Development of Rope Connected Life-Saving Equipment for Transferring Numerous People

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Abstract: Background: This study is focused on a rapid and safe transfer when there are many people who need rescuing in unapproachable location. Generally, a stretcher, a basket or a mesh drawing is used to transfer injured people or survivors in the emergency rescue, however, it turned out that it takes long time to transfer a number of people with a stretcher and it is difficult to transfer injured people safely with a basket or a mesh drawing. It would expect to transfer many people who need rescuing promptly and harmlessly.

Methods: In this article, Targeted Acceptable Responses to Generated Events of Tasks (TARGETS), an event-based team performance measurement methodology was used to investigate the effects of Mission Oriented Protective Posture (MOPP) on the behavioral processes underlying team performance during simulated rescue tasks while wearing chemical protective equipment. In addition, this study determined which team processes were related to team performance outcomes. Results of six primary analyses indicated that team process performance was not degraded by MOPP 4 on any rescue task and that the team processes critical for successful task performance are task-dependent.

Results: As a result, authors have developed a new life-saving equipment. Numerous people who need rescuing can be quickly and safely rescued and transferred to the hospital with it. From a medical point of view, it reduces the risk of secondary damage from transport and helps avoid missing the golden time for first aid caused by delay in transferring emergency patients as numerous people can be transferred safely and quickly.

Conclusion: The article is due to introduce the equipment which can transfer people who need rescuing promptly and effectively in a situation such as when numerous people need rescuing in the mountain. In a rescue situation such as mountain rescue, rope connected life-saving equipment is dropped to the rescue site with a rope from a rescue helicopter and laying down the injured on the life-saving equipment body and equip life-saving equipment to the rope consecutively. In this way, it is expected to transfer the injured rapidly and safely.

Keywords: Life-saving equipment■Rope■Rescue helicopter■Rope controller■ The injured

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INTRODUCTION

The purpose of this study is to explore rescue equipment, especially multiple rope connected life-saving equipment that helps to connect one rope to several sets of life-saving equipment.

In general, rescue equipment such as a stretcher is used for rescue and transfer of the injured or survivors in case of emergency relief. Such stretcher enables rescuers to transfer the injured by connecting rope to a rescue helicopter when it would take time and have a difficulty to approach the location of the injured. That is, it is a system that transferring the injured to a safe place after laying them on a stretcher that is connected to helicopter rope.

However, as only one stretcher is connected to the end of rope it might be difficult to conduct a rapid transfer of the injured when it is distant or there are a number of people who need rescuing to be transferred. To solve this problem, sometimes baskets or mesh drawings are equipped to transfer and it is still problematic when people who need rescuing are injured.

Earlier studies regarding to a hinge are as follows; Ram, G.L. and Oliver, C.I. (2012) emphasized the importance of disaster recovery networks in their study on "A Joint Network for Disaster Recovery and Search and Rescue Operations." A disaster recovery network is used to provide emergency support to both the disaster victims and the crew members that are helping the victims, and to provide a communication infrastructure in the disaster affected area.[1]

Nasuh, R. and Mumtaz, K. (2016) presented the Incident Based-Boat Allocation Model (IB-BAM), "A Multi-objective Model for Locating Search and Rescue Boats." IB-BAM considers all these criteria and determines optimal boat allocation plans with the objectives of minimizing response time to incidents, fleet operating cost and the mismatch between boats' workload and operation capacity hours. The results show that IB-BAM implementation led to a more effective utilization of boats considering the three objectives of the model.[2]

Joao, S., Alberto, V. and Rodrigo, V. (2015) proposed a design of a MULTI-PURPOSE Rescue Vehicle in their study on "A Multi-purpose Rescue Vehicle and a Human–Robot Interface Architecture for Remote Assistance in International Thermonuclear Experimental Reactor." A mobile platform equipped with different sensors and two manipulators with different sets of end-effectors. A human–machine interface is also proposed to remotely operate the MULTI-PURPOSE Rescue Vehicle and to carry out rescue and recovery operations.[3]

Pearlly, N., William, R.S., Albert, W. and Scott, E.M. (2015) made a study on "Advanced Avalanche Safety Equipment of Backcountry Users." This study shows that standard avalanche safety practices, including taking an avalanche safety course and carrying standard equipment, remain the most common safety practices. As a result, snowshoers remain an ideal target for further education in avalanche awareness and safety. The AvaLung and avalanche air bag have a favorable perceived mortality benefit among these users but have not yet been adopted for widespread use.[4]

Roberto, B.F., David, S., Jose, P.A., Javier, C.V., Cristian, A.G., Antonio, B.C., Sergio, L.G. and Antonio, R.N. (2016) carried out a study on "Assessing the Efficacy of Rescue Equipment in Lifeguard Resuscitation Efforts for Drowning." In this study, a controlled trial was conducted to study the time effect of 4 different rescue techniques and assess CPR (cardiopulmonary resuscitation) quality, along with the physiological effects of each rescue technique on 35 lifeguards. In conclusion, the experiment result shows that the use of propelling and/or floating equipment saves precious time with repercussions in the reduction of drowning mortality and morbidity. The Rescue Boat offers a significant advantage. Lifeguards need more Cardiopulmonary Resuscitation training, especially considering the importance of efficient ventilations for drowning victims.[5]

Katharina, G., Giacomo, S., Emily, P., Hermann, B. and Inigo, S. (2016) conducted a study on "Avalanche Survival after Rescue with the RECCO Rescue System: A Case Report." In this study, they report a case of survival of a completely buried avalanche victim after being located with the radar-based RECCO Rescue System. It is intended to increase our understanding of the effectiveness of this device in avalanche rescue. The RECCO Rescue System emits radio waves and requires a specific reflector. It is a portable device that is used by more than 600 rescue organizations worldwide, especially in secured ski areas. The device should be brought to the avalanche site together with electronic avalanche transceivers, a probing team, and avalanche dogs. In the hands of experienced professionals, the device may allow rapid location of victims not carrying an electronic avalanche transceiver.[6]

Nancy, L.G. and Brian, M.K. (2007) wrote "Effects of Chemical Protective Equipment on Team Process Performance in Small Unit Rescue Operations." In this article, Targeted Acceptable Responses to Generated Events of Tasks (TARGETS), an event-based team performance measurement methodology was used to investigate the effects of Mission Oriented Protective Posture (MOPP) on the behavioral processes underlying team performance during simulated rescue tasks while wearing chemical protective equipment. In addition, this study determined which team processes were related to team performance outcomes. Results of six primary analyses indicated that team process performance was not degraded by MOPP 4 on any rescue task and that the team processes critical for successful task performance are task-dependent.[7]

Antonio, D.G., Federico, V.M., Katia, C. and Joseph, V. (2003) wrote "Diving Emergencies." In this article, they investigated the clinical manifestations of a diving injury and reviewed pathophysiology of diving injuries as well as the acute treatment, and further management of these patients. The investigation result shows that the clinical manifestations of a diving injury may be seen during a dive or up to 24 h after it. Most diving injuries are related to the behavior of the gases and pressure changes during descent and ascent. The four main pathologies in diving medicine include: barotraumas (sinus, otic, and pulmonary); decompression illness (DCI); pulmonary edema and pharmacological and toxic effects of increased partial pressures of gases.[8]

S. Karma, E. Zorba, G.C. Pallis, G. Statheropoulos, I. Balta, K. Mikedi, J. Vamvakari, A. Pappa, M. Chalaris, G. Xanthopoulos and M. Statheropoulos (2015) carried out a study on "Use of Unmanned Vehicles in Search and Rescue Operations in Forest Fires: Advantages and Limitations Observed in a Field Trial." For planning and running the field trial a number of parameters were taken into consideration; logistics, safety plan, contingency plan, different agencies cooperation, time frames and ethical issues. Advantages of using unmanned aerial and ground vehicles in Search and Rescue (SaR) operations include capability of planning and monitoring the operations, integration with the manned resources, connectivity with command and control centers, as well as, coordination of the different unmanned aerial and ground vehicles' platforms. Significant increase of personnel safety is possible through the capabilities of air quality monitoring and search over dangerous areas. Current limitations include limited heat resistance of vehicles and limited flying capability in strong winds and turbulence. Failure of communications is also possible due to rough terrain (autonomy limitations). Against all the limitations, a number of unmanned vehicles already exist that can be adapted successfully for SaR operations in forest fires.[9]

Alexey, B. and Dmitriy, E. (2014) wrote "Complex Network Modeling for Maritime Search and Rescue Operations." This paper introduces a complex network model for collective behavior of floating drifters at sea. Direct simulation method for floating objects on irregular waves is used to express the network dynamics. The features of collective behavior (such as the network destruction) are considered. The model is applied to study of efficiency of maritime search and rescue operations at sea.[10]

Hajo, R., Sven B., Henning, O., Kai, J., Stefan, E., Axel, N. and Jochen, S.E. (2003) conduct a study on "Ventilation Performance of a Mixed Group of Operators Using a New Rescue Breathing Device – the Glossopalatinal Tube (GPT)." They studied how effectively a mixed group of helpers could ventilate a manikin with a new rescue breathing device after a short period of instruction. Results and conclusions show that mean Vttwith the OP