

THE BE-200ES FIREFIGHTING AMPHIBIOUS AIRCRAFT EFFECTIVENESS DURING THE FIRE SEASONS 2004÷2011 YEARS IN THE EUROPEAN UNION COUNTRIES

Duritsyn D.*, Ternovoy A.*, Krivinosova D.*, Sokolyansky V.**
***Beriev Aircraft Company, **Central Aerohydrodynamical Institute, TsAGI**

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Abstract

The article objective is to present generalized statistics about effectiveness and productivity practically reached by the Be-200ES firefighting amphibious aircraft during the fire seasons 2004-2011 years in the European Union Countries. Peculiarities of firefighting operations in the Italy, Portugal, Greece and France are described here for the better understanding of amphibious aircraft operation conditions.

Productivity data for the Bombardier CL-415 and the Beriev Be-200ES firefighting amphibious aircraft are compared in the article.

1 Introduction

International experience in wildfires suppression activity confirmed that a key factor for successful fighting such disasters is an ability for rapid localization and suppression of fires at the early stages of their propagation.

Firefighting aircraft are the most efficient water / suppressant (extinguishing liquids) delivery systems for wildfire suppression at the moment when quick and effective early response during the first minutes and hours of disaster predicts firefighting operation success. Especially at the beginning stages of wildfire propagation, firefighting amphibious aircraft can provide the highest suppression results due to water / suppressant delivery to a wildfire zone by means of water scooping from a nearby water resources and making repeated drops on a

wildfire without having to return to airbase for water reload. To demonstrate the above, the results of experimental and commercial operations of the Be-200ES firefighting amphibious aircraft, equipped with special high speed water scooping system able to take into and drop up to 12 t of water / suppressant [1, 2], are presented below in this article.

2 Firefighting report and aircraft productivity data

Wildfires statistics related to the firefighting amphibious aircraft Be-200ES operations during the fire seasons 2004÷2011 years in the European Union countries (Italy, Portugal, Greece and France) allows to:

- generalize statistical data;
- determine high hour productivity of the Be-200ES firefighting amphibious aircraft and
- evaluate effectiveness of the CL-415 firefighting amphibious aircraft, Bombardier Aerospace (Canada) in comparison with the Be-200ES.

Nowadays these two aircraft are amphibians only especially designed and built by aerial firefighting industry for the world aviation market.

Generalized statistics on wildfires suppressed by the Be-200ES firefighting amphibious aircraft in the mentioned fire seasons is specified below in the Table.

Table

Year	2004	2005	2006
EU Country	Italy	Italy	Portugal
Amphibious aircraft Register number	Be-200ES RA-21512	Be-200ES RA-21512	Be-200ES RA-21512
Operator	Beriev	Beriev	Beriev
Pilots	Beriev, Sorem	Beriev, Sorem	Beriev, Emercom
Wildfires	4	33	33
Dropped water, t: to wildfire; total, incl. training flights	324.1 1818.4	2624.5 3594.6	2112 2112
Total flights, incl. firefighting, training and patrol flights	46	63	33
Water scoops	255	435	256
Firefighting flight hours, h	87	133	92
Year	2007	2007	2011
EU Country	Portugal	Greece	France
Amphibious aircraft Register number	Be-200ES RA-21517 RA-32516	Be-200ES RA-32768 RA-21512	Be-200ES RA-21512
Operator	Beriev	Beriev	Beriev
Pilots	Emercom, Beriev	Emercom, Beriev	Beriev
Wildfires	58	15	3
Dropped water, t: to wildfire; total, incl. training flights	2560 2767.9	- -	134 1387
Total flights, incl. firefighting, training and patrol flights	58	15	36
Water scoops	342	127	185
Firefighting flight hours, h	130	45	4.35

The wildfires in reference considerably differed from each other by their origin and weather conditions when firefighting operations were performed. Considering landscape peculiarities, wildfires are characterized as plain fires, hill fires, mountain fires at altitude up to 1300 m above sea level. Depending on the type of vegetation being burned there were grass and bush fires, forest fires. Complexity of wildfires varied from the lowest category up to the highest one due to such parameters as the speed of fire propagation, the combustible material present, and the weather condition. Part of

wildfires took places at the nearest surrounding areas to urban territories. The Be-200ES firefighting amphibious aircraft demonstrated ability of quick suppression and fire propagation control without urban infrastructure damages.

Water scooping conditions on lakes, sea bays and at the sea shore of the Mediterrian Sea and the Atlantic Ocean are varied from calm to rough with wave height $H_w = 0.2 \div 0.8$ m and swell with wave height $H_w = 0.1 \div 0.6$ m, including mixed roughness at the sea. In percentage it is can be noted that water scooping procedures were performed by amphibians at the following sea state conditions: at wind roughness – 85%; at mixed roughness – 14% and at swell – 1%. Diagram (Fig. 1) represents sea state conditions occurred during firefighting operations, which were performed by the Be-200ES amphibious aircraft. It is necessary to point out that 88.4% of water scoops were performed at conditions closer to calm and at sea wave height up to 0.25 m. Only in a few cases the Be-200ES amphibious aircraft were operated at the upper limit of its seaworthiness ($H_w=1.25$ m).

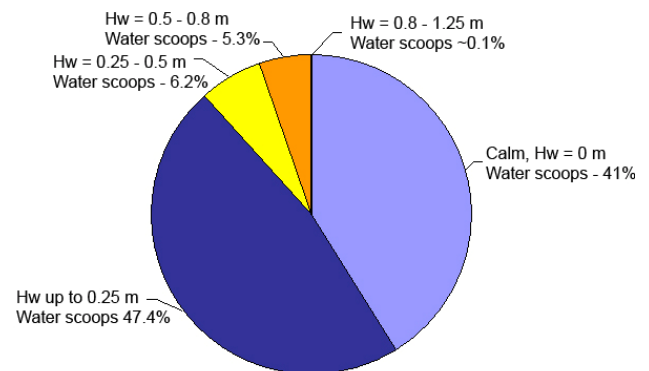


Fig. 1. Sea State Conditions At Water Scooping

Distances from wildfires to firefighting aircraft airbase had a wide range (Fig. 2). Maximal distances varied in a range of 380÷700 km in Italy. Due to the fact of high cruise speed ($V_{max} = 680$ km/h) the Be-200ES firefighting amphibious aircraft could provide early response and effective fire suppression even for such remote sites of wildfires.

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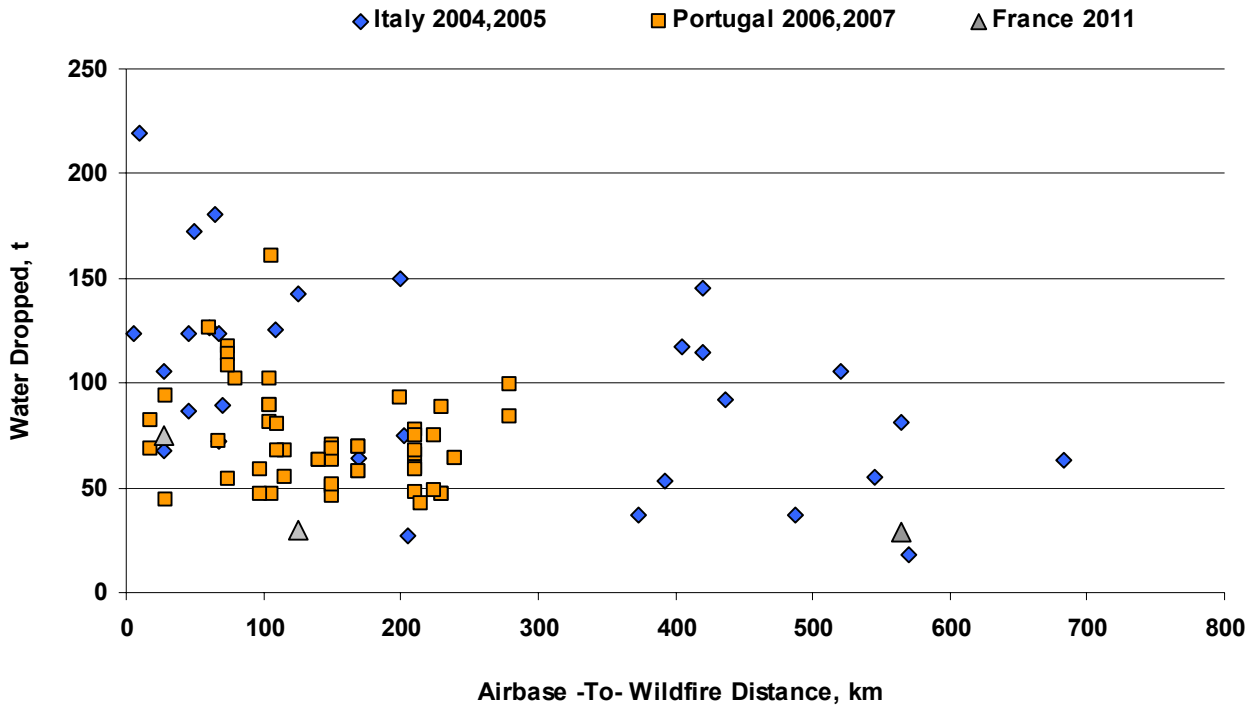


Fig. 2. Water Dropped Amount Depending On Airbase-To-Wildfire Distance

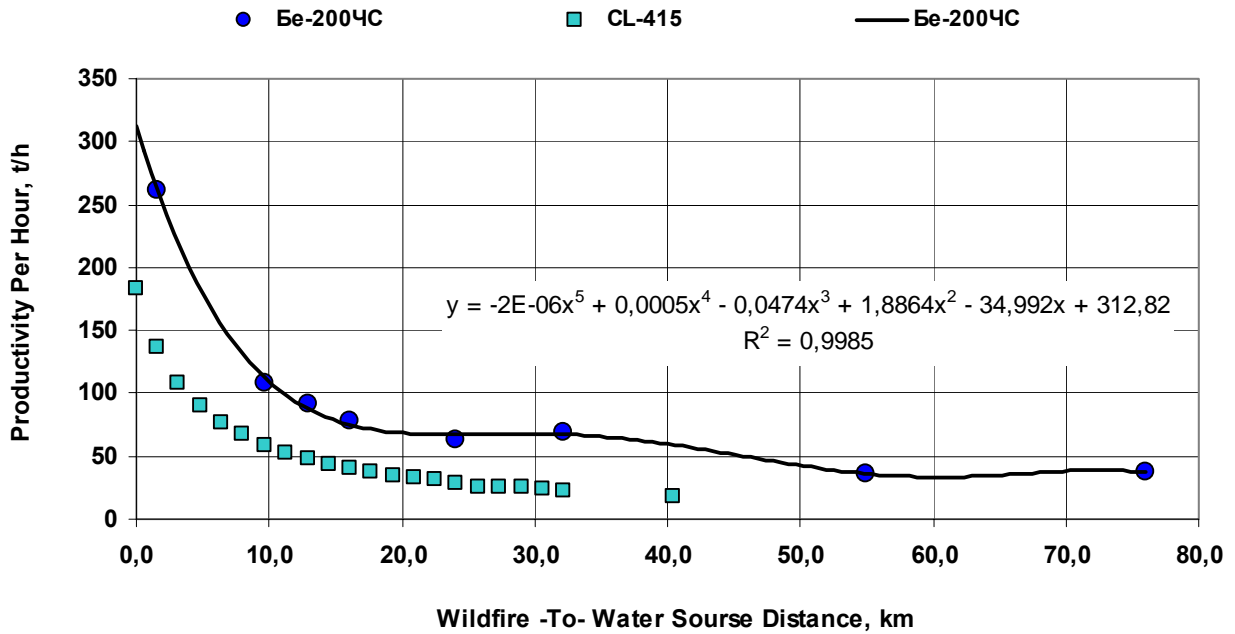


Fig. 3. Be-200ES And CL-415 Productivity Per Hour Depending On Wildfire-To-Water Source Distance

Mentioned wildfire statistics data depending on distance between fire and water source for water scooping were used while determining upper levels of Be-200ES practically reached productivity (training flights are not taken into account). Fig. 3 indicates maximal productivity per hour of the Be-200ES firefighting amphibious aircraft. This figure also contains an hour productivity data of the CL-415 turboprop firefighting amphibious aircraft by Bombardier Aerospace [3, 4]. Be-200ES productivity per hour is more than 2÷3 times higher in comparison with CL-415 productivity per hour at comparable conditions. It is remarkable feature that Be-200ES operation has an advantage when water source are located far from wildfire (more than 30÷80 km). Since CL-415 has the maximal flight speed twice as little about its suppression effectivity is much lower especially in a time when valuable early response to wildfire is required.

Are there ways to increase productivity of the Be-200ES firefighting amphibious aircraft?

Possibilities of special high-speed water scooping system (SWSS) allow to point out the following directions of works for SWSS:

- increase water scooped volume up to 14 m³ through inner water tanks structural space optimization (estimation in productivity up to plus 7÷9% up);
- improve dropping coverage in length at prescribed level of ground coverage density by means of implementation a controlled flow rate technology in SWSS system. According to investigation performed by TsAGI (Central Aerohydrodynamic Institute, RU) a controlled flow rate technology gives 40÷60 % increasing in length at single water drop (not subsequent water tanks door openings) [5].

Given the limited time period of commercial and experimental operations during the fire seasons 2007÷2011 years, it is rather impressive that the Be-200ES firefighting amphibious aircraft were well integrated in the existing European airports infrastructure and aircraft operational system supported by different government operators and private airlines engaged in in the aerial firefighting.

The amphibious aircraft demonstrated all their performance and capacity at different landscapes of wildfires including mountain areas (Fig. 4). Having amphibious possibilities, excellent speedy and maneuvering performance, high thrust-to-weight ratio and significant drop water load (12 t), nowadays the amphibian Be-200ES became the most effective firefighting aircraft at the world firefighting aviation market.



Fig. 4. Wildfire Water Drop Performed By The Be-200ES Firefighting Aircraft At Maneuvering In Mountainous Area

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