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**Don't Wing It!**

Are critical parts for your just-in-time inventory en-route from your sole source supplier in Taiwan? Does your main recovery strategy require you to hop on an airplane to get to your Kansas hot site? If your planning involves going to, or getting something from a Bay Area airport, you may be interested in the Association of Bay Area Governments' (ABAG) recent workshop 'Don't Wing It!: Airports and Bay Area Earthquakes.' This workshop was designed to identify problems and to provide current information from earthquake researchers on the vulnerability of our air transport system. It was also a collaborative effort among the participants to discuss solutions to minimize long-term impacts of reduced land-side access and airport damage. The results of the workshop will be published in the near future.

In the next 30 years we can expect 18 damaging earthquakes, thirteen of which will be larger in their effects than Loma Prieta and eight larger than Northridge. Immediately after a major earthquake, all airports will close for runway inspection; scheduled flights will be diverted to their alternate airports, held on the ground, or cancelled. All three major airports (SFO, OAK, SJC) are expected to sustain major runway damage from liquefaction. San Jose (SJC) should suffer the least damage. Oakland (OAK), which handles 70% of the area's cargo (mostly Fed-ex and UPS), will suffer the greatest damage. Runway settlement at OAK is expected to average one-half foot and exceed one foot over the Northernmost 30-40% of the site. The Loma Prieta earthquake caused 3,000 feet of the runway to sustain cracks, some of which were a foot wide and a foot deep. Emergency repairs took only 30 days to complete, but may take longer after a future event. Although the shorter general aviation runway was used until 7000 feet of the main runway was re-opened, large, heavy jets could not take off at this minimal length. The Alameda Naval Air Station, which was severely damaged after Loma Prieta, cannot be used as an alternate since it has been de-certified. Similarly, SFO can experience settlement between one-half to one and one-half feet and the longest runways may experience a Southwestward tilt. The ground under the fuel storage tanks could experience a liquefaction settlement of two and a half feet. Although a cargo building sustained major damage after the Loma Prieta earthquake and the terminal lost ceiling tile (complicated by broken sprinkler pipes), there was no significant damage to the runways. The airport remained closed for the night not because of the damage, but due to the inability to replace air traffic controllers who exceeded their permissible on-duty hours. In a personal conversation with the FAA representative, he agreed that the loss of Bay TRACON and the Air Traffic Control Center in Fremont represents a single point of failure in the system, although flights would use the 'see and be seen' protocol (Visual Flight Rules). We did not discuss what would happen under IFR (bad weather) conditions.

Liquefaction is also possible at SJC with settlement of up to two feet due to ancient stream channel deposits that cross the runways in three locations. Although closest to the epicenter of the Loma Prieta earthquake and in the midst of a regional power failure that lasted for five hours, the airport was operational just 40 minutes after the earthquake. The airport was to act as an alternate for SFO and OAK, but aircraft were not able to land due to the lack of refueling capabilities making it impossible for most of them to take off again. San Jose maintains only a one-day supply of fuel and air carriers that don't normally use the airport won't have fuel charge accounts at this location. SFO and OAK supply their tanks with the same pipeline that originates in Richmond. I pointed out that this pipeline closely parallels the main East Bay rail lines and a derailment could easily sever the line. Similar re-fueling problems could exist at other alternate airports (Sacramento maintains a three day supply, replenished by tankers).

The chance for liquefaction at other airports (based on USGS modeled earthquakes) include:

- Buchanan 6%
- Livermore 4%
- Gness Field 30%
- San Carlos 40%
- Palo Alto 50%
- Moffett 0 – 50%

Even if runways remain in a usable state, airports can close or become unserviceable due to structural problems, power and communication difficulties, and lack of access. Control towers were damaged (mostly lost windows) in most large earthquakes including San Fernando (1971), Whittier Narrows (1987), Loma Prieta (SFO, OAK, SJC), Northridge (Van Nuys airport), and Kobe (Osaka-Itami Airport). A M7.2 on the Peninsula-San Andreas segment will cause 800 road closures in San Mateo County and 360 closures in San Francisco. A similar event on the Hayward will cause 1,600 Alameda County road closures.

At this point, few options seem to exist. Those who plan to drive to Sacramento, Monterey, or Stockton may have a long difficult trip. Some regional airports may be able to get private flights out for a connection in Reno (the American Red Cross will be using Reno for staging) or to the LA area for flights to your hot-site. After Loma Prieta some regional airports closed due to damage or by choice to reduce congestion and sightseeing. Apart from SJC, Livermore, Buchanan, and Half Moon Bay may be good choices as they are mostly affected by road closures caused by faults immediately in their vicinity. Buchanan can support commercial aircraft.

Sacramento International Airport (SMF) cancelled its domestic flights after Loma Prieta so it could receive diversions from the Bay Area. Airport operations were quickly overloaded after 40 diversions were received in the first five hours. This was in addition to the transfer of Burlington's freight operations to SMF. Aircraft had to be parked on one of the two runways. Today SMF has the capability to receive 25 commuter, 25

narrow body, and 15 wide body aircraft out of the Bay Area's 80-100 flights per hour. Mather Air Force Base, another Sacramento area airport, has been de-certified for passenger flights but can accommodate 5 wide body and 20 narrow body diversions of air cargo flights.

Some planners believe that flights can be diverted to Travis Air Force Base or to Moffett Field if they are undamaged. This is a poor strategy for several reasons. Under current regulations, commercial or cargo flights cannot land at a military base unless an in-flight emergency is declared. Additionally, there must be some major cargo facility near-by to process the goods received or scheduled for shipment. FEMA intends to stage personnel and equipment at Travis and Moffett adding to the airport's normal military operations. Although UPS will use the Stockton Airport as an alternate location, they intend to redirect their resources to assist the Red Cross who will also use this airport for staging.

Subsequent to a regional disaster, we may need to look at non-traditional strategies to relocate critical employees. The difficulty getting to an airport, finding it operational with flights departing could seriously impact many current plans. Intended runway and facility expansions will minimize some of these risks. However, the three airports generate 33,456 air cargo related truck trips per week to and from the airport. Which one contains your desperately needed parts or your finished goods shipments?