Developing a Totally Automated Spreading System

Final Presentation for Clear Roads by Thompson Engineering

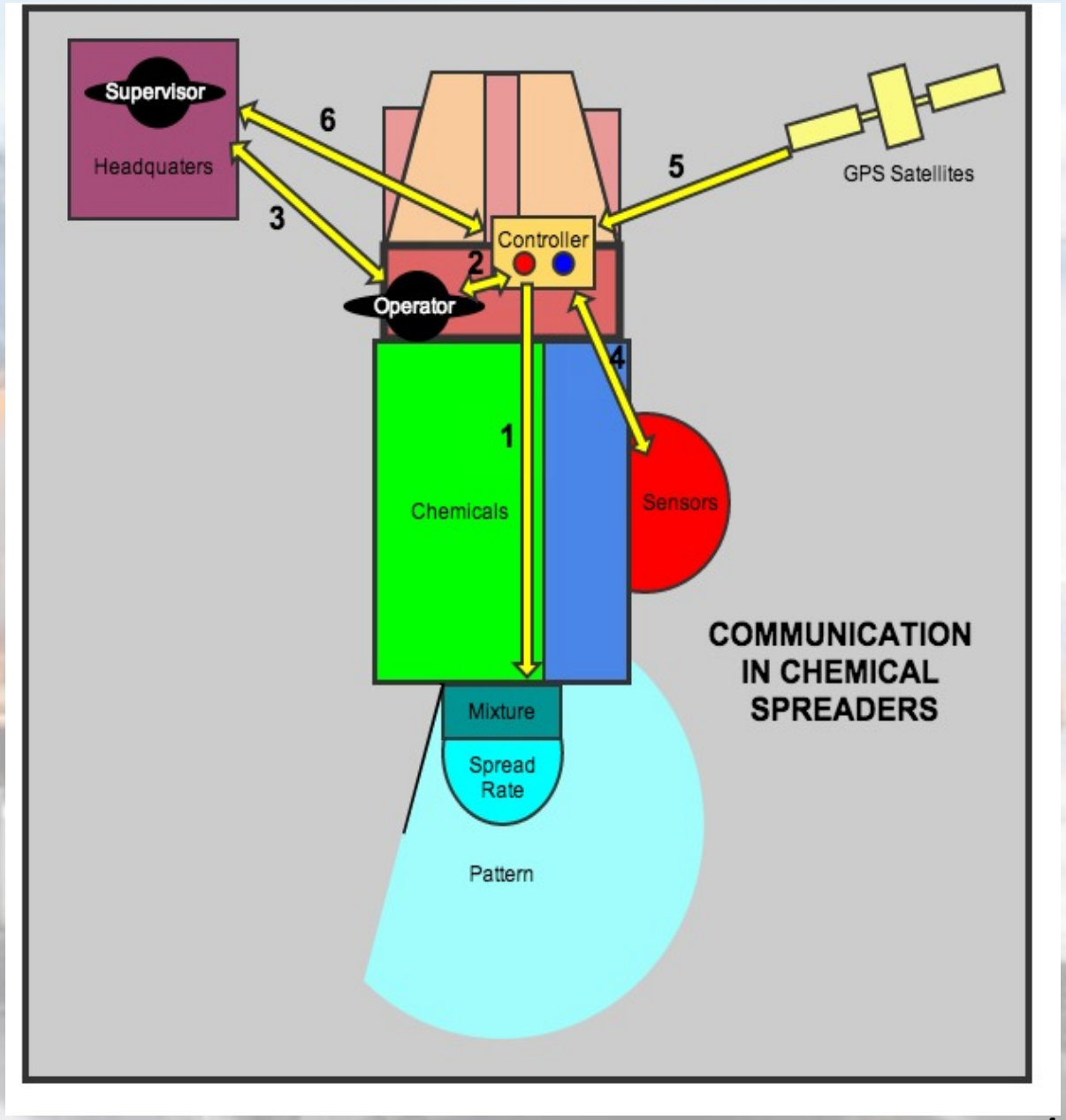
Outline

- Introduction
- Task 1 - Surveys
  - Literature Search
  - Survey of Professionals
- Task 2 - The Guides
  - Guide 1
  - Guide 2
  - Guide 3
- Conclusions

Introduction

- What is feasible?
- How effective is the technology?
- What do professionals need/want?
- What types of products is the industry producing?
- What is available now?
- How can we help professionals make informed decisions about this new technology?

What is feasible?



Task 1: Gathering Information

- Literature Search
- Survey of Professionals

Example of modern day controller, Cirrus Controls' NL7 controller

Literature Search

- No remote controlled systems were found (level 3)
- The agricultural industry has some similar challenges (discussed in Guide #3)
- Lack of quantitative comparative studies on automated spreaders
- Many currently available products

	Ground speed controller closed loop	Pavement Temperature sensor control	GPS recorded route control
Group 1			
Force America	Yes	No	No
Dickey-john	Yes	No	No
Cimlineya	Yes	No	No
Romaquip	Yes	No	No
Group 2			
Bosch Rexroth	Yes	Yes	No
Monroe	Yes	Yes	No
Multidrive	Yes	No	Yes
Group 3			
Giletta	Yes	Yes	Yes
Küpper-Weisser	Yes	Yes	Yes
Epoke	Yes	Yes	Yes
Cirus Controls	Yes	Yes	Yes
Falköping	Yes	Yes	Yes
Nido	Yes	Yes	Yes
AEBI Schmidt	Yes	Yes	Yes

Comparison of Spread Controllers

Survey of Professionals

- Accurately controlling the spread of chemicals on our roads is a very important.
- The automation is feasible and its use is increasing
- Automation is not the answer for everything
- Many components already are incorporated in the modern snowplow.
- There are advantages for information gathering and efficient use of chemicals.
- More research is needed: response time, liability, methods of control, etc.

Some Survey Results

Triggers/inputs used to control the spread rate.	Snow Fighters	Vendors
Location	51.7%	75.0%
Road surface temperature	59.7%	91.7%
Air temperature	48.3%	33.3%
Time of day	53.7%	41.7%
Treatment options (type of chemical available)	57.7%	50.0%
Plow position or configuration	25.5%	8.3%
Other	10.7%	33.3%
All of the above	52.3%	16.7%
None of the above	6.0%	0.0%

Task 2: The Guides

- **Guide #1: Best Practices and Functions of Automated Spreading Systems**
- **Guide #2: Levels of Automation**
- **Guide #3: Challenges and Currently Available Systems**

Joystick controller

Guide #1

- How the needs of snow fighters can be realized using the technology of automated spreading.
- Prioritizes which technologies are most useful and promising.

Example of prioritizing different capabilities

Priority Level	Capabilities
First	Automated setting of an average application rate
	Automated recording and archiving of what material was applied where, and when
Second	Automated variation from average application rate as a function of road surface temperature
	Automated variation in spread pattern as a function of location
	Automated variation from average application rate as a function of traffic conditions
Third	Automated variation from average application rate as a function of location
	Automated variation from average application rate as a function of current weather conditions
	Automated variation from average application rate as a function of forecast weather conditions

Guide #2

- A hierarchy of levels of automation is developed.
- Snow fighters can find what level of automation they are already using.
- Parts of a salt spreader (automated or not) are detailed and explained

Guide #3

- Present and compare currently available automated dispensing systems
- Discuss challenges, functionality and cost effectiveness
- Example spreaders from the agricultural industry

Example of an agricultural controller.

Available automated dispensing systems by manufacturer

	Ground speed controller closed loop	Pavement Temperature sensor control	GPS recorded route control	Remote Control
Hierarchy	**LEVEL 1**	**LEVEL 1**	**LEVEL 2**	**LEVEL 3**
Group 1				
Force America	Yes	No	No	No
Dickey-john	Yes	No	No	No
Cimlineya	Yes	No	No	No
Romaquip	Yes	No	No	No
Group 2				
Bosch Rexroth	Yes	Yes	No	No
Monroe	Yes	Yes	No	No
Multidrive	Yes	No	Yes	No
Group 3				
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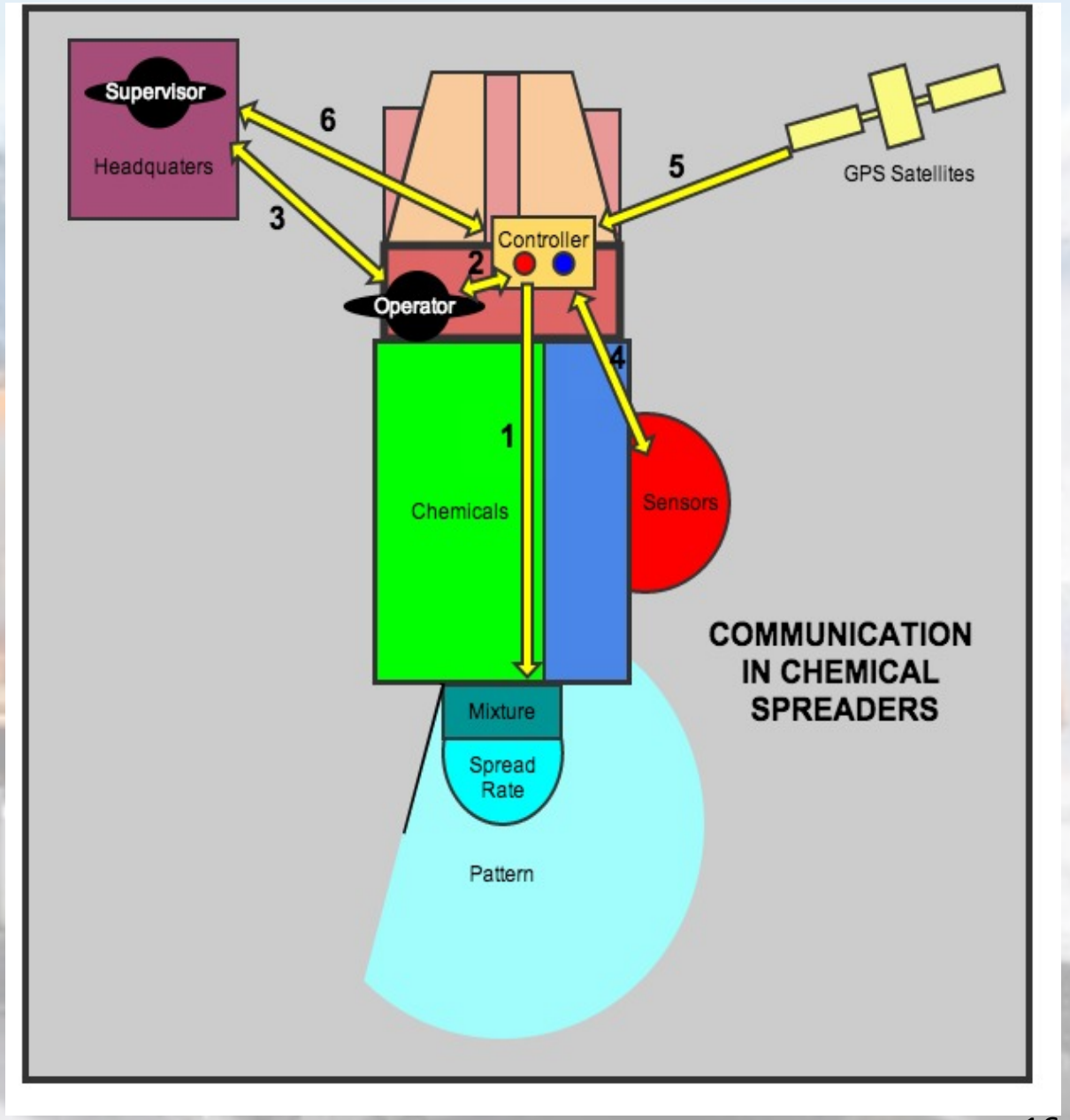
Levels of Automation



Challenges of Automation

- Accuracy of spreading
- Ease of programming the route
- Data gathering
- CAN bus utilization
- Cost/benefit considerations

Conclusions

- The technology is feasible and effective
- Professionals have expressed a need and desire for this technology
- Several products are available at various levels of sophistication
- Short term solutions are available
- Long term solutions
- Testing automated systems in the United States will be valuable to the decision making process