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Movable Aviation Light (MAL)

Mohd Khairun Nizam bin Sa'adan^{1*}, Vishnuu a/l Narayanan¹, Mohd Sandarshah bin Suaidi¹,
Mohd Ferhan Bin Suaidi¹ & Salleh Wong Kok Ming¹

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ABSTRACT

Aircraft maintenance hangars must have high levels of visibility and good colour rendering in order for personnel to detect defects in airplanes and make repairs. Poor illumination levels and colour rendering can obscure or mask the appearance of items that would otherwise be perceptible. Poor lighting systems in aviation hangar could lead the technicians and engineers to make mistakes in their duty of the inspection and identification of the defects on the aircraft. As a consequence, the MAL has various amount of features that able to help the LAE and technicians to do their inspections tasks with more efficient and without difficulties. The product LED Work light is attach with the flexible hose which make the product to use in various places around aircraft. Four Swivel Caster Wheels with Brakes is installed and makes the product is movable. Other than that, Solar panel and solar charge regulator is installed as backup source of the product.

Keyword: aircraft, maintenance

1. INTRODUCTION

1.1 Research Background

When installing airplane hangar lights, you have to light a large vertical area. For maintenance and cleaning of an airplane, you'll need good lighting near the top of the hangar. But to keep things safe at ground level, you'll also need clear lighting. High bay hangar lights make the most sense here. The quantity and quality of light in the aircraft hangers is extremely important given visibility factors that can create various safety issues if they are not working the way they are supposed to. According to the Illuminating Engineering Society (IES) 1995, hangar lights in aircraft maintenance facilities should produce a minimum of 75 foot-candles (fc). LED Pros World Wide understands that hangar lights plays a very important role in the performance and profitability of a fixed-base operator and its employees. With utility costs continuing to rise, adopting an energy-efficient lighting system is a necessity to a company's bottom line. Our goal is to not only provide our customers with hangar lights, but to offer solutions by designing energy-saving systems that improve work conditions and reduce maintenance costs.

“Because lighting systems are easy to upgrade and the precise energy savings gained by upgrades are already known, building owners and lessee are encouraged to focus on lighting improvements first.” (US Dept.of Energy, 2009).

1.2 Problem Statement

- i. Many of the aircraft technicians and maintenance engineers are suffering from the lack of the lighting in the hangar while doing their major and minor inspections.
- ii. Illumination reduces a maintenance technician's ability to discriminate detail and is caused when a light source in the visual field is much brighter than the task material at the workplace.
- iii. We found out that 56% experience that there are problem with illumination in hangar

2. LITERATURE

2.1 Dimensions of the project

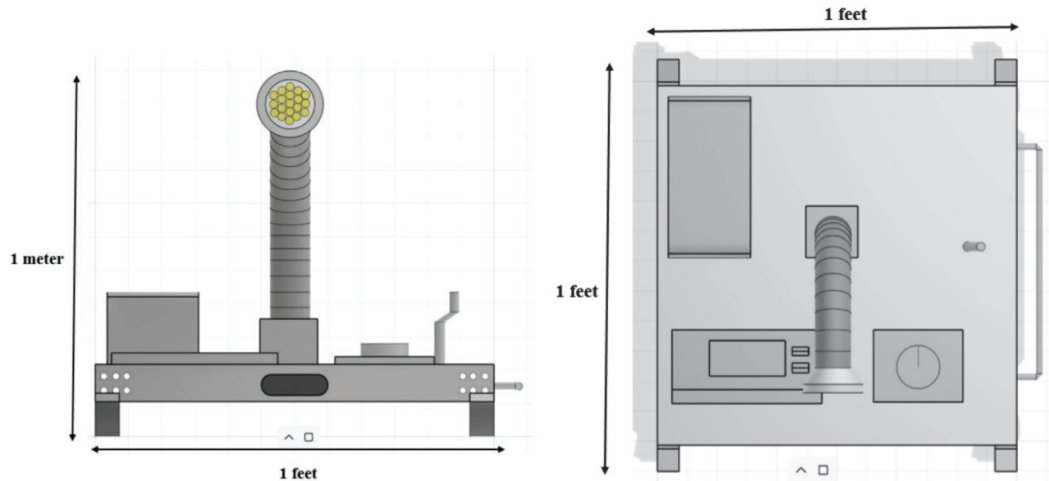


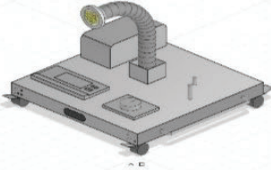


Figure 1: Dimensions details

2.2 Comparison between recent research and current project

Table 1: Comparison of recent research and current project

Name / Criteria	Recent Product (Hybrid Lighting Tower)	Recent Product (Stand Light)	Current Project (Movable Aviation Light)
Design			
Cost	High cost	Affordable	Affordable
Material	<ul style="list-style-type: none"> - Steel - Aluminium - Rubber 	<ul style="list-style-type: none"> - Steel - Rubber 	<ul style="list-style-type: none"> - Steel Metal - Rubber - Coated with epoxy spray paint
Retractable	Yes	Yes	Yes
Height	2.7 meter	1.5 meter	1.0 meter
Main source of function	Using Diesel	Using Electric Current	Using Rechargeable Battery. (Lead Acid Battery 12V)
Solar (Additional)	No	No	Yes
Areas of function	Use in construction areas and aviation industry.	Use in indoor areas	Use in aviation hangar and any other manufacturing areas.
LED Light	Yes	No	Yes
Light Intensity Regulator	No	No	Yes
Stability	Stable	Not stable	Stable

We came on this idea of building this product from collecting data from various aircraft technicians and aircraft engineers that come across the difficulties on doing their tasks or an inspection. This product is designed especially for the aircraft technicians and aircraft engineers to help them doing their tasks efficiently and precisely with doing any error that could lead the aircraft into a tragedy.

3. METHODOLOGY

This product of the project is generally a new type of invention in the aviation industry. This product has smallest fraction of similarities from the other product that has now days. This Movable Aviation Light is mainly for the maintenance work to be used by the aircraft engineers and technicians. This MAL is design for enhance the illumination when doing maintenance tasks especially under the wing and fuselage of the aircraft, and confine spaces.

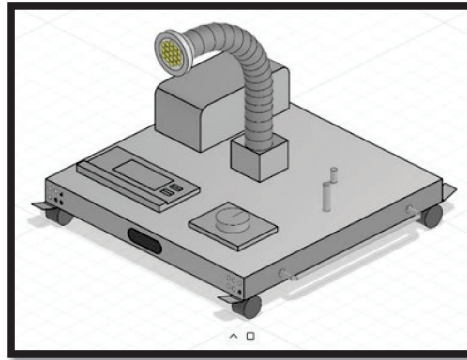


Figure 2: Prototype

There are 4 phases to produce this project.

- Phase 1 (Coding)
- Phase 2 (Base Structure)
- Phase 3 (Flexible Holder Light)
- Phase 4 (Attachments & Finishing)

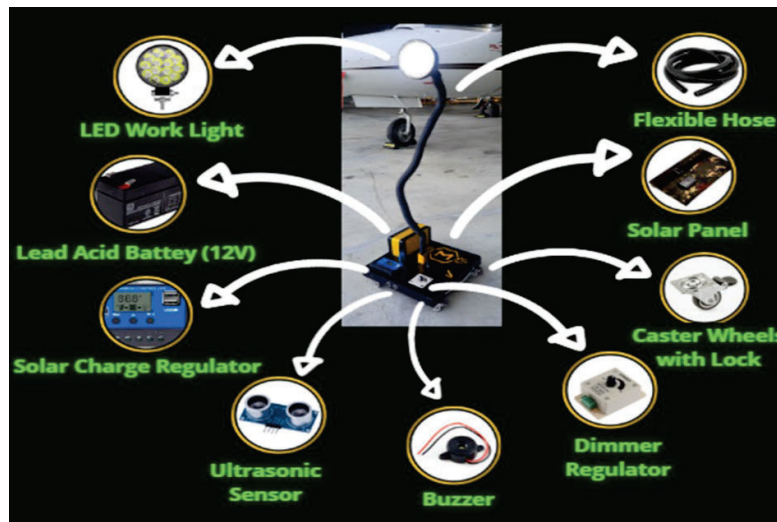


Figure 3: Feature of the product

The operation of this product is mainly from the LED Work lights that are installed on the product. The main LED work light and the two LED bar lights. The main LED work light is used for the main inspections on the aircraft structures such as upper surfaces on the fuselage and primary control surfaces and also confine spaces. ‘About one-third of those who said they intended to buy solar panels cited environmental concerns as a reason for their interest’ (Adam McHugh, 2018)

Solar Panel is also to be used as an emergency and it is portable to use it. It can covert to solar as a main source with a just push of a button at the control box panel install at the product. The dimmer regulator can also control the brightness of the LED lights according to the type of inspection taken place by the license aircraft personnel. The battery usage and the solar energy usage can be monitored through the solar charge regulator. The flexible hose in this product is use to help the LAE and technicians do different type of inspection. There are also ultrasonic motion sensor and buzzer installed in this MAL product. This operation is to detect and alert us with a beeping sound. From this operation, we can protect our MAL product from damage or malfunction. The surface is coated with Akzo UV powder, which can keep the color for 3 years without falling off. (MPMC Beyond Energy, 2008)

4. RESULT

The objective of this product to be design is to help those license aircraft personnel who are working in the confine spaces with dark places and low lighting sources. It is also help to increase the illumination when doing maintenance inspections tasks by the license aircraft personnel that help them to do without doing any human errors. The impact that we could expect from this project is there are varies many types of adjustable parts may help those license aircraft personnel to use it in various places of inspection. Advantage of this product is it movable and easy to bring at any places around the hangar without difficulties. This product is discussed to be design especially to the Polytechnic Banting Selangor students who are doing their practical assessment and the staffs also. If we satisfied with the product we have design, sure we will recommend this project to other industries who needed this kind of idea project. This could help those industries to improve their hangars facilities and reduce the problem of illumination to the license aircraft technicians and engineers to do their inspection and maintenance with highly performance manner.

Table 2: Illumination Result and Testing of the product

LENGHT (cm)	ILLUMINATION (lux)
20	1026
40	972
60	918
80	864
100	810

1 foot-candle = 10.8 lux. For inspection and maintenance tasks, the range of 75-100 foot-candles are the standard illumination. Which are within the range of 750-1000 lux. According to the data reading collected in Table 2, the higher the distance of light from the surface of the

inspection, the lower the illumination needed to perform the inspection tasks with efficiently and precisely.

Table 3: Specification of the product

SPECIFICATION	VALUE
Height	1 metre
Width	1 feet
Weight	7 kilogram
Sensor (ultrasonic)	1 unit
Buzzer (piezoelectric)	2 unit
Solar Charge Controller	1 unit
Lead Acid Battery (12V)	1 unit
Solar Panel	1 unit
Swivel Caster Wheel with Lock	4 units
LED Work light	1 unit
Flexible Hose	0.75 metre
Retractable String Pulley Handle	1 unit

Table 4: List of Problem Encountered & Solutions

List of Problems	Solution
Difficulties during drilling holes for the parts to be attached	Use a different sizes if drill bit with sharp end to make the process faster
Difficulties found during grinding the base metal of the product	Use a sharp grinding blade and with correct method
Holes the drilled not fit for the parts of the features	Drill a little bit more to make the features fit in the hole
The base of the metal tend to corrode	We respray and stored them in non-corrosive environment

‘It is suitable for use in aircraft maintenance and have workload places which can last longer even though any impact could happened to the surface.’ (Tampa Steel & Supply, 1983)

5. CONCLUSION

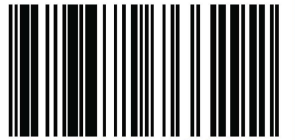
Our MAL product operates perfectly as we designed as per planned. Our MAL produce a better lighting source that helps the License Aircraft Technician and the Engineers to do their inspection tasks with more efficient and produce a better maintenance on the specific aircraft parts and place with confine spaces. It gives a better grip on the floor with the help of caster wheels with brake. The contribution of the project to our society is to shows that light plays an important role in our daily lifestyle. Even in aviation maintenance industry, light could bring a better result in inspection tasks to our License Aircraft Technicians and Engineers. If there are insufficient light source or excessive illumination in maintenance places, it could bring a major disaster to the aircraft system while on ground or even in flight condition.

Appreciation given to our project supervisor Mr. Mohd Khairun Nizam Bin Sa'adan because of his constant help, support and guidance which has steered us to finish our report project. His enthusiasms and professional works had motivated and inspired us whenever we feel down or lack of ideas while doing our project. A special thanks to our Aircraft Maintenance Department lecturers because letting us to use workshop to implement and complete the project. Once more time thanks a lot to team member for their cooperation to implement this project, sacrificing of time, energy, money, give outburst idea until completed this project without knowing the meaning of despair.

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