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From: Chief, Naval Technical Mission to Japan.  
To : Chief of Naval Operations.  
Subject: Target Report - Japanese Pyrotechnics.  
Reference: (a)"Intelligence Targets Japan" (DNI) of 4 Sept. 1945.

1. Subject report, covering Target O-12 of Fascicle O-1 of reference (a), is submitted herewith.

2. The target investigation and the report preparation were accomplished by Mr. H. H. Moore, U. S. Naval Technician, with the assistance of Comdr. G. R. Dolan, RN. Lt.(jg) K. C. Lamott, USNR, acted as translator and interpreter.



C. G. GRIMES  
Captain, USN

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## **JAPANESE PYROTECHNICS**

**"INTELLIGENCE TARGETS JAPAN" (DNI) OF 4 SEPT. 1945**

**FASCICLE O-1, TARGET O-12**

**JANUARY 1946**

**U.S. NAVAL TECHNICAL MISSION TO JAPAN**

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## **SUMMARY**

### **ORDNANCE TARGETS JAPANESE PYROTECHNICS**

Japanese pyrotechnic design and development were examined, key Japanese personnel were interrogated, and tours of inspection were conducted in an effort to bring to light significant pyrotechnic developments.

It was found that the Japanese had made no outstanding contribution to the art and had made very limited use of pyrotechnics during the war. With the exception of the "Menace" and "Dazzle" bombs, their use of pyrotechnics was limited to the usual fields of signaling, illuminating, marking, and incendiaries.

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## REFERENCES

### Japanese Personnel Interviewed:

Dr. A. SUZUKI - Experimentalist, First Naval Air Technical Arsenal.

Captain S. YAJIMA, IJN - Head of Projectile Production, Kure Naval Arsenal.

Captain M. MITSUI, IJN - Director, Ordnance Experiment Station, Kure Naval Arsenal.

Technical Lieutenant S. WAKAGI - Experimentalist, Ordnance Experiment Station, Kure Naval Arsenal.

### Related NavTechJap Reports:

Japanese Illuminating and Colored Burst Projectiles, Index No. O-11.

Japanese Incendiary Mixtures, Index No. O-27.

# INTRODUCTION

Japanese personnel interrogated in connection with this investigation insisted that all drawings and specifications covering Japanese pyrotechnics were destroyed by order of higher authority. Samples of many pyrotechnic items were recovered by bomb disposal and MEIU personnel and have been shipped to the Ordnance Investigation Laboratory, Stump Neck, Maryland.

The illustrations and descriptions in the enclosures of this report were prepared from memory by A. SUZUKI, and are considered sufficiently complete and descriptive. The various pyrotechnic items fall into the following classifications: marking, illuminating, incendiary, signalling, and devices for defensive tactics. The enclosures are grouped in the same order and according to the principal uses of the items described. It is obvious that many of these devices could be used for various purposes; signals could be used for marking; flares for signalling or marking; markers, for signalling, etc. In a number of cases, dual uses are indicated in the enclosures.

Because of the confused use of mark numbers, types, models, etc., in Japanese nomenclature, no attempt is made in this report to identify devices by such a system. Reference will be made only to enclosures. Mr. SUZUKI was unable to make clear the exact meaning of the terms mark, type, etc.

It is believed that little confidence can be placed in the candle power figures quoted in some of the enclosures, some values of which seem fantastically high.

# THE REPORT

## A. MARKER BOMB

The marker bomb, Enclosure (A), is strictly mechanical in principle and has no pyrotechnic or explosive charge. The dispersion of the marking agent, aluminum powder or fluorescent dye, is accomplished by impact with the water. The bomb has no superior qualities. It is included in this report because, in purpose and use, it is similar to other pyrotechnic devices.

## B. FLARES

The photo-flash bomb, Enclosure (F), reported to have given a flash of 700,000,000 candle power for a very short interval of time (not more than 0.02 seconds) was found to have been unsuccessful in service, for the reason that the time and position of the flash with respect to the camera and target could not be controlled to the required degree of accuracy; thus, the high intensity illumination was wasted and the photographic results poor.

Japanese star or illuminating projectiles (no illustration is available for this report) were, according to YAJIMA, copied directly from the U.S. star shell, samples of which were captured during the war. The Japanese had increased the size of their illuminating projectiles, by direct proportion from the U.S. star shell, up to and including the 36cm (14") shell and were intending to go to 40cm (16") and 46cm (18"). The 36cm illuminating projectile was found to be very satisfactory and was well liked by the service. Further details of Japanese illuminating projectiles are given in NavTechJap Report, "Japanese Illuminating and Colored Burst Projectiles," Index No. O-11.

Mr. MITSUI gave the following formula for the composition of the illuminating mixture for star shells (illuminating projectiles):

Magnesium .....	53.0%
Barium nitrate .....	42.5%
Beeswax .....	3.5%
Sodium oxalate .....	1.0%

Mr. SUZUKI indicated the following for illuminating flares:

Aluminum .....	22.5%
Barium nitrate .....	75.0%
Paraffin .....	2.5%

Mr. WAKAGI confirmed Mr. MITSUI's formula given above, and related further that favorable experiments had been conducted with higher percentages (up to 10%) of sodium oxalate and lower percentages of barium nitrate. The added yellowish tinge of the light produced by this change was considered to be advantageous.

## C. INCENDIARIES

The incendiary bomb, Enclosure (K), discloses a rather novel method of using white phosphorous as an incendiary, and steel tubes, in which the phosphorous is sealed, as missiles. This bomb was intended for use in attacks against airfield installations and airplanes on the ground. It is reported to have been very effective in counter attacks against airfields on OKINAWA.

The Japanese Navy also had a type of incendiary projectile constructed on the same principle and in a large variety of sizes, including 46cm. This projec-

tile is reported to have been well-liked by the services and very effective in anti-aircraft fire. Incendiary mixtures other than white phosphorous also were used in projectiles. These incendiary mixtures, including a special treatment of white phosphorous to induce a change in its molecular structure, are discussed and tabulated in NavTechJap Report, "Japanese Incendiary Mixtures," Index No. O-27.

D. DEFENSE BOMBS

The "menace bomb", Enclosure (O), and the "dazzle bomb", Enclosure (P), present rather unusual uses for pyrotechnic devices. Both bombs were used in last resort defense tactics by the pilots of airplanes which were in imminent danger of being shot down at night by enemy fighter pilots in hot pursuit. They were intended to be launched and exploded in front of the oncoming fighter plane and thus confuse the pilot and cause him to lose his target.

The "menace bomb", discharged from an improvised mortar, was for use by "kamikaze" planes, which generally were old, defenseless training planes and not especially fast. The "dazzle bomb", launched by hand after tripping of the firing mechanism, was for use by the "Betty", a twin-engine plane having very little defensive power and easily shot down. The "Betty" was known to the Japanese as "the lighter" because it would burst into flame or "light up" when hit by gun fire.

E. GENERAL

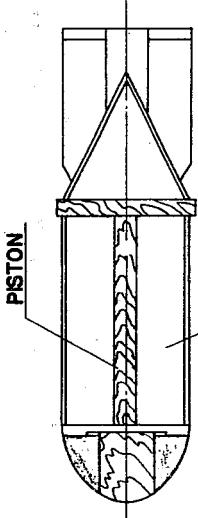
Enclosures (B) to (E), (G) to (J) and (L) to (N) show other pyrotechnic items not discussed in the text of this report. The various devices have no superior characteristics and are of conventional design. No further comment on their qualities is considered necessary. The enclosures describe the items in a very satisfactory manner.

Samples of pyrotechnic items recovered by bomb disposal and MEIU personnel and shipped to the Ordnance Investigation Laboratory, Stump Neck, Maryland, are listed in Enclosure (Q).

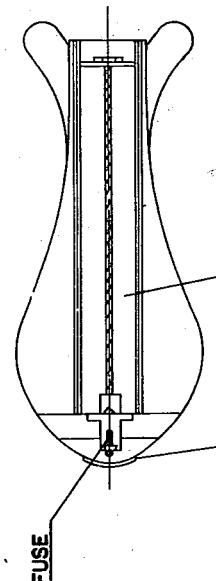
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**ENCLOSURE (A)**

NAME		Mk. O TYPE 18 II MARKER BOMB & Mk. II TYPE I.I MARKER BOMB			
APPROX.					
SKETCH		MARKING POWDER ( AL POWDER )			
CAPACITY	TYPE	ALTITUDE FOR USE	WEIGHT	MAX DIA.	X LENGTH (MM)
	I	< 3000 M.	2 KG.(APP)	75 X	300
	II	< 6000 M.	9 KG.(APP)	130 X	450
USE	FOR NAVIGATION AND MARKING OF SUBMARINE POSITION IN THE SEA DURING DAYLIGHT.				
HISTORY	PLANNED & EXPERIMENTED SINCE 1937, 1940 IN PRACTICE.				
REMARKS	ALUMINIUM POWDER IS DISPERSED ON THE WATER.				

## ENCLOSURE (B)

<b>NAME</b>		<b>MK. 96 TORCH FOR WATER LANDINGS AND SMOKE FLOAT (IMP. 4) (BLACK &amp; YELLOW)</b>	
<b>APPROX.</b>	<b>SKETCH</b>	<b>SMOKE</b>	<b>ILLUMINATE</b>
	 <b>STRIPPING CLOTH</b>	BLACK ANTHRACENE YELLOW AURAMIN O. AL 22.5% B <sub>4</sub> (NO) <sub>3</sub> 75% PARAFFIN 2.5%	AL 22.5% B <sub>4</sub> (NO) <sub>3</sub> 75% PARAFFIN 2.5%
<b>CAPACITY</b>	<b>USING</b>	<b>TIME OF COMBUSTION</b>	<b>MAX DIA X LENGTH</b>
	NAME MK 96 TORCH SMOKE FLOAT	ABOUT 3 MIN 2 MIN-2.5 MIN	APP. WEIGHT 4 KG 4 KG 4 KG 50,000 MM 130X400 MM 130X400 MM
<b>USE</b>	<b>MK 96 TORCH FOR WATER LANDINGS AT NIGHT. SMOKE FLOAT IMP. 4; FOR SIGNAL IN DAYTIME.</b>		
<b>HISTORY</b>	<b>PLANNED ABOUT 1935.</b>		
<b>REMARKS</b>			

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## ENCLOSURE (C)

## NAME MK.O MARKER LAMP &amp; MK.O TYPE I MARKER LAMP

APPROX.	SKETCH	IGNITION BLOCKS (CALCIUM PHOSPHATE)			
		USING CANDLE POWER (CP)	TIME OF ILLUMINATION	APP WEIGHT	MAX DIA X LENGTH
MK.O MK.O TYPE I	700M <3000M	200 (APP) 200 (APP)	60 MIN. (APP) 30 MIN. (APP)	3 KG 15 KG	150 X 400 MM 75 X 300 MM
USE	MK.O MK.O TYPE I.	FOR MARKING A POSITION AT NIGHT FOR NAVIGATION AT NIGHT			
HISTORY	MK.O	PLANNED IN 1939, IN PRACTICE SINCE 1940.			
	MK.O TYPE I	PLANNED IN 1937, IN PRACTICE SINCE 1939.			
REMARKS		ILLUMINATION IS PRODUCED IMMEDIATELY UPON REACHING THE SURFACE OF THE WATER			

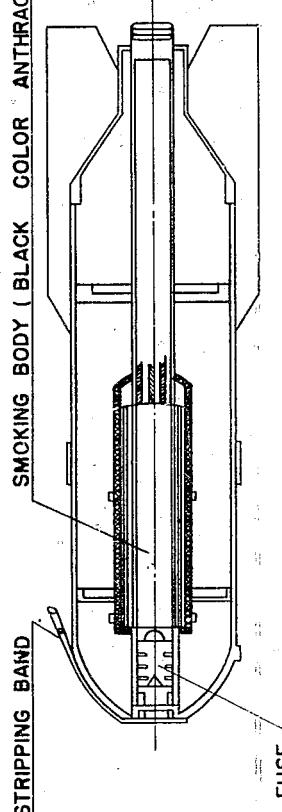
## ENCLOSURE (D)

NAME		WATER-SURFACE SIGNAL TORCHES ( RED & BLUE )	
APPROX.	SKETCH		<p>RED</p> <p><math>Sb(NO_3)_2</math> 75 % AL 22.5% PARAFFIN 2.5%</p> <p>BLUE</p> <p>(AL) <math>B_2(NO_3)_2</math> <math>H_3BO_4</math></p>
CAPACITY	USING ALTITUDE (M)	APP. POWER (CP)	APP. TIME OF FLARE (SEC)
3,000	20	500	3
USE	MARKING OF POSITIONS AND FOR NAVIGATION AT NIGHT.		
HISTORY	PLANNED IN MARCH 1944 & IN PRACTICE AFTER NOV. 1944.		
REMARKS	PRODUCES ILLUMINATION ABOUT 20 SECONDS AFTER REACHING THE SURFACE.		

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## ENCLOSURE (E)

TYPE II SMOKE FLOAT					
NAME	SMOKING BODY ( BLACK COLOR ANTHRACENE )				
APPROX.					
SKEETCH					
CAPACITY	USING ALTITUDE 700 M	APP. TIME 60 SEC	DELAY TIME 40 SEC	WEIGHT 1.5 KG	MAX.DIA X LENGTH 75 MM X 300 MM
USE	FOR SIGNAL AND FOR MARKING OF A SUBMARINE POSITION DURING DAYLIGHT.				
HISTORY	PLANNED IN DEC. 1944 COMPLETED IN MAR 1945.				
REMARKS					

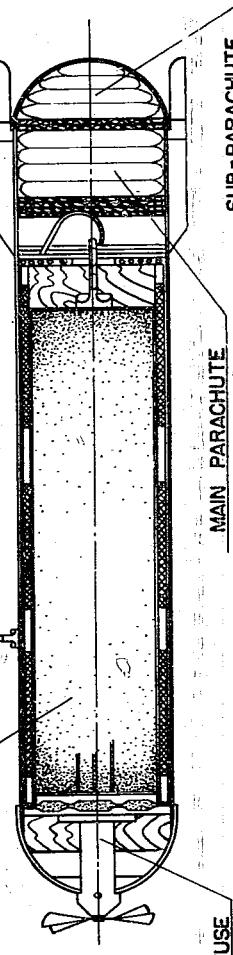
## ENCLOSURE (F)

MK. III FLASH BOMB (FOR PHOTOGRAPHY)					
NAME					
APPROX.	<p>SPECIAL FUSE - WATCH TYPE (MECHANICAL TIMER STARTED WHEN RELEASED BY WIND MILL)</p>				
CAPACITY	<p>USING ALTITUDE (m) 6,000 (APP.)</p> <p>CANDLE POWER 700,000,000 (?)</p> <p>TIME OF FLASH (sec) 0.02 (APP.)</p> <p>WEIGHT (kg) 42 (APP.)</p> <p>MAX. DIA. &amp; LENGTH (mm) 240 X 1,200</p>				
HISTORY	<p>PLANNED IN 1938, CHANGE OF DESIGN IN 1939 &amp; 1942 FOR SLOWER FALL. EXPERIMENTS WERE ALMOST COMPLETED IN 1943. IN 1944, REMODELED, DISRUPTING CHARGE FOR THE PURPOSE OF EXPELLING &amp; IGNITING BOMB IN A SHORTER TIME, GIVING BRIGHTER ILLUM. PEAK.</p>				
USE	FOR AERIAL PHOTOGRAPHING AT NIGHT.				
REMARKS	<p>FLASHING HEIGHT ABOUT 2,000 M. ANGLE OF AFTER-SEEING TO A PERPENDICULAR ABOUT 23°. ALTITUDE OF USING AND FLASHING ARE POSSIBLE TO CONTROL BY WATCH TYPE SPECIAL FUSE. SPECIAL FUSE ERRATIC (REMODEL OF MK. II NO. 25 NO. 3 BOMB FUSE) AND NO. 3 BOMB FUSE WAS USED NOT SATISFACTORY. COULD NOT SUCCEED IN GETTING IN PROPER POSITION AT THE CORRECT TIME.</p>				

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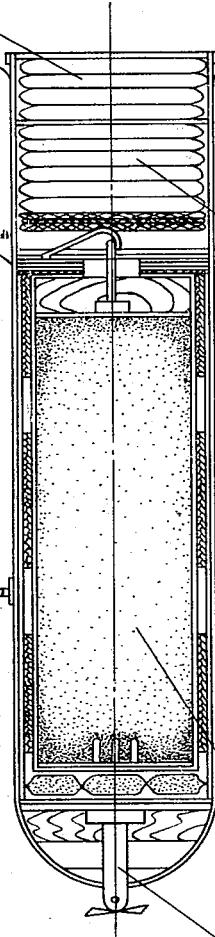
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## ENCLOSURE (G)

NAME		MK. O FLARE BOMBS					
		ILLUMINATING BODY (AL 22.5% Ba(NO <sub>3</sub> ) <sub>2</sub> ) 75% PARA 2.5%					
APPROX. SKETCH							
TYPE	USING ALTITUDE (M)	2ND DELAY TIME (SEC)	DROP TIME (SEC)	VEL (M/SEC)	FLARE TIME (MIN-SEC)	WEIGHT (KG)	MAX DIA X LENGTH (MM)
I	1,500	3	2.0	4.5	3 - 40	36 KG.	168 X 130
II (IMP 1)	2,500	"	2.0	7.0	"	"	168 X 130
II (" 2)	3,500	2.4	2.0	11.0	4 - 0	"	168 X 130
III (" 2)	7,000	4.5	—	4.5	"	"	"
HISTORY		SINCE 1937, PLANNED & EXPERIMENTED AND VARIOUS IMPROVEMENT WERE APPLIED AFTER BOMB WAS USED.					
REMARKS		USED FOR BOMBING AND TORPEDOING AT NIGHT.					

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## ENCLOSURE (H)

NAME		SUB - PARACHUTE					
APPROX	SKETCH	MAIN PARACHUTE					
							
		<u>FUSE</u> (AL 22.5% BANNO <sub>3</sub> 75% PARAFFIN 2.5%) <u>ILLUMINATING BODY</u> (AL 22.5% BANNO <sub>3</sub> 75% PARAFFIN 2.5%)					
USING ALTITUDE (M)	DELAY TIME (sec)	SECOND DROP TIME (sec)	DROP VEL (m/sec)	CANDLE POWER (min/sec)	TIME OF FLARE (min/sec)	WEIGHT (kg)	MAX DIA X LENGTH (mm)
800	3	10	2.5	1,000,000 (?)	3-4.0	47	240 X 150
USE		FOR TORPEDOING AT NIGHT.					
HISTORY		PLANNED AND EXPERIMENTED SINCE MARCH 1944, AND IN PRACTICE SINCE AUG. 1944.					
REMARKS		CANDLE POWER SAME AS MKO FLARE BOMB.					

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ENCLOSURE (I)

NAME		TYPE II FLARE BOMB	
APPROX.	SKEETCH		
CAPACITY	USING ALTITUDE 1,500 M	DELAY TIME 3 SEC.	DROP VEL. 4.5 M/SEC.
USE		FLARE TIME 300,000	WEIGHT MAX.DIA.XLENG. 3MIN.20SEC. 7kg 90X800
HISTORY		FOR BOMBING, TORPEDOING & MARKING A POSITION AT NIGHT.	
REMARKS	PLANNED IN OCT. 1941, IN PRODUCTION SINCE MARCH 1942. IN JUNE 1945, IMPROVEMENTS FOR INCREASING VELOCITY (230 KT) WERE COMPLETED. USED INSTEAD OF MK 3 FLARE BOMBS WHEN SPACE OR OTHER CONDITIONS ARE LIMITED - HAND LAUNCHED.		

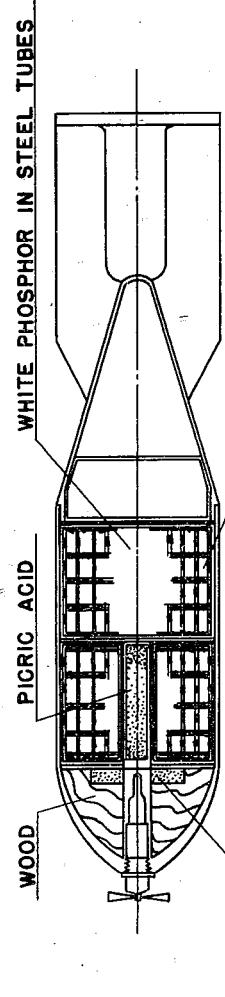
## ENCLOSURE (J)

NAME		WATER-SURFACE FLARE BOMB, TYPE A,B&C		
APPROX.		SKETCH		
CAPACITY	TYPE OF FLARE	A TIME OF FLARE (MIN.)	B TIME OF DELAY	C TIME OF DELAY
		3 40 SEC.	3 3 MIN. 20 SEC.	3 6 MIN.
USE	FOR TORPEDOING AT NIGHT AND MARKING A POSITION.			
HISTORY	PLANNED AND EXPERIMENTED SINCE DEC. 1944 IN PRACTICE AFTER JAN. 1945.			
REMARKS	THESE BOMBS ARE SAME TYPE & CAPACITY AS MKI FLARE BOMB ON THE SEA, BUT DELAY TIMES ARE CHANGED.(TYPE A OF THIS BOMB IS EXACTLY SAME AS MKI FLARE BOMB			

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ENCLOSURE (K)

NAME	MK. 3 PHOSPHOR BOMB			
APPROX.				
SKETCH				
CAPACITY	USING ALTITUDE	TIME OF COMBUSTION	WEIGHT	MAX DIA X LENGTH
	> 500 M	8 MIN — 30 SEC.	70 KG.	240 X 1300
USE	FOR INCENDIARY EFFECT			
HISTORY	PLANNED IN 1942, SINCE 1943 IN PRACTICE.			
REMARKS	SCATTERS THE PIECES OF IRON TUBE, INCLUDING WHITE PHOSPHOR, WHICH BURNS WITH INCENDIARY EFFECT. USED ON OKINAWA FOR ATTACKS ON AIRFIELDS.			

## ENCLOSURE (L)

NAME		TYPE II FLARE BOMB & MK 90 FLARE BOMB (WHITE, RED & BLUE)	
APPROX.		SKETCH	
			<p>WHITE AL 22.5% <math>\text{Ba}(\text{NO}_3)_2</math> 75% PARAFFIN 2.5%</p> <p>RED <math>\text{Sr}(\text{NO}_3)_2</math> 75% AL 22.5% PARAFFIN 2.5%</p> <p>BLUE AL 20% <math>\text{Ba}(\text{NO}_3)_2</math> 70% <math>\text{H}_3\text{BO}_4</math> 10%</p>
CAPACITY	T.Y. II MK. 90	USING	TIME OF FLARE POWER
		1,500 >700	3 MIN — 20 SEC 2 — 0 40,000
USE	TYPE II FLARE BOMB; FOR BOMBING & TORPEDOING AT NIGHT. MK 90 FLARE BOMB; FOR SIGNAL AT NIGHT.		
HISTORY	PLANNED ABOUT 1933.		
REMARKS	NOT PRODUCED SINCE 1944.		

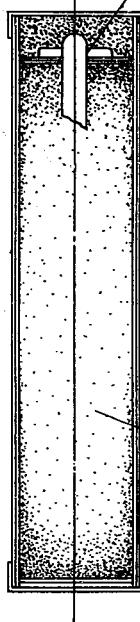
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## ENCLOSURE (M)

NAME (SINGLE COLORS, CHANGE COLORS & STARS)	
APPROX.	
SKETCH	
CAPACITY	<p>USING ALTITUDE IS ABOUT 700 M. CANDLE POWER IS 40,000 ILLUMINATING TIME 2 MIN. — 1 MIN — 30 SEC.</p>
USE	FOR SIGNAL AT NIGHT, TRANSMITTING MESSAGES ETC.
HISTORY	PLANNED 1937, IN PRACTICE SINCE 1942 IN MAY 1945, IMPROVEMENT MADE NECESSARY BY INCREASED PLANE SPEEDS - CORDS MADE STRONGER.
REMARKS	MK. O SIGNAL BOMBS, SINGLE COLORS WERE FIRST NAMED THE MK. I SIGNAL BOMB (WHITE, RED & BLUE) BUT CHANGED IN 1944.

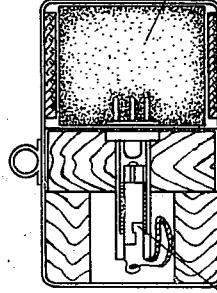
## ENCLOSURE (N)

NAME		MK I SIGNAL SMOKE ( WHITE, RED, YELLOW & BLUE )	
	APPROX.	COLOR	
	SKETCH	WHITE AL OR MG RED PARANITRO- ANYLIN RED YELLOW AURAMIN O BLUE INDIGO	IGNITION BODY
			SMOKING REAGENT
CAPACITY		SMOKING TIME ABOUT 2 MIN	MAX. DIA X LENGTH 60 MM X 280 MM
USE		SIGNAL FOR AEROPLANE IN FLIGHT	
HISTORY		PLANNED IN MAY 1937, IN PRACTICE SINCE SEPT 1939.	
REMARKS	USED ON THE GROUND.		

## ENCLOSURE (O)

MENACE BOMB, TYPE A,B,C,&D			
NAME	SKETCH	STRIPPING CORD	TYPE OF FLASHING
APPROX.	USED TO EXPELL BOMB FROM PLANE SHOT FROM IMPROVISED MORTAR.	PROPELANT (BLACK POWDER)	A. ONE TIME OF LARGE FLASHING. B. THREE TIMES OF MIDDLE FLASHING. C. ABOUT TEN TIMES OF SMALL FLASHING. D. COMBINATION OF A & C.
CAPACITY	USED WITH SIMPLE GUN DELAY TIME (sec) 3	CANDLE POWER 500,000	WEIGHT (kg) 0.5 MAX. DIA. (mm) 120 (ball)
USE	NIGHT FIGHTERS, A DEFENSE FOR KAMIKAZE PLANES WHICH WERE OFTEN OLD UNARMED TRAINING PLANES.		
HISTORY	SINCE MAR. 1945, PLANNED AND IN PRACTICE AFTER APRIL 1945.		
REMARKS	EXPLODED IN MID AIR. TYPES ARE CLASSIFIED BY FLASHING. IMPERIAL YELLOW DRAGON, SAME SHAPE AS MENACE BOMB.		

## ENCLOSURE (P)

<b>DAZZLING BOMB (IN MID-AIR)</b>		
NAME		
APPROX. SKETCH		<b>FLASHING POWDER</b> (AL 25% Ba(NO <sub>3</sub> ) <sub>2</sub> 75%) (LOOSE POWDER-NOT PRESSED)
CAPACITY	<b>USING FUSE</b> <b>TIME</b> <b>CARTRIZ FUSER</b> <b>TIME OF FLASH</b> <b>WEIGHT</b> (sec.) (kg) (mm) 3 sec. ca. 0.02 90 X 180	<b>MAX.DIA.BALLENG.</b>
USE	USED AS A DEFENSE TACTIC FOR THE "BETTY"	
HISTORY	PLANNED IN JAN 1945 SINCE FEB 1945, IN PRACTICE.	
REMARKS	FLASHING IN MID-AIR.	

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**ENCLOSURE (Q)**

**LIST OF JAPANESE PYROTECHNIC EQUIPMENT SHIPPED TO ORDNANCE  
INVESTIGATION LABORATORY, STUMP NECK, MARYLAND**

<u>NavTechJap Equipment No.</u>	<u>Item</u>
JE21-4080(0-1) -4099	Type 2 Flares
JE21-4094	Special Flares
JE21-4355	Parachute Flares
JE21-4464	"HE" Shell Mk 1 Flare
JE21-4451	Experimental Type Flashing Shells Model 2 Flare (Black Overall)
JE21-4453	Experimental Type Flashing Shells Model 1
JE10-4074	Signal Flares, Large
JE10-4075	Signal Flares, Small
JE21-4432 -4442 -4448	Flare Containers
JE21-4441	Flare Containers, Large
JE21-4435	Large Fiber Flare Containers
JE3-322	Flare Candles
JE21-4450 -4460 -4097 -4343	Flares, Unspecified
JE10-3104-SD	Signal Pistols
JE10-4079 JE21-4115	Pyrotechnic Devices (Unspecified)
JE21-4104	Special Pyrotechnic Fuze
JE21-4359	Sea Marker (?)
JE50-3398(1-6)	Colored Burst Containers