

# The bend at Angrois (A)

## Crisis management in a railway accident

On Wednesday 24<sup>th</sup> July 2013, a train from Madrid headed for Galicia (Spain's northwest corner) derailed and crashed into a wall near the small village of Angrois, about three kilometers from the station at Santiago de Compostela. On board were 218 passengers and a crew of six. 145 people were injured and 80 were killed: these figures make this the second most important accident in the history of the railways in Spain.<sup>i</sup>

This case study analyses the social, political, and economic contexts of the event, and the chain of decisions which brought it about and the institutional response to the tragedy which has left an indelible mark on the history of rail transport in Europe.

### ***Finis terrae***

Tradition has it that Jacob Bar-Zebdi, one of the 12 apostles of Jesus Christ, preached the gospel in the Roman province of Hispania. After almost a decade, in the year 43 of our time, he returned to Jerusalem, where he was executed by King Herod, who in addition forbade his burial. In secret, his disciples recovered his body, placed it in a casket and sent it by sea back to *finis terrae* (Land's End), the most westerly point of the known world at that time.

They sailed round the Iberian Peninsula until they arrived at the port of Iria Flavia, the capital of Roman *Gallaecia*, and from there they took the body to a nearby wood called *Liberum Donum*, where they buried the casket and raised an altar. It was a period when Christians were being persecuted and, in time, the existence of the tomb was forgotten.<sup>1</sup>

Almost eight centuries later, in the year 813, a hermit named Pelayo observed a starry splendence near his house at the foot of Mount Liberon. He informed the bishop of Iria Flavia, Teodomiro, who, guided by the shining lights, discovered a stone with the following inscription: "Here lies Jacobus, son of Zebedee and Salome"<sup>2</sup>. King Alfonso II visited the site and proclaimed Sanctus

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<sup>i</sup> The railway accident with the highest number of fatalities which had happened up to that moment in Spain occurred on 3<sup>rd</sup> January 1944, when a packed passenger train collided with a locomotive in a tunnel near the Torre del Bierzo station in Leon province, with an outcome of about 500 deaths. Cf. Vicente Fernández Vázquez (2019), *La verdad sobre el accidente ferroviario de Torre del Bierzo (1944)*, IEB.

Jacobus to be the patron of the kingdom. He ordered that a shrine be built at that *campus stellae* (field of stars) which was later to become the cathedral at Santiago de Compostela.

The tomb became the destination of pilgrimages from all over Europe and the St. James Way (the Camino) developed into an important route of cultural, artistic, and commercial exchange in the Middle Ages. Over a thousand years later, pilgrims from every continent continue to visit the tomb, at times after covering enormous distances on foot, by bicycle or on horseback.

The time when most people visit the shrine is around St. James feast day, on 25<sup>th</sup> July. That date is also the Day of Galicia, one of the 17 autonomous communities of Spain, located in the north-west of the Iberian Peninsula and bathed by the Atlantic Ocean (**Exhibit No. 1**). Galicia covers an area of about 30,000 square kilometers – like the size of Belgium – and has a population of 2,700,000 inhabitants, which tends to be mainly rural: just over half the population live in municipalities of fewer than 5,000 people.<sup>3</sup>

Galicia is separated from the rest of the country by a mountain range which, until as recently as a generation ago, had been a huge obstacle to any kind of ground transport. Narrow, winding roads, often in need of repair, used to make the journey from Madrid to the coast of Galicia an interminable affair, often requiring an overnight stop.

For centuries, this isolation meant that the economy of the region was fundamentally primary, with industrial and economic development lagging behind that of other regions. This situation of economic backwardness was a factor which boosted emigration. In 2023, almost 140,000 people born in Galicia were resident abroad<sup>4</sup> and almost 400,000 more, children of parents from Galicia in the diaspora, held Spanish passports and considered themselves as natives of Galicia, especially in the Argentine, Brazil, Cuba, Switzerland, and Uruguay.<sup>5</sup>

The improvement of roads, both the internal network and its connection with the national grid, which had begun in the nineteen eighties thanks to finance from Europe, brought industrial development to the region and reduced the centuries-old economic differences.

Today, apart from agriculture, livestock farming and fishing, other sectors contribute to economic growth: the automotive industry, renewable energies, and the textile industry. In respect of textiles, special mention must be made of the largest company in Galicia, the fashion giant Inditex, matrix of the Zara brand. In 2013, the per capita GDP in Galicia was 20,399 euros, halfway between the richest autonomous regions in Spain (the Basque Country, with 29,959 euros and Madrid with 28,915 euros) and the poorest (Extremadura, with 15,026 euros).<sup>6</sup>

However, the development of railway infrastructure was noticeably behind that of other autonomous regions. The old railway network depended heavily on level crossings many of which were in urban settings; Galicia often ended up getting the leftovers in rolling stock which had been declared obsolete in other areas.<sup>7</sup> In 2010, the Madrid to Santiago train took over 8 hours to cover the 600 kilometers separating the two cities, while trains on the Madrid to Barcelona line covered an equivalent distance in just over 4 hours and the Madrid to Cadiz train took just four and a half hours to cover 645 kilometers.

## The Spanish railway system

In 2013, the Spanish railway sector was managed by two different state-owned companies: Adif which oversaw building, administering and the upkeep of infrastructures and the management rail traffic; and Renfe, responsible for providing passenger and freight transport services.<sup>8</sup>

Up until 2005, Adif and Renfe were united, but European regulation regarding the liberalization of the rail sector meant that the State had to separate them into two different entities.<sup>ii</sup> Adif builds, maintains and administers the infrastructure, which it leases to any authorized operator; its main client – but not the only one – is Renfe, which transports people and goods.<sup>iii</sup>

Both companies used to depend on the Ministry of Development, which was responsible for the infrastructures of ground, air, and maritime transport, and of the management, control and regulation of public and private services.

The first High Speed Train line (HST line) between Madrid and Seville was opened in 1992 by President Felipe Gonzalez (1987-1996). In the year 2000, President José María Aznar (1996-2004) presented an ambitious project to connect all parts of the country with this type of line, the idea being that no provincial capital should be more than 4 hours away from Madrid. From 2005 onwards, the project continued under the presidency of Jose Luis Rodriguez Zapatero (2004-2011), who, in 2008, inaugurated the HST line Madrid-Barcelona and approved plans for the line to Galicia (**Exhibit No. 2**).

## The High-Speed Line and Galicia

In the same way as the road system, the rail line to Galicia had to overcome the same orographic obstacles. Railway lines, and especially in the case of HST lines, require routes with open curves and gentle gradients. To build lines of these characteristics in mountainous areas demands the almost continuous use of tunnels, viaducts and earthworks and converts projects into formidable engineering challenges. To give an example, 60% of the line between Orense and La Coruña consists of tunnels and viaducts.<sup>9</sup>

But orography was not the only factor causing delay. Almost all the HST lines in Spain have had to cross mountain ranges and complicated and expensive sectors. In fact, the Madrid-Barcelona and the Madrid-Valencia lines were more expensive than the line to Galicia.<sup>10</sup> The main obstacle has in fact been a consequence of the peculiar Spanish political system.

Unlike other countries, political parties of a local nature, which defend exclusively the interests of their regions, can be present in general elections and win seats in the parliament. This is what has happened with two of the richest regions: the nationalist parties of Catalonia and the Basque Country have been able, since the return of democracy to our country, to consistently secure something like 8% of the seats in parliament.<sup>11</sup>

Because usually 15 or more parties obtain parliamentary representation in any election, the dispersal of votes makes it very difficult for any one party to obtain an absolute majority. This means that this 8% has conditioned every Government since 1993: except on two occasions, the winner of the elections has had to pact with the nationalists to form a government and govern. In return for their support, these regions have received more competencies, fiscal benefits, and, as far as the present case is concerned, preference in respect of infrastructure investment.

For external observers, this problem could be solved through agreements between parties with representation throughout the country to ensure territorial balance and the same rights, obligations, and taxes for all citizens.<sup>12</sup> However, the new left in Spain considers national unity to be a “conservative concept” and as a result systematically supports the demands of the nationalist

<sup>ii</sup> The separation was established in the Law of the Rail Sector (39/2003) and came into force on 1 January 2005.

<sup>iii</sup> The liberalization became effective in December 2020. In the following years, the French company Ouigo and the Hispano-Italian consortium Iryo began to operate passenger services in Spain, although at present (2023) they have concentrated on the lines with highest passenger traffic that is Madrid-Barcelona and Madrid-Valencia. Cf. Comisión Nacional de los Mercados y la Competencia, *Informe Sector Ferroviario 2021*, 10 November 2022.

parties, even when those demands increase the imbalance between the rich and poor regions. In fact, in the least industrialized region (Extremadura, with a GDP which is barely half that of the Basque Country, Madrid or Catalonia) the party which has won most votes has been the same Socialist party whose government subordinated its legislative action to the demands of the nationalist parties. On the other hand, the conservative executive of Mariano Rajoy, despite governing alone between 2011 and 2015, did not correct any of the budget imbalances among regions since the party considers itself to be “center-right, progressive and moderate”<sup>13</sup> and tries to avoid being perceived as “centralist conservative”.<sup>14</sup> Far from improving, the problem has become aggravated over time.<sup>iv</sup>

Like Catalonia and the Basque Country, Galicia is one of the three historic Spanish communities with its own language and culture. Despite this, Galician nationalism has not been a conditioning factor in national politics. On the contrary, this community has been the principal electoral stronghold of the (conservative) Popular Party (PP). Having no rivals on the right, it has made its own most of the principles of Galician nationalism and has won eight out of the nine autonomous regional elections held since 1978.<sup>15</sup>

For all these reasons, infrastructure in Galicia has never been a state priority. When the left governs in Madrid, they know that whatever they do, they will probably never win in Galicia; when the right governs, they know that whatever they do, they will probably never lose Galicia.<sup>v</sup>

As a result, Galicia has had to wait until well into the twenty first century to see the modernization of its antiquated rail network. The first internal line to be renovated, between La Coruña, Santiago de Compostela and Orense, was opened in December 2001; and the connection to the national network was completed in December 2021,<sup>vi</sup> almost 30 years after the HST line Madrid-Seville.

The same situation, but in reverse, happens in Extremadura, an electoral stronghold of the socialist party (PSOE): the first internal “fast train” (89 KPH) was inaugurated in July 2022,<sup>16</sup> while an HST connection with Madrid is still on the drawing board.<sup>17</sup>

Seriously tarnished by their inadequate handling of the economic crisis which began in 2008, the then president, Rodríguez Zapatero, refused to acknowledge that there was a crisis until the public accounts imploded<sup>18</sup> and the European Union forced his government to freeze pensions, reduce salaries in the civil service and make drastic cuts in the social programs which had been his flagship measures.<sup>19</sup> In the private sector, unemployment shot up and broke records; in over

<sup>iv</sup> In fact, the message has spread to other autonomous regions and even to single provinces: the only way to avoid losing out in the distribution of investment is to have seats in parliament and leverage in the formation of the government, however few those seats may be. Cf. Laura Carnicero, “Teruel Existe apoya los presupuestos del Estado tras aumentar en 20 millones las inversiones en la provincia”, *El Periódico de Aragón*, 24 November 2021; “Coalición Canaria, PRC y Teruel Existe esperan mejorar los presupuestos para sus territorios”, *La Vanguardia*, 26 October 2022.

<sup>v</sup> Information regarding infrastructure investments in the National Budget is not designed (to put it mildly) so as to be easily accessible to citizens so that they can draw their own conclusions, it has not been possible for the authors of this case study to demonstrate the existence or not of a cause-effect relationship between the different investments in one region or another and the reasons for those differences (for example, density of population, international agreements, etc.), so the quest is open to research and to public discussion. In this study we just point out the correlation between the lesser importance of votes in Galicia and the delay in carrying out projects and the budgetary cuts in their implementation.

<sup>vi</sup> At the time of closing this case study, the 400-kilometer journey from Madrid to Orense can be made by AVE (Spanish HST) with sectors at 300 KPH in 2 hours, 15 minutes, or in Alvia (at a maximum speed of 250 KPH) in 2 hours, 35 minutes or more, according to the number of stops. From Orense to Ferrol, the line is standard gauge on which only Alvia trains can run. The journey from Madrid to Ferrol by Alvia takes 5 hours, 12 minutes.

4 million Spanish households, almost a quarter of the total, all members were unemployed.<sup>20</sup> It was inevitable that these measures would have an impact on the elections.<sup>vii</sup>

To avoid an electoral debacle, Rodríguez Zapatero's executive had to fight in every corner of the country with all the resources they could muster. Their trump card in Galicia was José Blanco, the (Galician) Minister of Development. The ministry, responsible for infrastructure, provided him with ample opportunities. He announced the long-awaited ring road for Santiago, the enlargement of the Rande Bridge over the Vigo Estuary,<sup>21</sup> and, as the main dish, ending the decades of dallying and unfulfilled promises by bringing the HST to the region.<sup>22</sup>

The HST Project for Galicia went overnight from being the ugly duckling to become the star of the program: it had to be inaugurated before the elections, come what may. But the speed of construction of this type of railway in those days meant that it would have taken 12 years, and furthermore the moment was one of containing public spending not expanding it. The only solution – to be able to build and use the Galician sectors without waiting for the Madrid sector to be finished – meant modifying the project.

## Quick and cheaper

Some of the modifications, such as the duplication and electrification of the lines between Santiago and La Coruña, improved the project but others turned out to be very bad ideas:

### a) Two gauges

The conventional rail network in Spain and Portugal has a gauge which is different from that of the rest of Europe and is called the Iberian Gauge.<sup>23</sup> From 1998 onwards, new lines, including the HST lines were built with the international gauge, which permitted both uninterrupted trans-frontier transit and the use of locomotives and rolling stock certified in other countries.

The first cutback in the project entailed the use of some sections of the old track of conventional lines. These sections had to maintain the Iberian gauge in order not to strangle freight traffic with the rest of the country. The HST to Galicia would therefore have gauge changes over the length of the route. At the time, the modification was defended as a provisional solution, but changes are unlikely to happen in the medium term, as Adif confirmed some years later.<sup>24</sup>

### b) Different trains

The fact that there were sections of the track of different gauges or without electrification meant that a type of train different from the rest of HST would be necessary. Blanco's ministry set about the creation of a new model – the Talgo S-570, an electric train of variable gauge incorporating a diesel generator car (the so-called CET – coche extremo técnico) to power traction and on-board services in un-electrified sections.

The train would be composed of front and rear power cars each accompanied by its own generator car, eight passenger cars (one less than in the original solution) and a dining car. The generator cars were much heavier and had a higher center of gravity than the other cars; these factors had considerable impact on weight distribution and the dynamics of the train. It could no longer be considered a light train, such as those on the other Spanish HST lines.<sup>25</sup>

<sup>vii</sup> In 2011 there were almost 9 million pensioners in Spain and 3 million public employees. These two groups made up almost 35% of the electoral roll. Cf. "[Mercado laboral y retiro](#)", Instituto Nacional de Estadística, November 2012; and Marga Castillo, "[Así ha cambiado el empleo público en España en una década](#)", *Expansión*, 8 November 2017.

This train design modified a well-integrated electrical light train, in which passenger cars were replaced with heavy diesel generator cars. It soon began to be known by drivers as *Frankenstein*.

### **c) An incomplete safety and security system**

The conventional rail lines in Spain used a driver support system called (ASFA – Announcement of Signals and Automatic Braking, in Spanish), introduced in 1970 and which was updated periodically.<sup>viii</sup> Other European countries had similar systems which, however, worked in different ways. This made trans-frontier traffic difficult since it was necessary to equip trains with different reading devices, which had to be certified in each country; and train drivers had to study and be certified in different warning systems in many languages.

To eliminate these barriers and organize a uniform rail traffic control system, the EU promoted the creation of a new and much more modern safety system, called ERTMS (European Rail Traffic Management System). All HST lines in Spain and in the rest of Europe use ERTMS.<sup>ix</sup> This system provides much greater safety and control, but it is also much more expensive than ASFA.

The third modification to the project was that certain rail sectors would not be provided with ERTMS but run only with ASFA. Although the original project included this cut, further cutbacks meant an even greater reduction in the implementation of the European system, which was to terminate seven kilometers from the station at Santiago, four before the bend at Angrois.<sup>26</sup>

### **d) Lack of risk and testing analysis**

All the above modifications had precedents: the changes of track gauge are in the process of disappearance, but they are still an accepted feature; diesel-electric locomotives have been in use since the fifties; and although the transition between safety systems and traffic control systems are complex, trans-frontier trains work daily with them.

The exceptional and unprecedented feature was that all these special factors should accumulate on the same stretch of line. However, to meet deadlines, all the proposed modifications were approved without carrying out exhaustive safety tests. Each element had been certified individually and Adif considered that was sufficient.<sup>27</sup>

<sup>viii</sup> ASFA consists of a track mounted balise near every rail signal; when a train passes over the balise, it sends a luminous signal to the driver's dashboard and an acoustic warning via an on-board reading device. At stop signals (for example a red signal), a balise is placed 300 metres before the signal warns the driver he is approaching the signal. If the driver does not react in 3 seconds, the system automatically begins to apply the brakes. If the train passes over a second balise at the foot of the signal, ASFA assumes that the train is not authorized to continue and applies the emergency braking system. Cf. "Introducción a ASFA en 4 minutos", *Exclitic*, 25 April 2017; "Renfe: Explicación del ASFA", Renfe, 1983; "Sonidos del ASFA - Renfe", Renfe, 1 August 2012.

<sup>ix</sup> ERTMS is a digital system of varying levels. The most important of these is the ETCS (European Train Control System); apart from more sophisticated beacons than the ASFA beacons, it included satellite GPS positioning, GSM-R data links to the traffic control center, a voice channel and other on-board and ground control systems. The main advantage of ERTMS is that it can provide permanent connection between on-board systems and the control centers, whereas with ASFA assistance was only intermittent. Thanks to this permanent connection, ERTMS supervises in real time all trains on all lines and monitors their speeds and the distances between them. ERTMS also embodies different levels of control. The most basic, the ETCS-1, functions like a greatly improved version of ASFA. When the advanced level (ETCS-3, under development) is in place, vertical visual signaling will no longer be necessary and the system will be able, if necessary, to take over complete control of the train. Cf. "ETCS-ERTMS", Rail System Net, 22 February 2015; "ERTMS in brief", *ertms.net*, 2023; "ERTMS Signaling levels", *ertms.net*, 2023; "ERTMS para 'dummies'", *Geotren* (blog), updated on 23 August 2023.

The approval stages of the new train were extraordinarily expedite. In the four days prior to the inauguration, INECO (the technical consultant firm responsible for the certification of rail infrastructure) and the Traffic Safety Department of Adif stamped their respective safety certificates, and the General Directorate of Rail Infrastructure (DGIF in Spanish) gave its authorization for the starting of service.<sup>28</sup>

Such swiftness was possible because the three organisms – INECO, Adif and the DGIF – all depended on the Ministry of Development, and their senior executives had been appointed by and depended on the same minister who had made a public promise that the line would be opened before the year's end.

## **The inauguration**

In June 2011, the Minister of Development announced that the first HST line in Galicia would be opened in December, three months before the General Elections set for March of the following year. However, as the electoral polls showed a day-by-day deterioration of the fortunes of PSOE, President Rodriguez Zapatero decided that same summer to bring the election forward to 20 November 2011. In the election, the PP won with an absolute majority.<sup>29</sup>

Shortly afterwards, on 10<sup>th</sup> December, the HST to Galicia was officially inaugurated, with the opening of the section between La Coruña, Santiago and Orense. The journey time was reduced from 135 to 55 minutes.

On the inaugural run, the protocol included Blanco, the outgoing minister, Francisco Alvarez-Cascos, who had been minister when work began in 2002, the President of the Government of Galicia, Alberto Nuñez Feijóo and the Mayors of the three cities which the line connected.

The arrival of the HST to Galicia was a historical milestone which boosted the cohesion and economic development of the region. However, the line opened that day was only the first step: the most difficult part was still to come – connecting the community network with the line to Madrid. But hopes were high.

On 21<sup>st</sup> December, the new president Rajoy, appointed Ana Pastor as Minister of Development (2001-2016). Both were from Galicia and the government's absolute majority allowed them to make decisions without constraints. However, the country was mired in a deep economic crisis and Rajoy was in favor of austerity in infrastructure. The connection of the HST line would have to wait another ten years.

## **Risky decisions**

The defects arising from the changes and cutbacks in the project could not be detected before the line was opened because specific tests were not carried out. But they began to surface as soon as normal passenger services were under way.<sup>30</sup> However, the chain of decisions which contributed to the accident had begun years beforehand.

### **a) Cancellation of regular safety meetings**

In January 2008, the director of Traffic Safety at Adif, Andrés Cortabitarte, cancelled the regular meetings of the Safety Commission between his company and the train operator, Renfe. Cortabitarte justified his decision on the grounds that these meetings, according to a decree law of the

previous year,<sup>x</sup> no longer had the power of decision. However, the terms of that decree provided for the continuity of those meetings on an advisory basis.<sup>31</sup>

### **b) Refusal to install more beacons**

Also, in 2008 (in other words, when the original project was still in force), Renfe petitioned Adif to install more ASFA beacons at various points of the line. In the operator's opinion, the sections in question required more safety measures. The proposal was refused on the grounds that the present installation fulfilled all regulatory requirements (in this respect, it should be noted that these requirements had been drafted by Adif itself).<sup>32</sup>

### **c) Incomplete driver training**

In order to accelerate the process, the training of train drivers took place while work on the line was still in progress, that is, on the only line then available, the N<sup>o</sup> 2 line.<sup>33</sup> However, when line N<sup>o</sup> 1 was finished, no new training programs took place, in spite of the fact that – in the opinion of the instructors – circulation on the new line was very different. Precisely at Angrois, there was a critical change of speed not covered by ERTMS, with no prior signaling and no ASFA beacons. The only warning signal was 200 meters before the bend, too near to be able to slow down in case of need.<sup>34</sup>

### **d) The “Mazaira Report” goes unheeded**

Under these precarious conditions, the passenger service was put into operation. The problems were immediately apparent, and several drivers registered complaints about the situation. On 26<sup>th</sup> December 2011, the head of Renfe drivers in Galicia, José Ramón Iglesias Mazaira, sent an email to the Head Office of Renfe in which he clearly drew attention to the danger of the bend at Angrois, and requested the installation of the signals and beacons necessary to lessen the risk. The reply he received stated that the signaling fulfilled regulatory requirements<sup>35</sup> and that carrying out those modifications would require very complicated procedures.<sup>36</sup>

There is no official record of the report reaching Adif, who would have been responsible for installing the safety measures called for by the drivers. Nor could the matter be discussed in the proper forum – the joint Adif-Renfe safety meetings, which had been cancelled in 2008.

### **e) “Acceptable with limitations”**

After six months of use of a provisional solution (the CAF S-121 train), on 30<sup>th</sup> May 2012 INECO certified the Talgo S-730 train – nicknamed *Frankenstein* – which, thanks to its CET generator, could circulate with diesel power and avoid a change of locomotive during the journey.<sup>xi</sup> In the technical certification document, INECO certified the S-730 as “acceptable with limitations”, limiting its use to lines equipped with ERTMS-ETCS-1, the most advanced safety system.<sup>37</sup>

<sup>x</sup> This was a Regulation on traffic safety in the national rail network, approved in the Royal Decree n<sup>o</sup> 810/2007 of 22 June 2007 ([BOE N. o 162, of 7 July 2007](#)), and which regulated the working of the organisms involved and the Rail Accident Investigations Commission (CIAF in Spanish).

<sup>xi</sup> The CAF S-121 was a middle-distance electric train which could only circulate on the recently opened electrified section of the line. Since the greater part of the line to Galicia had still not been electrified, this train, when departing from Madrid, had to change locomotives at Medina del Campo, which meant a delay of 20 minutes.

Although ERTMS was not installed along various sections of the line, both Adif and DGIF accepted the certification and granted their respective administrative authorizations. As a result, the Talgo S-730 entered service on the line to Galicia.

### **f) The on-board ERTMS disconnected**

From their first day of service, the S-730 began to have problems with the ERTMS coverage on departing from Orense station. On occasions, the on-board systems were unable to read the beacons, with the result that the *fail-safe* mode was activated, and the train would slow down or be brought to a halt – all of which produced delays.<sup>38</sup>

For this reason, on 23<sup>rd</sup> June Renfe requested authorization from Adif to disconnect the on-board ERTMS until the problem was solved; it also pressured Bombardier, the maker and installer of the systems, to put it right within one month.

The request to disconnect was approved by Adif the same day: everything appears to indicate that this was done without a prior analysis of risks and without consulting the manufacturer or waiting for his answer, because “regulations allow circulation with ASFA”<sup>39</sup> and regulations were always fulfilled.

Two days later, Bombardier replied, advising against disconnecting the system. As a provisional solution, they proposed that the train should make a 5-minute stop to reboot the system. This proposal was ignored.

Four weeks later, after an on-site analysis of the problems in the transition between the ERTMS and the ASFA systems, Bombardier proposed two alternative solutions: either to install new beacons and reposition the existing ones; or, that trains should circulate at a slower speed in the problem area, which would make the journey less than one minute longer.<sup>40</sup>

Neither of these two proposals by the manufacturer was accepted by Renfe, who wanted to avoid any type of delay. Disconnection was requested and authorization was obtained from Adif, and the ERTMS was disconnected. One year after the inauguration of the line, Renfe management sent a circular to all drivers indicating that trains would circulate only with ASFA on all sections of the line between Orense, Santiago and La Coruña.<sup>41</sup>

As railway slang has it, all the risk inherent in the Angrois bend is “exported to the driver”.<sup>42</sup> The high speed ERTMS system was not installed in this section, nor the appropriate beacons; the driver must rely exclusively on the timetables and the authorized maximum speeds contained in written documents available for consultation in the cabin during the journey... but not updated.<sup>43</sup>

## **The accident**

On 24<sup>th</sup> July 2013, Alvia nº 04155 from Madrid and destination Ferrol was approaching Santiago de Compostela when the driver, Francisco José Garzón Amo, received a call on the corporate telephone from the train controller. It was a consultation without importance regarding passengers getting off at the station at Pontedeume, where the new Alvia trains had already had problems with the station platforms.<sup>44</sup>

Cruising at a speed of 200 KPH, the train covered a distance of 5 kilometers of straight line in the course of the 100-second call; in that time, it passed the reduce speed to 80 KPH signal, which the driver, distracted by his conversation, failed to see. It also passed an ASFA signal, which continued to show green.

On exiting the last tunnel, at a speed of almost 200 KPH, the driver saw the warning light just before the bend and applied the emergency brakes, but it was too late. The train entered the bend at 178 KPH, more than double the permitted speed.<sup>xii</sup>

The front generator car, owing to its great weight and higher center of gravity, became unbalanced, derailed, and crashed into the containing wall; it pulled after it the front power car and the first four passenger cars. The inertia of the rear power car and its generator continued to exert forward pressure and produced an accordion effect on the rear cars. One of them was thrown on to the embankment and the others were mangled up against each other on the tracks (the highest number of fatalities were in these cars). The second power car ended up against the embankment and the wrecked generator car caught fire.

This is how one of the passengers described it:

We are coming into Santiago because I could see the city from my window...at that moment, apart from being thrown to one side, I felt something pulling me upwards. I was thrown out, as if I was flying, and I remember trying to catch hold of something. [...]. After that everything sort of went black [...] When I woke up, there was silence, you couldn't hear anything, and there was dust everywhere, as if a bomb had gone off, but I was fully aware that we had had an accident, [...] I looked at my leg, all the right side was hurting, I couldn't breathe very well and my leg didn't look good, and my arm... I thought it must have been a pretty serious accident, that everyone else was dead and I was the only one alive [...] Then, about ten yards away, because this carriage which had fallen on top of me must have been the one behind, a fire started. I had a feeling that my legs, especially the right one, were pretty bad. And then at that moment I said to myself: "I've got to get out of here".<sup>45</sup>

## **"Oh my God! Those poor passengers!"**

In the overturned front power car, the driver was trapped inside the cabin. With injuries to his head and back, but conscious, he made three calls to the Renfe Control Center in Atocha (Madrid). This is the transcription of the second call:

**Garzón:** There must be a lot of people injured, A lot, understand? because it's overturned. I can't get out of the cabin.

**Atocha:** OK, take it easy, driver.

**G:** Don't you hear me? I'm saying I can't get out of the cabin, and I can't help anyone,

**A:** Yes, I can hear you. There are people injured, right?

**G:** Yes, because it's that... it was green and ... and I got distracted. I should have passed it at 80 and I was doing 190 or something like that. But I already told the safety people about that, that it was very dangerous. That one day we were going to get distracted and ... and that we'd have a pile up.

**A:** OK. How about you? Are you OK?

**G:** Me... my back hurts, I've got blood on my face and I can't...(..)

<sup>xii</sup> According to the CIAF report, "the train was travelling at a speed of 195KPH when the driver applied the brakes" (p.97) and "the train was travelling at 178KPH at the moment of derailment" (p.7). Cf. "[Informe final sobre el accidente grave ferroviario Nº 0054/2013 ocurrido el día 24.07-2013...](#)", CIAF, Ministerio de Fomento, n.d.

**A:** You're at kilometer 80, right? Is there any reference point?

**G:** Yes, kilometer 80, that's where I took the bend at 200. Well maybe not 200, at 190 or something like that. Because it was showing green. Showing green...

**A:** And you should've passed it at 80, right?

**G:** Yea, I should've passed it at 80.

**A:** OK, ok.

**G:** Oh, my God! But I'd already told the safety guy about it, that the bend was very dangerous. We're all human and it could happen to anyone. That bend, it's inhuman...I mean, with just one warning light. I mean, it's just not right, that they should do things like that. They say the driver should be.... Yea, but we're all human.

**A:** Ok, take it easy, try to relax...[...]

**G:** Oh, my God! Those poor passengers! And my conscience....<sup>46</sup>

## **The people of Angrois**

The collision shook the houses in the village of Angrois. The people "spread out like an army as soon as they heard the noise of the crash, as if they had done it every day of their lives, as if they had trained in dozens of emergency drills. Some looked for blankets, boards or anything that could be used as a stretcher, the strongest and the youngest broke the windows and smashed in the doors or cut through them with radial saws to get into the carriages and bring out the dead and the injured".<sup>47</sup>

These are the accounts of the helpers:

I ran out of the house and saw this cloud of smoke, and then the train on fire. People were shouting "Get me out! Get me out!" Help hadn't arrived yet and we neighbors tried to pull them out through the windows, using bits of the train as stretchers. There were dead people and injured people all over the place.<sup>48</sup>

The worst part was when we got to the tracks and just when we're starting to see the first bodies, the mobile phones in the pockets of the dead people started ringing.<sup>49</sup>

When the emergency crews arrived, all the neighbors continued to pitch in. Between them, some lifted cars that were blocking access for the ambulances and the fire trucks; others took away the slightly injured in their own cars, and many became improvised medical auxiliaries.

Then help arrived, the police and the ambulances. They'd ask us to hold a drip bottle, or one would suddenly say, "Don't let this man go to sleep". And so I spoke to them so they wouldn't fall asleep and they wouldn't die. I'd ask them where they were going, what their names were... just to keep talking to them. And they'd ask: "Where is my son?" There were old people and young people, small kids they carried out in their arms... it was an inferno.<sup>50</sup>

They didn't rest until dawn. Days later, some of the neighbors needed profound psychological treatment to mitigate the effects of the horror they had lived through that night.<sup>51</sup>

The communication media arrived shortly afterwards too and began transmitting from the scene of the accident. At first details were scarce: information was given about a derailment near Santiago, but not even the number of the train or its direction were known.

## Fifteen hours of anguish

Many relatives of the passengers were awaiting the arrival of the train at Santiago de Compostela station. The atmosphere was one of disquiet. Something was not right. The train had still not arrived, the media were talking about an accident somewhere near Santiago and the social media viralized the first photos and videos of the stricken train.

From the station or from their homes, families and friends of passengers began to telephone Renfe in search of answers. This is what one family member recalls:

To begin with I didn't think it was his train. They were saying Madrid-Ferrol and my son was travelling to La Coruña, so I didn't associate it. But then I saw a TV screen and I started to get nervous. I got the phone and rang Renfe. I asked them: "That train which had the accident, did it stop at Segovia?" "Yes, of course, yes" and they hung up immediately.<sup>52</sup>

Large numbers of family members of the passengers began to gather at the stations in Santiago and La Coruña, where Renfe personnel and the national and local police took down their names and telephone numbers in order to be able to inform them as soon as they had confirmed information.<sup>53</sup> Others went to the site of the accident and some broke through the police cordon to get to the carriages; it was impossible to hold them back or to calm them down.

After the first urgent medical care at the accident site, the injured were transferred to the Santiago University Clinic Hospital, the foremost hospital of the Compostela region. Many families also went there searching for information.

That hospital was soon overwhelmed and the injured were redirected to two other hospitals in Santiago, and to those in Pontevedra, Vilagarcía de Arousa and Vigo. Injured passengers with burns were transferred to La Coruña.

At the request of the National Emergency Attention Center 112, which was coordinating the local help center, the Santiago city council assigned the Fontes do Sar multi-use pavilion as an emergency mortuary and the headquarters of the public entity CERSIA in the nearby neighborhood of San Lázaro as an attention center for families.<sup>54</sup>

In the early hours of the morning, Renfe facilitated families with a telephone number for information, but there was still no list of affected passengers.<sup>55</sup> At 3 a.m. there were still two passenger cars which rescuers had not been able to examine because a crane was needed to move them. At 5.30 a.m. the number of fatalities had risen to 72, but they were still not identified. At 6.30 a.m. there was only an incomplete list of injured passengers and still no list of the dead.

In the CERSIA building, dozens of families spent a sleepless night waiting for news. Numerous specialized psychologists and emergency personnel tried to relieve the anguish of the families, but the atmosphere was heart-rending.<sup>56</sup>

"I don't want tea. I don't want anything. I want to know! All I want is to know!", a man repeated over and over again in a corner of the main hall of CERSIA, the emergency center in San Lázaro. "Tell us something, please..." was the angry appeal which relatives directed to the Mayor of Santiago who had arrived at the hall. "We want to know!" others shouted. In a pool of tears, a mother sobbed again and again, wanting to embrace her daughter - "my little girl, even if it's for the last time..., please, oh please".<sup>57</sup>

At 8 a.m. autopsies began to be performed at the hospitals. Meanwhile, the heads of the police forensic scientists, who had worked through the night trying to identify victims, appeared before

the families in an attempt to explain why the identification process was taking such a long time. “We can’t afford to make any mistakes and you wouldn’t forgive us either”.<sup>xiii</sup>

At 12.30 p.m., the authorities began to call families to give them information. A few of the dead, among them passengers from France, Italy, the U.S.A., Mexico, the Dominican Republic, Columbia, Venezuela, Brazil and Algeria, were not identified until two days later.<sup>58</sup>

## The recollections of a police officer

During those days, extraordinary security precautions were taken in Santiago, because whenever there is a focus of attention and a large number of people present, radical left-wing groups usually organize parallel demonstrations, which can be more or less violent. In fact, there were three times the usual number of police officers in Santiago at the time

The first calls to the police were made by neighbors. They were calls about the accident, that there was a police van in the town square, that there had been explosions and that there was a smell of explosives. That was suspicious, because the smell of burning diesel fuel is similar to that of Goma 2 high explosive.

The senior police officer who had come to Angrois was in the detail assigned to protecting the authorities. Without waiting for instructions from his superiors, he ordered his men to help in the rescue and evacuation of the injured. It was not an easy task and it took a long time: the acoustic panels which separated the tracks from houses in the village were very difficult to break, as were the windows of the carriages, and they had to use a chain-saw lent by one of the neighbors.<sup>xiv</sup>

This police inspector rescued the train driver and took him to one side in order to protect him, fearing the anger of the relatives of the victims who had come from the nearby station. Nobody tried to interfere. The driver repeated over and over his sorrow at taking the bend too fast. When asked if he was carrying any other mobile device in the cabin, he said no. However, when the police went to check and found another mobile phone and a tablet, they suspected that he had not told the truth, and he was arrested.

The removal of the bodies took a long time; on the one hand, because of the technical difficulties at the place where the accident had happened, and on the other, because of the requisites prescribed by Spanish law: the magistrate must describe the situation of each body before it can be removed. “Meanwhile, in the midst of a horrendous silence, the mobile phones of the passengers were ringing. “We didn’t answer any of them. What could we have said to the relatives who were calling them?”

The relatively speedy process of evacuation was also the result of a coincidence. The inspector called a friend of his who was the owner of a crane company and asked him to immediately send some heavy-duty cranes in order to raise the carriages. It was a lucky chance that he was near Santiago and was soon on the scene: the cranes arrived shortly afterwards. This is how the officer explained what he did:

I wasn’t in charge. I was number two. Sometimes, in these situations people wait for the big boss to arrive. But at that moment, I was in fact the person responsible and that’s why I took that decision and many others, without waiting for my boss. In situations like that, you can’t

<sup>xiii</sup> Cf. María Cedrón and Alberto Mahía, “Accidente en Santiago: ...y el amanecer más duro”, *La Voz de Galicia*, 27 July 2013. The reference is to the airplane crash of the YAK42 in May 2008., in which 75 people died. The remains of numerous victims were wrongly identified, causing grief and indignation among the families.

<sup>xiv</sup> In fact one of the changes introduced in the AVE trains after the accident was the use use of windows which could be broken more easily in an emergency.

hide or do nothing; you must make the decisions which your conscience dictates. If you do it that way, you'll be right nine times out of ten.

From there he went to the sports complex which had been turned into a support center for families and where there were about 700 people. For a long time, no news was given, and no one spoke to the families. As a result, when the Government spokesman and the two senior police officers spoke to the people gathered there many hours later, the atmosphere was extremely tense: there were shouts, insults and scuffles. They left to avoid being assaulted.

It was the psychological support workers who kept saying: "Someone has to tell them something!". As no one was willing to come forward, the inspector who had recently arrived from Angrois offered to take the microphone. The first five minutes were a tirade of shouted insults ("which was completely understandable") but finally he was allowed to speak. The information he gave was centered on three areas: first, about the work that was being carried out at Angrois; then he gave the number of dead who had already been located, with the warning that there would be more since there were two more carriages which had not yet been examined; finally he explained the procedures which were necessary in order to identify the bodies. As a result of his address, the atmosphere in the Sports Center was notably less tense.

When he was about to leave in order to rest (he had been on duty all the previous night), the psychologists told him: "You can't leave now. You've won their trust, which is the most difficult thing. You've got to carry on". After consulting with his superiors, he was persuaded to carry on as spokesperson.

Two things contributed to give him credibility with the families of the victims. The first was the way he introduced himself: "I am a policeman, a public servant and my job is to serve my fellow citizens (anger against the politicians had already begun to make its appearance). The second was that, as spokesperson, he undertook to inform about each death, one by one. This process lasted until about 3.00a.m., because identification is a slow process and a certain number were particularly complicated: for example, the case of foreign nationals, or that of a handicapped girl whose parents had died in the accident and whose grandparents were waiting in the holding area.

I had a really bad time. It was one of the worst experiences of my whole life. Whenever I had a free moment, I went into a corner, sat down on the floor and immediately went to sleep: my body needed it. Now that I think of it, I would suggest to anyone who had to manage a situation like that to make sure that all the rescue teams always had enough water: dehydration is worse than hunger - it doesn't let you think: and also to make sure there are areas where the emergency teams can rest every now and then - that's absolutely necessary.

## **A tidal wave of solidarity**

It was not only the people of Angrois whose reaction to the disaster was exemplary. The whole of Galicia responded as one when the alarms began to ring:

- The public services involved saw their numbers reinforced immediately by hundreds of professionals who were either not on duty or on holiday or retired. Doctors, nurses, policemen, firefighters, and civil protection volunteers reported spontaneously to their respective centers or went directly to the accident site.<sup>59</sup>
- Specialized psychologists reported to the CERSIA building; forensic and police experts and judiciary agents went to the mortuary at Fontes do Sar.<sup>60</sup>

- Renfe also mobilized its customer care and coordination personnel to attend to hundreds of passengers who had been stranded as a result of the accident. Technicians from Adif inspected the rails in search of information.

With over a hundred people injured, the blood bank at Santiago hospitals soon began to run low. The health authorities appealed for donors, especially those of groups O negative and A negative. The townspeople of Santiago immediately began queuing at the Clinic and at the Transfusion Center of Galicia; demand was more than covered in a question of hours. There was such an avalanche of volunteers that donors were asked to go to other cities in Galicia, where reception centers were opened.<sup>61</sup>

At the time of the accident, Obradoiro Square, in front of the cathedral, was crammed with people awaiting the audiovisual spectacle of the fireworks of the Apostle, which marked the opening of the fiestas of St. James. Alameda Park, with a fun fair and a stage ready for the concerts, was also full of people. When the loudspeakers announced that the whole of the festival was to be suspended, tens of thousands of people dispersed in silence without any kind of incident. Many restaurant and hotel owners, aware that they had lost their clientèle, opted to offer free food, hot drinks and accommodation to the volunteers who were working at the accident site or running the emergency services.

The newspaper archives contain stories from those days when, as had happened a decade before, when an oil slick from the tanker *Prestige*,<sup>xv</sup> had sullied the coastline of Galicia, the people of the region took part in an enormous tsunami of spontaneous solidarity in the face of adversity.

From that day, on each anniversary of the accident, the victims are remembered and the extraordinary reaction of the local people is commemorated as the Day of Galicia.

## Mourning and grief

The first institutional reaction followed the usual protocol in cases of accidents or natural catastrophes with numerous victims. The Xunta or Regional Government proclaimed seven days of mourning throughout the region and the flags at half-mast in official buildings bore black ribbons. Santiago City Council cancelled the festivities of the patron and throughout the whole of Galicia many local fiestas and events were either suspended or postponed.

That same day, the president of the Government, Rajoy, and the leader of the opposition, Alfredo Pérez Rubalcaba, visited the scene of the disaster accompanied by the president of the regional government, and offered their condolences to the victims and their close relatives. The King Juan Carlos and Queen Sofía also travelled to Santiago to visit the injured and to share the grief of the families of those who had died.

The social networks and digital media publicized the messages of support and consolation from the Royal Household, from the President of the Government, the Xunta of Galicia and the other

<sup>xv</sup> In November 2002, the oil tanker *Prestige* collided with a drifting tree trunk off the coast of Galicia; the impact produced a leakage of water into the ship and of oil into the sea. Instead of towing the vessel to the nearby port of La Coruña – a solution which would have caused less damage – the authorities decided to tow the ship away from the coast where it drifted about for days. Finally, it split into two and sank, spilling the whole of its cargo of 77,000 tons of crude oil into the sea. It was one of the greatest maritime environmental disasters of all time, both in terms of the volume of oil spilled and of the area affected; it provoked an oil slick which extended from Portugal to France, with the principal impact hitting the whole of the coastline of Galicia. Tens of thousands of people from the region and from all over Spain worked for months to clean up the beaches rock by rock. Cf. “*Prestige. La tragedia del 13-N*”, *La Voz de Galicia*.

regional communities, and also from a multitude of the Mayors from all over the country.<sup>62</sup> Celebrities from the world of the arts, entertainment and sport joined in offering their condolences.<sup>63</sup>

Dramatic photographs of the accident filled the front pages of the international press and produced a wave of declarations of condolence.<sup>64</sup> Pope Francis prayed for the victims from Brazil; presidential condolences arrived from Washington, Moscow, Lisbon, Paris, Rome, and Berlin, along with messages from the U.N., the European Commission, NATO, OPEC...

Through Twitter and WhatsApp, meetings were called to hold a minute's silence in many cities and towns in Spain and abroad. In Obradoiro Square and in the seats of Parliament and of local governments five minutes silence was observed.<sup>65</sup>

On 30<sup>th</sup> July, the fifth day of mourning, a state funeral for the dead was held in Santiago cathedral. Families of those who had died, institutional representatives and representatives of those who had taken part in emergency work, and the people of Angrois were present at the ceremony. Outside, in Quintana Square, over 2000 people watched the ceremony on a giant screen and many hundreds more in Obradoiro Square followed the ceremony but without sound or vision.<sup>66</sup> On few occasions has that busy and noisy square observed such a respectful silence.

At the end of the funeral, the crowd outside the cathedral, with knowledge of the first revelations in the press regarding the facts surrounding the accident, released their pent-up indignation after four days of mourning. The Prince of Asturias and Princess, the relatives of those who died and the people of Angrois were greeted with applause; the political representatives, with booing and whistling.<sup>67</sup>

There was skepticism and rage, because it was all a *déjà vu*: memories of the Prestige catastrophe returned: the minister of Development had called it "the Spanish Chernobyl" in the European Parliament, but in Spain had downplayed the gravity of the crisis; with the damage done, the ship's captain took all the blame. No account was given of the long chain of inexplicable decisions that had extended the slick along the coasts of Galicia.

Once the official mourning was over and the dead given back to their families, with the injured convalescing in hospital and with the rail service running again, the focus of attention now turned to Renfe and Adif, the two state-owned companies responsible to the Ministry of Development.

What should the two state companies involved, Adif and Renfe, do now? And the Ministry of Development, which supervised both? What technical, juridical, political and economic responsibilities for the accident should they assume regarding the victims, the other affected parties and society? And who should do it?

# Exhibits

Exhibit No. 1: Map of Galicia



Source: Design by Ignacio de la Cierva

Exhibit No. 2: Map of Spanish HST lines, with dates of inauguration



Source: Design by Ignacio de la Cierva

## Endnotes

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- <sup>5</sup> M. Varela, “[Galicia tiene la mayor comunidad en la diáspora: más de medio millón de gallegos viven en el extranjero](#)”, *La Voz de Galicia*, 16 March 2023.
- <sup>6</sup> “[Producto Interior Bruto regional – Año 2013](#)”, Instituto Nacional de Estadística, 31 March 2014.
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- <sup>14</sup> Gonzalo Cortizo, “[Alberto Núñez Feijóo: ‘El PP gallego sigue siendo un punto de encuentro para la mayoría, esto no ha ocurrido en el PP en España’](#)”, *elDiario.es*, 10 March 2020. Check from min. 10:26.
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- <sup>31</sup> Pablo González, [“Un testigo revela que el cargo del Adif procesado en el caso Alvia eliminó las comisiones de seguridad conjuntas con Renfe en el 2008”](#), *La Voz de Galicia*, 23 November 2022.
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- <sup>49</sup> Cedrón y Mahía, [“Accidente en Santiago”](#), cit.

- <sup>50</sup> Junquera, “Les hablaba para que no se durmieran”, cit.
- <sup>51</sup> Alberto Mahía, “Accidente en Santiago: Ocho vecinos de Angrois están a tratamiento psicológico severo”, *La Voz de Galicia*, 29 July 2013.
- <sup>52</sup> Cristina Liras, mother of one of the deceased in the train accident, in the film *Frankenstein-04155*.
- <sup>53</sup> María Vidal, “Descarrilamiento en Santiago: Angustiosa espera a pie de vía”, *La Voz de Galicia*, 25 July 2013.
- <sup>54</sup> Measures to be taken in cases such as the accident at Angrois are defined in the Territorial Emergency Plans of Galicia (PLATERGA). For the first time in the history of the community, PLATERGA Level 2 was activated: Level 2 permits the mobilization of any public or private resources in the four provinces of Galicia. Véanse *Plan Territorial de Emergencias de Galicia, Xunta de Galicia, enero del 2009; Informe de intervención 20130099576*, Axega 112, July 2013.
- <sup>55</sup> Ana Isabel Martínez Arranz, “Intervención psicológica en el accidente de tren Alvia en Santiago de Compostela (I)”, *Psicosocial y Emergencias*, 24 April 2014. These psychologists belonged to the Grupo de Intervención Psicológica en Catástrofes y Emergencias (GIPCE).
- <sup>56</sup> María Cedrón y Alberto Mahía, “Accidente en Santiago: ...y el amanecer más duro”, *La Voz de Galicia*, 27 July 2013.
- <sup>57</sup> “Accidente en Santiago: 74 ya en casa y 81 hospitalizados”, *La Voz de Galicia*, 27 July 2013.
- <sup>58</sup> “Accidente en Santiago: La solidaridad desbordó previsiones”, *La Voz de Galicia*, 26 July 2013.
- <sup>59</sup> “El Multiusos Fontes do Sar, habilitado como tanatorio provisional para las víctimas del accidente de un tren en Santiago”, *Europa Press*, 25 July 2013.
- <sup>60</sup> “Descarrilamiento en Santiago: La espectacular respuesta satura los centros de donación”, *La Voz de Galicia*, 25 July 2013.
- <sup>61</sup> “El mundo político, sindical, empresarial y social muestra sus condolencias por el accidente del tren de Santiago”, *La Vanguardia*, 25 July 2013.
- <sup>62</sup> “Accidente en Santiago: Ternura para el dolor de Galicia”, *La Voz de Galicia*, 27 July 2013.
- <sup>63</sup> “Descarrilamiento en Santiago: El accidente da la vuelta al mundo”, *La Voz de Galicia*, 25 July 2013.
- <sup>64</sup> “Accidente en Santiago: Largas horas de minuto de silencio”, *La Voz de Galicia*, 26 July 2013; M. Cheda, “El corazón de Galicia deja de latir cinco minutos”, *La Voz de Galicia*, 26 July 2013.
- <sup>65</sup> M. Cheda, ““Os llevamos en el corazón””, *La Voz de Galicia*, 30 July 2013.
- <sup>66</sup> M. Cheda, X. V. Gago y O. Sánchez, “Galicia dice adiós a las víctimas del accidente de Santiago”, *La Voz de Galicia*, 30 July 2013.
- <sup>67</sup> Gabriela Cañas, “Álvarez-Cascos: ‘Este es el Chernóbil español’”, *El País*, 7 December 2002.