in this trial.

2. The Panel RECOMMEND extended trials of these Floats, in which they should be compared with the Flame Float No.3 Mark II instead of the No.3 Mark I.

PLATE 1.

Legend. P.P. 563



ASWDU 425 G TYPES OF FLAME FLOATS.

Remarks by the Panel (Contd.)

3. They also RECOMMEND, as stated in P.P. 554, that drastic rough usage trials be carried out on the Float, Smoke and Flame, A/C. No.2 Mark III to confirm that the somewhat sensitive composition is not likely to ignite by accident.

4. The Panel notes that the explosion at static test by C.S.A.R. of one "Float Smoke and Flame A/C. No.2 Mark III" was caused by the failure of the brass blow-off disc to rupture soon enough. This may be another example of excessive soldering, such as is always liable to cause trouble in a small percentage of cases wherever soldered blow-off discs are used on pyrotechnic stores.

ACTION

1. Forward to D. Arm.R.D., C.E.A.D. and C.S.A.R.

2. Ask D.Arm.R.D. to note the Panel's recommendation in para. 2 of Remarks for further trials.

3. Ask C.E.A.D. to forward a copy of the design of the Float to C.S.A.R.

4. Ask C.S.A.R. whether he can suggest a means of applying greater pressure to the delay, without over pressing the sensitive main filling.

D.N.O., C.N.R., D.D.O.F., C.I.N.O., D.D.I.Arm., D.R.A.E., A.S.W.D.U., D.A.W., U.S. Naval and Military Attaches, B.S.O. Washington for information.

CONFIDENTIAL

No. P.P. 564
9.7.46
Former P.P. 439

Cartridge Flash Photographic 1.75 in. (Ref. 30/3)

C.S.A.R. to C.E.A.D. on XC(4)1005/12/20 dated 18.4.46.

"1. Six 1.75-inch photoflash cartridges have been fired from a mock-up projector originally supplied by D.Arm.D. Half of the Flash units were fitted with 4-second delays and half with six second delays. The modified initiating system functioned satisfactorily and the H.E. bursters were detonated completely. The light characteristics of the flash were similar to those quoted previously but further trials are being carried out in order to confirm this.

In view of the satisfactory functioning of the photo-flash it is suggested that air trials can now be carried out.

2. In certain of the flash units made up at Tondu it was observed that the aluminium containers had swelled round the canellures and would not fit into the projector. As this projector may not be of the latest design will you please say what tolerance can be allowed on the diameter of the filled store so that it will fit properly into the Service projector."

Notes of a Meeting held at Thames House on 3.5.46.

"Present:	Representing
Mr. C. Lea	D.Arm.R.D. (In the Chair)
Dr. W. F. Coxon	do.
Dr. A. N. Mosses	D.R.A.E. (Armt.)
Mr. H. C. Reynard	do.
Mr. C. J. Duncan	D.R.A.E. (Photo)
Mr. J. C. Cackett	C.S.A.R.

1. The Chairman informed the Meeting that in future, executive responsibility for this development up to the

stage of Service Trials, was to be delegated by D.Arm.R.D. to D.R.A.E. The present position and the arrangements for further investigation were then discussed.

2. Requirements. As stated in D.Arm.D.'s SB.61476 dated 28.12.44 to C.E.A.D. and C.S.A.R. the cartridge is required to have a "safe" filling, to be electrically fired and to give sufficient illumination for night photography from altitudes between 0 and 3,000 ft. It is to be suitable for use in the tropics, and the detonator required to initiate the H.E. charge must not be in position in the cartridge in storage and transit.

3. Progress to Date. Preliminary work by C.S.A.R. on the light output of flash units of approximately suitable size is reported in P.P. 366 and P.P. 439, and in a minute XC(4)1005/12/20 dated 18.4.46 to C.E.A.D. C.S.A.R. had reported that the failures encountered in the detonating system of cartridges to the original sketch design had been overcome in the latest pattern. Mr. Cackett said that owing to a partial breakdown in the recording apparatus, reliable figures for the light output of the cartridges fired on this occasion could not be quoted. Further trials would be done to ascertain the correct values, but it is expected that they would be similar to those given in P.P. 439 for flashes made in tinplate. The luminous cloud is flattened, and has a peak intensity of about 64 million C.P. when measured at right angles to the axis. The need for stabilisation of the flight of the flash unit was discussed but it was pointed out that, fired upwards as it must be when used at low altitudes, a stabilised flash unit would probably not point in the optimum direction at the moment of firing, and moreover the space occupied by the stabiliser, even if it consisted only of streamers, would have to be provided at the expense of part of the filling. Comparing with the 1.1/2 in. photoflash cartridges, which gives about one-fifth the light output (Note: in P.P. 137 the peak intensity of the 1.1/2 in. cartridge is given at 10,000,000 C.P.) and is effective to about 1200 ft., it was

estimated by R.A.E. (Photos) that the 1.75 in. unit should give enough light for photography up to 2,800 ft. and it was agreed that at present the unit need not be stabilised.

Mr. Cackett mentioned that in preliminary trials with a filling consisting of T.N.T. mixed with a large proportion of aluminium, higher light outputs had been obtained, and it was agreed that research on this system should be pursued, and its vulnerability to small arms fire determined.

In reply to an inquiry by C.S.A.R. in the minute quoted above, it was stated that the bore of the 1.75 in. discharger is now L.1.767 + .006 ins. and it was agreed that C.S.A.R. should be supplied with a discharger as soon as one can be made available, and with the remaining flash units of the present pattern, which will not be required for air trials.

4. Design: D.R.A.E.'s representatives pointed out that air trials could not be undertaken with cartridges of the present design which have no shuttering device and might detonate in the aircraft if the delay were defective or the expelling charge were omitted. Discussion followed on means of ensuring safety: e.g.

(a) Air-arming the projectile.

(b) Igniting the delay in the flash unit by a detonator fired by a striker which is restrained by a drive-fitting lead bush, in such a way that it is not operated unless the propelling charge generated sufficient pressure to throw the flash unit clear of the aircraft. This system has been used in an experimental mortar bomb developed by Imber Research Ltd.

(Note:- The U.S. T12 photoflash cartridge employs a baffled primer, which does not ignite the delay column in the flash unit unless reinforced by the expelling charge)

(c) Interposing a shutter in the delay train, to be moved into the firing position only when the barrel ceases to restrain a transverse spring-loaded plunger.

(Note:- Sec. P.P. subsequently pointed out that the use of a rifled barrel would enable a normal fuze shuttering system to be adopted.)

It was agreed that D.R.A.E., consulting C.E.A.D. at Fort Halstead and Cheshunt, and the Ordnance Board as necessary, would redesign the cartridge so as to be suitable for air trials and would carry out the necessary photographic tests to demonstrate that the Staff requirements are satisfactorily met. Since the aircraft likely to be available for these trials is equipped with dischargers firing downwards only, it was agreed that trials at 500 ft. and 3,000 ft. would be considered sufficient.

It was agreed that when details were furnished by R.A.E. D.Arm.R.D. would raise contracts to provide stores required for these experimental purposes and for subsequent service trials. Before the store can be submitted for approval the following should be made available.

(a) from C.S.A.R. a Report on static trials, giving full data of luminous output.

(b) from R.A.E. (Armst.) - Report on functioning trials of the flashes in a service discharger and an assurance that the store can be accepted as safe for service trials in aircraft.

(c) from R.A.E. (Photos) - Report on photographic trials from aircraft at 3,000 ft. and 500 ft. (zero height if possible).

It was agreed that these reports would be forwarded to D.Arm.R.D. as soon as the information became available, and that close touch would be maintained between the Departments

concerned and with H.Q. throughout the investigation.

6. Actions:

C.S.A.R. (a) to determine in static trials the performance of the filling now proposed in units modified as necessary to embody improved safety devices.

(b) to study further the characteristics of the experimental aluminised H.E. flash compositions and to supply details to C.C.I. so that specifications can be prepared to cover experimental filling by Ordnance Factories.

R.A.E. (a) to redesign the cartridge in consultation with C.S.A.R. C.E.A.D. and the Ordnance Board, to suit the present pattern of discharger and to be acceptable for service trials from aircraft.

(b) to carry out photographic tests with the equipment on aircraft, to cover stated requirements.

D.Arm.R.D. (a) to supply a discharger to C.S.A.R. for use in static trials.

(b) to arrange contracts for experimental stores as required for the above programme, and for service trials.

D.Arm.R.D. (Contd.)

(c) to arrange Service trials when satisfactory reports are received on the above-mentioned investigations.

(d) to keep in touch with R.A.E., C.S.A.R., the Ordnance Board and the Pyrotechnic Panel during the development."

ACTION — Forward to D.Arm.R.D., D.N.O., C.I.N.O., C.S.A.R., B.S.O. Washington, Sec. P.I.F.I. Cttee, C.E.A.D., C.N.R., R.A.E. Arm., R.A.E. (Photos), D.D. (Photos) (A.M.), R.D. (Photos) and Sec. O.B. for information.

No. P.P. 565
9.7.46

Marker, Smoke, Red, Air/Sea Rescue. (Ref.21/3)

D.Arm.R.D. to Sec. P.P. on S.B.39238 dated 9.5.46.

"A requirement has arisen for a long-burning red smoke marker for Air/Sea Rescue use which would give a large volume of smoke for approximately two hours. Mention was made of the possibility of this requirement during the discussion on Item 7 of the 74th Pyrotechnic Panel meeting on March 19th, and C.S.A.B. stated that if such a duration were required it would be necessary to use a float filled with approximately 100 lbs. of composition and of a size similar to that of the Smoke Float, No.2 (originally known as 200 lb. Smoke Float). Full details of the visibility requirement are being obtained from Air Staff, and it is hoped that they will be ready for presentation at the next Panel meeting.

Will you be good enough to put this item on the Agenda so that arrangements can be made for the production of three or more stores for preliminary trials to be witnessed by representatives of the branches interested."

C.S.C.D.E.S. to Sec. P.P. on T.C.S.1815/50/46 dated 29.5.46.

"The following possibilities are summarised briefly for consideration.

Pyrotechnic Type

A composition containing Brilliant Fat Scarlet has been developed, which burns without special baffling arrangements at a rate of 3/4 inch per min. For 2 hours duration therefore a column about 7½ feet long would be required. This might be achieved by arranging a number of columns in parallel using relay links from one to another. For example, three columns 30 inches long could be housed in a float of the type Float, Smoke, Aircraft, No.2. The diameter of the float would depend on the volume of smoke

required, but a good cloud might be possible with a reduced diameter. This composition has not been used in such long columns and work would be needed to clear its use in this way. There is the possibility of fading.

It is suggested that a demonstration should be staged to the users showing columns of this composition 2 in., 3 in., and 4 in., in diameter to determine the minimum acceptable volume of smoke. When this has been determined, the possibility of design could be examined further.

Comings Type

The American device consists of two compartments, one holding 5 lbs. of a 50/50 mixture of dye and diphenylamine (to reduce the melting point) and the other holding 3.3 lbs. of pyrotechnic fuel-oxidiser mixture. The whole (including float) occupies a space 7 inches diameter and 10 inches high and burns for 4-5 minutes. At this rate, a device 24 times larger would need 120 lbs. of dye mixture and 80 lbs. of heater mixture and the float to support these weights. There would also be a considerable problem in controlling the uniform burning of this weight of heater mixture.

The expenditure of ½ lb. of dye per minute is not excessive for a good smoke signal, and we should probably require 60 lbs. dye (100 lbs. total composition) in the pyrotechnic system mentioned above. This should, however, be more controllable, and does not require the use of 60 lbs. of inert material (diphenylamine) as a melting point depressant.

Vaporised Solutions

We have successfully vaporised dye solutions (about 30% dye in creslyic acid or dimethylaniline) by spraying into the exhaust systems of internal combustion or jet engines. It is estimated that 240 cals. are needed to vaporize 1 g. of dye solution, but owing to the low

efficiency heat exchange in simple systems double this amount of heat should be provided. This could be supplied by the combustion of liquid fuel such as paraffin oil in a Primus type heater, or by electric current generated by Sea cells. The former method would introduce obvious difficulties in ignition and air supply in a float, while insufficient is known of the efficiency and performance of the new Sea cell at Porton to judge its capabilities.

This system uses up a large proportion of the heat in vaporising the solvent, which contributes little to the efficiency of the signal. On the other hand, if dyes without solvent were used, the range of dyes is restricted to those with reasonably low melting points and difficulty has been noted in another connection in obtaining uniform melting. There is a tendency in simple designs for the dye adjacent to the heat conductors to melt and leave a large residue of dye which remains unmelted. Assuming that dye at the rate of $\frac{1}{2}$ lb. per minute is necessary for the required signal strength then the following would probably be required to vaporise 60 lbs. of dye in two hours:-

Dye solution (say 180 lbs.) ..... about 1 gallon paraffin oil or 40 KWH electric power

It will be seen from these remarks that the best hope of an early solution for a Mark I design rests with the pyrotechnic system, but it is suggested that the experiment proposed above should be carried out with the users present to cut down the expenditure rate of dye to the minimum before discussing the design further."

Remarks by the Panel — It is understood from C.D.E.S. that the rates of burning quoted in his minute dated 29.5.46 are only approximate, and it is not possible at this stage to design a float for this purpose. He considers that the likelihood of obtaining a satisfactory signal would be much higher if the 1,000 lb. storage could

Remarks by the Panel (Contd.)

be utilised; but that, in any case, the visibility of 20 miles that is understood to be desired may not be attainable.

2. The Panel concur with C.D.E.S. that a demonstration should be arranged at sea, with various sizes of smoke Generator, to enable users to judge the acceptability of the smoke volume produced, before any work is undertaken to design a store to meet this requirement.

ACTION

Forward to D.Arm.R.D. and C.S.C.D.E.S. to note the Panel's remarks.

D.N.O., C.N.R., C.E.A.D., C.S.A.R., C.I.N.O., D.D.I.Arm., and A.D./S.R. for information.

P.P. No. 566
30.7.46
Former P.P. 515 and as quoted

Photometry, Theory of Photographic Flashes (Ref. 1/1)

Secretary acknowledges receipt of A.R.D. Explosives Report No. 1001/46 entitled 'A Study of the Experimental Data available for various types of Photographic Flash' by R. F. Wilkinson. (Ref. XC(4) 1049/2/1.)

Summary

This report reviews the results obtained up to January 1946 from various experiments carried out with 1.7", 4. 5" and 6" flashes, most of which have been reported in P.P. minutes (P.P. 276, 458, 480, 481, 515, 523). The 22 tables appended also contain the dimensions of the flashes. In addition there is a short section describing the ciné pictures of the explosion of small shaped charges of R.D.X/T.N.T/AL.

The author applies the relations between the variables derived from E. F. Caldin's theory of the emission of light from a cloud of incandescent particles (P.P. 504) to the different sets of results and speculates on the mechanism and structure of the flash. He comes to the conclusion that "the results seem to agree at any rate qualitatively with the theory considering the doubtful accuracy of a considerable amount of the data used. It would appear, however, that the peak-intensity and total light are more interdependent than the theoretical treatment suggests, since these two characteristics frequently change in the same proportion, while the shape of the intensity-time curves remains almost constant." Realising that the structure of the flash may be quite different from the simple model considered by Caldin, the author recommends that ciné pictures of the greatest possible speed should be made and that some of the physical properties involved in the theory should be more accurately determined. Other recommendations are made similar to those made in the P.P. minutes referred to above.

Remarks by the Panel

The Panel understands that some of the ciné pictures which the report recommends should be taken have now been examined. They show that the flash has a complicated structure to which E.F. Caldin's theory cannot be directly applied. They are informed that an A.R.D. report has been prepared and will be issued shortly.

ACTION

Forward to D.N.O., D.G. of A., D.Arm.R.D. C.I.N.O., C.I.A., D.D.I. Arm., C.E.A.D., C.S.A.R., C.N.R., B.S.O., Washington, U.S. Naval and Military Attaches, O.C.O. India, N.R.C. Canada, A.M.R., Sec. Photoflash Panel (12 copies) for information.

CONFIDENTIAL

No. P.P. 567
30.7.46

This minute contains matter of American origin.

Signal, Distress, 1 Star, Orange Smoke and Signal Distress Orange Smoke
(Ref. 176/1)

Extract from S.B.39238 dated 14.8.45.
A.D./R.D.Arm. (P. and I.) to D.D.Arm.R.1 ref. Res. Arm. 5679 and 6718

With reference to R.D.Arm.8.(c)'s recent conversation with Coastal Command, it is understood that there is a requirement for the following stores.

1. Air/Sea Rescue

(b) A hand-held Smoke Generator to emit orange smoke, giving the largest possible volume in the shortest possible time, say about 20 seconds.

(c) A hand-held Distress Signal, giving a red star and orange smoke, contained in the case of the present Signal, Distress, 2 Star, Red, Mark 4.

2. It would be appreciated in view of the present identity as regards the purposes of 1(b) and 1(c) above, if you would confirm that there is, in fact, a requirement for both stores.

A.O.C. in C. Coastal Command to Sec. M.A.P. 9491/4/Arm.3bJ290 dated 4.9.45

"As regards the possibility of producing one store instead of two, as in the case of the Air-Sea Rescue items mentioned in Para. 1 (b) and (c) it is understood that a hand held distress signal giving a red star and orange smoke, has been requested by another Command. It can, nevertheless, be stated that a store of such a design will be

sufficient to meet this Command's Requirements for a hand held Smoke Generator.

Regarding the United States Signal Distress Hand A.M. Mk.I, it is presumed that supplies of this item will shortly be curtailed."

R.D.Arm.8(c) to R.D.Arm.(N)4 ref. S.B.39238 dated 1.12.45

It has been found during trials that it is impossible to obtain a sufficient height of ejection of the smoke unit due to the unit being a slack fit in the steel tube. It was found, however, that if the smoke unit and star are bolted together, the two are propelled to a satisfactory height. It is therefore proposed to make up a number of composite units consisting of a cylinder open at both ends with a central diaphragm. The smoke will then be filled in one end and the star in the other."

Summary of trial carried out on 19.6.46 by C.S.A.R. reported to D.Arm.R.D. on XC(4)0028/1/7 dated 22.6.46

(a) An aluminium star container with a proposed filling of Red Composition S.R.232, giving a time of burning of about 5-6 seconds, was bolted to the Smoke Generator, the two being expelled as one projectile.

(b) The Smoke Generator contained extruded pellets, about 0.25" x 0.25" of Orange Smoke Composition containing Dye oil orange, C.I., No. 24. 50%: Potassium Chlorate 25% Lactose 25%.

This Smoke Generator takes about 1-2 seconds to reach full emission, which lasts for about 4-5 seconds, thus ceasing at about the same time that the star burns out.

(c) 10 Signals were fired. The projectiles reached heights of between 20 and 150 feet, mostly between 50 and 75 feet. With the lower heights, the star and smoke unit reached the ground before burning out.

(d) 3 Signals were fired with modified Smoke Generators filled with two compressed perforated pellets of about 8 grammes total weight. These smokes were slower in reaching full emission (about 3-5 seconds) and had a longer time of burning, about 15 seconds.

(e) Verdict of Observers

It was agreed that the thin trail of smoke produced by the falling generator is quite insufficient for a satisfactory signal. The Service Signal Distress 2 Star Red Mark III, fired for comparison, is definitely to be preferred, the stars in this case having reached a height of about 300 feet.

(f) It is not possible, within the size of a Distress Signal that will be acceptable, (see remark below) to increase the emission of smoke or to hang the smoke generator on a parachute so as to give a cloud instead of a trail.

Remarks by the Panel — Recent developments of American hand-held Distress Signals are summarised in P.P.574. The principle proposed for the T.63 Signal appears to involve substitution of red smoke composition for the present delay composition in the 2 Star Signal. The amount of coloured smoke composition which could be accommodated thus would not exceed 10 grams: the emission of smoke from this small amount would be much less than that from the Signal Distress Hand Smoke AN. Mk.I. Mod.1, which consumes about 40 grams in 20 seconds. Moreover, the existing smoke compositions are not altogether suitable to be directly substituted for S.R.214 in this pattern of pyrotechnic.

2. In European waters, the atmospheric and weather conditions are usually such that a smoke

signal is less likely to be observed than a star signal.

3. The space available in K Dinghies is so little that no store larger than the existing Service Signal Distress 2 Star Red can be accepted.

4. The Panel, therefore, RECOMMENDS that the star and smoke project be abandoned and that a separate Signal Distress Orange Smoke be developed.

5. This store could be issued in part or complete substitution for Signal Distress 2 Star Red when the local conditions under which the Aircraft are operating make it likely that the use of the smoke signal might be profitable.

ACTION — Forward to D.Arm.R.D., and D.N.O., to note the Panel's recommendation in para. 4 of their remarks.

D.N.O./L., C.I.N.O., D.D.I.Arm., D.G.S.M./S.M.14, C.E.A.D., C.S.A.R., A.D./S.R., B.S.O. Washington, C.N.R., D.G.C.A., Ministry of Transport, C.I.A., M.L.O., New Zealand, D.G.T.S., South Africa, O.C.O. India for information.

No. P.P. 568
30.7.46
Former P.P. 547

Rockets Line-carrying filled Cordite (Ref. 29/5)

Paraphrased Extracts from L.P.B. 7607 Ballistics Note No.38 dated 17th May, 1946 (by A.R.D. Low Pressure Ballistics Section).

Use of Sustained Reaction Units, employing Coated Cordite Charges, to carry a 500 yard length of 1 inch rope

(a) During the war rocket motors were developed by L.P.B. Section, Woolwich, for towing ropes, hoses (empty or filled with explosive) and other purposes. These rocket motors used "coated charges"; that is, cordite sticks of appropriate geometrical shape and with their burning surface restricted by means of a coating applied to the outer curved surface. Thus in the case of a tubular stick, burning proceeds from the inner hole radially outwards and is sustained for a longer period than would be possible were the charge uncoated. The shape of the charge is arranged so that the thrust of the rocket shall be generally constant throughout the time of burning.

(b) H.M. Coastguard Service, Ministry of Transport, is interested in such rockets to carry a 1 inch hemp line for establishing contact with a distressed ship. The existing Boxer rocket apparatus, in use for many years, gives a range of the order of 350 yards.
H.M. Coastguard wish to get 500 yards maximum useful range, still using a 1 inch hemp line. The new apparatus must be simple, light, portable and sufficiently robust to stand up to rough usage.

(c) Firing Trials were carried out on the 8th, 9th and 10th May. In all, 24 rockets were fired, including 2 rounds with the existing Service Boxer Equipment.

All rocket projections were satisfactory without breakages or failure of other parts, except when a rocket hit the ground heavily and damaged its stirrups, etc.

The best performances were obtained with the 3" Viper Motors, although the ranges with these were only 400 to 450 yards. Regularity of flight and accuracy of flight were good.

The two Boxer rockets gave a good performance with ranges of 350 and 380 yards.

(d) Results with 3 inch Viper Motors

Date	Rd. No.	Range Yds.	Deviation	Remarks	Q.E.
8.5.46	3	470	80°L	Angle of projection too great (40°)	39°50'
"	4	410	1°L		35°30'
"	5	370	1°L	Bad tangle in rope.	30°15'
"	7	390	3°L	Projector unstable.	- " -
9.5.46	3	420	2°R		29°10'
"	4	410	1°R		- " -
10.5.46	4	400	1°L		30°40'
"	5	400	0°		- " -
"	6	410	9°R	Projector unstable.	- " -
"	11	450	0°		- " -

With the exception of the last, all these rounds were fired with a 50 ft. length of 3-inch rope as a tail. At the request of H.M. Coastguard, the last round was fitted with a 25 ft. tail, and functioned satisfactorily.

CONCLUSIONS

An informal discussion was held after the demonstration on May 10th, between representatives of H.M. Coastguard and of L.P.B.S. The following points were made:-

(i) H.M. Coastguard were interested in the 3-inch Viper motor, as a replacement for the present Boxer rocket.

(ii) They would like a range of 450 yds. to 500 yds. if this could be achieved without increasing the weight of the motor.

(iii) They would prefer to dispense with, or at least reduce to short length, the 3-inch rope tail, provided this could be done without risk of line breakage or loss of accuracy.

(iv) L.P.B.S. stated that a slightly modified version of the 3-inch Viper motor was available, with increased charge weight, giving 330 lbs. thrust for 2 1/2 seconds, as against 300 lbs. thrust for 2 1/2 seconds given by the motors used in the trials. By reducing unnecessary weight in the assembly, the total weight of the motor might be reduced even below the present figure of 18 lbs.

(v) L.P.B.S. would undertake to design a projector for use with these motors, more stable and robust than that used in the demonstration, but bearing in mind the need for portability.

(vi) It was hoped that a number of rocket motors, and a new projector, would be available for a further trial shortly. A range of 450 yds. to 500 yds. was expected using the new motors.

(vii) Trials should be arranged to investigate the following points:-

(a) Suitability of the new projector.
(b) Optimum angle of elevation of the projector.

(c) Possibility of reducing the length of the 3-inch rope tail.
(d) Regularity series with suggested final assembly.

The appendix tabulates all the rockets fired in these trials.

Remarks by the Panel

This development is here placed on record, but the decision (asked for in P.P.548) about whether the Panel are to be concerned in the future developments of cordite rockets to be used for signalling, line-carrying or other non-lethal purposes, has not yet been given.

2. The Panel understands, from Ministry of Supply Memorandum No.97, that the responsibility for Cordite Rocket development lies with C.E.A.D. and for research with C.S.A.R., but that any new equipment, before being approved for introduction into the Services, must be "cleared for safety" by the Ordnance Board.

3. The Panel will be glad to be told when the Equipment has been cleared for Service.

ACTION

Forward to D.N.O., D.G. of A., D. Arm. R.D., Sec. O.B. and M. of Transport asking them to note the Panel's remarks.

D.N.O./L., C.S.P.D.E., C.I.N.O., C.I.A. and D.D.I.Arm. for information.

Ballistics (L.P.B.) Note No.38

1-inch Line Throwing Trials: Details of Rounds Fired

Date	Rd: No.	Rocket	Projector	Q.E.	3" tail (ft.)	Range Yds.	De-viation	Remarks	Wind
8.5.46	1	C.N.	V.	30°20'	30'	440	3°R	Grounded 80 yds. out, continued on line.	Slight, 20°
"	2	C.N.	V.	40°0'	30'	615	5°R	High flight	left
"	3	3"V.	V.	39°50'	50'	470	8°L	High flight	rear
"	4	3"V.	M.V.	35°30'	50'	410	1°L	Flight slightly high.	Fresh 60°
"	5	3"V.	M.V.	30°15'	50'	370	1°R	Bad tangle after 100 yds. out.	left rear
"	6	C.N.	M.V.	30°15'	30'	550	1°L	Low flight	
"	7	3"V.	M.V.	30°15'	50'	390	3°L	Good flight, Projector pulled over.	
9.5.46	1	C.N.	V.	35°0'	30'	600	13°L	Good flight Pulled into wind)	Strong
"	2	C.N.	V.	35°40'	30'	540	16°L	Good flight Pulled into wind)	
"	3	3"V.	M.V.	29°10'	50'	420	2°R	Good flight	90°
"	4	3"V.	M.V.	29°10'	50'	410	1°R	Good flight	left
"	5	No.6	M.V.	34°15'	30'	650	6°L	Grounded before burnt.	
"	6	No.6	M.V.	34°15'	30'	690	10°L	Ground at burnt.) Pulled into wind)	
10.5.46	1	C.N.	M.V.	35°20'	30'	540	6°L	Good flight	
"	2	C.N.	M.V.	35°20'	30'	550	0°	Good flight	Fresh
"	3	C.N.	M.V.	35°20'	30'	460	10°L	Pulled into wind)	
"	4	3"V.	M.V.	30°40'	50'	400	1°L	Good flight	45°
"	5	3"V.	M.V.	30°40'	50'	400	0°	Good flight	
"	6	3"V.	M.V.	30°40'	50'	410	9°R	Projector leg slipped during firing.	left front.
"	7	No.6	M.V.	35°0'	25'	415	4°R	Grounded still burning.	
"	8	No.6	M.V.	40°30'	25'	650	6°L	Grounded burning) and rocket continued few yds.	
"	9	Boxer	Boxer	25° approx.	-	350	(a)	Good flight 6 yds. right of flags.	
"	10	Boxer	Boxer	25° approx.	-	380	(a)	Good flight 5 yds. right of flags.	
"	11	3"V.	M.V.	30°40'	25'	450	0°	Good flight	

(a) These rounds were aimed slightly into the wind, the angle being estimated.

Abbreviations.		
	Rocket.	Motor Rocket, 5-inch. No.6 - No.6.
		Motor Rocket, C.N., Mark III.A.- C.N.
		Motor Rocket, 3-inch, Viper - 3"V.
	Projector.	Standard Viper projector - V.
		Modified Viper projector - M.V.
	Deviation.	Right of line of fire - R.
		Left of line of fire - L.

No. P.P. 569
30.7.46
Former P.P.'s 355, 424 and 543

Rockets Signal 1-lb. and Target Practice. Ref. 64/1

I. Abolition of Wartime concessions.
II. Adhesive RD.1256 for gluing on the sockets

D.N.O. to Sec. P.P. on No.6748/46 (Ref. G.04449/43) dated 3.7.46

"1. With reference to P.P. Minute 355, Remarks by the Panel: paragraphs 1, 3 and 4 are noted.

2. Paragraph 2. Drawings and specifications have already been amended with regard to Italian Twine.

The reversion to tinned plate or copper for the sockets, and to screwed wooden plugs is concurred in.

3. Paragraph 5. All 1-lb. Signal Rockets with sockets secured by glued tape have either been withdrawn from Naval Service or are being made surplus to Naval requirements.

With regard to sockets secured by tape on Rockets Target Practice 1-lb., since no failures have been reported attributable to this cause, and as these rockets are not used operationally, it has been decided that repainting is not worth the work involved, particularly in view of the shortage of labour in Armament Depots.

4. I.C.I. Rocket composition has been dis-continued (P.P.424 refers).

Remarks by the Panel — Except for the trying out of adhesive RD.1256 to replace the adhesive at present specified for gluing on the sockets of paper rockets (P.P.467), no further climatic or other trials are outstanding, and none are considered necessary by the Panel.

ACTION — Forward to D.N.O. to note the Panel's remarks.

D.G. of A., D.Arm.R.D., D.N.O.(L)., C.S.A.R., C.E.A.D., C.I.N.O., C.I.A., D.D.I.Arm., D.A.S., A.M.R., M.L.O.(N.Z.), O.C.O. India for information.

No. P.P. 570
30.7.46
Former P.P. 326

Float Smoke and Flame Surface Mk.1 (Homing Aircraft) Ref. 154/1)

D.N.O. to Sec. P.P. on No. 9142/44 dated 19.6.46 (G.014611/44)

"With reference to your minute No.154/1 dated 4.4.46 and para. 4 of action to P.P.326, the Naval Airstaff have now withdrawn the requirement for the Float, Smoke and Flame, Surface No.1, for homing aircraft to carriers by night.

2. No further work on the development of this store is therefore required, and arrangements are being made for the disposal of the filled floats already held, also of the empty bodies which were being retained against possible requirements for filling as Smoke and Flame Floats."

C.S.A.R. to Sec. P.P. on XC(4)0021/1/5 dated 2.5.45

Five floats of type A and five of type B were received on 16.4.45. The stores were functioned and the following figures were obtained for the time/intensity measurements.

Type A

Time	(1) C.P.	(2) C.P.	(3) C.P.	(4) C.P.	(5) C.P.
0	-	-	-	-	-
30 secs.	1300	2000	2500	2500	2000
1 min. 00 secs.	1000	1800	1600	1600	1700
1 " 30 "	1200	1100	1500	1600	1600
2 " 00 "	1200	800	1400	1600	1100
2 " 30 "	1100	600	1900	1600	1300
3 " 00 "	1100	700	1500	1600	1400
3 " 30 "	1100	600	2000	1500	1600
4 " 00 "	1100	700	2100	1700	1800
4 " 30 "	1100	600	2300	1800	2600
5 " 00 "	1100	500	2000	1500	2200
5 " 30 "	1100	500	1900	2000	2600
6 " 00 "	700	200	100	500	1400
6 " 15 "	300	-	-	200	600
6 " 30 "	100	-	-	-	-

The brass sealing disc of (1) failed to rupture and the flame was emitted vertically from the striker hole: in all the other floats which functioned (Types A and B) the sealing disc ruptured correctly.

Type B

Time	(1) C.P.	(2) C.P.	(3) C.P.	(4) C.P.	(5) C.P.
0 secs.	-	-	-	-	-
30 "	500	500	400	500	
1 min. 00 "	700	600	800	400	
1 " 30 "	500	600	700	500	
2 " 00 "	750	600	800	700	
2 " 30 "	700	700	700	700	
3 " 00 "	700	700	800	800	
3 " 30 "	700	900	800	700	
4 " 00 "	700	900	700	700	
4 " 30 "	800	400	300	900	
5 " 00 "	400	-	-	100	
5 " 30 "	100	-	-	-	

Failed to ignite

The striker mechanism of No. (5) failed to fire the cap. In their time of burning regularity of burning and brightness the Type B floats appear to be inferior to the Type A floats.

C.E.A.D. to Sec. P.P. Ref. 154/1 dated 18.5.46

Herewith extract from Messrs. Albright and Wilson's letter:

> "The two types of floats were called "Type A" and "Type B", the former being the one which gives the greater candle power.
>
> Type A contained straightforward composition SR 414 and weight of filling was 322 grams (as the mean of five candles).

Type B contained:-

Magnesium	3/4-lb.
Calcium Silicide	1/4-lb.
Manganese dioxide	3.1/2-lbs.
Amorphous Phosphorus	9.1/2-lbs.
Limbux Hydrated Lime	10-lbs.

We have no record of the exact weight of filling for Type B but it will be, we believe, rather smaller than the weight in Type A because of the lower packing density of Limbux. All the materials used in filling Type B were as specified in mixture SR 414, e.g. the magnesium was Grade V, I believe, and acaroid coated."

Remarks by the Panel — C.S.A.R. states that the "Luminous efficiencies" of these two fillings are as follows:-

Type A 1562) Candle secs.
Type B 612) per gramme

2. The Panel note that no further work is required on this Store. They understand that a number of empty floats remain, but that these are not wanted by any Department for trials in connection with any other project.

Action — Forward to D.N.O., D.Arm.R.D., C.E.A.D., C.S.A.R., C.I.N.O., D.A.S., D.A.C.R., D.A.W., C.N.R., D.O.F./F., Messrs. Albright and Wilson for information.

No. P.P. 571
30.7.46

Photometry. Measurement of Atmospheric Transmission of Light (Ref. 1/1)

Extract from a report on a visit to the U.S. and Canada October - November 1945. By J. C. Cackett (Ref. Armament R. - H.D. - T)

Paragraph 8. Measurement of Atmospheric Transmission during Static Trials

The problem of obtaining an accurate measure of atmospheric transmission during static trials such as at Margam were discussed.

The suggestion was made to use a MacBeth Illuminometer in conjunction with a long focus lens in front of the objective aperture.

The lens would be focussed on a 5 feet square, matt white, test screen placed at the bomb site. A focal length of 20 inches would be necessary to obtain an image of the screen on the central aperture of the illuminometer which is only 0.1 inches in diameter. The brightness of the screen would then be measured at two distances and the transmission calculated.

This method has the advantage over that of using two PE cells to record the flash at two distances because there is no light reflected by the sand to interfere with its accuracy.

D.R.A.E. to Sec. P.P. on Air. Ph.126/12/CJD/110 dated 20.3.46

"Measurement of Atmospheric Transmission during Flash Trials

With reference to your query dated 23rd January this was discussed at the last meeting of the Night Photography Sub-Committee A.P.R.C. The sub-committee is of the opinion that

two methods may suffice, both of which are under trial by C.S.A.R.

(a) The use of existing data to estimate atmospheric transmission from the visibility of a standard target at a standard distance, as determined by workers of Sub-Committee G. of the Ministry of Home Security.

(b) The use of photocells at different distances from the flash, the true value to be estimated from the differences between the two readings. This latter method will be preferable if sufficient differentiation is obtained between the two signals. This remains to be demonstrated with the multichannel recorder.

2. The Sub-committee are aware of the necessity for using both an attenuating correction factor and a colour correction factor, and that accurate determination of these factors under all reasonable atmospheric conditions would probably extend, although not considerably, the number of working days at Margam.

3. The method suggested at N.R.C. of using a telephotometer on a special target, has been applied in comparison to the use of the G.E.C. nephelometer in measurements of vertical atmospheric transmission from balloons and is reported in various papers of the Sub-Committee G referred to above.

4. In the opinion of the sub-committee, however, losses due to scatter will be negligible compared with those due to absorption, and absorption can be determined precisely on the spot by the use of the G.E.C. nephelometer, a compact and convenient apparatus to use. C.S.A.R. will contact Mr. Waldram at Wembley Labs. to discuss this further.

5. Should no success, due to lack of accurate discrimination or reflection, attend the present C.S.A.R. tests at Tondu on the twin photocell method, then this method or the

telephotometer ought to be attempted. It is not anticipated that great difficulties would be encountered with a telephotometer although the screen would have to be placed out of range of possible damage at the bomb site."

C.S.A.R. to Sec. P.P. on X.118/21/2 dated 5.6.46

"With reference to D.R.A.E's. minute of 20th March, the two methods for measuring atmospheric transmission described at (a) and (b) have been tried at Margam.

Method (a) can only yield qualitative results since there are insufficient objects on this range which can be used as standard targets.

Method (b) which uses the flash as the source of light, gave differences of the order of 2 or 3 per cent of the quantities measured but since they were of the same order as the errors in measurement they could not be relied upon.

2. The measurement of atmospheric transmission was discussed with representatives of G.E.C. who suggested that probably the most reliable method would be to measure the candle power of a standard lamp in a reflector unit set up at a known distance in the direction of the flash. The illumination would be measured by means of a barrier layer cell optically screened from daylight. A suitable reflector unit is being obtained for trial of this method.

3. The measurement of transmission during dropping trials is much more difficult. The method used by N.R.C. Ottawa was to fire a sashalite flash in an integrating sphere in the aircraft. The densities of two photographs of this flash, one taken with a camera in the aircraft and the other with a camera on the ground, were compared. G.E.C. considered that the accuracy was not greater than $\pm$ 20 per cent. Another method suggested was to measure the brightness of an oblique searchlight beam at various heights and from these measurements to determine the scattering due to the

atmosphere. This was admittedly a difficult procedure, the theory of which would need to be worked out in detail.

Remarks by the Panel

The Panel awaits the results of C.S.A.R's experiments with the standard lamp and reflector unit.

2. They note the difficulty in measurement of atmospheric transmission, especially in Air Trials, and consider that, in the circumstances, the only practicable method will be to confine trials to occasions on which the atmosphere is relatively clear.

ACTION

Forward to D.N.O., D.G. of A., D.Arm.R.D., Sec. Photoflash Panel (12 copies) U.S. Naval and Military Attachès, O.C.O. India, B.S.O. Washington, N.R.C. Canada, A.M.R., D.D. Photos (A.M.) R.A.E. Photos, R.D. Photos, (M.O.S.), C.S.A.R., C.E.A.D. for information.

No. P.P. 572
30.7.46
Former P.P. 519

Rustproofing the Tubes of "Roman Candle" type stores
Ref: 48/2

C.E.A.D. to Sec. P.P. on 4/P/3/1 dated 25.1.46 with reference to Sec. P.P's. minute dated 21.12.45 in P.P.519

"It is pointed out that our minute dated 17.10.45 covers the inclusion of the copal varnished centre tubes of the Signal Distress 2 Star Red, and it is assumed that your remarks refer to the 5 Star Signal. The 5-Star Signal was not included at the issuing of the order, due to the use of welded tube, with its rust formation at the weld, as discussed in our minute dated 29.8.45 to A.D.F.F./D/Pyros, referred to in P.P.519.

We now understand from E.P.O., that solid drawn tube can be supplied and we have therefore issued instructions to cover the additional 40 signals with copal varnished centre tubes.

The 5 Star Signals are being filled as Signals, Distress 5 Star, Red and not as Signals, Emergency, 5 Star White."

Sec. P.P. to C.C.I. dated 7.2.46. Ref: 48/2

"The Panel asks for your remarks on C.E.A.D's. views of the unsuitability of Copal Varnish for protecting welded steel tubes.

This matter will be further considered by the Panel when C.S.A.R's. answer to your minute S.3244/2 dated 26.1.46 is available."

C.C.I. to Sec. P.P. on S.3274/2 dated 13.2.46

"It is agreed that the painting or varnishing of welded surfaces is always liable to give rise to trouble if precautions are not taken to ensure removal of residual welding fluxes or oxidation products prior to the application of paint or varnish. This is not, however, a problem peculiar to the application of copal varnish, and it is equally important to ensure that welded surfaces are thoroughly clean prior to the application of a paint such as Anodite.

It is probably true to state that corrosion due to application of a paint or varnish over a dirty weld would become apparent much quicker when using copal varnish than when Anodite paint is employed. This however can be attributed:-

(a) To the clear varnish film which permits ready observation of corrosion products forming under the film, as against a red-oxide coloured paint which does not contrast markedly with rust which will eventually penetrate the film.

(b) The fact that the copal varnish film is probably slightly thinner than the paint film.

Experience has however shown that copal varnish can be satisfactorily applied to a clean welded steel surface, and that the film so applied will afford good protection to the underlying metal.

C.E.A.D. to Sec. P.P. on P.3/1 dated 14.2.46

"It is hoped that when C.C.I. comments on the Copal varnishing of the central tubes, the following will be taken into account:-

(1) The central tube is used on Signals, 10 Stars with a length of 20 inches.

(2) One end is closed with a cap or disc brazed in position.

(3) Internal cleaning of the tube for removal of rust would be troublesome and for this reason was not attempted in the wartime production. Further, increased inspection would have had to be carried out to confirm clean interior of tube."

Sec. P.P. to C.E.A.D. dated 21.2.46

With reference to C.C.I's. S.3274/2 dated 13.2.46 copy attached, the Panel asks that information about the suitability or otherwise of Copal Varnish for protecting welded tubes shall be obtained by including, in the trials, you have already arranged, 5 star or 10 star Signals with welded central tubes using Copal Varnish.

C.C.I. to Sec. P.P. on S.3274/2 dated 7.5.46

With reference to Pyrotechnic Panel Minute No. P.P. 519 dated 8.1.46, will you please note that comparative laboratory tests have now been carried out on samples of Copal Varnish, Anodite Paint, and Akard Lacquer, and the question has been discussed in detail with C.S.A.R.

The following report on the joint findings of C.S.A.R. and C.C.I. is submitted.

(a) Time and Temperature required for stoving

(i) Akard Lacquer - 30 minutes at 300°F.

(ii) Anodite Paint - 45 minutes at 300°F.

(iii) Copal Varnish - Time would probably be in excess of 60 minutes at 300°F. but less than 120 minutes. The most suitable time

would need to be established under production conditions.

(b) Physical and Chemical Properties of the Stoved Films

(i) Akard Lacquer - A hard but slightly brittle film of good durability.

(ii) Anodite Paint - Markedly inferior as regards durability and not acceptable to C.S.A.R. due to the presence of pigments which might sensitise the fillings.

(iii) Copal Varnish - A tough non-brittle film of good durability.

(c) Conclusion

Anodite Paint is not acceptable to C.S.A.R. for the reasons stated above, and as it is a proprietary article supplies could not in any case be adequately controlled at the inspection stage.

There is every reason to suppose that either Akard Lacquer or Copal Varnish would be satisfactory for the purpose intended. Akard Lacquer has the advantage of a shorter stoving time but is probably more sensitive to stoving conditions and might become somewhat brittle if over stoved. Copal Varnish on the other hand will take longer to stove but once stoved is probably less sensitive to over stoving.

The Copal Varnish coating is appreciably thicker than that given by Akard Lacquer (approximately 0.0007" against 0.0002") and might be expected to give better long term durability.

Provided stoving times between 60 minutes and 120 minutes are not impracticable from a production point of view the use of Copal Varnish is recommended. In the event of shorter drying times being necessary the use of a Service substitute for Akard Lacquer is agreed but in such an event it will be necessary to draw up a specification to enable the quality of supplies to be controlled. In this connection "Furophene" synthetic resin stoving varnish, dealt with in A.R.D. Explosives Report 115/43, would provide an effective non-proprietary alternative to Akard. Furophene is satisfactorily stoved in 30 minutes at 350°F. The stoved film is at least equal to those of analagous proprietary varnishes in respect of general protective efficacy."

Sec. P.P. to C.E.A.D. on Ref. 48/2 dated 13.5.46

"1. C.C.I's. attached S.3274/2 dated 7.5.46 is referred for your remarks, before a P.P. Minute is drafted.

2. C.S.A.R's. objections to Anodite seems to rule out the future use of this paint for this purpose although we have no evidence that its use during the war in 5 Star Signals has caused any danger.

3. The climatic trial arranged by C.E.A.D. in P.P.519 may enable C.S.A.R. to confirm his objection to Anodite by critical examination of some of the fillings.

4. It seems clear to recommend the use of Copal Varnish, stoved for 60 - 120 minutes, for normal production with a "production permit" in war time for the use of Akard Lacquer or "Furophene" varnish.

Sec. P.P. to C.S.A.R. dated 28.5.46

"With reference to C.C.I's. S.3274/2 dated 7.5.46 (copy sent to you 13.5.46), item 16 of 73rd P.P. Meeting. The Panel enquires whether the lacquers "Akard" and "Furophene"

could be used effectively without stoving and, if so, what times of drying would be needed."

C.S.A.R. to Sec. P.P. on X(7)226/2/6 dated 31.5.46

"Neither Akard nor Furophene will harden without stoving in any reasonable time."

Remarks by the Panel

The Panel notes that both Akard and "Furophene" lacquers must be stoved and, therefore, they see little advantage in the use of such articles instead of Copal Varnish.

2. The Panel RECOMMENDS C.S.A.R's. climatic storage test as arranged by C.E.A.D. in P.P.519 should be extended to cover a total period of twelve months.

3. Pending the completion of these trials by C.S.A.R. and C.E.A.D. The Panel RECOMMENDS that the Specification should be amended at once to call for Copal Varnishing, stoved, or "Furophene" lacquering, stoved.

Action

Forward to D.N.O., D.G. of A., D.Arm.R.D. and C.S.A.R.

2. Ask D.N.O., D.G. of A., D.Arm.R.D. to note the Panel's remarks and recommendation in paragraph 3.

3. C.S.A.R. to note Panel's recommendation in paragraph 2.

Forward to C.E.A.D., C.I.N.O., C.C.I., C.I.A., D.D.I.Arm., D.O.F./F. for information.

CONFIDENTIAL

No. P.P. 573
30.7.46
Former P.P's 489 and 537 (Ref. 150/2 and 23/2)

Cartridges Signal 1.1/2 inch Aluminium Cases
Rough usage in tropical packing

C.S.A.R. to I.N.O./W. Ref: X.C(4) 0008/1/31 (Z9898/2) dated 26.4.46

"Will you please proceed with the rough usage trials of the 1.1/2 inch signal cartridges with aluminium cases as outlined in this Department's XC(4)0008/1/31 dated 14/3/46. Although the aluminium cartridge cases are not of the type which is now being developed, these cases

(a) are not fitted with paper liners and have a wall thickness approximately the same as that being adopted for the new type, and

(b) are closed by the method which it is proposed to suggest for the new type of case.

The results of these trials, in which C.E.A.D. is also interested, will therefore be of great assistance in the development of the new type of case."

I.N.O./W. to C.S.A.R. dated 25.6.46

"A Rough Usage trial was carried out at Woolwich on 19th June, 1946, on one box containing six tin cylinders each containing Cartridges Signal 1.1/2 inch Aluminium Cases.

Eight hours modified jolt caused two tins to leak slightly at the bottom seam.

Rolling end for end through two revolutions on concrete caused no further damage.

Cycle 1

Each cycle consists of six drops one on each side and end from 18" on concrete. No damage.

Cycle 2

Drops from 2'. No damage.

Cycle 3

Drops from 3'. No damage.

Cycle 4

Drops from 4' 6". One split, extending along front of box one split along rear of box.

On testing in hot water no further leaks had developed.

Conclusion

The box and cylinders withstood the rough usage trial in a satisfactory manner and can be recommended for Naval use.

Remarks by the Panel

The designs of this package are as follows:-

Cylinder No.471 to Designs D7/L/548/G/164 and D7/L/549/P/164, holding 7 cartridges. Six of these cylinders packed in Box B555 Mark I. Design A.I.D.Arm.295.

2. The Panel notes that this tropical package has successfully withstood rough usage.

3. For Naval Service, the replacement of the outer wooden package by a steel package, which is advocated by the mission to Far Eastern Armament Depots, reported in O.B. Proc. 33664, is not considered to be an urgent requirement for purely Naval purposes, but would presumably be acceptable by the Navy if and when the change is made for R.A.F. supply.

Action — Forward to D.N.O., D.G. of A., D.Arm.R.D., C.E.A.D., C.S.A.R., C.I.N.O., C.I.A., D.D.I. Arm., Sec. O.B., O.C.O. India, P.P.C.O., D.P.S., A.M.R., M.L.O. (N.Z.), D.A.C/R., E.29, D.M.S., Ottawa, B.S.O. Washington, for information.

CONFIDENTIAL

No. P.P. 574
13.8.46
Former P.P. 293
394, 481, 534 and 565

This minute contains confidential matter of American origin.

American Pyrotechnics for Distress Signalling. (Ref. 101/6)

D.Arm.R.D. to Sec. P.P. on S.B.5369 undated.

The following summary of the American developments in pyrotechnics for use as distress signals in air/sea rescue operations which have been brought to our notice is forwarded for the information of the Panel in present discussions on allied subjects:-

The Signal, Aircraft, Red Star, Parachute, M.11 was standardised in U.S. Ordnance Committee Minute 17617, and used for this purpose by the U.S.A.A.F. It is designed for firing from a 1.1/2 in. pistol (e.g. the Pistol Pyrotechnic AN.M8) and projects a red star, suspended on a parachute and burning about 30 seconds, to a height of about 150 ft. Particulars are given in U.S. Army Specification No. 50-55-4C and U.S. Ordnance Dept. Drawing No. 78-0-10. The signal was declared obsolete by U.S. Ordnance Committee Minutes 29893 and 30053.

The Signal Distress One Inch Single Star Red, M.73 - Sec. P.P. Minute 534 - was standardised by U.S. O.C. Minute 26407. It was designed for firing from 1 inch signal pistols such as the British Pistol Signal 1 inch No.2 Mk.V as used in aircraft dinghies. A Projector Pyrotechnic, M.10 was designed for use with this cartridge, but only a few samples were made (U.S. O.C. Minutes 23990, 25050 and 28688 refer). The Signal was declared obsolete by U.S. O.C. Minutes 29893 and 30053.

The Signal Distress 2 Star Red AN-M75 - Sec. P.P. Minute 411 - was standardised by U.S. O.C. Minutes 26895 and 28732 and remains in service use up to the present. The stars are required to reach 100 - 250 ft. and the intensity is stated to be 13,380 C.P. compared with 9,000 C.P. for the British 2 star signal, as determined by Picatinny Arsenal.

U.S. O.C. Minute 26599 records the initiation of development of:-

Signal, Smoke, self-contained T.60
Signal, Red Star, self-contained T.61

The T.60 was meant to project "coloured streaming smoke" at least 100 ft. but from U.S. O.C. Minute 26997 it appears that the requirement for these items was withdrawn and the development was cancelled.

The Signal Distress Smoke Hand AN-Mk.I Mod.1. was standardised by U.S. O.C. Minute 28021. It is shown in Bureau of Ordnance Drawing No. 398760, is 3.7/8 in. long by 1.5/8 in. diameter and weighs 4.3/4 ozs. It consists of a tinplate cylinder with a sealing patch soldered on one end. A "pull match" friction igniter is housed in this end, with the operating wire secured to the patch so that when the latter is pulled off, the igniter is fired. The smoke composition is loaded into an inner tinplate container by a screw filling operation, an axial cavity being formed to receive the igniter and the quickmatch priming, and to facilitate the exit of the orange smoke.

The charge of smoke composition weighs about 40 gms. and burns for about 20 seconds; the smoke is claimed to be visible for 8.3 miles from aircraft and 12 miles from surface craft, down sun. These signals, as supplied by Aerial Products. Inc., Merrick, N.Y., were demonstrated at Porton in September 1945 and found to emit a fairly dense stream of orange smoke for 20 seconds. They were tested by

R.A.E., and found to withstand low temperature, and low pressure followed by submersion: but adoption by the R.A.F. could not be considered owing to the termination of Lend-Lease.

The Signal, Distress Day and Night, Mk.13. Mod.0 has now been adopted by the U.S. Naval Services, to replace Very cartridges and the Signal Distress Hand Smoke Mk.I. Mod.1 in distress kits for aircraft and surface vessel life-boats, rafts and floater nets.

This store is about 5 inches long x 1.5/8" diameter and weighs approximately 7 ozs. At one end is a smoke generator similar to that in the Hand Distress Smoke Signal, burning 18 + 3 seconds while at the other end is a second pull-match, which ignites a flare giving reddish-white light, of 20,000 candle power for 23 seconds.

This signal is now marketed by Aerial Products Inc. as the "Daynite" distress signal.

The results of visibility trials of various distress signals at the U.S. Naval Air Station, San Juan, are summarised in the attached extract from an article in the U.S. Naval Aviation Confidential Bulletin for August 1945. (See Appendix).

The U.S.A.A.F. have now stated a requirement for a combined day and night distress signal T.63 - see U.S. O.C. Minute 30134. This is required to operate similarly to the Signal Distress 2 star Red and to be approximately 5 ins. long. It is to project one or more red stars, visible in clear weather at night from a slant range of 30 miles, and emitting a dense smoke trail if possible, to a height of 200 ft. The total burning time is to be 30 seconds, and orange red smoke, with volume as great as or greater than that produced by the Signal Distress Hand Smoke Mk.I. Mod.1 is to be discharged from the signal container except when stars are being expelled.

The Comings smoke generator referred to in P.P.565 (q.v.) was developed by the N.D.R.C. Munitions Development Laboratory at the University of Illinois and is described in O.S.R.D. Report No. 6375 as the Floating Distress Signal (DS-4). The total weight is 12 lbs. The hot gases from the burning fuel pass through a venturi into which the dyestuff mixture (50% Calco Oil Orange Y-293 and 50% diphenylamine) is forced through a small hole. The necessary pressure in the dye chamber is obtained by a small hole which communicates with the fuel chamber above the level of the molten dye mixture.

Note:- Successful trials of an earlier pattern of generator were made with other dyestuffs also:- Calco Oil Green CG, du Pont Oil Orange and du Pont Oil Yellow N.

So far as is known, this generator has not yet been adopted for service.

During the War, a store based on the Marker Marine Mk.2 was made experimentally (Marker Marine T.2) in the U.S.A. (see P.P.394) but was not entirely successful: recently the development of a Marker Air/Sea Rescue, Red, T3, has been initiated (U.S. O.C. Minute 30121). This is required to be provided with a delay mechanism variable up to 12 hours, and to emit flame and red-orange smoke for not less than 3 hours. The visibility is to be not less than 10-15 miles by day or night.

The American Dye Marker for life jackets (Specification AN.S.10 Sea Marker) contains 3.1/2 ozs. of uranine dyestuff (see Note by the Panel in P.P.293).

Fluorescein (uranine) was used in a cartridge designed by the Kilgore Manufacturing Co. for use with M.10 hand projector, which were tested by the Inyokern Naval Station (Report TED. No. PTR 2533 refers). Since they weighed 1 oz. each, but contained only 1/4 oz. of uranine, they compared unfavourably with the standard marker, and were not adopted.

A Plane Crash Position Marker was developed by the General Printing Ink Co. of New York. (O.S.R.D. Report 4571 refers). It was found that a mark visible at 8 miles from 10,000 ft. could be maintained by the liberation at the surface of 0.3 to 0.4 lbs. of uranine per hour. This was achieved by means of blocks of uranine, compressed with water and a binding agent such as polyvinyl alcohol, and housed in a float which was to be released mechanically from the aircraft when a sea-switch closes an electric circuit including an igniter fitted in a gunpowder charge.

It is not known whether this device was adopted for service."

Aircraft Crash Marker Buoy

By June, 1945, this buoy had been developed. It was tubular in shape, 27" long x 2 1/2" diameter and contained a battery-lit electric light, visible for 2-5 miles at night and burning for 20 hours, and a fluorescein block which produced a green "slick" for 15 hours. This device was carried externally and released automatically when the aircraft submerged to a given depth, but remained moored to the fuselage by 600 feet of 75 lb. nylon cord.

Remarks by the Panel

The American practice differs from our own in two important respects:-

(a) More reliance is placed on devices which reflect light (coloured smoke, fluorescein) by the U.S. than the British. This is no doubt due to the brilliant sunlight prevailing by day over the Far Eastern theatre of operations.

(b) The U.S. Navy do not consider it essential to project a signal light into the air, and use a hand-held flare by night. If 125 ft. cutters or larger vessels are

Remarks by the Panel (Contd.)

always available for searching, the visibility of such flares may suffice, as indicated by the trials in the Appendix; but in a seaway, a projected star is more likely to be seen from the motor launches used by the R.A.F. air/sea rescue service. The U.S.A.A.F. seem to hold the same view, and in this connection it is of interest that the Luftwaffe introduced a two-star distress signal (Seenotsignalpatrone") in 1944, although both signal cartridges (cf. O.B. Proc. 3951) and a hand-held flare ("Notsignalfackel") were in use previously.

2. The Panel would like to be informed in due course of the progress of development of the T.63 signal and the T3 marine marker.

3. They RECOMMEND that the principle of the Plane Crash Position Marker be investigated as a possible alternative to the long-burning coloured smoke floats at present under discussion, bearing in mind, however, that such markers may not be sufficiently visible in a rough sea.

Action

Forward to D.Arm.R.D., to note the Panel's Remarks and Recommendations.

C.S.A.R., C.E.A.D., D.N.O., D.N.O.(L), D.O.R., D.D. Rescue, Sigs.5, Sec. O.B., C.S.C.D.E.S. Porton, U.S. Military and Naval Attachés, B.S.O.

Extracts from: U.S. Naval Aviation Confidential Bulletin, August 1945

Tests conducted on visual range of Emergency Signalling Equipment for Air-Sea Rescue

The Bureau of Aeronautics carried out tests extending over 60 days at N.A.S. San Juan, using a P.B.M. for air search and a 125 ft. coastguard cutter for surface search.

"In the up sun areas (150° sector) the veiling brightness of the haze is three times that of the down-sun haze with the result that land, sea and objects on the sea lose their distinctive colour. This means that small objects are lost in a confused pattern of glaring light and shadow. In the down-sun areas the sea is much darker, there is no glare, the haze is more transparent and white caps are highly visible. As a result, all coloured objects show colour brightness contrast to their backgrounds. It should be noted however that the San Juan tests were conducted in moderate seas; in a flat calm it is possible that raft silhouettes may be visible at greater ranges up sun than those indicated in the tests."

"The sighting ranges obtained in these tests are given in the following tables:-

SIGHTING RANGES IN NAUTICAL MILES

	Equipment Item	ob-served from	DAY CLEAR Down-sun	Cross-sun	Up-sun	Over-cast	Night
1.	Yellow Life Rafts (Mark I, II, IV, VII).	Air	1.9	1.4	1.1	1	.0FM
		Sea	2.2	1.9	1.2	1	.5SL
2.	AR-10 (Black Rubber Boat).	Air	3.9	3.3	3.7*	-	-
		Sea	-	-	-	-	-

	Equipment Item	ob-served from	DAY CLEAR Down-sun	Cross-sun	Up-sun	Over-cast	Night
3.	Learned Mirror	Air	6.3	7.0	4.8	-	-
		Sea	4.4	4.5	4.0	-	-
4.	Dye-Marker Life Jacket Packet /	Air	3.8	2.5	2.2	-	-
		Sea	2.8	1.7	1.0	-	-
5.	Orange Smoke	Air	8.3	7.4	7.1	6.7	-
		Sea	12.0	9.0	10.0	-	-
6.	White Smoke	Air	16.8	11.5	12.0	-	-
		Sea	15.0	12.0	13.0	-	-
7.	Red Fluorescent Paulin	Air	3.1	3.6	1.5	-	-
		Sea	3.6	3.8	2.0	-	-
8.	Pararaft Yellow Paulin	Air	1.2	.7	.8	-	-
		Sea	-	-	-	-	-
9.	Depth Charge Marker (Day)	Air	4.7	4.4	3.4	-	-
		Sea	-	-	-	-	-
10.	Depth Charge Marker (Night)	Air	-	-	-	-	19.0
		Sea	-	-	-	-	6.4
11.	Mark V Float Light	Air	-	-	-	-	20.0
		Sea	-	-	-	-	-
12.	Mark VI Float Light	Air	-	-	-	-	19.0
		Sea	-	-	-	-	5.6
13.	Electric Float Lantern	Air	-	-	-	-	1.5
		Sea	-	-	-	-	2.7
14.	Two-Cell Flashlight	Air	-	-	-	-	2.4
		Sea	-	-	-	-	11.0
15.	Life Jacket Light	Air	-	-	-	-	0***
		Sea	-	-	-	-	-
16.	Balloons (2 ft. diam., red and orange) //	Air	1.0	1.0	.4	-	-
		Sea	2.0	1.9	1.3	-	-
17.	M-75 (2 stars)	Air	-	-	-	-	32.0
		Sea	-	-	-	-	21.0
18.	Very Light (Red)	Air	-	-	-	-	17.5
		Sea	-	-	-	-	21.0
19.	Reflector Buttons (Mirror)	Air	-	-	-	-	0
		Sea	-	-	-	-	.5 SL

	Equipment Item	ob-served from	DAY CLEAR Down-sun	Cross-sun	Up-sun	Over-cast	Night
20.	Scotchlite Oar	Air	-	-	-	-	0
		Sea	-	-	-	-	.3SL
21.	Scotchlite Paulin	Air	-	-	-	-	0
		Sea	-	-	-	-	1.5SL

FM - Full Moon's Path.
SL - Searchlight.
* - Good up-sun target.
** - A fine cross-sun signal. Good 360° in high sun.
*** - Failed to pick up at 1,000 ft. circling raft for one-half hour. No surface tests made.
/ - No aid from surface in calm sea or up-sun.
// - Does not help raft sighting from air. Big help to man in "Mae West".

"General Conclusions:-

"3. Size of very small targets apparently does not affect range in the direct proportion experienced in the laboratory. Ranges on the life-jacket dye marker packet were in proportion to intensity rather than dispersal area while ranges on smoke depended on density rather than expanding volume.

"7. Night Signals are more effective than day signals.

"8. In a night search from the air for rafts without signals, discovery is purely a matter of chance. They were not seen in repeated attempts searching the full moon's path from 500 ft. altitude. Day and night search for a man in a Mae West without signals is almost hopeless.

"9. The best search altitudes are 500 ft. for day and 1,000 ft. for night.

"12. Binoculars give best results from surface vessels but are not as yet reliable from the air.

"13. Training is necessary, not only for look-outs, but for operators of the signalling equipment as well.

"14. The present signalling equipment is excellent, and some visual signals may be expected to reach the airplane or surface vessel as far as the person operating the equipment can see the searching craft or their lights.

"Results of Equipment Tests:-

"Life Rafts

2. Orange is a better colour than yellow in clear daylight in a white capped sea. Although a bright yellow reflects in the order of 55% of incident light and a bright red approximately 18% to 20%, yellow is easily confused with white caps while red or orange are extremely conspicuous. Yellow, however is better in overcast, twilight and under searchlight and is the best colour in calm seas. Orange makes a good compromise.

"Dye Marker. The dye marker bag was trailed behind the drifting raft to form a long green line which made an excellent visual target.

(1) the intensity of the dye is more important than the size of the dispersal area.

(2) since the life-jacket dye-marker packet is exhausted in a No.4 sea in 20 to 30 minutes, and ceases to be a good target after one hour, it is

preferable to conserve this signal until a rescue craft is known to be in the vicinity and then to disperse the dye as quickly as possible.

"Smoke Signals. Smoke signals have the advantage over all daylight signals in that they are effective in all bearings relative to the sun and also during overcast. Of the smoke signals tested, the orange smoke hand-held signal was the best. It went into action fast and immediately became a most conspicuous visual target, lasting from 1.1/2 to 3 minutes depending on the wind. When used with the dye marker, there is a high probability of pick-up as far as 10 miles.

"Distress Signal Mk.13. This item, which consists of orange smoke by day and red flare by night, was received too late for complete tests. From limited tests it is considered excellent for both day and night.

"Land Survivor signalling. A separate test was conducted on the beach where the tropical foliage was similar to that of operational areas in the Pacific.

"Dye Marker in Surf. The life jacket dye marker is not very effective in signalling from shore as it is practically the same colour as the shoal water.

"M-75. The hand-held two-star signal can be picked up against jungle foliage in full daylight at 3 miles with binoculars and 1 mile with unaided vision.

"Orange Smoke. The maximum range is approximately 5 miles with unaided vision. However, it should be operated inland as the pink sand does not provide sufficient colour contrast to the smoke."

No. P.P. 575
30.7.46

Magnesium and Aluminium Powders. Ignitability Effect of temperature. (Ref. 162/1)

The Secretary reports the receipt of P.I.F. 185 A.C. 8668 on -

"The Effect of temperature on the ignitability of Mg. and Al Powders. by A. P. Boyle and F. T. Llewellyn.

The following is a summary.

It had already been shown that Grade 5H magnesium powder ignites spontaneously in air when heated to a temperature of about 600°C. It is now found that the electrostatic energy required to produce ignition of this magnesium is a little greater at -150°C. than at room temperature, does not change much between room temperature and about 200°C. and as would be expected falls to zero value at 600°C. The curves not reproduced attached to this paper show that much greater energy was required between the temperatures 173°C. and 0°C. when the magnesium cooled with 'drikold' (solid CO_2) and alcohol was surrounded by an atmosphere of carbon dioxide.

In the second part of this paper the ignition points of aluminium and magnesium powders are reported. Four different samples of flake aluminium did not ignite when heated in 30 minutes from room temperature to 600°C. Fine and coarse magnesium powders ignited at about 540°C. The temperatures of ignition when different samples of aluminium powder were dropped into a furnace varied, however, from 350°C to over 600°C and it seems to be indicated that the temperature is lowered when the stearic acid content is increased. In the same circumstances fine and coarse magnesium powders ignited at temperatures between 520°C. and 540°C. The addition of water to the magnesium powders lowered these ignition points by 10 to 40°C. Blown aluminium could not be ignited below 600°C., the highest temperature used.

Remarks by the Panel

Enquiry of Birmingham University shows that no record exists of the densities of the powders concerned in this report; and that no samples are available of those powders which showed abnormally low ignition points, for examination or further trials.

ACTION

Noted.

Forward to N.R.C. Canada, D.M.S. Canada and D.G.O.F. for information.

No. P.P. 576
13.8.46
Former P.P. 210

Enemy Munitions. German 15 c.m. Rocket.
Propelled Multi-Candle Flare. (Ref. 145/2)

C.S.A.R. to D.Arm.R.D. on XC(4)7003/18/3 dated 17.7.46
photographs attached

"Three rocket propelled multi-candle flares have been received and examined. Photographs are attached. The rocket was nearly seven feet long and six inches in diameter. It weighed about 124-lbs. and was made up of a propellant shaft and a flare head joined to one another by a pressed steel connecting sleeve. The sleeve screwed onto the forward end of the shaft and fitted tightly over the flare head to which it was secured by three rivets. Three collapsible fins were attached by a steel collar to the rear end of the shaft.

The propellant shaft consisted of a strong steel cylinder 36.1/2 inches long, closed at its forward end by a thick steel disc in the centre of which was a tapped hole. The rearward end was closed by a multi-channelled venturi ring. It contained 26-lbs. of propellant in cylindrical form arranged in two bundles of seven cylinders. The bundles were separated by a steel spider. Between the propellant and the forward end of the shaft was a steel ring inside of which was a celluloid disc held in place by metal tongues. A perforated igniter pellet of yellow composition, the nature of which is being investigated, was situated in the centre of the disc. A narrow celluloid tube passed down the centre of the shaft from the venturi ring to the igniter pellet. The tube held eight gunpowder pellets, three near each end and two in the middle.

The tapped hole in the centre of the closing disc of the shaft received a steel mushroom-shaped delay unit with delay composition pressed into the stem. The mushroom head was hollow and contained 12 gms. of fine grained gunpowder

enclosed in a disc-shaped celluloid container on which was painted V.22. The head protruded into the flare container. The centre of each celluloid disc was a blob of yellow composition.

The flare container consisted of a rolled paper cylinder 45 inches long and 6 inches in diameter varnished externally and closed at its forward end by a spun metal cap painted red. Its contents starting from the rearward end were as follows. Firstly, covering the gunpowder charge of the delay unit was a celluloid disc with a circular blob of yellow composition in the centre. The yellow material is thought to facilitate ignition of the celluloid and is being examined. Then came a steel wheel shaped ejector unit which had a cambric bag in the centre containing 5 gms. gunpowder and a hollow plastic rim which was tightly packed with 45 gms. fine grained gunpowder. Next to the ejector unit was an igniter disc consisting of two stout paper lids which fitted one into the other to form a flat cylindrical box. Each lid was perforated by nine holes and was coated internally with priming paste.

The greater part of the flare head was filled with 28 coloured flare candles in four bundles of seven candles, alternate bundles containing red and green flares respectively. Between the bundles were igniter discs and in the centre of each bundle were two short celluloid flash tubes similar to the longer one in the propellant shaft. The remaining space in the nose was filled with packing discs.

The flare candles were 8 inches long, 1.5 inches in diameter and weighed 11.1/2 ozs. Each candle consisted of a rolled paper cylinder having tinplate collars secured with three punches to each end and turned over onto the closing discs. It was filled with a fairly soft flare composition which was primed with grained gunpowder.

The compositions were:-

Red

Magnesium	16.6 per cent
Wax	6.0 " "
Strontium nitrate	56.5 " "
Acid insoluble residue	20.9 " "

Green

Magnesium	11.0 per cent
Wax	7.0 " "
Barium nitrate	68.0 " "
Acid insoluble residue	14.0 " "

The acid insoluble residue contained chlorine and was similar to polyvinyl chloride. The flares burned with a small flame and reached their maximum intensity slowly. The slag tended to choke the flames so that they issued in blowpipe fashion and the intensity was much reduced.

The colours were poor, that of the red flare being orange to brick-red and that of the green flare being greenish yellow. Four flares of each colour were burned and the times of burning, intensities and luminous efficiencies are set out in the table below.

	Time of burning seconds	Intensity candles	Efficiency candle secs. per gm.
Green Flares	130	1700	590
	154	1100	450
	143	800	300
	120	900	290
Red Flares	117	10300	3200
	124	6400	2100
	112	7800	2300
	116	5400	1700

Functioning: When the rocket is projected the mushroom shaped delay is ignited by the propellant gases and presumably burns under full gas pressure.

The delay ignites the gunpowder ejector charges which in turn ignite and eject the flare candles from the nose of the flare head. The ignition of the flare candles is facilitated by the igniter discs situated between the bundles of flares and which are ignited by means of the celluloid flash tubes in the middle of the bundles."

Remarks by the Panel

In the report on B.I.O.S. Trip No. 1458, Part I, Page 25, it is recorded that Dr. Fritz Feistel stated that German Target Markers were made as copies of those used by the British and were used as decoys; some were used as the head filling for rockets. Therefore, it seems very probable that some of the "Scarecrow" and other phenomena seen over Germany early in 1944 and reported by O.R.S. Bomber Command (see P.P. 210) were caused by incorrect functioning of the heads of these rockets.

2. The Panel understands that this rocket was fired from ground projectors to simulate the cascade effects of the T.I. Bombs used by the R.A.F. Pathfinder Forces; and that B.L.C.50, flare bodies, filled with similar candles, were fired from improvised mortars on Germany decoy sites to simulate British T.I. Candles burning on the ground.

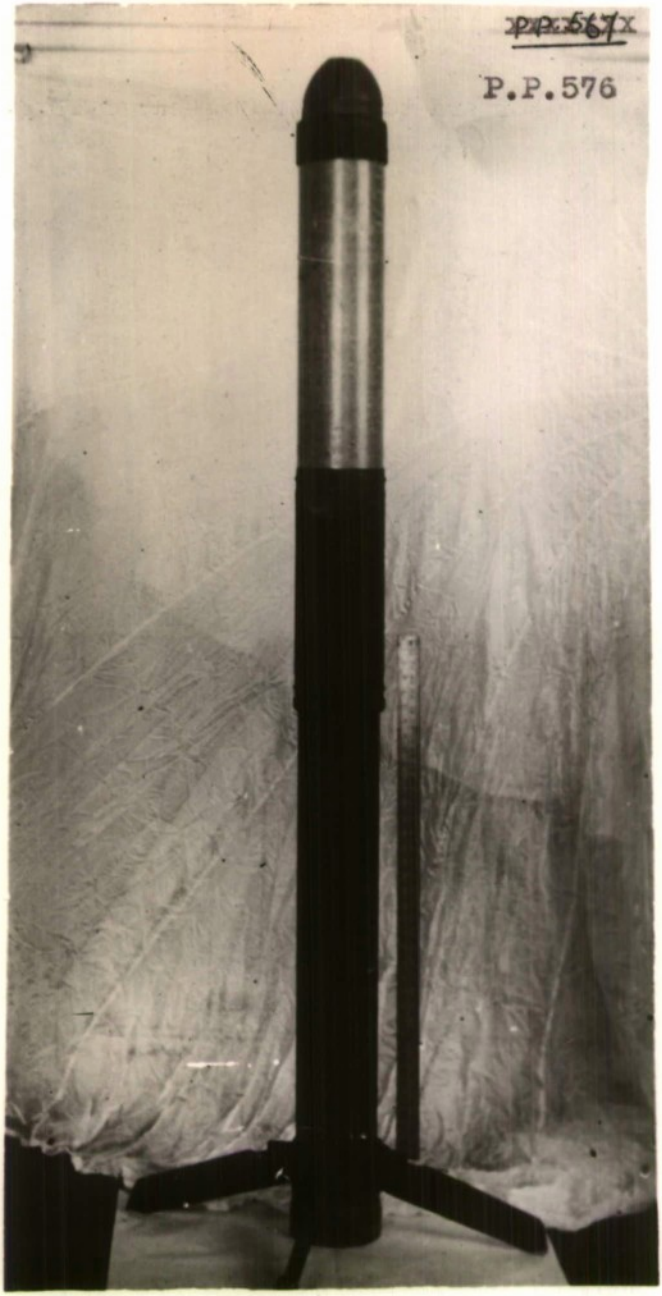
3. Details of some of these stores are contained in a report by H. J. Eppig entitled "Anti-Pathfinder Pyrotechnics". No. XXXII - Item 56.

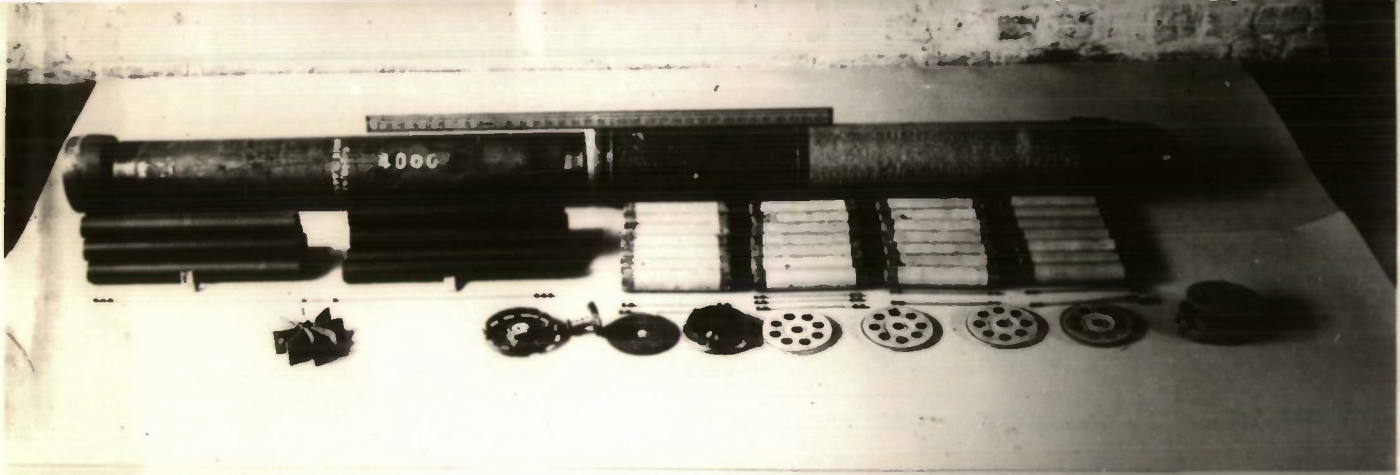
ACTION — Forward to Bomber Command and D.O.R. (A.M.) asking them to note the Panel's Remarks.

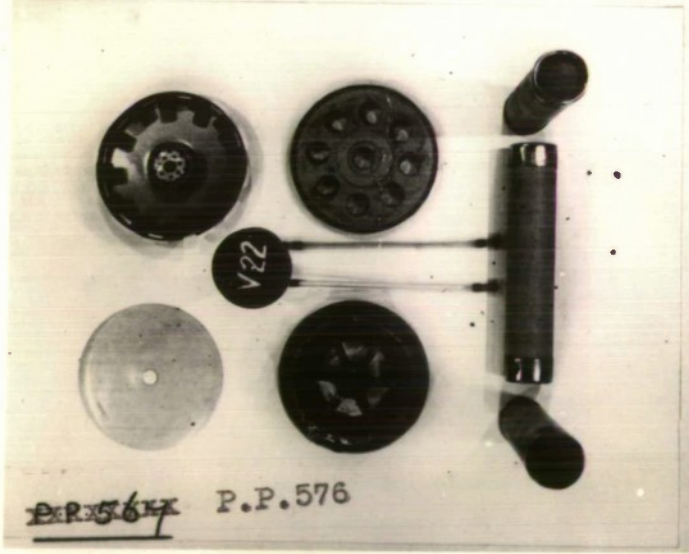
D.N.O., D.Arm.R.D., C.E.A.D., C.S.A.R., and Sec. B.I.O.S. (Group 2) for information.

~~P.P.567~~

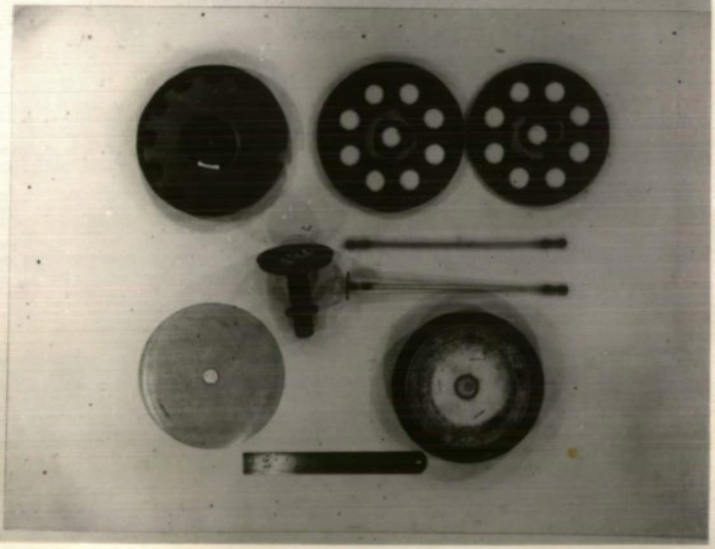
P.P.576







~~P.P.567~~ P.P.576



No. P.P. 577
13.8.46

Rocket Measuring Cloud Height. (Ref. 97/4)

Notes of a discussion at M.O.4. on 22.5.46

"1. The object of the meeting was to lay down a specification of requirements for a rocket to be used for measuring the height of cloud base by day. Captain Frankcom stated that current commercial rockets, especially the Wells rockets at 3/6d. each, were very near to what was required, and if they had been more consistent in performance he would have recommended adopting them.

2. After some discussion the following specification was agreed:-

(a) Height. The rocket should preferably reach 3,000 ft., but anything above 1,500 ft. would be worth while.

(b) Rate of Ascent. The rocket should take at least 10 seconds to reach 3,000 ft. and the time to reach any given height must not vary more than ± 10% from the mean. A minimum overall accuracy in the measurement of cloud height of ± 10% may be expected from the timing errors.

(c) Visibility. The track of the rocket must be clearly visible against different cloud backgrounds. A distinct puff of smoke should be emitted at the top of the ascent, preferably accompanied by a loud bang.

(d) Firing. This must be as simple as possible, e.g. a port fire match. An inexpensive electrical firing would be equally satisfactory.

(e) Safety Precautions. The firing must be free from danger. If the container is heavy, a parachute must be provided for the descent.

(f) Price. The price must be as low as possible. For quantities of 10,000 a year, a figure not exceeding 2/6d. each should be aimed at.

(g) Packing. If the rockets deteriorate when exposed to air or moisture, they must be protected by suitable packing.

3. The first step should be to invite assistance from M.O.S., either R.D.Arm.8 or PD 4X might be approached as they are responsible for pyrotechnic development."

NOTE. At a trial carried out at Shoeburyness for the M.O. on 22.3.46 with rockets supplied by Messrs. Wells, the results were inconsistent. Of six smoke rockets fired, two failed to burst and one shed its stick: of four red star rockets fired, one was very erratic in flight: one head failed to burst and the head of another functioned erratically.

This matter was referred by M.O. to D.Arm.R.D. and by him to the Panel, who discussed the matter at their 80th and 81st Meetings on 9.7.46 and 30.7.46.

Item 16 of 81st Pyrotechnic Panel Meeting

"The requirements were re-stated by representatives of M.O.4., who said that the rocket would be required for use by day at all meteorological reporting stations, including ships at sea. At present a small free hydrogen balloon is used, but the inconvenience of using hydrogen, especially on board ship, is disliked. Tracer bullets had been considered, but were thought unsuitable, especially as many stations are in towns. For this reason, any rocket would have to be provided with a parachute to control the descent of the spent case. A rocket reaching 1,000 feet above station level would be useful, if the accuracy were within ± 100 feet. 1,500 feet would be much better and 3,000 feet would cover all present requirements. In connection with the effect of wind on the

trajectory, it was pointed out that the lateral displacement of the rocket could be estimated and a correction made in the height to allow for this. C.S.A.R. said that deflections up to 15° would probably have little effect on the results. The sound signal is desirable for occasions when the cloud base is above the vertex of the rocket, but it was finally agreed that for the present this sound signal could be omitted.

2. C.S.A.R. suggested the use of a small steel rocket, which had been designed during the war for P.F.F. use and which was stated to reach a height of 1,800 feet in 8 seconds. If fitted with a tracer, this should meet requirements; but as the cost was estimated to be at least 10s., it was decided, for the present, to ascertain the best performance which can be obtained by modifying the Service 1 lb. Paper Rocket.

3. It was agreed that the Secretary should write to C.E.A.D. requesting him to prepare a design of 1 lb. Rocket, preferably vane stabilised, with a tracer burning to the vertex and a parachute to control the descent of the spent case. A small experimental order will be arranged by M.O.4. with a trade firm on receipt of the design; and to give the Ordnance Factories experience in manufacturing rockets, the Panel will place a small order on Swynnerton to run in parallel, in view of the fact that it might be found necessary to place bulk contracts with a R.O.F.

4. The desirability of carrying out trials with the C.S.A.R. type of steel body rocket modified to reach 3,000 feet will be further considered by M.O.4. and the results communicated to the Panel.

Sec. P.P. to C.S.A.R. ref. 97/4 dated 15.7.46

"With reference to attached copy correspondence:-

(S.B.67147, E.1841/46/M.O.4a, Notes of Discussion). The Panel instructs me to refer this matter to you

for remarks especially on the probability of getting the required height with satisfactory consistency."

C.S.A.R. to Sec. P.P. ref. 97/4 dated 7.8.46

"The Mark III signal rocket will not reach a height of 1,500 feet unless it is operating at such a high pressure that it is likely to burst. This height could only be obtained if the head and its filling were reduced to a quarter of the present weight.

To obtain the necessary accuracy in the estimation of the height of the cloud-base with gunpowder rockets, it will be necessary to have the rockets carefully filled by an experienced firm and to prove them for peak-height before issue. They should be proved periodically during storage. observers responsible for determining cloud-heights should reject observations made with rockets which they estimate have diverged more than 20° from the vertical.

A single-stage gunpowder rocket which could reach a height of 3,000 feet would be expensive, clumsy and liable to burst. The Rossman 4-stage rocket which weighed 2 lb. 11 oz. (15 oz. of head filling) reached a height of 3,000 feet. Rockets to this design (3-stage) were made in this Department but occasional bursts were never eliminated. This rocket would not be cheap.

A small steel rocket which may be suitable for this work was designed (R.22) by this Department for the P.F.F. It has a short burning time and high acceleration and should give adequately reproducible ballistics. It could probably be projected vertically with much greater regularity than any paper-cased rocket fitted with a stick. This rocket will reach 2,000 feet and could be fitted with a tracer and parachute. If the gunpowder charge was replaced by cordite, the rocket should attain a height of 3,000 feet and have very regular ballistics. A short tube, about 2 1/2 feet long, would be required as a projector.

Remarks by the Panel

The Panel agrees with C.S.A.R. In their considered opinion, it may be a waste of time, effort and money to experiment any further with single-stage paper rockets for this purpose.

2. They think that no satisfactory solution "on the cheap" such as desired by M.O. is feasible.

3. The Panel RECOMMENDS that C.E.A.D. consulting C.S.A.R., should be asked to design a modified R.22 rocket to comply with M.O's. requirement.

4. They further RECOMMEND that, in the first instance, this design should be submitted to trade firms, e.g. Schermuly, for an estimate of the cost of mass production. Then M.O. could seek financial approval for the project of supply before any large-scale departmental trials are undertaken by C.E.A.D. to perfect the design.

5. The Panel discussed the suggestion made by I.S.A.A. that a tracer bullet would be a much more economical store to meet the purpose envisaged than any rocket, and that if it were provided with a self-destroying charge, the objection to its use in towns would be met.

ACTION

Forward to Sec. O.B. to remark on the possibility of developing a low velocity self-destroying tracer projectile to be fired from any suitable weapon such as the .5" Vickers barrel, to meet M.O's. requirements.

D.N.O., D.Arm.R.D., D.G. of A., C.S.A.R., C.E.A.D. and M.O.4 for information.

No. P.P. 578
13.8.46
Former P.P's. 505 and 537

Cartridges Signal (Etc.)
Aluminium Cases. 1.1/2 in. and 1 in.
(Ref. 23/2 and 87/3)

C.S.A.R. to Sec. P.P. on X.C.(4)0008/1/32 dated 14.3.46 and to D.Arm.R.D. on X.C.(4)0008/1/41 dated 5.7.46

"1. The above two papers report the results of Departmental trials by C.S.A.R. with extruded Aluminium Cartridge cases 1.1/2 in. and 1 in. not using paper liners.

The object of these trials is to get information that will be useful later on to C.E.A.D. and D.G.O.F., both in producing empty Signal Cartridges by impact extrusion, and in the subsequent design of filled cartridges of all natures using these aluminium cases.

The reports deal with:-

(a) The desirable wall thickness of the empty cases.

(b) Design and methods of turn-over for the mouth of the cartridges.

(c) Methods of mouth sealing and closing.

(d) Length of cartridges and their behaviour on firing, especially when they project beyond the muzzle of existing pistols, e.g. (Smoke puff cartridges).

(e) Behaviour of cartridges filled brown smoke puff or white smoke puff, with regard to the collapse of smoke units, and premature bursts.

(f) Increasing the present design diameters of the cartridge cases to reduce the clearances in the barrels of pistols, to avoid split cases.

2. C.S.A.R. makes the following tentative recommendations:-

A. Cartridges 1 in. (Aluminium) Signal and Illuminating

(i) The number of different lengths of cases can be reduced to two. The final lengths adopted will depend on whether the use of paper liners and of compressed paper base wads can be avoided; and on the amount of "turn-over" of the lip (90° or 30°). It appears that the paper liner is not necessary.

(ii) Wall thickness of about 0.030 in. should be satisfactory.

(iii) Clearance in pistol barrels should be reduced. The diameter of 1 in. cases should be H 1.075 - L 1.055 inches.

NOTE - For a fairly successful trial of Cartridges 1 in. Illuminating J with Al. cases see P.P.533.

B. Cartridges 1.1/2 in. (Aluminium) Signal and Smoke Puff

(i) Paper Liners can probably be avoided.

(ii) Wall thickness of about 0.030 in. should be satisfactory.

(iii) Clearances. Diameter 1.1/2 in. cases should be H 1.56 - L. 1.54 inches.

(iv) The reliable functioning of Smoke Puffs from these metal cases with turn-over lips calls for further investigation. With the existing designs of smoke puff signals, thus confined, the firing pressures are such as to cause collapse of the smoke containers. The movement of the fillings inside the cartridges under rough usage is also troublesome, tending to break the mouth sealing.

(v) With 1.1/2 in. cartridges protruding from the muzzle of the pistol, as in the case of Smoke Puffs, a turn-over of the lip of the cartridge of 30° can probably be used, but a turn-over of 90° is liable to cause such a swelling of the unsupported mouth of the cartridge as to create serious extraction difficulties.

Remarks by the Panel — The Panel agree generally with C.S.A.R. and are informed by C.E.A.D. that extruded aluminium cartridge cases will shortly be available for filling trials. They await the result of these trials, especially those to ascertain whether the difficulty mentioned in B (iv) of C.S.A.R's. tentative recommendations is overcome by his proposal, i.e. that the cartridge should be tightly packed with the minimum of longitudinal movement of the filling, any felt washer used being tightly compressed.

ACTION — Forward to C.E.A.D.

2. Ask C.E.A.D. to inform the Panel of the results of the trials when available.

D.N.O., D.G. of A., D.Arm.R.D., D.G.O.F., E.P.O., C.S.A.R., Sec. O.B., C.I.N.O., C.I.A., D.O.F./S.A.A., D.D.I. Arm., D.A.S., E.29, O.C.O. India, A.M.R., B.S.A.C. Washington, M.L.O. (N.Z.), N.R.C. (Canada) and D.M.S. (Canada) for information.

No. P.P. 579
13.8.46

Bombs, A/C. Practice. Naval Requirements.
10 lb. Flash. Former P.P.512. (Ref. 83/1)
10 lb. Flame. Former P.P.538. (Ref. 83/2)
10 lb. Brown Smoke. Former P.P's. 378 and 420. (Ref. 83/3 and 131/2)
8.1/2 lb. Break-up Smoke. (No file)
8.1/2 lb. Break-up Flame. Former P.P. 459 (Ref. 98/2)
8.1/2 lb. Break-up Coloured Dye Filling. Former P.P. 468. (Ref. 83/4)
25 lb. Flash. Former P.P. 320. (Ref. 83/6)
12-14 lb. (Day and Night) (Ref. 83/7)

The following decisions were reached at a meeting held at Thames House on 19th August, 1946, by representatives of D.Arm.R.D., D.A.W. and N.A.I.

"A. 10 lb. Bombs

1. It was pointed out that Naval stocks of 10 lb. Practice Bomb Flash (filled S.R.541B) will suffice until 1948. Since, even in the event of Naval Service trials on Bombs filled S.R.807 proving satisfactory, financial approval for provision of 10 lb. Bombs with this filling would probably not be forthcoming, it was agreed that such trials need not be arranged unless and until it appears that the proposed 12-14 lb. replacement for the 10 lb. bomb will not be developed in time."

"3. The requirement for the 10 lb. Practice Bomb filled Brown Smoke has been withdrawn.

B. 25 lb. Bombs

1. The Navy do not wish to use this Bomb for stowage reasons.

2. No Naval acceptance trials of any of the fillings for this bomb need be done at present, unless it is found that the 12-14 bomb will not become available before stocks of 10 pdrs. are consumed.

C. 12 - 14 lb. Bombs

1. The Naval requirement is for a bomb (or bombs) to give visible effect by day and night on land and water. The duration required is 5 seconds: the earlier requirement for 15 seconds was to enable the pilot to see the fall of his own bombs in dive bombing practice and this is not now considered essential.

2. No fillings to produce a coloured dye-patch, or smoke of distinctive colour from that of the ordinary 'day' filling, are now needed.

D. 8.1/2 lb. Bombs

1. The bombs already developed, i.e.

Smoke (issued unfilled)
Flame (issued filled)

continue to be required.

2. Trials of dyestuffs to produce colours distinguishable from Rhodamine B, at present approved as an alternative filling for smoke bombs, were agreed to be desirable."

Remarks by the Panel: Noted.

2. The trials in Bombs, A/C., Practice, 10 lb. Flash, of filling S.R.807 to replace S.R.541B, recommended by the Panel in P.P.512, can be suspended agreeably to paragraph A.1. of the decisions of the meeting above. (Ref. 83/1).

3. The Panel RECOMMENDS with reference to paragraph D.2 that the trials for Dye patch and/or Foam patch fillings for the Bomb, A/C., Practice, 8 1/2 lb. Break-up, (P.P's. 468 and 423) should be continued. (Ref. 83/4).

4. The Panel were informed by C.E.A.D. that promising results have been obtained with bombs containing a mixture of dye-stuffs with P.E.T.N. and wax. They would like to receive reports on these trials when available.

ACTION

Forward to C.S.A.R., D.Arm.R.D., C.E.A.D. and D.N.O.

2. Ask C.S.A.R. if he will prepare 5 gallons of each of the recommended dye solutions for use in the Naval Trials.

3. Ask D.Arm.R.D. to issue disposal instructions for this material and to note the Panel's recommendation in para. 3 of the Remarks.

4. Ask C.E.A.D. to supply reports on the trials of coloured smoke fillings for the 12/14 lb. bomb referred to above.

5. Ask D.N.O. to note the Panel's recommendation in para.3 of the Remarks.

D.N.O./L., C.N.R., C.C.I., D.D. Rescue (Rescue 1), Sec. P.I.F.I., D.D.I.Arm., A.D/X.2., U.S. Military and Naval Attaches, A.M.R., M.L.O., (N.Z.), D.G.T.S., (S.A.), O.C.O. India, Naval Office, Melbourne, C.S.L.O. (N.R.C.) and Sec. O.B. for information.

DS 82227/1/2895 100 12/46 R 265

P.P. MINUTES BOUND VOLUME XIII

CORRECTIONS.

Page	Line	Corrections.		
9	12	for "shore"	read	store
18	4	"Anotide		Anodite
26	24	"not"		now
33	10 & 18	"TNT/A1"		TNT/Al.
35	6	"10-6"		10^6 (in 2 places)
49	4	"Msrker"		Marker
84	29	"A1"		Al.
99	12	"hand-hold"		hand-held
114	27	"nito-amines"		nitro-amines
149	7	"A1."		Al.
261	17	"A1."		Al.

Please correct your copy of Vol. XIII herewith.

W. Ross.
Sec. P.P.

25.3.47.
P.24324.

Volume XIII

Corrections to Bound Volumes of P.P. Minutes

In addition to those corrections already printed inside the back cover of volume XII.

P.P. No.	Vol.	Page	Correction
42	2	24	Action. Last 2 lines. for "his approval" read the improvement.
68	3	66	Heading. to read Flare, Ground, 15 Minute, Coloured.
98	5	8	do.
150	7	15	Heading. Reference should read 98/2 not "89/2".
184	8	12	Remarks by the Panel. Line 1. For "D.D./L/5744A read D.D./L/8744A.
344	10	2	Last line for "Fosine" read Eosine.
474	XII	57	Heading. To Former P.Ps. add 368.

[dstl]

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