D11 Evaluation of a Prototype Field Deployable Device for Rapid Acoustic Analysis of Liquids and Contraband in Opaque Containers

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After attending this presentation, attendees will learn of a prototype device that is being tested for its ability to be deployed in the field for acoustic, non-invasive analysis of containers of varying sizes and the ability to detect contraband.

This presentation will impact the forensic community by optimizing acoustic field devices used to acquire safe, rapid, and accurate data from containers which will prevent dangerous or illicit substances from penetrating transportation networks and border entry sites.

In the ongoing efforts of the Federal Bureau of Investigation to characterize and block terrorist threats to multi-modal and air transport systems of the United States, research has been accomplished to generate a field deployable device which acoustically interrogates containers of various sizes and material composition, and responds with quick, real-time identification of potential threat liquids and/or contraband.

The beta version of this portable device has been evaluated for performance via examination of ultrasonic time-of-flight measurements, attenuation responses, comparative studies of liquid and dry transducer couplants, and the device's ability to discern the presence of foreign bodies hidden in containers. Upon determination of the operational stability of this prototype device, a goal is to be one step closer to bringing a non-invasive, user friendly instrument to the field that will provide quick assessment of threat liquids and/or contraband, without the concerns associated with destructive or discharging methods.

The protocol by which the device was evaluated included use of containers fabricated from five materials found in the "stream-of- commerce". Three sizes of each of the five container wall types were employed, to vary diameter and thus the acoustic time-of-flight responses within the same liquid type. Four commercially available liquids were used to determine if the instrument would identify the contents and respond with velocities and attenuations that could be compared to literature values and/or to independently measured baseline values.

A Phase I study was completed and results indicated that improvement was achieved by changing the transducer couplant material from wet to dry mode, such that all RSD's for velocity responses were less than 1%. Additionally, the transducer dry couplant material was found to be more robust with daily, consistent use. It was discovered that improvements in the area of distance acquisition from caliper readings were necessary for this prototype, and such improvements have already been implemented in a currently designed bench top analog at PNNL. Phase II studies will include expanding the database for precursor and threat liquids. Obstruction analysis was also performed using various materials, of varying shapes and sizes, placed within each container type and liquid type, as previously described.

It is the intent of this evaluation to assist those interested in deploying an acoustic field device to reach the goal of acquiring safe, rapid, and accurate data which will help prevent dangerous or illicit substances from penetrating transportation networks and border sites. Insights will also provide direction for a Phase II evaluation/modification of the device.

Systems (GIS) **Ultrasonic, Acoustic, Liquid**

 ** Presenting Author*