

Model copes with chaos to deliver relief

Computer program helps responders transport supplies in tough conditions

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WASHINGTON — Getting blood or other perishable supplies to an area that's been struck by an earthquake or hurricane isn't as simple as asking what brown can do for you. But a new model quickly determines the best routes and means for delivering humanitarian aid, even in situations where bridges are out or airport tarmacs are clogged with planes.

The research, presented February 18 at the annual meeting of the American Association for the Advancement of Science, could help get supplies to areas that have experienced natural disasters or help prepare for efficient distribution of vaccines when the flu hits.

Efficient supply chains have long been a goal of manufacturers, but transport in fragile networks — where supply, demand and delivery routes may be in extremely rapid flux — requires a different approach, said Anna Nagurney of the University of Massachusetts Amherst, who presented the new work. Rather than considering the shortest path from one place to another to maximize profit, her system aims for the cleanest path at minimum cost, while capturing factors such as the perishability of the product and the uncertainty of supply routes. "You don't know where demand is, so it's tricky," said Nagurney. "It's a multicriteria decision-making problem."

By calculating the total cost associated with each link in a network, accounting for congestion and incorporating penalties for time and products that are lost, the computer model calculates the best supply chain in situations where standard routes may be disrupted.

"Mathematical tools are essential to develop formal means to predict, and to respond to, such critical perturbations," said Iain Couzin of Princeton University, who uses similar computational tools to study collective animal behavior. "This is particularly important where response must be rapid and effective, such as during disaster scenarios ... or during epidemics or breaches of national security."

The work can be applied to immediate, pressing situations, such as getting blood, food or medication to a disaster site, or to longer-term problems such as determining the best locations for manufacturing flu vaccines.