

QUANTITATIVE RESOURCE ALLOCATION MECHANISMS: EXPERIMENTAL ANALYSES

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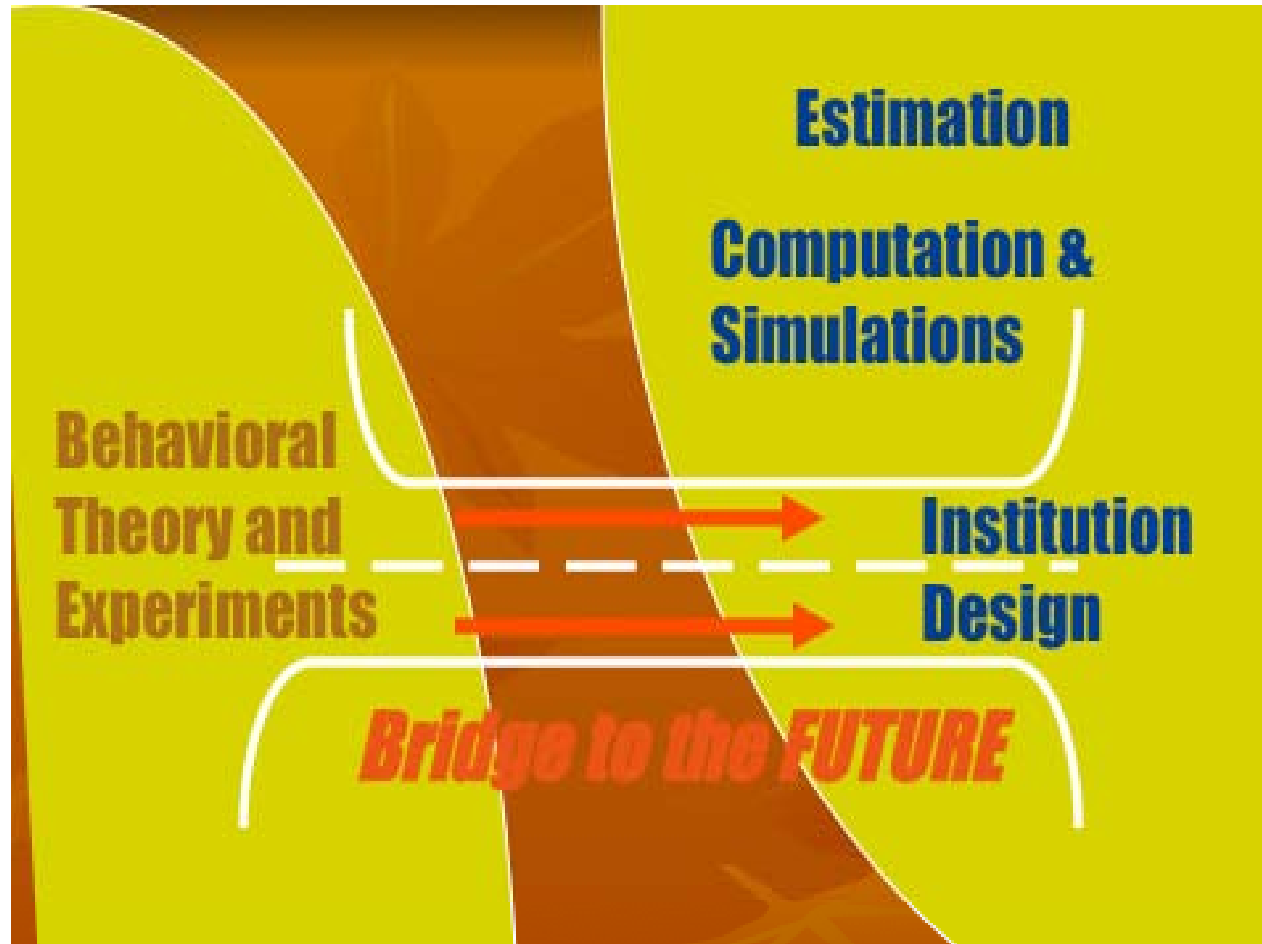
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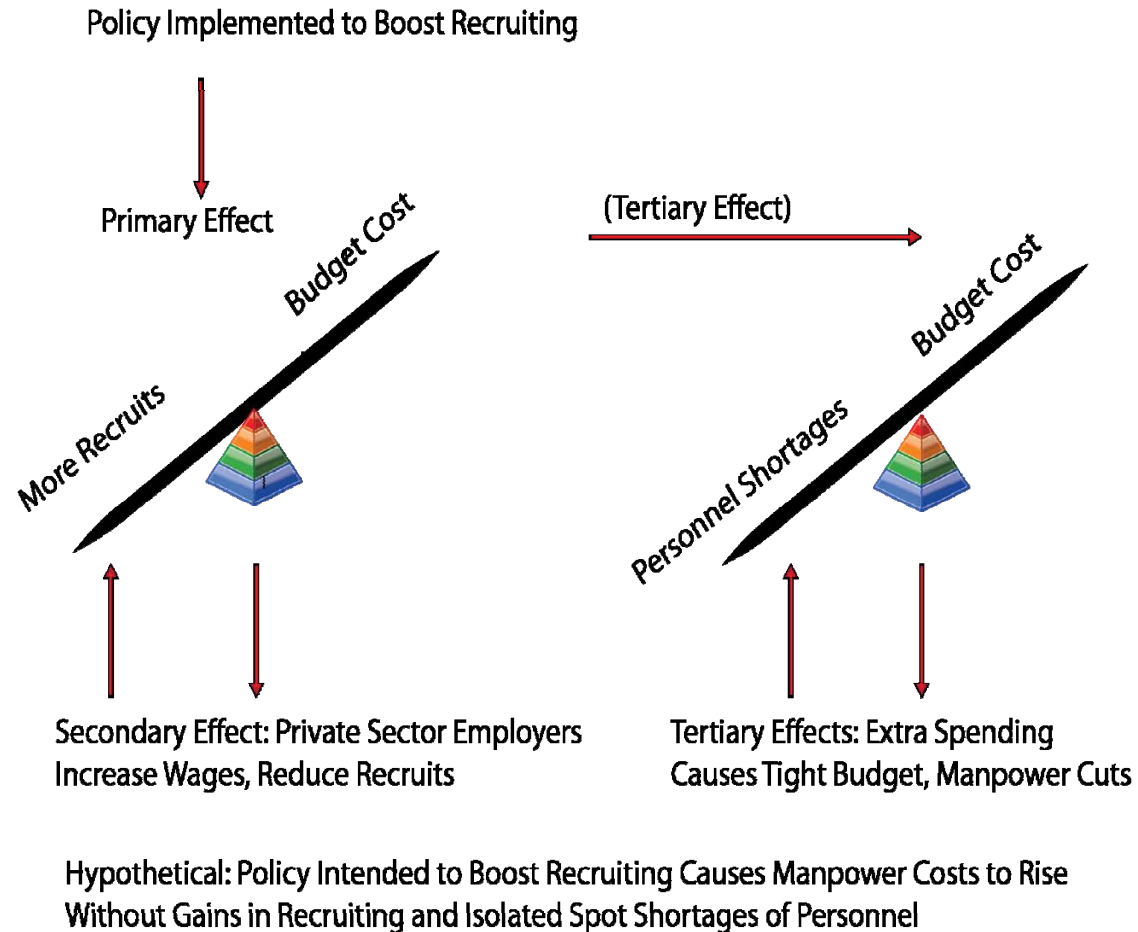
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Experiments: A Key to Institution Design



Why experiment?



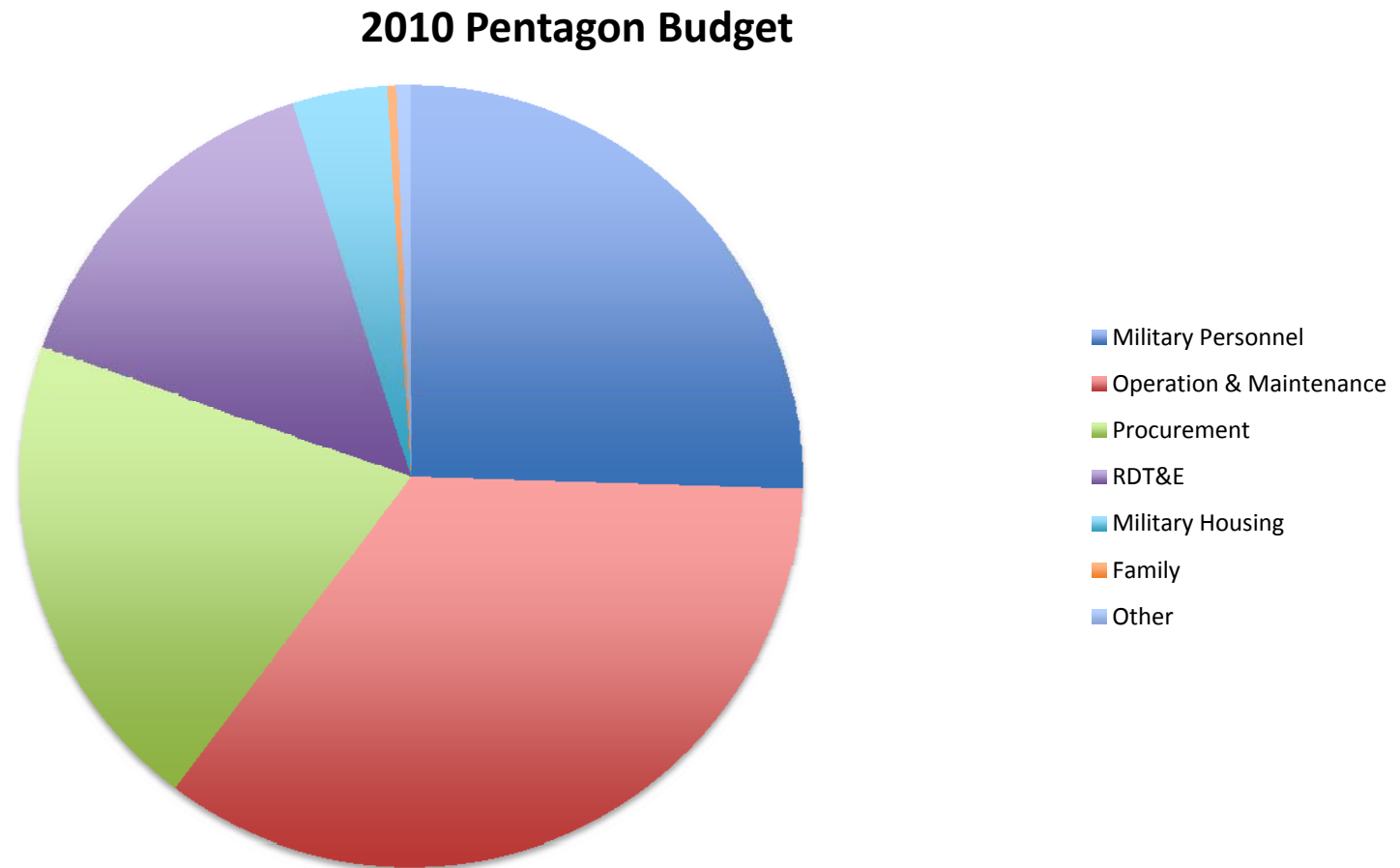
Practical Applications of Experimental Markets

- At ICES, we have used experimental markets to model:
 - Electricity
 - Health care
 - Fisheries
 - Water markets
 - Natural gas
 - Labor Markets



THE NPRST “RAILS” PROJECT: QUANTITATIVE INVESTIGATIONS OF RECRUITMENT AND RETENTION POLICIES

FY'10 Budget: \$133B for Personnel Costs



MORS/OSD Conference January 25-29,
2010

Maybe More ...

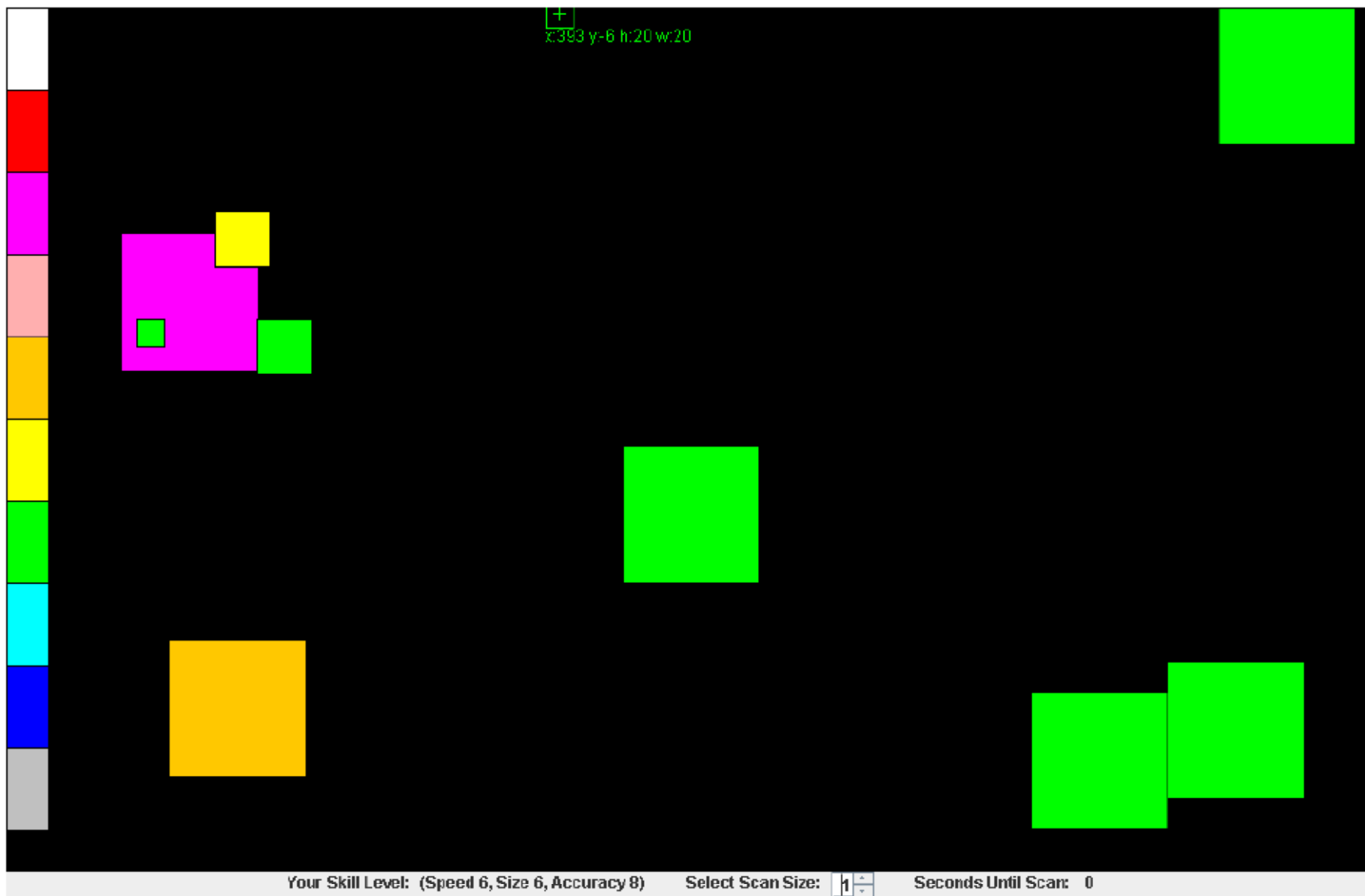
Line Item	Agency	Amount (billion)
1. Active Association Direct Costs		
Military pay	DoD	\$117.6
Retirement benefits	DoD	23.7
Retiree health benefits	DoD	10.7
Miscellaneous benefits	DoD	13.1
Defense Health Program	DoD	28.0
2. Passive Association with Military		
Military health care	DoD/VA	21.0
VA entitlements	VA	56.9
3. Indirect Personnel Costs		
Single housing	DoD	1.8
Family support	DoD	9.2
Transportation	DoD	11.8
Subsistence of persons	DoD	1.2
Communications/utilities	DoD	6.2
TOTAL		\$301.1

Source: Jim Arkedis, Progressive Policy Institute memo 11/2009

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Key Design Requirements

- Real work environment
- Team and individual production
- Mimic dynamics of competitive recruiting environment, including competition with civilian sector
- Heterogeneous human skills
- Flexible decision architectures
- Ability to nest the environment within different pension schemes



Commander Job Posting Screen

Current Manpower						
Staff	Skill			Wage	Score %	Periods Left
25	1	2	1	15	0	1
9	3	3	4	28	0	1
11	4	3	5	32	0	1
21	5	6	7	47	29	1

Postings							Available Personnel				
Position	Minimum Skill			Wage	Bonus	Duration	Staff	Skill			Score
2	2/9	2/10	2/9	24/76	0/0	Actual/Target	4	2	2	1	0
1	1	1	1	12	0	1	6	2	3	2	0
2	1	1	1	12	0	1	8	3	3	3	0
							10	3	4	4	0
							12	4	5	4	0
							16	5	5	5	29
							18	6	5	6	0
							22	5	6	7	29

Post

Reset

Commander Ranking Screen

Position 11		5	5	6		
Rank	Staff	Skill Required			Score	Team Score
	18	6	5	6	0	0
	22	5	6	7	15	0

Reset Ranks

Position 12		4	5	3		
Rank	Staff	Skill Required			Score	Team Score
	12	4	5	4	0	0
	16	5	5	5	15	0
	18	6	5	6	0	0
	22	5	6	7	15	0

Reset Ranks

Submit Ranks

Sailor Ranking Screen

Job Postings											
			Current Skill:		6	5	6				
Rank	Location	Adjustment	Bonus	Score	Skill Required			Skill Improvement			Duration
	A	-10	0	31	5	5	6	1	0	1	2
	A	-10	0	31	4	5	3	1	0	1	2
	B	-20	0	0	1	1	1	1	0	1	2
	C	0	0	0	1	1	1	1	1	0	2
	B	-20	0	0	1	1	1	0	1	1	2
	B	-20	0	0	1	1	1	1	0	1	2
	C	0	0	0	1	1	1	1	1	0	2
	C	0	0	0	1	1	1	0	1	1	2

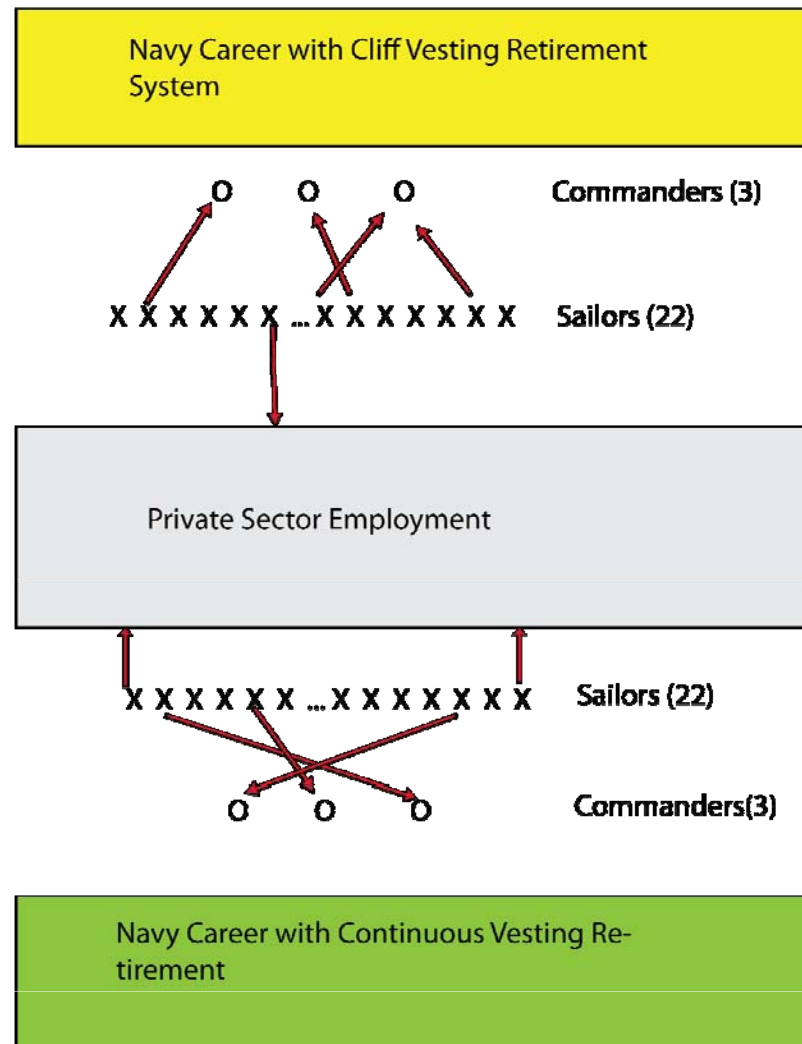
Reset Ranks

Submit Ranks

Periods to Pension	5
Navy Pension	0
Periods to Retirement	5
Navy Wage	67
Civilian Wage	$(50 + 67) \times 88\% = 102$

Quit The Team!

Cliff Vesting Versus Continuous Vesting Scenarios in NPRST Rails



“Wind Tunneling” Algorithms

- Current software uses well-studied “Greedy Algorithm”
 - Similar to professional sports draft model
 - Each commander takes turns selecting best pick until all candidates are matched.
- Many other algorithms are possible and can be implemented easily in this environment

What We Measure At Each Match

1.	id		RequirementSkill1Billet	40.	Manpower(ship)
2.	treatment ID	21.	Commander	41.	actualWage(ship)
3.	PeriodID		RequirementSkill2Billet	42.	bonusPool(ship)
4.	JobID	22.	Commander	43.	bonusPost(ship)
5.	ShipID		RequirementSkill3Billet	44.	bonusPaid(ship)
6.	SubjectID	23.	Skill1Deficit/Surplus	45.	positions(ship)
7.	SailorRatingForJob	24.	Skill2Deficit/Surplus	46.	earnings(ship)
8.	SailorPreferenceForJob	25.	Skill3Deficit/Surplus	47.	CurrentValueofPension
9.	SailorRankofJobID	26.	Skill1Improvement	48.	PerfRatingofSailor
10.	CommanderRatingforSailor	27.	Skill2Improvement	49.	PerfRatingofShip
11.	Sailor0Skill1	28.	Skill3Improvement	50.	AssignmentExpiresInPeriodX
12.	Sailor0Skill2	29.	SalaryPostedJobID	51.	CivilianBasePay
13.	Sailor0Skill3	30.	SalaryPaid	52.	BudgetShip
14.	Commander	31.	BonusPaid	53.	BudgetNavy
	RequirementSkill1Ship	32.	adjustment	54.	BonusShip
15.	Commander	33.	pension	55.	CommanderCompensation
	RequirementSkill2Ship	34.	civilianBasePay	56.	CommanderBonus
16.	Commander	35.	perfRating	57.	NavyReadinessScore
	RequirementSkill3Ship	36.	balance		
17.	ShipSkill1Requirement	37.	careerBalance		
18.	ShipSkill2Requirement	38.	totalWage(ship)		
19.	ShipSkill3Requirement	39.	postedWage(ship)		
20.	Commander				

Let's Experiment!

- The NPRST_Rails team completed development of software, interfaces, databases, and communications for an initial study of two alternative types of retirement compensation for Navy personnel: continuous, versus “Cliff” vesting of pensions.
- We look forward to continuing this initiative!

What other questions we can explore?

- Virtually any kind of initiative can be modeled in an experimental market.
 - RAILS offers the communications and data processing capabilities to manage the transactions.
 - RAILS allows us to look at a wide variety of behavioral characteristics, measure the characteristics, assign weights to the most/least desirable and apply them to assignment decisions and experiment with effects.
 - Experiments with RAILS help us to discover causal effects

Thank You!