Application of Prediction Markets for Cost and Risk Assessment in Defense Acquisition Programs

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Motivation/ Problem

Historically, Defense programs for weapons acquisition have taken longer, cost more and delivered fewer quantities and capabilities than planned.

❑ Lack of discipline in estimation; unrealistic expectations
❑ Initial estimates "anchor" expectations
❑ Cost Models not sensitive to non technical events like attrition, funding volatility, etc
❑ Of 23 programs assessed in GAO report 2006, 10 expecting development cost overruns greater than 30%

Objective:

❑ Determine feasibility of implementing prediction markets to surface potential program risks, and generate cost /schedule estimates as a supplement to existing estimation methodologies.

Research Questions:

❑ How can prediction markets influence decision making in general?
❑ What are the design principles for implementing prediction markets?

A New Approach: Prediction Markets

What are Prediction Markets?
Prediction markets are speculative markets that provide an environment for traders to buy and sell contracts whose values are tied to uncertain future events.
An effective way to capture knowledge and utilize collective intelligence of all team members

Companies Using Collective Intelligence Software
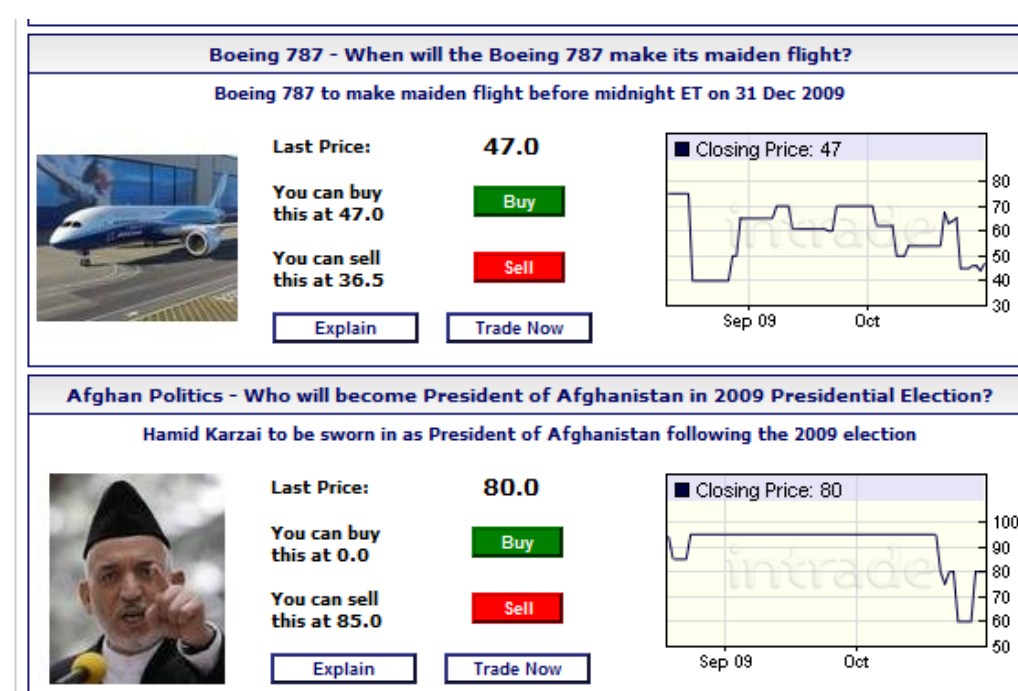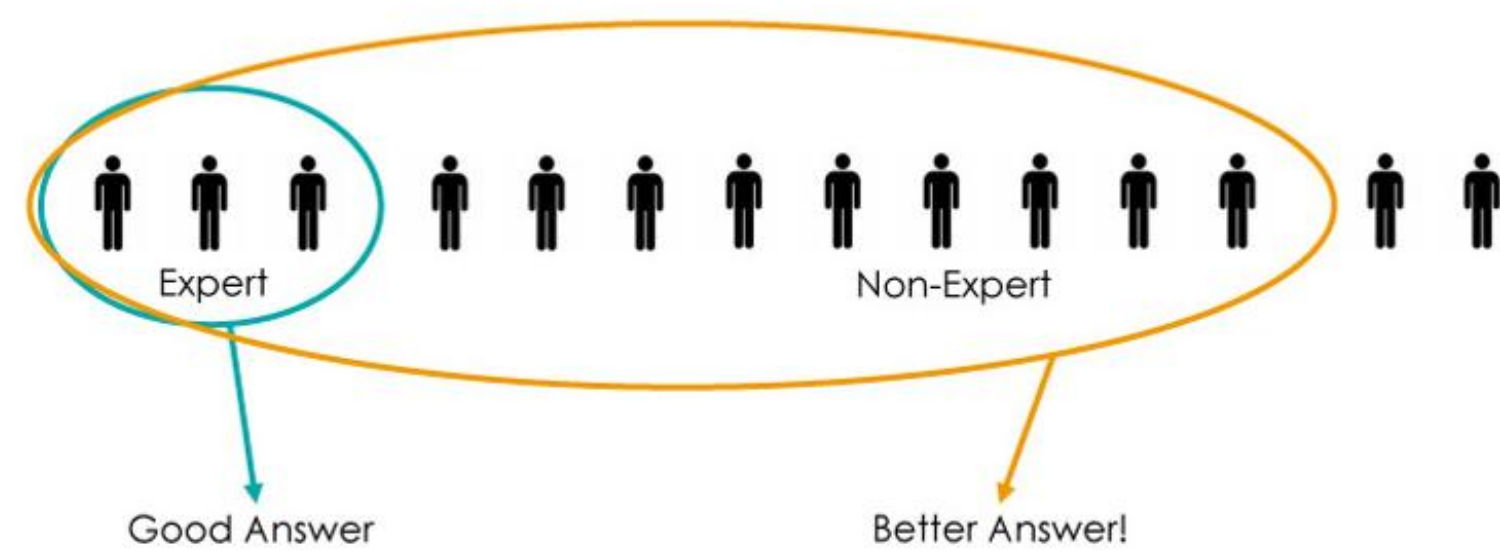
Case Study

Designing Prediction Market for Shallow Water Combat Submersible (SWCS)

Establish set of questions for all participants and run prediction market for 3-6 months

❑ **First-Order Questions**: Questions against which trading will be done. Will provide Information about the program of Interest.

- SWCS is a planned replacement to the MK 8 MOD 1 SEAL Delivery Vehicle.

Conceptual View

IOC FY 14
FOC FY 16

❑ **Second-Order Questions**: Will provide Information about traders and trading process.

❑ **Third-Order Questions**: Will provide Information On behavior of participants outside Prediction Market.

Perceived benefits to SWCS:
❑ SWCS will benefit from the prediction markets event forecasts.
❑ increased involvement of the participants in anticipating events.
❑ information can also help SWCS identify informal information channels in their organization.

Collaboration with MITRE to share best practices: Hanscom Air Base

Existing Estimation techniques and Prediction Markets

Probable limitations of existing cost methods:

> Cost Estimating Relationships (CERs) based on technical factors rather than programmatic "soft" factors

> Not dynamically updated as a program evolves, making the original estimate outdated as soon as the climate changes

> Manifestation of a few decision makers, under tremendous time pressure, working with limited and perhaps biased information.
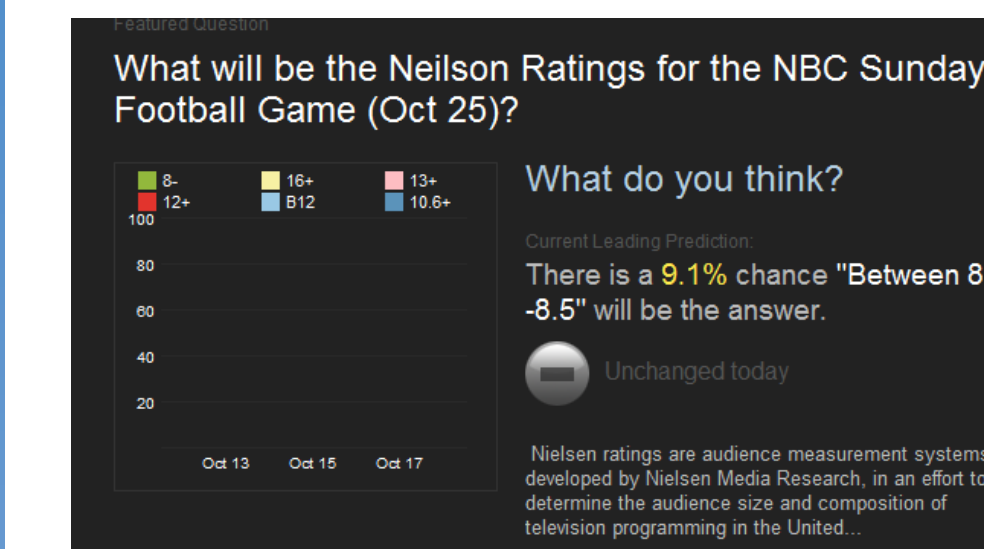
Possible value propositions of Prediction Markets:

> Shift of focus from estimating by individuals to groups

> Provide way to leverage information from diverse sources

> Mitigate biases stemming from pressure to 'price to win' or hide damaging information

> Enable frequent sampling of information

> Incentivize traders to seek out quality information that will help them do better

Preliminary Observations

Some General Design Principles:
❑ Should require unbiased tacit knowledge of crowd
❑ Should be designed in well- incentivized environments
❑ Should be designed for a non – hierarchical environment
❑ Should have well defined end dates or closing criteria
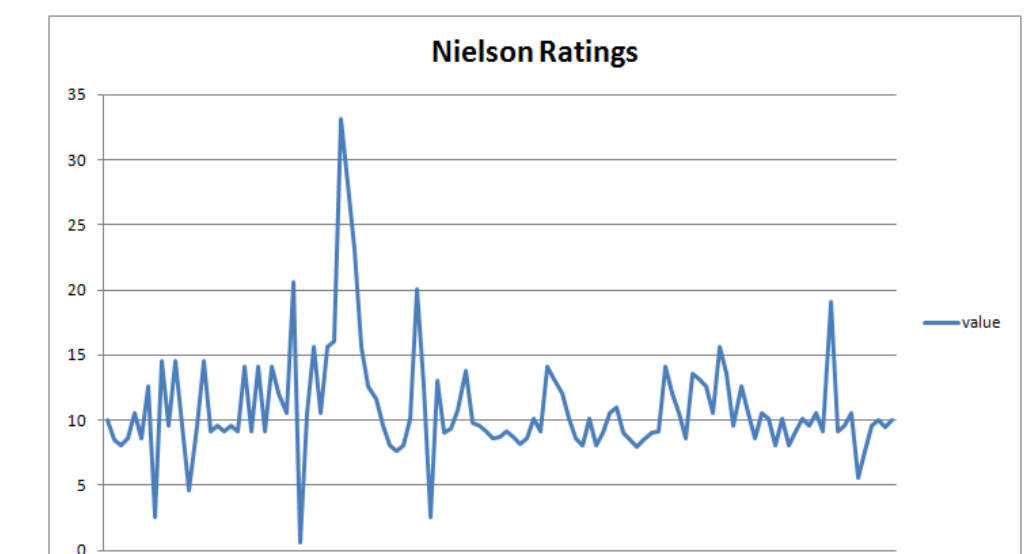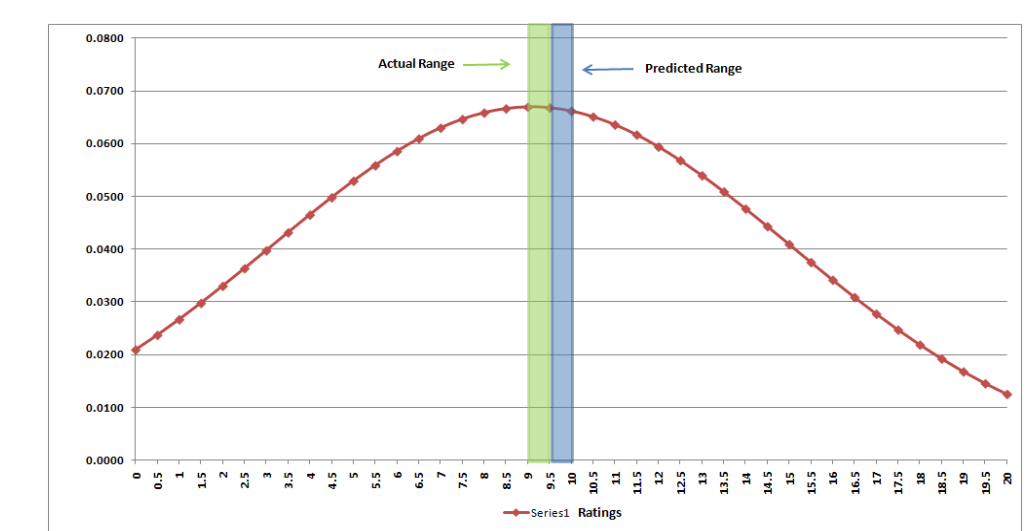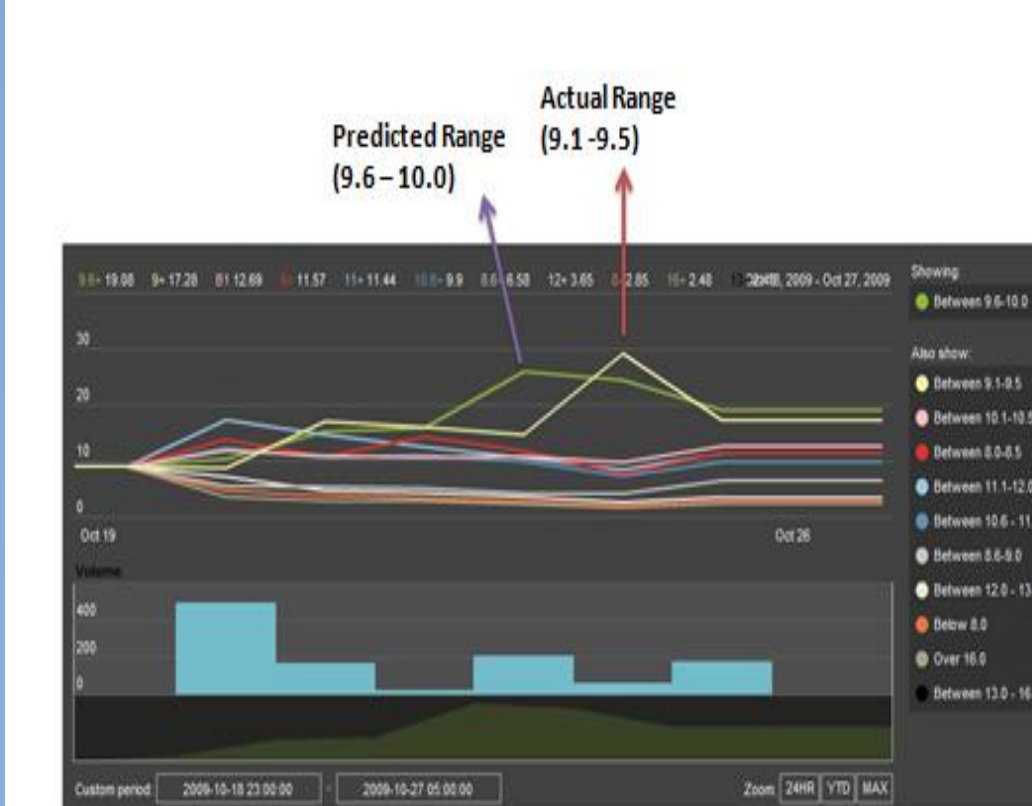❑ Choices should be mutually exclusive and have a definitive outcome

Behavioral Observations from Pilot Simulation runs:

❑ Increased participation due to Internal competition
❑ Attempts at market gaming
❑ Trying to make use of First mover advantages
❑ High incentive to participate led participants to gain more knowledge on the subject.
❑ Use of statistical models by some participants to forecast ratings

Other Observations:
❑ Markets should be less volatile
❑ There should be new developments or information flow update during trading cycle
❑ Incentives should be aligned with participants' interests