Tompkins EMS

A Systems Approach to Service Improvement

Stephen McCarthy sfm72@cornell.edu
Manav Lamichhane ml2522@cornell.edu

10 May 2018

Systems Approach Overview

- **What we did:**
  - Analyzed the current EMS system's response times and response rates
  - From a **county** perspective, designed ways to improve current performance through an array of possible solutions ranging from mild to extreme
  - Estimated the costs of these solutions
  - Developed a way these solutions could be phased in over time

- **What we did not do:**
  - **Provide all the answers** on how to execute each solution
  - Independently determine optimal solutions for individual districts

- **What we hope you will walk away with:**
  - Decision makers at each municipal level may **make a more informed decision** on "how far to go" with each solution by understanding the performance improvements and the associated cost for each solution increment

Cornell University
Systems Engineering

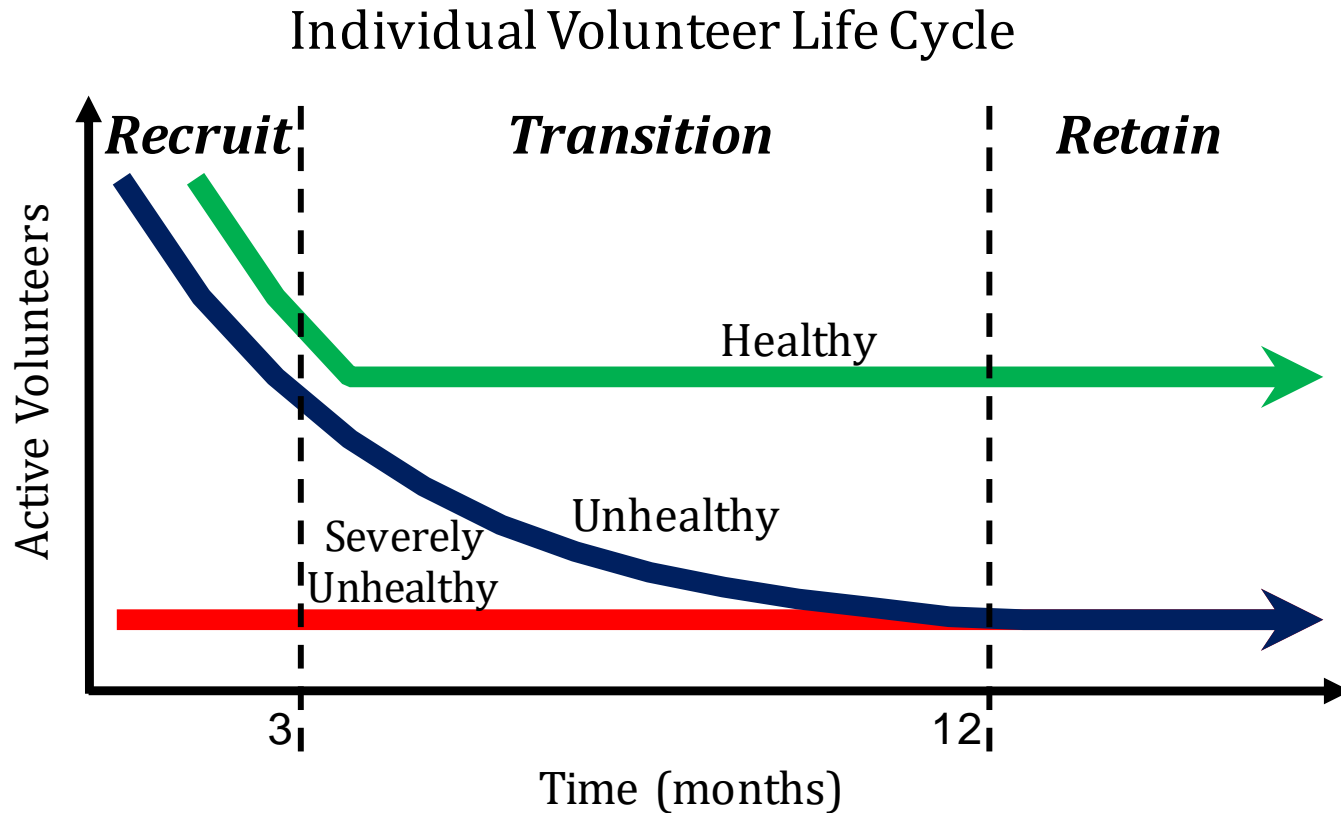# A General Model for Social Factors Affecting Volunteer Organizations

Social Factor Importance

- The current two-tier system relies heavily on volunteer organizations.

- Volunteer agencies must overcome existing barriers to recruitment and retention of volunteers to have long term reliability.

- ***This model is not quantitative, but it is more than just a "list of possibilities".***

- It is transferable to firefighting and other volunteer (or hybrid) organizations.
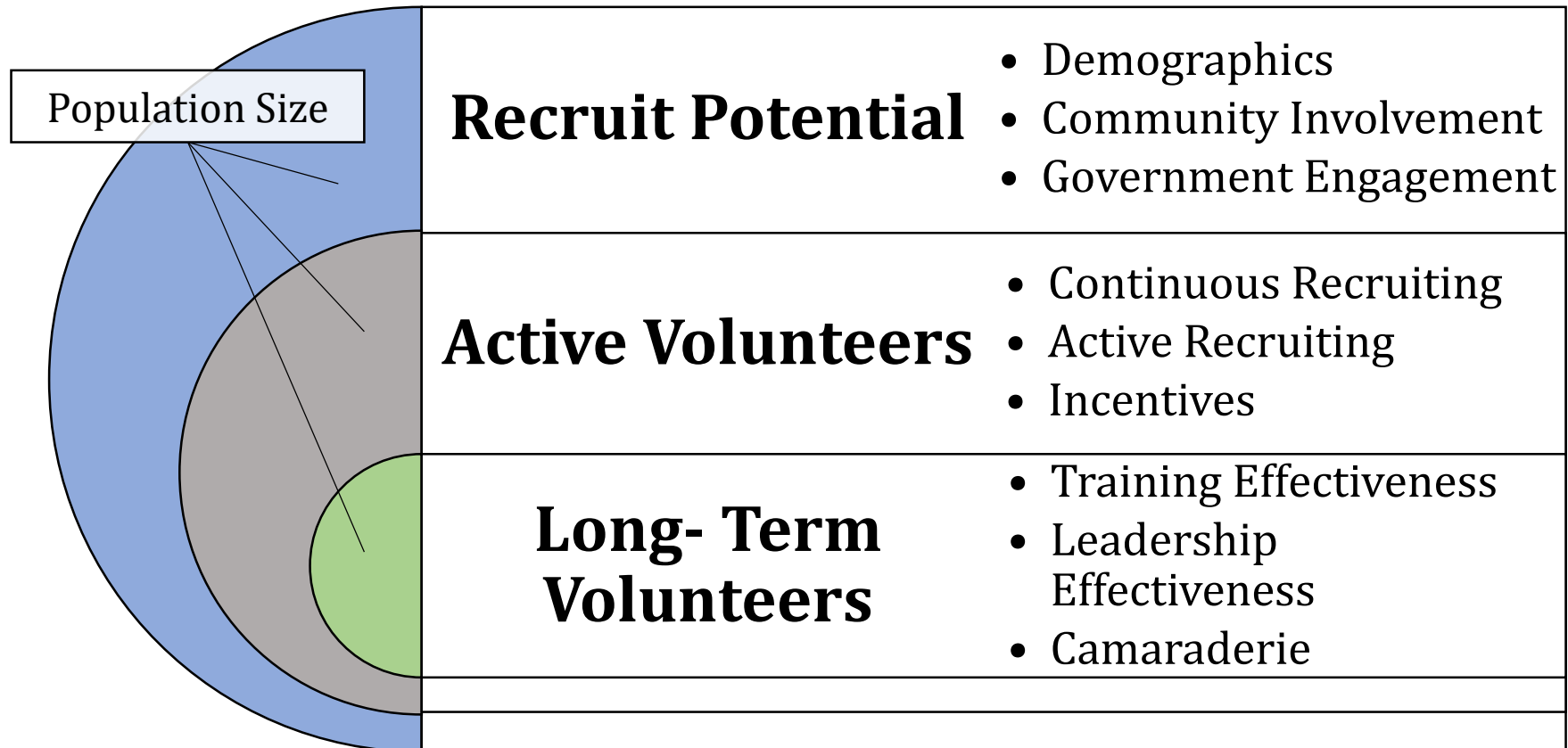
Cornell University
Systems Engineering

The Recruit to Retain Cycle

Individual Volunteer Life Cycle

- Long-term volunteers are gained and lost *after* they are recruited.

Cornell University
Systems Engineering

The Social Factor Model

Population Size	**Recruit Potential**	• Demographics • Community Involvement • Government Engagement
	Active Volunteers	• Continuous Recruiting • Active Recruiting • Incentives
	Long- Term Volunteers	• Training Effectiveness • Leadership Effectiveness • Camaraderie

▪ Shrinking populations: from those who "can" be recruited to those who will *remain in the long-term*

Social Model Take-aways

- Understand the organization's external environment and know what populations can be affected- by whom and what.

- Departments can choose any number of ways to "increase volunteerism", but they may not be the right efforts.

- Thoroughly plan recruitment efforts- have a plan for when volunteers show up.

- ***The greatest impact to long term volunteerism – training and leadership- requires little money, but substantial effort.***
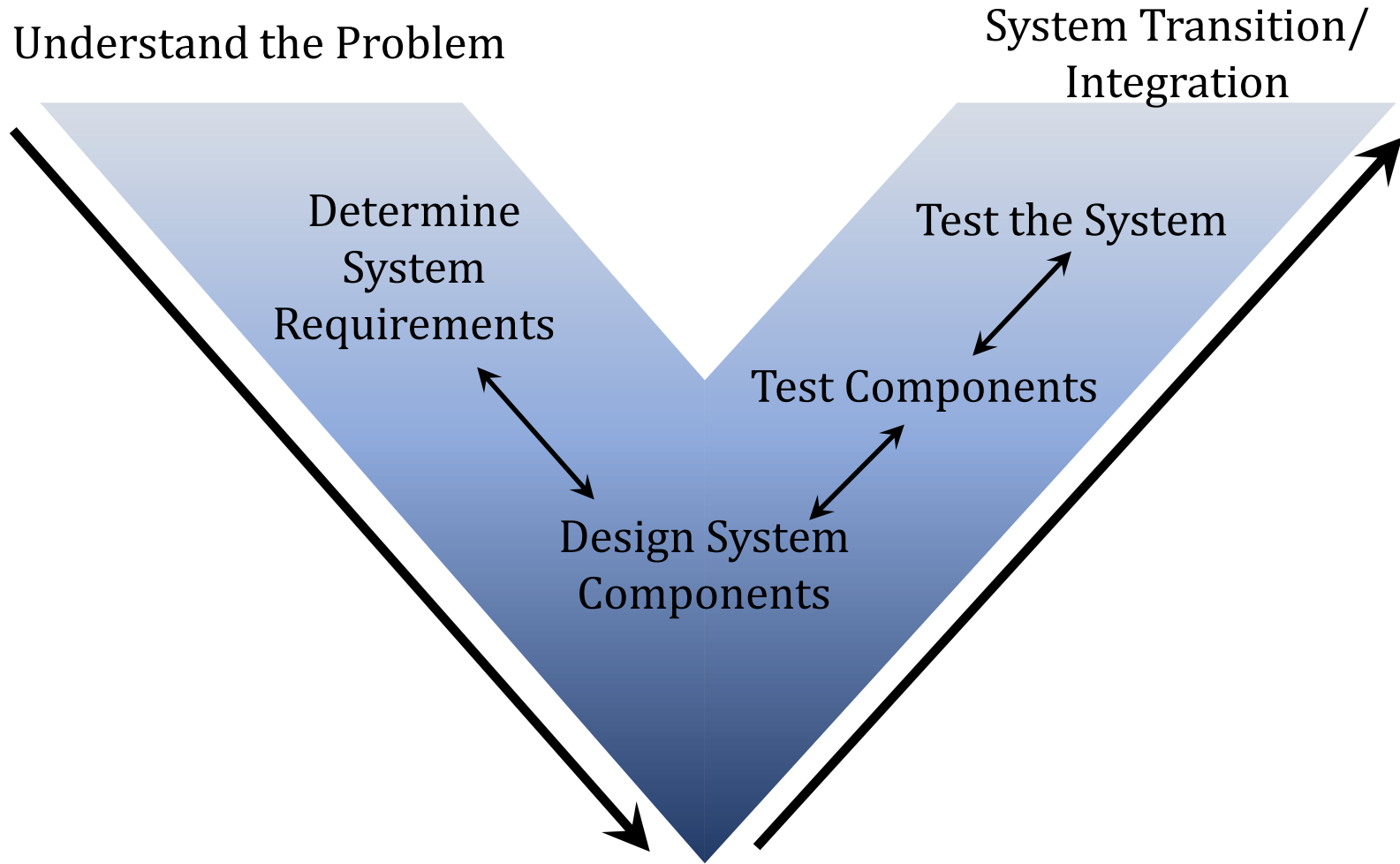
Cornell University
Systems Engineering

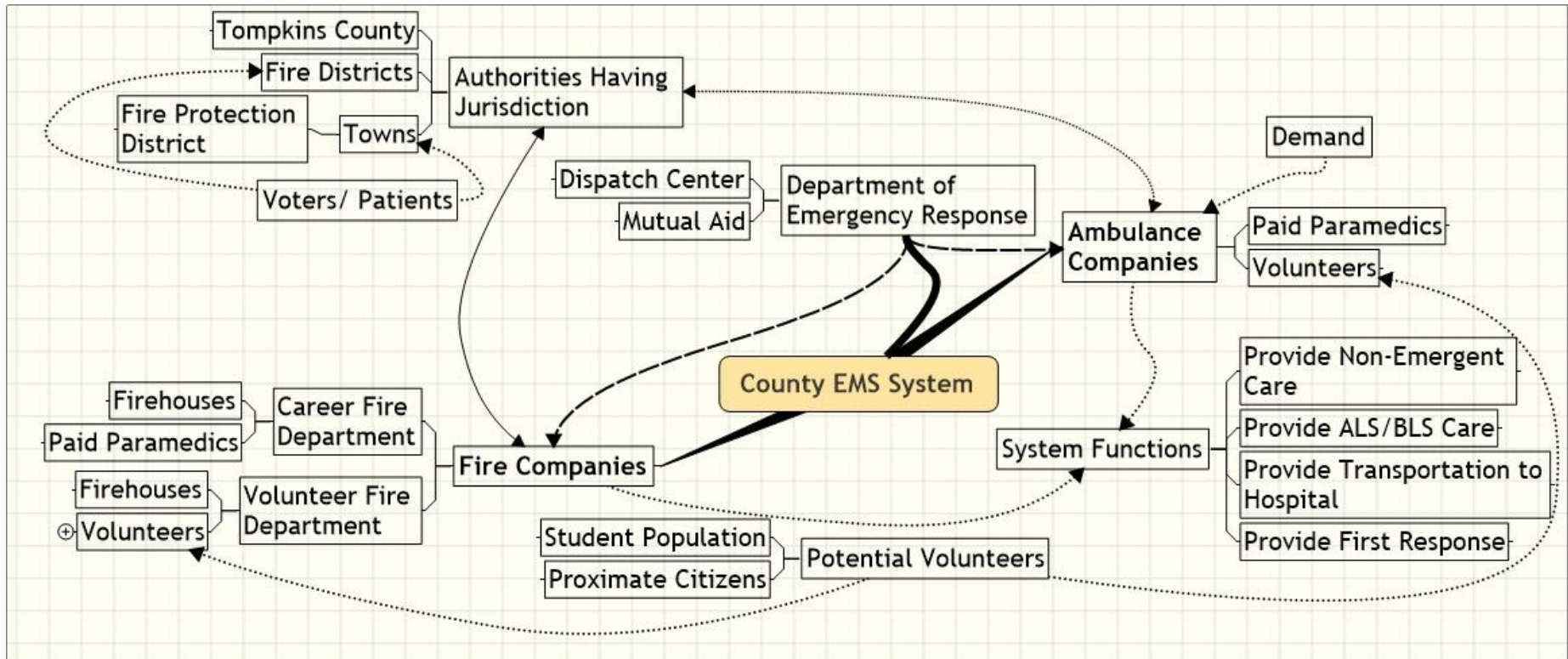# Systems Engineering Approach to Development and Testing of Solutions

The Systems Engineering Process

Understanding the Problem: Modeling the EMS System

- Numerous dependencies: some are obvious and clear; many are vague
- Each district, department, municipality, ambulance company is unique.
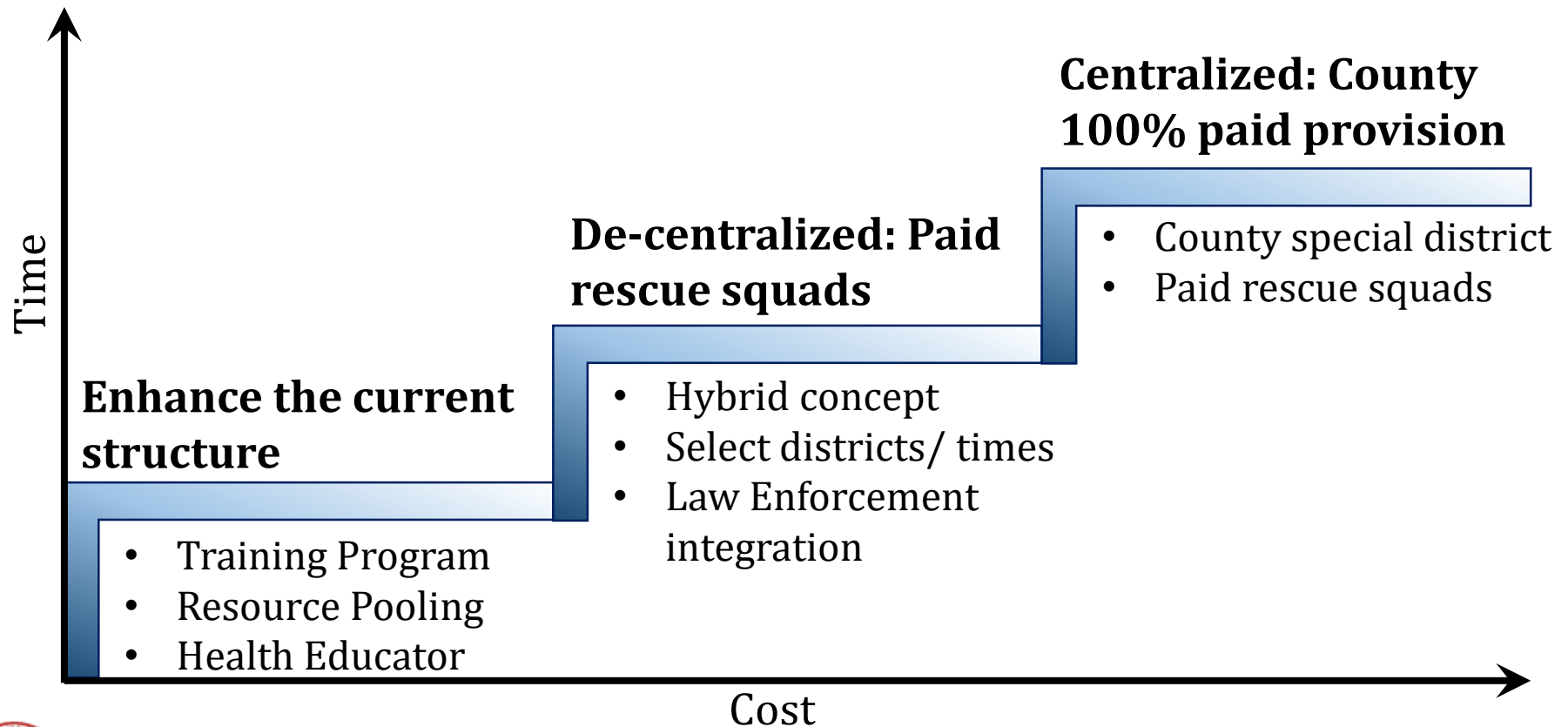
Determining Goals and Requirements

1. Make the System address acute demand failures
   - Reduce call volumes
   - ***Increase EMS supply***

2. Engage/develop and recruit volunteers
   - Recruit volunteers
   - ***Retain volunteers***

3. Optimize county EMS resources
   - People, equipment, locations, money

4. Create a shared vision for all EMS providers in the county
   - ***Standardize levels of basic service provision***

Cornell University
Systems Engineering

Incrementally Achieving Paid Provision

- Begin with mild adjustments to current structure; end with extreme changes and entirely new EMS structure
- *Reaching a "step" may be considered a "final solution" depending on decision maker desires.*

Centralized: County 100% paid provision
- County special district
- Paid rescue squads

De-centralized: Paid rescue squads
- Hybrid concept
- Select districts/ times
- Law Enforcement integration

Enhance the current structure
- Training Program
- Resource Pooling
- Health Educator

Time

Cost

Enhancing the Current Structure

1. ***County Training Program***
    - Facilitates the training and certification of all volunteer rescue squads; if desired, to execute certification at the county level

2. Resource Pooling
    - Sharing resources to capitalize on "excess first response capacity" of some districts

3. Health Educator
    - Certified EMT working in conjunction with Training Coordinator to address recurring call locations

- It is difficult to quantify how these, mainly procedural, methods will change performance measures.

- Social Factor Model- By increasing capability of volunteers, reliability of organizations (response rates) will increase.

Cornell University
Systems Engineering

Measuring System Performance

- Response time averages used as the primary measurement of service *standardization*

National Fire Protection Agency 1720 Response Time Standards (Volunteer Fire- Applied to EMS)			
Demand Zone	Demographics Population/ mi^2	Response Time (Minutes)	Applicable Departments
Urban	>1000	9	Ithaca*
Suburban	500-1000	10	Cayuga Heights
Rural	<500	14	All others
Remote	Travel dist > 8 mi.		
* Response time standard for career department is 7.17 minutes (1710-10)			

- Volunteer rescue squad first response rates used as the primary measurement of *reliability*

Calls Within District	→	911 Activations	→	Rescue Responses

Enhancing the Current Structure: Cost and Performance

- Simulated response time averages with a county training and certification program and compared results to current rates

Component	Estimated Annual Cost
Training Coordinator	$93,500
Resource Pooling*	None
Health Educator*	$16,000
Training Certifier	$96,500

Time to Implement	**3 Years**
Cumulative Annual Cost	**$206,000**
Capital Cost	**$2,000**

* Not simulated

Cornell University
Systems Engineering

Response Time Averages		
District	Current	Simulated-County Training Program
County	9.263	8.754
Brooktondale	12.566	12.396
Cayuga Heights	7.5106	7.421
Etna	12.5582	10.610
Danby	**16.5141**	12.124
Dryden-Village	8.3959	7.451
Enfield	12.2871	10.399
Freeville	12.0635	9.560
Groton	11.2887	9.760
Ithaca City/Town	7.1685	7.390
Lansing	12.6799	11.975
McLean	9.5790	9.403
Newfield	13.4188	11.982
West Danby	13.1737	11.820
Slaterville	**18.3221**	**15.646**
Speedsville	12.9843	13.151
Ulysses/T-burg	10.3662	9.047
Varna	9.6376	9.695

Law Enforcement Integration

- Potential Capability: Train law enforcement (LE) officers as EMTs and integrate LE into EMS first response network as a ***secondary responsibility***

- Potential Benefits:
  - Training police officers as EMTs increases the overall number of first responders
  - Villages/ towns that do not currently have police can adopt a model that integrates Police and EMS or Police, EMS, and Fire.

- Potential Drawbacks:
  - Police department willingness and availability
  - Law enforcement unit availability

- Cost: Aid bags, training

- Recommendation: As an added capability in those districts with LE, train officers as responders and activate on an "as available basis"

Decentralized Approach to Paid Provision

- The authority to increase paid provision and set standards of service remains at the municipal level.

1. Scalable paid provision approach- decision maker may assume as much risk as desired

2. Creates a "hybrid" rescue squad structure which supplements volunteer rescue squads

3. EMS provider must operate under a certified agency

4. Less costly and faster to implement, limited benefits – BLS provision only

Component	Estimated Annual Cost
1 Employee	$62,895
2 Employee (Peak Hours)	$125,790
4 Employee (24/7)	$251,580

Time to Implement	1-3 Years
Capital Cost	$4,000

Cornell University
Systems Engineering

Decentralized Approach to Paid Provision: Cost and Performance

- *In some cases, one paid rescue can respond in multiple districts, thus reducing cost with minimal impact to response time averages*

District	Current Response Avg	Simulated Response Avg- 24 hr Coverage	Simulated Response Avg- Peak hr Coverage	Current District/ Village* Tax Rate	Rate Increase: 4 Employee	Rate Increase: 2 Employee
County	9.263	7.1484	7.8784			
Brooktondale	12.566	8.4856	9.9835	1.3243	1.936	0.968
Cayuga Heights	7.5106	7.1649	7.2760	6.4900*		
Etna	12.5582	7.4823	9.279	1.2173	0.302	0.151
Danby	16.5141	8.4772	10.632	1.6663	0.800	0.400
Dryden-Village	8.3959	6.4954	7.1544	7.9000*		
Enfield	12.2871	7.1785	8.9513	1.7101	01.252	0.626
Freeville	12.0635	7.4974	9.0047	4.3930*		
Groton	11.2887	8.4848	9.4741	0.8733	01.690	0.845
Ithaca City/Town	7.1685	6.4969	6.7258	12.1400*		
Lansing	12.6799	8.5018	9.9548	0.9200	0.178	0.089
McLean	9.5790	6.5330	7.5409	2.0598	2.568	1.284
Newfield	13.4188	7.5073	9.5613	1.2639	0.842	0.421
West Danby	13.1737	7.5052	9.2963	1.6663	0.800	0.400
Slaterville	18.3221	8.5254	11.952	1.1451	3.432	1.716
Speedsville	12.9843	7.5130	9.4020	1.4496	4.616	2.308
Ulysses	10.3662	8.4901	9.1372	0.6035	0.656	0.328
Varna	9.6376	8.4850	8.9015	1.2173	0.302	0.151
Rates shown per $1,000 assessed value						

Centralized Approach to Paid Provision

- A 100% paid first response system represents the most extreme of solution increments and should only be considered if "forced" to do so over time.

- The authority to increase paid provision and set standards of service will exist at the county level.

- This approach represents the highest improvement to response times, highest ability to standardize service, and highest cost. It is achievable through creation of a county-wide ambulance special district.

- ***In its feasible form, a centralized paid provision approach will still rely on volunteer rescue at the district level.***

Possible Transition Process
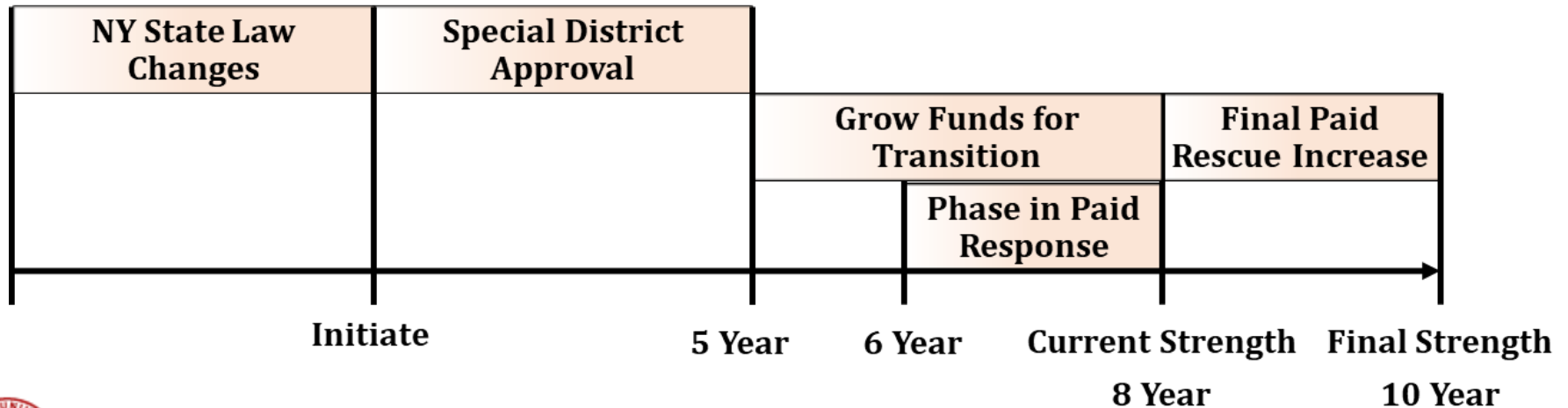
Centralized Approach to Paid Provision: Cost

- Cost to maintain current response time averages by transitioning to a paid first response network that adds ALS/ transport capability to every first response

- Example- Increase capability of Bangs Ambulance so that it serves as the singular "first response" organization in the county
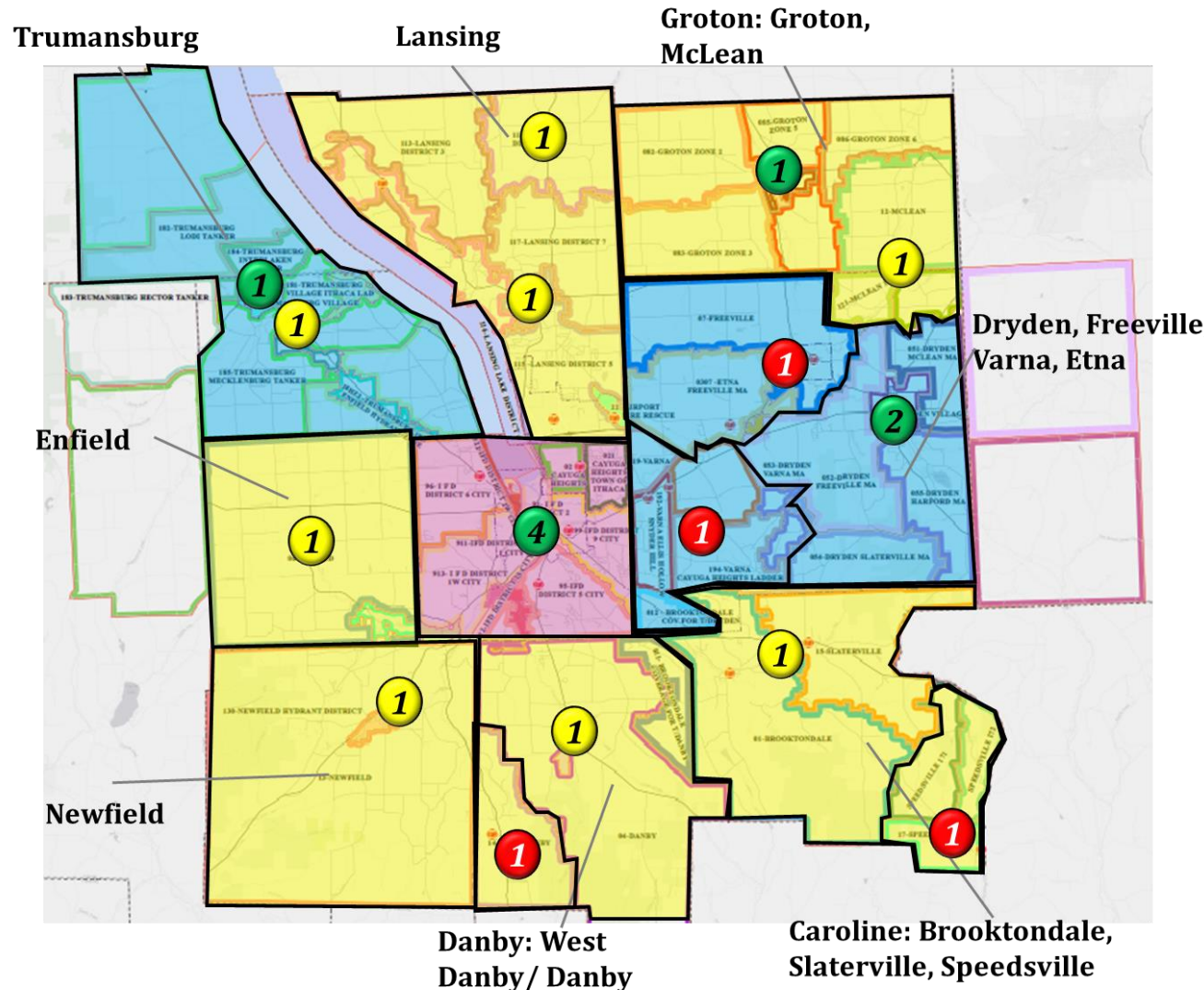
Town	County Taxable Property Value in Town	Current Total Town Tax Rate	Existing Ambulance District Tax	Ambulance District Tax Rate Required	% Increase in Current Total Tax Rate
Caroline	235,084,902	11.894566		0.74289679	6.25%
Danby	293,774,444	11.935663		0.74289679	6.22%
Dryden	996,012,423	10.196330	0.442442	0.74289679	2.95%
Enfield	192,709,297	12.005680		0.74289679	6.19%
Groton	281,984,456	10.829106		0.74289679	6.86%
Ithaca (Town)	1,470,266,711	13.187924		0.74289679	5.63%
Lansing	1,317,740,299	9.001320		0.74289679	8.25%
Newfield	285,944,799	10.527036		0.74289679	7.06%
Ulysses	506,369,479	9.180644	0.658525	0.74289679	0.92%
Total	5,579,886,810				

Centralized Approach to Paid Provision: Required Response Locations

- Response locations are determined through call volume and geographical distance.
- A new county ambulance district would assume responsibility of existing districts.

Centralized Approach to Paid Provision: Cost

- To reduce cost, the composition of rescue squads may be reduced to one EMT with an aid bag/ vehicle. This will ensure Basic Lifesaving (BLS) only first response. This solution would require to maintain current ALS/ transport resources.

- To further reduce cost, the county may pursue "peak-hours only" paid rescue in addition to decreased crew composition.

- Costs do not take into account the building of new facilities, as may be required in some locations.

Component	Estimated Annual Cost	Component	Estimated Capital Cost
ALS/ Transport Capability (24/7)	$6,423,920	ALS/ Transport Capability (24/7)	$1,200,000
BLS Capability (24/7)	$3,211,960	BLS Capability (24/7)	$122,000
BLS Capability (Peak hrs)	$1,605,980	BLS Capability (Peak hrs)	$122,000

Cornell University
Systems Engineering

Centralized Approach to Paid Provision: Performance

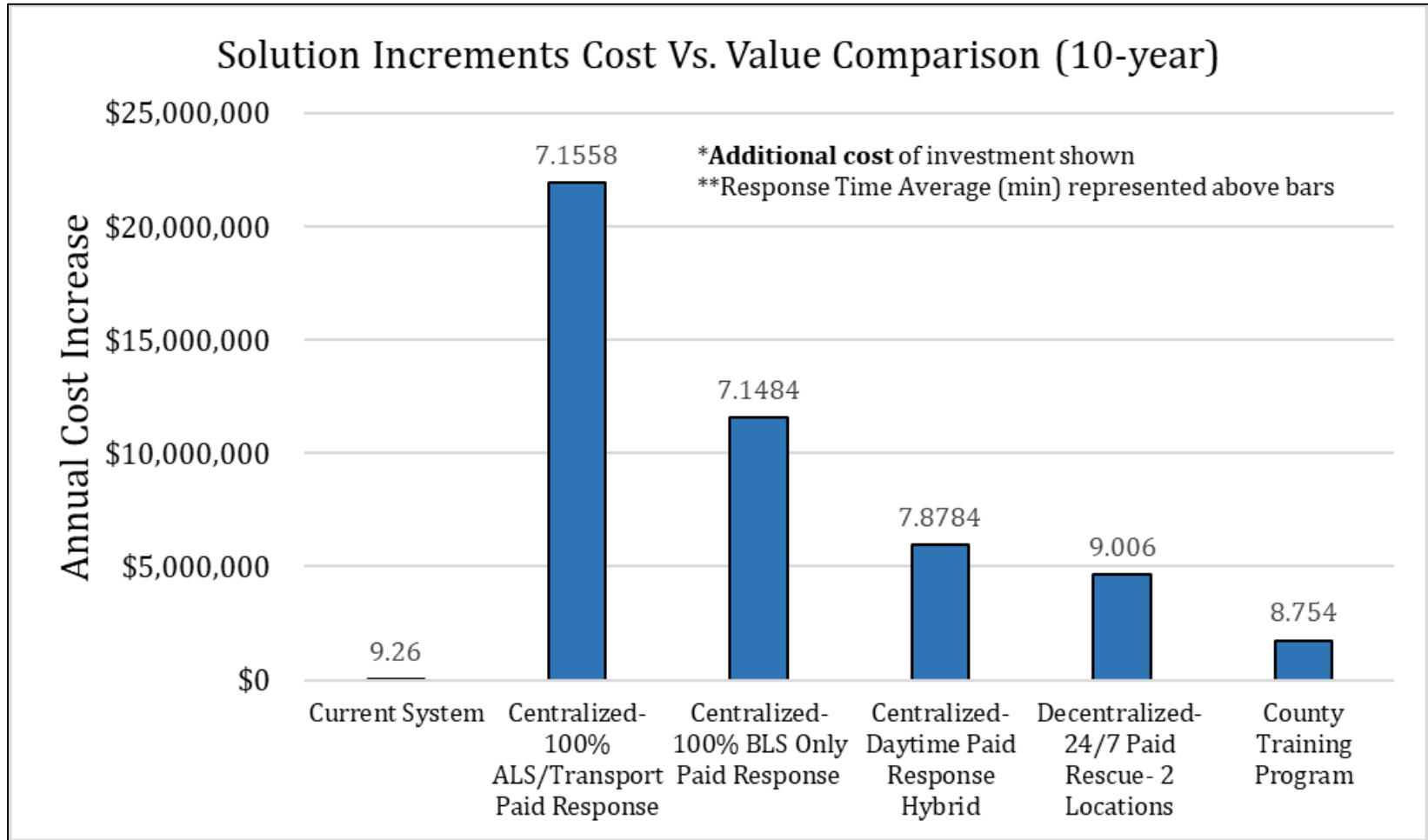| District	Current Response Time Avg	Paid Rescue Squads Only Avg	Hybrid Rescue Squads- Day (8am-8pm) Avg	Hybrid Rescue Squads- Night (8pm-8am) Avg
County	9.263	7.1484	7.1429	9.2576
Brooktondale	12.566	8.4856	8.4968	12.7712
Cayuga Heights	7.5106	7.1649	7.1662	7.4820
Etna	12.5582	7.4823	7.4978	12.6197
Danby	16.5141	8.4772	7.4983	16.5103
Dryden-Village	8.3959	6.4954	6.4999	8.3817
Enfield	12.2871	7.1785	7.1588	12.3124
Freeville	12.0635	7.4974	7.4899	11.8452
Groton	11.2887	8.4848	8.4981	11.3042
Ithaca City/Town	7.1685	6.4969	6.4952	7.1582
Lansing	12.6799	8.5018	8.4963	12.6895
McLean	9.5790	6.5330	6.5201	9.4550
Newfield	13.4188	7.5073	7.4996	13.4270
West Danby	13.1737	7.5052	7.5134	12.6394
Slaterville	18.3221	8.5254	8.4679	18.4860
Speedsville	12.9843	7.5130	7.5007	12.9672
Trumansburg	10.3662	8.4901	8.4968	10.3380
Varna	9.6376	8.4850	8.4891	9.6750

Centralized Approach to Paid Provision: Performance

- Peak hour paid rescue squad provision will improve response times for most calls. Out of 23 daily calls (average), 15 will be received during the day.

- Average response time with a hybrid, peak hours only, structure is 7.88 minutes (decreasing response time averages by 15%). Compared to 7.15 minutes with a 24/7 paid rescue structure, this shows **only marginal improvement for twice the required employees.**

Solution Increment Comparison

Solution Increments Cost Vs. Value Comparison (10-year)

*Additional cost of investment shown
**Response Time Average (min) represented above bars

Key Findings

1. County training program marginally beneficial towards county average response times (.5 min), but highly beneficial in most rural districts.

2. Decentralized- hybrid rescue in individual districts is the most tailorable approach to improving specific response averages *according to district desires and fund availability.*

3. Centralized- 100% paid rescue squads (without volunteer rescue) provides greatest reduction in response time averages.

4. Centralized- Hybrid rescue at county level is the most cost effective way to standardize service to an acceptable level.

Conclusion

1. We believe volunteer rescue squads will have an integral role in Tompkins County EMS provision ***for a long time***. Therefore it is essential for the county and individual districts to make effort to increase volunteer retainability.

2. Initiate a county training/ certification program and *decide what response time standards are acceptable in each district.*

3. Pursue solution increments in order, making effort to enhance existing system before taking highly disruptive and costly measures.

4. Supplement volunteer rescue with "peak time" paid rescue in select districts as soon as possible.

5. Continue planning for the next increment, but stop increasing paid provision if the level of service (response time standards) are acceptable.

Cornell University
Systems Engineering

Questions

Contact Information

Stephen McCarthy: sfm72@cornell.edu

Manav Lamichhane: ml2522@cornell.edu

Professor Albert George: arg2@cornell.edu

Cornell University
Systems Engineering