

# Remarks on Election Integrity

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# Outline

- 4 Goals
- 4 Challenges
- 4 Principles
- 4 Myths
- 4 Tools
- Example: hypothetical NH post-election audit

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- **4 Goals**
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Goal 1/4

**Improve Security.**

Goal 2/4

**Outcomes that are correct.**

Goal 3/4

Outcomes perceived correct.

Goal 4/4

Outcomes verifiably correct.

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Challenge 1/4

**Secret Ballots.**

## Challenge 2/4

**Diverse voters and elections.**

Challenge 3/4

**Adversaries!**

## Challenge 4/4

**No free lunches!**

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## Principle 1/4

**Election integrity is nonpartisan.**

## Principle 2/4

**It takes a thief...**

## Principle 3/4

**Adversaries attack weakest link.**



# Principle 4/4

**Detect and Recover.**

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Myth 1/4

**Federal certification ensures  
security.**

## Myth 2/4

Logic and accuracy testing  
ensures security.

## Myth 3/4

**“Not connected to internet”  
ensures security.**

Myth 4/4

**Decentralization ensures  
security.**

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Tool 1/4

Public verification of  
(almost) everything.



Tool 2/4

**Voter verification of  
their own paper ballots.**

Tool 3/4

**Compliance audit.**

Tool 4/4

**Risk-limiting post-election audit.**

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# Example: 2016 NH Governor

- Reported outcome:
  - 354,040 Chris Sununu
  - 337,589 Colin Van Ostern
  - 33,234 others
- Margin of victory: 2.4%
- *Comparison risk-limiting audit* compares randomly chosen paper ballots with their cast vote records until “risk limit” (e.g. five percent) is met.

# Audit

<b>Sample size</b>
<b>Errors found</b>
<b>Risk</b>

# Audit

<b>Sample size</b>	100
<b>Errors found</b>	0
<b>Risk</b>	33%

# Audit

<b>Sample size</b>	100	200
<b>Errors found</b>	0	0
<b>Risk</b>	33%	10%



# Audit

<b>Sample size</b>	100	200	300
<b>Errors found</b>	0	0	0
<b>Risk</b>	33%	10%	4%

# Audit

<b>Sample size</b>	100	200	300
<b>Errors found</b>	0	0	0
<b>Risk</b>	33%	10%	4%

Examining only 300 randomly-chosen ballots  
(out of 724,863 cast) achieves our “risk limit” of 5% !

# References

- Stark, P.B., and D.A. Wagner, 2012. [Evidence-Based Elections](#). *IEEE Security & Privacy*, 10, 33–41.
- Lindeman, M. and P.B. Stark, 2012. [A Gentle Introduction to Risk-Limiting Audits](#). *IEEE Security & Privacy*, 10, 42–49.

The End

Thanks for your attention!