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## **The Alternative Energy Coalition: A Struggle for Power in the Expeditionary Environment**



**Tom Lederle, VP  
Product Development**

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# THE CHALLENGE





# REDUCE RISKS TO WARFIGHTERS

## REDUCE FUEL CONSUMPTION

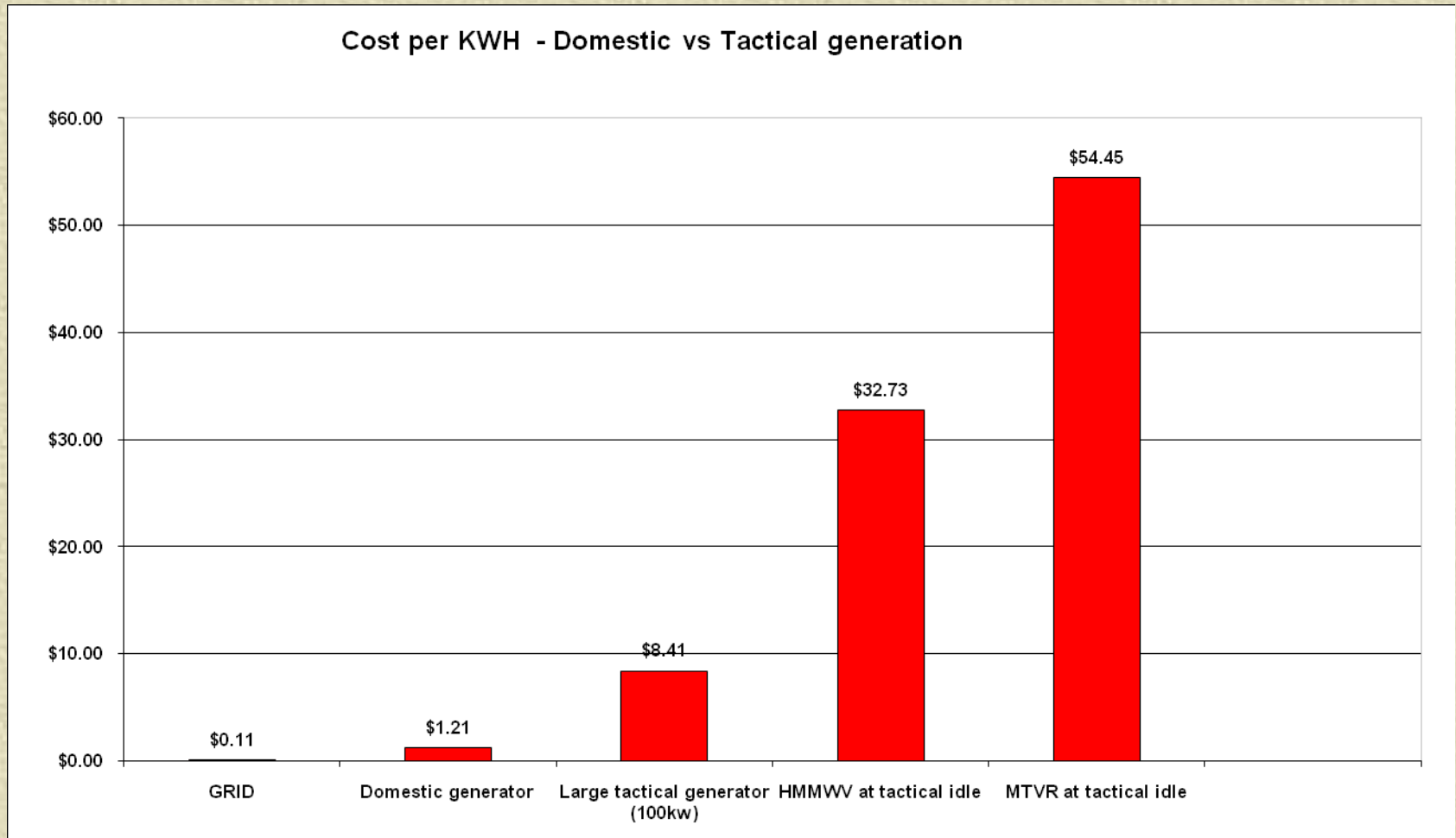
**Marine Commandant General James F. Amos:**

(Excerpt from the General's comments on March 1, 2011 before the House Armed Services Committee)

*“The Marine Corps is leading the development of expeditionary energy solutions .... reducing energy demand in our platforms and systems, increasing the use of renewable energy, and instilling an ethos of energy and water efficiency in every Marine. **Our priority is force protection — saving lives by reducing the number of Marines at risk on the road hauling fuel and water.**”*



# DOLLAR COST OF TACTICAL GENERATORS



**Assumes fully burdened cost of fuel**

**Assumes 33% typical load factor**

**Disregards maintenance and depreciation**

# THE HUNT



## EXFOB EVALUATORS LOOK FOR ALTERNATIVE-ENERGY SOLUTIONS

- ✓ That are light-weight, portable
- ✓ That will endure harsh climates
- ✓ That will stand up to rough handling
- ✓ That ensure electrical power off-grid
- ✓ That are easy to set up by a small team under stress
- ✓ **That reduce fuel consumption**



# MARINE EXFOB EVALUATIONS

## QUANTICO

## 29 PALMS

M  
A  
R  
  
2  
0  
1  
0



A  
U  
G  
  
2  
0  
1  
0



# NEST ENERGY AT EXFOBS - 2010

**QUANTICO**



**MARCH**

**29PALMS**



**AUGUST**



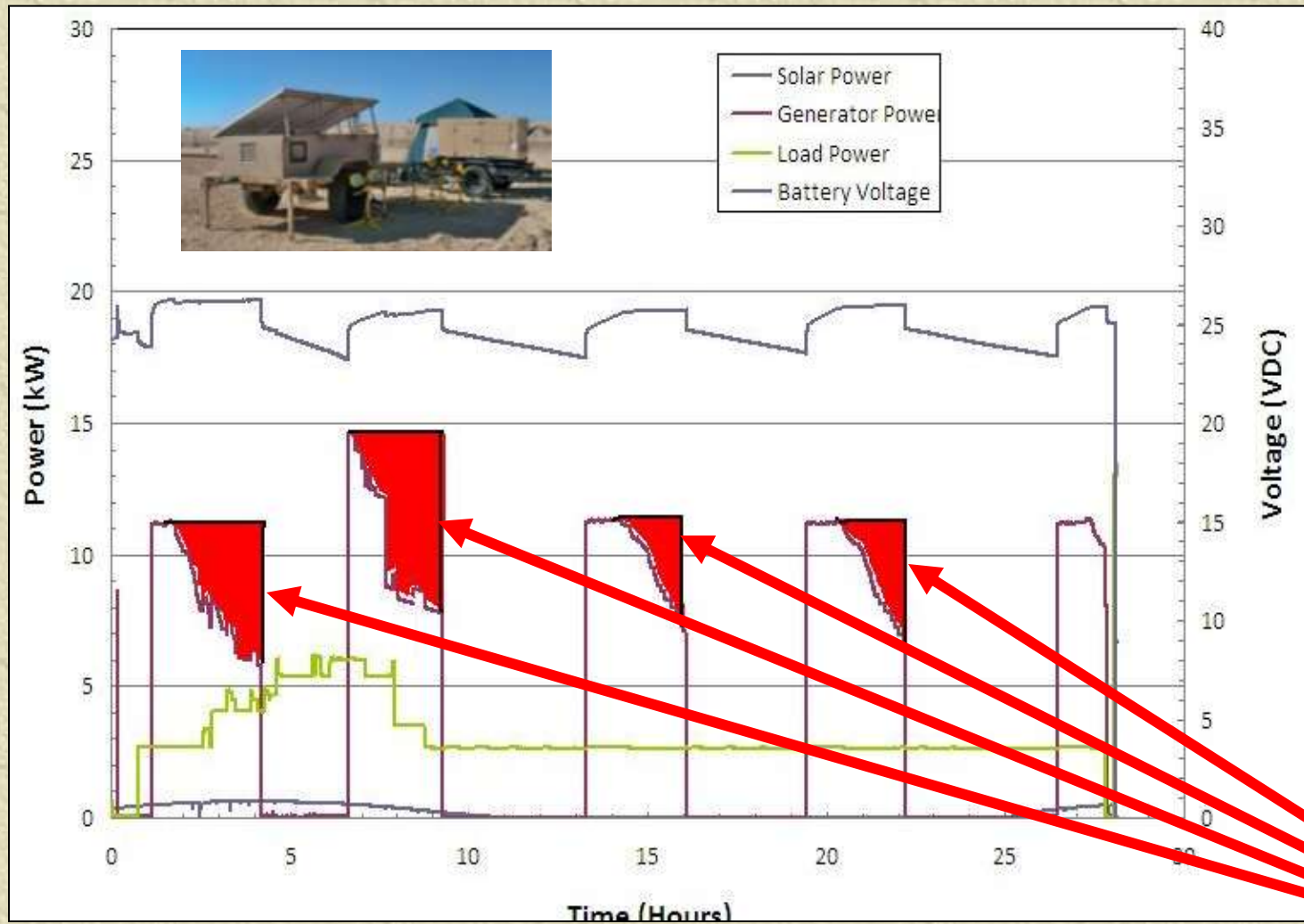
# ONR DATASET FROM EXFOB4 / 29PALMS

## Eagle Hybrid Power Trailer – AGM Batteries

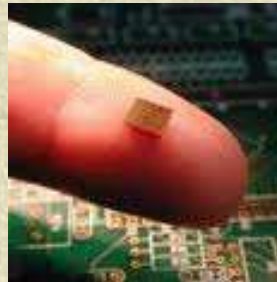


# ONR DATASET FROM EXFOB4 / 29PALMS

## Eagle Hybrid Power Trailer – LiFePO Batteries



# THE MASTERMIND



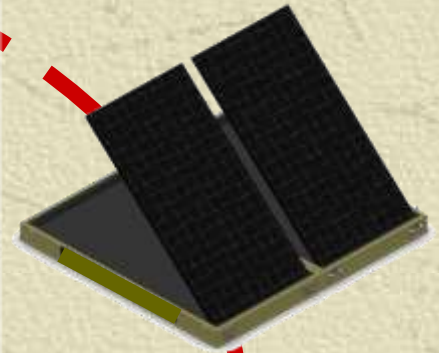


# A “SYSTEM OF SYSTEMS”

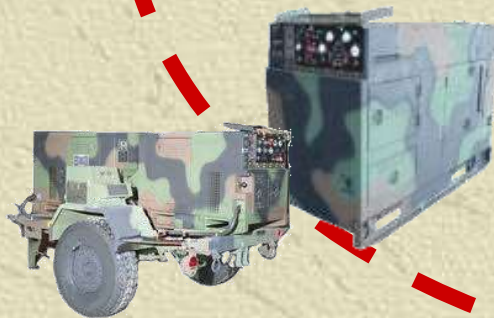
**Eagle Hybrid  
Power Trailers**



**Future renewable  
energy sources**



**SOLIS-EM**

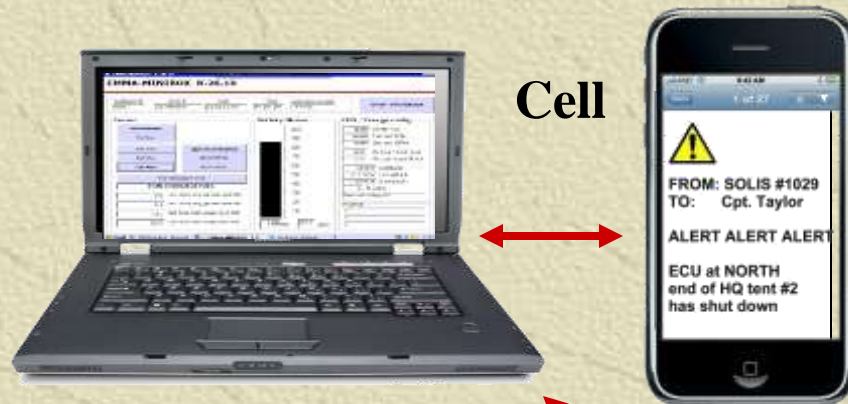


**ROCS  
Remote Operational Control System**



**Raptor Solar  
Light Trailers**

# SOLIS ENERGY MANAGEMENT & CONTROL



- Monitors fuel/battery status
- Alerts to potential problems
- Secure “extranet” data transmission
- Manages fossil & renewable resources
- Climate database helps predict fuel use
- Controls multiple resources simultaneously

✓ **Reduces fuel consumption**

Command

FOB



Field





# REMOTE OPERATIONAL CONTROL SYSTEM

## ROCS



- Generator management
- Compatible with TQG “family”
- Local or remote access (Internet)
- Simple operation, field installable
- Controls up to 256 tactical gensets

✓ **Reduces fuel consumption**





# SYSTEM OF SYSTEMS DEMO

SOLIS Energy Management System v2.1


SOLIS Energy Management System

CUSTOMER	UNIT	LOCATION	CTL TYPE	DESCRIPTION	SERIAL#
00001	0005	NEST Energy 2604 N 3rd St	LC	Local Microgrid Control	CBP0000002
00001	0001	NEST Energy 2602 N 3rd St	RL	Raptor Light Controller	CBP0000099
00001	0003	NEST Energy 2604 N 3rd St	AG	HPT Generator Control	CBP0000004

SYSTEM IDENTIFICATION

User Name: nest  
Customer: 00001  
Location: Local Microgrid Control  
Unit #: 0005  
Serial #: CBP0000002  
Date: 04/06/2011  
Time: 12:50:54  
Update: 30 seconds

SECURITY CAM



LOAD AND ENERGY CONTROL:

Load #1	Load #2	Load #3	Load #4
OFF	OFF	OFF	OFF
<a href="#">Load 1 ON</a>	<a href="#">Load 2 ON</a>	<a href="#">Load 3 ON</a>	<a href="#">Load 4 ON</a>
<a href="#">Load 1 OFF</a>	<a href="#">Load 2 OFF</a>	<a href="#">Load 3 OFF</a>	<a href="#">Load 4 OFF</a>

TQG Start-Stop

Microgrid - Building

Raptor Light Trailer

END SOLIS



Date	Time	Power (W)	Voltage (V)	Current (A)	Status
2023-10-27	10:00	100	12.0	8.3	OK
2023-10-27	10:05	150	12.0	12.5	OK
2023-10-27	10:10	200	12.0	16.7	OK
2023-10-27	10:15	250	12.0	20.8	OK
2023-10-27	10:20	300	12.0	25.0	OK
2023-10-27	10:25	350	12.0	29.2	OK
2023-10-27	10:30	400	12.0	33.3	OK
2023-10-27	10:35	450	12.0	37.5	OK
2023-10-27	10:40	500	12.0	41.7	OK
2023-10-27	10:45	550	12.0	45.8	OK
2023-10-27	10:50	600	12.0	50.0	OK
2023-10-27	10:55	650	12.0	54.2	OK
2023-10-27	11:00	700	12.0	58.3	OK
2023-10-27	11:05	750	12.0	62.5	OK
2023-10-27	11:10	800	12.0	66.7	OK
2023-10-27	11:15	850	12.0	70.8	OK
2023-10-27	11:20	900	12.0	75.0	OK
2023-10-27	11:25	950	12.0	79.2	OK
2023-10-27	11:30	1000	12.0	83.3	OK
2023-10-27	11:35	1050	12.0	87.5	OK
2023-10-27	11:40	1100	12.0	91.7	OK
2023-10-27	11:45	1150	12.0	95.8	OK
2023-10-27	11:50	1200	12.0	100.0	OK
2023-10-27	11:55	1250	12.0	104.2	OK
2023-10-27	12:00	1300	12.0	108.3	OK
2023-10-27	12:05	1350	12.0	112.5	OK
2023-10-27	12:10	1400	12.0	116.7	OK
2023-10-27	12:15	1450	12.0	120.8	OK
2023-10-27	12:20	1500	12.0	125.0	OK
2023-10-27	12:25	1550	12.0	129.2	OK
2023-10-27	12:30	1600	12.0	133.3	OK
2023-10-27	12:35	1650	12.0	137.5	OK
2023-10-27	12:40	1700	12.0	141.7	OK
2023-10-27	12:45	1750	12.0	145.8	OK
2023-10-27	12:50	1800	12.0	150.0	OK
2023-10-27	12:55	1850	12.0	154.2	OK
2023-10-27	13:00	1900	12.0	158.3	OK
2023-10-27	13:05	1950	12.0	162.5	OK
2023-10-27	13:10	2000	12.0	166.7	OK
2023-10-27	13:15	2050	12.0	170.8	OK
2023-10-27	13:20	2100	12.0	175.0	OK
2023-10-27	13:25	2150	12.0	179.2	OK
2023-10-27	13:30	2200	12.0	183.3	OK
2023-10-27	13:35	2250	12.0	187.5	OK
2023-10-27	13:40	2300	12.0	191.7	OK
2023-10-27	13:45	2350	12.0	195.8	OK
2023-10-27	13:50	2400	12.0	200.0	OK
2023-10-27	13:55	2450	12.0	204.2	OK
2023-10-27	14:00	2500	12.0	208.3	OK
2023-10-27	14:05	2550	12.0	212.5	OK
2023-10-27	14:10	2600	12.0	216.7	OK
2023-10-27	14:15	2650	12.0	220.8	OK
2023-10-27	14:20	2700	12.0	225.0	OK
2023-10-27	14:25	2750	12.0	229.2	OK
2023-10-27	14:30	2800	12.0	233.3	OK
2023-10-27	14:35	2850	12.0	237.5	OK
2023-10-27	14:40	2900	12.0	241.7	OK
2023-10-27	14:45	2950	12.0	245.8	OK
2023-10-27	14:50	3000	12.0	250.0	OK
2023-10-27	14:55	3050	12.0	254.2	OK
2023-10-27	15:00	3100	12.0	258.3	OK
2023-10-27	15:05	3150	12.0	262.5	OK
2023-10-27	15:10	3200	12.0	266.7	OK
2023-10-27	15:15	3250	12.0	270.8	OK
2023-10-27	15:20	3300	12.0	275.0	OK
2023-10-27	15:25	3350	12.0	279.2	OK
2023-10-27	15:30	3400	12.0	283.3	OK
2023-10-27	15:35	3450	12.0	287.5	OK
2023-10-27	15:40	3500	12.0	291.7	OK
2023-10-27	15:45	3550	12.0	295.8	OK
2023-10-27	15:50	3600	12.0	300.0	OK
2023-10-27	15:55	3650	12.0	304.2	OK
2023-10-27	16:00	3700	12.0	308.3	OK
2023-10-27	16:05	3750	12.0	312.5	OK
2023-10-27	16:10	3800	12.0	316.7	OK
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2023-10-27	16:25	3950	12.0	329.2	OK
2023-10-27	16:30	4000	12.0	333.3	OK
2023-10-27	16:35	4050	12.0	337.5	OK
2023-10-27	16:40	4100	12.0	341.7	OK
2023-10-27	16:45	4150	12.0	345.8	OK
2023-10-27	16:50	4200	12.0	350.0	OK
2023-10-27	16:55	4250	12.0	354.2	OK
2023-10-27	17:00	4300	12.0	358.3	OK
2023-10-27	17:05	4350	12.0	362.5	OK
2023-10-27	17:10	4400	12.0	366.7	OK
2023-10-27	17:15	4450	12.0	370.8	OK
2023-10-27	17:20	4500	12.0	375.0	OK
2023-10-27	17:25	4550	12.0	379.2	OK
2023-10-27	17:30	4600	12.0	383.3	OK
2023-10-27	17:35	4650	12.0	387.5	OK
2023-10-27	17:40	4700	12.0	391.7	OK
2023-10-27	17:45	4750	12.0	395.8	OK
2023-10-27	17:50	4800	12.0	400.0	OK
2023-10-27	17:55	4850	12.0	404.2	OK
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2023-10-27	18:10	5000	12.0	416.7	OK
2023-10-27	18:15	5050	12.0	420.8	OK
2023-10-27	18:20	5100	12.0	425.0	OK
2023-10-27	18:25	5150	12.0	429.2	OK
2023-10-27	18:30	5200	12.0	433.3	OK
2023-10-27	18:35	5250	12.0	437.5	OK
2023-10-27	18:40	5300	12.0	441.7	OK
2023-10-27	18:45	5350	12.0	445.8	OK
2023-10-27	18:50	5400	12.0	450.0	OK
2023-10-27	18:55	5450	12.0	454.2	OK
2023-10-27	19:00	5500	12.0	458.3	OK
2023-10-27	19:05	5550	12.0	462.5	OK
2023-10-27	19:10	5600	12.0	466.7	OK
2023-10-27	19:15	5650	12.0	470.8	OK
2023-10-27	19:20	5700	12.0	475.0	OK
2023-10-27	19:25	5750	12.0	479.2	OK
2023-10-27	19:30	5800	12.0	483.3	OK
2023-10-27	19:35	5850	12.0	487.5	OK
2023-10-27	19:40	5900	12.0	491.7	OK
2023-10-27	19:45	5950	12.0	495.8	OK
2023-10-27	19:50	6000	12.0	500.0	OK
2023-10-27	19:55	6050	12.0	504.2	OK
2023-10-27	20:00	6100	12.0	508.3	OK
2023-10-27	20:05	6150	12.0	512.5	OK
2023-10-27	20:10	6200	12.0	516.7	OK
2023-10-27	20:15	6250	12.0	520.8	OK
2023-10-27	20:20	6300	12.0	525.0	OK
2023-10-27	20:25	6350	12.0	529.2	OK
2023-10-27	20:30	6400	12.0	533.3	OK
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2023-10-27	20:40	6500	12.0	541.7	OK
2023-10-27	20:45	6550	12.0	545.8	OK
2023-10-27	20:50	6600	12.0	550.0	OK
2023-10-27	20:55	6650	12.0	554.2	OK
2023-10-27	21:00	6700	12.0	558.3	OK
2023-10-27	21:05	6750	12.0	562.5	OK
2023-10-27	21:10	6800	12.0	566.7	OK
2023-10-27	21:15	6850	12.0	570.8	OK
2023-10-27	21:20	6900	12.0	575.0	OK
2023-10-27	21:25	6950	12.0	579.2	OK
2023-10-27	21:30	7000	12.0	583.3	OK
2023-10-27	21:35	7050	12.0	587.5	OK
2023-10-27	21:40	7100	12.0	591.7	OK
2023-10-27	21:45	7150	12.0	595.8	OK
2023-10-27	21:50	7200	12.0	600.0	OK
2023-10-27	21:55	7250	12.0	604.2	OK
2023-10-27	22:00	7300	12.0	608.3	OK
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2023-10-27	22:10	7400	12.0	616.7	OK
2023-10-27	22:15	7450	12.0	620.8	OK
2023-10-27	22:20	7500	12.0	625.0	OK
2023-10-27	22:25	7550	12.0	629.2	OK
2023-10-27	22:30	7600	12.0	633.3	OK
2023-10-27	22:35	7650	12.0	637.5	OK
2023-10-27	22:40	7700	12.0	641.7	OK
2023-10-27	22:45	7750	12.0	645.8	OK
2023-10-27	22:50	7800	12.0	650.0	OK
2023-10-27	22:55	7850	12.0	654.2	OK
2023-10-27	23:00	7900	12.0	658.3	OK
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2023-10-27	23:10	8000	12.0	666.7	OK
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2023-10-27	23:25	8150	12.0	679.2	OK
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2023-10-27	23:35	8250	12.0	687.5	OK
2023-10-27	23:40	8300	12.0	691.7	OK
2023-10-27	23:45	8350	12.0	695.8	OK
2023-10-27	23:50	8400	12.0	700.0	OK
2023-10-27	23:55	8450	12.0	704.2	OK
2023-10-27	00:00	8500	12.0	708.3	OK
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2023-10-27	00:20	8700	12.0	725.0	OK
2023-10-27	00:25	8750	12.0	729.2	OK
2023-10-27	00:30	8800	12.0	733.3	OK
2023-10-27	00:35	8850	12.0	737.5	OK
2023-10-27	00:40	8900	12.0	741.7	OK
2023-10-27	00:45	8950	12.0	745.8	OK
2023-10-27	00:50	9000	12.0	750.0	OK
2023-10-27	00:55	9050	12.0	754.2	OK
2023-10-27	01:00	9100	12.0	758.3	OK
2023-10-27	01:05	9150	12.0	762.5	OK
2023-10-27	01:10	9200	12.0	766.7	OK
2023-10-27	01:15	9250	12.0	770.8	OK
2023-10-27	01:20	9300	12.0	775.0	OK
2023-10-27	01:25	9350	12.0	779.2	OK
2023-10-27	01:30	9400	12.0	783.3	OK
2023-10-27	01:35	9450	12.0	787.5	OK
2023-10-27	01:40	9500	12.0	791.7	OK
2023-10-27	01:45	9550	12.0	795.8	OK
2023-10-27	01:50	9600	12.0	800.0	OK
2023-10-27	01:55	9650	12.0	804.2	OK
2023-10-27	02:00	9700	12.0	808.3	OK</

# SYSTEM OF SYSTEMS DEMO

SOLIS Energy Management System v2.1

SOLIS Energy Management System

CUSTOMER	UNIT	LOCATION	CTL TYPE	DESCRIPTION	SERIAL#
00001	0005	NEST Energy 2604 N 3rd St	LC	Local Microgrid Control	CBP0000002
00001	0001	NEST Energy 2602 N 3rd St	RL	Raptor Light Controller	CBP0000099
00001	0003	NEST Energy 2604 N 3rd St	AG	HPT Generator Control	CBP0000004

SYSTEM IDENTIFICATION

User Name: nest

Customer: 00001

Location: Local Microgrid Control

Unit #: 0005

Serial #: CBP0000002

Date: 04/06/2011

Time: 12:50:54

Update: 30 seconds

SECURITY CAM

LOAD AND ENERGY CONTROL:

Load #1	Load #2	Load #3	Load #4
OFF	OFF	OFF	OFF
<a href="#">Load 1 ON</a>	<a href="#">Load 2 ON</a>	<a href="#">Load 3 ON</a>	<a href="#">Load 4 ON</a>
<a href="#">Load 1 OFF</a>	<a href="#">Load 2 OFF</a>	<a href="#">Load 3 OFF</a>	<a href="#">Load 4 OFF</a>

TQG Start-Stop

Microgrid - Building

Raptor Light Trailer

END SOLIS





# SYSTEM OF SYSTEMS DEMO

SOLIS Energy Management System v2.1


SOLIS Energy Management System

CUSTOMER	UNIT	LOCATION	CTL TYPE	DESCRIPTION	SERIAL#
00001	0005	NEST Energy 2604 N 3rd St	LC	Local Microgrid Control	CBP0000002
00001	0001	NEST Energy 2602 N 3rd St	RL	Raptor Light Controller	CBP0000099
00001	0003	NEST Energy 2604 N 3rd St	AG	HPT Generator Control	CBP0000004

### SYSTEM IDENTIFICATION

**User Name:** nest  
**Customer:** 00001  
**Location:** Local Microgrid Control  
**Unit #:** 0005  
**Serial #** CBP0000002  
**Date:** 04/06/2011  
**Time:** 12:50:54  
**Update:** 30 seconds

### SECURITY CAM



### LOAD AND ENERGY CONTROL:

Load #1	Load #2	Load #3	Load #4
OFF	OFF	OFF	OFF
<a href="#">Load 1 ON</a>	<a href="#">Load 2 ON</a>	<a href="#">Load 3 ON</a>	<a href="#">Load 4 ON</a>
<a href="#">Load 1 OFF</a>	<a href="#">Load 2 OFF</a>	<a href="#">Load 3 OFF</a>	<a href="#">Load 4 OFF</a>

TQG Start-Stop

Microgrid - Building

Raptor Light Trailer

END SOLIS



DATE	TIME	LOCATION	TYPE	STATUS
2023-10-27	14:30	Room 101	Access	Success
2023-10-27	15:45	Room 102	Access	Success
2023-10-27	16:15	Room 103	Access	Success
2023-10-27	17:30	Room 104	Access	Success
2023-10-27	18:00	Room 105	Access	Success
2023-10-27	19:15	Room 106	Access	Success
2023-10-27	20:30	Room 107	Access	Success
2023-10-27	21:45	Room 108	Access	Success
2023-10-27	22:00	Room 109	Access	Success
2023-10-27	23:15	Room 110	Access	Success



# A CLOSER EXAMINATION...



# EAGLE HPT-T (TACTICAL)



- Supports 10kw peak load
  - Cuts attached genset run time by 50%
  - Easy to set up, “plug & play”
  - Towable—weight under 4200#
  - Manages genset from local or remote
- ✓ **Reduces fuel consumption**

# **EAGLE HPT-G (GENERATOR ONBOARD)**



- **Lithium battery pack**
- **Supports 10kw peak load**
- **Supports 3kw average load for about a week**
- **Towable—weight under 4200#**
- **Controls onboard genset automatically**
- **Integrated SOLIS Energy Management**
- ✓ **Reduces fuel consumption**



# RAPTOR SOLAR LIGHT TRAILER



- Zero maintenance
- 12-hour nighttime illumination
- 100% solar, uses no fossil fuel
- Complete automatic operation
- Easy to set up, “plug & play”
- Inverter for plug-in items



✓Reduces fuel consumption



	<b>Terex AL4000</b>	<b>NEST Raptor</b>
Purchase price	\$8,900.00	\$17,609.19
Fuel cost, annual	\$36,724.00	\$0.00
Maintenance, annual	\$13,140.00	
Battery pack, every three years, annualized cost		\$1,066.67
Total annual cost of operation	\$49,864.00	\$1,066.67
<b>Total 3-Year Cost of Operation</b>	<b>\$308,492.00</b>	<b>\$20,809.19</b>



# RAPTOR SOLAR LIGHT TRAILERS, POST EXFOB





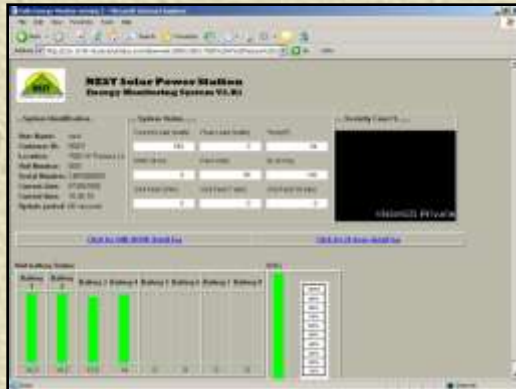
# EAGLE HPT, POST EXFOB



# NEXTFOB



# EAGLE HPT-EM (EXTENDED MISSION)



- Supports 3kw missions for 15 days
- Lithium battery pack (U.S. MADE)
  - NEST super-light solar panels
  - Handles 10kw peak load
  - Towable—weight under 4200#
- Controls onboard genset automatically
- Integrated SOLIS Energy Management

✓ **Reduces fuel consumption**

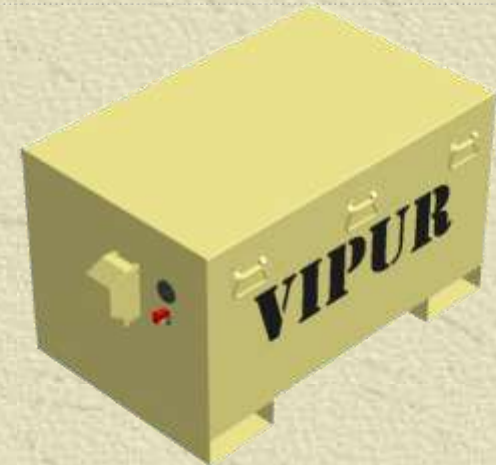
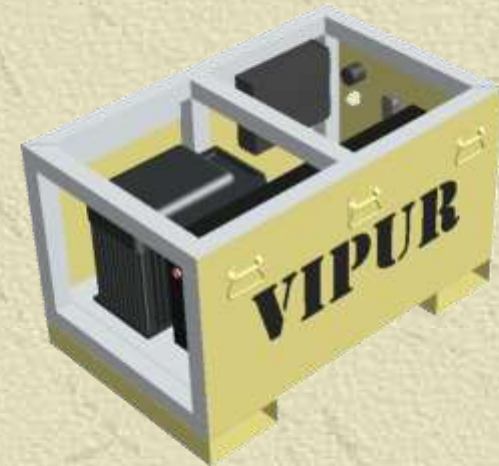




# VEHICLE INTEGRATED POWER UNIT REGULATOR

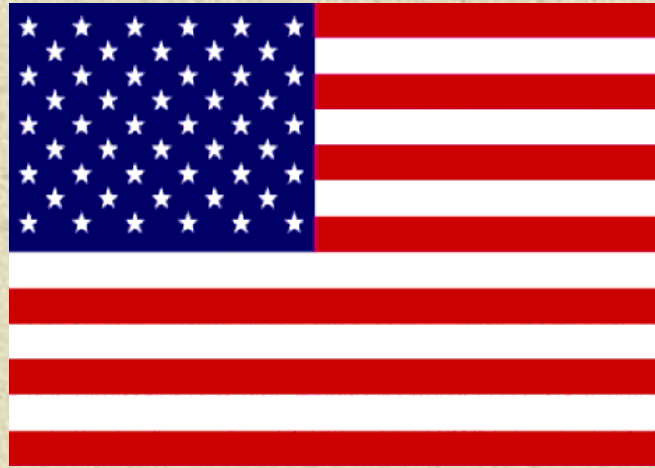


- Mounts to tactical vehicles
- Three models - support 1.5 to 4kw peak load
  - Reduces vehicle idle time by 50%
  - Automatic engine start/stop
  - Simple field installation
- Supports 12 or 24v battery systems



✓ **Reduces fuel consumption**

**EXFOB = WIN-WIN**



# REDUCE FUEL CONSUMPTION

## REDUCE RISKS TO WARFIGHTERS

*NEST Energy has alternative energy-based systems—in production-- that will reduce risks Marines and other branches of service face hauling and guarding fuel supplies in expeditionary environments.*

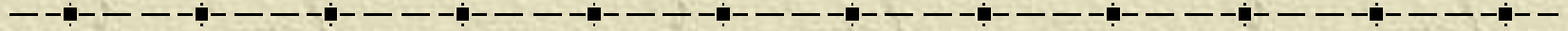


*They're ready now.*





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