

Assurance Optimization

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Assurance Optimization Goals

The selection of assurance activities such that:

For a given set of resources
(time, budget, personnel, test beds, mass, power, ...)
benefits are maximized

or

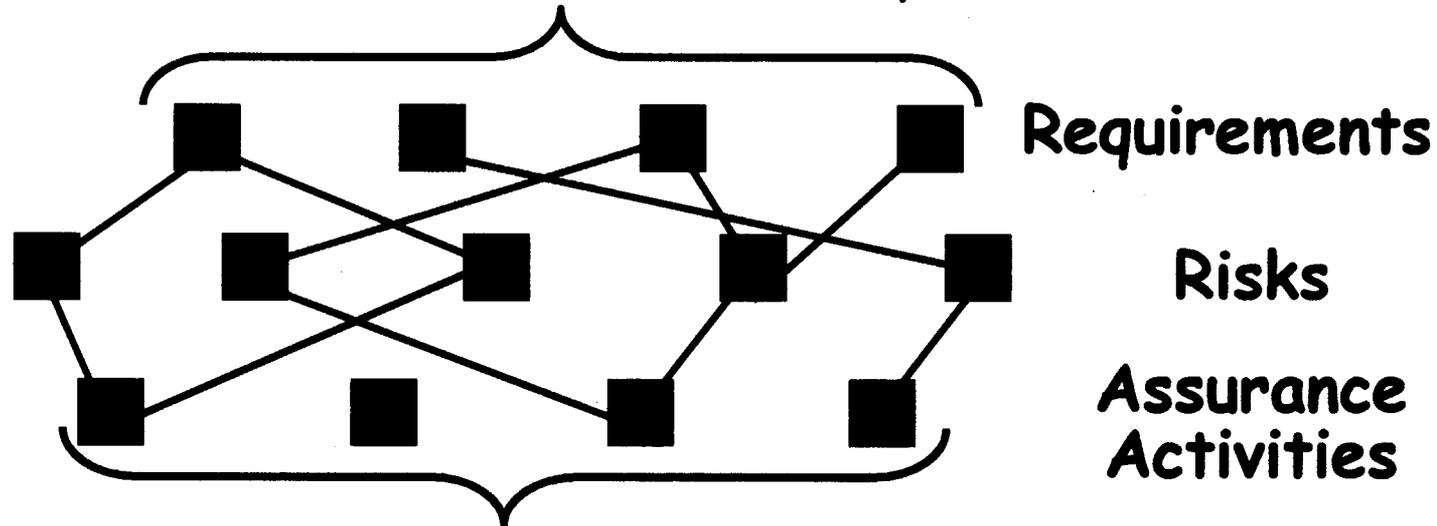
For a given set of objectives
(science return goals; on-time and in-budget
development; 99+% expectation of successful landing)
costs are minimized.

What's Needed to do Assurance Optimization

1. A model to calculate assurance costs & benefits - we use Defect Detection and Prevention (DDP)
2. Data to populate the model - we populate with metrics from experience (when available) augmented with experts' best estimates
3. Optimization over the model - we use Menzies' TAR2 treatment learning system (also exploring use of genetic algorithms)

1. DDP Cost/Benefit Model

Benefits = Σ attainment of requirements

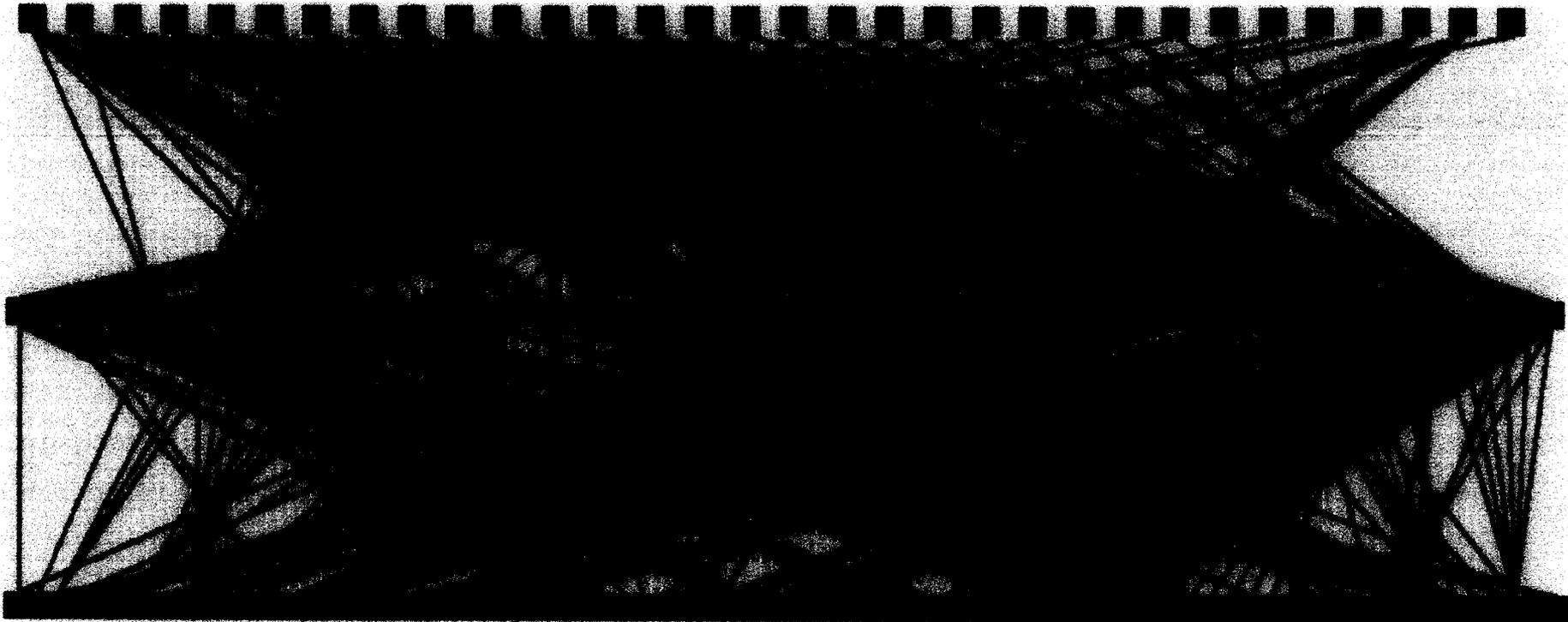


Costs = Σ costs of selected assurance activities

Model holds *quantitative* measures of:
How much each risk impacts each requirement, and
How much each assurance activity reduces each risk.

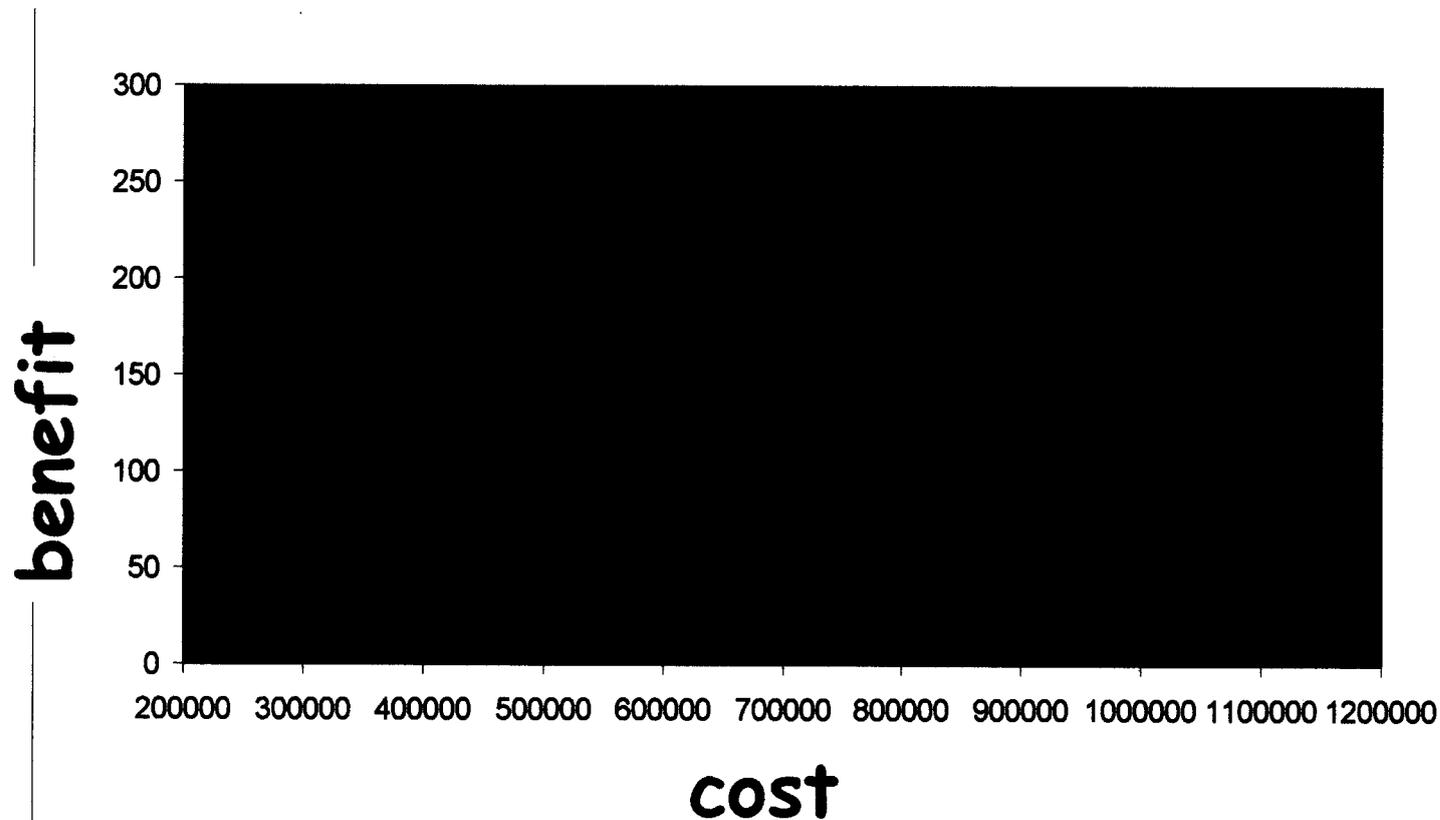
Risks are crucial intermediaries in the model -
requirements impacted by risks to differing extents
assurance activities mitigate risks to differing extents

2. A Populated DDP Dataset (Real Data from Experts)



32 requirements, 69 risks, 99 assurance activities
352 non-zero quantitative requirement-risk links
440 non-zero quantitative assurance-risk links

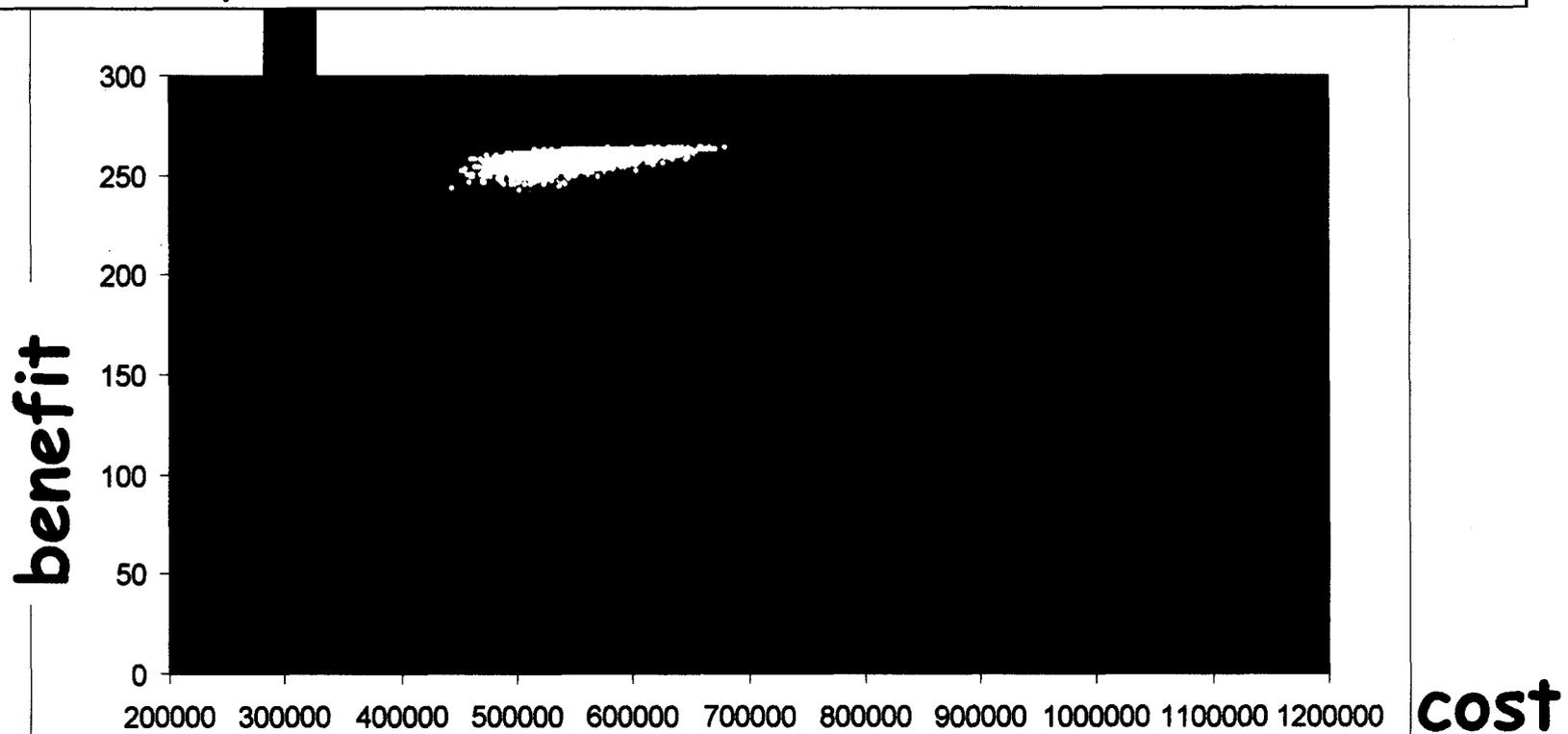
Dataset *before* Optimization



Each black point a randomly chosen selection of dataset's assurance activities. DDP used to calculate **cost** and **benefit** of each such selection.

3. Dataset *after* Optimization

Each white point is an optimized selection of dataset's assurance activities (33 critical ones are as directed by TAR2, other 6 chosen at random).



Menzies' TAR2 identified 33 most critical decisions:
21 of them assurance activities to perform
12 of them assurance activities to *not* perform.

Assurance Optimization *for more information:*

Defect Detection and Prevention (DDP):

- <http://ddptool.jpl.nasa.gov>
- Steven.L.Cornford@Jpl.Nasa.Gov
- Martin.S.Feather@Jpl.Nasa.Gov

TAR2 (treatment learner used here for optimization)

- Tim Menzies: email: tim@menzies.com