

# A Game-Theoretic Approach to Innovate Government Procurement: The Case for Non-Traditional Acquisitions



**Eighteen months after the Build America, Buy America act took effect in May 2022, the federal government has obligated \$18 billion to contractors.<sup>i</sup> As the costs from onshoring construction purchases continue to rise, now estimated to be equivalent to a 25 percent tariff and 5-10 percent increase to prices<sup>ii</sup>, the application of game theory holds the potential to yield considerable savings for procurement professionals.**

**By: Ben Wilson**

The government shoulders a significant responsibility in procuring products, a critical endeavor that propels agencies towards fulfilling their mandates and serving citizens. With the enactment of the Build America, Buy America Act, there is a renewed emphasis on onshoring spending within the United States, necessitating government agencies to allocate more funds to products and supplies that were traditionally offshored for cost savings.

Procurement officers are now tasked with the challenge of onshoring purchasing, a move that inevitably raises prices due to the premiums associated with domestic production and decreased supply for procurement. In light of these changes, the time is now for procurement offices to reevaluate their strategies as the conventional closed bid procurement process falls short in optimizing results for agencies. To address this, A&M has introduced a three-part series that delves into the application of game theory to government procurement.

Starting with ***A New Paradigm for Public Sector Procurement with Vickrey Second Price Acquisitions***, we dismantle the limitations of traditional closed bid acquisition formats and unveil the innovative potential of the Vickrey second price format to slash bid prices. In our second installment, ***The Power of Proposal Reduction with Combinatorial Clock Acquisitions***, we explore the innovative use of Combinatorial Clock Acquisitions (CCAs), showcasing their unparalleled ability to streamline government procurement processes and amplify efficiency. Culminating the series, ***Hidden Bias: Rate Discounting and Its Distorting Effect on Contract Award Equity*** offers a critical examination of the subtle interplay between game theory and behavioral decision-making, revealing the hidden cognitive biases that are inadvertently tilting the scales in government contract awards.

This series aims to equip procurement officers with innovative strategies to navigate this new terrain with a promise of curbing costs and amplifying contract allocation efficiency, providing agencies with a robust tool for stretching their budgets and ensuring they receive the greatest value for their investments.

# The Power of Proposal Reduction with Combinatorial Clock Acquisitions

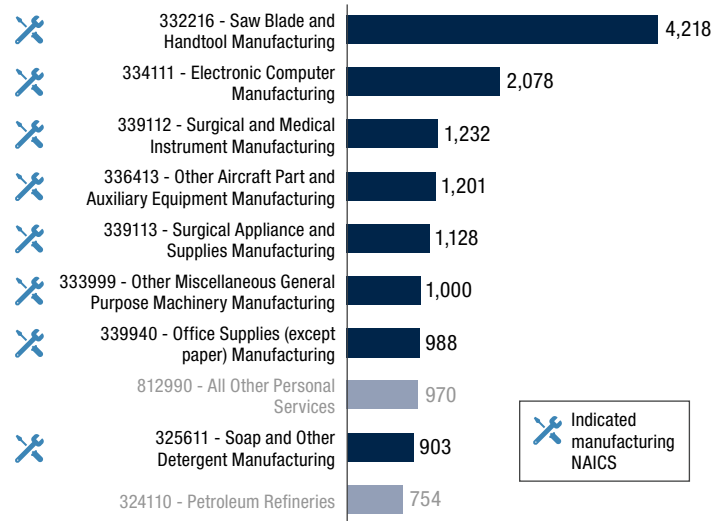
Estimated Time to Read: 6-8 minutes

The first part of this series, ***A New Paradigm for Public Sector Procurement with Vickrey Second Price Acquisitions***, introduced an innovative approach to public sector procurement using the Vickrey model. While this method can reduce government contract costs, it does not minimize acquisition frequency. Embracing an approach that consolidates government bids would enhance procurement efficiency by reducing redundant acquisitions. The mechanism to achieve this is Combinatorial Clock Acquisitions (CCAs).

## Efficiency Through Synergy

Traditional acquisition formats have another drawback: they are limited to one acquisition at a time. This poses challenges to the federal government, which handles over 250,000 contracts<sup>iii</sup> annually, requiring significant time and resources for each acquisition of products. Government contract vehicles aim to reduce participants for each task order, and Vickrey formats align contractors, government and prices, but neither handle bidding on multiple items simultaneously. Combining items in single bids offers cost savings via economies of scale to contractors, translating to lower government prices. For manufactured products as one example, bundling contracts improves alignment of comparable items, reduces costs and potentially limits contract cancellations as economies of scale provide superior manufacturers price competitiveness (see Figure 1 of top 10 North American Industry Classification System (NAICS) by terminated contracts from 2019-2023).

**Figure 1 - Top 10 NAICS by Federal Government Contracts Terminated 2019-2023**



Source: Deltek FPDS Report

## Introducing Combinatorial Clock Acquisitions

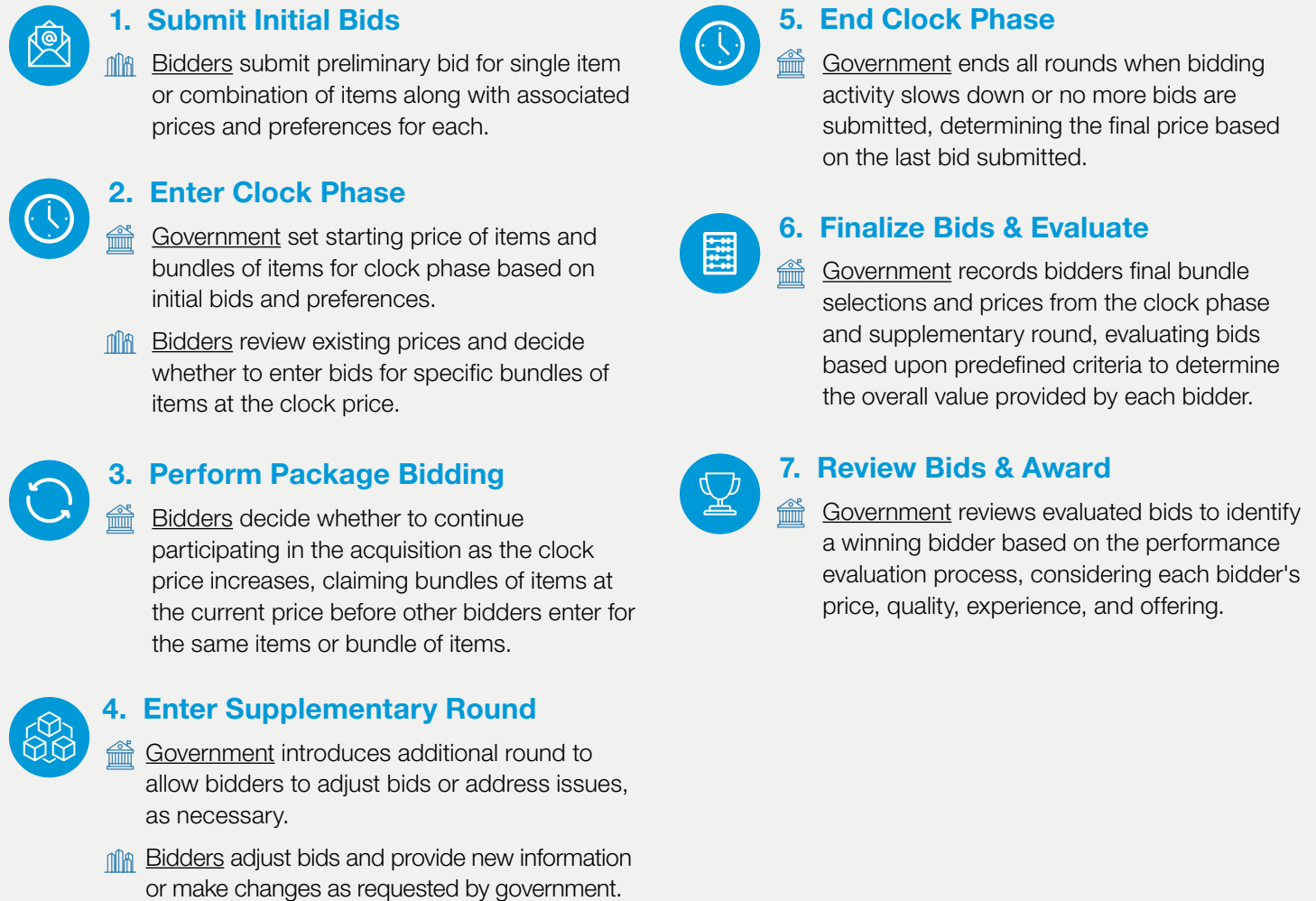
Multi-round procurement formats entail participants submitting iterative bids across rounds, enabling adjustments based on changing information to better determine the best value for the government. Popularized in public sector for spectrum, multi-round spectrum procurements were pioneered by Congress in 1993, generating \$230 billion<sup>iv</sup> over the past 30 years and earning two Stanford academics a Nobel Prize<sup>v</sup>.

A CCA is a specialized **multi-round format for allocating interconnected products**, focusing on substitute and complimentary contract bundles. "Combinatorial" refers to participants bidding on item combinations that share traits or benefits, enabling the consolidation of bids simultaneously within the procurement process. For instance, a manufacturer producing screws and nails benefits from a joint contract due to economies of scale, a significant benefit to agencies navigating the increased cost complexities stemming from the Build America, Buy American act. The "clock" element signifies changing prices, wherein bids are accepted each 'round' until bidders exit, guiding efficient allocation. This dynamic provides the government with accurate pricing and participants with a straightforward method to express preferences for contract bundles, promoting efficiency and effectiveness in the acquisition process as emphasized in the FAR.

CCAs involve seven key stages, illustrated in Figure 2. Starting like a standard procurement, bidders in a competition **submit initial bids** for bundles of products based upon their preferences. This provides the government with demand information for the **Clock Phase**, where the government establishes initial prices. Bidders subsequently decide whether to participate in each round, thereafter, guided by the changing prices. Here, a Vickrey format is used to incentivize participants

to bid their true value, as elaborated in **A New Paradigm for Public Sector Procurement with Vickrey Second Price Acquisitions**. Participants can then **package bids**, adjusting offers and prices based upon the substitute or complimentary product bundles. **Supplementary rounds** are introduced as necessary for participants to refine bids in response to government questions and the **Clock Phase ends** with the clearing price established for individual or bundled contracts. **Finalization and evaluation of bids** is performed by the government as part of the source selection process, where technical evaluation is conducted to **review bids** holistically, considering factors beyond price, to determine the winner<sup>vi</sup>.

**Figure 2 - Combinatorial Clock Acquisition Stages**



There are five key benefits to utilizing the CCA format:

- 1. Efficiency:** CCAs allow for the simultaneous auction of multiple items, saving time and resources for the government in reducing the number of bids for the same items.
- 2. Price Discovery:** The format helps the government discover the true market value of the items and item bundles through competitive bidding.
- 3. Flexibility for Bidders:** Bidders can express their preferences for combinations of items, leading to more satisfied winners and potentially lower per item costs for the government.
- 4. Transparency:** The process creates transparency for the government, reducing the risk of corruption and ensuring fair competition amongst bidders.
- 5. Optimal Allocation:** Items are more likely to be allocated to the bidders who can deliver the product at the best value to the government, leading to an efficient outcome.

## Navigating CCA Hazards

Governments considering CCAs must recognize **complexities and pitfalls to avoid**, including: 1) participants dictating contract allocation, 2) emergence of monopolies, 3) price manipulation, and 4) unacceptable price ranges.

**Firstly**, participants can materially influence contract allocation within CCAs, leading to collusion in the bid or post-award process for more favorable outcomes beyond a fair and reasonable price. Governments can minimize this by disallowing participant communication and implementing post-award surveillance for unusual patterns. **Secondly**, monopoly risks arise when bidders exploit economies of scale with large contract bundles, reducing opportunities to promote socio-economic policies. It is crucial to set limits on contracts won to deter monopolistic behavior and promote participant diversity. Measurements like the Gini coefficient aid in monitoring market power concentration. **Thirdly**, strategic price manipulation such as bid snipping (concealing true intentions until the end of the auction) may occur in early stages to shape later round outcomes. Activity rules limiting the number of bids based upon prior round activity minimize this manipulation and regulates ethical conduct. **Lastly**, maintaining acceptable price thresholds is critical. The government should use initial round bids to set reserve prices for individual and bundled items, serving as limits to verify contracts remain within an acceptable threshold.<sup>vii</sup>

## Embracing CCA Efficiency

**CCAs excel in scenarios** where contract awards for products factor in numerous considerations and bundling substitute or complimentary items is advantageous to both government and contractors. Diverging from a Vickrey format, the goal is not restricted to selecting the lowest bid, but to stimulate price competition across item bundles while considering diverse product elements. CCAs introduce an innovative procurement approach, offering the public sector a robust framework to reduce the number of proposals. Leveraging multi-round formats and practical strategies, CCAs can revolutionize the procurement process. As the public sector evolves, CCAs offer a pathway to efficient procurement practices. By adopting CCAs, the public sector is embracing innovative acquisition practices that are in line with the FAR's objectives of improving efficiency, promoting competition, and ensuring the responsible use of taxpayer funds.

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## Appendix: Sources

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