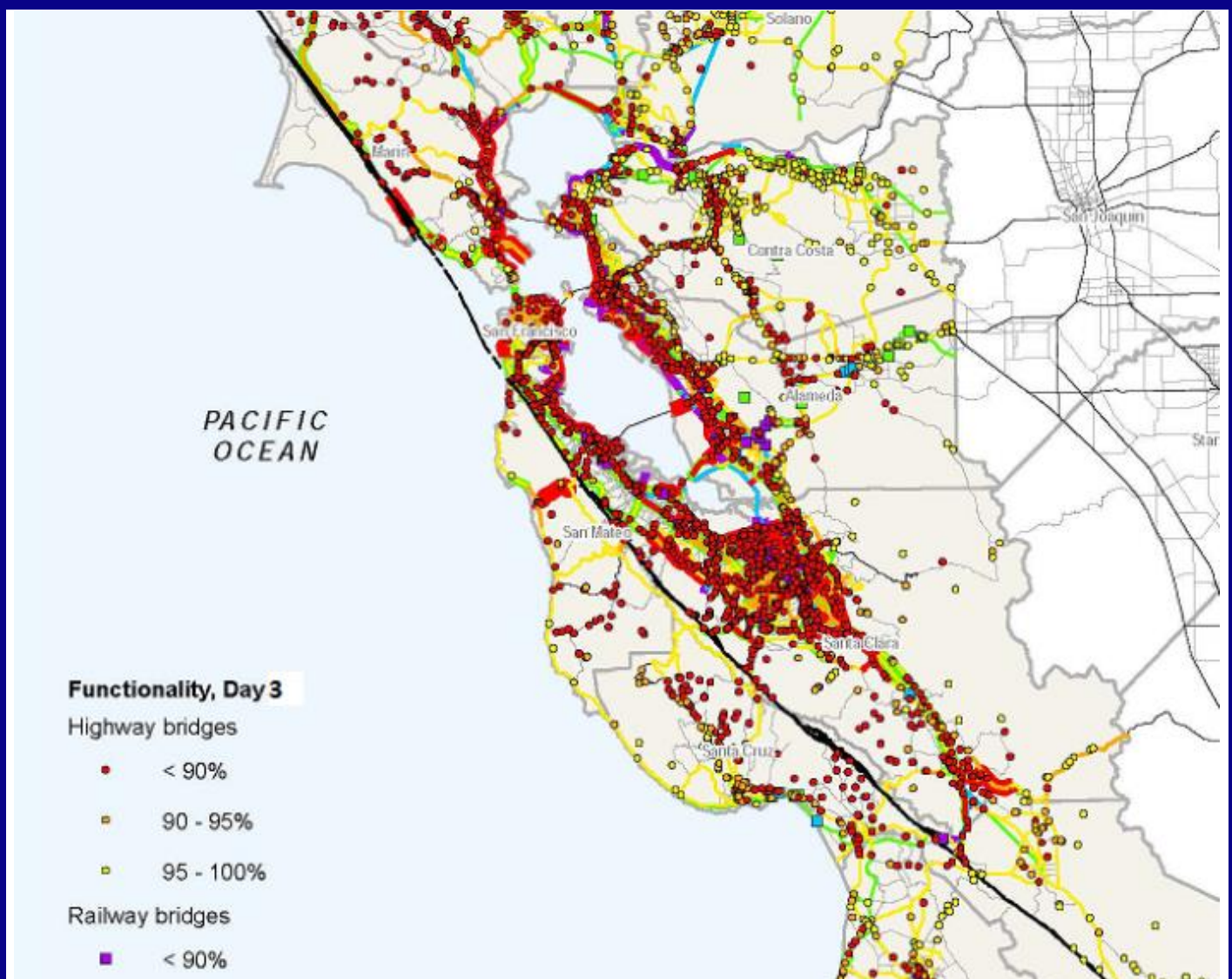


# **Utilizing General Aviation in a Disaster which Compromises Regional Surface Transportation**

**By Paul Marshall, President, CalDART**



## Table of Contents

Acknowledgments .....	3
Disclaimer .....	3
Overview .....	3
Bay Area Catastrophic Earthquake Scenario.....	5
Transportation Applications Supported by General Aviation .....	9
Delivery of Vital Response Personnel, Equipment, Food and Supplies .....	9
Local Emergency Air Commute .....	9
Out-of-Region Disaster Worker Airlift .....	10
Food Airlift.....	10
Supply Airlift .....	10
Situational Assessment.....	10
Damage Assessment Flights and Fire Watch .....	10
Evacuation and Transportation of Civilians and Animals .....	11
Evacuation – Uninhabitable Housing .....	11
Evacuation – Fragile People.....	11
Evacuation – Tourists.....	11
Evacuation – small to mid-size pets.....	11
Family Reunification .....	11
Airline Transport Local Shuttle .....	11
Emergency Medical Air Transportation of Last Resort .....	12
Disaster Airlift Response Teams (DARTs).....	12
CalDART’s Role in expanding DARTs in California .....	16
Aviation Assets and Capacity in the Bay Areas and California .....	17
Applying Groups of Airports to Accomplish Specific Response Objectives .....	25
One-to-One Air Bridge (Mojave – Tehachapi 2015).....	25
Using Several Air Bridges Together .....	27
Many-to-One Airlift (Loma Prieta Earthquake 1989) .....	28
Maximum DART Food and Supply Importation with Maximum Evacuation .....	35
Regional GA Alternate Transportation Grid .....	37
Airline Transport Shuttle.....	38
Airline Transport Augmentation .....	39
Positioning for a Best Aviation Contribution in the Next Disaster .....	40
What should the emergency management community and airport owners do? .....	40
Further Information.....	41
References.....	41
Acronym Listing .....	42

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## Disclaimer

The concepts and opinions expressed herein are solely those of CalDART and do not reflect the positions of the Governor's Office of Emergency Services, The California Department of Transportation, U.S. Department of Transportation, U.S. Department of Defense, Federal Aviation Administration, or California Pilots Association. Further, this document primarily addresses the potential CalDART portion of disaster flight operations, spending little time on the many other aviation segments of the response.

## Overview

Throughout the world, GA time and again has helped communities overcome the challenges of being cut off from the outside world. Earthquakes, hurricanes, tropical storms and other disasters cause mudslides, flooding, and other damage to surface transportation infrastructure. Because planes are not dependent on the roadways, planes can help bring in the first responders and supplies and evacuate the injured and homeless early in the response and recovery while the roadways are being cleared. Communities can add another tool to their disaster preparedness toolbox by incorporating GA in disaster planning.

This document focuses on a 7.9 earthquake striking the San Francisco Bay and Monterey Bay Areas, centered at the Golden Gate Bridge on the San Andreas fault. It shows how GA could be used to respond to the disaster through The California DART Network. The document was developed as a contribution to a project by the Bay Area UASI to develop its critical transportation capability. Although developed for the bay area, the principles apply across the state and nation. It is important to note that federal and state agencies have well-developed plans to handle the primary aviation transportation needs of the bay area in a disaster, and that some portion or all of the airspace and/or airports may be under a Temporary Flight Restriction (TFR) under the control of the federal or state agency managing the air response. Further, commercial and governmental aviation assets generally perform with higher capacity and safety than GA assets – the governmental and commercial aviation assets should be fully utilized before considering the use of any GA assets. That said, there will be plenty of secondary and tertiary transportation needs where these preferred assets are not able to satisfy every urgent need. Having a clear view of potential uses of GA in a Disaster Response will help move along the conversations of

- how to augment and not impair the planned responses from Federal and State aviation assets,
- how to utilize the airspace and airports to the highest public benefit during disaster response, and
- how to have back-up plans in place if primary plans are unusable for some reason.

This particular earthquake causes widespread damage along the San Andreas fault from south of Monterey to far north of San Francisco. The earthquake collapses buildings throughout the Bay Area, deprives 1.8 million households of running water, and cuts electricity to 500,000 households in the broader 12 county San Francisco and Monterey Bay Area. Nearly 5 million people need bottled water or other potable water source. 300,000 people seek shelter, another 330,000 seek evacuation, and 2.2 million people require feeding and other basic commodities. Multiple refineries are incapacitated in the Bay Area, causing a west coast fuel shortage with fuel allocations ordered by state authority. But fuel can't be used much in the Bay Area because there is widespread damage to bridges, tunnels, overpasses and exchanges in the freeway system, making it very difficult to go more than just a few miles by roadway for the average citizen. Stores and employers find it hard to open because of one or more problems with

- employees driving to work,
- supply and delivery trucks getting through,
- electricity to power the lights, tools, computers, ventilation and air conditioning
- workers accessing the internet to do their jobs,
- point-of sale terminals connecting to corporate pricing, billing, inventory and resupply systems.

The Federal Emergency Management Agency (FEMA) and The Governor's Office of Emergency Services (CalOES) respond, along with the military and all local emergency management authorities. Large federal cargo planes bring commodities in to Travis Air Force Base. Heavy rotary wing aircraft temporarily base at Concord Buchanan Field and Livermore Airport, distributing commodities around the bay area. Moffett Field and Stockton airport provide additional federal and state functions. These are the plans that exist today, and these plans will be modified in real time to fit the needs of the actual disaster when it happens.

GA pilots and their planes may also go to work in support of their local community, and in support of local city and county emergency managers. As shown in the rough estimates of Table 4 and pairing disaster zone airports with outside airports as shown in Figure 8, in a fully built out Disaster Airlift Response Team (DART) Network, DARTs could possibly carry as many as 50,000 people per day or 5 million pounds of supplies per day, or some combination like 25,000 evacuees outbound (the maximum possible) and 2.5 million pounds supplies inbound to help with the general response effort. Many factors could combine to make the achievable capacity substantially less than these figures as discussed later in the document. In Table 4, a group of 5 Bay Area DARTs is estimated to be able to organize an airlift with possible combined capacity of 10,000 people per day, or 1 million pounds of supplies per day, or a combination of each. Such a response would stand on the shoulders of the greatest GA airlift in recent California history where GA pilots flew one half million pounds of supplies in to Watsonville Airport ([see six minute video](#)) to aid Watsonville and Santa Cruz after the Loma Prieta earthquake of 1989. That quake demonstrated the willingness of pilots to contribute to the disaster response, but also highlighted the constraints of a lack of prior preparation.

This document details how local communities can use local airports to help solve their logistics issues when faced with a massive disaster that impairs their surface transportation networks. The document also discusses how this aviation capability is harnessed through DARTs, and how local communities can assist the continued growth of The California DART Network so it can achieve this kind of operational potential. We believe the California DART

Network offers a significant advance in the availability and resilience of air transportation service during disaster response, and is a model that should be grown and replicated throughout the nation. For instance, several communities on the Puget Sound of Washington state have formed their own DARTs, Washington pilots support these DARTs, the system is expanding, and either Washington or California pilots could and have come to the other's aid in an emergency.

## **Bay Area Catastrophic Earthquake Scenario**

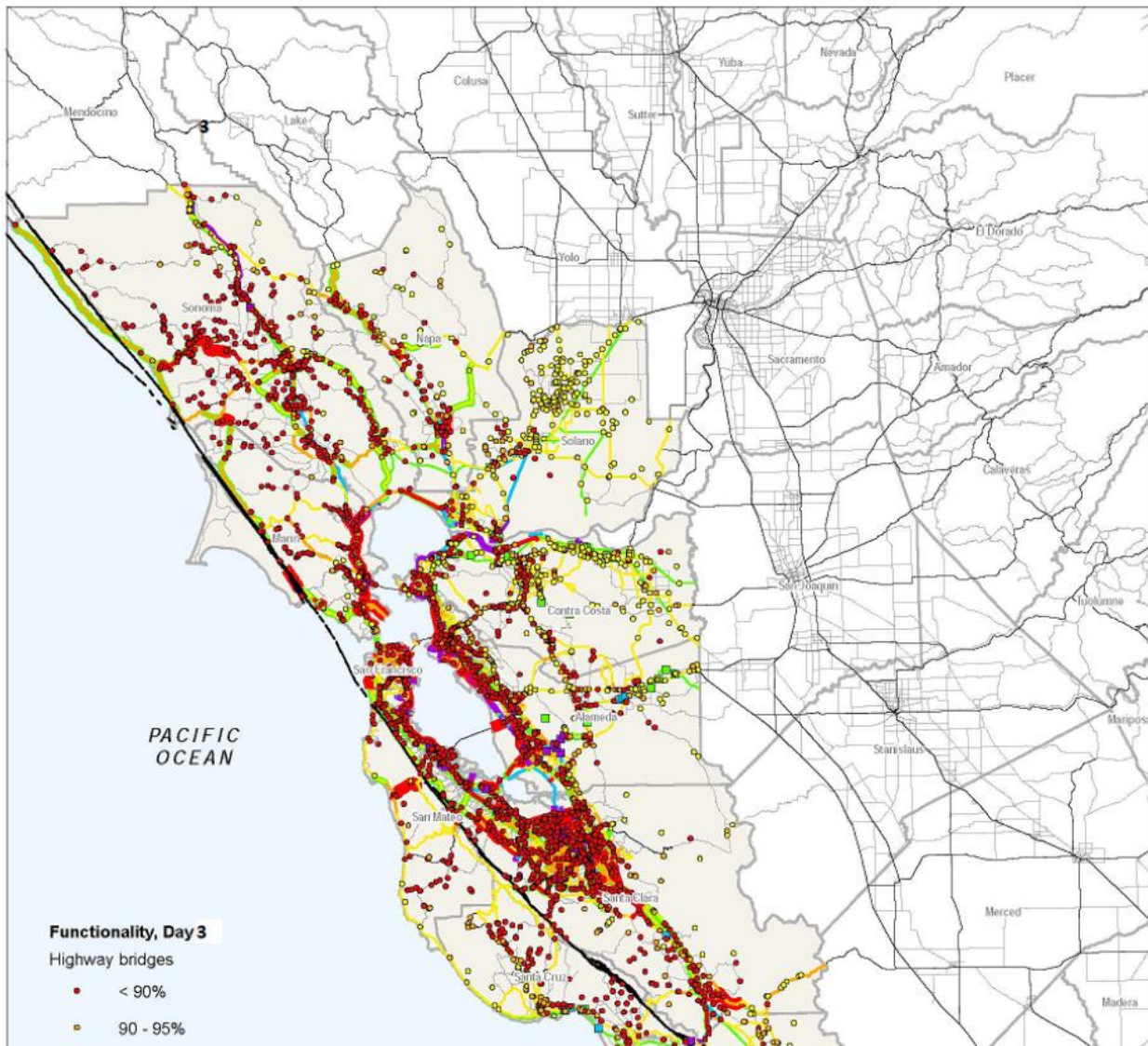
The Bay Area Urban Area Security Initiative (UASI) worked through table top exercises on an earthquake disaster scenario in Q2 and Q3 of 2019 as part of a 2-year Critical Transportation Building Project. Between those exercises and the 2018 THIRA (Threat and Hazard Identification and Risk Assessment), in the 12 counties surrounding the San Francisco Bay and Monterey Bay, they estimate needing to

- evacuate 330,150 people within 14 days (averaging 23,600 per day), including 82,400 with access and functional needs,
- provide 2 million people daily food and other basic commodities,
- provide potable water to 1.8 million households holding 5 million people,
- ameliorate the effects of 500,000 households without electricity, and
- provide shelter to 300,000 people.

Additionally, the exercise materials contained the following description of possible damage to regional transportation systems:

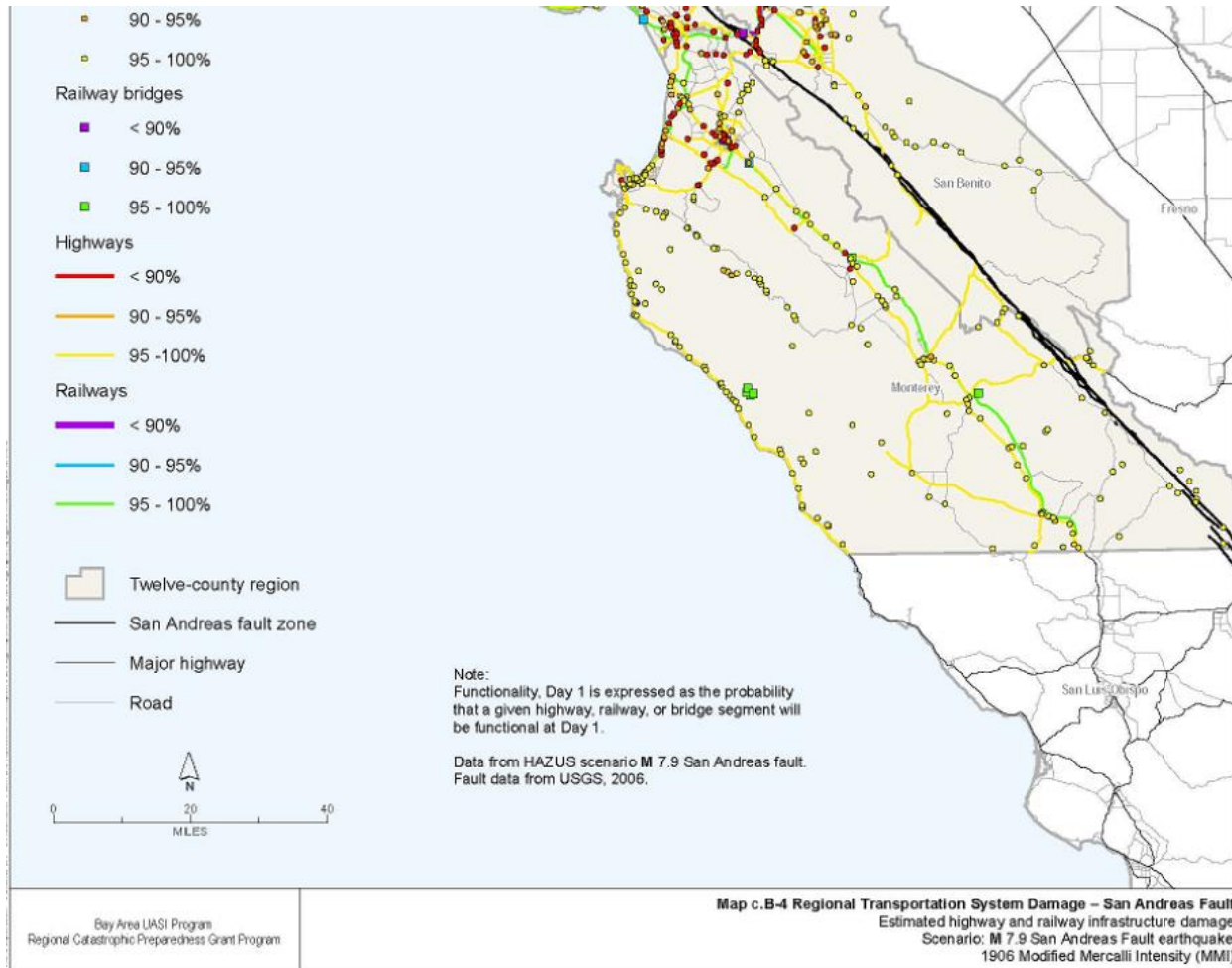


**Figure 2, Status of Bay Area Transportation Systems, E+72 (Adapted from Appendix C, Regional Catastrophic Earthquake Logistics Response Plan)**



(Figure continues next page)

**Figure 2 –**



**Figure 2**—This figure above and on the previous page details widespread impairment in the regional freeway system. These are individual bridges, overpasses, underpasses, and sections of roadway that experience some sort of failure or impairment. When you add them all up, it is an extraordinary job to get these roadways working again, taking weeks or months to restore full capacity. There is less damage in the southern half of the sector, and details on the origin of the maps are seen in the notes at the bottom.

The map of the damage is supplemented by a tabular listing of damage to key routes connecting the region. The damage is assessed in two segments – roadways and bridges. Any part of the system that is damaged can prevent traffic from using the highway, and different sorts of interim repairs and clearing can result in differing levels of capacity being available after the work is completed. Note that even if the highway is reopened, damaged overpasses may cause severe local transportation circulation problems. Alternate transportation methods may be needed for weeks or months to compensate for a freeway system operating at less than full capacity.

Table 7. Expected functionality of Caltrans Lifeline routes after the earthquake.				
Route	Segment	Location	Functionality Immediately after the Scenario Event	
			Roadways	Bridges
SR 24	Contra Costa County	From Interstate I-680 in Walnut Creek to SR 13/I-580 in Oakland	High Caldecott Tunnel: Low	Low to high
SR 24	Alameda County	From I-680 in Walnut Creek to SR 13/I-580 in Oakland	Low	Low
I-80	San Francisco and Alameda counties	From U.S. 101 in San Francisco to I-580 in Oakland	Low to high (San Francisco side) Low (Oakland side)	San Francisco–Oakland Bay Bridge (Bay Bridge): High Bay Bridge approaches: Low
I-80	Solano County	From I-780 in Vallejo to the Nevada state border	High	Low (Vallejo) Low to high (North of Vallejo to Solano county line)
SR 92	San Mateo County	From U.S. 101 to I-280	High	Low
U.S. 101	Monterey County	From SR 170 in Los Angeles to I-280 in San Jose	High	Low (Salinas) Medium to high (remainder of county)
U.S. 101	San Jose–San Benito County	From SR 170 in Los Angeles to I-280	High	Mainly high
U.S. 101	San Jose–Santa Clara County	From SR 170 in Los Angeles to I-280	Medium (south of San Jose to county line) Low (San Jose)	Low
U.S. 101	San Francisco	From I-280 to I-80	Medium	Low
U.S. 101	Del Norte County–Marin County	From the Golden Gate Bridge in Marin County to U.S. 199	Medium to high (north of Golden Gate Bridge to SR 1) Low (SR 1 to Novato) High (Novato to county line)	Medium to high (north of Golden Gate Bridge to SR 1) Mainly low (SR 1 to county line)

Table 7. Expected functionality of Caltrans Lifeline routes after the earthquake.				
Route	Segment	Location	Functionality Immediately after the Scenario Event	
			Roadways	Bridges
U.S. 101	Del Norte County–Sonoma County	From the Golden Gate Bridge in Marin County to U.S. 199	Low to medium (southern County Line to Santa Rosa) High (Santa Rosa to county line–north)	Low (southern County Line to SR 128) Low to high (SR 128 to county line–north)
SR 12 SR 29 SR 116 SR 121	Sonoma County	From U.S. 101 in Petaluma through Napa to I-80 in Solano County	High	Low
SR 12 SR 29 SR 116 SR 121	Solano County–Napa County	From U.S. 101 in Petaluma through Napa to I-80	Low (western County Line to American Canyon) High (American Canyon to southern County Line and eastern County Line)	Low to medium
SR 12 SR 29 SR 116 SR 121	Sonoma County–Solano County	From U.S. 101 in Petaluma through Napa to I-80	High	Medium
I-280	San Francisco–Santa Clara County	From U.S. 101 in San Jose to U.S. 101 in San Francisco	Low	Low
I-280	San Francisco–San Mateo County	From U.S. 101 in San Jose to U.S. 101	Medium	Low
I-280	San Francisco	From U.S. 101 in San Jose to U.S. 101 in San Francisco	Medium	Low



Table 7. Expected functionality of Caltrans Lifeline routes after the earthquake.

Route	Segment	Location	Functionality Immediately after the Scenario Event	
			Roadways	Bridges
I-238 SR 580	Alameda County	From I-880 in Alameda County east to I-5	High	Low to high (San Leandro to Castro Valley) High (Castro Valley to Pleasanton) Low to high (Pleasanton to Livermore) Medium to high (Livermore to eastern county line)
I-238 I-580	Alameda County	From I-80 to SR 24	Low	Low
I-680	Benicia– Santa Clara County	From I-280 in San Jose to I-780	Medium	Low
I-680	Alameda County	From I-280 in San Jose to I-780 in Benicia	High	Low to medium
I-680	Contra Costa County	From I-280 in San Jose to I-780 in Benicia	High	Low (Walnut Creek and Pleasant Hill) Low to high (rest of county)
I-680	Solano County	From I-280 in San Jose to I-780 in Benicia	High	Benicia Bridge: High Benicia Bridge approaches: Low
I-780	Solano County	From I-680 in Benicia to I-80 in Vallejo	Medium	Low to high

Source: URS analysis (2009)  
I = interstate  
SR = State Route  
U.S. = U.S. highway  
High = roadway/structure is likely usable  
Medium = roadway/structure is likely to have sustained some damage and requires some repair but can be reopened in time to support evacuation efforts  
Low = roadway/structure may have sustained major damaged and may be unusable until repaired

## Transportation Applications Supported by General Aviation

Here are some of the many transport applications that can be used during a disaster response. Together they address three of the Core Capabilities in FEMA's National Response Framework – Critical Transportation, Logistics and Supply Chain Management, and Situational Assessment. Note that most of these trips have several transport sections. For example, a person or supply must move from where they are to the nearest airport, then the DART staff at the airport determines to which airport the person or supply should be transported. (Note – the DART assigns its resources to flights in support of the local Incident Commander or Emergency Operations Center as detailed in the DART section.) Next, the actual air transport is accomplished. Upon arrival at the destination airport, the person or supply will need surface transportation to their final destination. Successful completion of a trip requires solutions for each section of the trip, employing multiple transportation modes. Typical disaster air transportation applications include:

## Delivery of Vital Response Personnel, Equipment, Food and Supplies

### Local Emergency Air Commute

Air commute assistance may be necessary for emergency responders and other key disaster workers who are unable to make their daily drive from their home to their place of employment. It is common in the Silicon Valley for people to drive 40 minutes to 90 minutes one way to get to work. When the roadways and rail lines are disabled, these commutes become prohibitive. GA can assist by making the surface transportation portion of their

commute a short component from home to the local airport, and another short component from the destination airport to work. Note that regional airplanes cannot handle nearly the volume that the roadways can, so only high priority commuters can be accommodated, and people might need to stay at work for multiple days at a time while other high priority air operations take place.

### Out-of-Region Disaster Worker Airlift

In a disaster it will be necessary to transport out-of-region medical, police, fire, emergency management and other disaster workers and mutual aid providers into the region to assist local responders and emergency operations centers. In most disasters mutual aid responders drive to the place where they are needed in their own vehicles, or perhaps fly in on a scheduled airline flight, and take a taxi to their end destination. When regional surface transportation is degraded in the disaster zone, out-of-region disaster workers may need to be transported via private plane to small airports much closer to their assigned workplace.

### Food Airlift

When grocery store, restaurant and food bank trucks cannot make it into the disaster zone, food will need to be flown in until FEMA, CalOES and other emergency management organizations can begin the resupply needed to support a community's recovery. If GA is being used for food airlift, food packaging is broken down into loads suitable for transport in small planes. Commodity Points of Distribution (C-PODs) can be set up at the airports where the food is delivered, or the food could be transported off-airport to the distribution sites. Most of the food airlift will likely be accomplished by federal and state resources. And yet there may be pockets of application where GA can be of assistance such as assisting food distribution channels which may be outside the mainstream distribution. Or, primary assets may not have the capacity to reach smaller communities in need.

### Supply Airlift

During a disaster it may become necessary to import high value, low weight/volume supplies such as water filters, water purification tablets, medicines, drugs, blood products, first aid supplies, field hospital supplies. For instance, lifesaving medicines to serve 1000 people may be able to be delivered in a single plane load. Evacuating those 1000 people may require 300 plane loads. Many supplies will likely be distributed through federal and state resources. Yet the volume and diversity of communities' needs may outstrip the federal and state organization's ability to process them all. The GA airlift may be able to provide additional capacity addressing the kind of supplies not transported in the federal and state effort, or by directly serving the public and local response efforts without absorbing the bandwidth of state and federal emergency responders.

## Situational Assessment

### Damage Assessment Flights and Fire Watch

Quick assessments of disaster damage can be supported by aerial observation and relayed back to local authorities. Reservoirs and levees can be overflown to make initial damage assessments. Aerial fire assessment can help spot blazes quickly after the first sighting of smoke to alert appropriate responsible parties. In some places aerial photo reconnaissance may be available. Note that this application is best supported by the Civil Air Patrol (CAP), and they should be used first where available as they have the training, expertise, deep volunteer staff, and specialized equipment to provide superior service. If CAP resources are unavailable, then DART resources may be applied. In the major earthquake disaster described here, the 5 or so CAP Aircraft in the San

Francisco and Monterey Bay Region may need support from their outside regions and/or from DARTs to meet the needs of all the cities and the counties in the region in the first hours and days of the disaster.

## **Evacuation and Transportation of Civilians and Animals**

Note that transportation of the general population has the most potential to overwhelm the available GA resources. As a result, these civilian transportation applications may need to be highly restricted based on demand for transportation versus supply of GA aircraft, pilots, and airport capacity.

### **Evacuation – Uninhabitable Housing**

People whose housing has become uninhabitable can be transferred to a logistics center just outside the earthquake zone where further transportation can be arranged for them using commercial carriers or other specially arranged transit. Or, people can be flown directly to the one of California’s 250 public-use airports that is closest to where they want to go. Note that if shelters in the evacuation zone run out of room, that additional people needing shelter can be flown to available shelters outside the evacuation zone.

### **Evacuation – Fragile People**

Some ambulatory, fragile people are unable to survive in a disaster zone because of lack of clean water, electricity, and/or medical supplies. Examples include dialysis patients, people using portable oxygen tanks, senior citizens living in nursing homes without air conditioning and potable water, and people requiring daily medicines or services which for some reason are unavailable inside the disaster zone. For these people, prompt evacuation may be a matter of life or death.

### **Evacuation – Tourists**

The San Francisco and Monterey Bay Areas are popular tourist destinations. Tourists travel around the area on day trips visiting the popular locations. When an earthquake occurs, they may need transportation back to their hotel, or, back to the airport from which they will fly home. Or, if their airline flight has been canceled, they may need evacuation from the airport closest to where they are to an airport from which they can get home.

### **Evacuation – small to mid-size pets**

Small to mid-size pets can be evacuated with their owners in a small plane, or can be flown to be reunited with their owners. In some cases, wildlife rescue may also be facilitated.

### **Family Reunification**

If the disaster occurs while families are temporarily separated for work, school, or distant activity, the dislocated family members may need air transportation to be reunited so they can navigate the disaster together. Or, an adult family member who doesn’t reside with an aged parent or other fragile extended family member may need urgent transportation to assist that person during the disaster.

### **Airline Transport Local Shuttle**

In the San Francisco Bay Area, most airline travelers use the San Francisco International (SFO), San Jose Norman Mineta International (SJC) or Oakland International (OAK) airports. In a very large earthquake striking the bay, liquefaction of waterfront soils and/or tsunamis may put SFO, OAK, and Moffett Field airports out of service. SJC, on firm higher ground, may be the only major airport in operation. SJC will likely have an operational route pushed through to the airport, but that route may be limited in its ability to be of service to all regional travelers

who need to use SJC. Airline travelers around the region who couldn't drive to SJC could be air-shuttled from their local airport (26 of them in the 12-county area) to Reid Hillview airport. From there they would be helicoptered or bussed across town on a cleared route to SJC where they could fly to their national or international destination. With two runways, Reid Hillview could support quite a bit of regional air shuttle traffic. It would be disadvantageous to clog up SJC with both the shuttle and airline traffic – SJC's airlines would make fewer flights. In this multimodal transport solution people may have walked from their home to a local airport, flown in a small plane to Reid Hillview, sat in a bus or helicopter to get a ride across town to SJC, and then flown in an airliner to their city of destination.

### Emergency Medical Air Transportation of Last Resort

In a large disaster, existing medevac helicopters and other specialized medical aircraft may be completely overwhelmed with injured people needing transport. It is possible that GA aircraft could be used to save lives. Compared with normal medevac operations, transport times to hospitals would be substantially increased using airplanes, due to the delays associated with getting to the local airport, getting the plane scheduled and loaded, making a flight to a distant airport instead of directly to the hospital, and arranging surface transportation from the remote airport to the remote hospital. Yet, these delays may be far preferable than the alternative of waiting for treatment within the disaster zone, or waiting for the dedicated medical aircraft to become available. Two early trial transports to the Stanford Medical Center and San Joaquin General Hospital from San Martin airport delivered people in 2.5 hours and 3.5 hours from the time they showed up at San Martin airport until the time they walked through the respective emergency room doors. This is an area for further development between DARTs and the emergency medical community if it is to be used optimally during an actual disaster.

### Disaster Airlift Response Teams (DARTs)

DARTs are organized within California by The California DART Network (CalDART). CalDART members have the opportunity to individually support CalDART at their home airport, or join together with other CalDART members and form a DART. As of December 2021, there were 12 DARTs in the state who have had practice exercises during the last 2 or more years. These DARTs are supported by CalDART members and other volunteers at their home airports, CalDART members are located in another 46 or more airports around the state, besides the 12 DART airports. CalDART publishes on its web site a CalDART Network Overview which is updated from time to time which details the location of CalDART Members and DARTs around the state.

DARTs are Volunteer Organizations Active in Disaster (VOADs) that bring together pilots, ground teams, passengers and supplies to serve their local community's need for disaster-related air transportation. Pilots volunteer their time and aircraft to operate these donated flights under Part 91 of the Federal Aviation Regulations (FARs). Note that there are about 75 or so volunteer-based public-benefit aviation transportation groups in the United States operating under the same Part 91 regulations. See the list at <http://www.aircarealliance.org/directory-groups>. DARTs may be organized at a single airport or may serve a group of airports in a specific region. DARTs around the state share contact information among their managers so that they can reach one another during a disaster to request and offer mutual aid. CalDART can make statewide announcements of need and opportunity to its members at any time.



Unattached CalDART members (members who are not a part of a specific DART) are encouraged to reach out into their community and get to know the emergency management and VOAD key people so that the unattached CalDART members can have the opportunity to educate them about and offer disaster air transportation services through CalDART should their community need it. These unattached members can also be asked to contact the pilots at their airport to assist the scale-up of a DART's activation. Unattached members can also contact CalDART and request mutual aid for their community in a disaster, and help coordinate the application of that aid as it becomes available.

DARTs hold a practice exercise approximately each year to build and maintain their emergency response skills, supplies, equipment, and storage space. They have a protocol for activating the DART after a real disaster occurs:

- Who will be the DART Incident Commander.
- What kinds of service will be offered
- Which DART functions will be utilized.
- Who will fill out the leadership team.
- Asking the key local disaster partners whether they see a need for air transportation service.
- If disaster air transportation service is needed, recruiting the pilots and ground volunteers to fill out the DART for that incident.
- The DART informs CalDART and the California Air Coordination Group that it is activating, and requests any desired mutual aid from CalDART and/or its peer DARTs around the state.

The DART sets up a service operation with one or more of the following elements:

- Local people can request air transportation by telephone, email, or possibly walk-up in-person,
- outgoing cargo can be dropped off for air shipment,
- incoming cargo can be received for distribution,
- customer service staff weigh the outgoing cargo and passengers and log them in for transport,
- flight operations staff match cargo and passengers up with available pilots and aircraft, and
- ramp operations volunteers (if any) assist pilots and passengers with loading and unloading while maintaining a safe operating environment if the public is allowed access to the ramp.
- Communications operators use radio or telephone to maintain contacts with other DARTs, local EOCs, and other entities engaging with the DART if cellular service is compromised.

Operations are prioritized to deliver the highest possible public good at no cost to the requesting party. That highest good is defined to be in priority support of the local agency managing the disaster response, and the DART's local VOAD partners. In the absence of requests from these groups, or in the event of extra available capacity, the DART reaches out directly into the community to offer air transport services, delivering the highest possible public good in the remaining capacity.

If requested by the coordinating agency, the DART will work at the specific direction of that coordinating agency. The coordinating agency is the local city or county that is managing the incident territory inside of which resides the airport. That control may be passed upward to the California Air Coordination Group (ACG) at the State Operations Center. A passing of DART control to the coordinating agency assumes that the coordinating agency

will utilize the DART to the fullest extent possible within necessary limitations for safety, congestion at certain airports, and congestion in certain airspace. It is possible that the coordinating agency will not be comfortable making direct requests of DARTs non-commercial flight operations – in that case, the DART offers free public-benefit air transportation service directly to its VOAD partners and the local community, and the coordinating agency can inform the general public of the availability of free service from the DART which is requested directly through the DART.

The DART and its pilots conform to the requirements of Part 91 flight, including obeying the terms of any TFRs in effect. TFRs may be written restricting certain classes of air operations in certain places during an emergency.

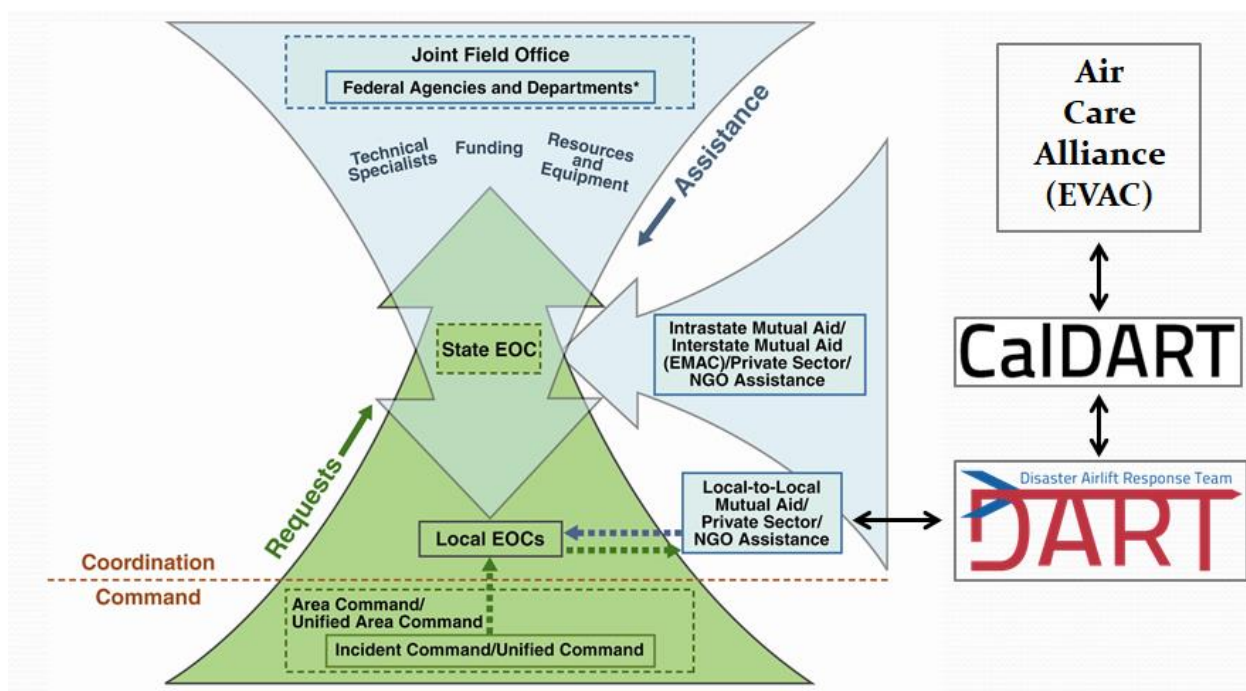
Prior to setting up DART service at the airport, if requested by the Airport Manager, the DART assists the airport manager in many ways. The DART may assist by inspecting for damage to taxiways and runways, as well as the damage or operational abnormalities of the lights, beacon, glideslope indicators, Instrument Landing System, and other features of the airport. They may assist the Airport Manager in efforts to bring portions of the Airport Facilities back into service. The Airport Manager is responsible for communicating changes in airport status directly to the ACG and also to the FAA via the NOTAM (Notice to Air Men) program. NOTAMS communicate important changing aviation information to pilots during their briefing prior to making a flight. The FAA instantly distributes the NOTAMS posted by the Airport Managers and other sources of important flight information electronically via the internet. NOTAMS are updated as frequently as weather, airports, navigation facilities, and other kinds of status changes. NOTAMS are a key part of effective and safe usage of the national airspace and public airports. DARTs will also keep track of key NOTAMS impacting the disaster area and share them with participating DART pilots.

The DART may also assist Airport Management by encouraging the formation of an Airport Community Emergency Response Team (A-CERT). An A-CERT is a special type of Community Emergency Response Team (CERT) that provides additional staffing to airports in times of emergency when existing airport staff may be overwhelmed or not available for work. The A-CERT is typically formed from the community CERT in whose community the airport is based. See the Airport Cooperative Research Program Report 95, Integrating Community Emergency Response Teams (A-CERTS) at Airports. A-CERTs can be quite helpful during a major incident at the airport such as the crash of an airliner, or during a disaster where the airport needs lots of people to work towards resuming full and normal operations. A-CERTs do not make air transportation arrangements for goods or people.

If telephones and the internet are available, the DARTs may provide service remotely, organizing these same flights over the phone and through email, with the pilots in charge of airport operations and managing the passengers and supplies at the airport, perhaps with the assistance of a participating Fixed Base Operator (FBO), a business which operates at the airport.

DARTs fit into the National Incident Management System (NIMS), the Standardized Emergency Management System (SEMS), and the Incident Command System (ICS) as VOADs who assist their local communities with air transportation services during a disaster. The DART communicates with community emergency responders and past exercise partners to see what transportation needs they have that are not being fulfilled by primary aviation emergency responders such as medevacs, FEMA, US Department of Transportation (USDOT), the Department of Defense (DoD), and the ACG. Each year the DART conducts an annual exercise which builds ties with the local

emergency community so that they can call on the DART when needed with confidence that they will get the service they need. The DARTs advertise their services directly to the emergency management community and past exercise partners. If capacity is available, the DART also advises the community about DART service availability through radio and social media and word of mouth and their CERT partners. The DART calls in mutual aid from The California DART Network (CalDART) as necessary to build up the responding resources to the level necessary to handle the community's urgent needs. CalDART can make a request to the national Air Care Alliance through its EVAC disaster coordination member. Each responding DART submits each day a form CA 220a to the ACG advising of the number of airplanes active at which airports, and other details of interest. See Figure 1 which shows how DARTs fit in to the National Incident Management System.



**Figure 1** – How DART fits in to the National Incident Management System

DARTs are structured to grow to a very large size in a general mobilization. The yearly exercises build the skills of the administrative core within the DART so that it is better prepared to run a large operation. In an actual disaster the DART can utilize any pilot who holds a Private Pilot Certificate or better, in-force aircraft liability insurance for \$1,000,000 or more, and can meet all requirements of a Part 91-conforming flight. This structure takes advantage of the many pilots who are willing to volunteer in a disaster, and could lead to large and effective transport operations across the region when required. It should be noted that GA flights have an accident record that averages around 1 fatality per 100,000 flight hours, not nearly as good as the airlines. GA capabilities for the general community should be reserved for times during emergencies when urgent transportation requirements arise – when there is no other suitable alternative and/or this level of risk is acceptable. In any case, people should be informed of the risk and accept it prior to taking GA transportation. DART passengers, ground volunteers, and pilots all execute waivers of liability associated with DART operations. DART practice exercises are kept small to maximize the skill building benefit but minimize risk.

CalDART state management represents the interests of DARTs when working through issues with TFRs, working to provide earliest access to the airspace and airports consistent with safe operations and congestion levels. CalDART state management can also act as an agent for a local DART that communicates a need to CalDART but who does not have the time or working communication network to arrange mutual aid resources to come to their location. CalDART can also respond to a request from a community that does not have a DART to see if an ad hoc DART can be transported into the affected community to provide local service with the assistance of available local ground volunteers. The ad hoc DART is assembled from the management staff of existing DARTs around the state.

If there are problems with the telecommunications network and the internet, then the DART's communications unit goes to work via amateur radio or satellite phone or whatever other resource is available to arrange alternate communications with the outside world to coordinate transportation services.

## **CalDART's Role in expanding DARTs in California**

DART germinated in the South County Airport Pilots Association in 2008 as an outgrowth of those pilots' participation in the Watsonville Lifeline airlift of 1989 after the Loma Prieta Earthquake. Pilots from Watsonville incorporated the DART system into their Watsonville Emergency Airlift Command Team (WEACT). The DART concept was brought to CalPilots at their annual conference in October 2016 where interest was shown and cooperation began. CalDART (The California DART Network) was incorporated as a wholly-owned subsidiary of the California Pilots Association (CalPilots) in the summer of 2018. Then beginning January 1, 2022, CalDART became an independent 501(c)3 non-profit charitable corporation. Today CalDART ([caldart.org](http://caldart.org)) is a VOAD (Volunteer Organization Active in Disaster) with members in 58 or more airports around the state whose mission is to prepare California pilots and ground personnel to provide volunteer emergency air transportation services to benefit communities experiencing a major earthquake, flood, mud slide, or other event which degrades regional surface transportation. CalDART is one of 75 or so public benefit organizations which provide private, no-charge air transportation service to the general public under FAA Part 91 Federal Aviation Regulations. CalDART

- provides a standardized plan for all DARTs to use,
- purchases the insurance that covers DARTs and the general public,
- raises money to benefit all DARTs,
- encourages the formation of new DARTs,
- stimulates interaction between the various DARTs to
  - promote common operating procedures and
  - build personal relationships between teams statewide to foster smoother disaster coordination
- educates and creates awareness of DART capabilities within communities and their emergency managers, and
- addresses common problems to take much of the burden off local DART management.



## Aviation Assets and Capacity in the Bay Areas and California

The Bay Area and California enjoy some of the finest and most utilized aviation assets in the country. The Bay Area's network of 32 public and military airports, 6,000 aircraft, and 12,000 pilots put quite a potential fleet at the disposal of the public. Further, these Bay Area pilots are backed up by 28,000 aircraft and 54,000 pilots in California. Overall, in the USA and its territories there are over 19,000 airports, heliports, seaplane bases, and other landing facilities – of these, 3,330 are included in the National Plan of Integrated Airports Systems (NPIAS), are open to the public, and are eligible for Federal funding via the Airport Improvement Program (AIP) funding. Many people are familiar with some of the 378 primary airports which host scheduled airline flights. Another 2903 airports, 10 heliports, and 39 seaplane bases primarily support GA aircraft and are referred to as GA airports. The overall usage of these airports is illustrated in Figure 3 below, excerpted from "General Aviation Airports, a National Asset, 2012, FAA"






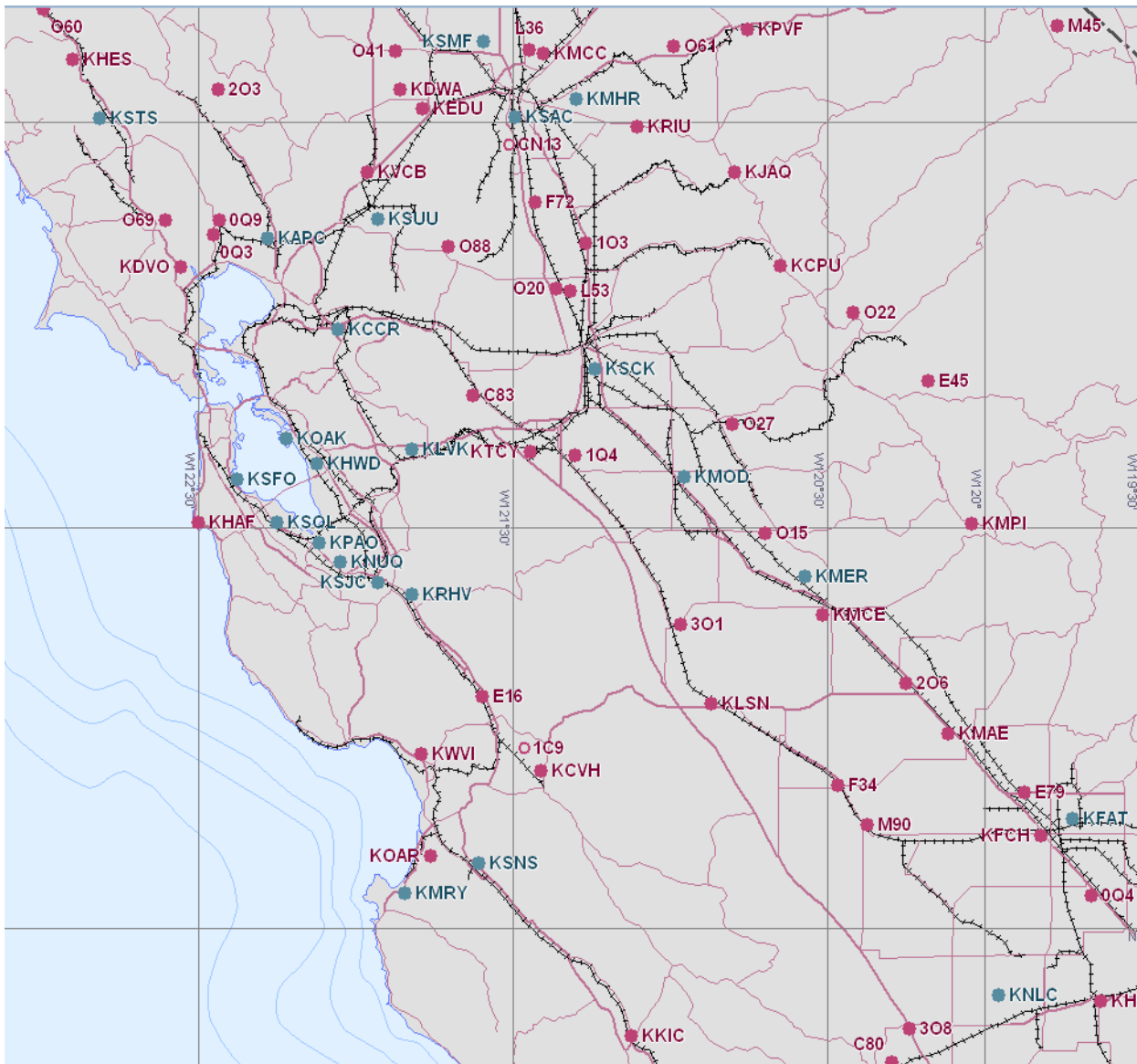
<b>Emergency Preparedness and Response</b>	<ul style="list-style-type: none"> <li>▪ Aeromedical Flights</li> <li>▪ Law Enforcement/National Security/Border Security</li> <li>▪ Emergency Response</li> <li>▪ Aerial Fire Fighting Support</li> <li>▪ Emergency Diversionary Airport</li> <li>▪ Disaster Relief and Search and Rescue</li> <li>▪ Critical Federal Functions</li> </ul>	
<b>Critical Community Access</b>	<ul style="list-style-type: none"> <li>▪ Remote Population/Island Access</li> <li>▪ Air Taxi/Charter Services</li> <li>▪ Essential Scheduled Air Service Cargo</li> </ul>	
<b>Other Aviation Specific Functions</b>	<ul style="list-style-type: none"> <li>▪ Self-Piloted Business Flights</li> <li>▪ Corporate</li> <li>▪ Flight Instruction</li> <li>▪ Personal Flying</li> <li>▪ Charter Passenger Services</li> <li>▪ Aircraft/Avionics Manufacturing/Maintenance</li> <li>▪ Aircraft Storage</li> <li>▪ Aerospace Engineering/Research</li> </ul>	
<b>Commercial, Industrial, and Economic Activities</b>	<ul style="list-style-type: none"> <li>▪ Agricultural Support</li> <li>▪ Aerial Surveying and Observation</li> <li>▪ Low-Orbit Space Launch and Landing</li> <li>▪ Oil and Mineral Exploration/Survey</li> <li>▪ Utility/Pipeline Control and Inspection</li> <li>▪ Business Executive Flight Service</li> <li>▪ Manufacturing and Distribution</li> <li>▪ Express Delivery Service</li> <li>▪ Air Cargo</li> </ul>	
<b>Destination and Special Events</b>	<ul style="list-style-type: none"> <li>▪ Tourism and Access to Special Events</li> <li>▪ Intermodal Connections (rail/ship)</li> <li>▪ Special Aeronautical (skydiving/airshows)</li> </ul>	

Figure 3 – Uses of GA airports

So what is the potential value of these aviation assets in a potential disaster, over and above the contribution that we could get out of our 3 major bay area airline airports and responding state and federal agencies? We explore that question below.

Here is a map of the airports in the 12 counties surrounding the San Francisco and Monterey Bays, as well as the airports immediately to the east:



**Figure 4:** Airports in the San Francisco and Monterey Bay Area 12 county footprint, with adjacent airports to the east

The distribution of pilots and planes registered by county in the San Francisco and Monterey Bay Areas is as follows:

Pilot and Aircraft Registrations in California and Bay Counties				
Statewide Statistics				
			<u>Aircraft</u>	<u>Pilots</u>
			<u>28,600</u>	<u>54,227</u>
Bay Area UASI Region:				
	<u>County</u>		<u>Aircraft</u>	<u>Pilots</u>
	Alameda		1,006	1,774
	Contra Costa		600	1,558
	Monterey		537	570
	Marin		342	559
	Napa		103	330
	San Benito		66	103
	San Francisco		373	926
	San Mateo		592	1,277
	Santa Clara		1,392	2,641
	Santa Cruz		374	647
	Solano		287	813
	<u>Sonoma</u>		<u>474</u>	<u>1,083</u>
	<u>Totals</u>		<u>6,146</u>	<u>12,281</u>

**Table 1:** State and 12-county plane and pilot registrations

The list of public and military airports in the 12 county San Francisco Bay and Monterey Bay Areas is:

<u>Bay Area GA Airport Data</u>					
	<u>Airport</u>	<u>County</u>	<u># Rwy's</u>	Maximum Airplane Weight (000 lb)	<u>Length' x Width'</u>
	Novato Gness	Marin	1	26	3300 x 75
	Cloverdale	Sonoma	1	12	2909 x 60
	Healdsburg	Sonoma	1	12	2652 x 60
	Santa Rosa	Sonoma	2	300	6000, 5202
	Petaluma Municipal	Sonoma	1	12	3600 x 75
	Schellville-Sonoma	Sonoma	1	12	2700 x 45

	Sonoma Skypark	Sonoma	1	8	2840 x 40
	Angwin	Napa	1	not stated	3217 X 50
	Napa	Napa	2	120	4146, 2510
	Vacaville	Solano	1	30	4700 x 75
	Travis (Fairfield)	Solano	2	837	primarily for military use
	Rio Vista	Solano	1	30	4199 x 75
	Concord	Contra Costa	4	140	4600, 2800
	Byron	Contra Costa	2	29	4500, 3000
	Oakland (north fld)	Alameda	3	467 est	62, 54, 33
	Oakland (south fld)	Alameda	1	877 est	primarily for airlines and commercial carriers
	Hayward	Alameda	2	75	5694, 3107
	Livermore	Alameda	2	90	5263, 2699
	San Jose Int'l	Santa Clara	2	875	primarily for airlines and commercial carriers
	San Jose Reid Hilw	Santa Clara	2	17	3100, 3099
	Palo Alto	Santa Clara	1	12	2443
	Moffett Field	Santa Clara	2	877 est	primarily for military and private use
	San Martin	Santa Clara	1	12	3099
	Frazier Lake	San Benito	2	6.7	3000, 2500
	Hollister	San Benito	2	45	6300, 3149
	King City	Monterey	1	12	4479
	Marina	Monterey	1	50	3483
	Salinas	Monterey	2	62	6004, 4825
	Monterey	Monterey	2	300	7175, 3503
	Watsonville	Santa Cruz	2	167	4501, 3991
	Half Moon Bay	San Mateo	1	360	5000
	San Carlos	San Mateo	1	12.5	2621 x 75
	San Francisco	San Francisco	4	877	primarily for airlines and commercial carriers

**Table 2:** Public and military airports serving the San Francisco and Monterey Bay 12-county area

Utilizing most of the airports in the Bay Area at capacity for 8 hours per day for DART flights could yield the following figures per airport leading to approximately 17,000 operations, 50,000 passengers flown, or 5 million pounds of food and supplies flown, or some mix of the two per day. This contribution would be over and above the contributions of Travis, Moffett, SFO, SJC, Concord Buchanan, Livermore and OAK's south field, all of which would also be contributing to the response effort primarily for airline transport or heavy airlift FEMA/CalOES/DoD transport. Approximately 1100 volunteer pilots and aircraft would be needed to support the DART operation – representing 18% of Bay Area aircraft, 9% of Bay Area pilots, 4% of California aircraft and 2% of California pilots.



Note that these calculations are only a rough estimate. Some factors could significantly increase capacity during an actual disaster:

- Larger aircraft could participate in higher numbers.
- Additional ground volunteers and pilots could extend the 8 hours of operations at maximum capacity to 12 or 16 hours.
- Many additional experienced air traffic controllers could be brought in to safely increase airport capacity, as appropriate and possible at each airport.
- Customized air and ground traffic control procedures might be developed for one or more airports to increase capacity. In an extreme example of what is possible, Witman Field in Oshkosh, Wisconsin uses customized air and ground traffic control procedures to each year become the busiest airport in the world during the Airventure Fly-in. It safely reaches a peak capacity of 10 planes per minute. In comparison, the average airport gets pretty busy averaging 1 to 2 planes per minute. In a disaster, it may be desirable to implement special procedures to help safely boost airport capacity. Examples of special air traffic control procedures used at Oshkosh Airventure include
  - staging numerous approach controllers in the field underneath the approach path telling planes to rock wings and issuing them arrival instructions,
  - placing numerous controllers in the tower handling various aspects of traffic management and control,
  - placing controllers on the ground at the runway entrance directing planes to line up and wait and take off,
  - lining up small aircraft for takeoff on both the left and right sides of the 150' wide runway, but releasing them separately,
  - instructing planes to exit the runway at the earliest possible moment, directly onto the grass on either side of the runway while avoiding the runway edge lights,
  - staging flagmen on both sides of the runway to immediately direct exiting aircraft where to go,
  - painting 100' diameter brightly colored dots at different points down the runway to give landing aircraft at least two separate points at which they can touch down, providing safe separation for two aircraft landing at the same time, and
  - controlling ground traffic on all taxiways and aprons with flagmen to prevent congestion spots.

Other factors could work to reduce the throughput that a DART effort can achieve:

- Other segments of the disaster aviation response as well as unaffiliated traffic would use some of the available airport capacity for operations, reducing the number of airports and/or capacity available to DART operations.
- DART members at airports within the disaster zone may be personally impacted by the disaster and unable to volunteer for response.
- The statewide supply of qualified DART managers may not be adequate to meet the staffing needs of a response.
- It may not be possible to get the required number of pilots and DART staff to volunteer to meet this volume.

- Volunteers may be unable or unwilling to work for the days or weeks on end to fully achieve operational goals.
- Avgas may be in short supply or gas pumps may be inoperable, grounding many of the aircraft.
- Many of these airports or the aircraft may be damaged and unable to operate or unable to operate at capacity.
- Aircraft mechanics may be in short supply to keep the airplanes running.
- TFRs may close portions or all of the airspace and airports to GA operations.
- Rain, snow, ice, winds, smoke, and low clouds may reduce runway throughput or shut down operations.



These Air Traffic Controllers set up on the ground under the arrival route at Oshkosh Airventure. This on-site in-person approach control is one of many special procedures developed over many decades which temporarily safely boost peak airport capacity to as much as 10 planes per minute.

Also note that today's set of 9 DARTs in the Bay Area may not be staffed to manage simultaneous DART ground operations at all 25 airports identified in the 50,000 passenger or 5 million pounds per day estimate. If the 9 DARTs could support their airports running at capacity with DART operations, then the daily output would be on the order of 20,000 passengers per day or 2 million pounds of food and supplies per day, or a mix of the two. Note that these figures are rough estimates, useful as a directional target. See the tables below, which were developed with 5 local DARTs. The average weight per flight and number of passengers flown per flight vary somewhat at each airport. Airports with longer runways are assumed to have a few larger planes participating which bring up their averages. Finally note that the table uses operations per hour. An operation is a takeoff or a landing. A flight carrying one person between two airports in the region counts an operation for the takeoff at one airport and another operation for the landing at the other airport, and counts as 2 people flown. Of course, in reality, there was one person flown in one flight. If all flights are paired with airports that are out of the region, then the number of people flown in

each operation counted in the table is the same as the number of people flown in each flight. Finally, the exact figures which would be realized in an actual mobilization are not known and are only roughly estimated here.

<b><u>Estimated Pilot and Aircraft Requirements</u></b>		
<b>Operations Limited by 5 DARTs</b>	<b>All GA Airports Less LVK, CCR</b>	
<b>3,320</b>	<b>17,040</b>	<b>Rough Estimate of Maximum Operations per day</b>
<b>70%</b>	<b>70%</b>	<b>Percentage of flights in area</b>
<b>9</b>	<b>9</b>	<b>Flights per day per aircraft and pilot</b>
<b>217</b>	<b>1,114</b>	<b>Pilots and aircraft required</b>
<b>4%</b>	<b>18%</b>	<b>Percentage of Bay Area Aircraft required to participate</b>
<b>1%</b>	<b>4%</b>	<b>Percentage of California Aircraft required to participate</b>
<b>2%</b>	<b>9%</b>	<b>Percentage of Bay Area Pilots required to participate</b>
<b>0%</b>	<b>2%</b>	<b>Percentage of California Pilots required to participate</b>

**Table 3:** Possible Parameters of a 12-county San Francisco Bay Area GA airlift with 5 DARTs and with universal DART staffing at all airports, assuming DART able to use 100% of served airports' capacity.

**Table 4:** Possible Maximum GA Operations by airport for a San Francisco Bay Area 12-county GA airlift



## Applying Groups of Airports to Accomplish Specific Response Objectives

One helpful way to understand how to use aviation in a disaster is to look at different applications of groups of airports to accomplish various kinds of response objectives. This document identifies several such applications below and uses groups of bay area airports to show how they can satisfy the objectives.

Note that an important dimension of these applications is which authority is implementing the application. For convenience, this document generally assumes DARTs are implementing the application. This treatment facilitates discussion of the potential contribution of GA in a catastrophic disaster. In real emergencies, the management and implementation of these applications will likely be more complex. Federal and State authorities will have priority over DARTs as they assist the regional response. DARTs may have initiated operations ahead of a state or federal response, and will need to be ready to step aside, independently operate alongside, or, if requested, operate at the direction of the controlling authority. The current public Bay Area Catastrophic Earthquake plan shows that airports Concord, Livermore, Travis, Stockton and Moffett Field will be utilized under Federal and/or State agencies, and this document produces capacity figures that exclude those airports from CalDART use. In an actual disaster, the airports that are used by Federal and State agencies may be different, and restrictions to GA operations may be different.

Terminology and technique used to describe these applications may or may not be consistent with those used by state or federal organizations to implement comparable functions.

### One-to-One Air Bridge (Mojave – Tehachapi 2015)

A one-to-one air bridge is where two airports have flights running between them, “bridging” the two locations. These are simple to organize because the pilots just go back and forth all day, offering basic shuttle service between the two locations. The arrangement simplifies scheduling and features good throughput with few pilots. For example, in October of 2015 a disastrous series of El Nino storms unleashed mudslides on California Highway 58 cutting off the town of Tehachapi from Mojave. People were stuck on the road and stuck on the wrong end of the cut off with no good way to get around the blockage. At least 10 local pilots addressed the problem by flying people to and from Tehachapi and Mojave airports, ferrying stranded commuters back home and a host of other good results. Read the newspaper article [here](#). See below photos of some of the pilots, as well as one of the stuck trucks:



From left, Andrew Angelotti, Dave Robins and Dustin Moshier were among the at least 10 pilots who volunteered their services by making numerous flights Friday morning between Mojave and Tehachapi airports in an effort to assist stranded motorists as well as people caught in mudslides.  
Darla A. Baker/ Tehachapi News

## Pilots offer airlift support to mudslide victims, stranded motorists

By Darla A. Baker, Tehachapi News



One of 75 semis stuck in the mudslides, this one at Highway 58 and Cameron Road.  
Nick Smirnoff/ For Tehachapi News

Applying that example to the bay area, if Highway 101 and the Monterey Highway and Santa Teresa Avenue were all cut at the same point south of San Jose and North of Morgan Hill (where the red X is), you could organize a one-to-one air bridge between Reid Hillview (KRHV) and San Martin (E16) as shown below:

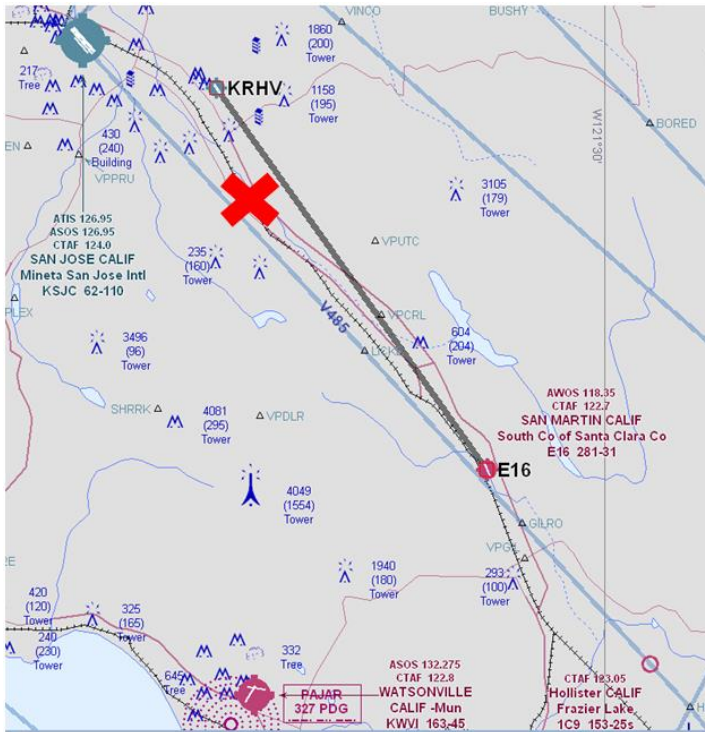
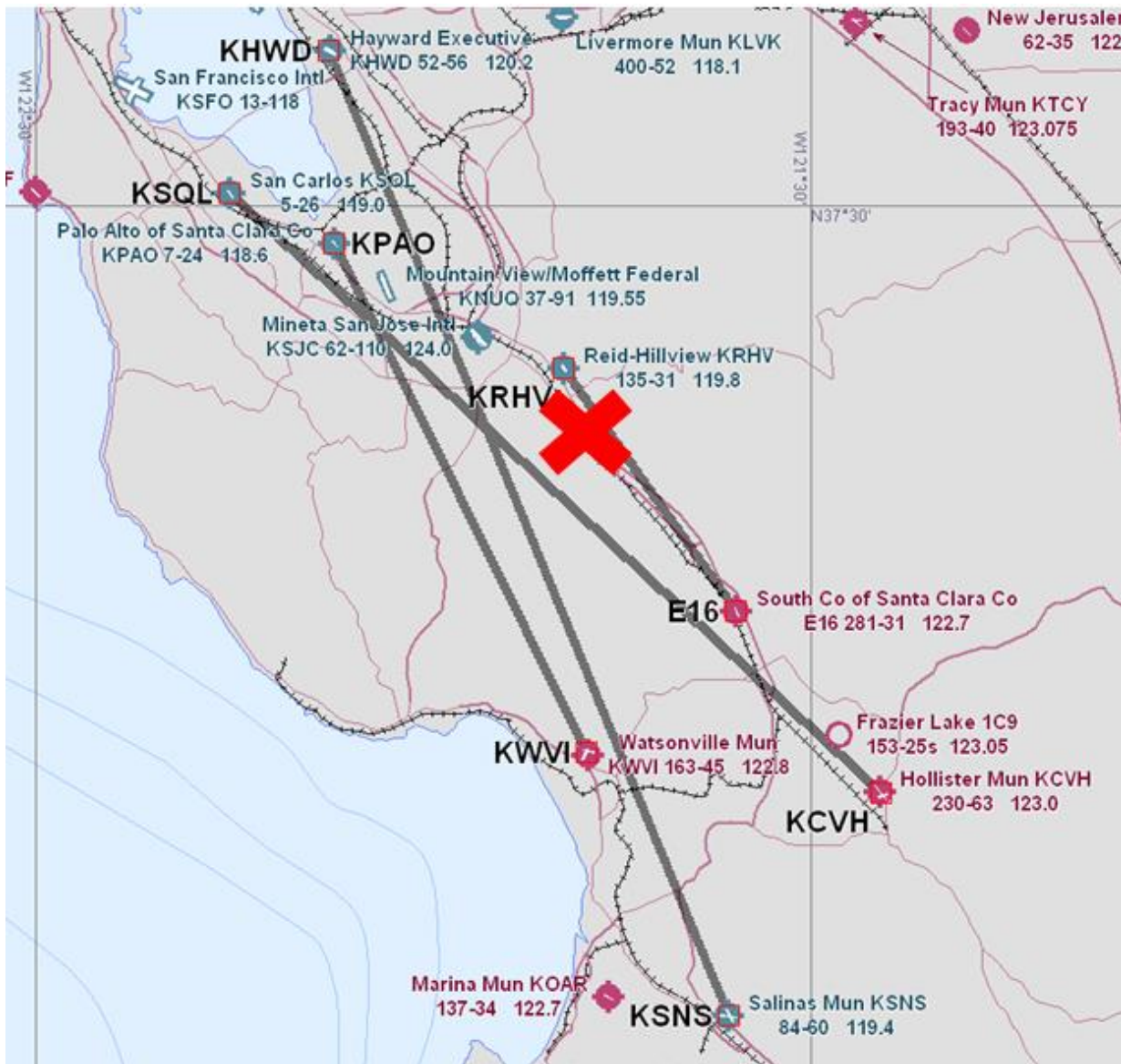


Figure 5: One-to-One Air Bridge

## Using Several Air Bridges Together

One problem with the one-to-one air bridge is that you might not be able to carry as many people and supplies between two airports as you would like, limited by how many landings and takeoffs you can do at the two airports, and the size of planes supporting the air bridge. One way of improving on this limitation is to fly out of multiple airports. So for instance, if Highway 101 and the Monterey Highway and Bernal Avenue were all cut at the same point south of San Jose and North of Morgan Hill, you could organize several air bridges between the airports of Salinas, Hollister, Frazier Lake, and Morgan Hill on the south side of the break, and Reid Hillview (2 runways), Palo Alto, San Carlos, and Hayward on the north side of the break. These several air bridges offer approximately 4 times the throughput possible with a one-to-one air bridge. The airplanes would be flying more miles because they would have to fly a longer distance to the airports further away from the break, but more airplanes and pilots could be utilized in this application if they were available. See the diagram below.





**Figure 6: Several-to-several Air Bridge**

## Many-to-One Airlift (Loma Prieta Earthquake 1989)

In the Watsonville Lifeline Airlift which mobilized in response to the Loma Prieta earthquake of October 1989, a many-to-one airlift was used. Supplies and food were flown in from other Bay Area airports to the Watsonville Airport where they were in turn distributed via surface streets to citizens in the cities of Santa Cruz and Watsonville. Fortunately, even though essentially every road into the area through the mountains (across the San Andreas Fault) was cut, surface streets in and between Watsonville and Santa Cruz were usable. See the 6 minute [video](#) on YouTube to see how one half million pounds of food and supplies were flown in by Bay Area GA pilots and their planes. The airlift was hugely successful and is a motivational example for future efforts. Building on this ad hoc airlift, our goal is to be better prepared for the next big one. After the next big one, we would like to

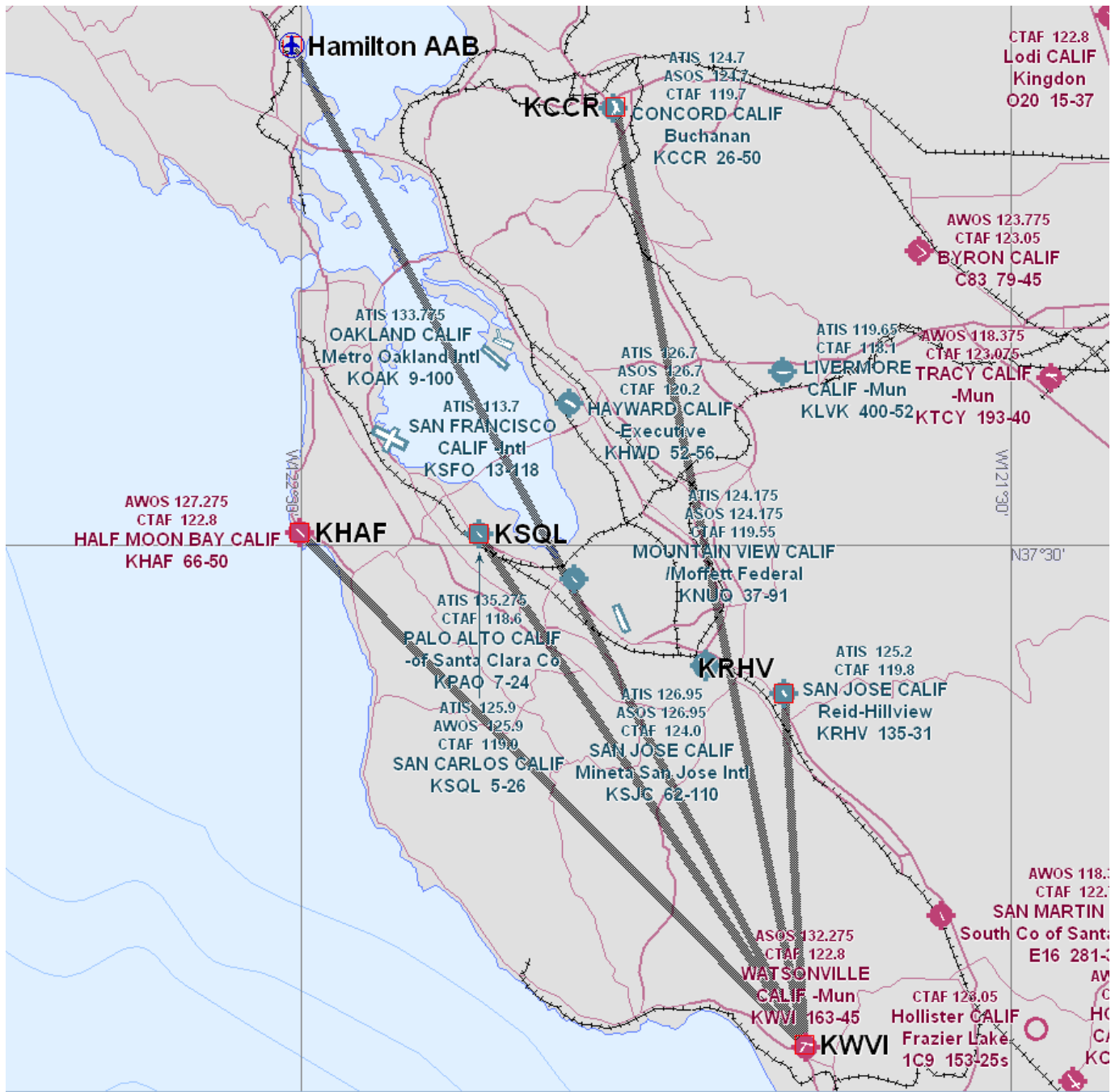
- start operations the same day or next day instead of the third or fourth day,

- solicit and manage donations more effectively, and
- serve a broader set of the community's logistical needs through
  - tighter and deeper connections between the DARTs and their local served communities, and
  - better-prepared DARTs who can better advise of potential modes of assistance, and
- gain access to the airspace more quickly through standing relationships with the controlling authorities

The airports supporting the Watsonville Lifeline airlift are shown in Figure 7 below, and some pictures snipped from the 1989 video are pasted below that. Note that Hamilton Army Air Base has been decommissioned and is no longer available as a base of operation in a future disaster.

As an aside, we need to protect our remaining airfields around the bay so that they remain available for disaster use as well as normal use. For instance, San Jose Reid Hillview is being set up for possible future closure by the Santa Clara County Supervisors. In the case of the Watsonville Airlift, 2 out of 5 responding airports would be unavailable for a future earthquake as outlined in this disaster scenario, if Reid Hillview is closed as Hamilton was years ago. San Jose Reid Hillview has enormous every day value to the people of Santa Clara County and Silicon Valley as a reliever airport that takes congestion out of SJC, and as a vital logistics resource with 2 runways and spare ramp space to serve the city and county for logistics purposes during disaster. During disaster, Reid Hillview and SJC could team up to provide the only viable airline service to the entire bay area region as outlined in the Airline Transport Shuttle application seen on following pages. Santa Clara County has by far the most planes and most pilots of any county in the bay area and is an important regional asset in maintaining strong GA emergency response capability. Reid Hillview has nearly the same number of operations per month as San Jose International. **DON'T CLOSE REID HILLVIEW – IT IS AN ASSET THAT BENEFITS THE ENTIRE BAY AREA AS WELL AS SANTA CLARA COUNTY.**





**Figure 7: Many-to-One Airlift – Loma Prieta Earthquake of 1989**

The “Watsonville Airport Lifeline After Loma Prieta” six-minute video created by Arlo Reeves tells a fascinating story of how aviation was used to respond to the Loma Prieta Earthquake of 1989. The airlift benefited the communities of Santa Cruz and Watsonville which were cut off from the outside world by the quake. See the video for yourself on [YouTube](#). Frames of the video are captured below for those who don’t have time to watch it:

**WATSONVILLE AIRPORT**  
**LIFELINE**  
**AFTER LOMA PRIETA**



Video created by Arlo Reeves      A bartender flees to safety as liquor bottles and glasses fly off the shelves.



Collapsed home



Tent Camp for people needing shelter



Food lines for those in need



Highway 17 landslides delayed full reopening 32 days.





Highway 1 was closed at Struve Slough.



Epicenter. Hwy 9 and 1 partly open; 17, 152, 129 blocked



Local newspaper headline



FEMA employees arrive in a C130 military transport.



The California Dept of Forestry battled fires.



Army Medevac Helicopters transported injured people.



USAF CH-53 helicopters delivered several tons of supplies.



The greatest number of relief flights was in small planes.



Linda Miloch organized flights from Concord Buchanan for the Food Bank of Contra Costa County.



Bill Dunn and John McAvoy of Reid Hillview organized 80 pilots in 300 flights to transport food, water, & gear.

## 100 private pilots assist relief effort

By Frank Sweeney  
Mercury News Staff Writer

With the cloudy vanguard of a major Pacific storm sweeping through the Bay Area, Friday was not the best of days to fly. But Walter Windus had precious cargo aboard his light airplane that couldn't wait.

Jammed into the back seat and luggage compartment of the single-engine Mooney Mark 20 were nearly 300 pounds of food and blankets for Watson-

ville Friday to airlift desperately needed supplies to Watsonville.

So, on a day when few light planes would normally be in the air, Windus peered through the plane's windscreen, searching the cloudy skies over Santa Cruz Mountain ridges for the path around a 1,500-foot television antenna and the way to Watsonville Municipal Airport.

The television tower was obscured by clouds, a trap for the

## Bay Area Pilots Aid Earthquake Victims

It is estimated that nearly 350,000 pounds of food and emergency supplies were airlifted by general aviation pilots to the earthquake-stricken area of Watsonville, California in the days following the major San Francisco earthquake. Over 450 missions were flown and more than 300 aircraft participated, according to figures compiled by AOPA.

General aviation pilots donated the use of their aircraft and fuel and responded quickly to the needs of the community whose only hope of receiving assistance was by air. This effort underscored the utility and on-the-spot reaction afforded by general aviation.

Watsonville, located southeast of San

Francisco, is a small town of about 10,000 people. general aviation pilots who readily agreed to volunteer the use of their aircraft for the lift, which ran several days starting on Saturday, October 21st.

With help from the local news media, calls went out to the community for donations. When the lift began at 7 a.m., cars filled with supplies were lined up at the airport. By 5 p.m. on Sunday, October 22nd, the Reid Hillview airfield had conducted 300 flights using 80 aircraft, piloted by 115 pilots. Everything had been donated, including the supplies, the planes and the fuel. Over 250,000 pounds of food, camping equipment, blankets and other items were flown to Watsonville.

When asked if they would do it again,





The California Conservation Corps and community volunteers delivered supplies from the Watsonville airport out into the community locally, including to the Second Harvest Food Bank of Santa Cruz.

**Since the Loma Prieta earthquake, Watsonville Airport has installed a generator to power landing lights, fuel pumps and navigational aids during power outages.**

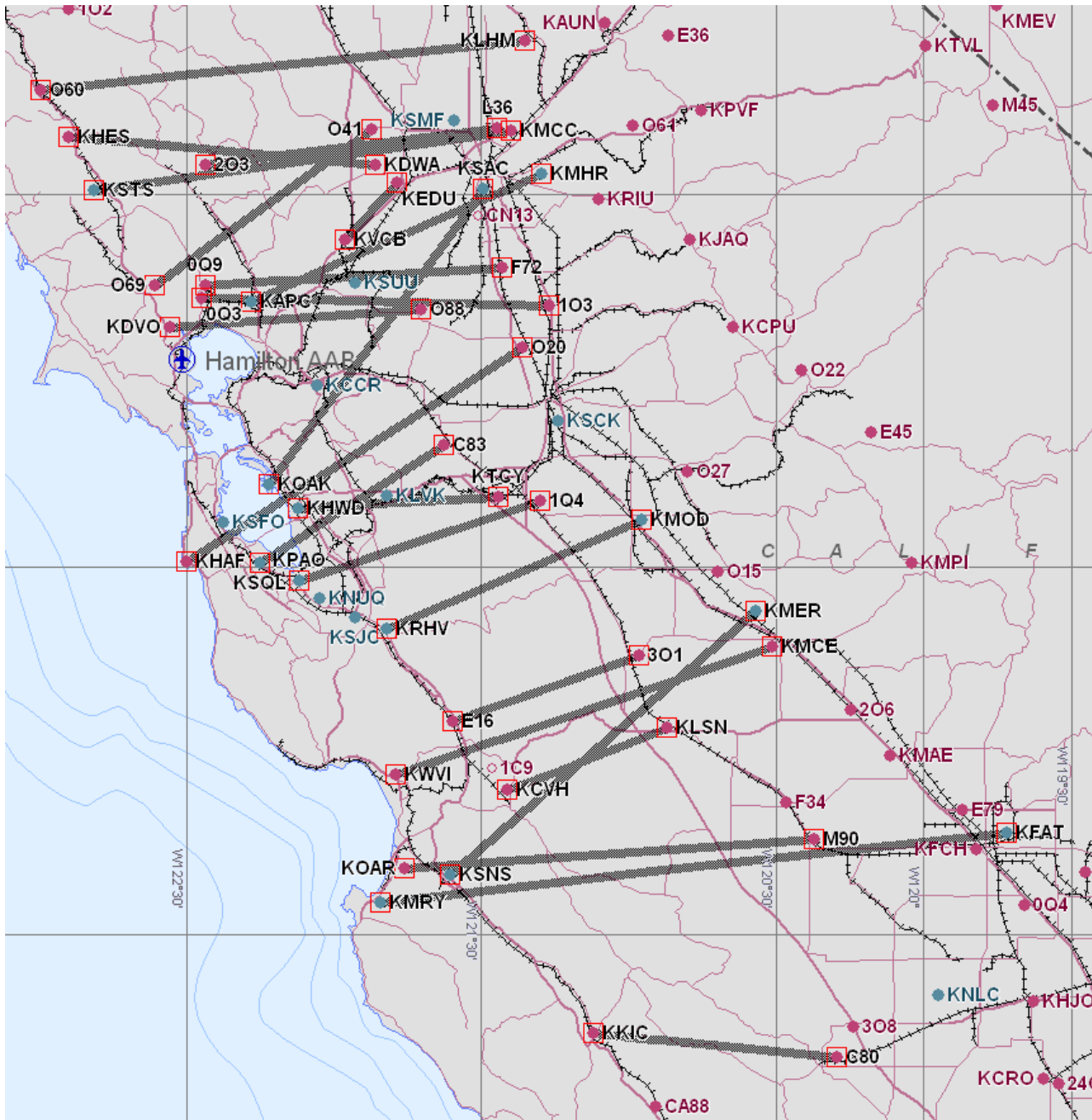


## Maximum DART Food and Supply Importation with Maximum Evacuation

In preparing for a region-wide disaster, DARTs ponder the questions of how can they bring in the most food, supplies, or other support while evacuating the most people given many participating planes with limited cargo capacity. Of course, any actual maximum response will first utilize the heavy transport capabilities of state and federal assets and managers. Federal and state response activities may completely eliminate the need for a group of DARTs to ever generate a maximum response on their own. Federal and State authorities are the place where the operational experience and capacity resides to manage these sorts of challenges. And yet, in the interests of a deeper level of preparedness, DARTs consider how they would do it on their own if the need should ever arise.

The way to accomplish a maximum response with DARTs utilizing GA aircraft is to set up supply points at as many airports as it takes to fully utilize all the participating aircraft while running each airport close to its maximum capacity. Start with the airports closest to the affected area so that flights are shorter and more trips per day can be made by each participating pilot. As more pilots join the operation, expand to airports that are the next closest to the disaster. A more distant airport may be used if there is an important operational advantage for doing so. A maximum configuration is shown below where each Bay Area airport is connected via air bridge to a supporting outside airport with similar runway length and weight bearing capability. An airport with 2 runways may be able to be paired with two airports each with a single runway. As shown previously in Tables 3 and 4 and their associated text, it takes an estimated 2800 pilots and aircraft to fully load up each participating airport, assuming an average of 6 flights per day per pilot in an 8 hour duty day and about 200 to 400 lbs supplies or two to four passengers average carried per load, for 2.5 million pounds of food imported, and 25,000 people evacuated per day. Note that these figures have not been operationally verified in an actual response. CalDART and its DARTs have no experience running any operation at full airport capacity, and no experience running a region-wide operation of this magnitude. It would be a most unusual result to be able to gather 2800 pilots who have other day jobs and activities for an operation like this. Additionally, a mass movement of personnel of this scale would include state and federal participation.

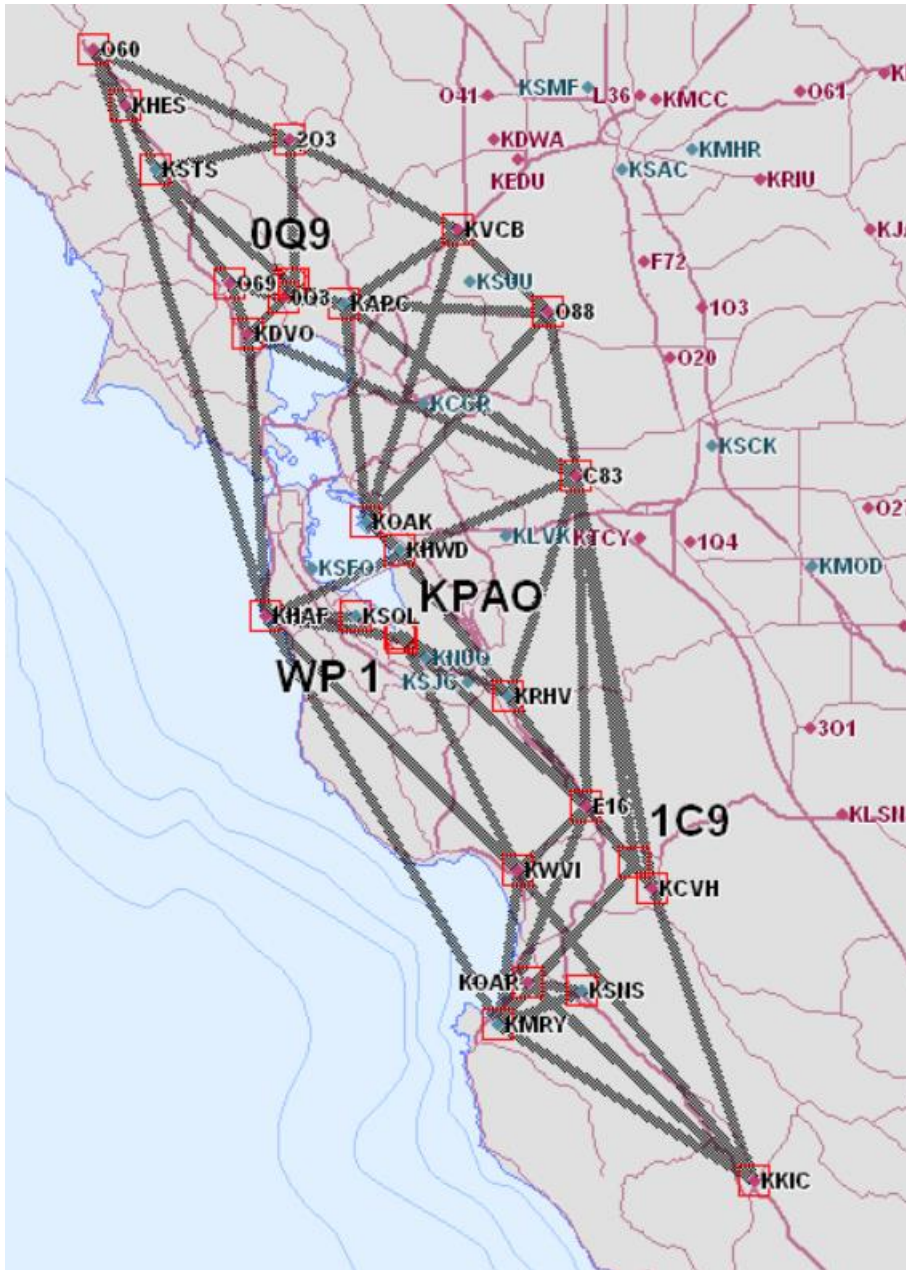
Making an operation like this happen would require many people at each end of each link, and a greater DART Network than exists today. Ideally we should have a DART or participating DART members at each California airport to ensure adequate delivery of service to each community that needs it. Note that because all of the airports are modeled to be 100% dedicated to the paired air bridge airport outside the Bay Area, that double the number of airports would be operating at capacity, requiring more pilots and planes, and moving the most total materiel and people into and out of the disaster zone as is possible with GA aircraft. The 2800 pilots and aircraft represent 46% of registered Bay Areas aircraft, 10% of California aircraft, 23% of Bay Areas pilots, and 5% of California pilots. An operation like this may require mutual aid from GA pilots and planes from surrounding states. Finally, note that the particular pairings shown in the diagram are illustrative only, actual pairings would depend on which airports were available at the time for use in this way – for example, Mather and McClellan would also be used by agencies such as CalOES and FEMA, and may not be available to bay area airports for extensive use. Finally, note that these capacity numbers assume that DARTs are the major user of these airports, which may or may not be the case in an actual disaster.



**Figure 8: Maximum Food and Supply Importation with Maximum Evacuation**

## Regional GA Alternate Transportation Grid

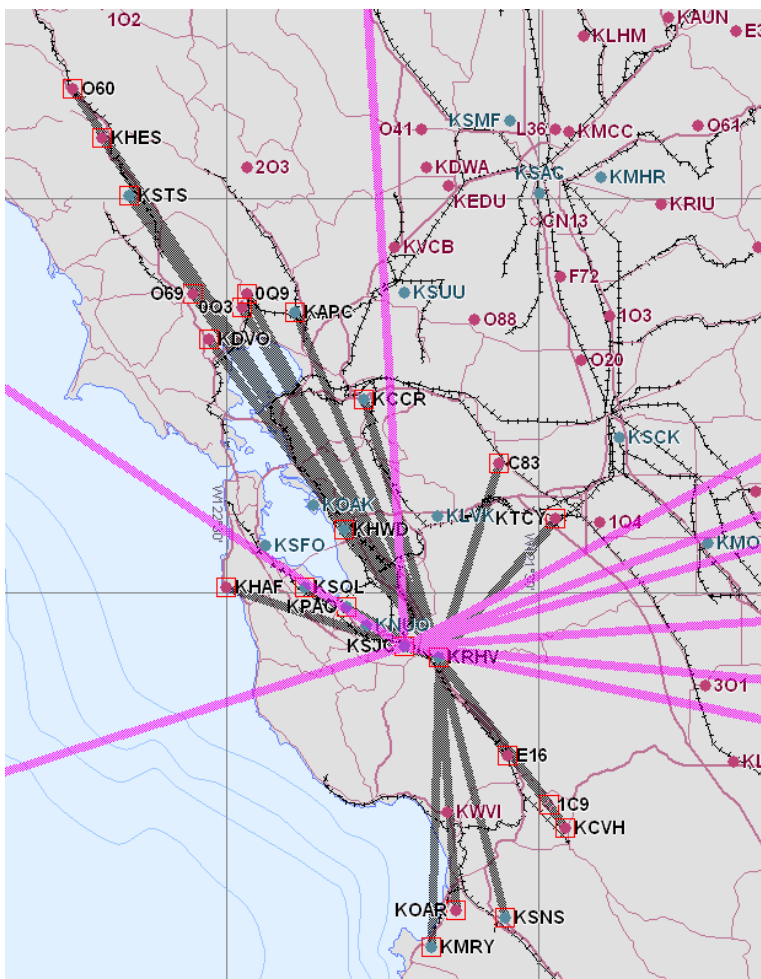
Yet another way to use the system of GA airports in the Bay Area is to immediately take people or things directly from any airport to any airport. The Airports can serve as a temporary freeway substitute, albeit with far less capacity. Figure 9 below shows how this regional transportation grid ties together the bay area. Keep in mind that in any disaster, the actual airports dedicated to state and federal assets or otherwise closed off to GA will be determined in real time according to the response to that disaster.



**Figure 9: Regional GA Alternate Transportation Grid.**

## Airline Transport Shuttle

In this earthquake scenario, OAK, SFO and Moffett Field airports may be inoperative due to liquefaction or tsunami damage. OAK and SFO are built on landfill nearly at sea level at the edge of the bay, and Moffett is in the low marshlands near the bay. In such a case, SJC may be the only operational primary San Francisco Bay Area airport. A key challenge may be how to get people and things to and from SJC and other airports when the surrounding Bay Area freeway infrastructure is substantially compromised and not carrying much traffic. Part of the solution may be to bus and truck people and supplies across town between San Jose Reid Hillview and SJC, and then let San Jose Reid Hillview distribute the people and cargo to airports throughout the Bay Area. In this way, DARTs deliver people from an airport close to their home to San Jose Reid Hillview, just across town from SJC, and SJC delivers them to or from a distant national or international destination. SJC would likely be in complete saturation running as many commercial flights in large planes as possible. Small planes will not be allowed to land there and reduce its capacity with their operations. In Figure 10 below, the pink routes originate from SJC, and the gray routes originate from San Jose Reid Hillview. In similar fashion, the 29 bay area airports could be used to get people to other nearby airline airports such as Sacramento International and Monterey.



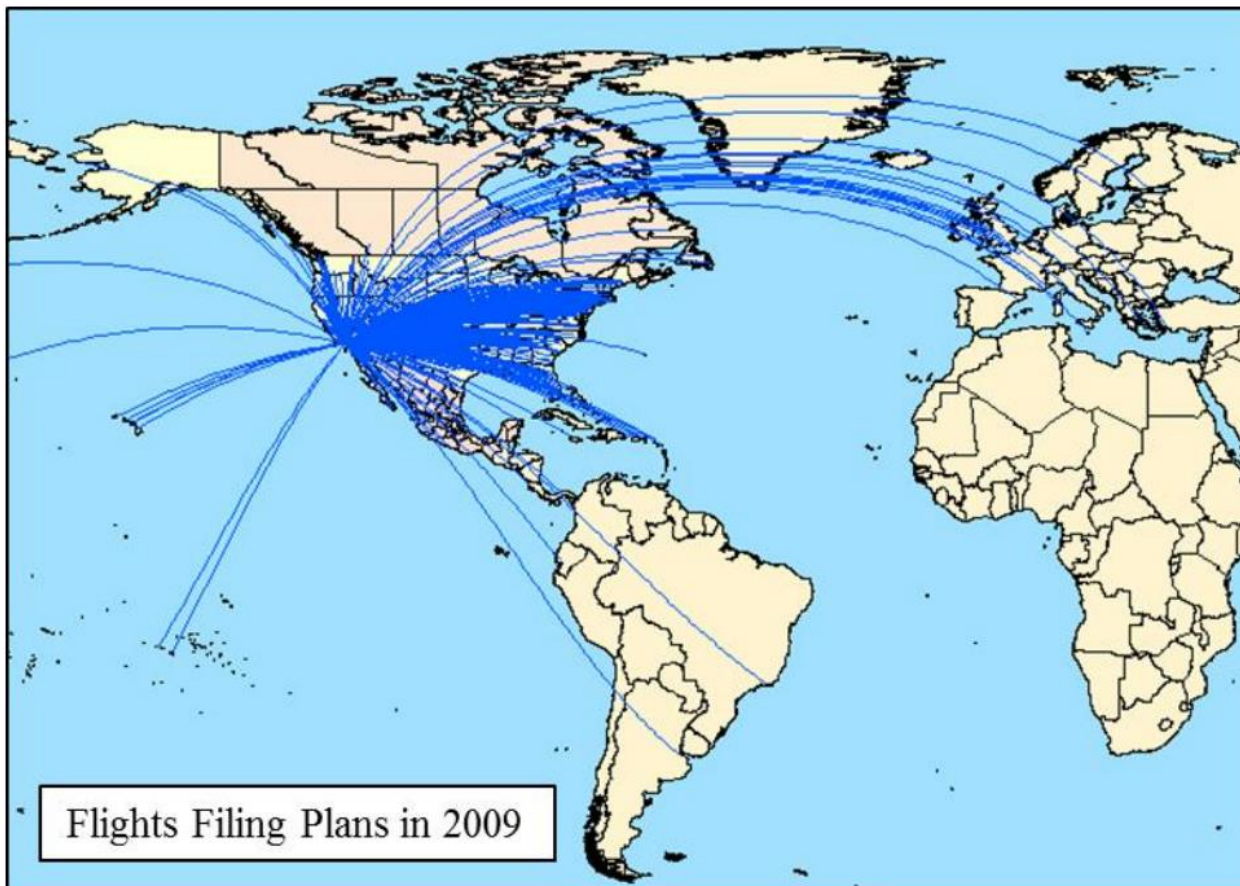
**Figure 10:** Airline Transport Shuttle – GA aircraft take people to and from their local airport to SJC. SJC might be the only operational airline airport on the San Francisco Bay after a major earthquake. The regional freeway



system is compromised making it difficult to drive to SJC from the full bay area. RHV takes the local air traffic (gray) to maintain high capacity at SJC (pink). A route is cleared through San Jose to bus people and cargo between San Jose Reid Hillview and SJC.

### Airline Transport Augmentation

An important GA disaster function is Airline Transport Augmentation. Although this function is not provided by DARTs, it is important to note that business aviation jets and turboprops will likely be serving their owners' urgent disaster transportation needs in parallel with the DARTs and government responders. Airports in the bay which have these kinds of planes and/or the runways to support them to some extent include Santa Rosa, Napa, Concord, OAK North Field, Hayward, Livermore, Hollister, Salinas, Monterey, Watsonville, and Half Moon Bay, in 9 of our 12 counties. These business jets and turboprops can take large payloads across many states fast and safely in all kinds of bad weather compared with the limitations of small piston engine airplanes. An airport similar to these airports, Van Nuys, illustrates this airline augmentation potential through flight plans filed in 2009:



**Figure 11:** These filed flight plans from 2009 at Van Nuys airport illustrate the potential use in airline transport augmentation available from Oakland North Field, Santa Rosa, Napa, Concord, Hayward, Livermore, Hollister, Salinas, Monterey and Watsonville. Graphic excerpted from General Aviation Airports, a National Asset, 2012, FAA



## Positioning for a Best Aviation Contribution in the Next Disaster

This document illustrates the extraordinary potential for GA to augment state, federal, and commercial efforts in a disaster which impairs regional surface transportation. GA will never have the capacity that FEMA, CalOES, the military, and commercial air carriers can deliver in response to a large disaster. And yet, the degree of disruption to transportation systems ensures that GA assets will be vitally important in handling the myriad needs not addressed by primary governmental and air carrier efforts. How do we make sure to realize this potential when the next applicable disaster occurs? We can

- help grow the California DART Network so that it has active members in every airport so that maximum daily operations can be more easily managed,
- continue to build connections between the DARTs and their surrounding communities so that all understand what can be offered when support is needed,
- work with the FAA and airports to discuss possibilities for making contingency plans to operate the airports at higher volumes during emergencies, and
- work with all California airports to improve their disaster resilience and readiness.

## What should the emergency management community and airport owners do?

The emergency management community and airport owners should

- provide storage space on the airport for DARTs,
- purchase a Satellite phone for the DART, pay its monthly expense, and register it with disaster-priority,
- provide Disaster Service Worker worker's compensation insurance coverage for DART volunteers in exercises and deployments,
- encourage emergency management professionals to attend DART organization meetings to talk about disaster management and the role of logistics in a disaster, encouraging and/or helping the pilots form their own DART,
- include CalDART members in the local disaster response community – invite CERT members to volunteer as ground support for a DART. The DART management needs some experienced pilots to help keep things safe. But, pilots often don't want to administer things. Many just want to fly. So get CERT and ARES/RACEs members and retired emergency management professionals and other similar people to manage some of the planning, preparation and administration duties in the DART.
- fund CalDART operational and capital expenditures. Principal expenditures are on equipment, supplies, and liability insurance. Airplanes, gas and volunteer labor are donated for free.
- be prepared to reimburse fuel expenses. Fuel is not fully reimbursable at this time under the Code of Federal Aviation Regulations Part 91, but it is helpful to be able to reimburse fuel in an emergency, eliminating a significant economic barrier to participation for volunteer pilots and airplane owners. CalDART may seek and the FAA may grant a fuel reimbursement exemption to CalDART in the future.

## Further Information

Send questions or comments to [paul.marshall@caldart.org](mailto:paul.marshall@caldart.org)

Visit [caldart.org](http://caldart.org)

- for more information about The California DART Network,
- to [join CalDART](#), or
- to [make a donation to CalDART](#) (the donate page is found under the Support CalDART tab).

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## Acronym Listing

ACA – Air Care Alliance  
A-CERT – Airport Community Emergency Response Team  
ACG – California Air Coordination Group  
CalDART – The California DART Network  
CalOES – The Governor’s Office of Emergency Services  
CalPilots – The California Pilots Association  
CERT – Community Emergency Response Team  
C-POD – Commodity Point of Distribution  
DART – Disaster Airlift Response Team  
DOD – Department of Defense  
EVAC – Emergency Volunteer Air Corps  
FAR – Federal Aviation Regulations  
FEMA – Federal Emergency Management Agency  
GA – General Aviation  
ICS – Incident Command System  
NIMS – National Incident Management System  
NOTAM – Notice to Airmen  
NPIAS – National Plan of Integrated Airport Systems  
OAK – Oakland International Airport  
SEMS – Standardized Emergency Management System  
SFO – San Francisco International Airport  
SJC – San Jose Norman Mineta International Airport  
TFR – Temporary Flight Restriction  
UASI – Urban Area Security Initiative  
USDOT – United States Department of Transportation  
VOAD – Volunteer Organization Active in Disaster