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Can **WE** **Mega Fires?**

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CAN WE STOP MEGA FIRES?

INTRODUCTION

As a firefighting community we are seeing as increasingly battling huge fires characterized as runaway “goliaths” called “mega fires”... For our purposes, let’s first propose a definition of what a “mega fire” is... [FIGURE 1]

FIG. 1 MEGA FIRE DEFINITION

- STARTS NEAR OR IN A HIGH FIRE DANGER AREA DURING APPROACHING OR ACTUAL RED FLAG CONDITIONS
- ESCAPES INITIAL ATTACK
- DEVELOPS INTO A CAMPAIGN FIRE COVERING A LARGE AREA
- REQUIRES THOUSANDS OF FIREFIGHTERS AND EXTENSIVE ADDITIONAL RESOURCES TO BRING FINAL CONTAINMENT
- OFTEN CAUSE HUGE PROPERTY AND OTHER CULTURAL LOSSES IN ADDITION TO VEGETATION DESTROYED

A mega fire starts near or in a high fire danger area under approaching or actual Red Flag conditions and escapes initial attack... leading to a campaign fire eventually covering a very large area and requiring thousands of firefighters and extensive wildfire fighting resources commitment to bring final containment. Frequently these fires are accompanied by huge cultural losses in addition to the vegetation destroyed. Most of these fires cost \$75-\$100 million in suppression costs alone, plus property and other resources destroyed.

In the aftermath of these fires, most often our firefighters tell us they use the best equipment, procedures and tactics available to them, but fuel, terrain, weather cause them to fall short... and the fires then got away! In my homeowner mind... the arsenal is not adequate if the fires get away... and something needs to change!

So if our arsenal is falling short... what can we do in the near and foreseeable future to gain mastery over these fires?...

Our plan here is to explore ideas and concepts to perhaps identify potentially fruitful areas to pursue towards mastery over these fires.

Let us consider the MEGA-FIRE Fundamental Challenges. [FIGURE 2]

FIG. 2 WILDFIRE FUNDAMENTAL CHALLENGES



- 1. Potential big fires are not attacked soon enough with effective resources**
- 2. Current air tankers do not carry enough suppressant to attack the heads of the big fires**
- 3. Airborne firefighting assets do not fight fires at night**
- 4. Current firefighting systems have limited effectiveness in high winds**
- 5. The fire services do not have an active, viable research & development program to identify appropriate technical resolutions**

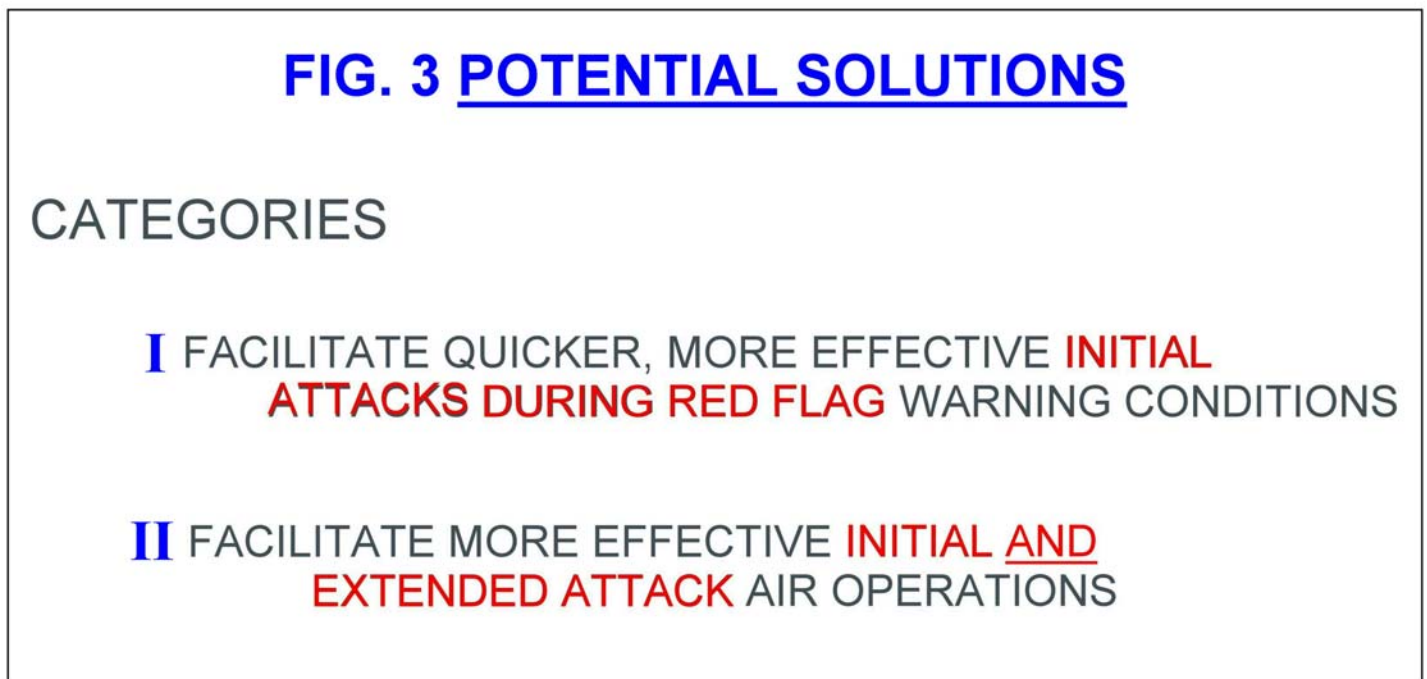
Wildfire Fundamental Technical Challenges:

- Technical challenges that aerial firefighting must address and overcome to provide true effectiveness versus mega fires include:
 - Fires are not attacked vigorously, soon enough
 - Aircraft do not arrive with sufficient suppressant at one time
 - Majority of aircraft cannot fight fires at night
 - Current aircraft have limited effectiveness in high winds

- A key administrative challenge is that currently there is no identified agency with the authority, expertise, and resources to conduct Research and Development of viable solutions to these challenges. Without solutions to these challenges, mega fires are going to continue to run away!

If you don't solve each of these technical challenges... some fires are going to get away!

POTENTIAL SOLUTIONS [FIGURE 3]



There are many potential partial solutions to the aerial technical challenges. Some of these to be presented below have or are now being used sporadically... The intent is to have them all used more consistently in the early stages of potential mega fires.

We start with the first group.

CATEGORY I

FACILITATE QUICKER, MORE EFFECTIVE INITIAL ATTACKS DURING RED FLAG WARNING CONDITIONS [FIGURE 4]

FIG. 4 CATEGORY I

FACILITATE QUICKER, MORE EFFECTIVE **INITIAL ATTACKS DURING RED FLAG WARNING CONDITIONS**

- (1) IMMEDIATE SCRAMBLING OF ALL INITIAL ATTACK FORCES
- (2) A PRE-DESIGNATED INCIDENT COMMAND SYSTEM
- (3) INITIAL ATTACK RECONNAISSANCE
- (4) HIGHER LEVEL AVIATION COUNSEL
- (5) FIVE MINUTE TURNAROUND AUTOMATED FIRE SPREAD MODELING

(1) IMMEDIATE SCRAMBLING OF ALL INITIAL ATTACK FORCES

When an ignition is detected in a **Red Flag** area, all ground and air assets with potential arrival times of ½ to 1 hour should be automatically and immediately dispatched to the fire with pre-assigned radio frequencies allowing first-in elements to communicate coordination factors to and from the first arriving de facto Incident Commander. This is currently being done by LA County.

On day one, the Station Fire moved only 1/3 of a mile in about 4 hours! The 12,000 gallon DC-10 and the 7,200 gallon Martin Mars heavy tanker assets were contractually available and on call during the whole first day of the fire. They could have made drops within one hour or less after being called. The DC-10 was under CAL FIRE contract and available via Mutual Aid Agreement. The Mars was under direct U.S. Forest Service contract. An experienced wildfire air coordinator in the area on the first day called the fire management and requested that any available air assets be summoned immediately. Such assets were not called!

(2) A PRE-DESIGNATED INCIDENT COMMAND SYSTEM

On many past mega fires, a broad/highly experienced TYPE 1 Incident Commander has not been available until days after fires start! On the Cedar Fire it was on about the third day.

Each season, each high-risk geographic area should have Type 1 Incident Commanders pre-assigned so when **Red Flag** conditions approach, the designated IC can be immediately accessible to a first-arriving (de facto) Incident Commander. Special electronic hookups and transportation provisions could allow the IC, within minutes, to advise arriving Initial Attack forces, start evacuations or call additional forces.

Selected other critical staff functions can be also pre-designated and on-call.

(3) INITIAL ATTACK AIR RECONNAISSANCE

To provide Incident Commanders with real-time direct-view, 360-degree fire information in the shortest possible time **[FIGURE 5]**

FIG. 5 WHAT THE FIRST RESPONDER/INCIDENT COMMANDER NEEDS TO KNOW FAST



NOTE: THE LONGER IT TAKES TO GET THE ANSWERS, THE LESS LIKELY THE FIRE WILL BE STOPPED QUICKLY AND LOSSES MINIMIZED.

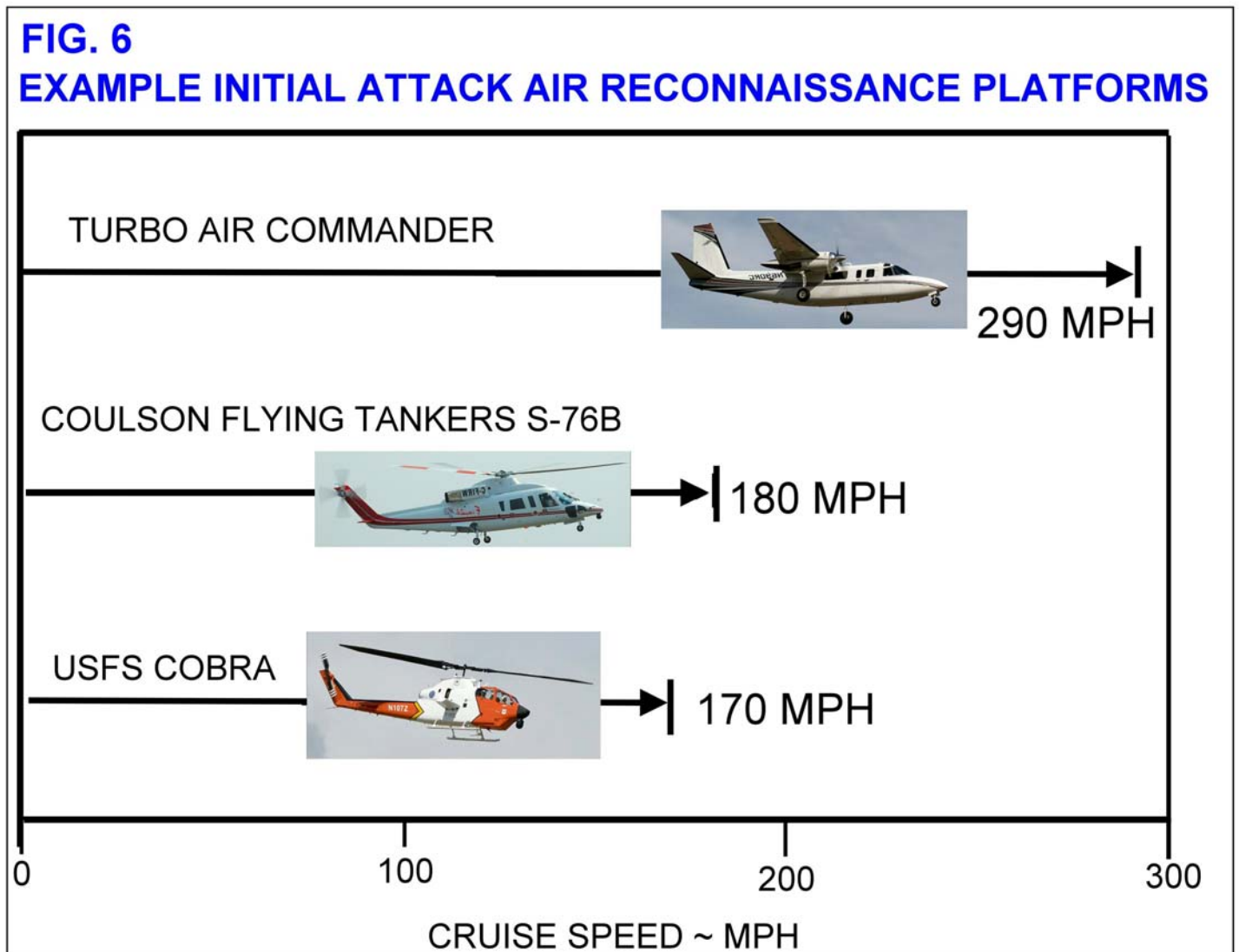


1. What is going on here.....?
2. What direction is it going.....?
3. How fast is it going.....?
4. How many homes or other critical facilities are in its path.....?
5. Do we need evacuation efforts and other emergency support.....?
6. What kind of resources should be applied to stop it and/or minimize losses.....?
7. Where are these resources.....?
8. How long will it take for them to get into position to be effective.....?
9. Where should I tell them to go
10. Etc, Etc as an ongoing cycle until resolution....

An aerial 360 view is much faster & more effective than a ground point-by-point survey.

Specialized helicopters or fixed-wing aircraft should be mobile based at the nearest practical base to potential high-risk ignition zone(s) evolving as **Red Flag** conditions transit the landscape.

Current aircraft can reach fire areas in 20-45 minute timeframes from fire start alert. Results of the initial and periodic air reconnaissance sweeps around the fire can be sent real-time by Internet to pre-designated recipients -- like the IC's and their highest ranking Air Advisors. Example available aircraft that can be configured for this role include: [FIGURE 6]



- a) USFS Cobra Helicopter now based in Lancaster, CA (170 mph capability)
- b) Coulson Flying Tankers S-76B Firewatch Helicopter (180 mph)
- c) A fixed-wing Turbo Air Commander aircraft (290 mph)

Note how far these aircraft can move in one hour once airborne.

The aircraft can also perform air traffic control of air assets converging on the fire if an Air Tactical Supervisor is aboard.

(4) HIGHER LEVEL AVIATION COUNSEL

WRN believes that because very specialized knowledge is required of numerous helicopters and fixed-wing aerial assets, their speeds, the variety of bases available, and their exact location, crew and aircraft status, etc., a senior “**Air Coordinating Officer**” must also be pre-assigned and available simultaneously with the Type 1 Incident Commander to advise on availability and capability of air assets to influence success of the Initial Attack.

To be a master chess player... you have to know where all the pieces are on the board all the time, what their **full** capabilities are, and how to use them effectively together.

(5) FIVE MINUTE TURNAROUND AUTOMATED FIRE SPREAD MODELING

Currently in the early phase of a fire, the IC must call a centrally located office to obtain fire spread prediction data. If this system were updated such that the data gathering usually done by personnel in the modeling office would be in computer data banks and continually updated automatically for latest weather predictions, then initial spread predictions would be available in the near real time with fire spread data in graphic form transmitted over the Internet.

CATEGORY II

FACILITATE MORE EFFECTIVE INITIAL AND EXTENDED ATTACK AIR OPERATIONS [FIGURE 7]

FIG. 7 CATEGORY II

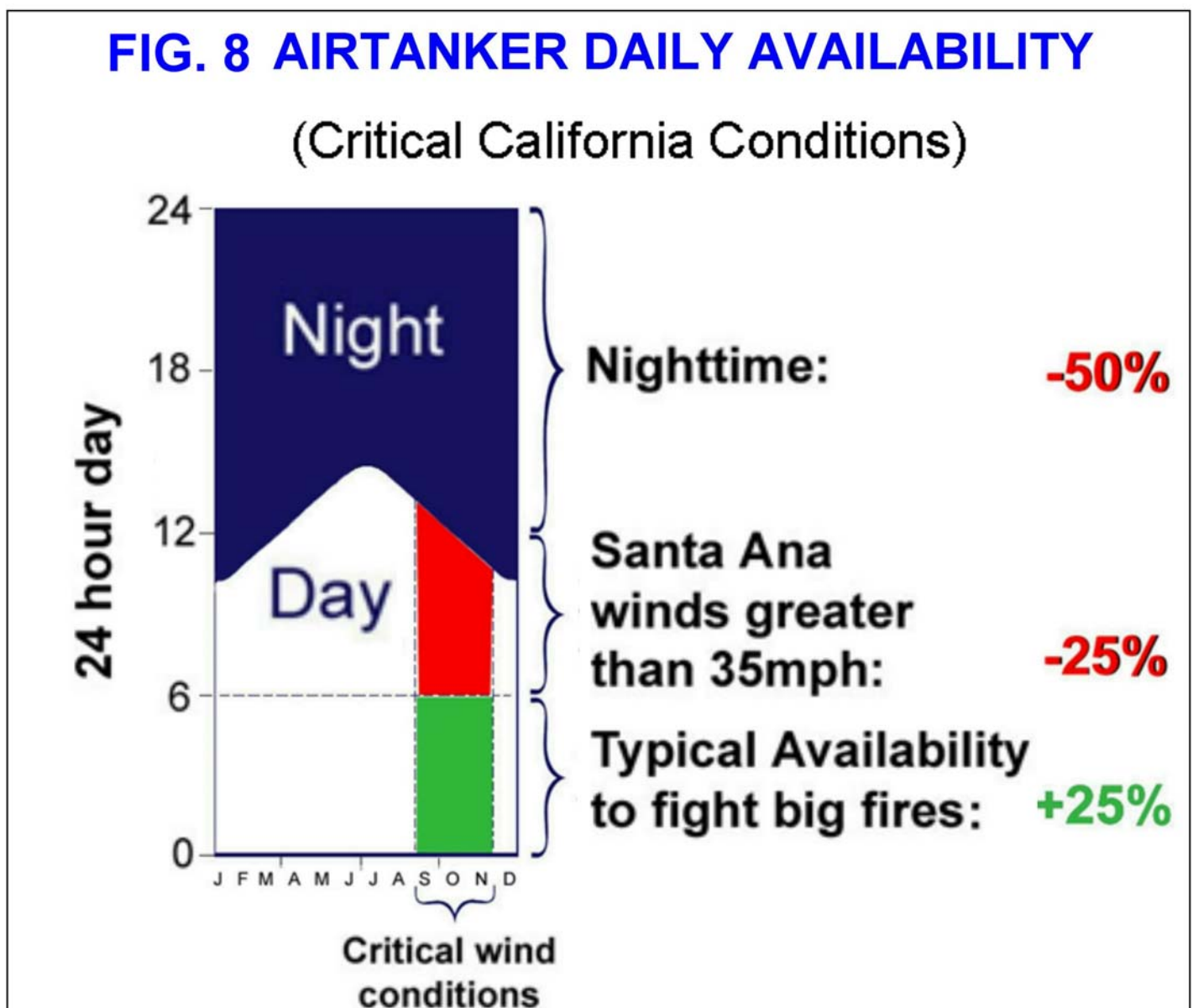
FACILITATE MORE EFFECTIVE INITIAL AND EXTENDED ATTACK AIR OPERATIONS

- (1) USE OF NIGHT VISION GOGGLE TECHNOLOGY
- (2) MULTIPLE AIRCRAFT TACTICS
- (3) USE OF CLOSE IN TEMPORARY BASING
- (4) INTEGRATED HELICOPTER SUPPORT OF
FIXED WING OPERATIONS
- (5) CALL WHEN NEEDED (CWN) PILOT POOL PROGRAM
- (6) MORE VERY LARGE AIR TANKERS (VLAT)
- (7) DEVELOP TECHNOLOGY FOR EFFECTIVE AIR DROPS
IN HIGH WINDS (PCADS)
- (8) INTEGRATED COMPUTERIZED RECORD/TRACKING
SYSTEM WITH DATA PRESENTED ON A COMMON
TIMELINE
- (9) A NEW TOP-LEVEL WILDFIRE AGENCY
- (10) INTERIM OPTION TO A NEW AGENCY

(1) USE OF NIGHT VISION GOGGLE TECHNOLOGY

Currently the aerial firefighting assets in this country, with few exceptions, don't fight wildfires at night. This is unfortunate because many fires are more manageable at night due to the lower temperatures, moderation of humidity and wind speeds, and shifting of wind directions that occur as day transitions to night in the local area.

Many wildfires including the October 2003 Cedar and Paradise Fires in Southern California (responsible for 25 deaths and 2,420 homes destroyed) started after nightfall (5:37 PM and 1:30 AM, respectively) and were raging out of control for several hours before aerial assets could be deployed to stall the fires' advance toward homes. Ten of the twenty fires in the October 2007 Southern California firestorm were started between dusk and dawn. **[FIGURE 8]**



With expensive and capable aerial assets grounded and not in use 50% of the time that wildfires are burning there is an unnecessary loss of critical firefighting capability! Equipping helicopter or fixed-wing air-tankers with night-vision goggles (NVG) capability can now be achieved at a fraction of the cost of buying another tanker of the same type. By adding NVG capability, aerial firefighting fleets can increase their availability by almost 100% for an increased investment of less than 2% of the initial purchase price including cost of equipment, cockpit modifications and the required initial pilot training.

There are currently more than 2,200 helicopter pilots certified to use NVG in the US.

In California, San Diego City Fire and Rescue, the Los Angeles County Fire Department, and Orange County Fire Authority helicopter operations, with the only fully capable night firefighting operations in the country, are pioneering the way. Others now have three successful operational models to follow. The Kern County Fire Department also has an active Generation III NVG EMS helicopter program. Santa Barbara County has a cooperative agreement to use local military NVG capable helicopters.

(2) MULTIPLE AIRCRAFT TACTICS [FIGURE 9]

FIG. 9 MULTIPLE AIRCRAFT TACTICS

CL-415s



1600 X 2 = 3,200 Gal

C-130s



3,000 X 3 = 9,000 Gal

The BLM has been getting more effectiveness from their 800-gallon Single-Engine Air-Tanker (SEAT) aircraft by employing them in multiples of up to four in tandem and dropping on the same fire with the equivalent impact of a 3,200-gallon aircraft. Use of this tactic with larger tankers can be a way to get the high volumes of suppressant delivered at one time to make successful direct attacks on the heads of some of the more intensely burning fires.

CAL FIRE and Navy/Marine helicopters have been using pairs of helicopters in three groups in trail with well-developed procedures.

LA County uses their leased two CL-415 Super Scoopers in this mode to get the punch of 3,200-gallon capacity from their 1,600-gallon Scoopers.

Italy uses the Scoopers with four in tandem to get 6,400-gallon effectiveness when they need it.

Three C-130s used in this manner would provide upwards of a 9,000-gallon punch.

It takes a little practice and coordination, but the users say it works fine. There could be good payoffs to look into using this technique more broadly in our wildfire operations.

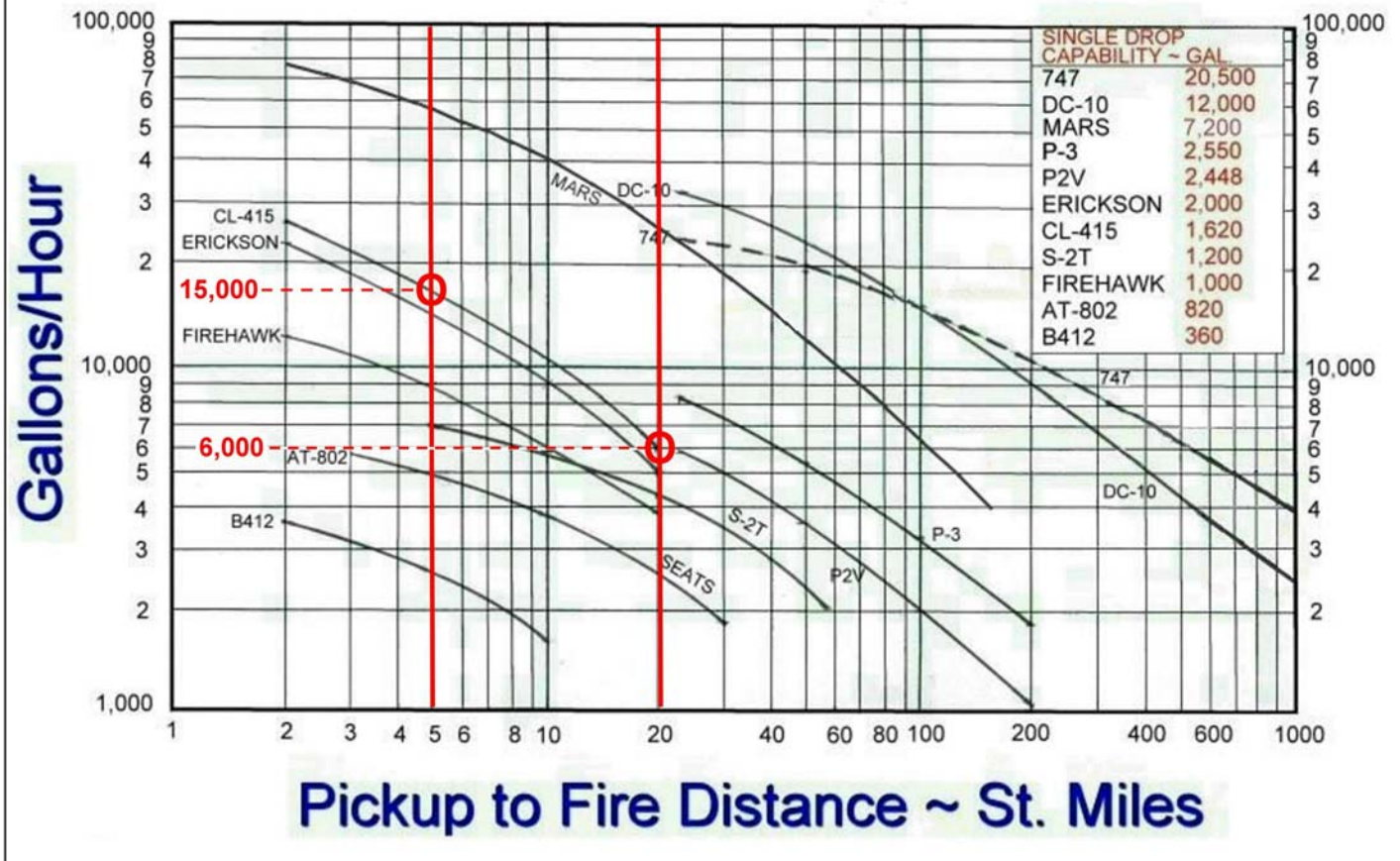
(3) USE OF CLOSE-IN TEMPORARY BASING [FIGURE 10]

One way to get to a fire faster or to get more gallons per hour on a fire is to operate from a base closer to the fire. Moving wind and heat weather patterns often determine the roving **Red Flag** conditions tend to dynamically define what geographic areas have the highest fire risk. Ideally, we would like to have our aircraft as close as possible to the highest risk ignition zones. The majority of our wildfire air assets operate from a limited number of bases prepared with facilities to support them. BLM and others occasionally use airstrips not normally used by bringing in temporary mobile support. More broad use of this operating concept should be investigated to increase the efficiency of our airborne fleets. The figure shows how gallons per hour productivity changes for select firefighting aircraft as a function of the distance from the operating base to the fire.

It is important to note that getting closer to the fire is a form of **force multiplier**. Often, by getting closer, one aircraft of a type can perform two or three times as effective as the same aircraft operating from a base farther from the fire!

Getting basing closer to emerging **Red Flag** risk areas or active fires may involve getting more conditional use agreements from existing airfields, provisioning more mobile wildfire support equipment and crews, building or improving airfields in critical areas or buying or equipping aircraft to provide capability to use softer or unprepared airstrips like some military aircraft. There may be favorable trades of some up-front money spent to get a quicker-acting **force multiplier** when the bell goes off.

FIG. 10 BENEFITS OF CLOSE IN BASING



(4) INTEGRATED HELICOPTER SUPPORT OF FIXED-WING OPERATIONS

At times, because of local terrain or fuel distribution anomalies, a fixed-wing airdrop may leave an area of thin or missing coverage. If ground crews cannot be employed to complete the line (as in the early Station Fire), coordinated helicopter followups can treat the under-covered areas to allow building continuous suppressive or defensive lines earlier in the fire cycle.

(5) CALL WHEN NEEDED (CWN) PILOT POOL PROGRAM

Many times in a fire season, when air activity is intense, the availability of aircraft is limited not necessarily due to insufficient numbers of aircraft but lack of qualified pilots having the required training and amount of rest between allowable continuous duty times...

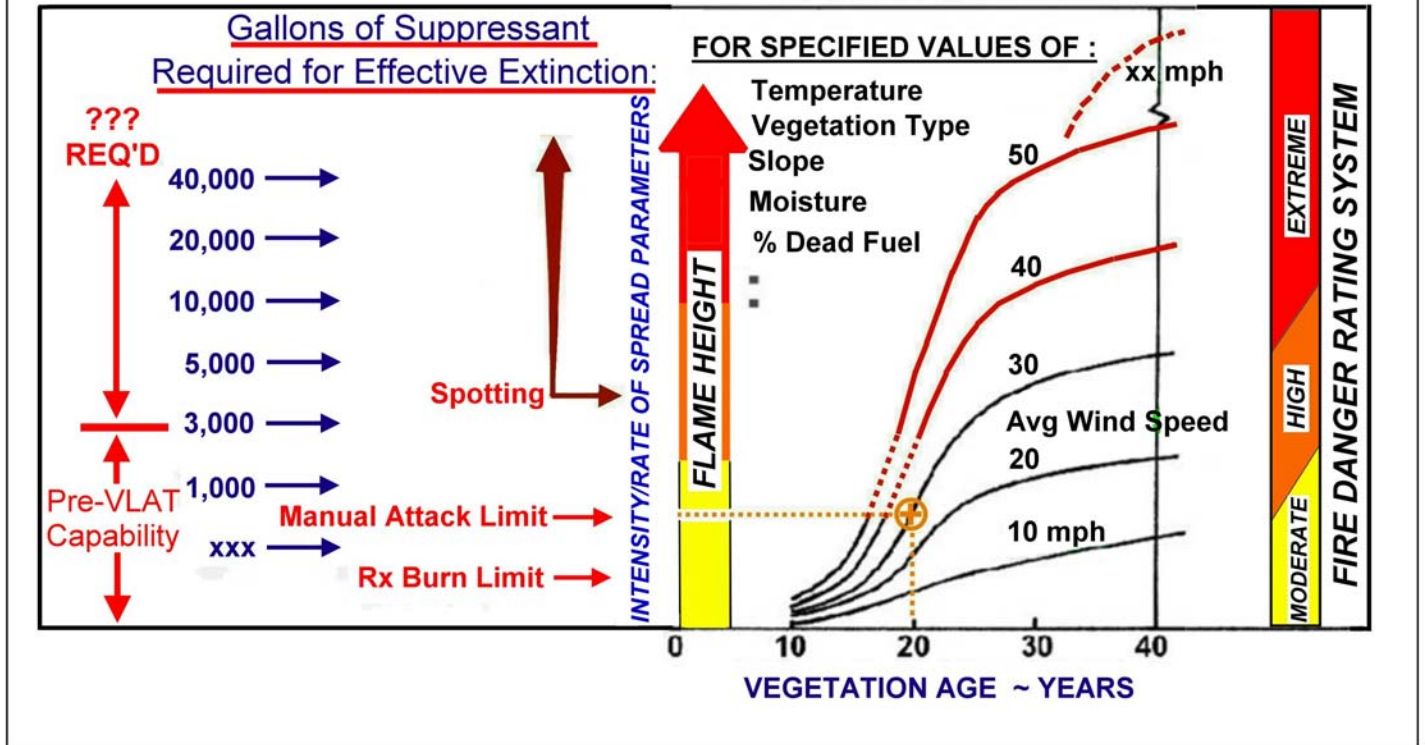
A program is needed to provide ready access to reserve pilots to keep essential aircraft flying a maximum of the 24-hour firefighting day as needed to suppress critically developing fires.

(6) MORE VERY LARGE AIR TANKERS (VLAT)

Most current wildfire fighting assets are seriously disadvantaged relative to suppression of the hotter, fast-moving, wind-driven fires that become “mega fires”. [FIGURE 11] shows that more

suppressant is required at one time to extinguish the more-intense fires. The only hopes currently available are the very few Very Large Air Tankers (VLAT) that have been offered to the agencies by private companies (DC-10, Martin Mars, and 747).

FIG. 11 MORE SUPPRESSANT IS REQUIRED TO PUT OUT SECTIONS OF THE MORE INTENSE FIRES



The figure shows qualitatively that we must find a way to get more suppressant on the heads of these fires quicker to stop them. Only air assets can move quickly over long distances and place large volumes of suppressant in just a few seconds that, if large enough, can extinguish a section of the fire. Currently, we do not have enough of these assets to decisively deal with every fire.

The system does not yet know how to get the best use of these aircraft and ultimately further improvements of such assets will be required. The aircraft must be equipped to operate safely at night and during high winds.

Current agencies do not have the budgets or expertise to efficiently implement the development programs required. Unanimous acknowledgement of the need would be a good first step. Higher level political forces must be cultivated to raise wildfire control higher on the list of national priorities to obtain necessary budgets and development programs.

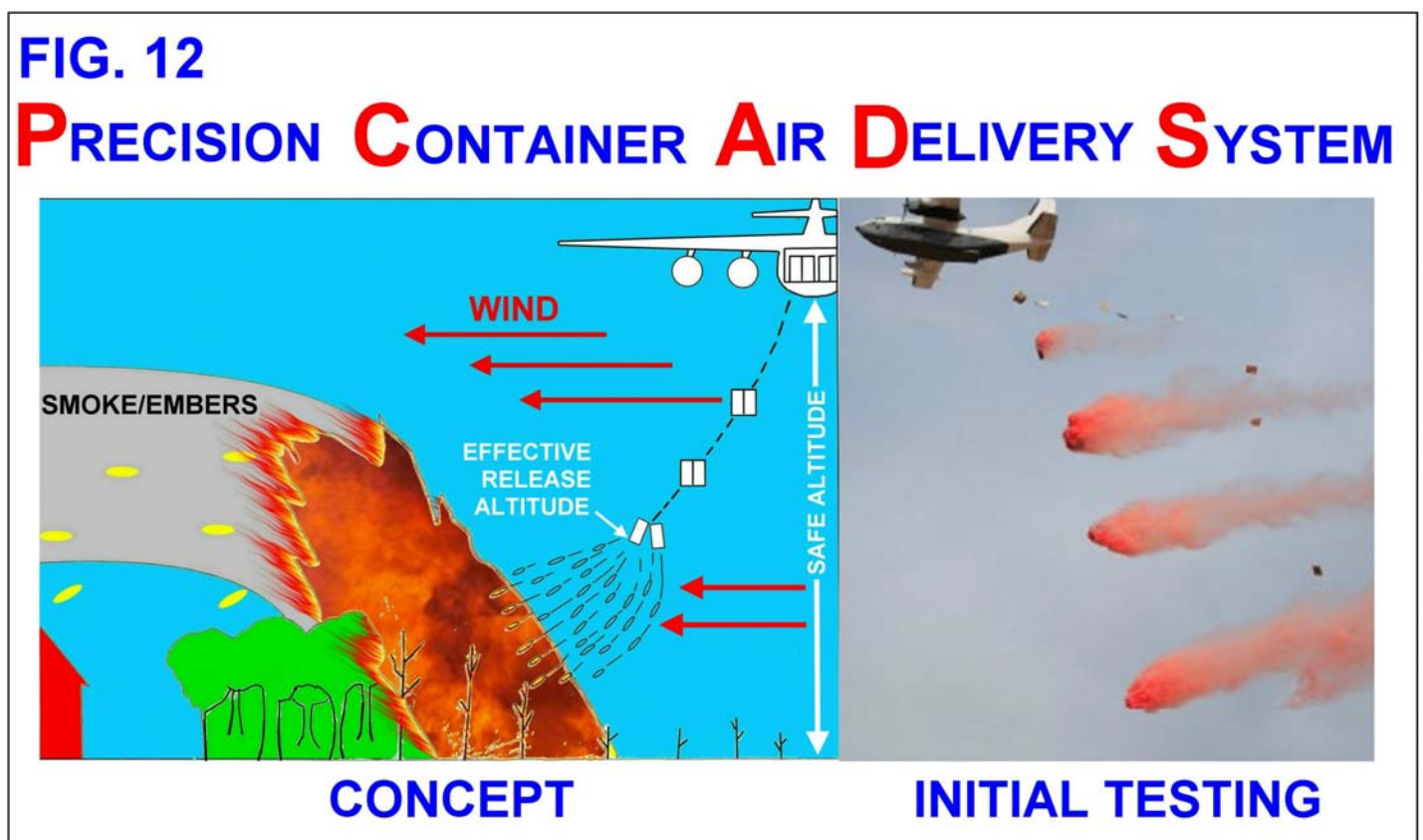
(7) DEVELOP TECHNOLOGY FOR EFFECTIVE AIR DROPS IN HIGH WINDS

Current airborne firefighting systems have limited capabilities in high winds. A current rule of thumb, flexibly applied to cover unusual circumstances, sends most of the airborne fleet home when surface winds move into the 35 mph range for flight safety reasons. Only a few helicopters and a few aircraft (e.g., Canadair CL-415) can continue fighting fires with winds in the 55 to 60 mph range. This is most unfortunate, since high winds cause fast moving, intense fires with the most potential for doing cultural damage.

Another critical aspect of firefighting performance affected by high winds and accompanying gusts is the effectiveness of the drops. If a strong wind or mischievous gust comes blowing 90 degrees to the path of the aircraft during and after release, the load will be blown laterally away from the pilot's intended path for the drop. The net effect of this is that for any given aircraft, tank design and wind conditions, there is a band of usable, effective drop speeds and altitudes that will work and others won't.

Ultimately, we need aircraft capable of effective use during higher wind conditions and/or systems that will allow suppression mediums to be delivered by aircraft without the loss of effectiveness currently experienced in high winds. One such concept is currently in development by a private venture called **Precision Container Air Delivery System (PCADS)** which drops disposable containers of suppressant out the back of rear-loading ramp transport aircraft that open at significant distances below the aircraft before dispensing into the fire.

[FIGURE 12]



Development work using a C-130 aircraft has been pursued. Tight money in the government has delayed decisions to move forward on this project. [FIGURE 13]

FIG. 13 PCADS C-130 DROP CONCEPT



This technology can probably be further developed to allow water or another suppression medium to be dropped at higher altitudes and speeds in a way that will preclude premature blooming and disintegration and also arrive at a previously designated spot regardless of gusts and turbulence. The system would keep the suppression medium protected from dispersal until it reaches an optimum altitude and speed relative to the fire such that there will be maximum suppression effect. A well-designed system of this type would make it unnecessary to provide any unusual amount of high wind capability in the air tanker and reduce the level of night capability required as well.

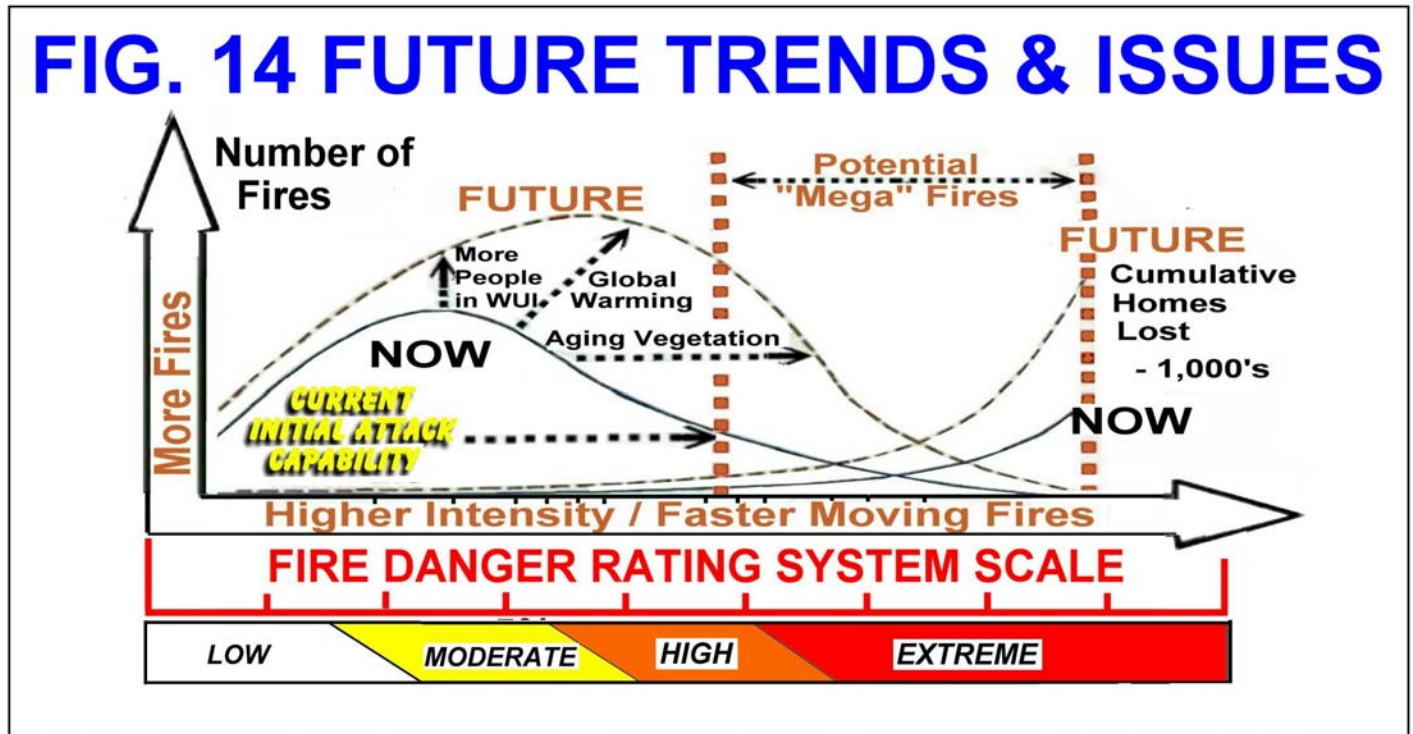
(8) INTEGRATED COMPUTERIZED RECORD/TRACKING SYSTEM WITH DATA PRESENTED ON A COMMON TIMELINE

Today much of the fire records are distributed over several different standard reports in their own formats, primarily aimed at accumulating cost-accounting information. The system should

be revised to present data on a common timeline with compatible formats that will facilitate operational planning and provide easily-digestible information for after-fire review.

(9) A NEW TOP-LEVEL WILDFIRE AGENCY

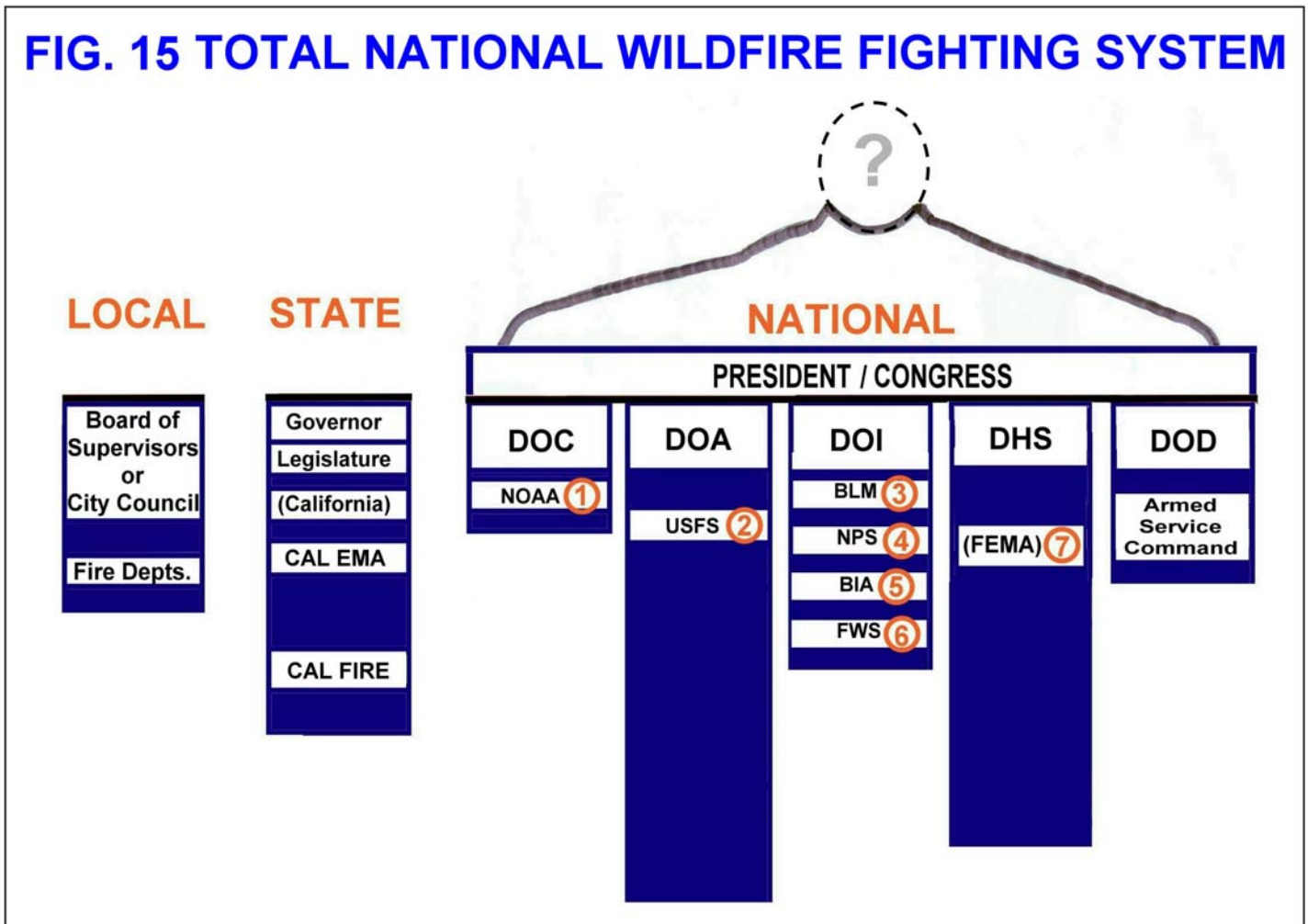
Our fire agencies are doing an excellent job of handling 95% or more of the wildfires that occur. Unfortunately, it is the very small percentage that escape initial attack that cause most of our cultural losses and suppression costs. [FIGURE 14] illustrates that wildfires will likely increase in number and severity due to climate changes, aging vegetation and number of people moving into the WUI areas.



In this environment [FIGURE 15] illustrates the parallel unfortunate administrative reality that there is no one in our country with overall responsibility, authority, and budget to adequately address this growing wildfire problem. The Forest Service, which has the most money, is three levels down in the Department of Agriculture (DOA). The DOA organization doesn't even have wildfire in its mission statement. The Forest Service gets only about 8% of the DOA total annual budget. The BLM also has only 8% of DOI's budget. FEMA emergency funds used in DHS vary significantly year to year. NOAA, NPS, BIA AND FWS wildfire funding is always very limited.

WRN recommends a new agency be established at the DOA, DOI, DHS level. It would be responsible to coordinate the activities of the current federal sub-agencies performing wildfire functions, secure more favorable budget allocations and direct a viable Research and Development program to resolve Mega Fire problems and issues. The R&D program would be

guided by ongoing centralized operations analysis studies (as in the Department of Defense) to pinpoint problems and develop optimized operating plans.



(10) INTERIM OPTION TO NEW AGENCY

If implementation of a new wildfire lead agency is not politically feasible at this time, an alternative is to establish a federally-funded, near term, contemporary working group or commission -- chartered only to provide a comprehensive plan to resolve technical challenges of quickly stopping high intensity/fast-moving Mega Wildfires.

CONCLUSION

- We cannot stop Mega Fires with current equipment, procedures and organization structure
- If solutions are not implemented, large costs and losses will continue
- There are many partial solutions waiting to be developed and employed that would significantly help

ABOUT WILDFIRE RESEARCH NETWORK

Wildfire Research Network is a 501 c (3) non-profit, public safety, research and education organization, created to improve wildfire suppression capability throughout the United States.

The objectives of the organization are:

- Research phenomena and promote improved methods to control wildfires.
- Provide information and recommendations to the public, private enterprise and all levels of government.
- Explore innovative **partnerships** and financial strategies to accelerate improvements.
- Facilitate establishment of a new top level federal wildfire agency to bring final resolution to the nation's wildfire control issues.

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