

## Transportation of 155-ton Transformer

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**Abstract:** This is the **heaviest transformer** ever to be transported by air. It weighs **155 tons** – the equivalent of 135 medium-size cars – and has been specifically designed so that the Antonov can carry it. The amount of energy transmitted by the transformer, when operating at full capacity, is enough to power 65,000 households. That's equivalent to a city of over 200,000 inhabitants. **Bolloré Logistics**, Colbun, Antonov and ABB was involved in the transportation of this 155-ton transformer. Nelson Figueroa, director of the industrial projects division at Bolloré Logistics Chile, said: "This shipment was the heaviest single piece ever airlifted in the Americas, and the second heaviest in the history of aviation."

**Keywords-**Heaviest transformer, 155 tons, Bolloré Logistics.

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### I. Introduction

This paper tells us how the 155-ton transformer was transported by air, what are all the operations involved in transporting the transformer, the risks and difficulties faced by the Bolloré Logistics, Colbun, Antonov, ABB in transporting it and moreover we will come to know about the supply chain management, operations management, project management, etc which was very effective in those companies which made a record of World First Heavy-lift Transport on American Continent.



Figure 1

### II. Worlds Largest Freighter

A complex trio of freighter charters co-ordinated by Bolloré Logistics Chile utilised an An-225, a Boeing 747 and a MD-11 to transport a 155-ton transformer and additional parts to Santiago in Chile. The November 2016 charter saw the transformer begin its journey with a seven km road transport from an ABB facility in Brazil to São Paulo Guarulhos airport, on behalf of Colbun, a Chilean power generation company, in preparation for its An-225 flight to Santiago. The Antonov An-225 was designed by the Antonov Design Bureau in the Ukrainian SSR within the Soviet Union during the 1980s. It is powered by six turbofan engines and is the heaviest aircraft ever built, with a maximum takeoff weight of 640 tonnes. The Antonov An-225, initially developed for the task of transporting the Buran spaceplane but over the years, it became the most efficient air transports solution for mega structures.



Figure 2

### III. Frame

The concentrated weight of the transformer required a weight distribution frame for its flight from Guarulhos, adding an extra 27 tons to the original piece. The weight distribution frame, consisting of parts up to 16.20 m long, first needed to be transported from Luxembourg on a chartered B747 nose-loading freighter to Viracopos where it would then be transported to Guarulhos by the An-225. At Viracopos the frame was customs cleared and re-assembled in a little over seven hours. The assembled frame was placed on board the An-225 and flown just 110 km on a 30 minute flight to Guarulhos. The transformer was then mounted onto the frame, just a few meters away from the giant aircraft, the world's largest freighter. After 15-hours of overnight work, the complete unit – with a total weight of 182 tons – was loaded onto the An-225, which then departed to Santiago, where the entire consignment was unloaded in just over three hours. This was an extremely complex and challenging operation which required over four months of thorough preparation.

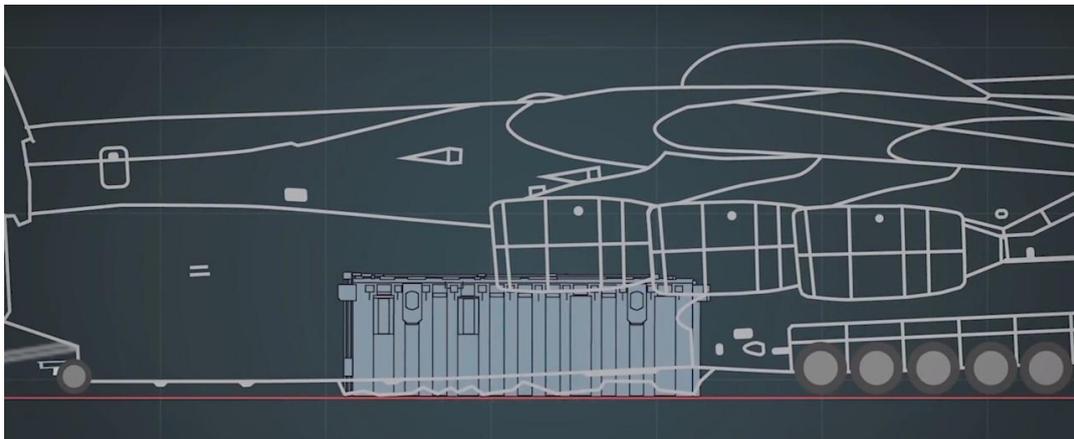


Figure 3

### IV. Project handling

The Projects teams of Bolloré Logistics Chile handled the transportation of a 155-ton transformer from São Paulo, Brazil, to Santiago, Chile, using the Antonov An-225, the world's biggest airplane. This massive operation was conducted from the facilities of technology leader ABB in Guarulhos (GRU), Brazil, and was completed at Bolloré Logistics Chile's client Colbún's facilities, a Chilean power generation company. The loading operations took place at two airports in São Paulo, namely Viracopos (VCP) and Guarulhos. In fact, the current airport congestion and customs requirements were preventing the full implementation of operations at the airport of Guarulhos. Also, the runway at the airport of Viracopos not being long enough, it was impossible to let the An-225 to take off fully loaded with this historic weight.

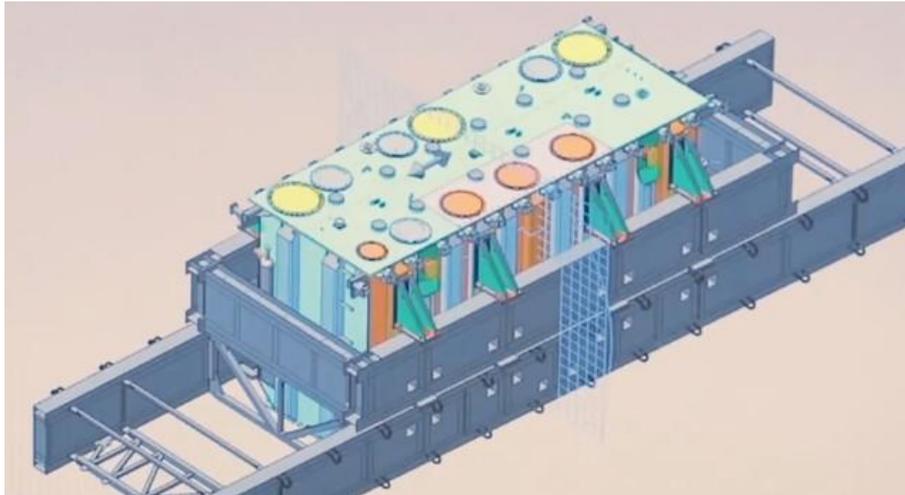


Figure 4

### V. Loading of assembled frame

The body of the transformer weighting 155 tons was handled at the premises of the supplier, ABB, in Guarulhos on November 7th and was transported over 7 km the following night under police escort, to reach the Guarulhos airport. The weight of the transformer being so concentrated, it required a weight distribution frame, adding an extra 27 tons to the original piece. This very special equipment consisting of parts up to 16.20 meter long was delivered in Viracopos, all the way from Luxembourg, by way of a Boeing 747 Nose- Loader, specially chartered for the occasion. The frame was then customs cleared and completely assembled at Viracopos, in a little over seven hours. On November 14th, a McDonnell Douglas MD-11 was also chartered from Guarulhos to Santiago International Airport (SCL), in order to transport the 42 tons of accessories measuring 5 meter long and 2.20 meter high. On that same day, the Antonov arrived in Viracopos to load the assembled frame and transport it to Guarulhos, a mere 30-minute flight (110 km), where it was unloaded.



Figure 5

### VI. Unloading Operations

The transformer, delivered and customs cleared a few days before, was successfully mounted onto the weight distribution frame, just a few meters away from the aircraft. On November 15th, after a long 15-hour of overnight work, the complete unit - with a total weight of 182 tons - was loaded onto the An-225, and departed to Santiago. Finally, the unloading which lasted for over three hours, marked the end of this massive project. These successful operations clearly demonstrate the expertise of the Industrial Projects teams of Bolloré Logistics to lead large projects, from the planning to the implementation phases.



Figure 6

### VII ABB and Colbun

ABB designed and manufactured the transformer for Colbún, one of Chile's leading electric utilities. It would normally take from 6 to 12 months to design and manufacture this type of power transformer, but ABB was determined to support Colbún with their urgent need and deliver it in just four months. It was decided to fly the transformer down as transportation by sea would have taken about six weeks longer. ABB designed and manufactured the transformer at its Guarulhos factory in Brazil, which is located close to the international airport. The factory is one of more than 70 transformer factories that ABB operates worldwide. The production was completed ahead of schedule and the transformer's design adapted to enable it to fit inside the plane's hold and remain safe and secure throughout the flight. When loaded the height clearance from the airplane roof was less than 50 millimeters! As soon as it arrived, the transformer was transported by road from Santiago Airport to the substation where it was energized in quick time and is since bringing reliable power to the people.

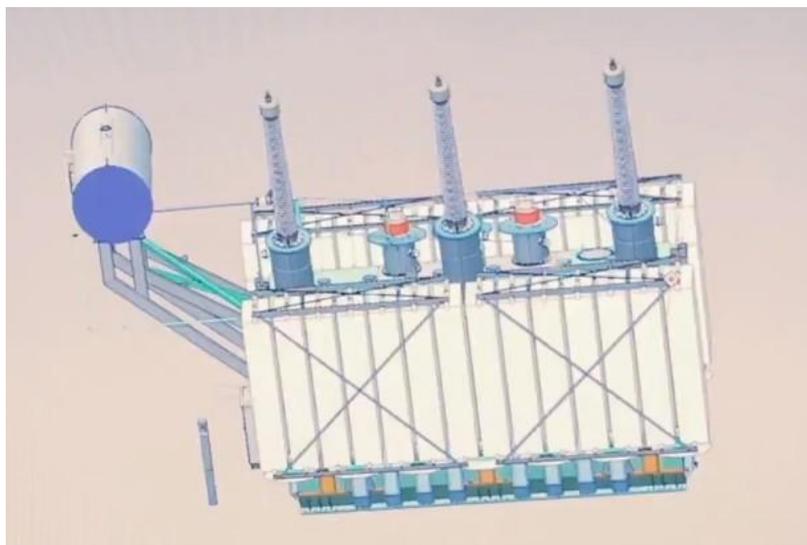
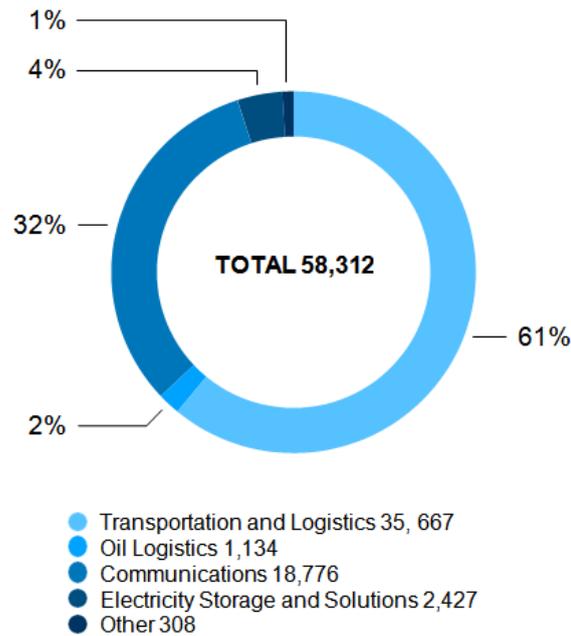


Figure 7

### VIII Bolloré Transport & Logistics

Bolloré Transport and Logistics is one of the world's leading transportation groups with 36,000 employees spread among 105 countries throughout Europe, the Americas, Asia and Africa where it carries out its business activities in ports, freight forwarding and railroads. It is a major player in oil logistics in France and Europe. Bolloré Logistics meets the demands of importers and exporters, be they large groups requiring complex supply chain management solutions, or small- and medium-sized companies requiring assistance with their international consignments. It has a turnover of 3.4 Billion Euros, with an Industrial investments of 62 Million Euros. The volumes handled by air freight was 580 thousand metric tons and by maritime was 844 thousand containers (TEUs).



**Figure 8.** BREAKDOWN OF WORKFORCE AS OF DEC 31, 2015 BY BUSINESS

### IX. Conclusion

We came to know how difficult it was to transport the 155-ton transformer through air. Just because of the Operation management, Project Management and supply chain management, etc of the company has been very effective and the transportation of the transformer has been successful.

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