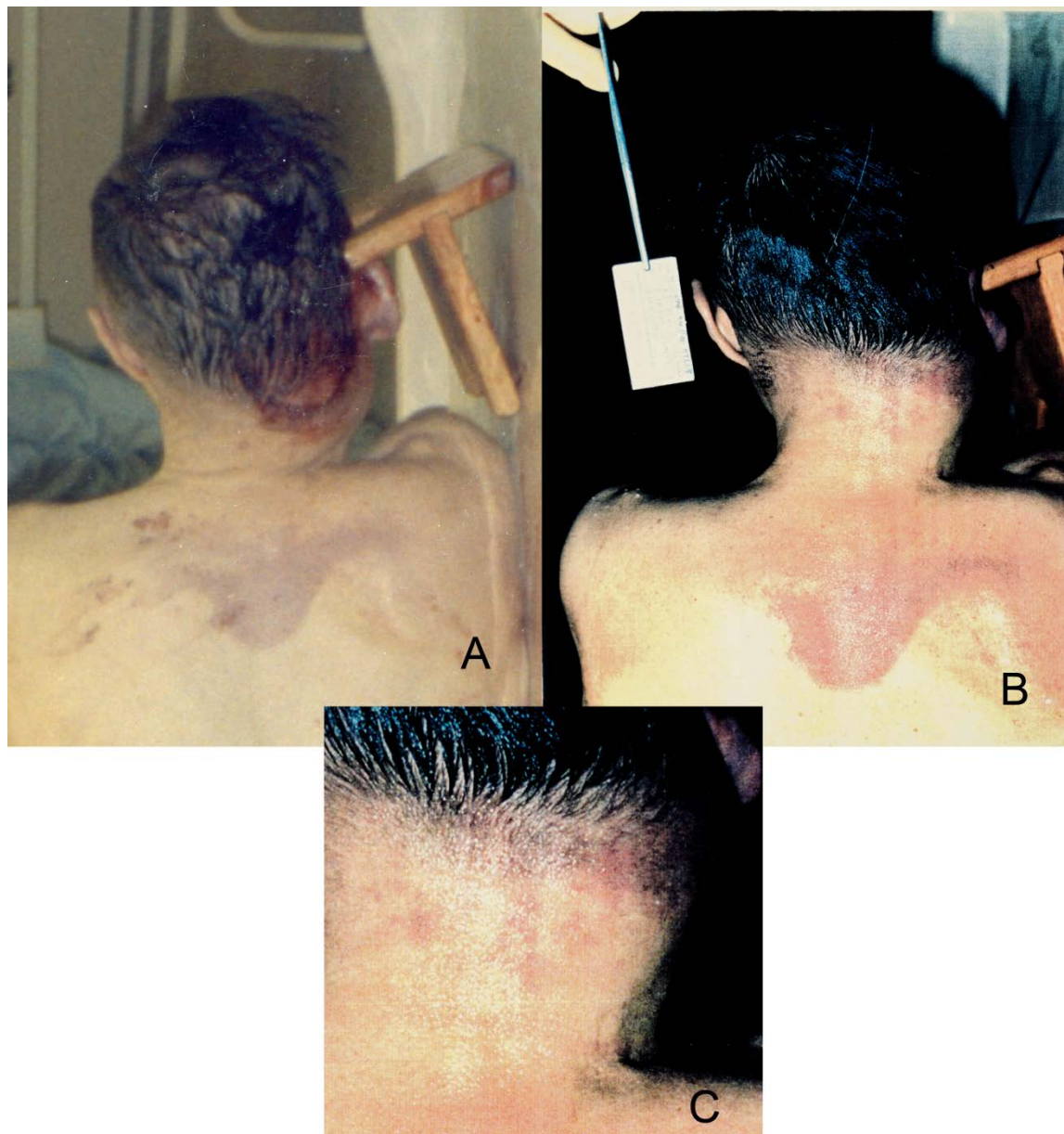


## **Analysis of a photograph submitted in the Colonel James Sabow case by the US Department of Defense.**

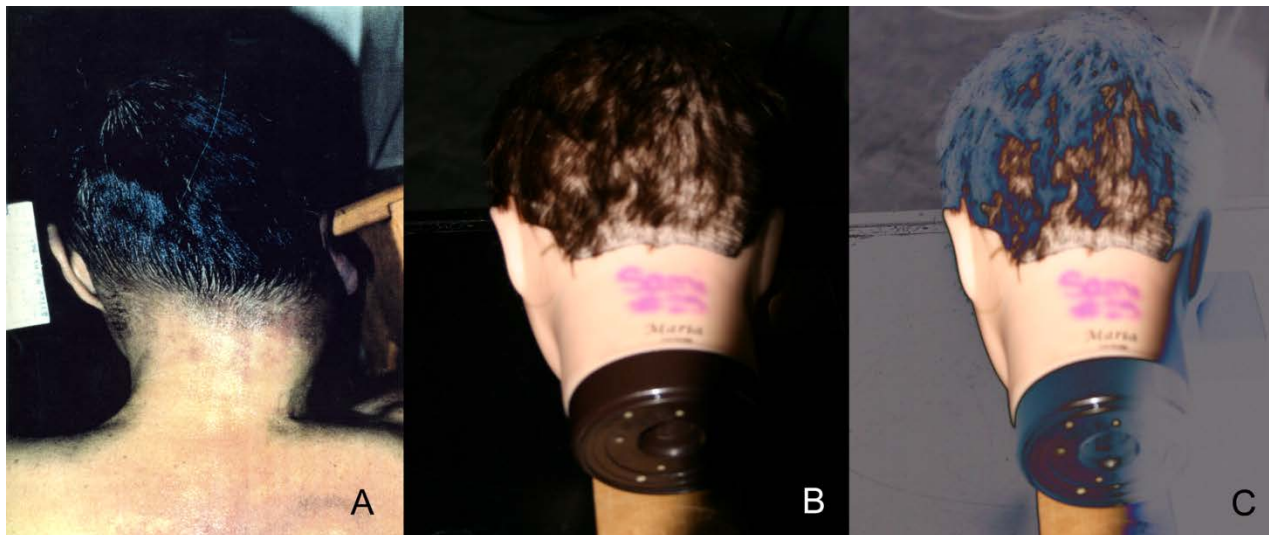
**Introduction.** The two images in Fig. 1 are scans of second generation (prints from the original negatives) autopsy photographs provided in the discovery by the United States Department of Defense in 1993 which were ultimately used for trial in Federal Court and submission to the United States Congress. The victim, United States Marine Colonel James Sabow, was alleged to have been hit with a club with considerable force on the right occipital region of his head prior to an intraoral shotgun discharge. An autopsy X-ray shows a depressed skull fracture in the right occipital skull. A massive hematoma was also discovered over the skull fracture. There are many other aspects of the death scene and autopsy photographs and reports that question the determination of suicide on the death certificate (Sabow & Burnett, 2011). At least four of the autopsy photographs show extraordinary swelling on the right side of the Colonel's head consistent with the pathological findings (Sabow & Burnett, 2011). The death scene photographs and reports support a homicide scenario for the Colonel's death (Burnett, & Sabow, 2011), not suicide.

**The questioned photograph.** Figure 1A was enlarged from an autopsy photograph which was taken prior to the body being cleaned. This photograph is notable not only for showing an apparent the heavy tramline bruising (see Cox, 2011) that outlines the impact area from a likely club strike to the back of the Colonel's head, but also displays the extraordinary swelling in the same region. Other autopsy images as well as skull X-rays support the club strike to the back of Colonel Sabow's head prior to the intraoral shotgun discharge.

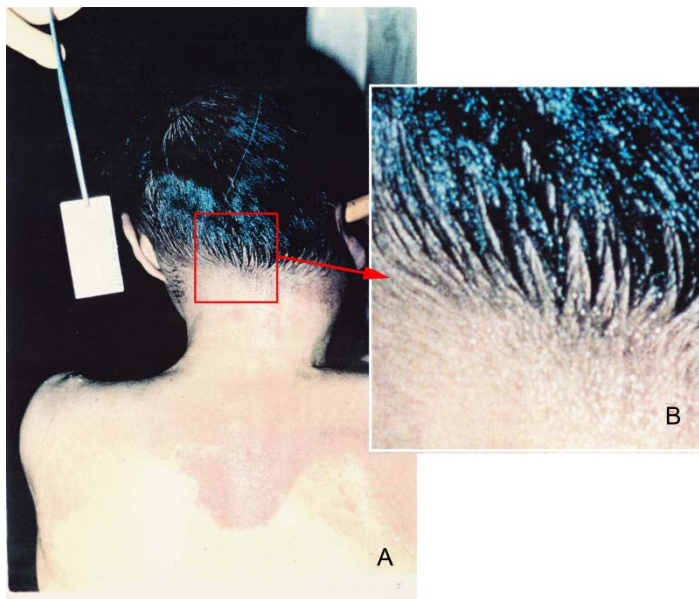
The photograph shown by Fig. 1B, which was part of the discovery released by the Department of Defense in 1993, shows a normal posterior head (no swelling or bruising Fig. 1C). This image was also used by Nordby (2004) in his report to the United States Congress. The photograph shown in Fig. 1B is inconsistent from the photograph of the Colonel Sabow's head (Fig. 1A) in a number of features which casts suspicion on its veracity, especially considering other autopsy images (see below). The large amount of shadow surrounding the head and the overexposed part of the back and neck as well as the peculiar light reflection by the head hair above the hair line suggest it is the image shown in Fig. 1B that could either be from a different autopsy or fraudulent. The tag displayed in the questioned photograph indicates the latter - it reads "Sabow James." This article will explore the features of this questioned photograph (Fig. 1B) both in gross aspect and by digital analysis.



**Figure 1.** The back of the head of Colonel Sabow. **A.** Image taken from a half body photograph before the cleaning of the body; a tramline bruise outlines a probable club strike. Massive swelling on the right side of the head is notable. **B.** Photograph of the alleged back of the Colonel's head that was with the discovery associated with the Colonel Sabow autopsy; no swelling of the right side of the head is or present. The reason for the mismatch between these two images will be explored in this paper. **C.** From B, but an enlarged right lower head and neck.



**Figure 2.** Back of head illumination. **A.** the questioned photograph for comparison to **B.** **B.** Mannequin head with short hair; the angle of the flash and camera lens in the questioned image was attempted to duplicated the lighting for this image. Unlike the head in the questioned image the illumination of the mannequin hair shows continuous structure and form to nearly the top of the head. The deep shadow surrounding the mannequin head was naturally produced. **C.** Detail in the shadow brought out by imaging processing (see below).



**Figure 3.** The questioned image's hair at the hair line. **A.** Square in the questioned image showing where the enlargement in **B** was taken. **B.** Enlarged area from **A**.



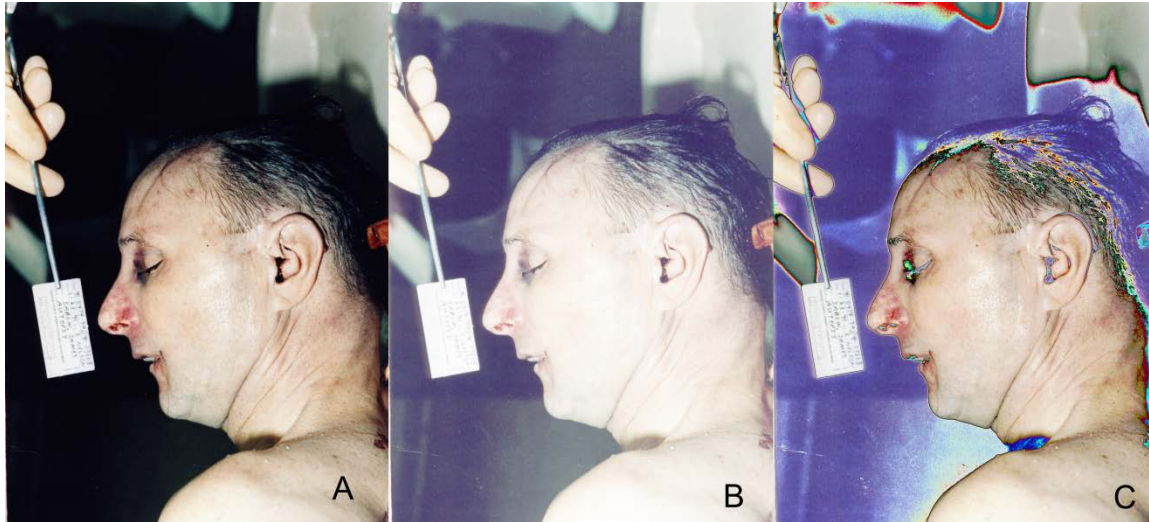
**Figure 4.** **A.** Left side of the Colonel's head. **B.** Enlarged area of the square in **A** showing a transition of the hair in the image to reflective (white) bands. Image gamma adjusted by Photoshop's Levels.

**Peculiar illumination.** From the way the body is illuminated in the questioned photograph (Fig. 1B), suggests with that flash and camera angle should have revealed more hair like that at the at the hair line. This is simply because the back of the head projects slightly higher than the neck. I attempted to duplicate the flash and camera angle with a hair dresser's mannequin head (Fig. 2B) with a 6 M-pixel SLR digital camera. The sole purpose of this image is to show that the back of the head would have similar illumination from the neck to almost the top of the head and therefore the imaging characteristics of the hair on the back of the head of the person in Fig. 1B should be somewhat uniform from the neck through at least to the distal part of the occipital region of the head. It is not.

I could not duplicate the odd transition from the hair at the hair line to the white reflective hair (from mid image to the top of Fig. 3B). I cannot discount the many variables at play which could result in the questioned photograph's odd character in this regard. However, another autopsy photograph of the left side of the head of the Colonel (Fig. 4A) shows similar hair light reflections (Fig. 4B) as seen in Fig. 3B, but not nearly as prominent. In this photograph (see Fig. 4B), there is a gradual transition to the white light reflective hair. Such a transition in the questioned photograph (see Fig. 3B) is abrupt and the white reflective hair is actually mixed with the normal-imaged hair at the hair line (Fig. 3B), a characteristic not shared in the somewhat similar autopsy image (Fig. 4B).

**Image information loss with copying.** How much information is lost when the original negative (first generation) is copied by optical means (photo enlarger) creating a second generation photograph? Information loss will always occur, but the amount depends on the amount of enlargement, quality of the optics etc. When a second generation photograph is scanned generating a third generation digital image, an additional amount of image information is lost. The images in Fig. 1 were scanned from the second generation photographs which make these images third generation. These images in this MSWord document result in additional information loss. Also available for this work are digital images made from photographic negatives that were taken of the second generation photographs (equals third generation images on the negatives). This means digital images from these negatives are fourth generation. There are deep shadows present in some of the fourth generation images which also have contribution from information loss by the copying. Figure 5A shows a fourth generation image.

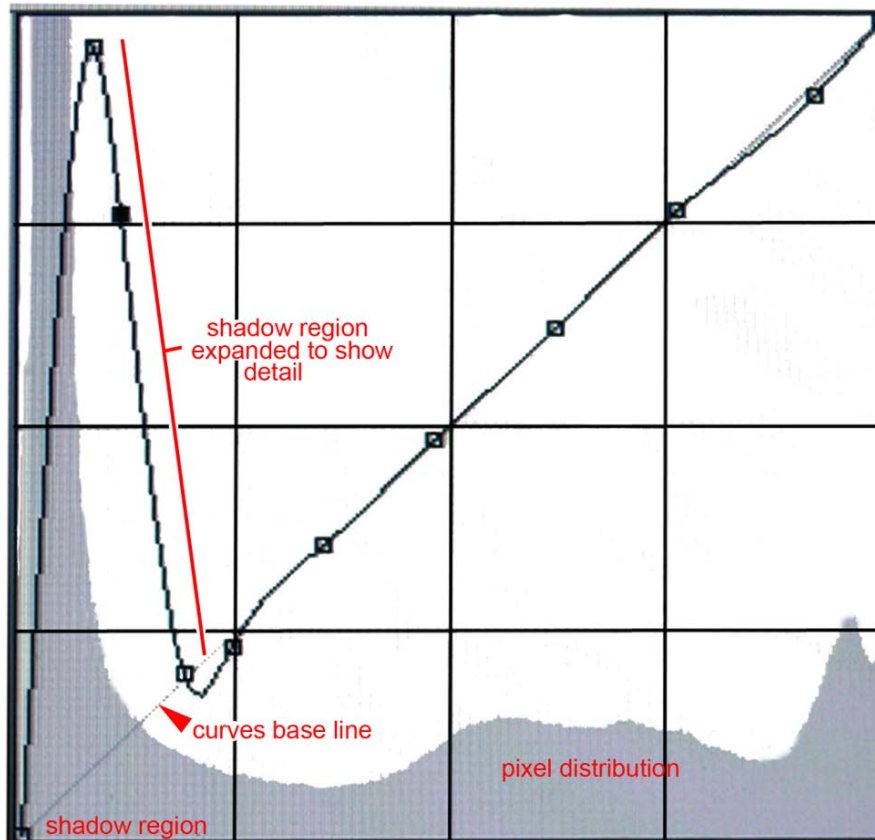
Even in a fourth generation image where some loss of image information would be expected, features within deep shadows can be still observed by image processing by Photoshop such as seen in Figs. 5B and 5C.



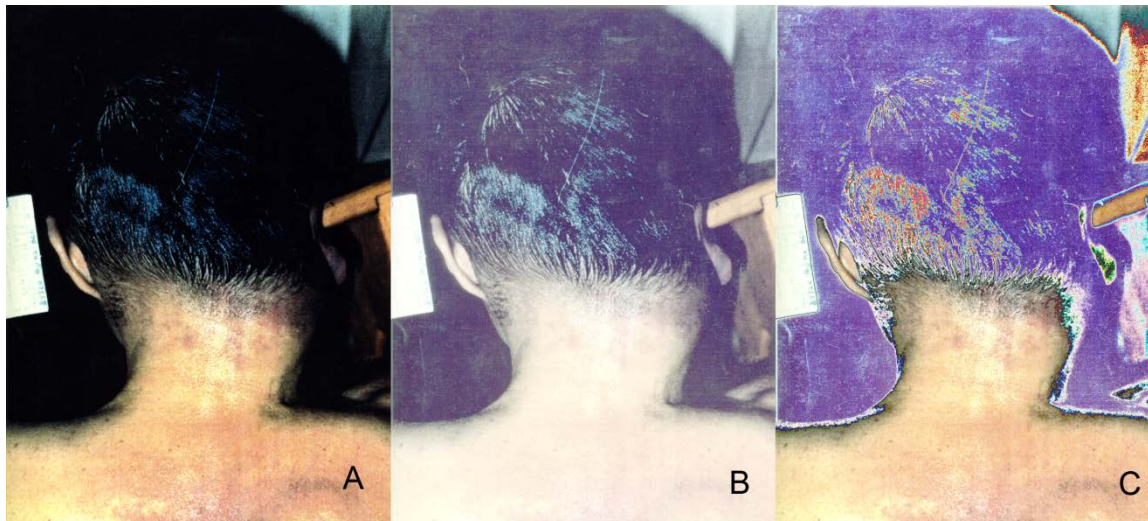
**Figure 5.** *A. Fourth generation autopsy image of Colonel Sabow's left head and left shoulder; a deep shadow surrounds most of the head. B. A full image gamma adjust (Photoshop Levels) brings out background detail within the shadow. C. A more robust accentuation of the shadow areas in A using Photoshop's Curves routine (see Fig. 6); notice the gradation of color below the chin.*

**Information in the shadows.** As noted previously, an aspect of the questioned photograph (Fig. 1B), assuming it was taken at the time of autopsy, is the large amount of shadow surrounding the Colonel's head considering the way the flash illuminates the body. Another photograph (Fig. 5A) shows a similar amount of shadow and both will be examined in this study.

The shadow area in the questioned photograph is so complete, without a hint of any detail or transition of any part into the shadow, should lead an experienced photographer to become suspicious of the veracity of this photograph. At this point, it needs to be pointed out that the human eye does not have the sensitivity to discern the full range of colors that are displayed in an image (Russ, 1994). For instance, a typical color image (8 bit, 3 channel) could have more than 16 million colors – our perception only can distinguish between a small fraction of those colors. So, for the shadow areas in Fig. 1B, the full range of colors possibly present in the black areas will not be seen by the human eye. The potential for any image where shadow is represented by total black such as in Fig. 1B is structures within the darkness can be elucidated or brought out by imaging processing techniques. This is done by both bringing the “black” pixels into the human visual range and increasing that color range. There are several ways to



**Figure 6.** The Photoshop Curves graphic and user interface which shows the final adjustment seen in Figs. 5C and 7C. The gray region represents the digital information range of the image shown in Fig. 1B. The number of pixels in the original dark (shadow) part of the image is at left. This Curves routine allows the operator to expand pixel regions as shown by the user “pulling” the base line up into the visual part of the image area which also expands the pixel range in the original dark area. This allows a viewing of detail within the shadow areas of the image as shown in Fig. 5C.



**Figure 7.** *The shadow of the questioned image in a scan of a first generation photograph. A. The original image for comparison. B. The image in A Levels adjusted for elucidation of background features within the shadow. None are observed. C. The same image as A, but the dark pixels in image A were expanded by the Photoshop Curves routine by as shown in Fig. 6. As seen in B, there is no background detail within the “shadow” surrounding the head. The main part of the head above the hair line has no features and is actually part of the uniform background. The highlighted hair appears to have been painted (better elucidated in B). Note the shadow to right of the head does not follow the contours of the wood head support.*

accomplish this: modern image processing programs such as Adobe Photoshop, using its Levels (gamma adjust) and Curves routines, colors present in a shadow of an image can be stretched so that the human eye can perceive the relative color differences that are within the shadow. The deep shadow in the photograph shown in Fig. 5A retained a color range that was revealed by image processing (Figs. 5B and 5C). Now, what would these procedures do with the questioned photograph shown in Fig. 1B? If the photograph imaged in Fig. 1B is just poorly taken - the flash was too close to the subject, washing out the color of the subject and creating shadows around him as was simulated with a mannequin head (Fig. 2B). The shadow surrounding the head should at least gradate into no hidden colors (total black) at perhaps some locations in this heavily shadowed image. This occurred when the shadow around the mannequin head was processed in Photoshop (Fig. 2C).

Especially effective in expanding the color within shadows is the Curves routine of Photoshop (see Fig. 5C). Figure 6 shows the Photoshop (version CS5) user graphic and

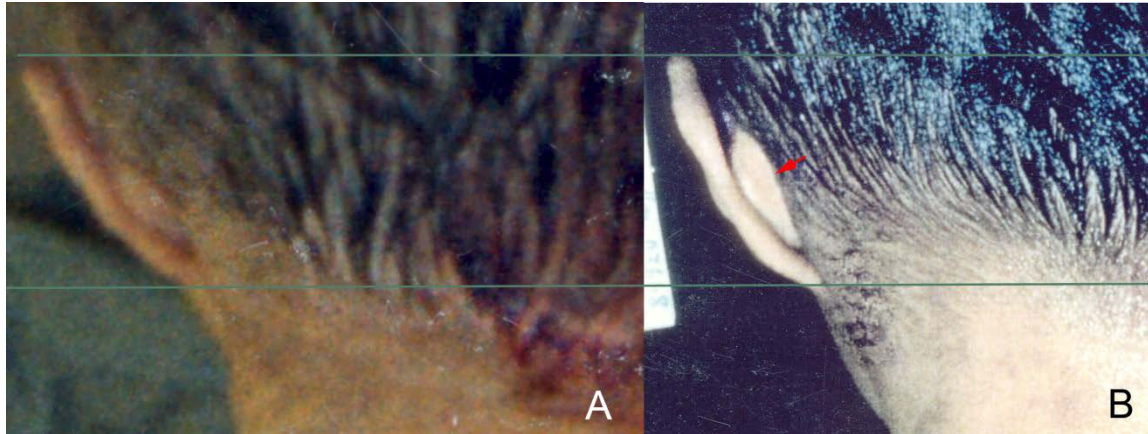


procedure to expand the color range in the image shadows.

The Photoshop Levels (gamma) image adjustment routine can also bring out shadow detail (e.g. Fig. 5B), but it is not nearly as effectively as its Curves routine in some images.

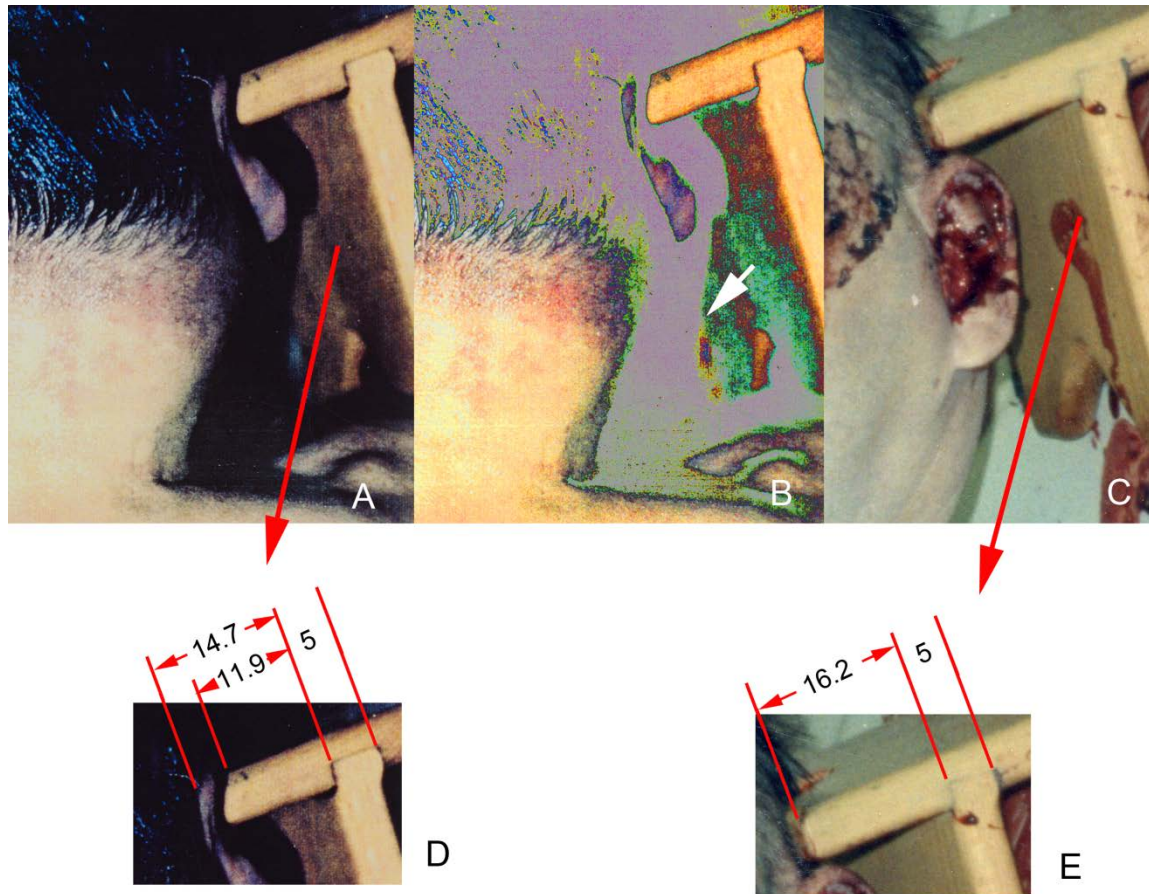
Indeed, as shown with the example fourth generation autopsy image (Fig. 5A) the levels routine adjust (Fig. 5B) show some detail of the background that was initially black. However, the Photoshop Curves routine (Fig. 6) on the autopsy image shown in Fig. 5A, shows a more dramatic reveal of background detail (Fig. 5C).

The Photoshop Levels and Curves (Fig. 6) routines were applied to the question image (Fig. 7) to the same degree as in the images of Figs. 5B and 5C. It is apparent there is little or no color range in the shadow areas of the questioned image (Figs. 7B and 7C).



**Figure 8.** Comparison of hair lines and left ear attachment. **A.** Left ear enlargement from Fig. 1A; note also hair overlays the ear base. **B.** The left ear of the questioned image sized and aligned with the ear in A; the ear base at the head (arrow) has a discreet border which extends proximately into the neck. No hair overlaps the border of the ear with the head. The black smudges under the ear are ink from a Bates stamp.

**Hair Line and left ear.** Figure 8 shows the posterior left head from the two images shown in Fig. 1 aligned and sized to match. The hair pattern and hair line do not match. The latter issue cannot be attributed to differences in the lens angles when the two photographs were taken – the orientations of the ears in the two images are almost identical. In addition, the base of the ear shown in Fig. 8B has no overlying hair like that seen in Fig. 8A. The left ear in the questioned photograph (Fig. 8B) appears to have been “pasted” onto the photograph.



**Figure 9.** The Colonel's right ear of the questioned photograph. **A.** An unprocessed enlargement of the questioned image (see Fig. 1B); the wood head brace appears to be depressing the upper part of the Colonel's ear. The sharp edge of the lower part of the ear and the lack of connection to the head suggest it was a pasted onto the photograph. **B.** Curves processing (Fig. 6) of A; there is no detail in the shadow (see Fig. 7C) or any gradation into shadow. Note the hair line has no transition into the shadow. It appears to be a cut out. Arrow points to where the neck and head shadow which, if real, should show a step-like transition. It does not. **C.** A Colonel Sabow autopsy photograph showing the behavior of the shadow in the same area is discontinuous. Image shows the right side of the Colonel's face (image was horizontally flipped – Fig. 10B shows the unaltered image). **D.** Relative head brace measurements from the questioned photograph. **E.** Relative head brace measurements from C.



**Figure 10.** Other autopsy images showing the extraordinary swelling on the right side of Colonel Sabow's head. **A.** Photograph of the anterior head and upper body after the cleaning in preparation for autopsy. **B.** Photograph of the right side of the Colonel's face prior to cleaning. **C.** Photograph of the anterior head and upper body prior to cleaning; the swelling of the right occipital region of the head is readily seen. Arrow points to the central part of the swelling. Photo retouching in area of the tramline bruising (Fig. 1A) appears likely.

**Right ear.** The Photoshop Curves application (Fig. 6) of the features of the right ear of the question photograph (Fig. 9A), generates the background color expansion shown in Fig. 9B. Again no detail was apparent within the shadow. Indeed, the shadow does not follow the contours of the wood head brace (for comparison, Fig. 9C). The right ear also appears to have been “pasted” onto the questioned photograph. Part of the wood head brace shown as being in contact with the right ear (Fig. 9A) was actually modified to appear to be part of the upper ear. Relative measurements of the head brace in the

questioned photograph with the brace from another autopsy image (Fig 9 C) were made. These measurements (Figs. 9D and 9E) were made on approximately the same brace orientation and size. The questioned photograph brace component (Fig. 9D) is too short when compared to the same part of the brace in Fig. 9E. It appears part of the wood brace in contact with the right head/ear of the questioned photograph was actually converted to appear to be part of the ear.

**Other autopsy photographs.** Two other autopsy photographs which have no evidence of illegitimate modification are shown in Figs. 10A and 10B. The massive swelling of the Colonel's right head is obvious. The photograph (Fig. 10C) shows the massive swelling on the posterior right head, but it does not show the tramline bruise so prevalent in Fig. 1A. It appears the photograph shown in Fig. 10C was modified, probably by an air brushing.

**Conclusions.** The questioned photograph (Fig. 1B) has many features which are inconsistent with the pathology and other autopsy images. I must point out that any one of these inconsistencies in the questioned photograph by itself is not sufficient evidence of a doctored photograph, but all taken together leaves little doubt as that this photograph is fraudulent. The questioned photograph:

1. Does not show the tramline bruise or massive swelling on the right posterior head (Fig. 1).
2. The illumination on the back of the head by a flash is inconsistent with the topography of the body (Fig. 2).
3. The hair line shows an odd combination of naturally imaged hair and reflective-white light hair (Figs. 3 and 4).
4. There is no color range within the shadow surrounding the head (Figs. 5 and 7).
5. Between the photograph showing the tramline bruise and swelling (Fig. 1A) and the questioned photograph (Fig. 1B), the hair lines and pattern show no similarity (Fig. 8). The left ear appears to be a cut out and dropped in (Fig. 8B).
6. The right side of the head does not cast a shadow consistent with the topography (headrest) of that side of the head. The shadow on the right side of the head has no color variability (Figs. 9A and 9B).
7. The wood headrest in contact with the right ear is too short (Figs. 9D and 9E). Part of the image of the headrest was modified to appear as the upper part of the ear (Fig. 9D).

Considering all the above, the photograph shown in Fig. 1B which was part of the original autopsy photographs of Colonel Sabow is determined to be fraudulent to a high degree of scientific certainty. An additional remarkable feature of this photograph is the back of the head and neck does not appear to be that of Colonel Sabow. The question is why present a fraudulent photograph when at least four other autopsy photographs in the discovery show either bruising or swelling or both (1 photograph) resulting from blunt force trauma to the back of the Colonel's head? I think the answer is to allow a Department of Defense expert to specifically point to the fraudulent image as overwhelming support for the Colonel dying by only a self-inflicted shotgun wound and to state the other conflicting images are artifacts (see Nordby, 2004).

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A handwritten signature in black ink, appearing to read "Bryan R. Burnett", with a long horizontal flourish extending to the right.

Bryan R. Burnett

January 16, 2012