A Typical Military Deployment Analysis

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This poster explores the methods used to perform analysis of military deployment from the UK or a similar place of embarkation, to theatre or a similar place of disembarkation. The viewer will be taken through the process from the decision to deploy a force to their arrival in theatre.

A military deployment analysis is done to test whether the UK's deployment policy is achievable or suggest ways in which deployment could be achieved within set time limits. First a possible scenario is selected where it is deemed that a military force is needed to resolve an overseas conflict or to help police a situation.

Figure 1: A picture of a future A400M concept aircraft taking off.

To start a typical military deployment analysis a particular force, known as an Order of Battle (ORBAT), needs to be selected. The ORBAT is selected using military judgement depending on the military tasks that need to be completed within a military scenario. The deployment of this force is then tested against a policy driven deployment deadline. To complete most military tasks an ORBAT needs to be compiled for all three services, navy, army and air force. Each of the three ORBATs will contain both combat units and support units (logistics units). The deployment of the three services is then normally but not entirely considered independently although the method adopted can assess joint service regiments.

Navy combat ships and their support ships (the Royal Fleet Auxiliary, RFA) can deploy to the area of the scenario themselves. Consideration needs to be made on the speed of the individual ships, the distance they will need to travel and when they are ready to travel. Once the government decision has been made to deploy, not all ships will be ready due to general maintenance of the ships, training of the crew and statutory allowed leave after they have returned from a previous operation.

For the air force all the aircraft that are needed for the scenario are considered to be able to deploy themselves to the area of operation, although they may need to refuel on route. Once again, the distance and speed of their travel and when the aircraft will be ready to deploy are taken into account. Those air force logistics units required to set up the air bases for the mass throughput of military units are unable to deploy themselves. Therefore they are deployed in strategic lift assets along with army units discussed below.

Figure 2: A picture a C-17 strategic lift aircraft landing.

The army units are unable to deploy themselves to the area of operations and so use Ministry of Defence (MOD) strategic lift assets. These lift assets can be ships, aircraft, trains, helicopters, or road transporters depending on where in the world the units need to get to.

To start a detailed deployment analysis of the units deployed by strategic lift assets at Defence, Science and Technology Laboratories (Dstl), the selected army ORBAT and air force logistics units are input into a model called the Source Information System for Tri-Service ORBAT Management (SISTOM). SISTOM acts as a pre/post processor for the main deployment tool, the Defence Force Deployment Estimator (DFDE).

Figure 3: A picture of a MOD RoRo loading at a port.

The ORBAT that is entered into SISTOM is grouped into force elements in terms of when each is ready to deploy, as not all units will be ready for immediate deployment and may need extra training. Within SISTOM, the ORBAT is broken down into the exact number of vehicles and personnel in each unit.

The availability, capacity and round trip time of all the strategic lift assets needs to be calculated and input into SISTOM. For ships, trains, helicopters and land transporters this is straightforward, and once distance and speed is known a round trip time can be calculated. The breakdown and maintenance of these assets are also taken into account with the number selected. For example if 10 helicopters are needed for a task then the ORBAT might contain 15 helicopters to ensure there are always 10 available for the necessary task

For strategic airlift assets this is more complicated. The readiness of the aircraft needs to be combined with a reliability factor and an engineering factor to calculate when the aircraft will be available to be used to deploy units. The reliability factor is the percentage of the time an aircraft develops a fault before it takes off and the engineering factor is the percentage of the time an aircraft is unavailable due to routine maintenance (Figure 4). To calculate the round trip times, the speed of the aircraft and the distance needs to be factored in with whether there is a crew available to fly it. Crew are restricted by flying regulations so normally the round trip time will have to be increased to fit in with crew slip patterns. All of these factors are taken into account in a model called the Air Transport Pre-Processor (ATPP).

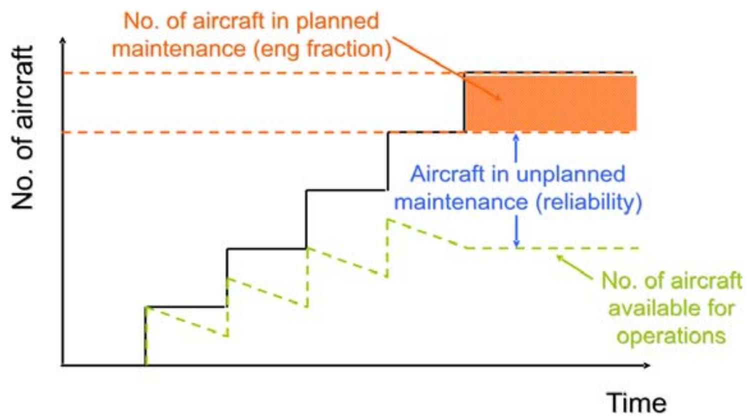

Figure 4: Graph showing how the number of aircraft available for operations is calculated.

ATPP includes all of these factors and considers the best crew slip patterns to get the fastest average round trip times and the periods when the aircraft will be available to deploy units. Many additional variables can be added to this to try and mimic a real life deployment. For example, different aircraft fly at different heights in the sky and so can take different routes to the destination resulting in different distances from the same Air Point Of Embarkation (APOE) to the same Air Point Of Disembarkation (APOD). Certain aircraft may be restricted from landing at particular airbases due to a threat level or the state of the landing strip. Therefore a hub and spoke network might need to be set up, where one aircraft type takes the unit to a base where it can land and then another aircraft type picks it up and takes it to its final destination.

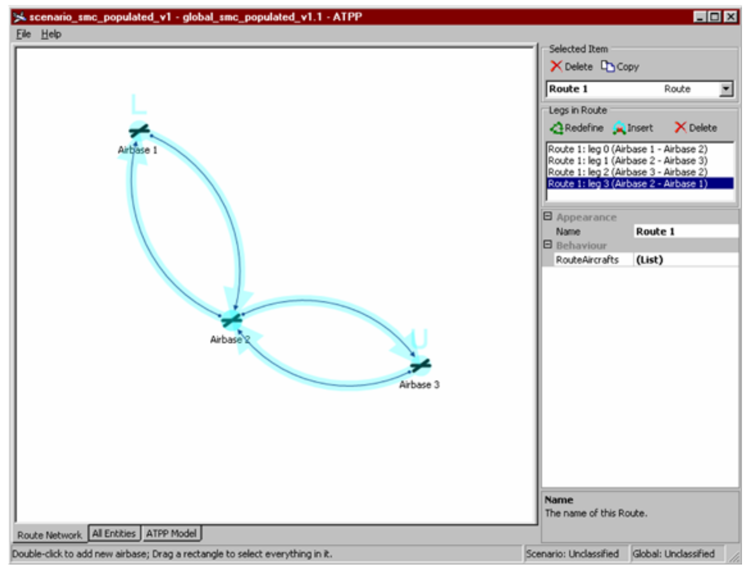

Figure 5: Screenshot of the model ATPP.

ATPP does not consider what will be carried in the back of the aircraft it just assumes there will always be a load available to deploy. The deployment of the units is then modelled in DFDE, where a strategic lift asset will only deploy if there is a load available to deploy.

For a full deployment analysis the personnel and equipment needs to be considered as well as the initial stockpiles that are required to be deployed to sustain the force. These include stockpiles of ammunition, equipment spares, operational ration packs and operational stocks. Operational stocks are the amount of extra equipment deployed to take into account the loss of equipment due to breakdowns. For example if 10 tanks were needed for a task an extra 2 tanks might be deployed to ensure that there are always 10 tanks available.

Figure 6: A picture of troops disembarking off the back of a Hercules aircraft.

Once all of the inputs have been entered into SISTOM, the movement of force elements comprising the ORBAT needs to be prioritised. The priorities depend on the order units are needed in the theatre of operations. For example the air logistics packages need to arrive first to set up the APOD ready for the large throughput of military forces that would not normally be flowing through the base. When the order of units does not matter the priorities will be decided by the readiness of the units.

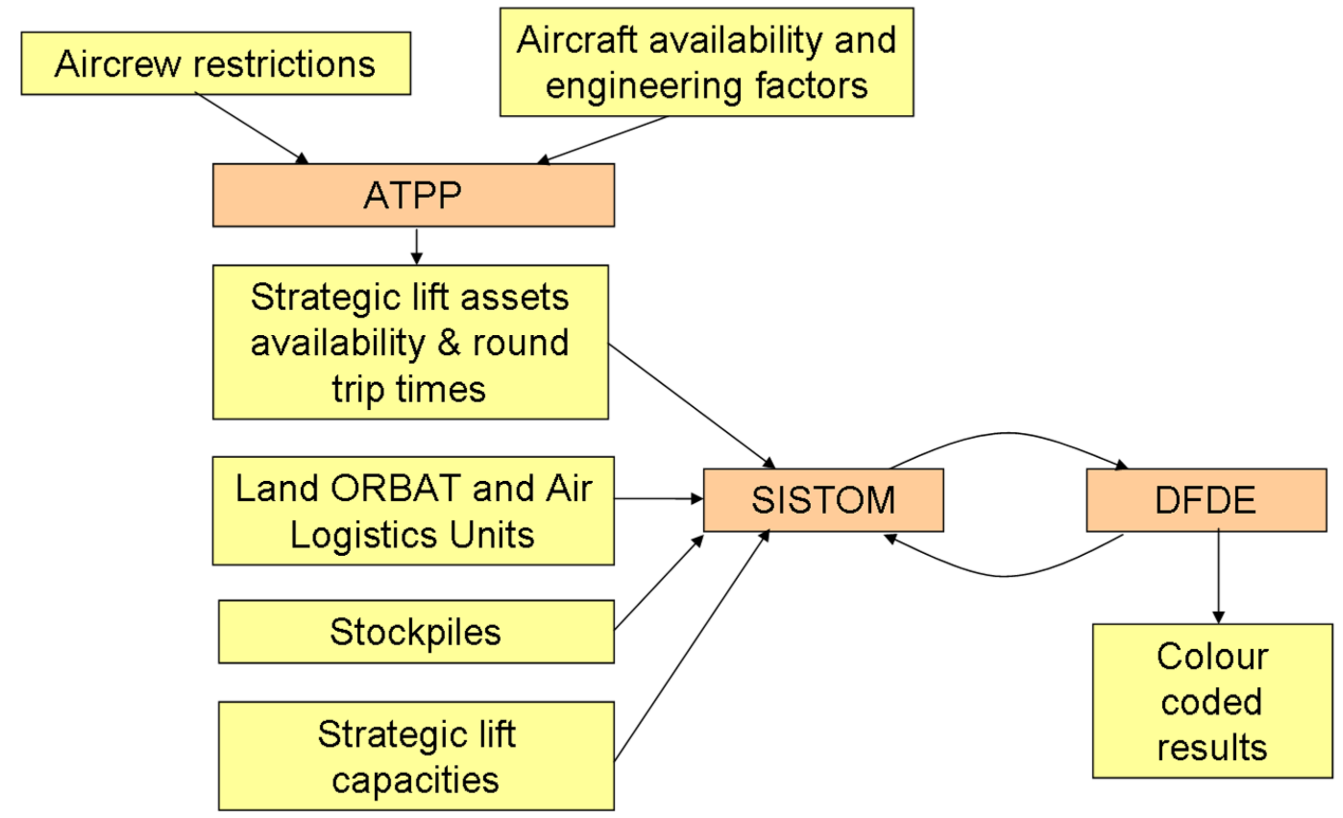

Figure 8: A flow diagram showing how a deployment analysis is conducted.

Figure 7: Screenshot of the models SISTOM (left) and DFDE (right).

The deployment analysis can now be performed. This is done by SISTOM converting the data into a form that DFDE can read and then running DFDE. DFDE is a discrete event driven simulation used in a non optimising mode. Every run represents a possible solution, but not necessarily the quickest. DFDE will load a carrier with whatever load is available at that time taking into account the priorities set. Therefore a ship might be carrying lots of pieces of equipment that can also fit in an aircraft rather than the pieces of equipment that can only fit in a ship.

To optimise the output the user needs to follow a few optimisation tips to enable DFDE to deploy the correct pieces of equipment in the right carrier. This can be done by feeding the DFDE output files back into SISTOM to look at what each carrier is departing with. This ensures that the analyst is very familiar with the subtleties of that scenario and can identify where (if any) the bottlenecks in the deployment are.

Typically the deployment analysis is colour coded according to how long it is estimated the deployment will take. If it takes less than 75% of the deployment target it is colour coded blue, between 75% and 100% green, between 100% and 125% yellow and more than 125% it is colour coded red. Blue then signifies that there is more than enough lift capacity to deploy the ORBAT within the timescales, green signifies there is the right amount of lift capacity, yellow signifies a slight shortfall in lift capacity and red signifies a large shortfall in lift capacity.