2018

Certificate Authority Cup International Mathematical Contest Modeling

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Problem A(MCM)
Aerial Refueling Flight Plan

Residents on a small island in the central Pacific Ocean are trapped by natural disasters. Rescuers need to dispatch a light aircraft to transport a small amount of emergency medicine to the island and transport a seriously wounded person to the medical base for assistance. The island has an unattended airstrip that can be used, but no aircraft or fuel reserves. The aircraft departs from the base that is 615 nautical miles away from the island. The aircraft has a maximum range of 680 nautical miles under normal load conditions. In order to return, we must carry out aerial refueling.

This type of aircraft has the ability to receive oil in the air. After a simple modification, the same type of aircraft can perform the task of partner air refueling, that is, to distribute its own fuel to partners. The maximum fuel capacity of the type of aircraft is 155kg. After the installation of aerial refueling equipment, the maximum oil load is increased to 170kg, but other loads cannot be carried. The base has a fleet of aircraft and sufficient equipment, which can be converted into tankers in a short time.

Questions:

1. Please design a viable air refueling program to enable rescuers to complete the task.

2. Air refueling is a high-risk operation and there is a possibility of failure. Transport and refueling aircraft also have a probability of failure. Please consider the probability of failure in each part of the work. When we need to ensure the total success rate, please give the corresponding optimal solution.