



# Fight Wildfires Sustainably



**“There is an eco-friendly solution to the increasingly damaging wildfires in the U.S.”.**

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# Introduction

- From many sources, it is clear **Global Warming is increasing destructive wildfires, especially in the western U.S. (1) (2)**
- **It is estimated 776,000 homes in the western U.S., worth approximately \$221 billion are at extreme risk of wildfire damage. (3) (4)**
- **In a recent year, U.S. wildfire damage totaled \$24 billion. (5)**
- **Fire retardants are coming under increased scrutiny as being harmful to the environment. (6)**
- **The impact on families (physical, emotional, and financial) must be considered.**
- **This presentation takes a fresh look at the problem, and offers an eco-friendly solution.**



# An Objective Basis for an Expanded Solution

- Examining the situation objectively, from an engineering project management viewpoint, yields the following:
- Across the next 10 years, assume the annual losses from western wildfires is \$18B, which is conservative.
- Assume these losses are occurring with largely ground-based response, with some aerial water drops.
- Assume the goal is to reduce those losses by 70%, a \$12.6B annual reduction
- Assume a pay-back for investment of 7 years, which is a very valuable project.
- This gives a maximum project cost of \$88 billion.
- Including potential operating costs of a solution , assume \$80 billion is the desired project maximum cost.
- A key: the project and it's operation must minimize harm to the environment.



## **Expanded solution: the C-130 aircraft, biofuel, and water**

- **C-130 aircraft are already used to drop water on fires around the world (7).**
- **Other types of aircraft that can carry at least 3,000 gallons of water can also work.**
- **There have been some crashes, and some concerns (important and valid) expressed by some people. (7)**
- **However, the reality is that ground fire-fighting often does not stop a fire in the first few days, resulting in a much larger, destructive fire (billions in losses).**
- **The expanded solution is to have fleets of 25+ C-130 planes strategically placed at air bases around California and the western U.S., ready to go quickly.**
- **The appropriate wildfire air defense strategy should be three-fold:**
  1. **During periods of drought, the C-130 planes could drop water on dry areas near homes and residential areas (prevention)**
  2. **In the first hours of a reported fire, to buy time for ground crews to move into position, 25+ planes could drop massive amounts of water on the blaze.**
  3. **Also, once the ground crews are close enough to provide leadership, it is they who should direct the location of water drops. Example: sending information about adjustments to the targeting of water drops.**

## Expanded solution (continued)

- Aerial water drops are an important supplement to fire-fighting in the first 1-3 days.
- Establish 8 air bases spread out across the western U.S.. (use of existing airbases is a possibility), each with 25 C-130 aircraft operating on bio-fuel, with water as the cargo. 200+ aircraft total.
- The 8 locations could be strategically placed within 500 miles of areas known to have wildfires, preferably within 300 miles.
- Each C-130 would have a water tank(s) installed in the cargo hold, capable of holding a large quantity of water, which could be dropped on any wildfire. (these types of planes are already in use)
- Each airbase would have water and biofuel reserves for filling the planes.
- When any wildfire begins, there is a critical time in the first few days when a quick response could stop the fire.
- This system could respond within hours.



# Why this Expanded solution can work

- Up to this point, there may not have been enough emphasis on:
  - the size of a project that can be justified with \$18+ billion per year in fire damage losses. Aerial water drop capability can be massive.
  - modifications to the C-130 to improve maneuverability in windy situations and mountainous terrain.
  - Pilot training and electronic devices to make accurate aerial water drops from higher elevations. This includes many practice runs in different conditions to safely deliver the water.
  - Dropping water on fires from planes is a technical challenge, and can be improved with study and design improvement.
  - Note: there are some conditions that make aerial water drops not feasible.



## Description of the Lockheed C-130 Hercules Transport Plane (8)

- In use by the military since 1960, several configurations, range of specs.
- Power: Four Turboprops, 4,200 to 4,700 horsepower
- Range with Payload: 1,150 – 2,070 miles
- Speed with Payload: 345 – 417 mph at 20,000+ ft of elevation
- Maximum Normal Payload: 36,000 pounds. Capable of + 4,000 pounds more.
- Has already demonstrated the capability of flying with 50/50 biofuel mix. (9) (10)



# Important Issues related to Fuel and Water

- **To prevent harm to the environment, aircraft design must maximize the % biofuel used in the planes. This is important for sustainability decade after decade.**
- **In fact, all the airbases and all ground vehicles must operate on renewable power.**
- **The two above goals can be achieved.**
- **Water is the safest fire-fighting substance known to human-kind. It is not a harmful chemical, and it can run-off to the ground and not harm the environment.**





# **This Project requires a special configuration of the C-130**

- **A modified design might look like:**
- **Four Turboprops, with 4700 Horsepower.**
- **Operates on 80-90+% biofuel. This protects the environment. Jets can already operate on 100% biofuel. (11)**
- **Maximum payload: 38,000 pounds or higher**
- **Bio-Fuel filling system allows filling of 6 aircraft in 8 minutes or less**
- **Large water tank(s) installed in cargo bay, probably aluminum (not plastic), capable of holding 4,000 gallons of water.**
- **Water filling system allows filling of 6 aircraft in 8 minutes or less. Water must contain minimal bacteria and contaminants.**
- **Piping system array under each aircraft can empty the water tank in less than 7-12 seconds. This would send a shower of water down on a fire.**
- **Improved targeting electronics (allowing for wind direction and speed) for dropping water from higher elevations.**
- **Improved aircraft design for windy conditions (see next page).**



# Special configuration of the C-130, windy conditions

- Wildfires spread rapidly in windy conditions.
- Planes must be able to drop water on wildfires in the first day and beyond, even in windy conditions.
- A re-designed turboprop plane for this service would include:
  - Sensors at various outside locations on the plane to sense relative wind direction and speed (wind-gusts)
  - Special flaps on wings and tail available for adjustment.
  - Computer control of these special flaps to adjust for wind conditions, without the need for a pilot to decide or react.
  - An override button available to the pilot.
  - This could greatly increase the operational effectiveness of the planes.
- Also, one day, these types of planes will be remotely-controlled and pilotless (large drones)



## How it Might Look when Implemented

- One of the bases has been built and has 25 C-130 planes available.
- A percentage of the pilots and ground crews could operate like volunteer firemen, not full-time.
- A small forest fire starts 300 miles away, the alarm is sounded.
- The planes are filled within a few hours.
- 25 planes take off, each loaded with 4,000 gallons of water. In about 2 hours, 25 planes drop 100,000 gallons of water on the fire.
- The aircraft would need to fly lower than normal at the drop sight, but not too low to be impacted by the smoke.
- Water could be targeted near residential areas where homes and people are at risk.
- Returning to base empty, re-filling and returning twice more could place a total of 300,000 gallons on the fire in one day.
- Would this be enough to allow ground crews to control the fire and put it out ? In the early stages of a fire, there is a very high probability the answer is yes.

# The Possibility for Cooperative Efforts

- Each airbase could be designed to handle 50 planes.
- For a particularly large and dangerous wildfire, 25 planes from another airbase 400 miles away, could either:
  - deliver their extra water to the wildfire from their base, or..
  - fly to the base nearest the fire and operate alongside the existing aircraft at that base.
- This would double the water delivery capability (600,000 gallons per day).
- This entire approach would greatly improve the safety of ground fire-fighters.



# Who Might Support this Plan?

- An expanded aircraft water delivery system could be supported by:
  - Fire-fighters
  - Business owners
  - Homeowners
  - Home Developers
  - Insurance companies
- This new approach has the potential to greatly lower insurance costs across the western United States.
- These air bases could pay for themselves in less than 8 years, a good return on investment.
- Of course, the first issue is how to pay for the first few bases. This could be a cooperative effort between all the people and organizations listed above.
- Could 8 bases be built for less than \$10B each, and would operating expenses be moderate? This would be confirmed when one base is operating.



## A Key Question

- **If this expanded plan reduced losses from wildfires by about \$12B per year, would insurance companies massively adjust insurance premiums downward?**
- **The history of the industry indicates premiums are based on the historical loss record, and premiums would eventually be lowered.**
- **This financial process is a huge negotiation area for all parties involved.**



## Summary of this Expanded Plan:

- **Greatly increases the capability to deliver aerial water drops.**
- **Uses water, which will not harm the environment.**
- **Ensures 200+ aircraft are available, with improved aircraft capability and improved accuracy of water drops; with extra pilot training.**
- **Allows aircraft to be used regularly to drop water on dry areas that are at risk to potential fires (prevention)**
- **This expanded plan is worthy of being evaluated for possible implementation.**
- **This evaluation would take a cooperative effort between private industry and insurance companies.**
- **Finally, let's remember and honor those brave firefighters who die each year, while fighting these destructive blazes.**
- **The stakes are very high, and the potential for a positive result is high.**



## Citations

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