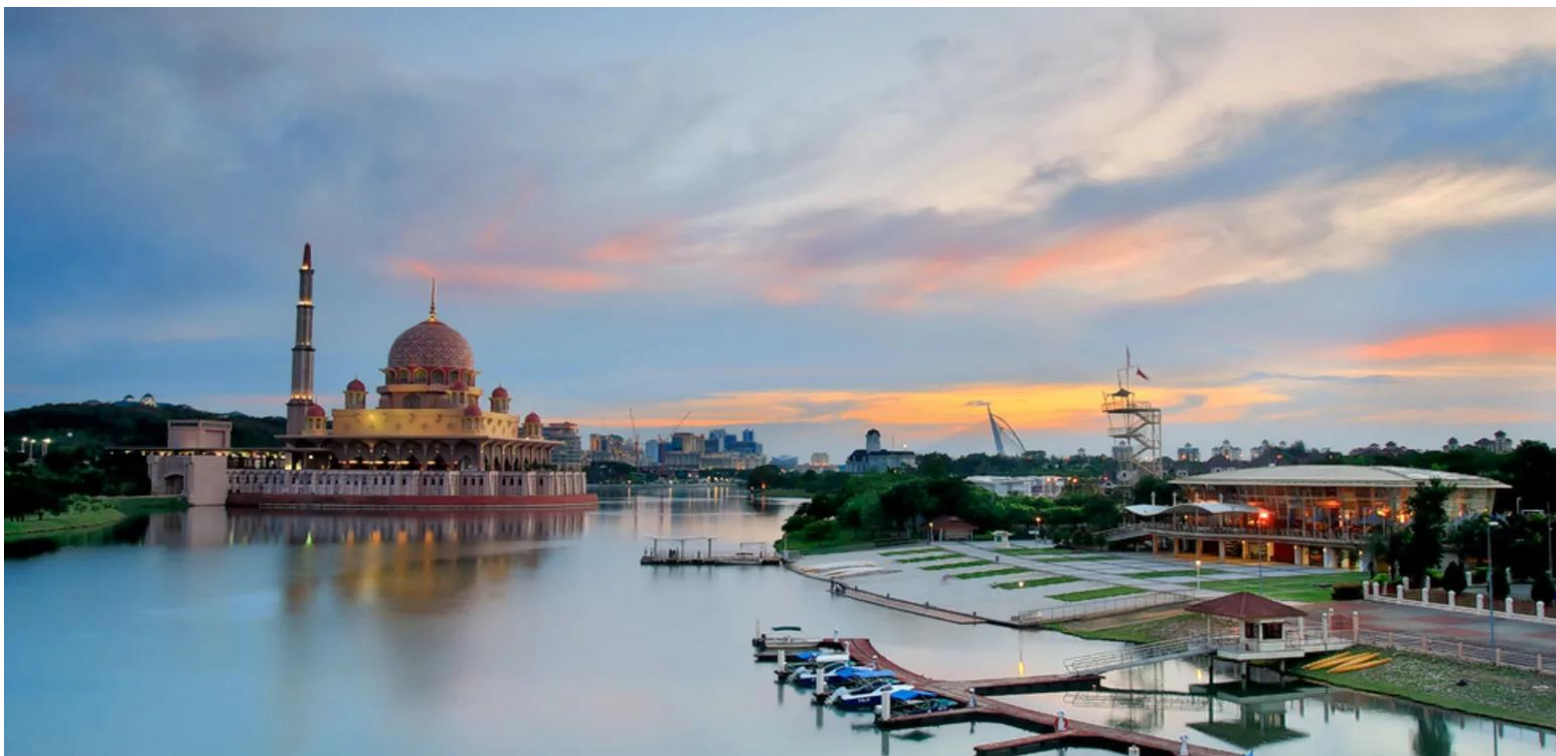


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**PUTRAJAYA INTERNATIONAL CONFERENCE ON
MULTI-DISCIPLINARY RESEARCH (ICMRES2020)**



18 JANUARY 2020

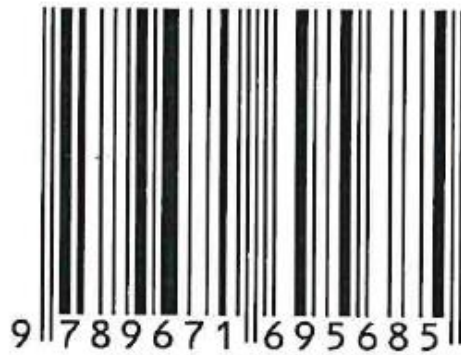
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PREFACE

Proceedings of the Putrajaya International Conference on Multi-Disciplinary Research (ICMRES2020)

It is my pleasure to welcome you to the **Putrajaya International Conference on MultiDisciplinary Research (ICMRES2020)** in PUTRAJAYA, Malaysia. The major goal and feature of this conference is to bring together scholars, researchers, industry practitioners, government leaders, policy makers and advanced students in a forum to exchange and share their experiences and research results about the most aspects of science, technology, engineering and social research, and discuss the practical challenges encountered and the solutions adopted.

I hope you will have a rewarding experience, and use this occasion to meet old friends and make many new ones. Do not miss the opportunity to explore beautiful and modern PUTRAJAYA the administrative capital of Malaysia and its surrounding interesting places.

ICMRES2020 promises to be both stimulating and informative with a wonderful array of presenters and keynote speaker. The program consists keynote address and presentations by the eminent delegates covering wide range of topics in science, technology, engineering and social research. This rich program provides all attendees with the opportunities to meet and interact with one another. I hope your experience with ICMRES2020 is a fruitful and long lasting one. With your support and participation, the conference will continue its success for a long time.

I would like to thank all members of the conference organizing committee, review committee and highly-respected strategic partners – Asian Scholar Networks, Global Academic Excellence and Akademia Baru (New Academia) fo their continous support and commitment to make the event a wonderful experience. I also would like to express my gratitude to the review committee who have worked very hard in reviewing papers and making valuable suggestions for the authors to improve their work.

I wish all attendees of ICMRES2020 an enjoyable and productive gathering in PUTRAJAYA Malaysia and look forward to seeing all of you at our future conferences.

Thank you.

Dr. Safaie Mangir
Conference Chairman

ABSTRACT

The objective of this conference is to be a discussion and networking forum for scholars, researchers, industry practitioners, government leaders, policy makers and advanced students. The conference welcomes all authors from multiple research disciplines to submit and/or present the research papers. All accepted papers will be published in the conference proceeding book with ISBN number. More importantly the accepted papers will also be published in refereed journals indexed by Malaysia Citation Centre (MCC). Our Review Committee will also select papers that have the merits for publication in high-indexed journals (such as ERA, ISI, SCOPUS). The respective authors will be notified accordingly.

Nearly thirty research papers were accepted by the review committee for publication in conference proceeding book and refereed journals. About twenty-six papers were presented by the authors in the conference. Papers cover wide range of research disciplines including business, education, engineering and technology, social science and humanities, supply chain and tourism. Sixteen delegates attended the conference as listeners.

The conference commenced with the opening address by the Conference Chairman Dr Safaie Mangir who took the delegates to the agenda of the day, the list of the presenters and listeners and the schedule of their respective presentation. Dr. Safaie also explained in greater details the process of publication in proceeding and refereed journal as well as publication in high-indexed journals in ERA/ISI/SCOPUS. The key points involve the review process and expected publication timeline. The next in the agenda was keynote address entitled 'Multi-Disciplinary Research for an Energy Efficient Tomorrow' delivered by the Dr. Izhal Abdul Halin of Universiti Putra Malaysia. This was followed by presentation of best paper awards to the two authors of best paper as evaluated and selected by the review committee. The delegates were then ushered for group photography session and short coffee break which was then followed by the presentation session. The presentation session was divided into four parallel sessions, two morning sessions and two afternoon session. The conference adjourned at 3.00 pm.

In conclusion, the conference was highly successful and generated intelligent discussion and knowledge-sharing among the delegates. Many new contacts and relationship were developed ushering for potential new collaborations and joint-initiatives. Some valuable feedbacks were also recorded for the authors to make amend and improve their research papers before being published in proceeding and journal.

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SEMI-AUTO LIGHT AIRCRAFT TOWING DEVICE (SALATD)

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Abstract: *Aircraft towing is generally known as a movement of an aircraft commonly with engines off, using the power of a specialized ground vehicle attached to or supporting the nose landing gear. This procedure is usually accomplished by towing with a tow tractor or sometimes called a tug. In the case of small aircraft, the towing is carried out by hand pushing by means of special equipment called towbar. Towing a light aircraft by using this method can be risky operation, causing damage mainly to the aircraft and injury to personnel, and take time to be installed. Therefore, here we have designed an innovative model of future towing device to transport the light aircraft which can maximizes safety by reducing personnel and equipment in and around aircraft ground operations. The device is known as Semi-Auto Light Aircraft Towing Device (SALATD) is an idea inspired by push back trucks that are widely used in the aviation field to move a wide body aircraft on ground. It is designed specifically for light aircraft such as Cessna 172 Sky-hawk with a weight of 1,700 lbs. The device is driven into the nose wheel landing gear of an aircraft, then secured, and finally transport an aircraft from the runway to an airport fleet and back to the runway. The device is remotely controlled, and the connection between the aircraft nose wheel and the device, is fully automatic. After the engagement with the device, it can be controlled by an operator from a distance as far as 500 meters thus during the towing process, only one personnel are required to carry out the towing instead of three persons using the conventional method for monitoring the wings tip and the tail section of an aircraft to prevent obstruction. SALATD is using a high torque winch motors for its operation. The motors are capable of towing load up to 3000lbs and equipped with a 12V battery.*

Keywords: SALATD, aircraft towing, towbar, light aircraft, aircraft push back.

1. Introduction

Although several light planes can be moved by human power alone by either pushing or pulling by landing gear, wing struts, or even the propeller blades, however this method is found to be inconvenience to some operator as it is time consuming and require more personnel to carry out the process especially when it is involving a large fleet with different types of light aircraft. Conventional aircraft tow bar involves attaching a short tow bar to the nose wheel which then pulled to the desired destination. Because the conventional tow bar has severe pinch points and two pivot points it lead to maneuverability limitation and can place the operator in very unusual positions and create restricted angle of vision. The ability of operators to see all-around them is essential for accurate maneuverability and overall safety. Reduced visibility increases the risk of injury or an accident.



Fig. 1: Typical towbar used to tow most light aircraft

When safety is taken into broader sense, the importance of choosing the right type of aircraft towing device may be seen as playing a vital role to ensure the security of the employees, aircraft, and equipment. Therefore, this paper is meant to introduce one of our innovative technology known as Semi-Auto Light Aircraft Towing Device (SALATD). In comparison to conventional tow bar, SALATD is towing device that operated remotely and doesn't require human power as it is equipped with its own motor which powered by using 12v battery.

2. Design and Development of the Salatd

The towing device presented in this study is capable of towing and pushing a light aircraft with a maximum weight up to 3,000 lbs. for instance the Cessna 310 a weight that is too heavy to move or maneuver by using conventional towbar. SALATD comes with some features such as fully driven by using an electrical power, extremely compact in design, and very high performance. This device as well equipped with a remote control feature which allows the operator to move anywhere around the aircraft to see every vital point of the aircraft and the operator's eyes never leave the aircraft while it is in movement. The complete SALATD device consist of the following elements:

- **Electric winch motors**
- **12v batteries**
- **High initial stroke to ensure smooth initial movement**
- **13-inch caterpillar type tyre track**
- **Jacking device**
- **Remote control systems and included Programmable Logic Controller**

In figure 2, a block diagram including the component of the SALATD is shown. Following is a detailed description of the device components.

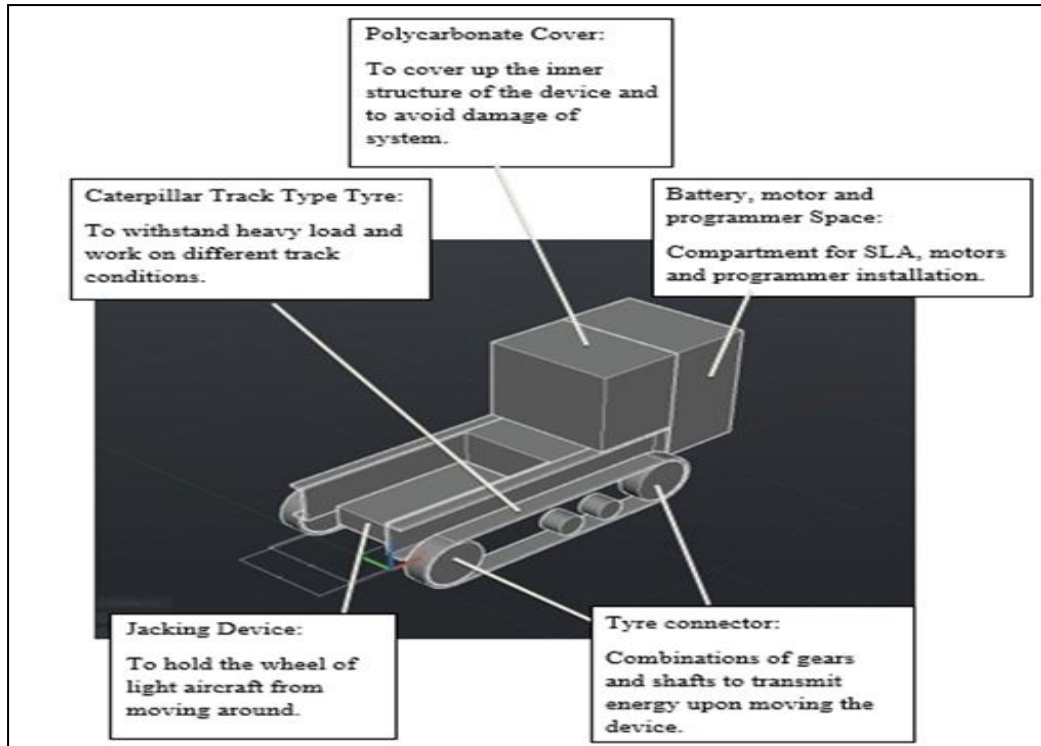


Fig. 2: The complete SALATD components

SALATD is equipped with powerful electric winch motor driven by high performance batteries to ensure enormous driving forces. These components are located in enclosed space at the rear part of the device together with the PLC board. This towing device features a heavy duty caterpillar type tyre track which generally used to withstand force from heavy object when moving thus prolonged the life of the tyres. The usage of this type of tyre may increase the efficiency of the towing device upon working on different track and various operating field condition. The jacking device is a vital part where the tyre of an aircraft will be lift up and then secured to ensure firm attachment with the device. Polycarbonate were used as a covering as it is dimensionally stable and having outstanding impact resistance properties.

Technical Specifications



Fig. 3. The SALATD in operation

SALATD have an ability for moving light aircraft with a maximum gross weight of 3,000 lbs. It has a long jacking platform which is recommended for towing up steep inclines and over challenging hangar doors. With weight of 330 lbs. and approximate size of 24" x 53" x 11". It is powered by high torque electric winch motors. Rechargeable 24-volt LiFe PO4 battery with recommended charge time of 2 hours for continuous usage time of 30 minutes. Intuitive remote-control transmitter features FHSS (Frequency Hopping Spread Spectrum), which operates 100% interference free from other 2.4 GHz systems. 4" wide tracks provides superior traction. Polycarbonate finish provides long lasting protection. Maximum speed is 160 ft. per minute (Approx. 1.5 - 2 kilometer per hour). Accepts most single wheel types. The summary of technical specifications of SALATD is provided in table 1.

Table 1. Technical specifications of SALATD.

Features	Specifications
Weight (lbs.)	330
Approximate size (Inch)	24 x 53 x 11
Motor strength (Nm)	251.92
Gear ratio	50
Track width (Inch)	3
Distance between gears (Inch)	By side 24 By front 25
Speed (km/h)	2.052
Towing capacity (lbs.)	3,000
Batteries	Rechargeable 12V Capacity of 7.0 Ah
Remote control	FHSS T8FB Radio link

Advantages of using SALATD over conventional towbar

The SALATD have various advantages, as well as comparable features over conventional towbar. Nevertheless, safety is the first priority that need to be taken into account including safety with respect to people, equipment, and infrastructure. SALATD is cost effective and is designed to be effective in the areas for which it was intended including improvements in the operational cost related with ground operations and in logistics. Therefore, the list of advantages of SALATD is summerised below as a series of priority aspects.

- a) Safety
- b) Cost effective
- c) Ground operation efficiency

Safety

As mentioned above, since SALATD is operated by using a remote control it has increased operator visibility, which also allows for peak maneuverability. Conversely, conventional towbar has few blind spots that lead to difficulty to the operators to carry out their job efficiently. SALATD allows the operator to walk around the aircraft during maneuvering, thus allow the operator the see clearly any obstacles ahead to prevent collision to any personnel or ground equipment. Since the SALATD equipped with powerful motor therefore manpower is no longer needed to pull the aircraft thus eliminating any possible injury to the operators.

Cost effective

SALATD powered by batteries, meaning that its require less maintenance and cost less money over time. For instance, no oil change is required, no oil filter change, and no wear out. Furthermore, the number of manpower required to operate the towing procedure is lesser compared to the conventional towbar. Therefore, the company can fully utilize their manpower to other task which more vital despite of arranging the aircraft in line.

Ground power efficiency

Since SALATD is emission free, it can be used safely inside any hangar. Due to its compact size SALATD can get into tight spots while maintaining smooth and highly precise movements. As mentioned above, SALATD have increased operator visibility, therefore it eases the movement and increases capability to stack aircraft closer together.

Table 2. Advantages of SALATD over conventional towbar

SALATD	Towbar
Increased operator visibility	Limited visibility
Easy maneuverability	Restricted maneuverability
Only one operator needed	Require more personnel to operate
Electrically operated	Require human power
Automatic loading	Require attachment
Safer operation	Susceptible to collision
Faster aircraft movements	Require feedback for safe movement

3. Conclusion

This paper has presented an innovative invention of remotely controlled towing device to ease the operation of moving the light aircraft at the hangar compared to conventional towbar. The approach presented here recognizes that SALATD have many advantages which eliminate the problem face when using the towbar. The most notable features that SALATD have over the towbar was it is remotely controlled thus enable the operator to walk around the aircraft during maneuvering. This special features as well increase safety and reduce employee turnover simultaneously reduce the cost to the operator. Various injuries which caused by manual towing can also be eliminated as SALATD is remotely controlled and electrically operated.

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