American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-10, Issue-6, pp-131-146
www.ajer.org
Research Paper Open Access

A "Specific" Drone for Night TimeAerial Wildfire Fighting &Drugs Plantations Fumigation

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ABSTRACT: *It is time for the Drone´s innovativeness to offer to the worldwide hardworking and risky fire fighters airmen and drugs plantations fumigation pilots, a "specific drone" able to extinguish forest fires and fumigate drugs plantations, at night, in order make their work mainly safer and at the same time easier, cheaper and operationally more efficient.Watching the disastrous fires that devastate worldwide forests every year and the impotence of fire fighters to combat them and as well as the increase in the production and consumption of plant-based and its harmful effects on modern societies, it is necessary to emphasize that it must be assumed that they employing obsolete weapons against those two every day stronger enemies and the battle is being lost.NitroFirex, is a new approach in the drone´s world, which aims to develop the capacity of spraying a large liquid payload in a hostile, difficult or impossible to access environment with a manned plane.This is the case of NitroFirex, an innovative project that integrates already available defense and Drones technologies for the guidance and control in order to attain an operational capability that can be applied, at night, in the battle against wildfires and fumigation of drug plantations.Or integrate modern available technologies to develop "unmanned" night aerial operational capability or the forest will continue burning away irretrievably and the drug´s consumption will go on increasing. This capability only can be accomplished developing a specifically designed drone.*

KEYWORDS: *Drones; night time, aerial forest fire fighting; drugs plantation fumigation.*

Date of Submission: 03-06-2021 Date of acceptance: 17-06-2021

I. INTRODUCTION

It may be the controversial climate change or perhaps human pressure on the natural environment, or may both, but the fact is that, year after year, alarming reports of devastating forest fires monopolize the media. During all he last summers It is possible to see how catastrophic fires razed through the California, Portugal, Canada, Spain Indonesia, Russia, Bolivia, Israel, India, Australia and Greece stood by helplessly before the devastation of their natural heritage (1). In the coming years, and this is unfortunately more than likely, will continue suffering from this modern plague that is ravaging our forests.

In another order of things, the consumption of drugs of vegetable origin, mainly cocaine and heroin, is a worldwide plague because of the number of human lives it causes and the social and economic repercussions it implies.

In facing those bitter realities, it is necessary to ask whether political, economic and technical levels are contributing in finding solutions, or at least methods to efficiently avoid and relieve those disasters. Unfortunately, the answer is a very clear and definite negative.

Respect to the forest fires and according to estimates from the Intergovernmental Panel on Climate Change (IPCC 2007), forest fires create at least 10% of all CO2 projected into the atmosphere annually.

On the other hand, all the activity of commercial aviation worldwide causes only 2% of all the CO2 emission. For example, the European project Clean Sky 2 has a budget estimated in €4 billion in order to reduce this 2% to 1% by obtaining a higher efficiency of engines, the employment of biofuels, intelligent wings and the reduction of weight, etc. (11). Paradoxically, very little technological effort is being put into research regarding the elimination or the reduction of the already mentioned minimum 10% emission of CO2 that results from wild

fires and, above all, the lack of research into aerial fire extinction - the most versatile and effective method to fight fires (12)(13).

In the face of the vast human and economic losses, social alarm and political upheaval engendered by those wildfires and drug composition, why is it that so few technical resources are available to fight those forest fires/drug plantations with the greatest efficiency possible? Why, for example, having at our finger tips technology that literally allows us to place a guided bomb carrying 200 or 300 kilos of explosives and fired from a warplane some dozens of miles away through a window? **(Fig. 1)** Why it can't be use the same technology to drop, throughout the night, loads of 2,000 to 3,000 litres of extinguish / defoliant agent continuously over a burning forest or a drug plantation?

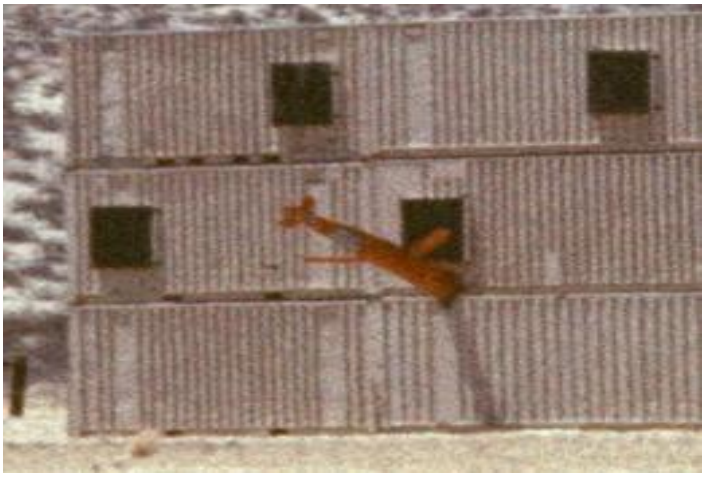

Fig.1: Guided/guided bomb striking a target.

Why is it that two aeronautical sectors, which internationally moves thousands of millions of $/€, is still confined to using methods, techniques and procedures developed almost 70 years ago in extreme high risk operations for their crews? Why not integrate available technology and develop the capacity to drop more fire extinguishing / defoliant agents in less time, but above all, to be able to do so at night? It is forgotten that the inability to fly at night is the greatest operational lack in present-day for forest fire fighting and drug plantation fumigation?

II. STATE OF THE ART

The fixed-wing aircraft employed to combat wildfires at present are principally slow-moving turboprops and the majority are planes used exclusively for the job. In isolation and in numerous high-risk operations for crews they visually discharge their loads only between sunrise and sunset.

Apart from the fact that the power plants have changed from piston to turbo, few other technical advances have been applied to the fire fighting fleets since the Second World War. And yet, as we have seen in other fields of aeronautics, the progress has been spectacular, (Photos 2 & 3).

Photo nº 2: CL-415 in action.

Photo nº 3: Airtractor AT-800 in training.

There is a great concern at the business and academic level to provide answers to the challenge of extinguishing forest fires. In the last decade several solutions have appeared. A good example is the use of the VLT (Very Large Tanker) aircrafts such are the Boeing B-747 Jumbo employed by the company Evergreen (http://www.evergreen.com) or MacDonnell-Douglas DC-10 employed by the company 10 Tanker Air Carrier (http://www.10tanker.com), because of their capacity to drop far greater loads of extinguishing agents, (Photos 5 & 6).

Photo nº 5: MacDonnell-Douglas DC-10 from company 10 Tanker Air Carrier in action

Photo nº 6: Boeing 747 from Evergreen Company in training

Obviously these aircraft are able to discharge vast amounts of extinguishing agent, but because of their lack of manoeuvrability at low altitudes, their scope of action is greatly reduced. Their excessive length of reaction time and high operational costs render them non-effective in 'first line attack' on the fire. They only become effective once the fire has reached huge dimensions.

But, above all, the use of these big aircraft offers no solutions to nocturnal fire fighting due to their inability to operate visually at night and at low altitude

Another project also aimed at changing methods and techniques of aerial wildfire fighting is the Precision Container Air Delivery System (PCADS). Supported by Boeing and Weyerhaeuser their method consists of launching, by means of parachutes with no guides of any type, via the rear ramp of heavy-duty transport aircraft a series of biodegradable cubic containers with a capacity of 250 gallons (some 950 litres) each of extinguishing agent from about 500 feet (http://www.caylym.com/the-guardian/). In this case the containers are launched at some 1.500 feet AGL.

The precision of the drop point achieved by a parachute without any form of guidance in an adverse atmospheric environment caused by wind, turbulence and the thermal currents produced by the on-going wildfire, does not appear to be sufficient enough to produce a coordinated and efficient action of extinction. At the same time this concept entails that all the solid components, although biodegradable, will be spread all over the fire zone. It doesn't either permit night-time operation due to the low altitude demanded by the operation (Fig 7 & 8).

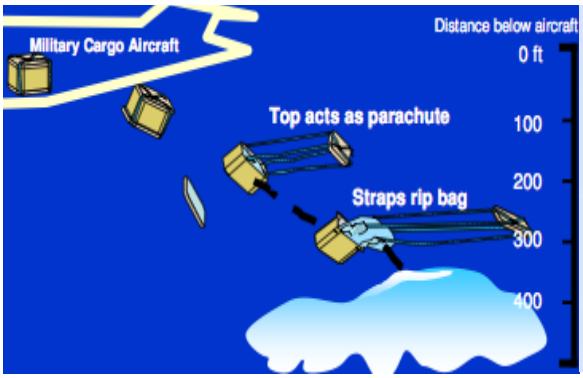

Fig. nº 7: PCADS picture.

Fig. nº 8: PCADS in action.

Alternative method proposed by Boing is that of using 'water bombs' (bomblets), a type of biodegradable dodecahedra shaped container filled with 50lbs. of water (23litres). Using path-calculating systems, 2800 of these 'bomblets' would be launched via the rear ramp of a C-17 from between 1.000 to 2000 feet above the fire to drop freely, with no form of guidance whatsoever. (http://www.boeing.com/news/frontiers/archive/2003/august/i_ids4.html) (Photos 9 & picture 10).

Assuming that the path calculating systems allow sufficient precision to allow the drop to occur within the designated zone, this would still imply that the impact of the bomblets, dropping at great speed in free fall

onto the ground would in the first place result in a high risk factor for ground crews, people and possessions in the fire area. Secondly, the water would on impact extinguish some of the fire but the effect would not be optimal since the always desired atomisation of the water never occurs, therefore the amount of energy absorbed is highly reduced, implying a big reduction in the extinguishing effect.

GINA VANATTER PHOTO

William Cleary, a project manager in the Boeing Integrated Defense Systems Advanced Airlift and Tanker organization, shows off the sphere he designed to drop from C-17s on wild fires.

Picture nº 10: "water bombs"delivery from C-17. "Photo nº 9: 50lbs "water bomb".

This concept, as with the two previous ones, is also not applicable to night-time operations because of low altitude flying. Should the altitude be raised to a 'safe altitude' the precision of the drops would decrease and the risk factor increases because of the higher speed at impact of the 'water bombs'

Finally, the Spanish company Singular Aircraft propose an unmanned propeller bi-motor hydroplane with a fire-fighting configuration, a cargo capacity of 1,500 – 2,000 liters and an operational speed of 130Kts so that, amongst other tasks, it can be used as a night time fire fighter (http://es.singularaircraft.com) (Fig 13 & 14).

Fig. nº 13: unmanned propellerbi-motor hydroplane Fig. nº 14: unmanned hydroplane in action

In the world of UAV's the operation of an unmanned seaplane scooping, either by day or by night, water from the sea or a dam, is fraught with the daily/usual problems of safety and other regulations. If the operation was ground based, its cargo capacity and its operation speed would require a big fleet to be deployed simultaneously to ensure a drop similar to the present daylight flights. But this would make the running costs soar and complicate the operation.

III. THE NITROFIREX CONCEPT

The developing technologies in the control and guiding of DRONE allow for the development of innovative operational options, such as the possibility of 'spraying' (a liquid) or 'scattering' (a powdered solid) an important amount of extinguishing or defoliant agent from a programmed point in the atmosphere.

This is the case of NitroFirex, an innovative project that integrates the industrial technologies of the Defense Force in order to attain an operative capability that could be applied in the battle against wildfires at night, the fumigation of drug plantations at night, to combat against an atomic, chemical or biological emergency, to operate with meteorological phenomena (inducing rain, avoiding hail, dissipating fogs), to fight against plagues or to sow in remote or inaccessible regions.

Discarding all these possible applications, and due to the human and economic losses, the ecological harm caused and the social alarm generated as well as that they bring forth, the project that NitroFirex is developing with maximum priority is the ones to combat wildfires and drugs producing.

For that very reason NitroFirex is concentrating on its night-time operations as an indispensible and necessary complement to aerial means already in use during daytime. This capability only can be accomplished developing a specifically designed manned / unmanned aerial system, able to take benefit of both forms of aviation. Taking from manned aviation the capability to transport big quantity of useful liquid pay load in a short time to the operation area and from unmanned aviation a "specific drone" able to spray this liquid pay load in environments that are dangerous, difficult or even impossible to execute with a manned aircraft.

To this specific-type patented NitroFirex drone we call AGC (Autonomous Glider Container) are released, in sequence by the rear ramp of medium or heavy transport planes, or from medium or heavy helicopters, one at a time (Launcher Aircraft, LAs) and at a save distance and altitude away from the flames. **(Fig.15).**

Fig. 15: NitroFirex AGC, s configurations (on board, flaying /dropping, landing / on ground)

The LA will then launch the AGCs from the rear ramp in a programmed sequence **(Fig. 16)** or one by one hanged like a bucket-Bamby from a helicopter **(Fig. 17)**.

Fig. 16: Launching of AGSs from the LA (heavy cargo transport) at night

Fig. 17: Launching of AGSs from the LA (heavy/medium cargo helicopter) at night

Once released, the AGCs will automatically homing onto their programmed target area within the drop zone and, with great accuracy, drop their load in the core of the fire or over the plantation. Once the drop of the proper agent on the programed point has taken place, these containers return to base performing an "escape" maneuver from the danger zone by taking advantage of the great and sudden loss of weight as well as the extra speed.

Then the empty NitroFirex AGC begins its autonomous return to the operations base of the LA where it can be swiftly reused and loaded into the LA, thus beginning a constant turnaround operation until sunrise.

IV. THE NITROFIREX PROJECT

Although, as It was seen in the previous paragraph, the concept has wide applications, NitroFirex is, first and foremost, a completely innovative project focused on night-time aerial wildfire fighting / drugs plantation fumigation. The main element used are the AGCs,launched, in sequence, at medium altitude (six to ten thousand feet), from the rear ramp of the cargo bay of a medium/heavy transport planes, **(Fig. 16)** (such as the C-295, C-27J, C-130 Hercules, AN-12, KC-390, A400M, IL-76, C-17 or even aircraft with greater cargo capacity), or, one by one, from any medium/heavy helicopter hanging like a bucket (Bamby) **(Fig. 17)** (such as Eurocopter models H-225, H-215 H-175, Bell models B-412, B-214, B-212, or Sikorsky models S61, S65, S70 or the Kamov-32 between others), which perform as the LAs**.**

These containers, loaded with a fire extinguishing / defoliant agent, are capable of gliding in their initial phase and are equipped with a proper navigation-guidance system according with the assigned mission (satellite, inertial, infrared or even laser designation). They fly automatically into the programed point and drop their load, in sequence and with great accuracy, on the targeted area over the flames or plantation **(Fig. 18).**

Fig. 18: AGCs dropping fire-extinguishing agent on the forest fire

For safety, but also economic reasons, the AGCs are recoverable. Once the drop of fire-extinguishing agent on the fire takes place, the AGCs perform an escape maneuver from the danger zone. Taking advantage of the great and sudden loss of weight as well as the surplus speed, the empty glider container is transformed, thanks to the previously activated small engine that propels it, into an DRONE and returns autonomously to the operation base of the LA where it can be swiftly reused.

In its guided bomb role, the glider container flies no more than 2-3minutesfrom the LAs to its target point over the fire or plantation. When compared to a guided bomb, it carries a bigger payload and has more wing surface, but with an equal gliding and guide capacity.

After concluding its 'escape' from the target area and until it lands at the LA.s operation base, it navigates at night as a DRONE at 500 feet above ground level and attains speeds of up to 70 Kts **(Fig. 19) (**https://www.youtube.com/watch?v=MTOjTWSHR64)**.**

Fig.19: Coordinated autonomous return and landing at the LA, s operation base

NitroFirex do not want to substitute current aerial means whose efficiency in daytime operations has been demonstrated over decades. The truth is that NitroFirex aims to be their night-time counterpart in order to achieve H-24 aerial combat against wildfires (24 hour non-stop fighting) and to make use of, as the toiling ground crews well know, the better weather conditions that the night usually has to offer (less turbulence and wind, lower temperature and higher humidity).

Regarding the fumigation of drug plantations, it is currently carried out with small fumigation planes that perform the high-risk operation for crews at very low altitude and speed, so they can be easily shouted down by anti-aircraft fire from the ground even if escorted by armed helicopters, for this reason NitroFirex offers the possibility of carrying out the night operation, as a substitute for daytime, and to be able to do it in an safer, effective, discrete and stealthy way.

In the next **Figs. 20, 21 and 22**, can be analyzed the advantages of NitroFirex with respect to the aerial means of daytime extinction of forest fires.

In the case of the nocturnal fumigation of the drug plantations, it is difficult to obtain official data on this activity but the advantages would be greater than the data for the nocturnal extinction since the aircraft used in the daytime fumigation have a discharge capacity of agent much lower than the used of the extinction aircraft.

1º the operations point of view: litters launched per hour of the operation in function of the distance from the LA ops base to the forest fire.

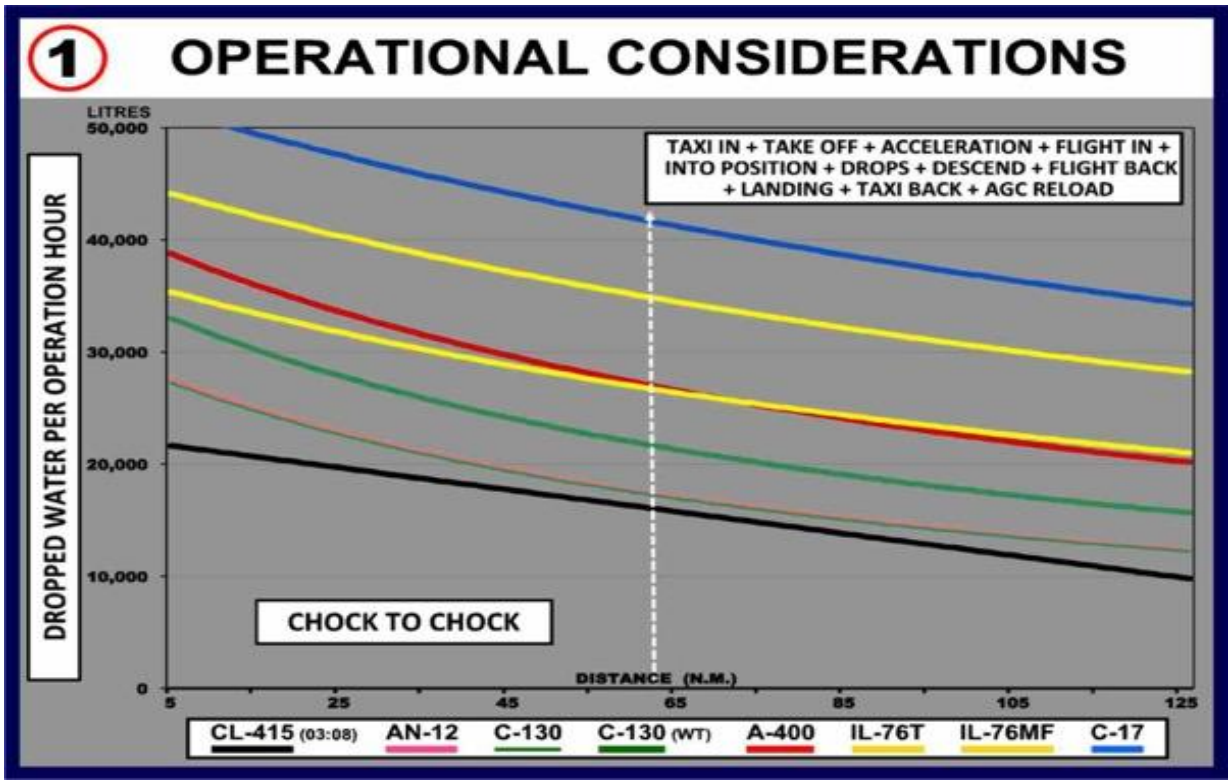

Fig.20: Dropped water per hour of operation

2º The economic point of view: litters launched per flight hour and the cost of the dropped litter in function of the distance from the LA ops base to the forest fire.

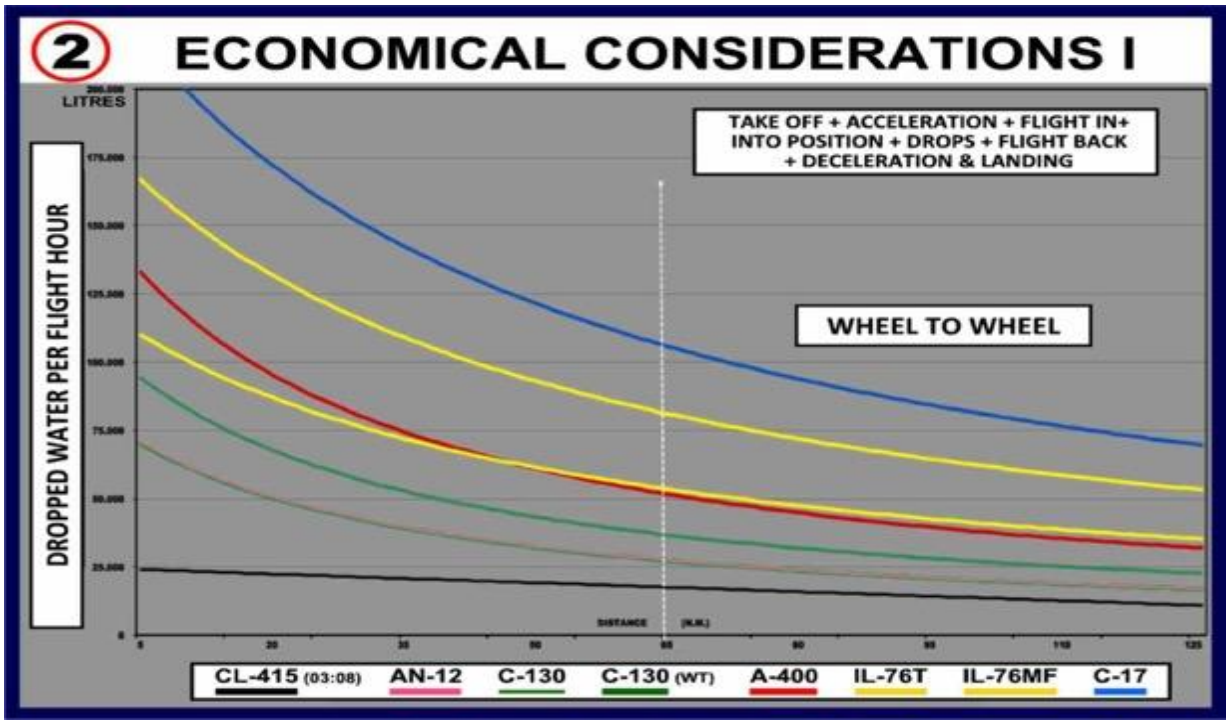

Fig. 21: Dropped water per flight hour.

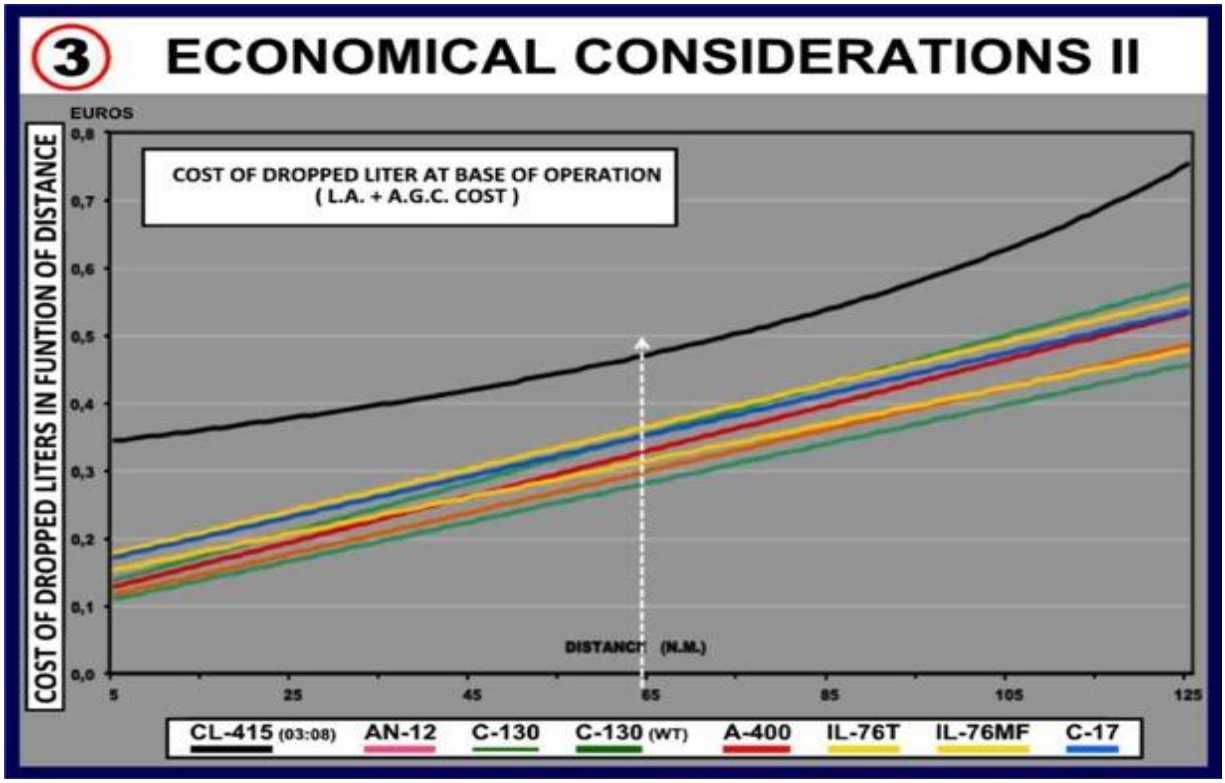

Fig. 22: Cost of dropped water as a function of distance

V. OPERATIONAL MODEL

5.1. Forest Fire Fighting model

Because of the great cargo capability and the increased deployment speed that the LAs offer, a new operational model will have to be put into use. This will include a regional operational base that could be situated in a strategic site in accordance to the operations area.

Should a supranational operation come to be, the ideal base that would cover, for example, the

Mediterranean Basin would be Marseille in France. Since the NitroFirex operation is nocturnal, It can be assured that under normal conditions, at least half a day would be needed to detach the LAs to any "available runway" in any country **(Fig. 23).**

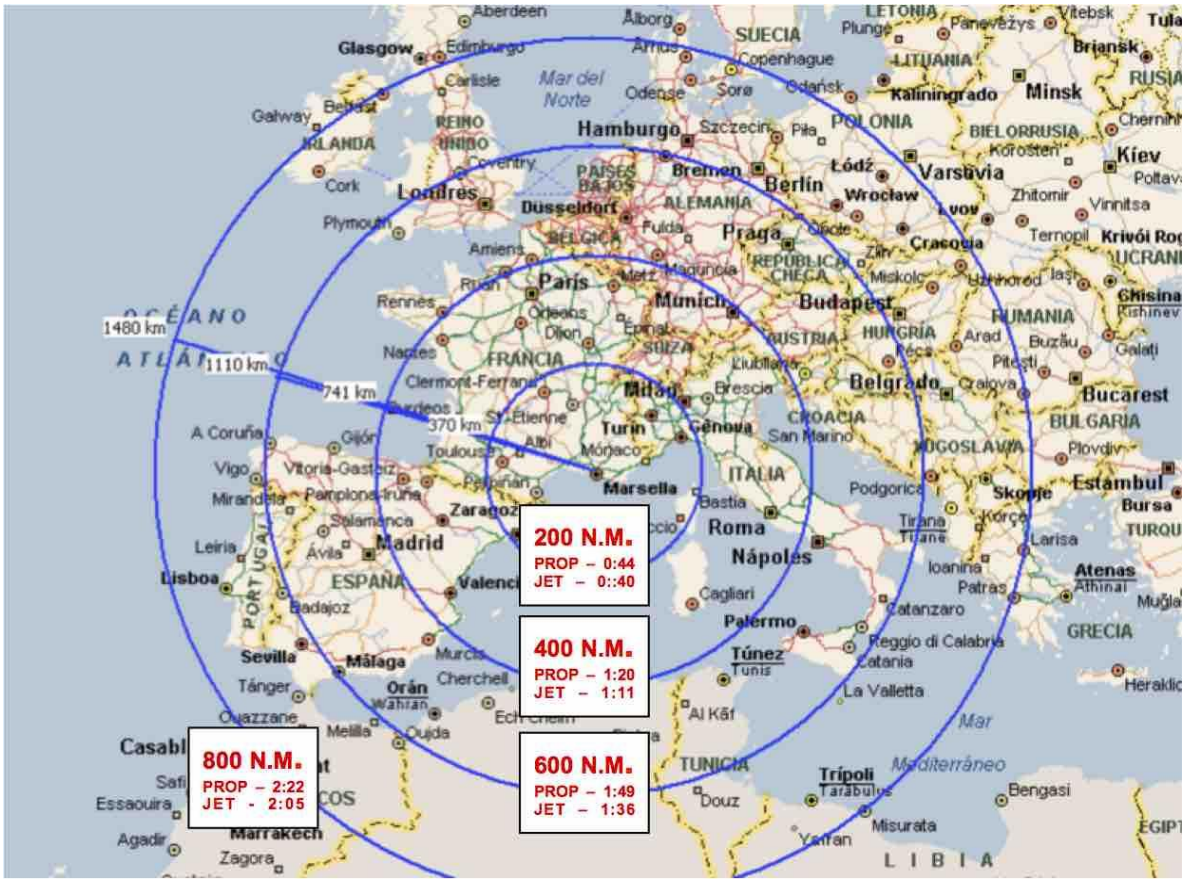

Fig. 23: Proposed base at Marseille in France
In the Mediterranean Basin for a supranational operation

The AGCs are transported from the "regional operational base" to the "mission base" (airport, air base or aerodrome closest to the fire). Two sets of empty AGCs are stacked on two levels in a 'rack' or specifically designed shelving in the cargo hold of the Las**(Fig. 24).**

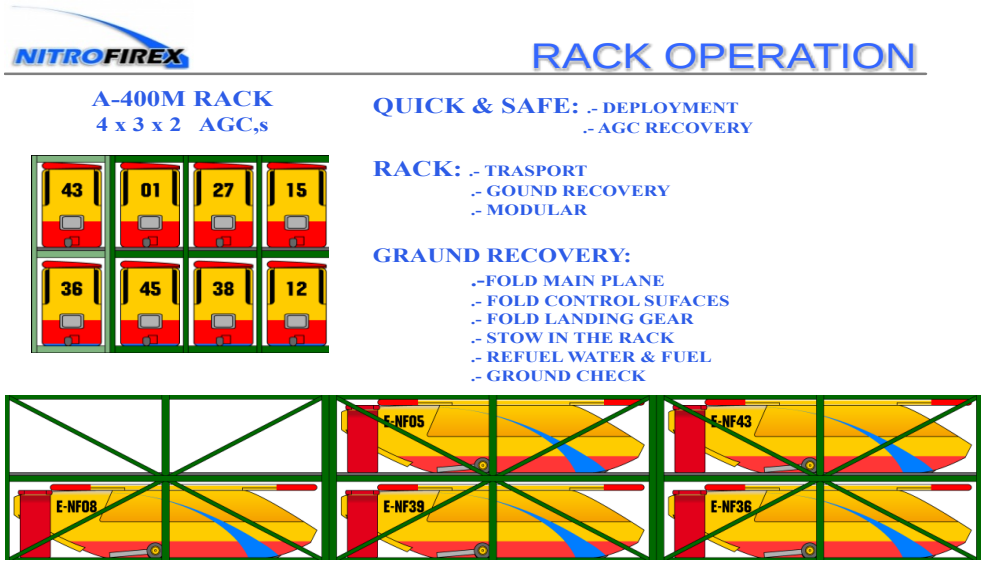

Fig. 24: Rack operations of the AGCs.

Later, during the mission this 'rack' will be used for the fast turn-around (pre-flight check, fuelling, loading of extinguishing agent and re-stacking) of the AGCs returning from the fire zone. Once a wildfire alarm has been activated, the LAs fly from their regional base to the detachment base, the airport closest to the fire, where the operation begins by downloading the rack of empty AGCs and the rest of the necessary equipment so as to proceed with the final preparation. The first set of AGCs (on the lower level of the 'rack') are filled with the extinguishing agent and are once again stacked in the LAs leaving them ready for take off at dusk.

As night falls they fly to the fire zone and, coordinated by the ground teams who provide direct support, the LAs begins launching the AGCs in groups with a 90º 'angle off' to the fire front, the goal being that at the moment of leaving the LA the AGCs make a 90º turn, so that when several AGCs leave the LAs they can form up in a "trail" formation and attack the fire.

The extinguishing agent is dropped over the area preselected by the fire management officer. In order to maximize the extinguishing effect the drops are overlapped. Once the first set of AGCs have left the LA, it returns to base to load the second set of AGCs so it can then return to the fire area in order to continue the attack on same fire or to attack more than one fire simultaneously. The AGCs autonomously return to mission-base after each drop. For example, one could consider an operation of an A-400 with a cargo capacity of 12 full AGCs.

Flying to the mission-base with a 'rack' holding 24 empty in each flight 12 containers filled with the extinguishing agent and rapidly returns to load the next 12. In the case of the A-400, the cargo load of each AGC would be 2,583 liters, which means that a single flight of an A-400 would be approximately equivalent to 6 drops of the Canadair CL-215/415. At a distance of 120 km (65 nm) between the mission base and the fire zone an A-400 can perform 9 flights in one night dropping 12 AGCs with each flight, being able to drop a total of 279.000 litter of extinguish agent in one night.

According to operative analyses carried out by NitroFirex, and assuming the loading and stowage coefficients for the AGCs, one can establish that having one LA and its two sets of AGCs detached to a mission base within 120 km (65 N.M.), the operation over the fire zone would be non-stop.

The LA turn-around at mission base for loading the AGCs would ensure a relentless dropping of water over the intended targets **(Figs. 25 and 26).**

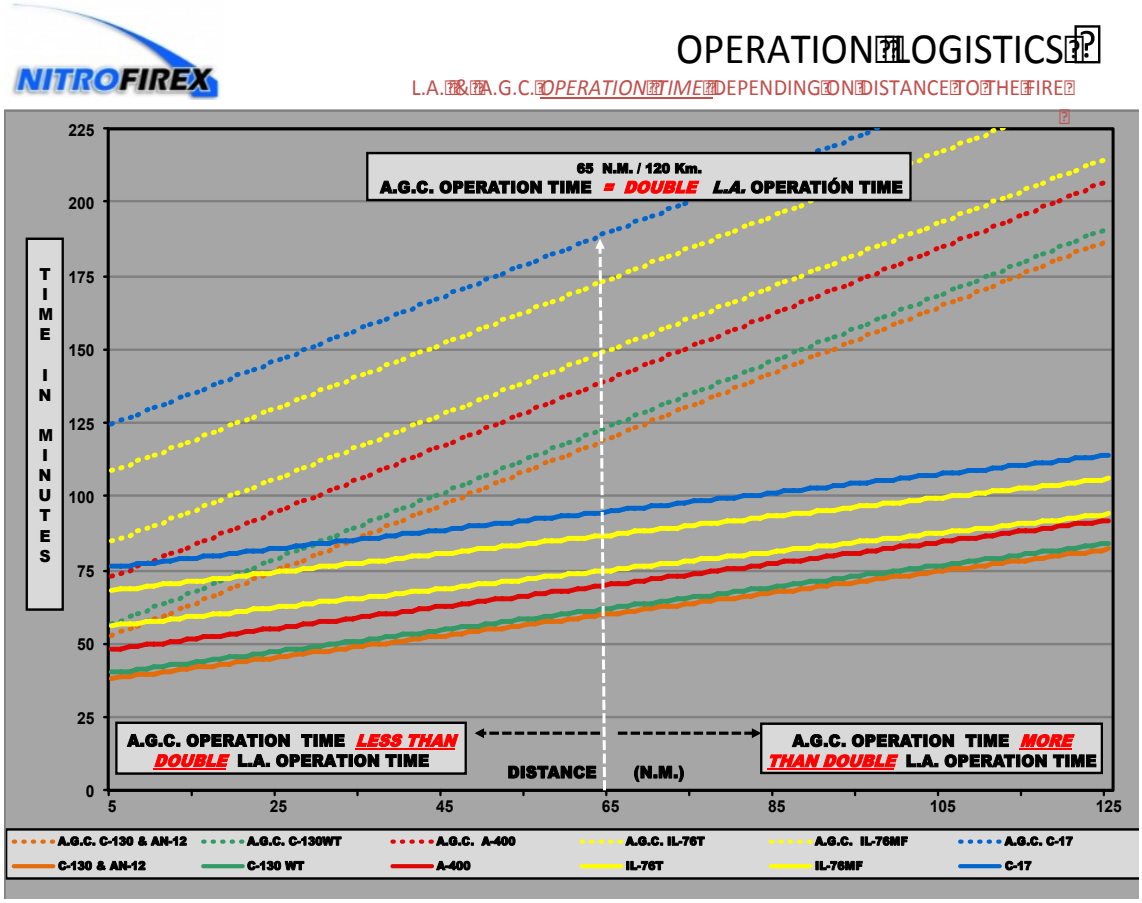

Fig. 25: NitroFirex operation logistics, Ops time LAs versus AGCs

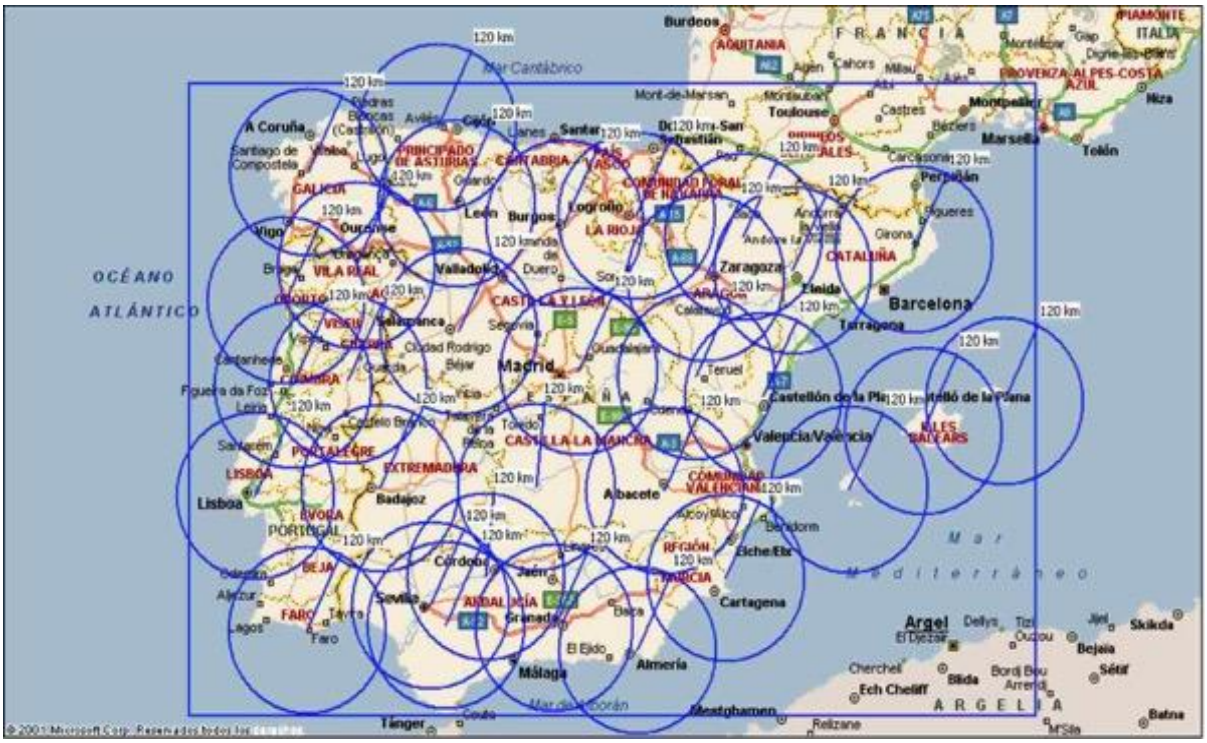

Fig. 26: NitroFirex mission analysis 65 N.M. airport radius.

5.2. Drugs Plantation Fumigation model

In the case of the nocturnal fumigation of drug plantations, the operation is initially projected with the same operative concepts as in the case of the nocturnal extinction of forest fires, although this operation is not of "urgent emergency" which implies much greater flexibility at the time of the planning.

Not being an emergency operation such as wildfires It can be can chosen without urgency the site and the moment of the operation, it is not necessary to operate from the airport closest to the fire or it is not necessary a quick recovery of the AGCs to be reused. Furthermore, coordination with the ground equipment is not considered, and precision and overlapping of the drops are not required, as in the case of forest fires.

Likewise it is not necessary that the operation is carried out continuously until the extinction as in the case of fires, if not that it can be carried out at the rate that it is considered according with our operational requirements.

Al these items make the night plantation fumigation planning and execution less demanding than in the case of night forest extinction.

VI. COORDINATION AND SAFETY

Those dedicated to aerial fire fighting know the importance of ground/air coordination to ensure an efficient and safe operation. With this objective in mind NitroFirex the implementation of new operative protocols and rules of communication with ground crews that are needed to adapt to the requirements of this project.

It should be the fire management officer who maintains radio contact with the LAs and the mission-base to coordinate the whole operation, principally the waiting points of the LAs as well as the approach routes and drop points of the AGCs.

In any type of aerial operation safety is of primordial importance at the time of planning, something to which NitroFirex is not indifferent. Consequently, the NitroFirex in their approach to the drop, as well as in the recovery phase to mission base, will have their flight parameters programmed and will accomplish them automatically and autonomously. Nonetheless, the safety concept of ‘a man in a loop’, in the case of having to abort the drop or reprogram the recuperation route, has been considered fundamental for the safety of the operation.

Therefore, during the approach phase, the NitroFirex will be capable of manually or automatically aborting their approach to the drop point, releasing their cargo at the abort point and then proceeding automatically into the escape and recovery phase. Should the flight trajectory deviate from the one established or an unexpected event occurs during the approach to the drop point and it becomes advisable not to continue, the abort can be manual, carried out by the fire management officer or by AGCs operators at LA or at mission-

base. The NitroFirex AGC can automatically abort if its flight path does not match with what had been programmed or if it approaches the ground and/or a non-desired location.

In any case, the AGCs never reaches the ground filled with extinguishing agents, because if any thing deviates from what was programmed the cargo is immediately released and it then moves into the recovery phase.

On the other hand, the return route of the AGCs to mission base will be programmed for the night, at 500ft or less and over uninhabited areas. Should, by any chance, the AGCs engine have a flameout or any other malfunction, during the return it is equipped with a parachute and an airbag, which opens up automatically and that allows for a 'soft landing' out of programed landing runway, minimizing any possible damage on ground to persons or goods.

In the case of nocturnal fumigation of plantations and drugs, coordination is not considered necessary since this operation is supposed to be carried out in "hostile territory" and with respect to the safety of the operation the concerns should be the same as those established for nocturnal extinction of forest fires.

VII. TECHNICAL REGULATIONS FOR THE OPERATION OF DRONES

Today, the great stumbling block in operating drones in purely civilian aerial operations is the regulations controlling the airspace where both manned and unmanned aircraft could operate safely and this regulation also has to ensure the safety of goods and persons on ground and his privacy. For promoting the development of such rules and regulations at European level the EASA (European Aviation Safety Agency) established the operation of drones. Considering the broad range of operations and types of drones, it is proposed to establish 3 categories of operations and their associated regulatory regime: Open, Specific and Certified.

OPEN are those drones that basically operate in 'Visual Line of Sight' conditions, that is to say that at all moments there is visual contact between the vehicle and the operator. The operator's responsibility is to avoid any situation that could endanger any other aerial vehicle (manned or unmanned) or properties or persons on the ground and also is his responsibility to safeguard the citizen's privacy. The regulations of this category are responsibility of the different states of the European Union and the MTOW (Maximum Take Off Weight) of the drones operating under the rules of these categories should be below 150 KG.

SPECIFIC is the category that "should be regulated in proportionate to the risk of thespecific operation", this category initially has not MTOW limitations and his regulations are responsibility of UE concern agencies and at the same time of the different states of the European Union. The objective of this category is regulating for a "specific fly profile for a specific operations" ensuring that this profile does not affect fly or ground safety nor citizens privacy. Inside this category should be included what it can be considered "state civil operations" like are SAR, disaster monitoring, border control, forest fire fighting, drugs plantation fumigation, police, etc.

Finally the third category is the CERTIFIED that will be drones able of fly in the same operational environment (air space and endurance) that the manned aircrafts, therefore, Certified regulating for drones is more complex, entailing greater technical requirements that will be needed because of the new players involved. These players range from the drones operator to the air traffic controllers as well as the pilots of the manned aircraft.

The final operational achievements of the drones advancement should be logically the full development of the Certified category but to achieve this objective the two other inferior categories, Open and Certified, should be fully operationally developed to demonstrate to the policy maker, regulators and the whole society that the drones are, in all aspects, safe enough to allows the certified operations category.

Reasonably, NitroFirex stands in the second group of drones that operate under the rules of the Specific category. But the airspace required by the project is in fact minimal: A segregated airspace over of the fire / plantation would be used for an LA flying at an altitude between 6.000 to 10.000 feet above and a distance of 6 to 10 NM in respect to the intended drop zone. The LA will launch the AGCs that would need no more than 2-3minutes with their filled tanks to reach the programed drop point, and finally no more than an hour of navigation at an altitude of 500 feet or lower between drop point and the mission base (the LA operating base), with the fly programmed by non populated areas to, ensure just in case any abnormal situation, a secure and soft landing out of programed runway.

What manned aircraft could be flying at night in the proposed zone? That is to say a zone at an altitude of 500 feet or less between a fire/plantation and the LA's mission base? It is for this very reason that a night-time operation is proposed, so that the regulations established could serve as a stepping stone for future operational regulations for drones in a civilian environment that need more flight time and airspace for manoeuvres.

Understanding the flight envelope proposed, and in context with the Specific regulatory authority, the profile of the AGCs recovery as proposed by NitroFirex should be the first to be regulated because the

operational hours and the airspace required couldn't affect manned traffic. This would serve the use of drones in a safe and secure manner within the civilian environment of Specific category. At the same time, it may take advantage of using it as a 'launching pad' for future regular of Certified category operations in the upper layers of airspace where safety requirement and coordination are far superior owing to the altitudes and flight times needed for drones operations.

In one word, if in a Specific operation the low altitude profile, as proposed by NitroFirex, is not regulated and it will be extremely difficult to regulate futures Certified profiles requiring higher altitudes and longer time spans where will be flying manned aircrafts.

VIII. THE AERONAUTICAL INDUSTRY AND "SPECIFIC" DRONESDEVELOPMENT

As confirmation of the viability of the drone and operational concept patented by NitroFirex years ago, you can watch in You Tube the next videos: ***DARPA and AIRBUS imitate, with public funds, an idea patented by Nitrofirex***, (https://www.youtube.com/watch?v=_rx2CP_6E9Y). This video is made with the key sequences of the Nitrofirex Concept 3 min vide video published in 2012 and the YouTube videos published by Airbus in 2017: ***Airbus launches its Future Air Power vision*** (https://www.youtube.com/watch?v=qCL1e1MJtSw&feature=youtu.be&t=70) and by DARPA in 2015: ***DARPA Gremlins to Launch & Recover Drones from Air Force C-130s*** (https://youtu.be/df__CjHECws?t=6).

Recently the initial Airbus Future Air Power project has become the European ***NGWS/FCAS*** (New Generation Weapons Systems / Future Combat Air System) project with the participation of different countries and companies. One of the components of this project is the Remote Carriers (https://defpost.com/airbus-mbda-to-jointly-develop-demonstrators-for-fcas-remote-carriers/).

The so-called "***Remote Carriers" (RC)*** of the ***NGWS/FCAS*** project are fully comparable to the "Autonomous Glider Container" (AGC) patented by NitroFirex more than ten years ago, the only difference is that some are loaded with weapons and others with extinguishing agent, but the technologies to be integrated and the operational concept are exactly the same, the Remote Carriers unload hundreds of kilos of weaponry over a military target and the AGCs thousands of liters of extinguishing agent are unloaded over the flames of a forest fire, among other possible operational applications of the AGC,s of NitroFirex.

The technologies and protocols of safety, control, navigation, coordination and communication, etc., to be integrated in the development of the ***Remote Carriers*** are just the same as those required by the NitroFirex AGCs. Using an automotive simile, one is a van and the other is a sports car, but both are driving on the same road, with the same Highway Code and the same rules of safety, navigation, coordination and control.

The only difference is in the aerodynamic design of each one of the drones, since the one for military use must be designed to transport, at high speed, hundreds of kilos of armament to hundreds of kilometers away from its release from the launcher plane to the target and the one for forest fire fighting use must be optimized to transport, at low speed, thousands of liters of extinguish agent at tens of kilometers away from its release until the drops over the flames.

As you can check the European ***NGWS/FCAS*** program, with its ***Remote Carriers***, and DARPA with its Gremlins program, assigned to be developed by Boeing and General Atomics, are both developing the operational concept patented by NitroFirex but only for military applications.

The development of "dual technologies" that can be developed both for military and civilian applications is a social and industrial demand. If the NitroFirex patent concept can be developed for military purposes, it can be developed for this very real and very necessary civilian applications like night aerial forest fire fighting (dropping extinguish agent), performing it in a safer and cheaper way than today.

Our lawyers have been in contact with Airbus and DARPA for a long time in order to defend our intellectual property and with the purpose of joining efforts and objectives, without any results so far.

All this is particularly incoherent considering that the above mentioned aeronautical companies can provide the military transport aircraft and medium/heavy helicopters needed for the innovative operation proposed by NitroFirex, being this contribution the most expensive part of the project.

Therefore, bearing in mind the high-tech power that those companies/agency represents, it is difficult to justify within the society, the media and the decision makers that the idea patented by NitroFirex years ago for civilian applications is only developed for strictly military purposes.

In May 2020 it was reported in the press that a team of more than 35 members of Australian industry lead by Boeing Company has presented the first "***Unmanned Loyal Wingman***" aircraft to the Royal Australian Air Force. (https://www.uasvision.com/2020/05/06/boeing-rolls-out-first-loyal-wingman-unmanned-aircraft/) because there is "a global market demand for highly capable but extremely affordable unmanned aircraft" and in February 2012 this drone has already made its first maiden test flight(https://www.defensenews.com/air/2021/03/02/australia-makes-another-order-for-boeing-made-loyal-wingman-drones-after-a-successful-first-flight/).

The aircraft, which uses artificial intelligence to "extend the capabilities of manned and unmanned platforms", is the first to be designed, engineered and manufactured in Australia in more than 50 years.
So there are "extremely affordable unmanned" technologies and engineering expertise able to develop a system capable to accomplish a manned fighter aircraft / Unmanned Loyal Wingman combat skill then, then with same technologies and less industrial and economic effort, why cannot be integrated this know-hows to develop a manned/unmanned night aerial bushfire suppression system and thus fill the empty niche market globally?

Also should be consider by the main western aeronautical companies that the nocturnal extinction of forest fires or night aerial drugs plantation fumigation are a completely virgin worldwide market niche and widely demanded by experts in fire fighting or drug fumigation as well as by policy makers all around the world so the first company that takes positions with respect to this market will be the leader of all the rest, in addition to contributing to the NitroFirex operation with the LAs, helicopters and transport aircraft manufactured by themselves.

With the support European Space Agency (ESA) our company NF Advanced Engineering is finishing to build MicroFirex a small NitroFirex concept demonstrator able to drop in flight several dozen of litters demonstrating the ability of a drone to suddenly discharge a quantity of liquid that represents a significant percentage of its MTOW (50 to 80%), being able to control the abrupt change of C of G(https://www.dropbox.com/s/sba3pxqa93ime4q/NFAE_MARIANO.mp4?dl=0).

This multi-mission modular vehicle will demonstrate NitroFirex's viability. Our next step is developing a pre-commercial concept demonstrator to be in the range of one to two thousand litters dropping capability maintaining the same percentage of MTOW dropping.

NitroFirex project has been presented in different national and international fairs and great interest was shown amongst the official organizations as well as private businesses in this sector, especially regarding the exclusive and original approach on the operative and technical levels of the project.

The NitroFirex concept is patented in those countries which have an economic and aeronautic capacity to face this type of project and who also have serious wildfire problems such as the USA(**Nº: US 7,690,438 B2**), Canada(**Nº: 2594783**), Australia (**Nº: 2006209377**)and Europe (Spain, France, Germany) (**PCT/IB2006/000122**) but also can be applied to those countries big producers of drugs like Colombia, Afghanistan or Mexico among others.

IX. DISCUSSION

Some reflections should be made about the technological evolution of the forest fire fighting and drugs plantations fumigations aerial means during the last decades in order to be able to assume the NitroFirex goals.

In the case of the forest fire the debate should not be whether LAT (Large Air Tanker) or a VLAT (Very Large Air Tanker), plane or helicopter, scooper or ground plane, direct or indirect water drops, the debate should be whether, in the middle of the 21st century, are being used the appropriate technological means to properly forest fire fighting from the air or not. And in respect the fumigation of drugs plantations the debate should be if dangerous daytime operations or safe and effective night operations.

Almost fifty years ago man went to the moon, for more than six years the unmanned vehicle Curiosity has been driving around on Mars surface, but here on heart our forest still burnt away at night only because hasn't been able to integrate already existing technologies.

When compared to all other sectors of aviation where the innovations have been really significant during the last seventy years, paradoxically in the sector of aerial fire fighting and drugs plantations fumigation no modern aeronautic technologies have been implemented up to now. Techniques and procedures are being used developed more than 70 years ago in a very risky only daytime operation and every day it is clearer that those methods are insufficient to combat the devastating fires that, due to climate change, are devastating the worldwide forests and the drug plague that invade our society.

Or modern available technologies are integrated to develop the operational capability of discharge more quantity of extinguish agent in less time over de forest fire, be able to make it at night and make it at safer and cheaper way than actual aerial means or our forest will burn away irretrievably and the drugs plantations will go on growing, and this capability only can be accomplished developing a specifically designed aerial unmanned vehicle.

That it is worth operating a LAT or a VLAT during the day if at night the fire will go on progressing without control. The great lack of aerial forest fire fighting and drugs plantations fumigation means is the night operation capability and its development is where must concentrate the efforts of the responsible agencies as well as of the operators and aeronautical companies.

X. CONCLUSIONS

. - It must be assumed that obsolete weapons are being used against every day stronger enemies, forest fires extinguish or drugs plantations fumigation, and the battle is being lost.

. - The big fires, the destructive ones are those that last one-day, one night and at next morning are out of control, that because the priority should be to develop the "first night" aerial operational capability and this is the NitroFirex's main objective.

. - Modern available technologies must be integrated to develop this operational capability and be able of discharge more quantity of extinguish agent in less time over de forest fire during first night and make it at safer and cheaper way than actual aerial means or our forest will burn awayirretrievably.

. - Just the same technologies and operational procedures can be applied to drugs plantations fumigation at night to alleviate the big problem that represents the drugs consumption worldwide.

. - The use of an autonomously guided glider container, such as the one patented by NitroFirex project, is the best and safest way to face the night aerial fire fighting and drugs plantations fumigation operations.

. – The NitroFirex operational approach eliminates risks for crews and increases the accuracy and concentration of the drops, in the same way the amount of agent dropped both per operating hour and per flight hour is increased with respect to the aerial methods currently used.

. - The Launcher Aircraft to be used are medium/large helicopters or military transport airlifters that are not single-role airplanes and are manufactured by the main western aeronautical companies.

. - This will help bring down to a great extent the final flight-hour cost (considering acquisition, amortization in addition to maintenance, personnel, etc.) for the part of operations performed on fire fighting/drug plantation fumigation, and ultimately the cost of each dispatched litter.

. - The new technologies have already been developed, matured and made available. It is only necessary to integrate them towards the objective that concerns and worries us.

. - It is therefore up to the politicians and technicians in charge of the operation to accept the seriousness of the problems and to raise a new strategy against the human and economic loss, the ecological damage, and the social alarm that those two big problems, forest fires and drugs consumption produce worldwide.

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