The Importance of CPS Testbeds

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Samuel Cody's tree
RAE Farnborough England 1908
Used to measure biplane thrust

CPS and CPS projects are diverse and there are multiple approaches and combinations of approaches:

- Experiment; design and build prototype
- Simulation; model and analyze results
- Theory; analysis of models and algorithms

Purposes of testbed

In general,

- Engage with realistic physical and engineering constraints
- Move towards application
- Educational to build testbed

In particular,

- For experiment: test prototype
- For models, ensure science basis;
  verify or find gaps in models
- Practical realization of an invention
  is needed for patents

Testbed concept is more straightforward for devices than systems

Testbeds are not limited to testing in hardware of prototypes

For some problems,

- established models or detailed simulations designed for the problem at hand can serve as testbeds… these can be chosen with reference to expert opinion in the field, or with a differing and wider interdisciplinary CPS view.

- can use observed real data instead of a physical testbed

Cautionary and hopefully atypical examples and consequences of wrong use of testbed

- Testbed is insufficiently close to reality to be effective
- Theory or software unrelated to system because models are wrong and not tested before or currently
- Testbed is too expensive relative to benefit … waste of funding on testbeds that are only marginally useful
- Physical testbed not necessary because models are sufficiently established for that problem, and detailed simulation is much cheaper and more effective.
- Cannot fund new ideas because testbed required too soon
- Jail – it is (rightly) illegal to experiment and test directly on some critical infrastructures

Concluding remark

Needs driving testbeds are real, but these needs should be satisfied efficiently, individually, and flexibly for each project

DISCUSSION?