

LOS RPAS Y LA EXTINCION NOCTURNA DE INCENDIOS FORESTALES

PROYECTO NITROFIREX

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NITROFIREX S.L.

Robótica y sistemas no tripulados para aplicaciones de seguridad

Madrid, 2 de Diciembre de 2016



NITROFIREX, is a new approach in the world of the RPAS, which aims to develop the capacity of spraying or spreading a large payload in a hostile, difficult or impossible to access environment with a manned plane. (WORLD-WIDE PATENTED CONCEPT)

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Luis M. Bordallo, NITROFIREX

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NITROFIREX's the main elements to be used are:

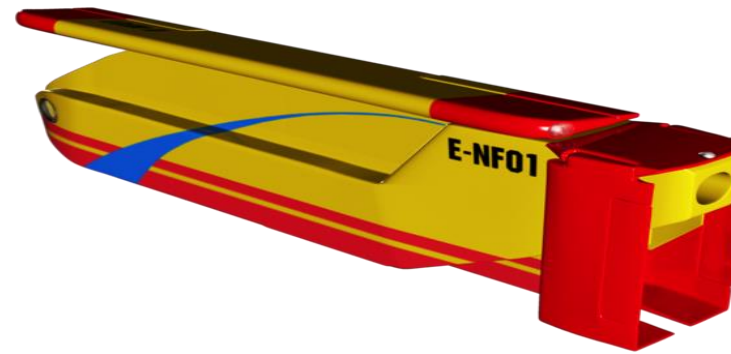
“LAUNCHER AIRCRAFT” or LA

A heavy transport aircraft with a rear ramp.



“AUTONOMOUS GLIDING CONTAINERS” or AGCs

These carry the payload from the LA to the the programed release point.



FOREST FIRE-FIGHTING AT NIGHT

OTHER FIRES

NUCLEAR, CHEMICAL or BACTERIOLOGICAL EMERGENCIES

METEOROLOGICAL PHENOMENA

DRUG PLANTATION SPRAYING

PESTS SPRAYING or SEEDING (Remote and / or inaccessible areas)



CHANGE OF PHILOSOPHY:

ACKNOWLEDGE THE SERIOUSNESS OF THE PROBLEM

APPROACH A NEW STRATEGY:

- **BIGGER DROPPING CAPACITY**
- **REACTION TIME REDUCTION**
- **NIGHT OPERATION**
- **NO RISKY OPERATION FOR AIRBORNE CREWS**
- **SIGNIFICANT COST REDUCTION**

FACE THE CHALLENGES: REGULATORY

ECONOMICAL

TECHNOLOGICAL

OPERATIONAL

BACK UP

SLIDES

DARPA CONCEPT

<http://www.darpa.mil/news-events/2015-08-28>



Artist's Concept



FIND THE DIFFERENCES...

Senate Bill 14-164, which authorized the Colorado Division of Fire Prevention and Control (DFPC) to purchase or contract for aerial firefighting assets, also created the Center of Excellence for Advanced Technology Aerial Firefighting (CoE). The CoE is an innovative, science- and data-focused entity that researches, tests, and evaluates existing and new technologies that support sustainable, effective, and efficient aerial firefighting techniques.

Location

The CoE is located at the Rifle Garfield County Airport. Rifle is home to the Upper Colorado River Interagency Fire Management facility, which houses U.S. Bureau of Land Management, U.S. Forest Service, Colorado River Fire Rescue, and DFPC resources. It also offers close proximity to the Grand Junction Air Center, which provides tactical aircraft resources (air tankers, smokejumpers, lead planes, and air attack) for initial attack and large incident support. In addition, Rifle is close to open lands and uncontrolled airspace with a variety of terrain, all of which support the evaluation of aerial firefighting techniques.



Photo Credit: Adam Trojanowski

Center of Excellence Staff

The CoE has compiled a staff with extensive experience and expertise in wildland and aerial firefighting, data research and analysis, policy analysis and development, and technical editing. The staff includes members with graduate-level degrees and years of relevant experience, all of whom are well-versed in technology. Most of the CoE staff are either pilots or closely affiliated with aviation.

The Center of Excellence is located at the
Rifle Garfield County Airport
375 County Road 352, #2065-A
Building 2060
Rifle, CO 81650
(970) 665-0034

Find us on 

www.facebook.com/COEATAF

Follow Us On Twitter:

https://twitter.com/CoE_DFPC



For more information, please visit
www.dfpc.state.co.us



Center of Excellence for Advanced Technology Aerial Firefighting



Mission

To protect the citizens, land, and resources in Colorado, the Center of Excellence will research, test, and evaluate existing and new technologies that support sustainable, effective, and efficient aerial firefighting techniques.

Vision

The Center of Excellence is the worldwide leader in collaboratively researching and developing innovative technologies and capabilities supporting or related to aerial firefighting.

General Atomics' PREDATOR UAV to Deliver Humanitarian Relief Supplies



NITROFIREX - NIGHTTIME AERIAL FIREFIGHTING SOLUTIONS



OPTIONAL USE OF A HELICOPTER AS LAUNCHER AIRCRAFT

REGULACION ESPAÑOLA SOBRE DRONES

3. Podrán realizarse actividades aéreas de trabajos técnicos o científicos por aeronaves civiles pilotadas por control remoto, de día y en condiciones meteorológicas visuales con sujeción a los siguientes requisitos:

- a)
- b)
- c) Las aeronaves civiles pilotadas por control remoto cuya masa máxima al despegue exceda de 25 Kg. y no sea superior a 150 Kg. y aquéllas cuya masa máxima de despegue sea igual o superior a 150 kg. destinadas a la realización de actividades de lucha contra incendios o búsqueda y salvamento, sólo podrán operar, con las condiciones y limitaciones establecidas en su certificado de aeronavegabilidad emitido por la Agencia Estatal de Seguridad Aérea, en espacio aéreo no controlado.
- d)

Real Decreto-ley 8/2014, de 4 de julio (Sección 6ª, Artículo 50.3)

REGULACION ESPAÑOLA SOBRE DRONES

Proyecto de Real Decreto por el que se regula la utilización civil de las aeronaves pilotadas por control remoto

ARTICULO 2. Ámbito de aplicación.

- 1.
2. Este real decreto no es de aplicación a:
 - a) Las aeronaves pilotadas por control remoto cuya masa máxima al despegue sea superior a 150 Kg., [salvo cuando efectúen actividades o servicios de aduanas, policía, búsqueda y salvamento, lucha contra incendios, guardacostas o similares](#), conforme a lo dispuesto en el Reglamento (CE) 216/2008 del Parlamento Europeo y del Consejo de 20 de febrero de 2008, sobre normas comunes en el ámbito de la aviación civil y por el que se crea una Agencia Europea de Seguridad Aérea, y se deroga la Directiva 91/670/CEE del Consejo.

ARTICULO 12. Requisitos de la operación

- 1.
- E) IGUAL ANTERIOR +

Si así se contempla en dicho certificado, [podrán operar más allá del alcance visual del piloto \(BVLOS\)](#), dentro del alcance de la emisión por radio de la estación de control, en espacio aéreo no controlado, siempre que cuenten con sistemas que permitan a su piloto detectar y evitar a otros usuarios del espacio aéreo.

ARTICULO 26. Limitaciones.

4. Solamente podrán realizarse vuelos en condiciones meteorológicas de vuelo visual (VMC) diurno. La realización de [vuelos nocturnos](#) requerirá la autorización expresa de la Agencia Estatal de Seguridad Aérea, previa solicitud del operador, que deberá acompañarla de un [estudio aeronáutico de seguridad que constate que la seguridad queda garantizada con las condiciones o limitaciones que se establezcan al efecto](#).

EUROPEAN RPAS REGULATION

RIGA MEETING (06/03/2015):

1. THE OPERATION OF DRONES SHOULD BE REGULATED IN A MANNER PROPORTIONATE TO
“THE RISK OF THE SPECIFIC OPERATION”
4. PUBLIC ACCEPTANCE IS KEY TO THE GROWTH OF DRONE SERVICES.

EASA DOCUMENT (15/03/2015) :

CONCEPT OF OPERATIONS FOR DRONES:

“A RISK BASED APPROACH TO REGULATION OF UNMANNED AIRCRAFT”

- .- OPEN CATEGORY
- .- SPECIFIC OPERATION CATEGORY (NITROFIREX)
- .- CERTIFIED CATEGORY

1.- LAUNCH

Initial phase of the operation in of which the AGCs are mechanically launched from the L.A.



2.- GLIDE and GUIDANCE

The AGCs containing the payload glide to their target and are equipped with a guidance system which makes it fully autonomous from the launch to the targeted release point (glided-guided bomb).

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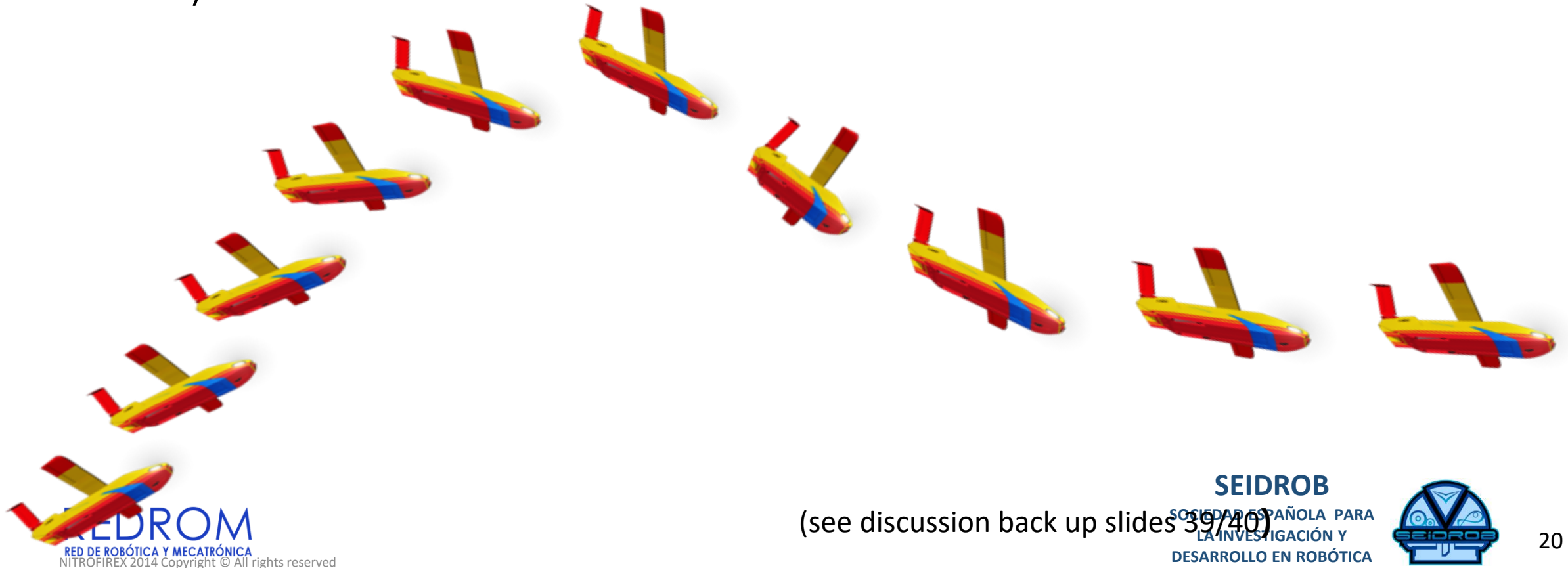
3.- DROP

Reaching their targeted release point the AGCs drop their content automatically and with great precision.



4.- ESCAPE MANEUVER

Then the AGCs rapidly escape from the hostile zone taking advantage of the amount of height gained due to the big and sudden loss of weight. This maneuver is used as a transition into the following phase of recovery.



(see discussion back up slides 39/40)

5.- RECOVERY and LANDING

Once empty and removed of the hostile zone, the AGCs begin their recovery phase by means of their small jet engine, recovering and landing in the base of operation of the L.A. in a completely autonomous way

Recovery is performed at night, below 500' and over non populated areas:

Air/ground SAFETY & PRIVACY are not affected



CURRENT TECHNOLOGICAL STATUS

Current airborne firefighters are:

Slow

Manual water drops

Daytime operation

Single role aircraft

Risky operations



TECHNOLOGICAL PARADOX:

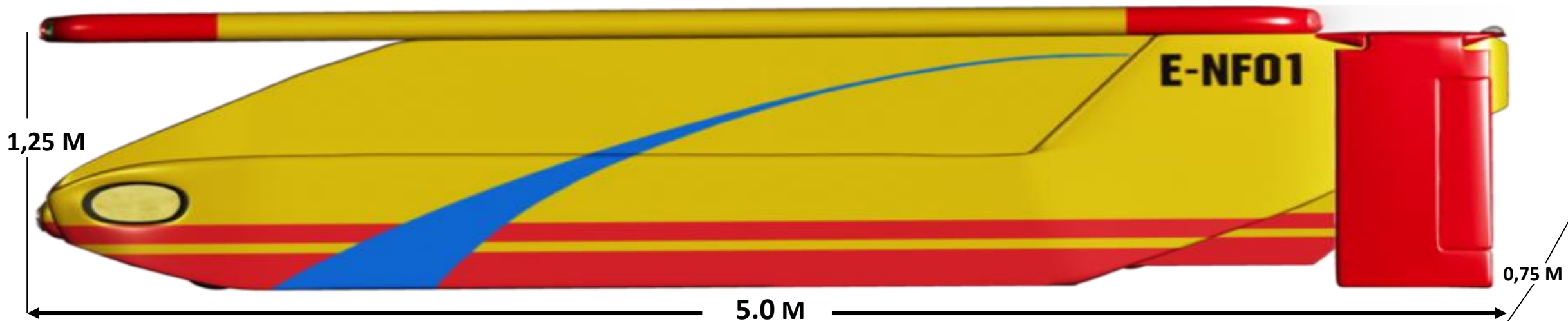
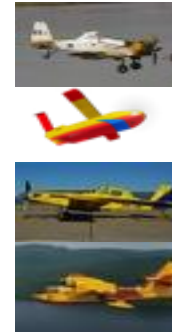
DETECTION TIME vs. REACTION TIME

DROMADER : 2.200 L

NITROFIREX: 2.500 ± 250 L

AIR TRACTOR: 3.100 L

CANADAIER CL-215/415: 5.500 L



AGCs TOTAL WEIGHT : 3.000 kg (+/-250 kg)

AGCs EMPTY WEIGHT : 500 KG (~20 % TOTAL WEIGHT)

AGCs PAY LOAD : 2.500 (+/- 250) LITRES (48 -58 % total volume / 73 -60 % AGCs volume)

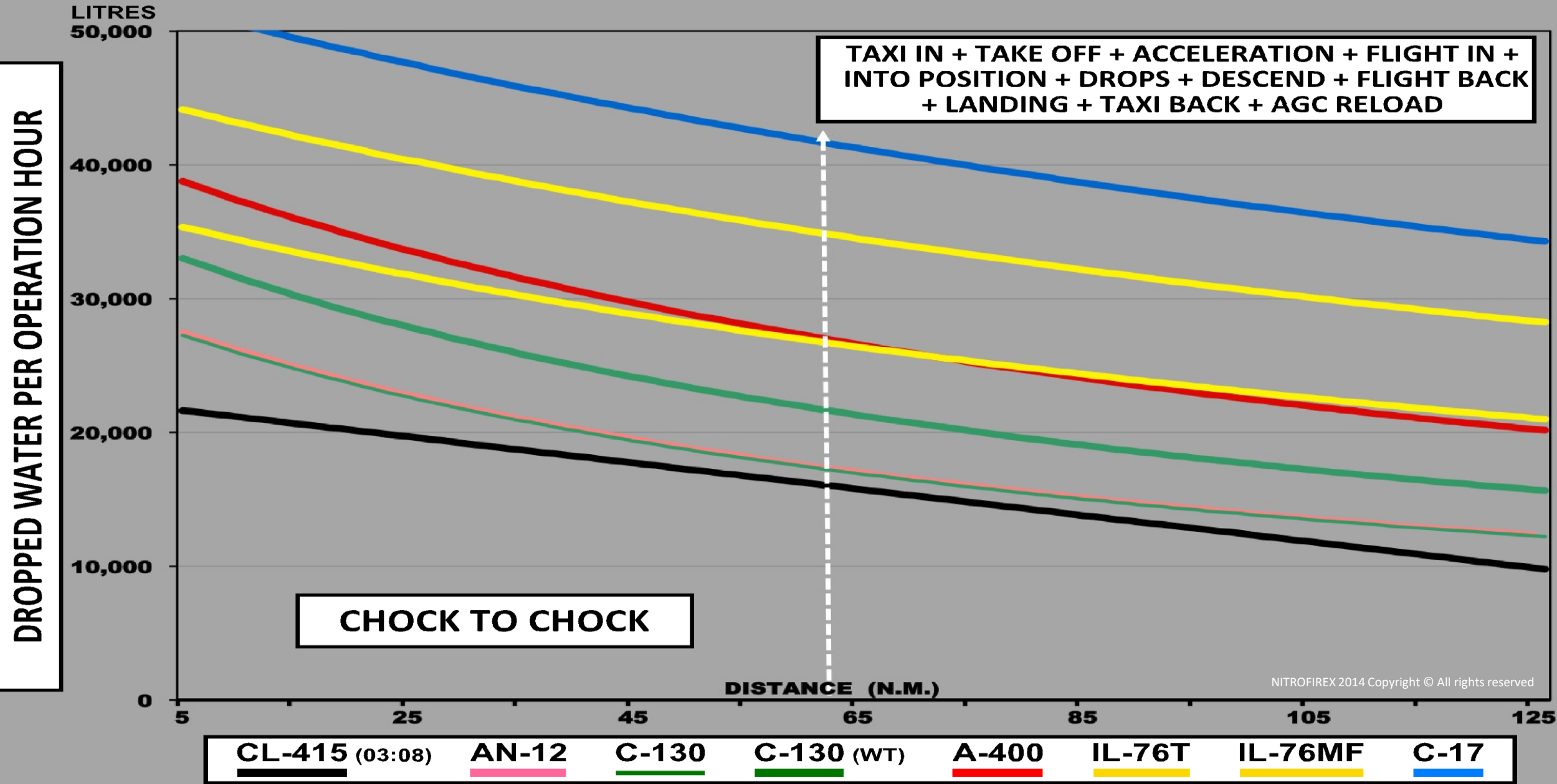
AGCs DIMENSIONS (meter): 5,00 LENGTH, 1,25 HIGH, 0,75 WIDTH

AGCs VOLUME: 3,75 M³ (80 % total volume)

TOTAL VOLUME NECESSARY : 4,6875 M³

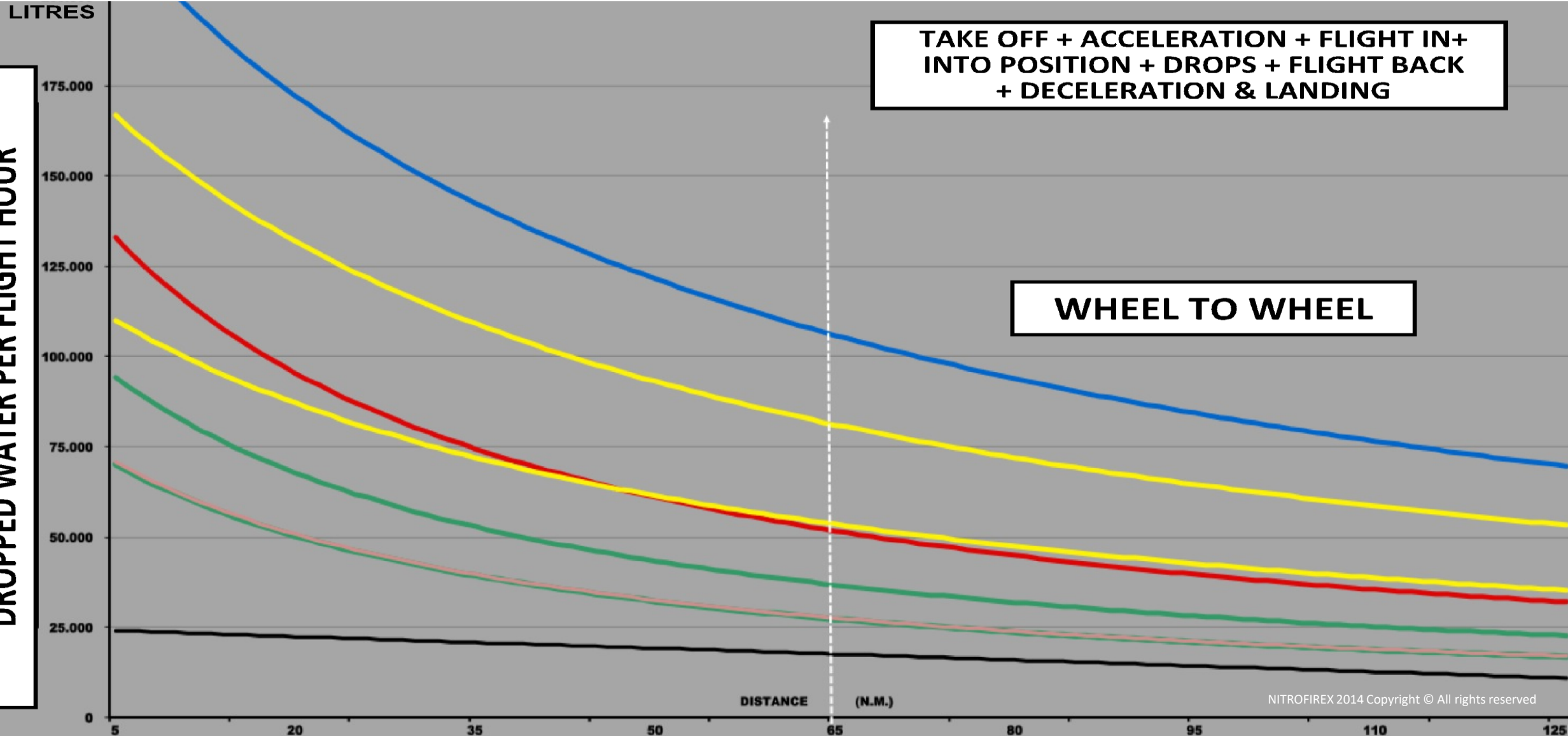
AIRCRAFT TYPE	PAYLOAD (T.M.)	USEFUL WATER LITERS	NUMBER OF AGCs
C-130 (WT)	19,4 -28,9	16.356 - 22.000	6 / 8
AN-12	20	16.500	6
A-400M	37	31.000	12
IL-76 (T / MD / TD / MF)	40 /47/50/60	33.000 - 50.000	14 / 20
C-17	77,3	65.290	24



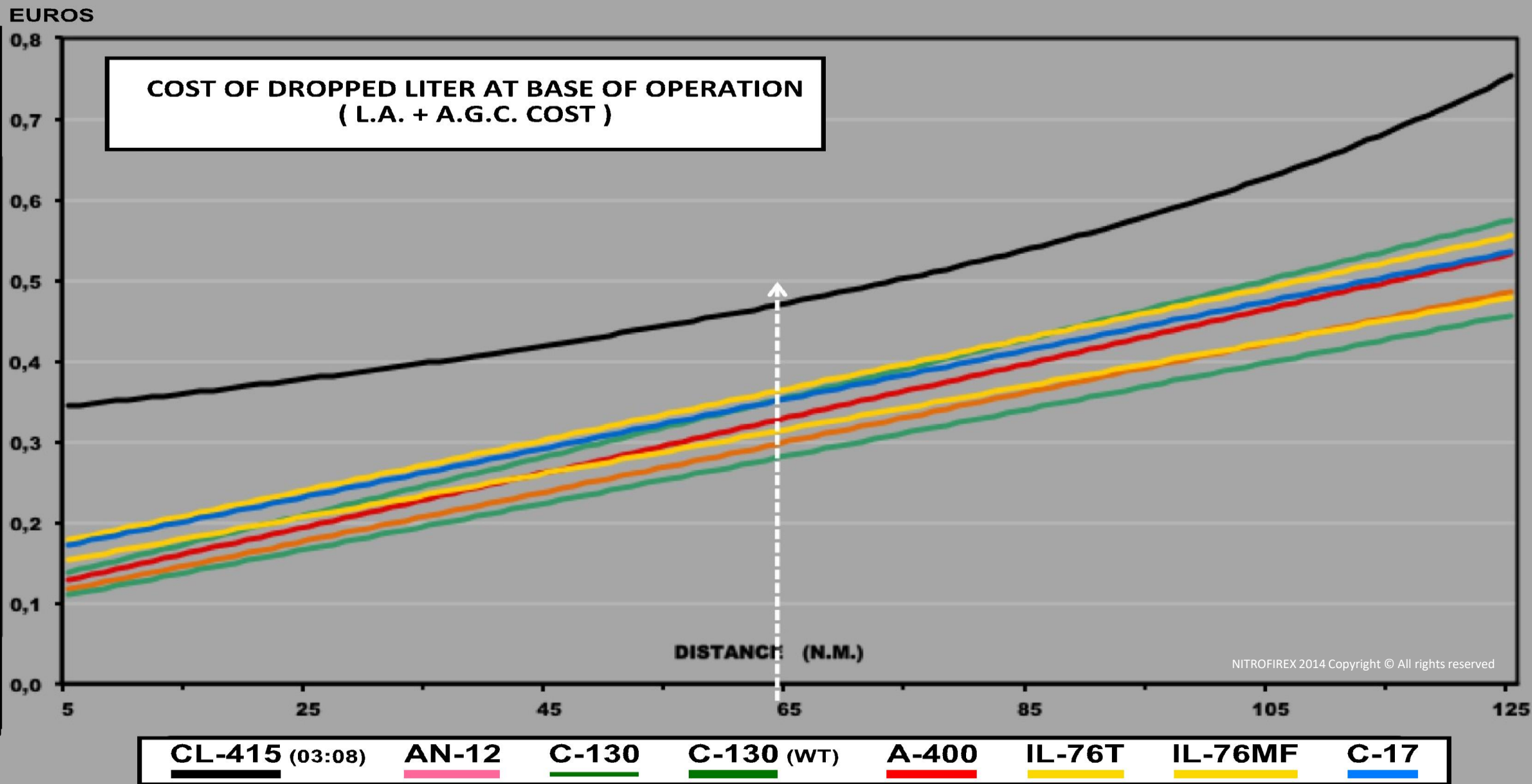


- **24H OPERATION (NIGHT Ops)**
- **REDUCED REACTION TIMES**
- **HIGHER WATER DROP** CAPABILITY PER **OPERATION HOUR** AS COMPARED TO CURRENT MEANS
- MAXIMUM WATER DROP EFFICIENCY DUE TO **SEQUENTIAL DEPLOYMENT** OF THE AGCs
- **MAXIMUM PRECISION** OF THE WATER DROP
- **MAXIMUM CONCENTRATION** OF EXTINGUISHING AGENT AT RELEASE POINT
- **UNAFFECTED** BY WIND, TURBULENCE, CLOUDS AND SMOKE
- **UNAFFECTED** BY GEOGRAPHICAL BARRIERS
- POSSIBILITY OF ATTENDING **MORE THAN ONE FIRE** SAME FLIGHT
- **BIG DISPLACEMENT CAPACITY**: HEAVY TRANSPORT L.A. PROVIDE THE LONG RANGE AND HIGH SPEED
- **NO RISK** FOR FLIGHT **CREWS**
- GIVES **DIRECT SUPPORT TO GROUND CREWS AT NIGHT**

DROPPED WATER PER FLIGHT HOUR



COST OF DROPPED LITERS IN FUNCTION OF DISTANCE



Forest Fire Statistics in Spain

- Economic loss over the last 20 years (1992-2011) 6.139 mill € (**307 mill €/year**)
- Average affected surface last 20 years (1993-2012) **133.288 ha/year**
- Average annual fires last 20 years (1993-2012) 18.322 fires/year
- Nº of fires years 05 to 12 → 25.492 / 16.334 / 10.932 / 11.612 / 14.793 / 11.722 / 16.028 / 15.902
- Number fires with use of aircraft 07 / 08 / 09 / 10 → 2.594 / 2.702 / 4.235 / 2.963
- Average number of aircraft used in firefighting (last 5 years) → **+160 (74 PLANES / above 85 HEL)**

DATA FROM REPORT "LOS INCENDIOS FORESTALES EN ESPAÑA. AÑO 2005", Pgs 105-107 (M.M.A.)

DATA FROM REPORT "INCENDIOS FORESTALES EN ESPAÑA. AÑO 2006", Pg 102 (M.A.R.M.)

DATA FROM REPORT "INCENDIOS FORESTALES EN ESPAÑA. AÑO 2007", Pg 11 / 108 (M.A.R.M.)

DATA FROM REPORT "INCENDIOS FORESTALES EN ESPAÑA. AÑO 2008", Pg 6 / 45 (M.A.R.M.)

DATA FROM REPORT "INCENDIOS FORESTALES EN ESPAÑA. AÑO 2009", Pg 10 / 41 (M.A.R.M.)

DATA FROM REPORT "INCENDIOS FORESTALES EN ESPAÑA. AÑO 2010". Pg 7 / 79 (M.A.R.M.)

DATA FROM REPORT "INCENDIOS FORESTALES EN ESPAÑA. AÑO 2011". Pg 35 (M.A.G.R.A.M.A.)

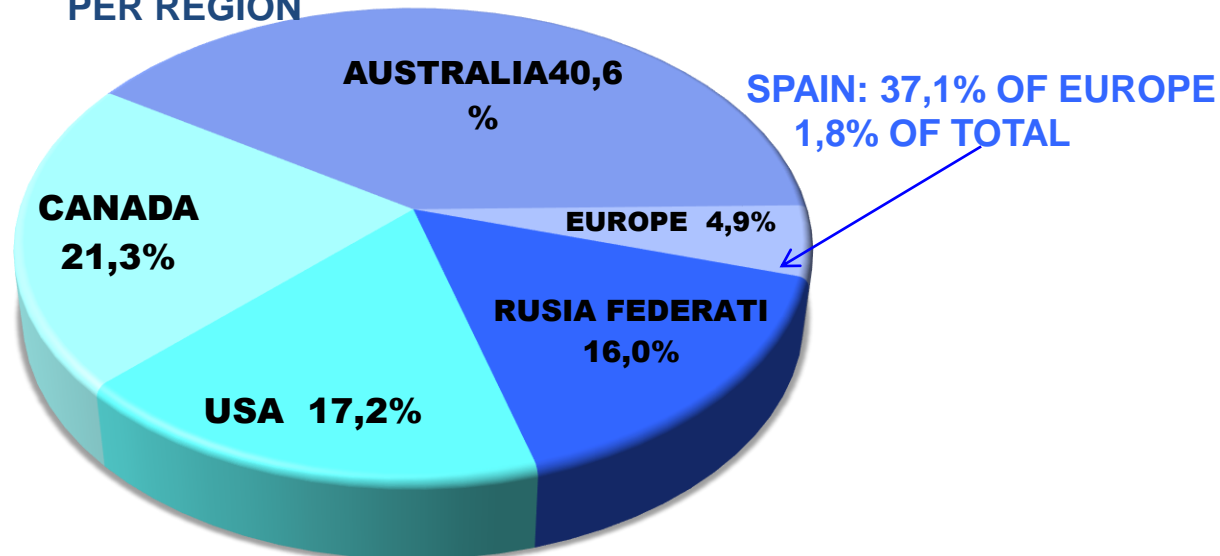
DATA FROM REPORT "LOS INCENDIOS FORESTALES EN ESPAÑA. AÑO 1 ENE - 31 DIC 2012" (AVANCE INFORMATIVO) Pgs 47 (M.A.G.R.A.M.A.)

NITROFIREX PATENTED COUNTRIES (see back up slide nº 40)	PERIOD (YEARS)	AVERAGE YEARLY BURNT AREA (HECTARES)
EUROPE (GERMANY-ITALY-SPAIN) (ENGLAND-FRANCE-PORTUGAL-SPAIN-FRANCE-ITALY-GREECE)	1980-2009	478.910
RUSSIA FEDERATION	1991-2001	1.580.455
USA	1960-2009	1.699.995
CANADA	1970-2008	2.101.522
AUSTRALIA	2001-2006	4.000.119
TOTAL:		9.861.001

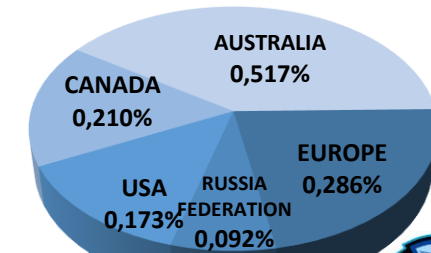
THIS REPRESENTS ONLY **2,7 %** OF THE WORLD'S YEARLY BURNT AREA

TOTAL WORLD'S YEARLY BURNT AREA = **371.2 Mha** = **6,3 TIMES IBERICA PENINSULA** (see back up slide nº 41)

BURNT YEARLY AREA
PER REGION



BURNT YEARLY AREA
% TOTAL COUNTRY



ECONOMIC LOSS

1,8 %.....307 M€

100 %.....17.028 M€

8.000 M€

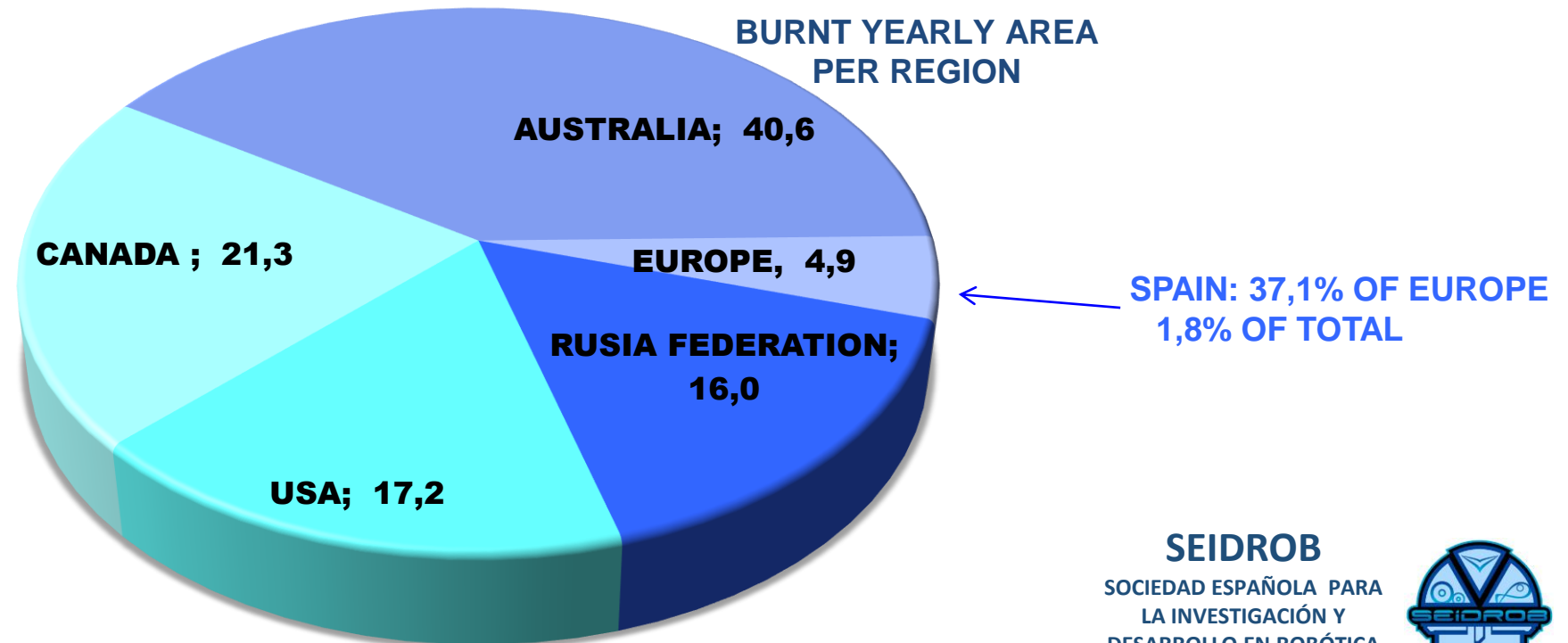
AIRCRAFT

1,8 %.....160 ACFT

100 %.....8.800 ACFT

4.000 ACFT

(1/2 Planes + 1/2 HEL)



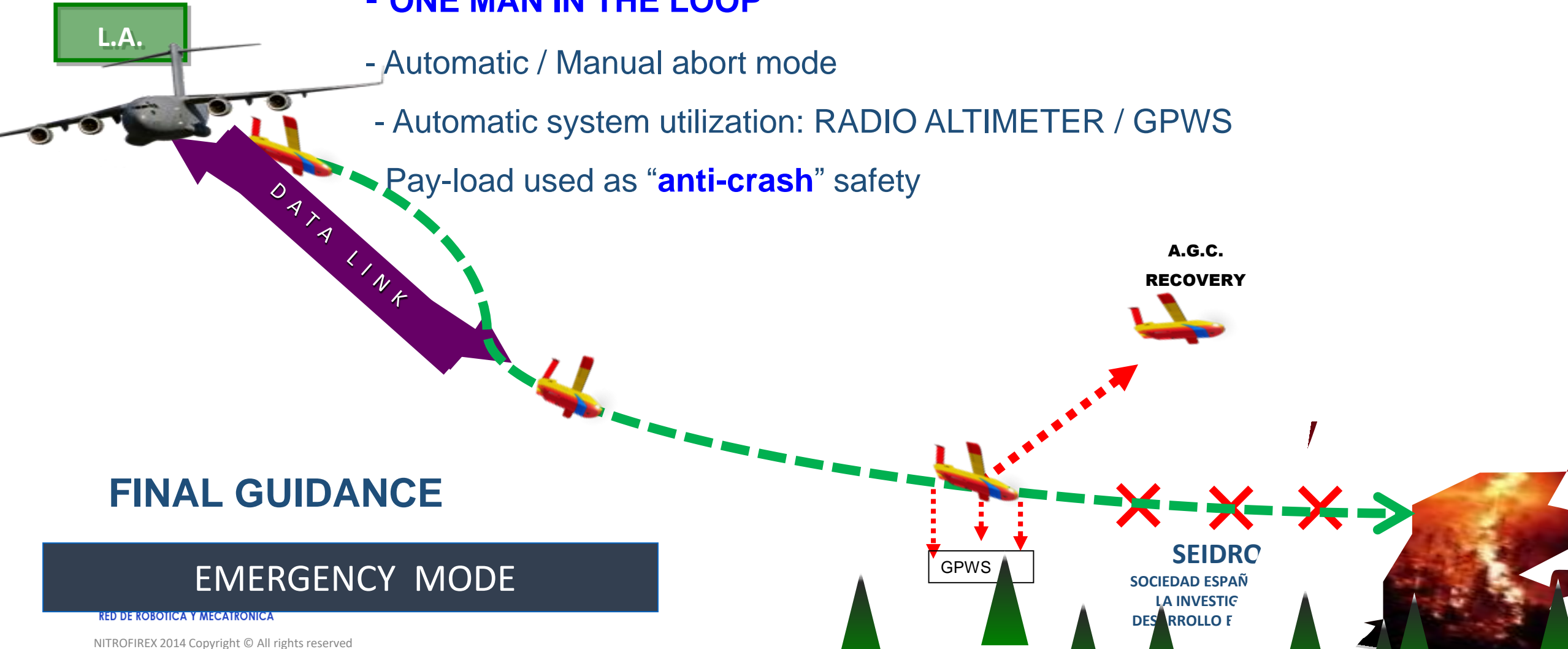
EMERGENCY MODE / FLIGHT ABORT:

- ONE MAN IN THE LOOP

- Automatic / Manual abort mode

- Automatic system utilization: RADIO ALTIMETER / GPWS

Pay-load used as “**anti-crash**” safety



- **MUCH HIGHER WATER DROP** CAPABILITY **PER FLIGHT HOUR** AS COMPARED TO CURRENT MEANS
- **LOWER COST PER** DROPPED **LITER**
- AGCs CAN BE LAUNCHED FROM **MANY KINDS OF TRANSPORT AIRCRAFT**
- **MINIMUM FLEET DEPLOYMENT**
- **NON EXCLUSIVE L.A.** - ONE AIRCRAFT TWO MISSIONS
- **BIG SAVINGS** IN AMORTIZATIONS, PERSONNEL, MAINTENANCE AND SUPPLIES.
- **GREAT AVAILABILITY** OF HEAVY TRANSPORT AIRCRAFT WORLDWIDE TO BE USED AS L.A.
- L.A. REQUIRE **NO MODIFICATION**
- **TECHNOLOGIES** USED ARE ALREADY DEVELOPED AND **AVAILABLE**

NITROFIREX FLIGHT PROFILE

APPROACH PHASE: FROM THE REAR RAMP OF THE L.A. TO THE DROPPING POINT OVER THE FOREST FIRE

- NIGHTTIME **LAUNCH & APPROACH** TO FOREST FIRE IS DONE IN **SEGREGATED AIR SPACE**

UNDER CONTROL OF : - A T C

- L A

- GROUND STAFF

RECOVERY PHASE: FROM THE FOREST FIRE TO THE L.A. OP's BASE

- NIGHTTIME **RECOVERY** IS AT **V.L.L.** (Very Low Level, 500')
- PROGRAMED TO **RETURN** OVER **NON POPULATED** AREAS
- STANDARD EQUIPMENT FOR AGCs **PARACHUTE** AND **AIRBAG** DEPLOYED JUST IN CASE OF
ENGINE **FLAME OUT** OR ANY EMERGRNCY SITUATION A **SAFE & SOFT LANDING IS ENSURED**

WHY AT NIGHT?

- TO BE A COMPLEMENT OF DAYTIME AERIAL MEANS:
 - NON STOP FIGHTING
 - H-24
- BETTER REGULATORY OPTIONS

NITROFIREX OPERATIONS DO NOT AFFECT RPAS BARRIER ENTRANCE:

AIR/GROUND SAFETY AND/OR CITIZEN'S PRIVACY

SPANISH PATENT :
Request date : 26 January 2005 14:00H
Application number: 2005 00143 (0)
Publication number: 2265260 (A1)
Date of publication and mention of the grant of the patent: 27/11/2007
Bulletin: 1 January 2008

EUROPEAN PATENT: Application number 06710264.0 (EP 1 845 017 B1)
International application number: PCT/IB2006/000122
International publication number: WO2006 / 079899
Date of publication and mention of the grant of the patent: 23/07/2008
Bulletin; 2008/30

USA PATENT:
Patent No.: US 7,690,438 B2
Date of Patent: April, 6, 2010
Application No: 11/795,711

RUSIA FEDERATION PATENT : Nº 2007129575 (0322079)

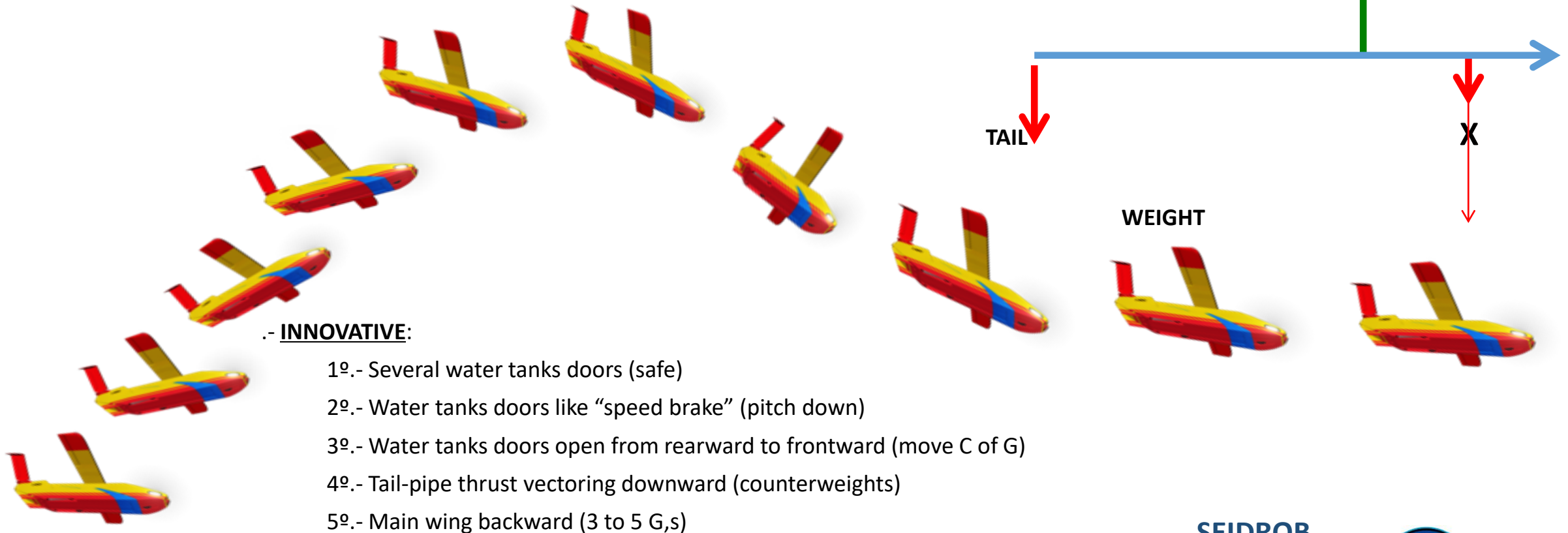
AUSTRALIAN PATENT: Nº: 2006209377

CANADIAN PATENT: Nº: 2594783

4.1.- ESCAPE MANEUVER CONTROL: CLASIC STABILITY SYSTEM

SOURCES: .- **DESING**: Control C. of G. during water drop (forward)

.- **CLASICAL**: Max Power / Max elevator down (extra deflection)



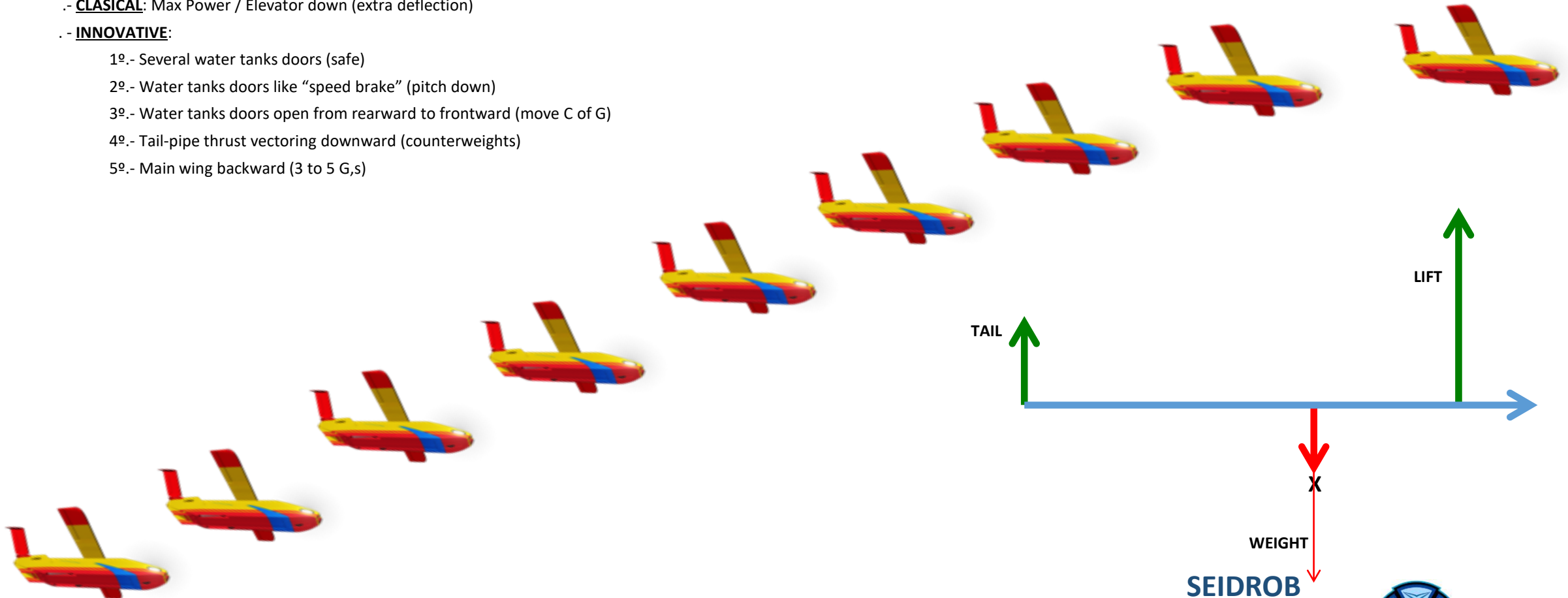
4.2.- ESCAPE MANEUVER CONTROL: DYNAMIC STABILITY SYSTEM

SOURCES: .- DESING: Electronic Flight Control

.- CLASICAL: Max Power / Elevator down (extra deflection)

.- INNOVATIVE:

- 1º.- Several water tanks doors (safe)
- 2º.- Water tanks doors like "speed brake" (pitch down)
- 3º.- Water tanks doors open from rearward to frontward (move C of G)
- 4º.- Tail-pipe thrust vectoring downward (counterweights)
- 5º.- Main wing backward (3 to 5 G,s)



REDROM

RED DE ROBÓTICA Y MECATRÓNICA
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SEIDROB
SOCIEDAD ESPAÑOLA PARA
LA INVESTIGACIÓN Y
DESARROLLO EN ROBÓTICA



Assessing variability and long-term trends in burned area by merging multiple satellite fire products

Table 2. 1997–2008 estimated annual regional and worldwide area burned.

Region	Area Burned ($\times 10^4 \text{ km}^2 = \text{Mha}$)												Mean
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
BONA	0.9	4.5	1.5	0.7	0.3	3.2	2.0	5.0	2.9	1.9	1.5	1.4	2.2
TENA	0.5	1.1	1.8	2.2	1.2	1.4	1.3	0.7	1.7	2.4	2.7	1.5	1.5
CEAM	0.9	3.2	1.3	1.7	1.0	1.0	1.7	0.8	1.9	1.3	1.1	1.2	1.4
NHSA	1.7	2.8	2.0	2.4	2.0	1.1	3.3	3.2	1.8	1.5	2.5	1.8	2.2
SHSA	16.0	38.9	30.9	15.8	19.4	21.3	16.1	18.7	22.1	12.5	33.8	13.4	21.6
EURO	0.4	0.8	0.6	1.2	1.1	0.4	0.9	0.5	0.6	0.5	1.0	0.5	0.7
MIDE	0.6	0.9	0.8	0.6	1.2	1.0	0.9	0.8	0.7	0.9	1.2	0.6	0.9
NHAF	152.4	148.7	143.5	145.9	114.4	126.1	128.0	116.4	139.9	115.2	123.4	117.7	131.0
SHAF	111.6	153.1	123.1	118.3	117.3	113.9	126.6	127.1	134.1	122.2	124.2	131.5	125.2
BOAS	3.1	12.9	4.7	7.2	5.8	8.1	15.9	1.6	2.8	4.3	3.2	12.0	6.8
CEAS	17.4	14.6	8.1	11.0	15.0	25.0	12.8	15.6	15.1	17.5	12.5	14.0	14.9
SEAS	3.9	7.9	9.5	4.5	4.5	7.7	6.3	10.7	7.1	5.9	9.9	7.0	7.1
EQAS	9.4	2.6	0.6	0.4	0.7	2.4	0.8	1.2	1.1	2.7	0.5	0.4	1.9
AUST	40.5	39.0	80.2	81.7	88.3	73.1	29.0	60.4	24.9	53.1	48.7	26.6	53.8
Global	359.6	431.2	408.7	393.8	372.1	385.6	345.6	363.0	356.7	342.0	366.3	329.7	371.2

MARKETING STRATEGY

- Niche market to cover a real need
- Best positioning in the new UAS American and European regulatory frameworks
- Focus on existing technologies
- Positioning of NITROFIREX as convenient technology for investment instead of defense programs
- NITROFIREX is an integrator and seller, not manufacturer
- This makes flexible our production rate and offer the possibility of industrial return to potential customers

SWOT Analysis

STRENGTHS

- Technologies to implement currently developed
- Real need of night forest firefighting capability worldwide
- Patented technology to cover unmanned systems to spread substances on the atmosphere
- Most easily civil unmanned flight operation to be accepted by the regulatory agencies
- Lower operational costs than existing firefighting technologies

WEAKNESSES

- Financial support required to continue with the design
- No demonstrator has been built to show the technology
- The Nitrofirex team is not working on the project full time, despite of being high experienced professionals
- Industrial partners required to finish the design and start the production

OPORTUNITIES

- Utilization of this same technology in other areas with less operational complexity
- Becoming part of the RPAS regulatory legislation board in Europe
- Vertical integration to cover other markets
- Forest firefighting service for Canada and Australia due to their lack in cargo aircraft

THREATS

- Public sector as main customer
- Regulatory framework for UAS in Europe and USA by 2015
- Reaction of firefighting companies that have long term relationships with different Public Agencies and Governments
- Project costs increment due to the implementation of Defense Standards in the design and certification

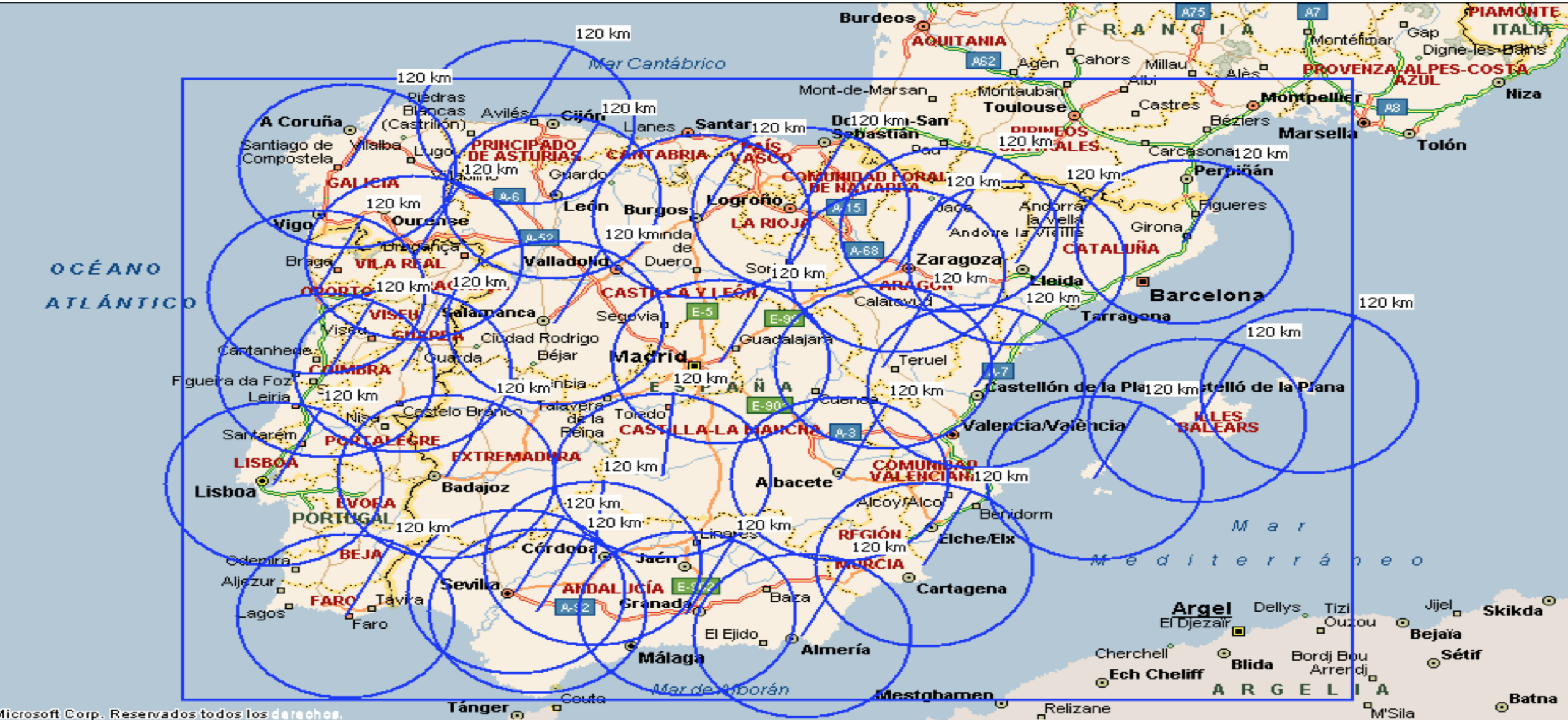
Estimation of AGCs Need per Region

REGION	% DAILY FIRE FIGHTING CAPACITY OF TOTAL BURNT AREA					
	1	1	2	2	3	3
	% OF AIRLIFT CAPACITY	TOTAL A.G.C. REQUIRED	% OF AIRLIFT CAPACITY	TOTAL A.G.C. REQUIRED	% OF AIRLIFT CAPACITY	TOTAL A.G.C. REQUIRED
EUROPE	7,5	227	14,9	422	22,4	650
RUSSIA FEDERATION	19,6	801	39,1	1.593	58,7	2.394
USA	4,6	860	9,2	1.719	13,8	2.579
CANADA	168,4	1.064	334,5	2.113	502,9	3.177
AUSTRALIA	422,2	2.020	841,7	4.027	1.263,8	6.047
		4.972		9.874		14.846
CORRECTED BY ACTUAL FLEET						
CANADA	25,5	161	46,6	295	55,3	349
AUSTRALIA	23,1	111	44,0	211	48,5	232
		2.160		4.240		6.204

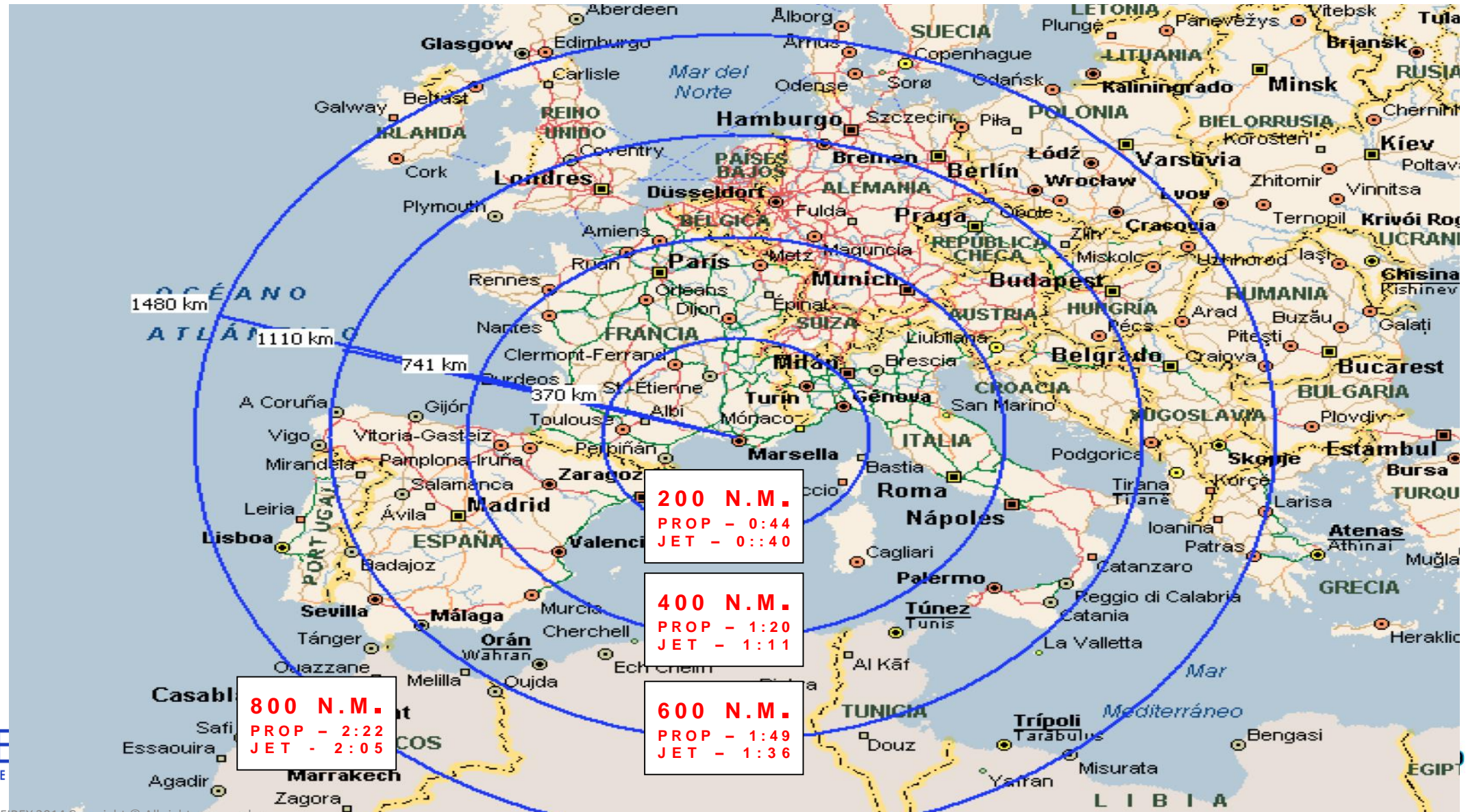
Project Development Costs

- Complete Project Development Budget: 15 – 20 M€
1 CANADAIR CL-415 PRICE: ~25- 30M€
- Project Milestones
 1. Company start up and demonstrator building: 6 months
 2. Fundraising: 4 months
 3. Preliminary design: 6 months
 4. Detailed Design: 8 months
 5. Prototype manufacturing and system real tests: 18 months
 6. Certification: 6 months
 7. Commercialization

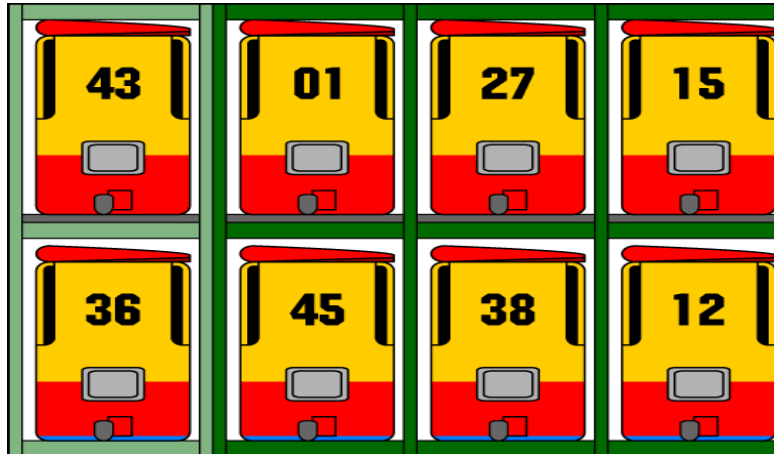
65 N.M. AIRPORT COVERAGE - OPERATIVE BASE



MARSEILLE DEPLOYMENT BASE



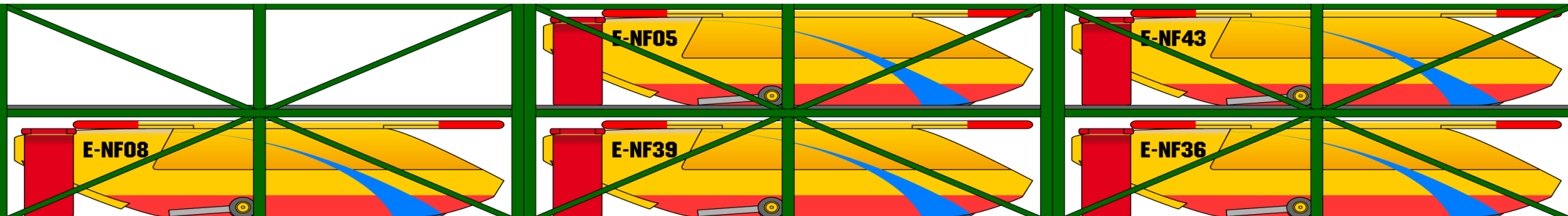
A-400M RACK 4 x 3 x 2 AGC,s



QUICK & SAFE: .- DEPLOYMENT
.- AGC RECOVERY

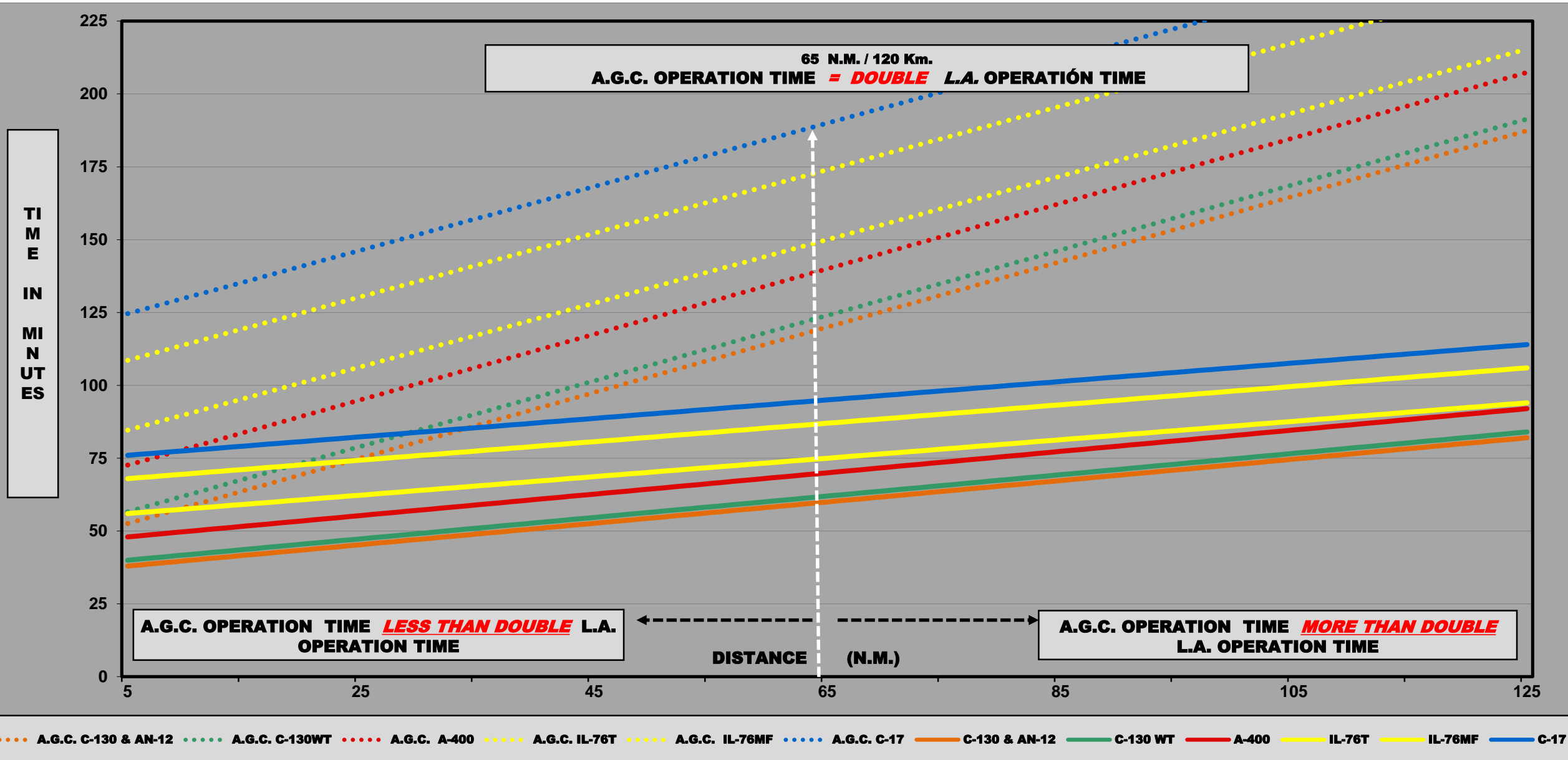
RACK: .- TRASPORT
.- GOUND RECOVERY
.- MODULAR

GROUND RECOVERY:
.-FOLD MAIN PLANE
.- FOLD CONTROL SUFACES
.- FOLD LANDING GEAR
.- STOW IN THE RACK
.- REFUEL WATER & FUEL
.- GROUND CHECK

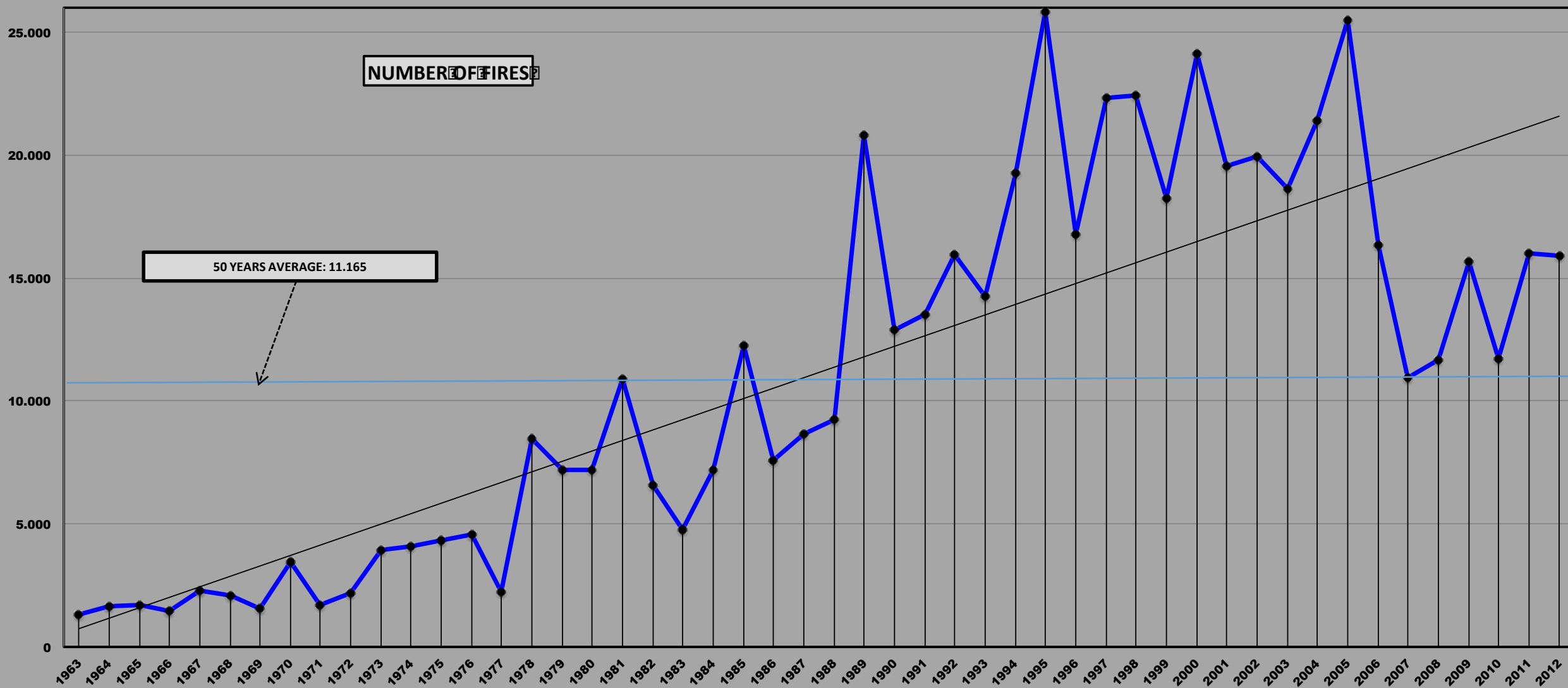


Economical assumptions

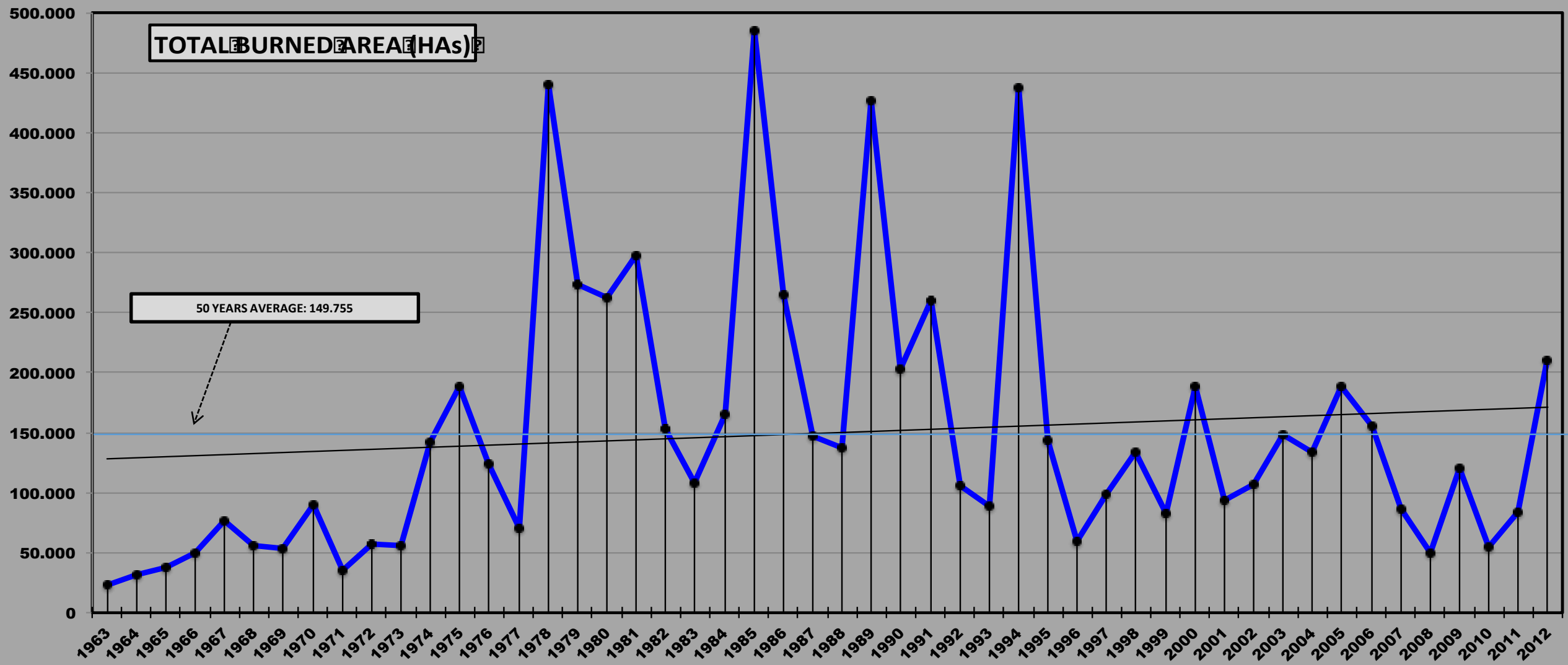
#	Assumption
1	The cost estimation for the project development including prototypes and tests is 18M€
2	The required resources to fully design the system are showed on the Project Annexes
3	The aircrafts sales are based on the 1% cargo fleet usage (pessimistic theater)
4	Maintenance incomes: 5% of aircraft price with first and second echelon maintenance done by the user
5	Maintenance incomes: 8% of Control System Price Per year:
6	Price per engine overhaul: 20.000€
7	Price per mechanic training: 10.000 €
8	Price per pilot training: 15.000 €
9	The Main Office costs are assumed to be the one showed on the Start-up costs
10	The Workshop expenses are assumed to be 144.000 €
11	The production cost per AGC is 200.000 € (based on guided bomb prices)
12	The annual number of AGC sales is estimated as progressive year by year
13	The initial price per AGC is 450.000 €



FORESTFIRE STATISTICS IN SPAIN



FORESTFIRE STATISTICS IN SPAIN



DISTANCE TO THE FIRE : 120 KM. (65 N.M.) // A.G.C. WEIGHT: 500 KG

- **SPAIN AVERAGE OPERATION DROPS BY CL FLEET:** **6.283 DROPS/YEAR**
(YEARS 2002-2012)
(average: 5.344 Liters /Drop)
- **NITROFIREX EQUIVALENT AIR DROPS (C-130 WT) :** **12.209 DROPS/YEAR**
(NITROFIREX: 2.750 Liters)
- **ESTIMATED AGC NEEDS FOR SPAIN :** **100 UNITS**

This means that
6 C-130-WT FLYING 916 H (AT NIGHT)
are equivalent to
22 CL FLYING 1.923 H (AT DAY)
(52,4 % flight time saved)

SEE FILE: MEDIA TIEMPO DESCARGA AVIONES CL MAR-10 (HOJA.: COMPARATIVA CL-A400)

DISTANCE TO THE FIRE : 120 KM. (65 N.M.) // A.G.C. WEIGHT: 500 KG

- **SPAIN AVERAGE OPERATION DROPS BY CL FLEET:** **6.283 DROPS/YEAR**
(YEARS 2002-2012)
(average: 5.344 Liters /Drop)
- **NITROFIREX EQUIVALENT AIR DROPS (A-400M):** **12.996 DROPS/YEAR**
(NITROFIREX: 2.583 Liters)
- **ESTIMATED AGC NEEDS FOR SPAIN :** **100 UNITS**

This means that
4 A-400 FLYING 650 H (AT NIGHT)
are equivalent to
22 CL FLYING 1.923 H (AT DAY)
(66,2 % flight time saved)

SEE FILE: MEDIA TIEMPO DESCARGA AVIONES CL MAR-10 (HOJA.: COMPARATIVA CL-A400)

DISTANCE TO THE FIRE : 120 KM. (65 N.M.) // A. G.C. WEIGHT: 500 KG

- **SPAIN AVERAGE OPERATION DROPS BY CL FLEET: 6.283 DROPS/YEAR**
(YEARS 2002-2012)
(average: 5.344 Liters /Drop)
- **NITROFIREX EQUIVALENT AIR DROPS (C-17) : 12.341 DROPS/YEAR**
(NITROFIREX: 2.720 Liters)
- **ESTIMATED AGC NEEDS FOR SPAIN : 100 UNITS**

This means that
2 C-17 FLYING 317 H (AT NIGHT)
are equivalent to
22 CL FLYING 1.923 H (AT DAY)
(83,5 % flight time saved)

SEE FILE: MEDIA TIEMPO DESCARGA AVIONES CL MAR-10 (HOJA.: COMPARATIVA CL-A400)

POSSIBLE USES OF THE CONCEPT

	FOTREST FIRE FIGHTING	OTHERS FIRES	NUCLEAR, CHEMICAL, BIOLOGICAL EMERGENCY	METEOROLOGICAL PHENOMENA	DRUG PLANTATION SPRAYING	PESTS SPRAYING or SEEDING
MAX URGENT	-2	-1	-1	-1	0	0
OPS CLOSET AEPTO	-2	-1	-1	0	0	0
FAST RECOVERY	-2	-1	-1	0	0	0
COORDINATION	-2	-1	-1	-2	0	0
DROPS PRECISION	-2	-2	-2	-1	0	0
DROPS OVERLAP	-2	-1	-1	0	0	0
NON STOP	-2	-1	-1	0	0	0
	-14	-8	-8	-4	0	0