Summary with Stakeholders comments, JIFX 17-3 E/T (Everything/Tactical) Light experiment:

STAKEHOLDERS Comments:

Stakeholder Evaluation(s):

Do you consider yourself to be a Subject Matter Expert?
1. Yes
2. No
3. Yes
4. No
5. No
6. Yes
7. No

Is this Experiment Relevant?
1. Yes
2. Yes
3. Yes
4. Yes
5. Yes
6. Yes
7. Yes

What Areas of the RFI does this experiment relate to?
1. C3. Small Vessel Cooperative Identification and Tracking (SVCT) and Non-Cooperative Vessel Imaging and Tracking (NVIT), E2. Maritime Domain Awareness
2. No response
3. I2. Deployable Lighting Technologies
4. I2. Deployable Lighting Technologies, I3. Energy efficiencies
5. F1. Non-combatant Evacuation Operations (NEO)
6. D5. Location, Tracking and Communication Technologies F1. Non-combatant Evacuation Operations (NEO) F2. Interoperable Communication Solutions in Network Denied Disaster Response Environments
7. E3. Improved Situational Awareness and Collaborative Tools/Applications for Synchronized Execution F1. Non-combatant Evacuation Operations (NEO) H1. Signature Reductions and Management I2. Deployable Lighting Technologies

Additional areas not listed above?
1. No response
2. No response
3. No response
4. No response
5. No response
6. Rapid visual patient tracking, marking for night operations, friendly troop
7. No response

How much of an improvement is this technology over existing solutions?
1. High
2. Medium
3. High
4. Medium
5. High
6. High
7. High

What are the observable strengths of this technology?
1. Physical Size, Physical Weight, Physical Robustness, Cost of Unit/System, Other
2. No response
3. Physical Size, Physical Weight, Power Requirements, Operating Endurance, Scalability to Multiple Units/Users, Ease of Integration
4. Physical Robustness, Operating Endurance, Usability/Intuitiveness, Complies with Existing Standards
5. Physical Size, Physical Weight, Physical Robustness, Power Requirements, Operating Endurance, Usability/Intuitiveness, Training Requirements
6. Physical Size, Physical Weight, Physical Robustness, Speed of Deployment, Usability/Intuitiveness, Scalability, Ease of Integration
7. Physical Size, Physical Weight, Physical Robustness, Power Requirements, Operating Endurance, Resilience to user during failure conditions, Speed of Deployment, Usability/Intuitiveness, Training Requirements, Scalability, Ease of Integration, Ability to operate in isolation

Additional strengths not listed before?
1. With this unit, the need to use 4-8 chemlights per CRRC per day over a 2 week training package could make a huge difference in money, weight, and overall space used for transportation.
2. Better visibility, longer life, resuable, less waste
3. No response
4. No response
5. No response
6. No response
7. No response

Observable weaknesses of technology?
1. No response
2. No response
3. Cost of Unit/System
4. No response
5. Cost of unit/system
6. Power Requirements, Resilience to user during failure conditions, Cost of Unit/System
7. No response

Weaknesses not Listed Before?

1. Would like to see how well they stay connected during surf passages with CRRCs and how they fare in salt water.
2. One more thing for the warfighter to carry
3. No response
4. None identified
5. No response
6. No response
7. No response

Does this experiment aid in refining RFI elements?
1. Yes
2. No response
3. Yes
4. No
5. No
6. Yes
7. No

Does this experiment represent a new approach to bridging a capability gap?
1. No
2. Yes
3. No
4. No
5. Yes
6. Yes
7. Yes

Did the experimenters modify current technology for a new application?
1. Yes
2. Yes
3. Yes
4. Yes
5. No
6. Yes
7. Yes

Did the experiments collaborate with other experiments on a potential solution?
1. No response
2. No response
3. No
4. Yes
5. No
6. Yes
7. Yes

Did you attend an experiment by the participant at a prior event?
1. No
2. No
3. No
4. No
5. No
6. No
7. No

Additional Comments
1. No response
2. So these comments just apply to the LED lights in general for both G-1 and I-1. Clearly these lights are better quality than the chem lights currently used. The fact that they have long battery life and can be turned on and off makes them a no brainer.
3. Lights can coexist with with chem lights. Cannot replace chemlight but can help supplement the use of chem light would be good for repeated task where you could collect the light at a later time.
4. No response
5. This item wont fully replace chem lights, but there are multiple situations where small reusabld lights would be useful, such as: in amphib ops, marking lines in a FOB, as a buzzsaw for marking an LZ.
6. Great product w a growing listof uses. Would like to bring down to Camp Pendleton for use at 1st Recon Bn for use/integration during a reconnaissance and amphibious package.
7. Very practical improvement over Chem lights in brightness, endurance and form factor. Potentially superior in terms of cost and environmental impact as well

Numbers:

For the purposes of determining how long the useful light output for the E/T lights, we will use the reported average number of days in the US Army Aberdeen Proving Grounds MIL-STD 810 lab test report. For determining how long the useful light output for the chemical lights we will use the advertised longevity for each color.

Red, green, and yellow chemical lights = 12 hours

Blue chemical lights = 8 hours

Chemical lights weigh 24.8 grams with their protective cover

Chemical light measure approximately 6" X ~0.75" X ~075" = ~ 3.375 cubic inches

E/T Lights have all four colors (R/Y/G/B or IR/R/G/B) in one light.

E/T Light set to constant red = 4.5 days (108 hours)

E/T Light set to constant yellow = 5.2 days (124.8 hours)

E/T Light set to constant green = 9.2 days (220.80 hours)

E/T Light set to constant blue = 9.5 days (228 hours)

E/T Lights weigh 43.2 grams with lanyard

E/T Lights measure approximately 3.125” X 1.125 X ~1.125 = ~3.955 cubic inches

From 2010 to early 2014 we spent approximately $179,536,123.00 in chemical lights just via the DLA alone. I have not been able to find more current numbers so for this analysis we will use the following information that was located back in early 2014.

Plastics & chemical waste generated by chemical lights:

Number of chemical light sticks used in the ~3 year period:

Spent from 2010 to 2013, ~$179,536,123.00 / $~1.13 per chemical light = ~158,881,524.78 chemical lights

Approximate chemical lights consumed per year:

~158,881,524.78 / ~3 year period = ~52,960,508.26 chemical lights per year

Plastic and chemical waste generated by chemical lights (Note, the chemicals in chemical lights have been found toxic to marine organisms)

Waste in Weight: ~52,960,508.26 chemical lights X 24.8 grams each = ~1,313,420,604.848 grams / 1,000 grams = **~1,313,420.60 Kgs of plastic and chemical waste per year**. By moving to a reusable marking/signaling system for common repetitive tasks we would reduce this by ~90+%.

Waste in Volume: ~52,960,508.26 chemical lights X ~3.375 cubic inches each chemical light = ~178,741,715.3775 cubic inches, which equals **~103,438.49 cubic feet of plastic and chemical waste per year.** This volume of waste would also be reduced by ~90+%.

Cost savings:

After speaking with many soldiers over the last 13 years and reading the September 2013 PEO Soldier SEP, LUE report, I’ve learned that only 5% to 10% of the tasks currently performed by chemical lights are truly crack and forget tasks. All other tasks may be performed by a re-usable alternative (augmentation).

Mentioned is the September PEO Soldier, SEP, LUE report. It is important to note the report misreported one of the more important findings. The report starts by stating the soldiers preferred the chemical lights but in the next page it states less than 40% of soldiers preferred the chemical lights. When you take a look at page 25, you see a pie chart. For some reason the report writer separated two versions (6.8A & 6.8IR) of the E/T Lights into 3 parts of the pie, and kept the IR chemical lights and the visible colored chemical lights as one. It turns out the report writer did not include 25% who preferred both the E/T Light and IR E/T Light in their math. Basically, 63% preferred the E/T Lights to 37% who preferred the chemical lights.

By moving to a reusable, four colors in one, personal signaling device, from a one time use crack and forget chemical light, for use in performing common repetitive tasks, taxpayers could be saving tens of millions of dollars every year, and Federal agencies/Military would significantly reduce the plastics/chemical waste generated every year by chemical lights.

Following is the summary of a Ft. Sam Houston Combat Medics School AAR, “Overall the NCOs at SMTS felt the E/T light would be plus to BAS training operations, both in the schoolhouse and also TOE units. Durability, ease of use, multifunctionality, cost and space availability played a factor into the decision making process.”

The calculation for the number of chemical lights required to match the longevity of an E/T Light follow:

Red – E/T lights last 108 hours. Chemical light lasts 12 hours. 108 hrs/12 hrs = 9 chemical lights

Yellow – E/T lights last 124.8 hours. Chemical light lasts 12 hours. 124.8 hrs/12 hrs = 10.4 chemical lights

Green – E/T lights last 220.8 hours. Chemical light lasts 12 hours. 220.8 hrs/12 hrs = 18.4 chemical lights

Blue – E/T Lights last 228 hours. Chemical lights last 8 hours. 228 hrs/ hrs = 28.5 chemical lights

Analysis:

One multi-program version 6.8A (NSN 6230-01-605-9650) is roughly $35 each (includes new improved lanyard and 3” EPDM plastic T-tab to easily attach the E/T Light to helmet straps, MOLLE, or other gear)

One chemical light is roughly $1.39 each (comes with plastic string).

Red – 9 chemical lights X $1.39 each = $12.51
Yellow – 10.4 chemical lights X $1.39 each = $14.46
Green – 18.4 chemical lights X $1.39 = $25.58
Blue – 28.5 chemical lights X $1.39 = $39.62

You spend the above versus the one-time purchase of ~$35 for the longevity of a four color in one E/T Light, and then spend ~$3 for a replacement battery.

The majority of chemical light expenditure is for the green colored chemical light. See contract SPM4A610D0285, showing $141,776,630.78

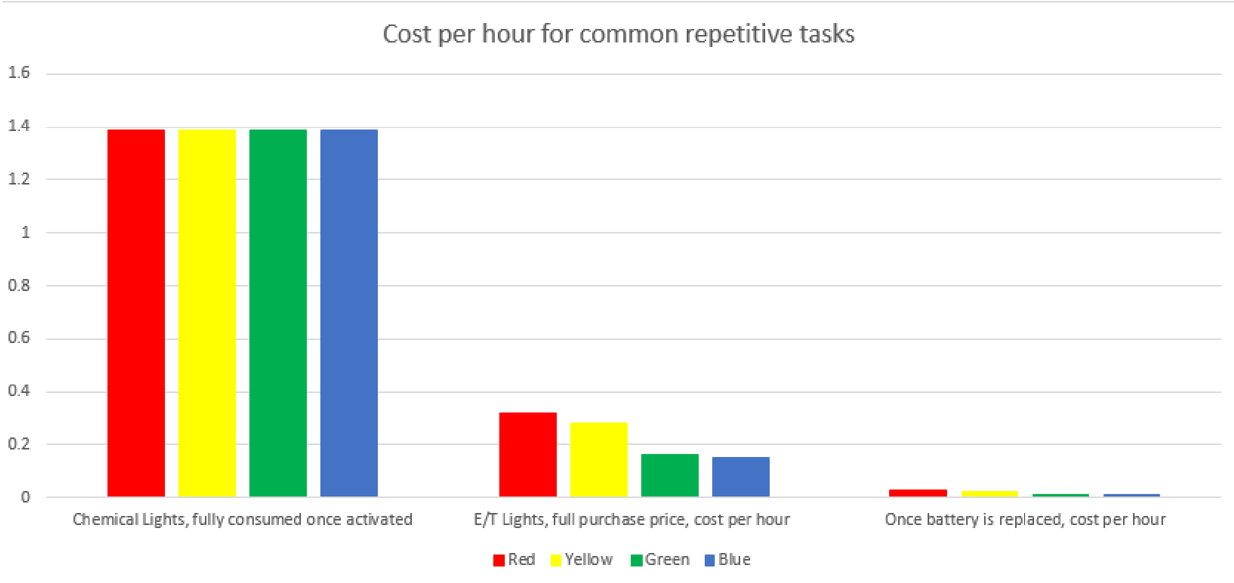
Each E/T Light, set to one color costs:

Red - ~$35.00 / 108 hours = $0.32 / hr.
Yellow - ~$35.00 / 124.8 hours = $0.28 / hr.
Green -~$35.00 / 220.8 hours = $0.16 / hr.
Blue - ~$35.00 / 228 hours = $0.15 / hr.

Each replacement battery costs ~$3.00

Red - ~$3 / 108 hours = $0.03 / hr.
Yellow - ~$3 / 124.8 hours = $0.02 / hr.
Green - ~$3 / 220.8 hours = $0.01 / hr.
Blue - ~$3 / 228 hours = <$0.01 / hr.

Chemical always will cost the purchase price ($1.39) since once cracked they are fully consumed. See cost analysis chart below:



	Red	Yellow	Green	Blue
Chemical Lights, fully consumed once activated	1.39	1.39	1.39	1.39
E/T Lights, full purchase price, cost per hour	0.32	0.28	0.16	0.15
Once battery is replaced, cost per hour	0.03	0.02	0.01	0.01

Weight reduction for capability:

1 E/T light weighs 43.2 grams for four color capability.

4 chemical lights weigh (24.8 g X 4 =), 99.2 grams.

The chemical lights weigh more than double for the one time use four color capability.

Weight reduction over time for the capability/longevity:

Red – 9 chemical lights X 24.8 grams each = 223.2 g
Yellow – 10.4 chemical lights X 24.8 g = 257.92 g
Green – 18.4 chemical lights X 24.8 g = 456.32 g
Blue – 28.5 chemical lights X 24.8 g= 706.8 g

It takes the above numbers per color to match the longevity of one 43.2 gram E/T Light. Then you replace one 11.2 gram battery to go back to full longevity.

Red 223.2g vs. 43.2g
Yellow 257.92g vs. 43.2g
Green 456.32g vs. 43.2g
Blue 706.8g vs. 43.2g

Battery:

I was asked by a Marine at JIFX 17-3 how other battery powered chemical light stick alternatives to chemical lights performed. I mentioned that the E/T Lights had been compared to the Lazerbrites by a US Army Ranger and that he mentioned they used coin cell batteries. In my experience coin cell batteries do not last as long and the light output diminishes quickly when compared to CR2's or CR123's. The E/T Lights utilize a CR2 Lithium Metal battery, a common camera battery that is in the supply chain. Following is the AAR that in part discusses this:

"ATSH-RBE-A

MEMORANDUM FOR RECORD

SUBJECT: Triage Lights vs. Lazer Brite Lights

Issue #1

Battery Life

Discussion:

Both lights were fitted with a new battery and turned on. The Lazer Brite only has red and the Triage light has multiple. So to keep things equal the Triage Light was set to red as well. At approx. the 96 hour mark the Lazer Brite light had lost almost all if it's luminosity. It was still on but it was effectively useless. The Triage light ran at full power for the duration of it's battery life of 162 hours of Operation. A fact to remember is also the red light is the most power draining of the four visible light colors. The Triage Light under different colors would last even longer. The Lazer Brite light did last for an extra 22 hours, but as stated before their effectiveness was essentially non-existent.

Recommendation:

Based on the ability of the Triage Light to operate at full capacity for the duration of the battery makes it a much more feasible light for long durations.

Issue #2:

Versatility

Discussion:

The Lazer Brite lights that were given to be tested were only single color. A set of Red and a set of IR. The Triage Lights contain in one light four visible colors, Red (steady/blink), Blue (steady/blink), Amber (steady/blink) and Green (steady/blink). They also have the IR light built in as well. Giving one light the ability of five separate Lazer Brite Lights. Each Lazer Brite light is approx. $32 making one $35 Triage light as cost effective as $160 of Lazer Brite lights. The fact that the Triage Lights have 5 multiple colors makes it useful for every situation. The Triage lights also have a lockout function that keep the light from being turned off accidentally when used as an actual Triage light. This keeps a patient from changing his light indicating his status to another color.

Recommendation:

A single Triage Light can be used in five times more situations than a single Lazer Brite light. That would cut down on how many lights must be carried. This helps with weight of packing lists and the ability to quickly utilize a single light instead of searching through a bag of lights to find the correct color. The Lazer Brite lights are simply marked with a color coordinated band near the switch. This would be hard to identify under limited visibility.

Issue #3:

Durability

Discussion:

There were multiple tests run on the Triage Light to test its ability to last in the most extreme conditions. One test that was ran here was to freeze the lights to see how they last under extreme cold. The same effectiveness for the luminosity was found for each light. The Triage Light ran at full power for the duration, with the Lazer Brite falling off around day 4. Strangely the frozen lights lasted longer by almost 21 hours vs. the ones at room temperature. I found quite a bit of testing done on the Triage light but could not find any on the Lazer Brite. I was going to conduct a slam test on both light. I repeatedly threw the Triage Light onto the pavement to see if it would stop functioning. It continued to function perfectly. I was not allowed to do this to the Lazer Brite since it would most definitely break due to its plastic shell. A few instructors have used the Lazer Brite lights before and reported that the on/off mechanism breaks often. I found where the Triage Lights have a life of over 30,000 cycles without problem. I attached more evaluations from the Triage Lights. I do not have or could not find equivalent evaluation for the Lazer Brite. There were such tests as freezing the Triage Light to -109F dropping it, boiling the light, then refreezing to -109F. The Triage Light worked normally in all situations. It can be used as a dive light to 200ft down, and it has been dragged behind cars just to name a few of the tests conducted.

Recommendation:

The durability of the Triage Light has been proven through multiple tests. Some conducted here and some conducted by the manufacturer. The Triage Light is essentially indestructible and the Lazer Brite lights seem to be lacking durability with its plastic components. There are multiple pieces that could easily break on a Lazer Brite light that would need replaced. The triage light has a silicon outer shell with literally no chances of breaking

Issue #4

Visibilty

Discussion:

The lights were used as DZ Marking for an Aerial Resupply via poncho parachute during a Ranger Class. The first pass was conducted used the standard sand bag lights for DZ/LZ use. The next pass was conducted using the Triage Lights set on Red (Lazer Brite only had red so it was done for equality) and the pass was conducted. The third pass utilized the red Lazer Brite lights. An AAR was conducted with the pilots and there was not distinguishable differences between the lights. For Reference the flight was at 100ft @ 30 Kias.

Recommendation:

There seems to be no difference in the light output of the two lights. The only issue I would point to is in issue #1 with the Lazer Brite lights losing their ability to output at max capacity for long periods.

Issue #5

Accessories

Discussion:

The Lazer Brite kit that was provided come with five red lights five IR lights, five stake adapters, five directional adapters and some elastic bands. It also came with replacement batteries and some replacement caps in the event they were broken. The stake adapters made it easy to emplace the lights during the DZ operation. The little elastic bands were similar to girls hair ties. These would make it easy to attach to rucks and MOLLE gear. Although the nature of the on/off switch which is a twisting motion can easily be switched off if the light is rubbed against an outside object. The directional adapters would give the ability to direct light if the situation arose. The Triage Lights test had looped bottoms along with bottoms that were magnetic. The bottoms of the Triage Lights are easy to pop on and off. They did not have a directional attachment. Although the light come in a small clear plastic container. With a piece of Gorilla Tape the small plastic containers were made into a directional adapter. The Triage lights did not have a stake adapter. But a purchase of 5 stakes at $0.49 at a local hardware store easily made such an adapter. The magnetic bottoms held onto the stakes at over 40 mph driving down the road which would be similar to rotor wash of an LZ/PZ. The Triage Lights come with the Lanyard for use as a triage light hanging around the neck of a patient. They also come with an EPDM band that will allow you to quickly attach the light to rucks, helmets, MOLLE gear etc. The nature of the switch and lockout function prevent the light from being accidently turned off like the Lazer Brite light. The Lazer Brite kit was sent specifically for test in a combat environment. The Triage Lights were purchased by an Instructor in a prior unit for use as Triage Lights during his deployment. So the kits were not something that they had available. They used some good 'ol field craft to make it work. The Triage Manufacturer was contacted and stated that similar kits could be constructed and thought that the price would be similar or less than the Lazer Brite kit.

Recommendation:

The Lazer Brite Kit came with many useful attachments. The Triage Lights with minimal field Craft became as bit effective as the Lazer Brite Lights. More contact with the Triage Manufacturer would be needed to get a good comparison. In this situation a $170 worth of Triage Lights and $4 in field craft made the Triage Lights as effective as a $400 kit of Lazer Brite Lights."

Volume reduction calculations:

One E/T Light = ~3.955 cubic inches

One chemical light = ~3.375 cubic inches

4 chemical lights R/Y/G/B) = ~13.5 cubic inches (~3.375 X 4)

Red – 9 chemical lights X ~3.375 ci = 30.375 ci
Yellow – 10.4 chemical lights X ~3.375 ci = 35.1 ci
Green – 18.4 chemical lights X ~3.375 ci = 62.1 ci
Blue – 28.5 chemical lights ~3.375 ci = 96.1875 ci.

The above numbers per color versus the 3.3955 cubic inch E/T Light for the longevity capability.

Red 30.375 cubic inches vs. 3.3955 cubic inches
Yellow 35.1 cubic inches vs. 3.3955 cubic inches
Green 62.1 cubic inches vs. 3.3955 cubic inches
Blue 96.1875 cubic inches vs. 3.3955 cubic inches

Logistical cost reductions:

There are unmeasurable cost savings associated with the recovery, management, and constant repurchasing of chemical lights. Simply think of shipping logistics. Would you prefer to be shipping barrels of chemical lights or a small box off replacement batteries? Use the room for more important items. Another benefit is the batteries can be used for a variety of equipment and/or rechargeable batteries are an option.

Other Chemical light shortcomings:

1. Cannot be turned off when needed, posing a hazard to our troops.
2. When processed as waste at sea, they leave a glowing trail behind the ships.
3. They function poorly if at all in low temperatures.
4. They can break and expose the warfighter to the glowing chemicals which can pose a risk to that soldier.
5. If used for triage they can break and contaminate the patients wounds not only with the "harmless chemicals", but also with the shattered vile inside the chemical light
6. Cannot flash.
7. Must be continuously replenished, adding to logistical costs and volume
8. There is a time and cost expense associated with repurchasing, collecting, and disposing of spent chemical lights.