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Buddy Tag CONOPS and Requirements

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1. Purpose

This document defines the concept of operations (CONOPS) and the requirements for the Buddy Tag, which is conceived and designed in collaboration between Sandia National Laboratories and Princeton University under the Department of State Key Verification Assets Fund. The CONOPS describe how the tags are used to support verification of treaty limitations and is only defined to the extent necessary to support a tag design. The requirements define the necessary functions and desired non-functional features of the Buddy Tag at a high level.

1.1 Buddy Tag Overview

The Buddy Tag was first proposed as a concept in 1991 by Sandia researchers[1] as a non-intrusive method to verify limits on numbers of treaty-accountable items (TAIs). In that concept, it was established that a Buddy Tag is a trusted token that can be associated with a TAI but it not physically attached to it. The original concept required that the tags be kept near the TAI so that during an inspection one tag could be presented for each TAI, and on-board motion sensing would allow the inspector to determine if the tag had been moved in the short notice inspection period as an attempt to cheat. In this new incarnation of the Buddy Tag, the team will use the original concept and alter it as necessary to create a working prototype.

[1] SAND91-1710C: "Buddy Tag's Motion Sensing and Analysis Subsystem", Sabina Jordan

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2. Buddy Tag CONOPS

Buddy Tags are used to verify a notional treaty in which all nuclear weapons of two countries, regardless of state (deployed, non-deployed, strategic, tactical, active, inactive, awaiting dismantlement, etc.) are subject to an overall limitation.

There are four phases of the treaty implementation:

1. *Start up or Initialization.* Each country gives the other a number of Buddy Tags equal to the treaty limitation at the national level. In this way, the inspector provides all of the tags. Each country (as the host) then distributes the Buddy Tags to its sites holding TAIs so that there is at least one Buddy Tag at each site for each TAI.
2. *Enterprise operations between inspections*. Once the Buddy Tags are distributed, a Buddy Tag will be stored somewhere on the same site as each TAI. If a TAI is moved between sites, a Buddy Tag must be moved with it.
3. *Conduct of short-notice inspections*. Each Treaty Partner is allowed a certain number of short notice inspections to the other country's declared sites. When a short notice inspection is called for a specific site, the Inspected Party may not move any TAIs or Buddy Tags until the inspection is over. The inspection consists of ensuring that there is an authentic Buddy Tag for each TAI present that hasn't been moved since the inspection was announced. This includes inspecting a subset of areas declared to contain TAIs and inspecting other areas large enough to contain a TAI in order to construct a site TAI count, followed by counting Buddy Tags.
4. *Destruction of Buddy Tags associated with reduction in numbers*. In the event that the treaty limitation reduces, a number of Buddy Tags equal to the difference are returned from the host to the inspector.

3. Buddy Tag Requirements

The high level requirements and goals for the Buddy Tag are defined in Table 1.

Table 1. Buddy Tag Requirements and Design Goals

Req. No.	Requirement	Verification Method
1	The Buddy Tag shall indicate to the inspector that it is authentic.	Analyze the authentication mechanism for possibility of false positives; analyze the system for ability to bypass authentication mechanism
2	If the Buddy Tag has been tampered at any point following initialization, it shall indicate to the inspector that it has been tampered. Otherwise, it shall indicate to the inspector that it has not been tampered. It is assumed that each Buddy Tag is used only once following initialization.	Look for indication of not being tampered; tamper the tag in various ways and look for indication of tamper
3	If the Buddy Tag has moved (translated) more than one meter from its original location during the short notice inspection period, it shall indicate this motion to the inspector.	Translate the tag more than one meter in various ways and look for indication of movement

4	If the Buddy Tag has moved (translated) less than .75 meter from its original location during the short notice inspection period, it shall indicate to the inspector that it has not moved.	Look for indication of not moving under quiescent as well as vibrational and translation less than .75 meter conditions
Goal No.	**Goal (in order of priority)**	**Evaluation Method**
1	Minimize time to verify the authenticity, tamper state, and motion state of the Buddy Tag	Measure time to perform each verification
2	Design for a ten year lifetime	Analyze design for power consumption over ten years
3	Minimize opportunities for tampering	Analyze design and prototype for opportunities for tampering
4	Maximize reliability	Analyze design and prototype for reliability concerns
5	Maximize robustness to handling	Analyze design and prototype for robustness to handling
6	Maximize robustness to environment	Analyze design and prototype for robustness to a variety of environments