

## Class 15: Back to the Future

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## logistics

Live pitches tonight, Tuesday and Thursday

Sign up for a time slot via link on Lore or email TAs

Problem Set 5 due Friday at 11:59pm

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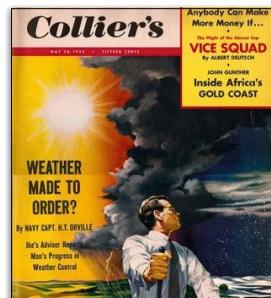
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## outline

1. retro futures
2. what might work
3. examples
4. perspectives

## past visions

### weather



### transportation



### robotics



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## present versions

weather



transportation



robotics

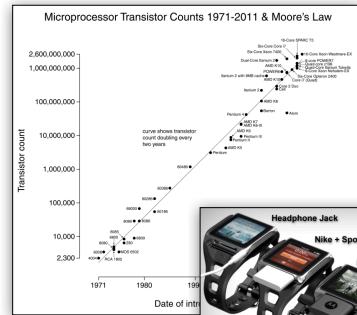
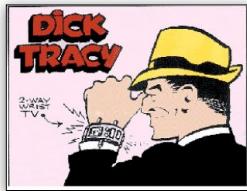


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## computer science

a vision of the future, largely on track

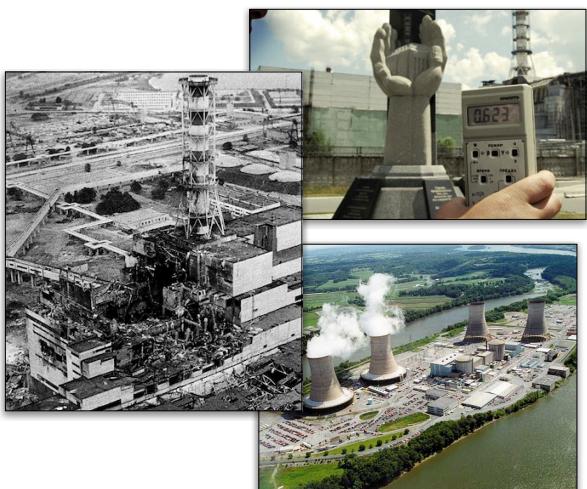
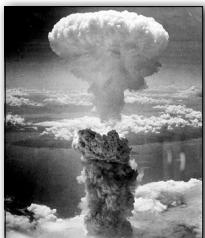


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## how futures can fail

the energy future



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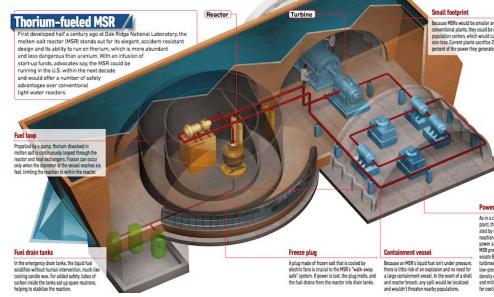
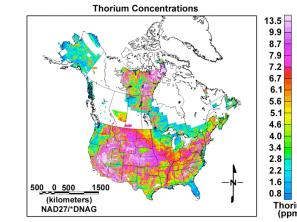
## going back to the future

lost, valuable lines of research  
renewed spirit of excitement  
truly new technology

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## example: energy future



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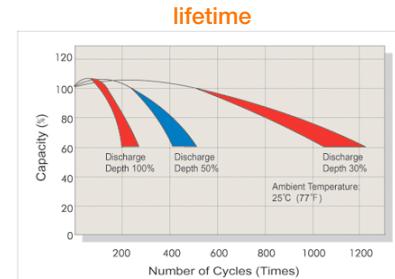
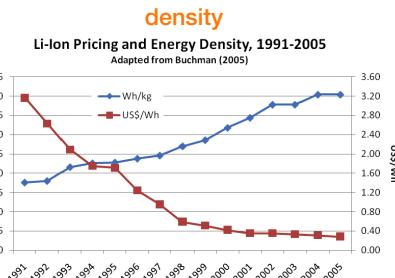
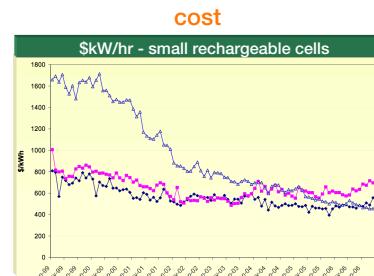
## what might work

energy storage  
weather  
robotics  
space

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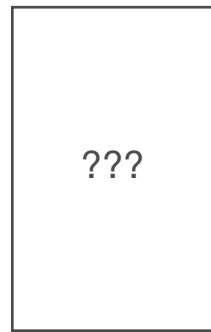
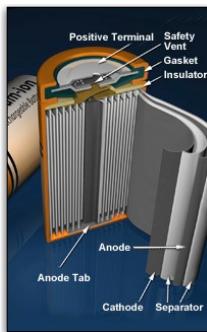
## the battery asymptote



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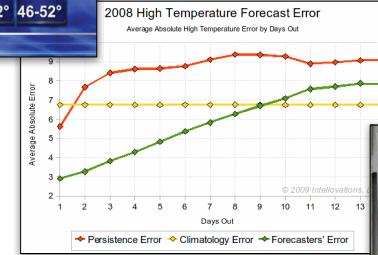
## batteries: is there a future?



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## the weather: can we predict it?



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## could we control it?



## robots: the popular focus

### humanoid design



History  
Robot Development Process



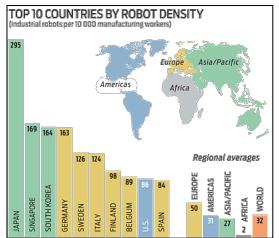
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## robots: adjusting our conception

### manufacturing



### safety

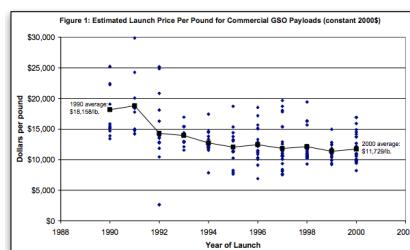


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## space: the persistent frontier

### price to orbit



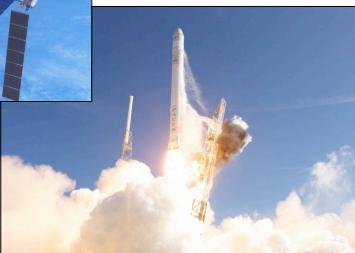
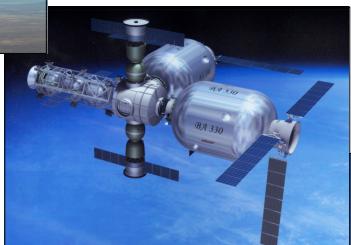
### manned safety



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## space: a new frontier



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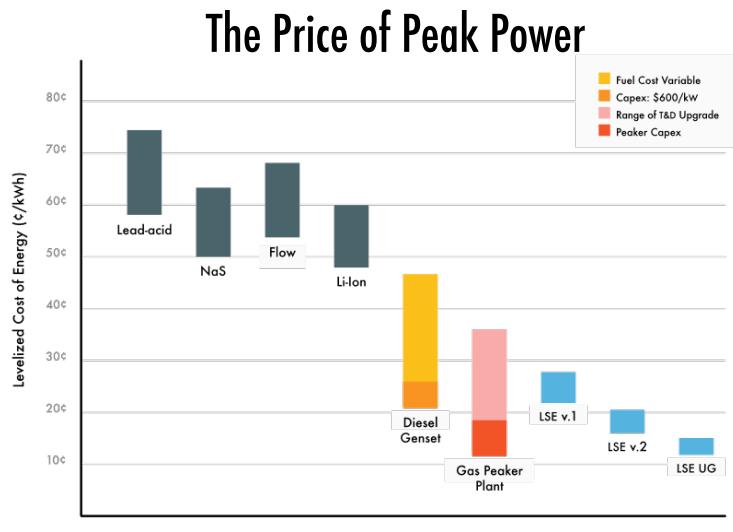
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# LightSail Energy



LightSail  
Energy

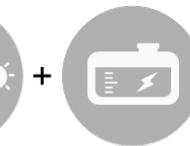
## The Trillion Dollar Formula

Lowest Cost Peak Power



### Baseload / Renewables

Efficient, economical environmental energy source



### Energy Storage

Near fluctuating demand to meet peaks



### Peakers

Inefficient plants throttled to meet peak demand



### Grid Upgrades

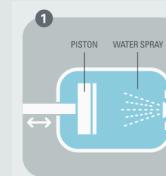
Extra wires, transformers, etc. to supply peak power

LightSail  
Energy

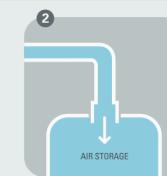
## Regenerative Air Energy Storage

10x cheaper than batteries. 10x longer lifetime.

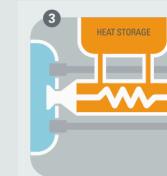
Breakthrough efficiency advance: regenerating energy from heat with water spray



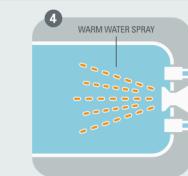
Spray water during air compression. Absorb heat



Store air in tank

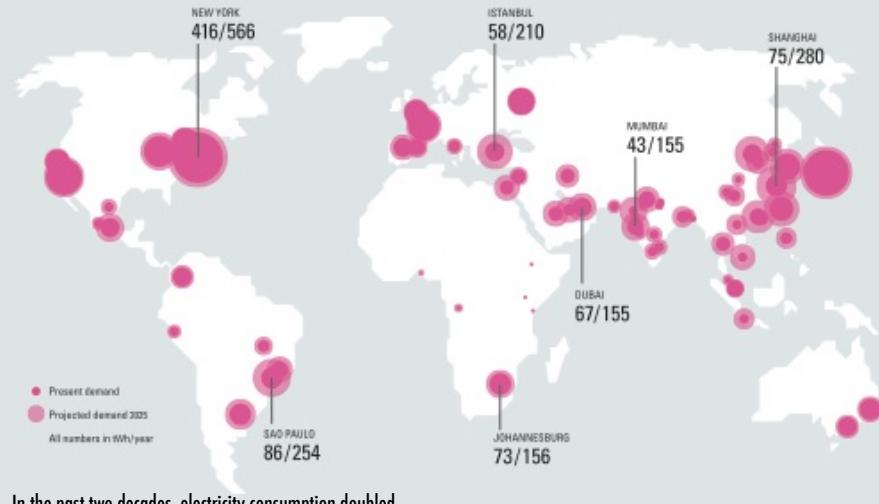


Store heat in water tank



Spray warm water during expansion Regenerate energy from heat of compression

# Global Electricity Demand 2025



In the past two decades, electricity consumption doubled.

In the next two decades, it will double again.

LightSail aims to meet this demand with economical, clean, distributed energy.

# THE CLIMATE CORPORATION



## THE NEED FOR TOTAL WEATHER INSURANCE (TWI)

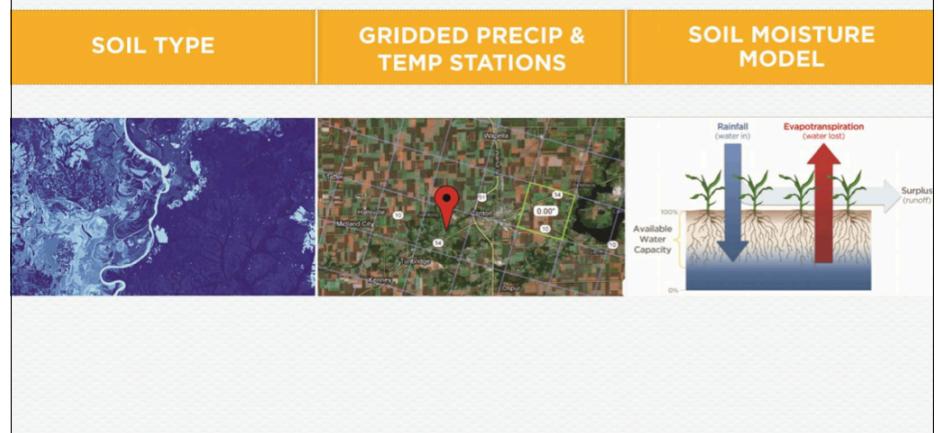
A Typical Illinois Corn Farmer's Financial Situation



## MEASURING THE WEATHER

**OBJECTIVE:** We aim to measure the weather in such a way that we can estimate the exact weather experience at a farmer's particular field.

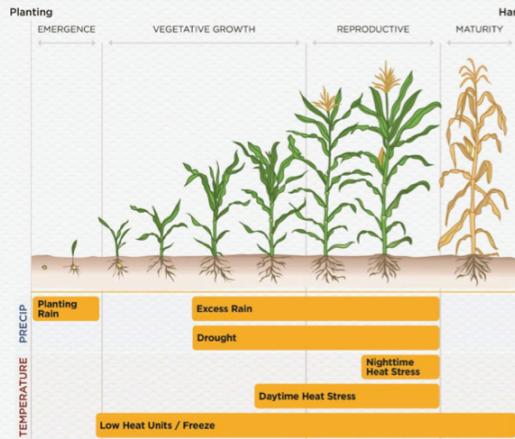
## HOW WE DO IT:



## AGRONOMIC STRUCTURES

**OBJECTIVE:** Estimate the exact yield for an individual farmer's field

**HOW WE DO IT:** Combine the operational details of a farmer, with hyper-local weather measurements and our unique knowledge of the relationship between weather and crop yield



## OUR CORE COMPETENCIES

- Aggregating/analyzing very large dynamic data sets (Platform)
- Modeling weather's impact on crop yield (Agronomy)
- Simulating weather to assess risk, recommend coverage and price policies (Climatology)



- 30 unique datasets
- 3 M weather stations
- 712 unique measurements
- 22 weather datasets ingested every 6 hours

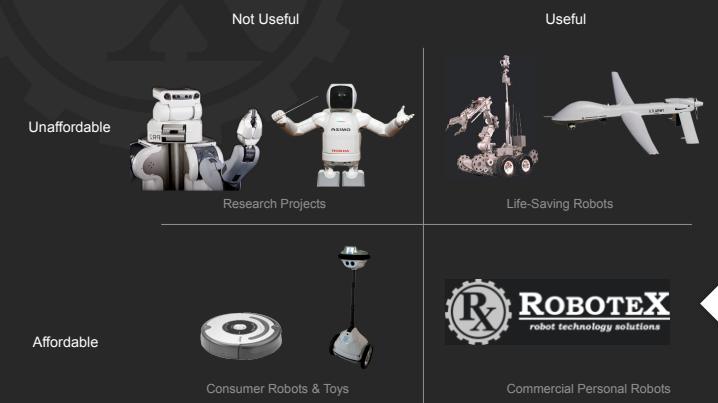
- 1000s of concurrent instances running map-reduce clusters
- Unique agronomic research (machine learning classification)

- 30 T simulation values
- 34 TB of simulations saved in S3
- Unique statistical models



## ROBOTICS TODAY – AN UNDEVELOPED SPACE

In order for robotics technology to be truly transformative, it needs to **solve important problems** and be **affordable** for the average user.



RoboTEx is the only robotics company focused on developing **inexpensive robots** to solve serious **real world challenges**.

## THE OPPORTUNITY – PERSONAL SAFETY ROBOTICS

Every day, humans are forced to deal with **dangerous** and **costly** problems.



Law Enforcement & Counter-Terrorism



Asymmetric Warfare



Hazardous Materials & Contaminated Sites



Fixed Location Security

RoboteX sees solving these **safety** and **security challenges** as the most effective way to **leverage robotics technology** in the short-medium term.

## ROBOTEK – LOW COST, HIGH VALUE TECHNOLOGY

RoboteX develops **affordable**, **commercial-grade** robotics technology for a **wide market**.

By employing the **product development** and **sourcing** methodologies of the **consumer electronics industry**, RoboteX is able to produce high-quality robotic systems at a **fraction of the cost** of other providers.

### Industry Standard

Cost Structure

Pass Thru Markups

### ROBOTEK

Price Point Targeting

R&D Financing

Government & Academic

Private Investment

Prod. Dev. Methodology

Gov't Specifications

End-User Feedback

User Base

Narrow & Specialized

Wide & Diverse



"The Avatar's superior mobility in conjunction with its durability and video technology separates it from any other tool we have used to date. This thing is a **game changer**".

- Sgt. Troy Greene, St. Paul Police Dept.

*RoboteX's systems achieve better outcomes than currently-deployed technology, at a fraction of the cost.*



## SpaceX

Mission: reduce launch cost to orbit by a factor of 10



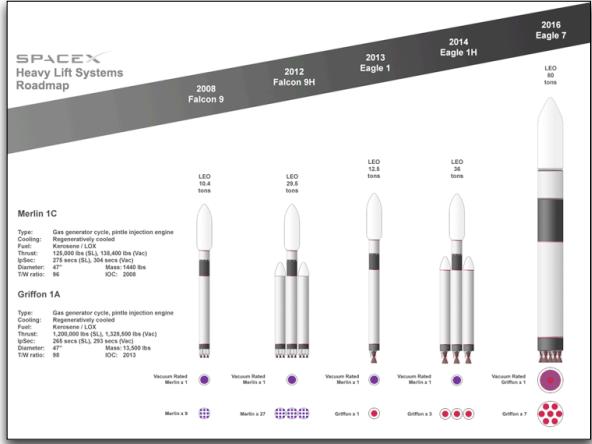
Result: space becomes affordable for commercialization

## SpaceX - product roadmap

### Falcon 1



### Falcon 9 and beyond



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## SpaceX - what's next

### First commercial mission to ISS



### Reusability and exploration



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