B107 The Digital Preservation of the President John F. Kennedy Assassination Bullet Artifacts

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Learning Overview: After attending this presentation, attendees will have learned about bullet artifacts that were part of the John F. Kennedy assassination. Attendees will learn how the National Institute of Standards and Technology (NIST) digitally scanned these artifacts and made them available for the public to view and download. Some of the measurement challenges faced will be discussed, providing a better understanding of measurement techniques for fragmented bullets.

Impact on the Forensic Science Community: This presentation will impact the forensics science community by expanding knowledge of the John F. Kennedy assassination and describing 3D surface maps of the bullet artifacts that are available to download and view.

The assassination of President John F. Kennedy was a defining moment in United States history and has left a lasting impact on generations. As the nation's record keeper, the National Archives and Records Administration (NARA) is responsible for preserving many of the artifacts and documents that were part of the assassination investigation, including the recovered bullets. NIST has a long history of developing and producing the technology required to preserve important and priceless documents such as the Declaration of Independence, the Constitution, and the Bill of Rights. This history combined with expertise in areal surface topography measurements enabled NIST to assist NARA in digitally preserving the assassination bullet artifacts, and in doing so, facilitated public access.

In collaboration with NARA, NIST acquired high-resolution photographs and 3D models of the bullet artifacts. State-of-the-art confocal and focus-variation microscopes were used to scan each artifact and obtain 3D surface topography and color maps of the artifact surfaces. The lateral point spacing of the obtained maps ranged from 1.5µm to 4µm. The measurements were then combined into 3D models of the entire bullet surfaces. NARA has made these data sets available online to the public for download and interactive virtual inspection.

Several technical challenges in scanning the bullet artifacts will be discussed. The bullet fragments had extremely complex features, including reentrant surfaces. This required scanning the surfaces at many different artifact orientations and then assembling all the scans using advanced software algorithms. These algorithms registered the individual scans to each other in 3D space using overlapping measurement regions and then merged the scans together into a single 3D surface model of each artifact. The large number of high-resolution scans resulted in large amounts of data that had to be managed, both during the merging process and for computer visualization. In addition, there were challenges related to surface illumination during measurement to acquire the color information of the artifacts accurately. This was achieved by using a combination of illumination techniques, including coaxial and ring lighting.

This presentation will be divided into the following sections: (1) review of the project scope; (2) overview of the instrumentation, methods, and challenges in measuring the surfaces of the artifacts; (3) a detailed look at the image stitching and merging process to create the 3D models; and (4) demonstration of the final color 3D artifact models that have been made available to the public for download and virtual inspection.

Kennedy, Assassination, Bullet

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