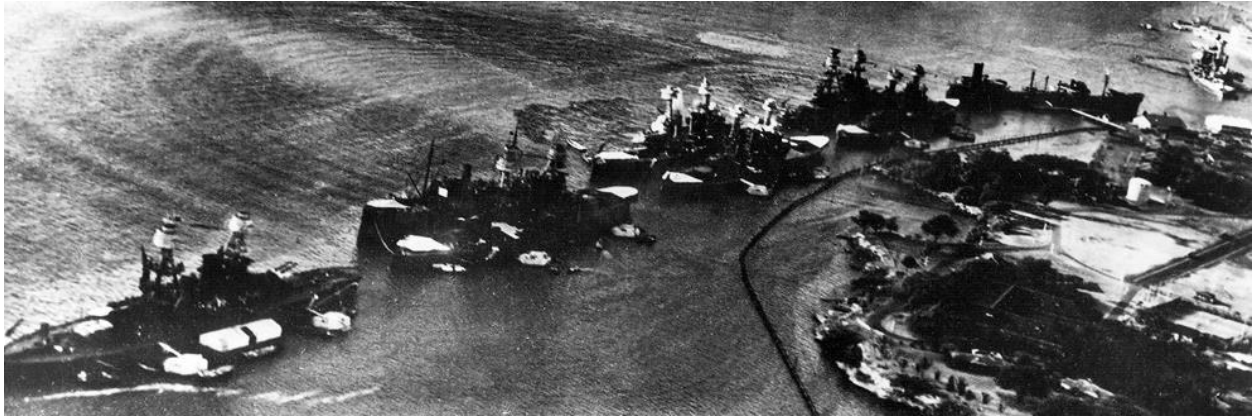


US Navy Camouflage and Color Doctrine – January 1 to December 16, 1941.



The Pearl Harbor Battle Line on December 7, 1941, was not the uniform, tidy and pristine row of warships that movies like *"Tora-Tora-Tora"* or *"Pearl Harbor"* depicted. To fully understand the colors and camouflage of the Pearl Harbor battle line, we have to review the chaotic state of camouflage doctrine throughout 1941 as a whole, as it ultimately culminates on December 7, 1941. Late 1941 was a transitional period concerning ship camouflage both in the use of colors and their application as a direct result of this chaos. Just 11 months earlier, in February 1941, the overwhelming majority of the US Fleet was still wearing #5 Standard Navy Gray (#5sng). This had been the standard pre-war color for decades, although the Navy was actively experimenting with numerous types of camouflage throughout the 1930s. In 1936 and 1937, camouflage experiments were conducted using graded and solid schemes under the guidance of Charles Bittering, who had worked on ship camouflage for the US Navy during World War I. The colors selected were Dark Gray, Ocean Gray, Haze Gray, and Light Gray, although these early colors were not the same 5-series colors to appear in 1941; they were neutrals. The 1937 experimental solid and graded camouflage schemes had several versions similar to the later Measures 1, 2, 12, 18, and 22 found in *SHIPS-2*. The results of these camouflage experiments were detailed in the 1937 *Bureau of Construction & Repair (BuC&R) Handbook No.4.*, pursuant to S-19-7 issued on Dec. 30, 1937, and was from this handbook that the basis of the Navy's 1941 camouflage doctrine was formed. With the war in Europe already into its second year and Japan rattling sabers in the Pacific, the US Navy decided to implement a camouflage system to reduce the overall visibility of its warships. This resulted in **No. C-S19-1 (1-28)**, dated 31 January 1941, which introduced 5-D Dark Gray as a replacement for #5 Standard Navy Gray.



USS Idaho BB-42 in overall #5 Standard Navy Gray, 1940, TIME-LIFE Archives, photo by Carl Mydans.

C-S19-1 (2-19), dated February 20, 1941, reiterated the previous memo, including application instructions and the chemical composition of 5-D Dark Gray and 5-U White Mixing Base. By mixing 5-D with 5-U, two additional shades, 5-O Ocean Gray, and 5-L Light Gray could be achieved. Because of the lesser required amounts of these two shades, these colors were not manufactured as specific colors. **C-S19-1 (2-19)** also referenced a new set of standardized camouflage instructions, known as *SHIPS-2*. These memos were

circulated by BuShips (Bureau of Ships) and each of the Fleet CICs to all navy yards, Force Commanders, supply depots, and commanding officers of all ships in commission. This was the memo that indicated that these changes were taking place.

On April 29, 1941, **C-S19-7** was issued, effectively telling ships' captains to get moving... "Turn into store at the nearest supply activity at the first opportunity all old stocks of light gray paint Formula 5 in excess of the quantity required for one complete painting of the vessel if the assigned camouflage measure has been applied or for two complete coats if the measure has not been applied." (Note- light gray paint Formula 5 is #5 Standard Navy Gray, not to be confused with the new light gray and later 5-L Light Gray).

This initiated the transition of the US Fleet from peacetime #5 Standard Navy Gray to 5-D Dark Gray, but it was soon realized that navy yards would wind up with large quantities of #5 Standard Navy Gray while attempting to supply ships with 5-D at the same time. **JJ52/L8-3** issued April 19, 1941, introduced a stop-gap measure to tint the already on-board stocks of #5 Standard Navy Gray with 5-TM Tinting Material. It also allowed for use of black striping paint in the event 5-TM was unavailable. Both mixtures for stop-gap tinting yielded a lighter than specified color and were slightly glossy, as #5 Standard Navy Gray already had a gloss factor of 44, and once tinted with black striping paint, was even glossier. Ships that were scheduled for yard work received their new camouflage color from the yard, other ships were required to submit requisitions for either the new paint or sufficient quantities of 5-TM tinting material, contingent upon how much #5sng that ship had on hand. When trying to comprehend the amount of paint we are discussing, encompassing all the ships of the fleet, memo **BB43/JJ52** from USS *Tennessee* to the Mare Island Commandant, says it all. *Tennessee* was carrying, as per orders, 1,170 gallons of paint, sufficient for one repaint of the ship.

When faced with the logistical nightmare of having to transfer hundreds of thousands of gallons of paint from the fleet to naval stores, then replace that paint with new paint, one can quickly understand the navy's decision to facilitate the tinting of the paint already onboard. Although orders were issued, vessels repainted as operational requirements allowed, and some ships carried #5 Standard Navy Gray well into the early summer of 1941.

The Pacific Fleet was always about 2-3 months behind the Atlantic Fleet when implementing camouflage, as Admiral King, Commander in Chief of the Atlantic Fleet, had an interest in camouflage, and logistics on the East coast were not difficult to deal with. Admiral Kimmel, Commander in Chief of the Pacific Fleet, appears to have been less interested in camouflage study initially, probably due to the demands placed on him for maintaining a fleet at a forward base and focusing on thwarting attempts to move his ships from the Pacific to the Atlantic. Based on the documents, the Pacific Fleet appears to have followed the lead of the Atlantic Fleet with regards to the implementation of new camouflage doctrines, albeit 2-3 months later. As a result of these factors, along with the logistical problems of supplying a forward base, Atlantic Fleet camouflage

U. S. S. TENNESSEE

BB43/JJ52/(018)

DF17/RAV/rhb

At Sea,

CONFIDENTIAL

FEB 27 1941

From: Commanding Officer.
To : Commandant, Navy Yard, Mare Island.

Subject: Outside gray paint.

Reference: (a) BUSHIPS confidential letter No. C-S19-1 (1-28)(DYr) over EN28/A2-11 of January 31, 1941.

1. Complying with paragraph 4 of the reference there are now on board this vessel 1,170 gallons (234 five (5) gallon buckets) of paint, light gray, outside, stock number 52-P-5285.



almost always occurred ahead of that of the Pacific Fleet. When the Pacific Fleet initially began painting their ships in 5-D Dark Gray in May of 1941, it was almost immediately realized that the color was too dark for the bright, blue Pacific, and was prone to chalking and fading. This, coupled with the Atlantic Fleet's 2-month head start with the color, resulted in **C-S19-1-5 (341)** dated July 11, 1941, which admitted that 5-D was too dark, and introduced 5-S Sea Blue. We have to remember that in 1941, things didn't happen overnight, and even though 5-D was almost immediately identified as inadequate, ships were nonetheless still painting into the color, as new orders had not yet been issued, and the new colors had not yet been manufactured. On July 30, 1941, the decision was made and orders issued in the form of **C-S19-7 (341)** to discontinue the production of 5-D and commence the production of 5-S, following the same process as before with the creation of 5-H Haze Gray and 5-O Ocean Gray, this time, however, using a new 5-TM tinting material based on a purple-blue color instead of a black-based one. The order to cease production of 5-D reiterated early- to mid-September, with further orders for all ships to return unused 5-D to stores, retaining only enough for one complete repainting of the hull. The July C-S19-7 (341) order also had the return paint order. By mid-October fleet, force type, ship type and yard commands had all responded to the order that 5-D be replaced by 5-S, most had replied by mid-September to the order to use stocks of 5-L in place of 5-H until 5-L stock was depleted.

An interesting aside is the mid-September/early-October order to use 5-H Haze Gray as a barrier layer when painting over 5-D to prevent bleed-through. When factored into the equation, 5-S Sea Blue over 5-H Haze Gray would certainly appear vibrant and more intense in color, whereas 5-S Sea Blue applied over 5-D Dark Gray could very easily be mistaken for the later 5-N Navy Blue, especially when freshly applied. For those not familiar with pre-EPA oil-based paints the solvents were *MUCH* hotter back in the day and would re-dissolve the upper layers of underlying paints, especially partially oxidized paint, leading to tonal variations.

Yard forces were required to apply a 5-H barrier layer, and ship's force (the crew) could apply a barrier layer at the Commanding Officer's discretion depending upon time and stocks. Due to the logistical issues facing Pearl Harbor Navy Yard, it is possible that during October and November 1941 PHNY may not have had enough 5-H for the barrier layers. The earliest known photos of the barrier layer are from Pearl Harbor on attack day (*West Virginia's* turrets and the cruisers at 10-10 dock).

The period of July through October 1941 saw a tremendous volume of traffic between Bureau C&R, Fleet commands, and naval yards. It was truly a chaotic time. As 5-D was being implemented in the Pacific, it was already replaced in the Atlantic with 5-S. As 5-S reached the Pacific Fleet, it was already being replaced by 5-N in the Atlantic. In early August, the Pacific Fleet began testing on the new camouflage color 5-D, officially listed in SHIPS-2 as Measure 1, and with Measure 5, a false bow wave. By August 18,

S19(SU)
(45)

CONFIDENTIAL

August 22, 1941

From: Commandant, Navy Yard, Mare Island
To: Commanding Officer, U.S.S. ARIZONA

SUBJECT: Low-visibility gray paints—Change in manufacturing formula

References: (a) USS ARIZONA Reqn. 138-42 dated Aug. 13, 1941
(b) BuShips conf. ltr S19-7(341) dated July 30, 1941

1. Reference (b) directs that this Navy Yard cease the manufacture of dark gray paint, formula 5-D; tinting Material, formula 5-TM, required to produce light gray, formula 5-L or ocean gray, formula 5-O; to continue the manufacture and issue of white untinted base, formula 5-U in five-gallon buckets and one-gallon pails; also to manufacture and issue blue-black composite paste in one-pint, quart and gallon containers, designated as formula 5-TM.

2. In view of the above, the items of paint required under reference (a) will be considered cancelled. A requisition should be submitted for a sufficient quantity of white untinted base, formula 5-U, together with tinting paste, formula 5-TM, to produce the desired amounts of haze-gray, ocean-gray and sea-blue as per the following formula:

To obtain haze-gray, add 2 Pts. 5-TM to 5 Gals. 5-U.
To obtain ocean-gray, add 5 Pts. 5-TM to 5 Gals. 5-U.
To obtain sea-blue, add 10 Pts. 5-TM to 5 Gals. 5-U.

W L FRIEDEL

A J MARSHALL
By direction

1941, **S19/ (0613)** had confirmed the Pacific Fleet's warnings about the problems with 5-D, and ascertained that the previously ordered Measure 5 was of little use. It was also during August that a slew of requisitions for 5-D were made to Mare Island Navy Yard, submitted by Pacific Fleet Ships, including the USS *Arizona* **S19-SU-(45)** (above), USS *Nevada*, USS *Pennsylvania*, USS *West Virginia*, and USS *Oklahoma*. In each instance, these requisitions were canceled by Mare Island, and a reply was sent back to each ship telling them to order 5-S Sea Blue.

It is interesting to note that the turn-around time for this memo was nine days – it is unknown when *Arizona* requisitioned paint for the second time, although we do know that she was partially repainted as of 13 October 1941, and completed her repaint while in dry dock following her collision with *Oklahoma*. Once the requisition was approved, how much time passed before the paint was manufactured then shipped to Pearl Harbor from Mare Island? An interesting aside: we know that USS *Oklahoma* never received a reply from Mare Island, as she followed up on September 12 asking for further instructions. This explains why she was wearing Measure 1, overall 5-D Dark Gray, on December 7. Although orders would be issued to repaint into 5-S during yard time, *Oklahoma* didn't spend enough time in drydock following her collision with *Arizona* to warrant a repaint.

In response to the lack of stock of 5-S Sea Blue, Modified Measure 2 (not the same as Measure 2 Modified), was authorized by Admiral King, in late September/early October. Due to shortages of new paints, at the ship captain's discretion, they could retain enough 5-D for one repaint of the hull, and the upper works could be painted in any combination of the new colors as they became available within the strictures of the new Measures (patterns). *West Virginia* and *Nevada* on Dec. 7 are examples.

As with the previous 5-D/5-S debacle, just as the Pacific Fleet was starting to transition from 5-D into 5-S, the Atlantic Fleet had determined that 5-S was, in fact, too light. Direct intervention by Admiral King resulted in 5-N Navy Blue, darker than 5-S but still much lighter than 5-D. By late 1941, the Atlantic Fleet had phased out 5-S altogether, just as the Pacific Fleet was starting to implement it. This chain of events adds to the confusion since Measure 1 was adopted as the standard measure for the Pacific Fleet. The Atlantic Fleet had messed around with Measures 1 and 2 and eventually settled on a hybrid graded pattern, which became Measure 12. As the new colors were introduced into the Pacific, Measure 1 remained in place using 5-D Dark Gray, while Measure 1A used 5-S Sea Blue in lieu of 5-D, Measure 1B was an experimental measure using Sapphire Blue, and Measure 1C which used 5-N Navy Blue in lieu of 5-S.

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517-7(0)g NOV 1941

Pearl Harbor Navy Yard 08-41 83M
INCOMING DESPATCH

UGET SOUND NAVY YARD

RESTRICTED 220133 RESTRICTED

MAILGRAM - *Bein d 12-3-41*

UYDER #1505 AND PACFLT NOTICE 150N-11 IN ORDER TO PROVIDE MORE TIME FOR OBSERVATION CAMOUFLAGE EXPERIMENTS LIMITING DATE SUBMIT SUMMARIZED REPORTS EXTENDED TO TWENTYSIX JANUARY X COMEDSATFOR REQUESTED TO DESIGNATE THE DESTROYER TO BE PAINTED IN ACCORDANCE MEASURE 11 OF REVISED SHIPS 2 EXCEPT "NAVY BLUE" (FORMULA 5-N) ACCORDANCE BISHIPS LTR. C-619-7(5)11 OF 25 OCTOBER 1941 TO BE SUBSTITUTED FOR "SEA BLUE" (FORMULA 5-S) X THIS EXPERIMENT IS DESIGNATED MEASURE 1C AND ADDED TO LIST PARAGRAPH THREE PACFLT NOTICE 150N-11 *****

DEC 3 '41 220133 MAILGRAM

FM: REARADM CINCIPAC	To: PACIFIC FLEET	Info: RESTRICTED
ACTION: One Patch		INFO: Two Patches
Comd: <input type="checkbox"/>	Adm: <input type="checkbox"/>	Op: <input type="checkbox"/>
Int: <input type="checkbox"/>	Log: <input type="checkbox"/>	Sec: <input type="checkbox"/>
Des: <input type="checkbox"/>	Dis: <input type="checkbox"/>	Y.G.G.:

Here is where things begin to get interesting, because we have to look back at the visibility studies conducted by the Pacific Fleet from August into late November of 1941. As these visibility studies continued, the Pearl Harbor battleships were wearing a variety of camouflage measures and colors to determine which colors, and which measures, afforded the best concealment. It is interesting to note that the actual

documents submitted by these ships pertaining to visibility reflect the commanding officers' opinions of those colors. The documents submitted by *Arizona*, *Tennessee*, *West Virginia* and *Nevada* all advocate for the removal of 5-D in favor of 5-S, and ironically, those are the ships that are in 5-S, or repainting into 5-S, at the time of the attack. Those captains who were less favorable of 5-S as being too light, *California*, *Oklahoma*, *Maryland*, *Pennsylvania* and *Utah*, were all wearing 5-D at the time of the attack. Although impossible to ascertain a definitive answer, the probability of it being a mere coincidence is remote.

There has been speculation that ships wore 5-N Navy Blue, based on the dark values of the black-and-white photos of the post-attack photos. There are several variables to consider before rendering this possibility unlikely. Although 5-N was already in use in the Atlantic, 5-N simply hadn't reached the Pacific. A memo was received on December 3 requesting the testing of 5-N on a destroyer, 4 days before the attack. It seems highly improbable that a memo of this nature would be sent if ships were already painted in this color, especially if they were battleships. This essentially debunks a current theory that the Pearl Harbor battle line was wearing 5-N, given the delays in the cycle of testing, ordering, logistics, and implementation in the Pacific Fleet at the time. Nine days after the attack on Pearl Harbor, the US Navy issued Fleet Order **21-CN-41**, which again changed the rules of the game – production of 5-S was to cease in favor of 5-N. Existing stocks of 5-S were to be used until exhausted, and additional quantities of 5-TM tinting material were to be used by ships at sea to darken 5-S to 5-N. This also took time to implement, especially in the Pacific, and it was not unusual to see ships in 5-S Sea Blue well into the summer of 1942, especially those vessels on extended forward deployments. In early February 1942, *USS Maryland* and *USS Colorado* departed Bremerton, after their refits, in overall 5-S. *Colorado* was already wearing 5-S and *Maryland* was likely painted to match her sister as a deception, since both ships were virtually identical at the time. This is a prime example of exhausting available stocks. In the Spring of 1942, a letter sent to *West Virginia* and *California* stated, when ready to go back to CONUS for overhaul, to repaint into MS-11 using 5-N, not 5-S as per *Maryland* and *Colorado*.

Because of the ongoing visibility studies, the logistical delays in supplying Pearl Harbor, the ever-changing and confusing fleet orders, and eventually, the attack itself, the Pearl Harbor battle line was caught in a perfect storm of transition. Based on photographic evidence, documents pertaining to the visibility studies, paint requisitions, and other memos and documents, here is what we know:

USS Arizona – Measure 1A, 5-S Sea Blue on her hull and upperworks, 5-L on her fighting tops. Mid-repaint according to survivors.

USS California – Measure 1, 5-D Dark Gray on her hull and upperworks, 5-L on her fighting tops.

USS Oklahoma – Measure 12, using 5-D on her hull, 5-O on her superstructure, and 5-L on her fighting tops. Her Measure 5 bow wave had been painted out.

USS Maryland – Measure 12 graded pattern, but using the older 1937 colors, 5-D, 5-O, 5-L.

USS West Virginia – Modified Measure 2 – In the middle of repainting from 5-D to 5-S. 5-D on her hull, 5-S on part of her upper works, 5-L on her fighting tops in accordance with with Mod. MS-2. Photos show 5-H Haze Gray barrier coat on her turrets at the time of the attack, apparently her CO was not happy with 5-S straight over 5-D.

USS Nevada – Modified Measure 2. 5-D Dark Gray on her hull, 5-S Sea Blue on parts of her upper works, 5-L Light Gray (earlier 1941 version) on her fighting tops. (At least one photo shows one turret with two different colored barrels) She had also painted her deck as per S19/50/01050 dated 10-31-41 (see below). She still carried her Measure 5 false bow wave.

USS Tennessee – Measure 1A, 5-S Sea Blue with 5-L fighting tops. She had also painted her deck as per S19/50/01050 dated 10-31-41 (see below).

USS Pennsylvania – Measure 1, 5-D Dark Gray, 5-L fighting tops.

Two ongoing debates continue to be the bane of naval historians... the use of colored turret roof plates, and the painting of decks. There is a survivor account that *Arizona's* turret roof plates were not painted red, as ordered in 1937 and reiterated with USL-1-41 dated March 25, 1941. This defies a standing order from the Commander-in-Chief of the fleet. If the ship were repainted, as *Arizona* was at least twice in 1941, why would the turret roof plates be painted over if there were no orders to do so? Why paint the turret roof plates in camouflage colors only to paint over them yet again with Insignia Red? Logic states we leave the turret roof plates red and simply paint around them, right? Why would all of the other ships in the battle line have painted roof plates, but *Arizona* doesn't? The answer lies in the photos, or lack thereof. There are no color photos of *Arizona* in 5-S known to exist *before* the attack. A photography ban was in place and strictly enforced, and photography in 1941 was a luxury not many had access to, unlike today. After the attack, no photos have turned up indicating proof-positive that the turret plates were, or weren't, painted. Turret One was destroyed, Turret Two was burned, and Turret Three was never photographed up close. When comparing the insignia red of the turret plates to 5-S Sea Blue, the color difference is strikingly obvious. In black and white photos, however, both of those colors hold nearly identical locations on the grayscale spectrum, especially if we take into consideration atmospheric conditions, lighting, exposure, orthochromatic shift of the film as a result of chemical degradation. It is relatively easy to see that red could easily be mistaken for blue in this instance. Feel free to duplicate this experiment using the color swatches provided.

The next topic of debate is painted decks. The US Navy was experimenting with 'darkened' decks in the Atlantic as early as June of 1941 with regards to the development of what would eventually become 20-B Deck Blue. During the visibility tests of late 1941 in the Pacific, several ships were painted with dark blue decks.

This supported by the following:

10-31-41 - S19-01050 orders specified ships to paint into blue decks for observation trials. Those ships include *Nevada* and *Tennessee*.

11-12-1941 S19-01537 directs aviation units from cruisers USS *Detroit* and *Raleigh* to conduct those observation trials.

1-21-42 BB43/S19-78 is a memo from USS *Tennessee* indicating that pursuant to S19-01050, her decks had been painted, the observation trials had been carried out (S19-01537), and that additional tests were being scheduled during her next at-sea period. Those tests did not happen (because of the attack).

U. S. FLEET LETTER NO. 1 USL-41

From: Commander-in-Chief, United States Fleet
 To : FLEET
 Subject: Turret Markings for Identification by Own Aircraft

1. This letter replace U.S. Fleet Letter No. 13L-40, which letter is hereby cancelled, since colored tails for aircraft are being eliminated.

2. Battleships and cruisers shall paint the tops of any or all their forward turrets or enclosed mounts with the following colors for identification by their own aircraft. When stripes are involved, they shall be painted parallel to the axis of the guns.

BATTLESHIPS	
Battleship Division ONE	Red (Solid)
Battleship Division TWO	White (Solid)
Battleship Division THREE	Blue (Solid)
Battleship Division FOUR	Black (Solid)
Battleship Division FIVE	Yellow (Solid)

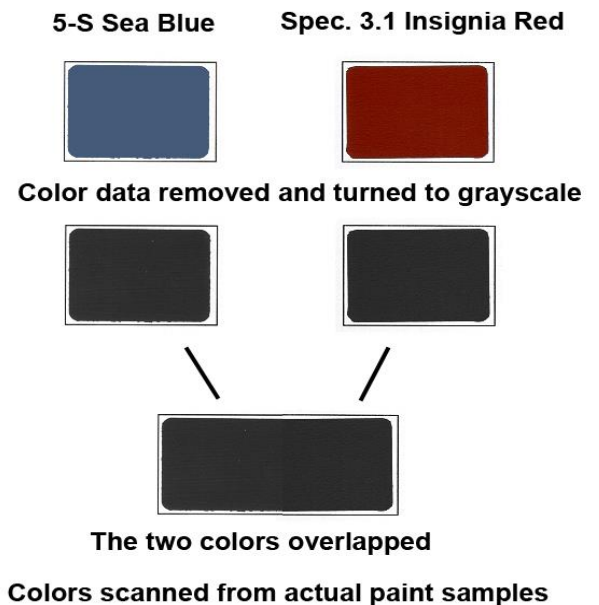
CRUISERS	
Cruiser Division TWO	Blue (Double Stripe)
Cruiser Division THREE	Red (Double Stripe)
Cruiser Division FOUR	Blue (Single Stripe)
Cruiser Division FIVE	Yellow (Single Stripe)
Cruiser Division SIX	Black (Single Stripe)
Cruiser Division SEVEN	Green (Single Stripe)
Cruiser Division EIGHT	Black (Double Stripe)
Cruiser Division NINE	Green (Double Stripe)
DETROIT and RALEIGH	Blue (Double Stripe)
RICHMOND	Red (Double Stripe)
AUGUSTA and OMAHA	Red (Double Stripe)

3. In addition, battleships and cruisers shall paint the top of their after turret or enclosed mount to correspond with the section their aircraft are in. The colors are red, white, blue, black, green and yellow for first, second, third, fourth, fifth and sixth sections respectively.

H. E. KIMMEL

DISTRIBUTION:
 List II, Case 2, O, X.
 List II, AI, AM, ENI-EN11,
 NA4-NA56, NB18, ND1-ND16, NV1-NV10.

P. C. Crossley,
 Flag Secretary
 USS Penn.--154--3-25-41--1,650.



UNITED STATES PACIFIC FLEET
BATTLE FORCE
U.S.S. CALIFORNIA, Flagship

Long Beach, California,
October 31, 1941



519 (01050)
CONFIDENTIAL

From: Commander Battle Force,
Commander Aircraft, Battle Force,
Commander Battleships, Battle Force,
Commander Cruisers, Battle Force,
Commander Destroyers, Battle Force.

Subject: Visibility of Ships.

References: (a) Cincpac. Conf. ltr. 519/50(01593) of October 6, 1941.
(b) Pac. Flt Conf. Notice 1503N-41.
(c) BuShips Conf. ltr. C-519-1(6)(310)/C-5123/42-11 of September 16, 1941.

Enclosure: (A) Copy of reference (a).
(B) Copy of reference (c).

1. Following informal conferences with Type Commanders, the following vessels of the Battle Force are designated to comply with the requirements of Enclosure (A):
TENNESSEE, SARATOGA, HELENA, FARRAGUT of Task Force One;
NEVADA, ENTERPRISE, JARVIS of Task Force Two;
LEXINGTON, FLUSSER of Task Force Three.

2. Aircraft carriers will disregard instructions contained in reference (a) with respect to painting of decks in view of the Bureau of Ships present experimental deck painting program for aircraft carriers.

3. Inasmuch as Destroyer Division NINE has been painted with experimental paints in accordance with reference (b), it is suggested Commander Destroyers, Battle Force, direct such destroyers to adopt the additional measures included in Enclosure (A).

-1-

UNITED STATES PACIFIC FLEET
DESTROYERS, BATTLE FORCE

U. S. S. DETROIT, FLAGSHIP

Pearl Harbor, T. H.,
NOV 12 1941

FILE
519
Serial 01537
CONFIDENTIAL

From: Commander Destroyers, Battle Force,
Commanding Officer, U.S.S. DETROIT (DL8).
Commanding Officer, U.S.S. RALEIGH (DL7).

Subject: Low Visibility Painting of Ships - Observation of various vessels by aircraft.

Reference: (a) Comsecfor ltr 519/50 Serial 0830 undated.
(b) Comsecfor ltr 519/01050 of October 31, 1941.
(c) Cincpac ltr 519/50 Serial 01593 of October 6, 1941.

Enclosure: (A) Copy of reference (c).

1. References (a) and (b) designate the following vessels for the application of the measures outlined in reference (c):

Task Force One	-	TENNESSEE, SARATOGA, HELENA, and FARRAGUT.
Task Force Two	-	NEVADA, ENTERPRISE, PERRAGOOLA, and JARVIS.
Task Force Three	-	LEXINGTON, ASTORIA, PORTER, FLUSSER, BRATTON, LAMSON, and MAHAM.

It is requested that the aviation units of the DETROIT and RALEIGH observe the above vessels during scheduled operations at sea and submit reports required by paragraph 4 of reference (a) to Commander Destroyers, Battle Force, before December 6, 1941.

W. M. FORTHELLER,
Chief of Staff.

Copy to: Comsecfor 1, Comsecfor, Cincpac.

FRED R. STORNEY,
Flag Secretary.

BB45/519-7/(78) U. S. S. TENNESSEE



From: The Commanding Officer,
The Commander-in-Chief, Pacific Fleet.

Subject: Camouflage experiments.

Reference: (a) Cincpac dispatch 220033 of November 1941.
(b) Pac Flt conf. notice #1503N-41.

1. The following camouflage measures were carried out on this vessel:

- All topside decks painted blue.
- All skylights painted or glass removed.
- Searchlight lenses and bridge windows covered, and main and fore top windows painted.
- All bright work painted.
- All white canvas topside painted.
- Port lenses painted with a light coat of blue deck paint.

2. Observation by air was used to completely apply the above measures to the ship. These measures had just been completed during the last period at sea and it was intended to cover the other points listed in reference (b) during succeeding periods. This was not possible.

3. The consensus of opinion of the aviators was that the above measures completely eliminated all glare effect on the ship and except for the grey upper part of both masts, made the ship much harder to pick up and identify. In this connection the white uniforms of the crew stood out very plainly against the blue decks.

C. E. RICHMOND.

Copy to: Comsecfor TWO,
Comsecfor THREE.

This is supported by photographic evidence taken both by the Japanese during the attack and by US aircraft conducting aerial surveys after the attack. It's pretty safe to assume that all of the vessels listed in these memos still had dark decks at the start of the war.

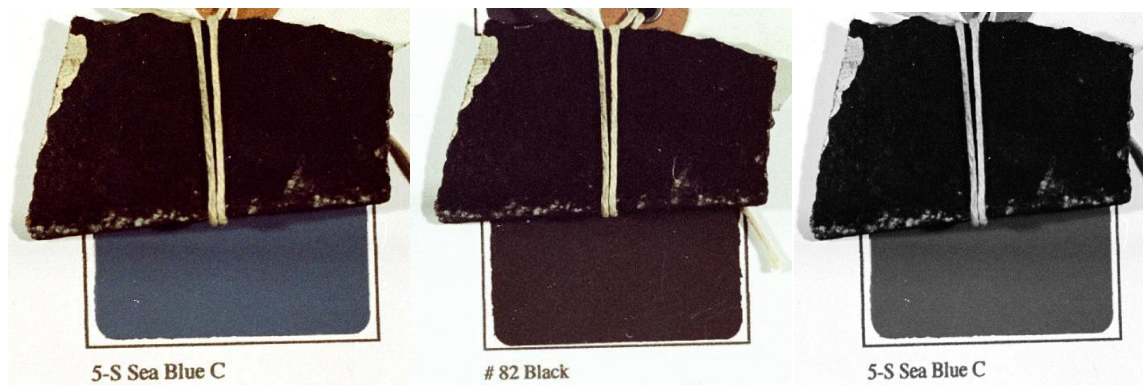
It is in the best interests of anyone who studies the Pearl Harbor attack from a camouflage/paint perspective, to look beyond the obvious, and factor in the less-obvious nuances of the recorded data both leading up to, during, and after the attack. There are thousands of documents pertaining to camouflage and paint doctrine leading up to the attack. Many are repetitive, many offer nothing new. A few contain hidden gems of information, many headers contain references to previously published documents that shed new light on the subject and offer new data to interpret and plug into the grand equation.

This document was written by Jeff Herne, and is the culmination of research compiled by members of the Warship Camouflage Research Group, including Ron Smith, John Snyder, Jamie Duff, Jim Azelton, Al Ross, and Don Andrews. Special thanks go out to Jamie Duff, who did the timeline illustration for this project, and Tracy White, proprietor of Researcher at Large, a repository of US Navy documents pertaining to the development, implementation, and changes to US Navy Camouflage practices during World War Two.

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Notes applicable to the subject-

- 1- Some modern 'authorities' claim the post-attack color films and photos of *West Virginia*, *California*, and *Nevada* do not reflect attack-day colors as the crews "repainted all the time". This is simply incorrect. A fleet letter written shortly after the attack clearly states that no camouflage paints are to be used on the "sunken" ships due to scarcity of these colors and ONLY red lead or zinc chromate as appropriate are to be used for corrosion control. The color films and photos clearly show this.
- 2- Most of the attack day and immediate post-attack photos are listed as "NO NEG", meaning you cannot trust the contrast of the image to make any meaningful tonal comparison. If there is a negative number, or it says "COPY NEG" you can safely make some tonal comparisons. COPY NEG is a copy made from the original nitrate-based negative and is close to 100% true.
- 3- You cannot trust any images sourced online, not even NARA (National Archives) or NHC (Naval Historical Center), because most have been manipulated with Photoshop or some other editing software. They are also usually lo-res. The same goes for the lo-res videos like Critical History and videos found on sites like YouTube.
- 4- Paint manufacturing and mixing. There is a lot of confusion and false assumption here. Not since white and spar had ceased to be the official paint scheme did USN ships mix their own paint, and they only mixed the spar (commonly called buff by those who do not know the official, correct name of the color). Once the USN settled on #5 Standard Navy Gray (#5sng) the paint was supplied pre-mixed from the two Paint Manufacturing Yards (PMY), Philadelphia and Mare Island. Despite mixing formulas in SHIPS-2, this was still standard practice throughout most of 1941 for both yard and ship's forces. PMYs produced 55-gallon, 30-gallon and 5-gallon pre-mixed paint containers, and eventually, 5-U and 5-TM for mixing onboard ship. With the exceptions noted in the text regarding: #5sng and 5-S re-tinting into 5-D and 5-N yards never mixed their own paint. Until *SHIPS-2 Revision 1*, September 1941, most ships did not mix their own paint unless specifically ordered to do so for an experiment, and this was commonly practiced well into 1942.
- 5- How to tell if 5-D is PMY new manufactured or re-tinted #5sng. Real PMY 5-D is almost black and matte, period. Re-tinted #5sng is lighter and will have some gloss to it. #5sng had a gloss factor of 44. Re-tinting with the neutral 5-TM would give a slight sheen, and with the 'last resort' black striping paint it would be even glossier, as black striping is high sheen.



Sample of 5-D Dark Gray from CV-6 Enterprise shown against Snyder & Short chips. The last is a grayscale, to illustrate the degree of contrast between 5-D and 5-S as per period photographs.

Any documents highlighted in red can be seen online in their original form, and in their entirety, at the Researcher at Large,

<http://researcheratlarge.com/Ships/S19-7/index.html>

The SHIPS-2 Documents can be found online at: www.shipcamouflage.com courtesy of Snyder and Short Enterprises.

This document is sponsored by Scale Colors, Inc. and Sovereign Hobbies, Ltd., producers of historically accurate hobby paints for the naval scale modeler. www.scalecolors.com and www.sovereignhobbies.co.uk

