Deployable Rapid Prototyping System and Library

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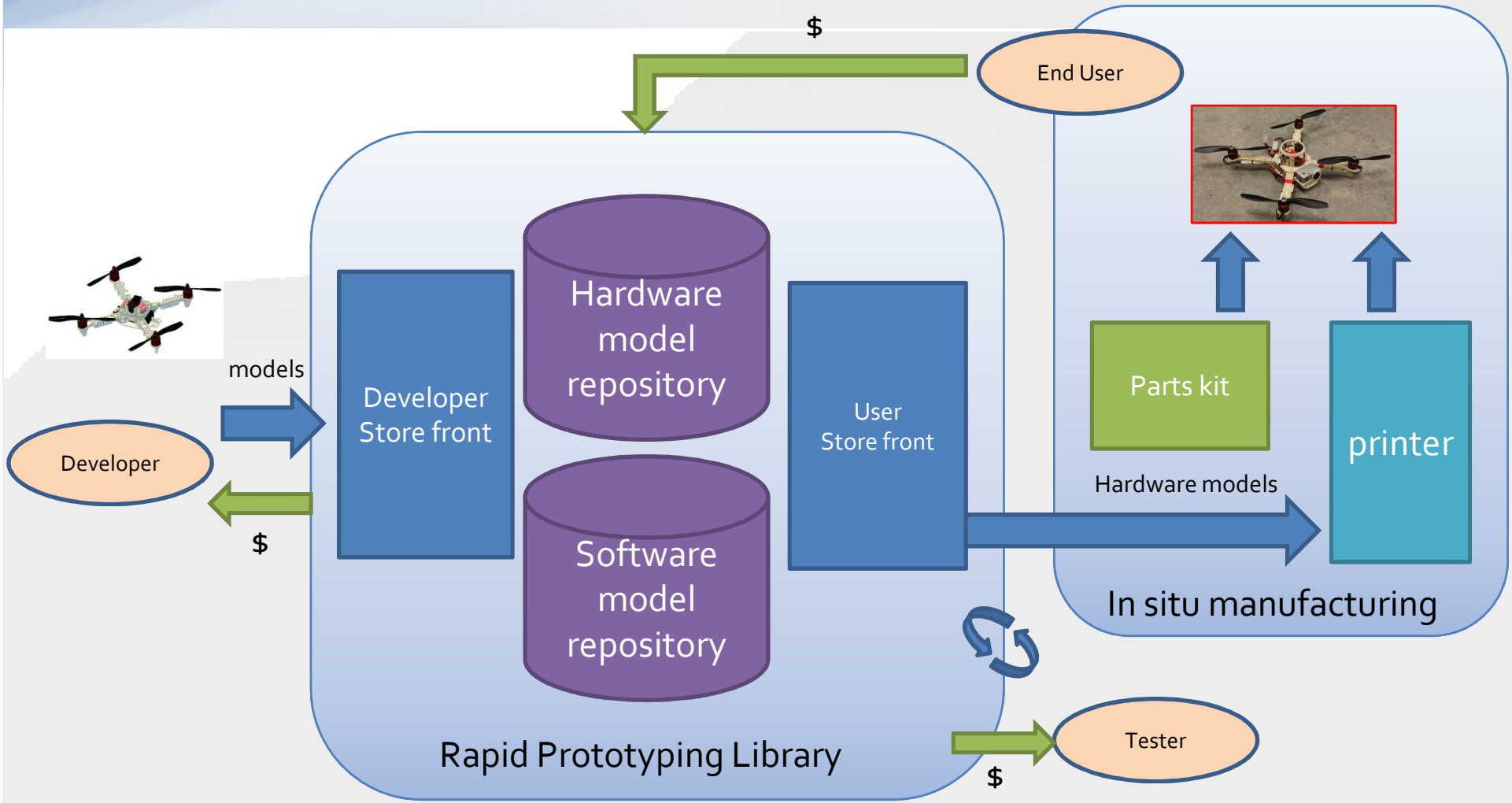
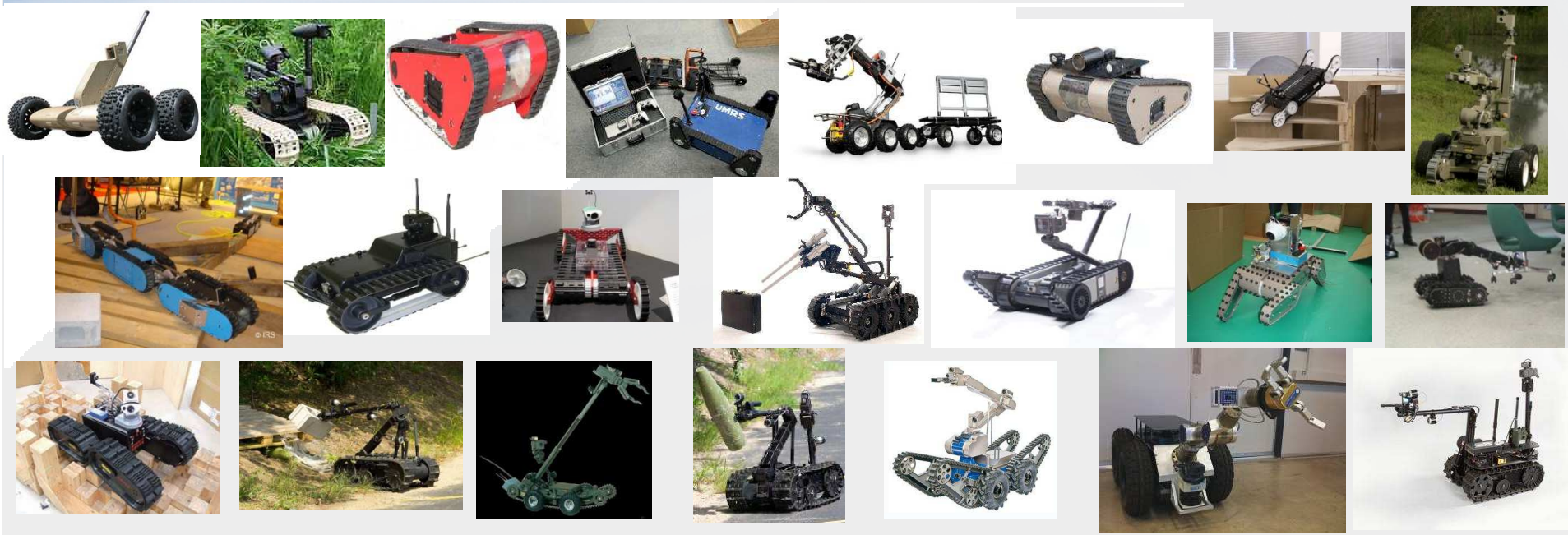
ROBOTIC RESEARCH

Rapid Prototyping Library



Deployed Robots (or in testing to be deployed)

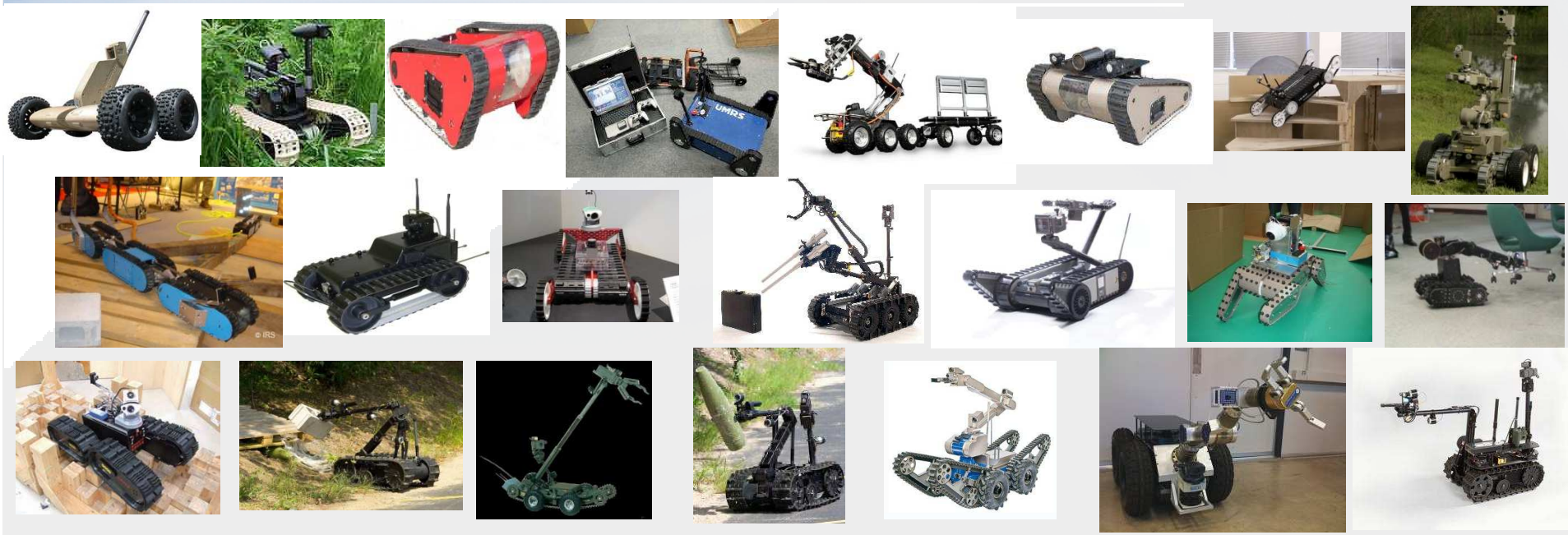


Common parts among manufacturers: close to ZERO

Why?: Because there is no incentive to make them common, and Lots of $$$ reasons why not to make them common

Effect to the USG:
- ***Logistic tail nightmare***
- ***Expensive parts***
- ***Single vendor sourcing***

Mission based "standard" parts set

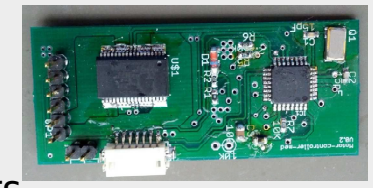


Motors

```
class classCar{
    protected:
    enumCarMake carMake;
    structTire carTires[4];
    classEngine carMotor;
    classPart carPartsList[100];
    public:
    classCar();
    virtual ~classCar();
    void GetCarLoc(classCarLoc& carLoc);
};
```

Code

Controllers



Processors

Sensors

Radios

Remarkably easy to map conventional robots into small parts set

Importance of reducing the parts sets

- Fielded 3D printers can make the logistic tail worst if system is not strategically architectured.
- Containers have limited amount of storage place
- Depots and FOBs are already overflowing with replacement parts, for conventionally manufactured systems
- We need to stop the avalanche of new parts before it happens, and more importantly there are a lot of advantages in doing so

Advantages of "standard" parts sets

- Reduction of parts to be sourced, warehoused, shipped, maintained, trained, and decommissioned
- Exposes all costs to the DoD and the user.
- Harnesses the crowd-sourcing process to create systems that are useful to the deployed systems
- Open source "standard" parts sets components can be procured from a variety of sources.
- Shifts the determination of obsolescence to the DoD and away from the contractors
- Allows for smooth upgradability paths and provides incentives for successful designs to be upgraded (no logistic tail for contractors to live off)
- Allows for upgrades to happen independently and transparently from the designer.

The life-cycle of a part (the O2 wrench)

$2.95 on Amazon

… Purchased

$

Warehoused CONUS

$

Shipped OCONUS

$

Shipped to FOB

$

Warehoused at FOB …

$ * #spares

Motivation (DHS)

Problem Description

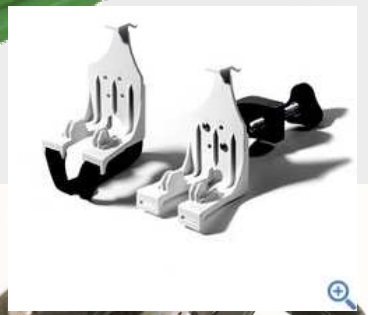
The DHS wanted us to design a lower cost robot that will satisfy all of their missions.
"we are tired of buying $200K robots, and not being able to use them for X,Y,Z reason"

No single robot will satisfy all their needs. And if we tried to compromise, the result is an expensive robot that it is not really good at anything.

Motivation (TATRC)

Problem Description

The logistic tail of medical needs on the battlefield is a big driver of costs of missions .
"we need to procure, ship, warehouse and inventory a never-ending set of relatively simple parts "





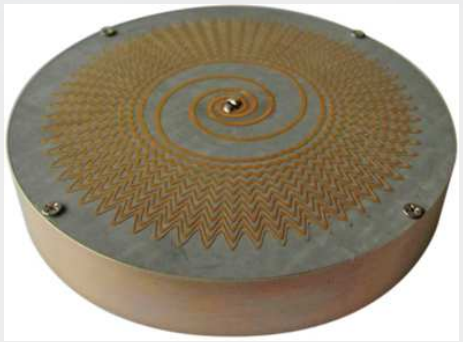
The cost of many of these simple to 3D printed devices is largely driven by the logistic tail, not by the cost of the devices.

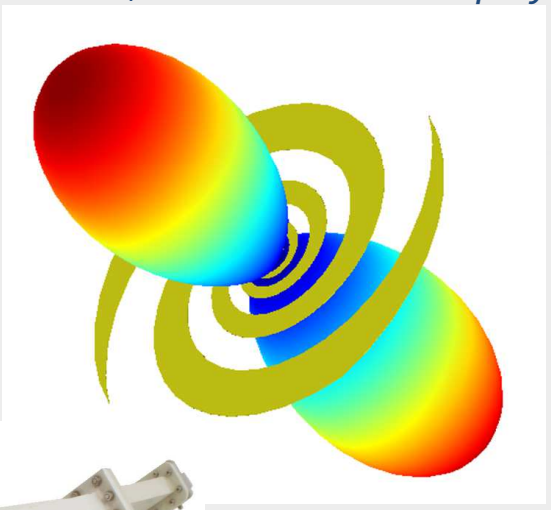
Motivation (SOCOM)

Problem Description

We would like to use highly specialized antennas that will improve the covertness of our missions.

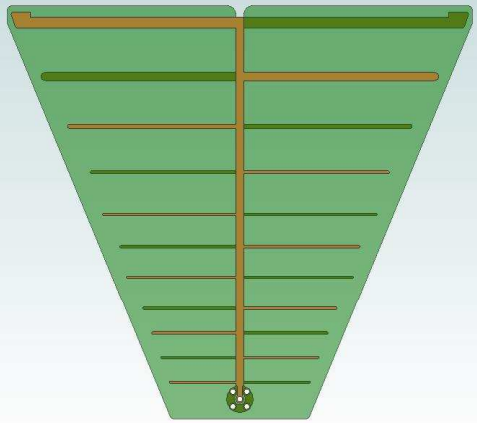
"there is an infinite variety of these things, they are a pain to manufacture, and we can not deploy them all"

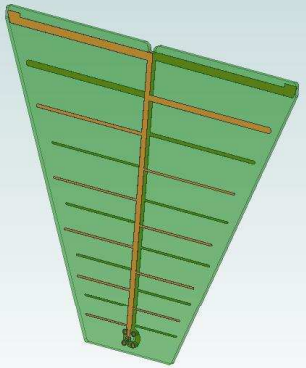


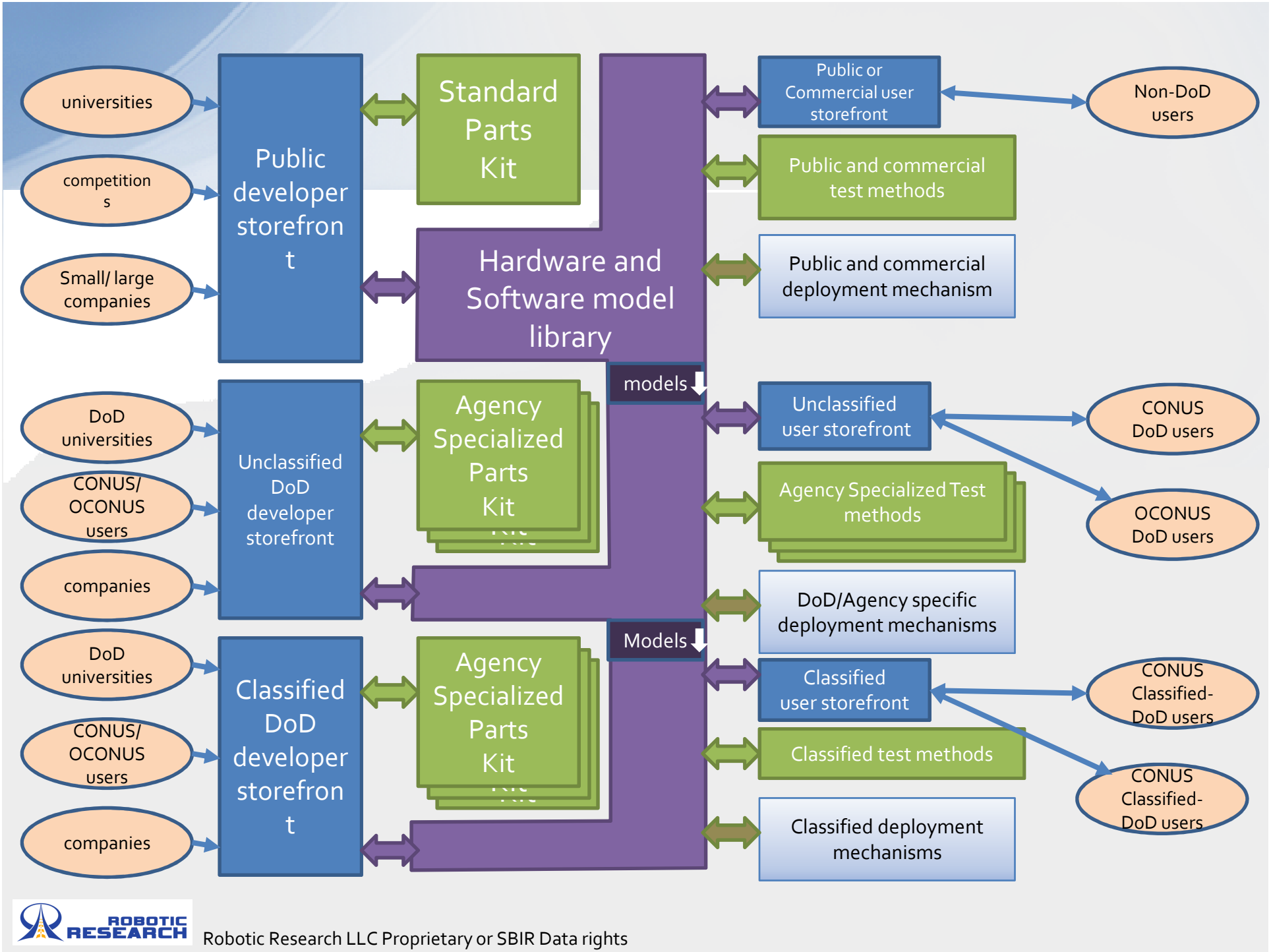


Because the mission drives the shape of these devices, is hard to predetermine what to deploy.

Custom 3D printed antenna design

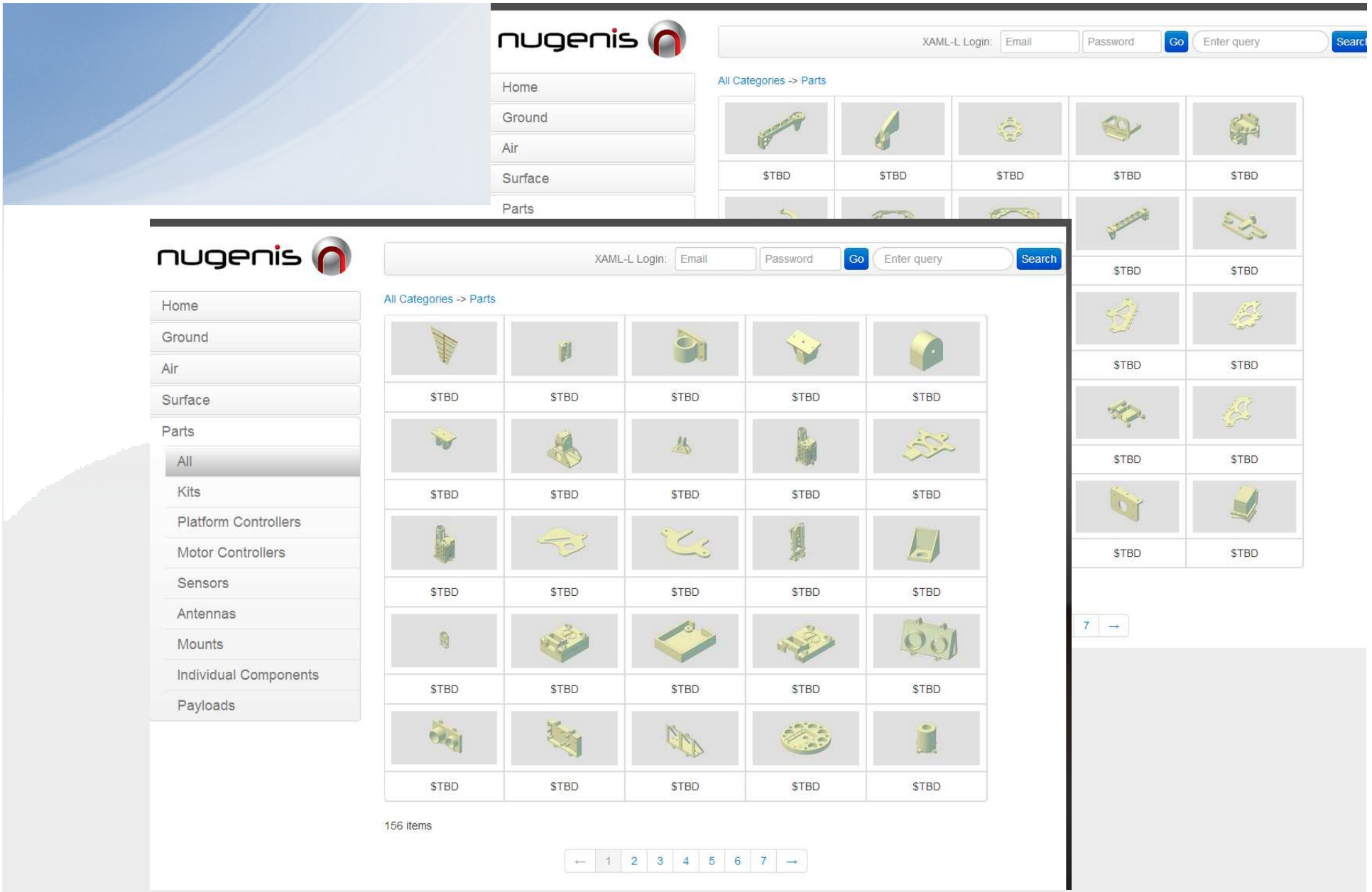






Current state of the system

- Implemented front and back end for developers and users
- Implemented first cut at "public" feedback system
- Implemented first cut at standards parts list
- Created a set of models that follow the library concept
- Created a visual scripting language for software implementation
- Started developing end-to-end IP protection system



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- Air
- Surface
- Parts

Tossable All-terrain Stair-climbing Robot (TASR)

Information

Title	Tossable All-terrain Stair-climbing Robot (TASR)		
Developer	Robotic Research, LLC		
Part Type	Platform		
Description	Small wheeled robot that is capable of climbing stairs to access multi-level structures.		
Tags	wheels, stair, ground, camera, rocky		
Assembly Time	3 hours		
Print Time	24 hours		
Specifications	Width	19 inches	
	Run Time	3 hours on a single battery	
	Vehicle Speed	5 feet/second	
	Length	12 inches	
	Height	5 inches	
Parts	Medium Motor Module - High Torque		
	Medium Motor Module - Low Torque		
	Medium/Large Motor Controller Module		
	Camera Module		
	Wireless Module		
	Medium Motor - High Torque		
	Medium Motor - Low Torque		
	Medium Robot Kit 1		
	Wireless Controller		
	RR Autopilot		
	RC Transmitter		
	RC Receiver		
Compatible Items	TASR		
	TRAKR		
Rating	★★★★		
Price	Purchase Hardware & Software - Includes only vehicle hardware (motors, controllers, etc.) and software. Does NOT include 3D printed components.	$TBD	Add to cart
	Purchase Complete TOSR Kit - Includes all components necessary to make the TOSR platform and any necessary sotware.	$TBD	Add to cart
	Printed Model - Includes only the 3D printed components.	$TBD	Add to cart

Reviews

modelmate88 35 days ago ★★★★★

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900 to 2600 MHz Antenna

Information

Title	900 to 2600 MHz Antenna		
Developer	Robotic Research, LLC		
Part Type	Antenna		
Description	Small 3D printed antenna for use in the 900 to 2600 MHz range. This antenna is field tunable for optimal results.		
Tags	antenna, log-periodic, 2.4 GHz, 900 MHz		
Assembly Time	30 minutes		
Print Time	1 hour		
Specifications	Width	5.25 inches	
	Length	5 inches	
	Frequency Range	900 to 2400 MHz	
	Height	.7 inches	
Compatible Items			
Rating	★★★★★		
Price	Complete antenna with connector pre-soldered	$TBD	Add to cart
	Antenna with connector. Requires soldering to connector.	$TBD	Add to cart

Reviews

modelmate88 35 days ago ★★★★★

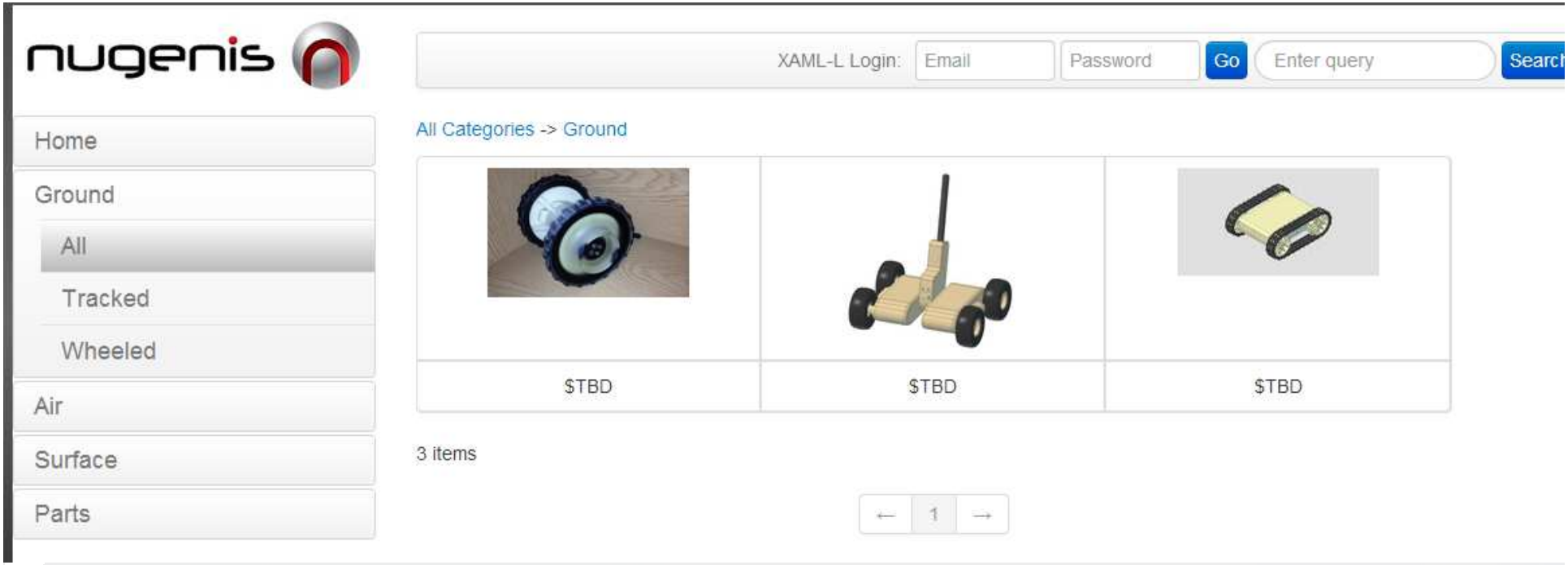
Great pre-built antenna. Light-weight and easy to use.

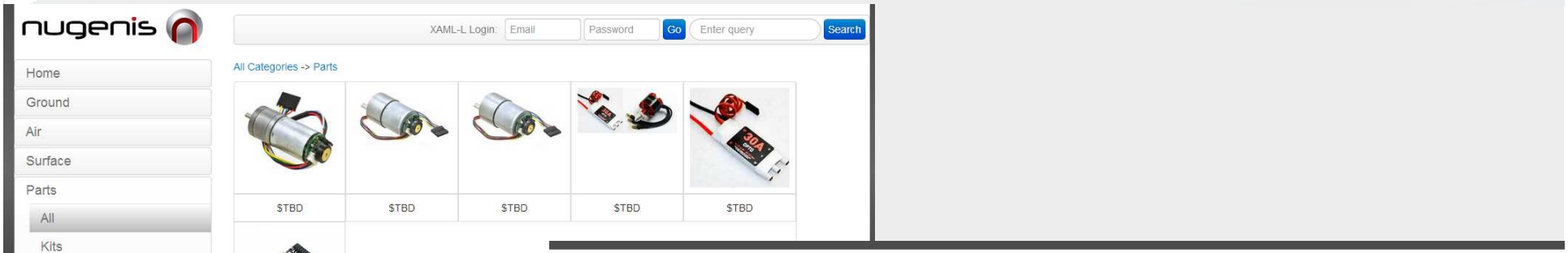
barsoompd 35 days ago ★★★★

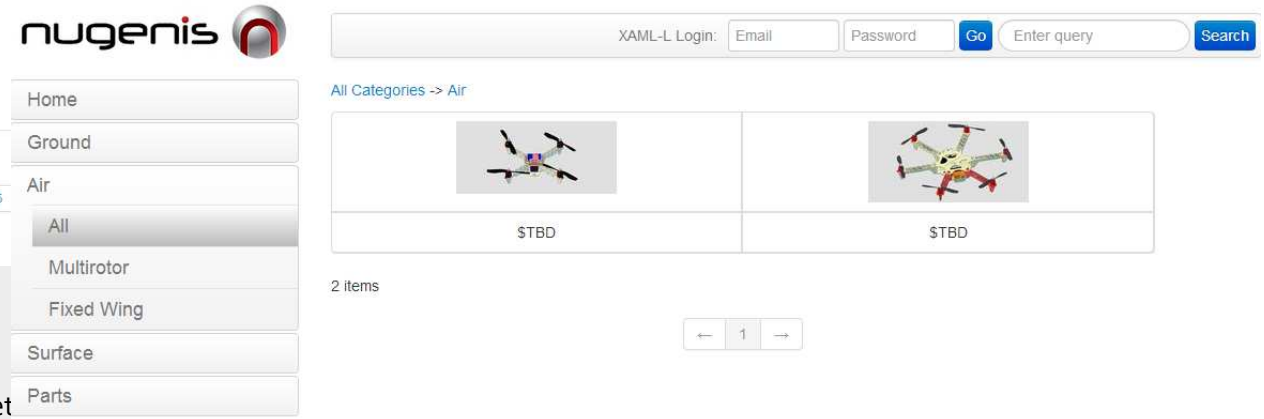
Easy to use simple antenna.

specops99 35 days ago ★★★★★

Best field tunable antenna. Light and easy to use.





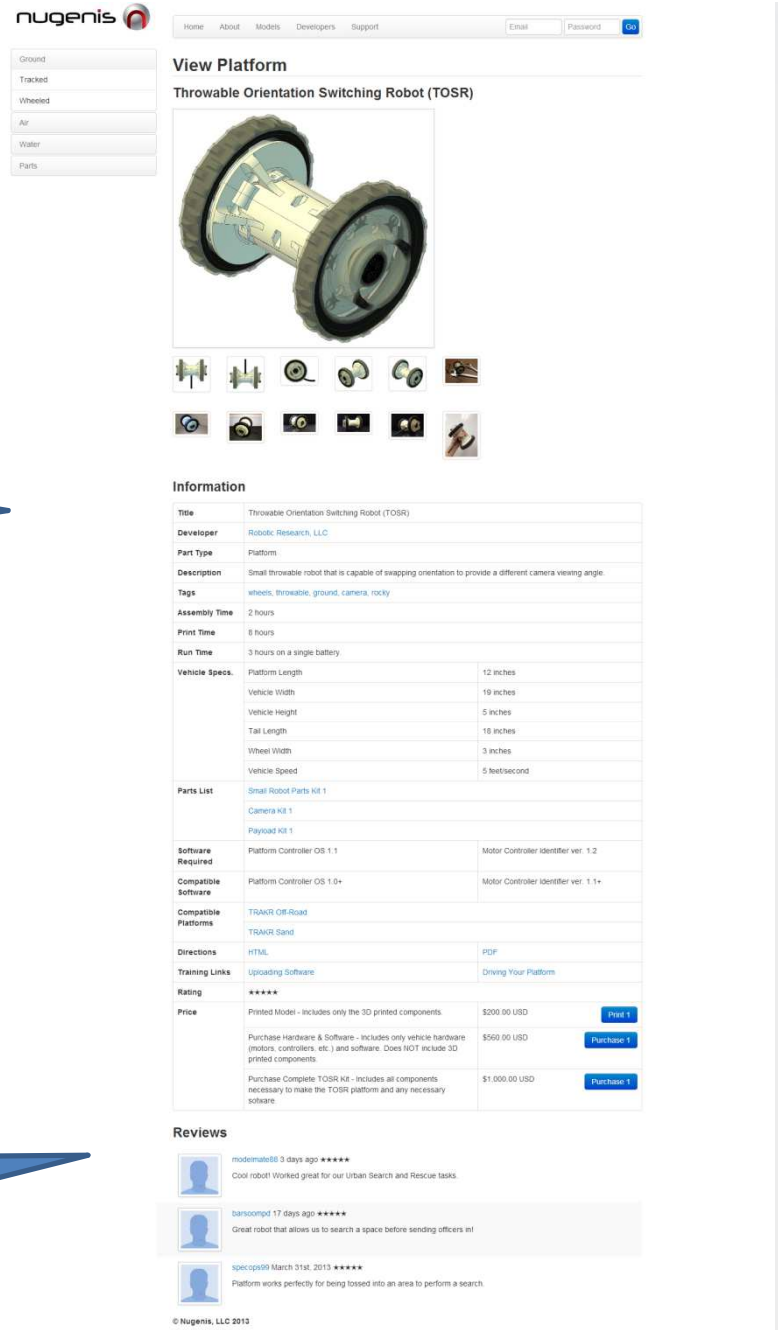


User front end

Key words bring up a match

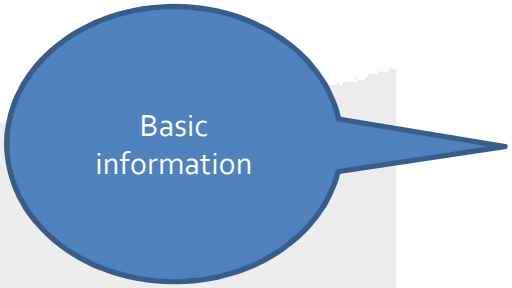
Basic information

Comments in a format everyone understands from online reviews



User frontend (cont…)

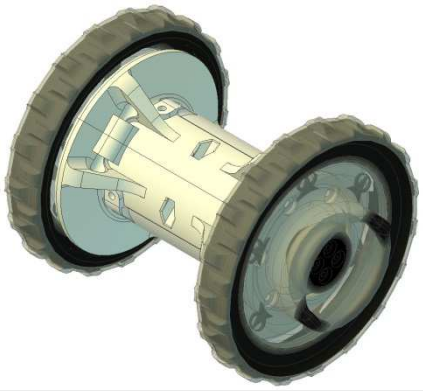
Key words bring up a match



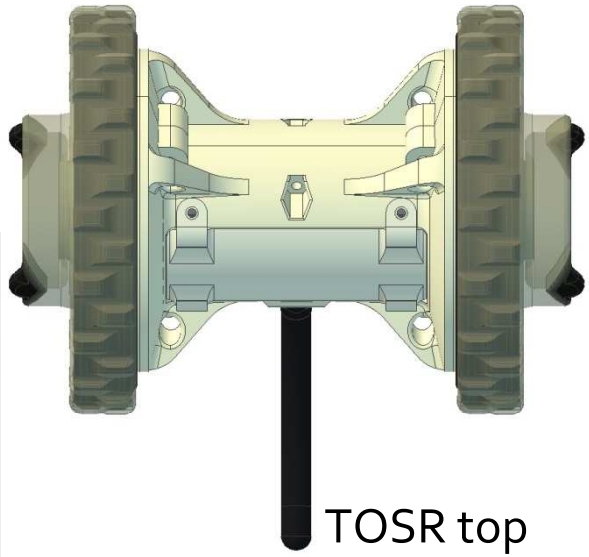
Information

Title	Throwable Orientation Switching Robot (TOSR)		
Developer	Robotic Research, LLC		
Part Type	Platform		
Description	Small throwable robot that is capable of swapping orientation to provide a different camera viewing angle.		
Tags	wheels, throwable, ground, camera, rocky		
Assembly Time	2 hours		
Print Time	8 hours		
Run Time	3 hours on a single battery.		
Vehicle Specs.	Platform Length	12 inches	
	Vehicle Width	19 inches	
	Vehicle Height	5 inches	
	Tail Length	18 inches	
	Wheel Width	3 inches	
	Vehicle Speed	5 feet/second	
Parts List	Small Robot Parts Kit 1		
	Camera Kit 1		
	Payload Kit 1		
Software Required	Platform Controller OS 1.1	Motor Controller Identifier ver. 1.2	
Compatible Software	Platform Controller OS 1.0+	Motor Controller Identifier ver. 1.1+	
Compatible Platforms	TRAKR Off-Road		
	TRAKR Sand		
Directions	HTML	PDF	
Training Links	Uploading Software	Driving Your Platform	
Rating	★★★★★		
Price	Printed Model - Includes only the 3D printed components.	$200.00 USD	Print 1
	Purchase Hardware & Software - Includes only vehicle hardware (motors, controllers, etc.) and software. Does NOT include 3D printed components.	$560.00 USD	Purchase 1
	Purchase Complete TOSR Kit - Includes all components necessary to make the TOSR platform and any necessary sotware.	$1,000.00 USD	Purchase 1

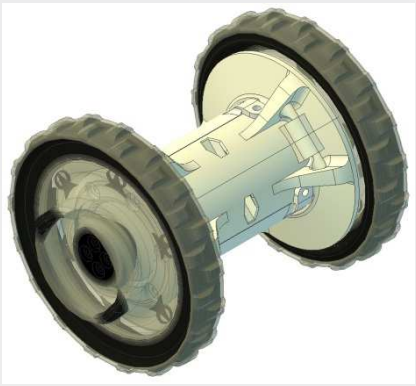
Detailed images of Robot Selected



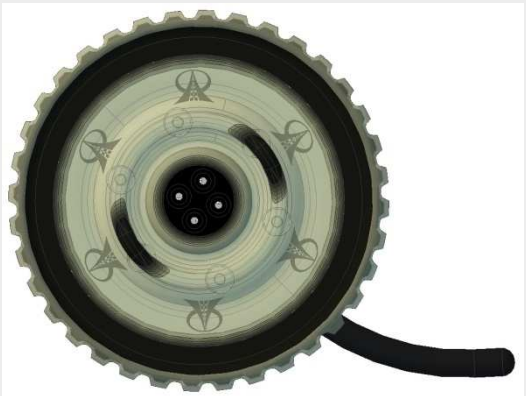
TOSR left



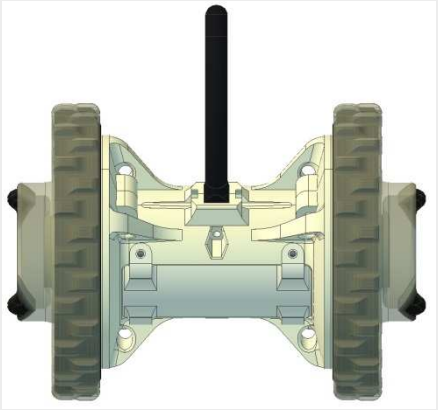
TOSR top



TOSR right



TOSR side

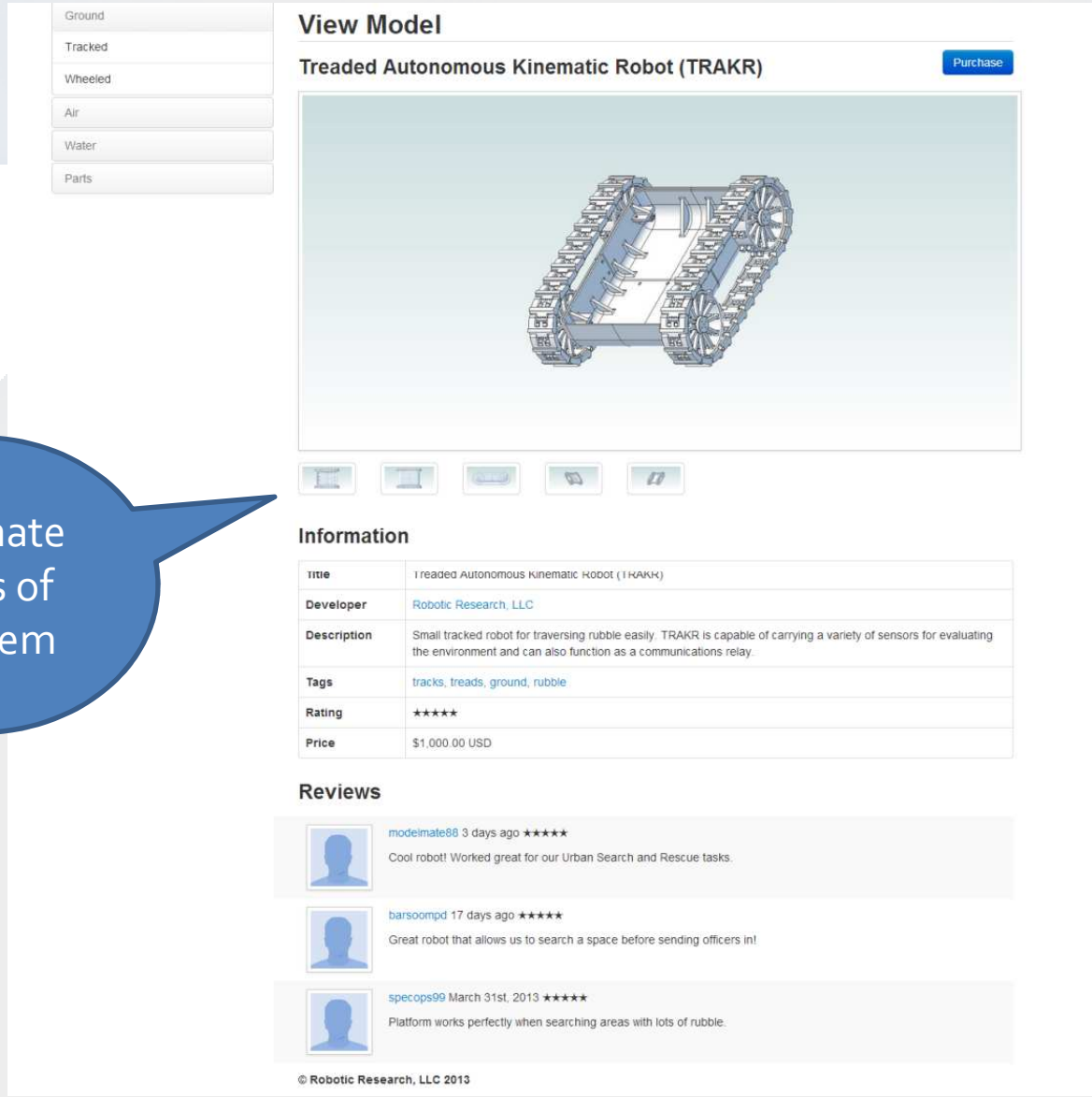


TOSR bottom

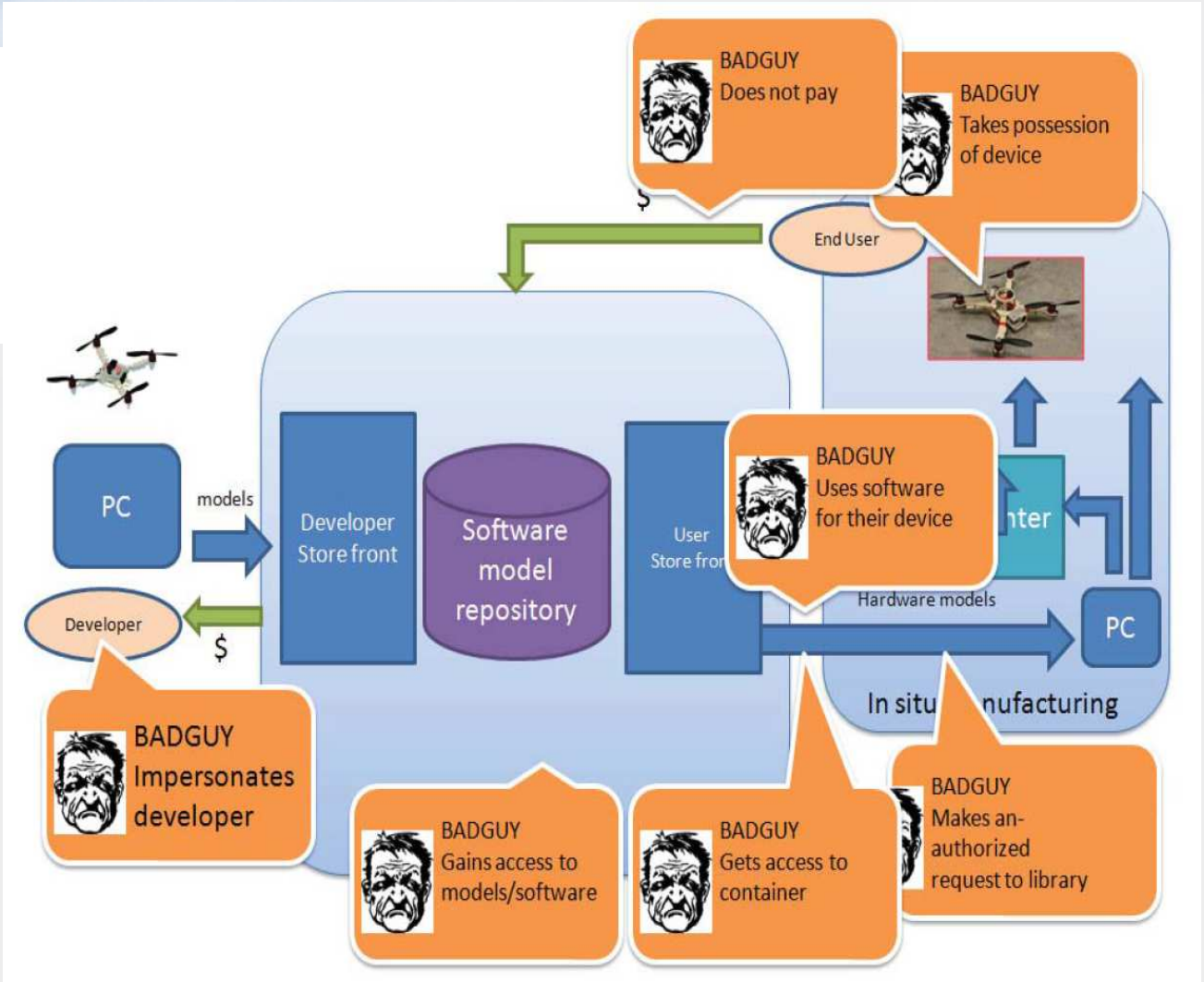
STORE

Key words bring up a different match

Alternate views of the item



SAARP Store - Security



How are we going to deal with the bad guys?

Developer authenticated encryption of models

PC

models

Developer Store front

Encryption of models

Software model repository

User Store front

$

End User

Hardware based trusted platform cores

Parts kit

printer

Hardware models

PC

In situ m

Developer

$

Secure authentication of developers

Trusted Machine

Keypair A

Trusted separate computer for encryption and validation

Device specific encryption

Secure authentication of users

Steps Forwards:

- The problem:
  - Different agencies are creating separate efforts for AM (just at the CTMA: DLA, Navy, AF, etc).
  - They do not have a method for sharing and many reasons why not to share. They are going to repeat work without knowing.
  - Testing will be expensive and we do not want to waste $ on duplicating efforts
  - No outside of group version control
  - No attribution to developer (look AF is using Navy parts)
  - No crowd sourcing of models (closed system and few contractors)
  - No combined cyber approach
  - No compatible non-3D-printed components
  - No means for private industry to make this profitable for industry
- The solution:
  - Use CTMA wide library of 3D printable parts (or other OTA) to create a government wide consortium repository probably run by non-profit (CTMA may be the perfect venue)
  - Use presented library to provide access to users across the gov to this CTMA instantiation
  - Provide private instantiation ("own stash") to stakeholders so as not to force sharing from the beginning.
  - Implement single cyber policy and TTPs designed for the complete group
  - Use CTMA to grow library components (either gov owned or not) using competitions and other means (War College, NPS, internal engineering, etc)
  - Use the library as a means for sharing version control, testing results, manufacturing instruction, assembly instructions)
  - Grow CTMA membership by asking developers to register as part of the CTMA.