

Brazil began the new century with meaningful improvements in civil aviation safety. The annual count for all civil aircraft accidents decreased from 75 to 58 between 1997 and 2005, while the number of fatal accidents decreased from 40 to 22 (Figure 1). Meanwhile, the civil fleet in Brazil increased from 9,962 to 10,831

aircraft. Scheduled commercial aviation had zero fatalities and zero accidents from 2003 to 2005. The perception grew that Brazil finally had reached the top ranks of aviation safety, particularly in air traffic management.<sup>1</sup>

Then all hell broke loose on a bright afternoon over the Amazon jungle on Sept. 29, 2006, when a Gol Boeing 737-800

and an ExcelAire Embraer Legacy 600 collided at 37,000 ft. Both aircraft were flying on the same airway, in opposite directions. The business jet pilots conducted an emergency landing at a nearby air base with nobody injured. The 737 spiraled into the jungle, and 154 people died.

Public trust in the soundness of the country's air traffic control (ATC)

# A System UNDER FIRE

**Brazil struggles to return to world-class safety status.**

BY EDVALDO PEREIRA LIMA



Cindacta I in Brasília is the busiest part of Brazil's air traffic control system and the place most heavily impacted by controller discord and system disruptions.

system began to shatter. In parallel with the technical investigation begun by the Center for the Investigation and Prevention of Aeronautical Accidents (CENIPA), the Federal Police started a criminal investigation of its own. It was said that the two U.S. pilots of the business jet would be indicted, as well as the air traffic controllers (ATCOs) who were working the Legacy flight.

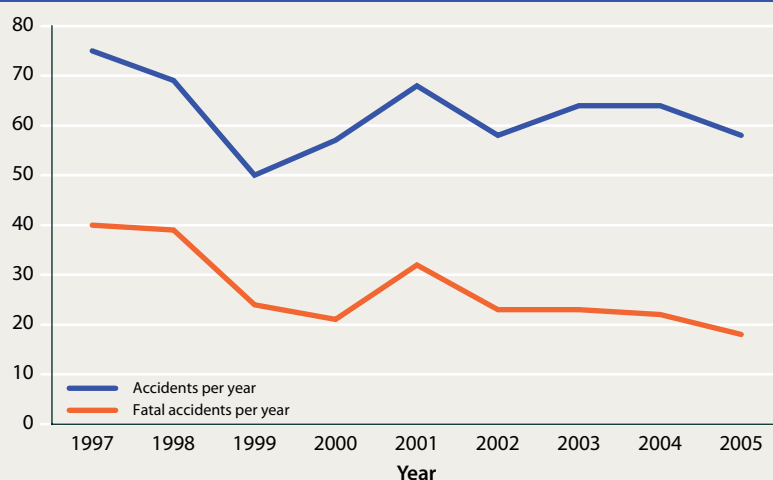
The business jet, on a delivery flight out of Embraer's main plant, had departed from São José dos Campos to North America via Manaus. The 737 was flying south from Manaus to Brasília. News was leaked that the Legacy should have descended from 37,000 ft to 36,000 ft after overflying Brasília, which it seems, never happened. The Brasília Area Control Center (ACC) lost radio contact with the Legacy and failed to regain contact until the tragedy occurred. The business jet's transponder, it appears, was not on. In June 2007, a federal court judge proceeded with indictments against both Legacy pilots and four ATCOs.

### A Road of Trials

A month after the accident, on Oct. 20, a cascade of events began that nearly brought the air transport system in Brazil to its knees. On that day, a small number of ATCOs who had monitored the two flights were removed from work at Cindacta I, the top ACC in Brazil's ATC system. Several others requested and took medical leaves.

Brazil Flight Information Region (FIR) airspace covers 22.0 million square km (8.5 square mi), of which 8.5 million square km (3.3 million sq mi) are over Brazil's vast territory. The continental airspace management is split between

### Brazilian Civil Aviation Safety 1997–2005



#### Note:

Data include commercial aviation (scheduled and non-scheduled service), corporate aviation, air taxi operations, helicopters and private aircraft.

Source: CENIPA

Figure 1

four ACCs, of which Cindacta I is the busiest. It covers 1.5 million square km (0.6 million sq mi), including the capital city, Brasília, and three other major cities, São Paulo, Rio de Janeiro and Belo Horizonte. Five of the busiest airports in Brazil are in Cindacta I airspace.

ATCOs working at Cindacta I felt the pressure. The additional controller absences compounded a heavy workload for the already understaffed work force. That pressure, the possible prosecution of their colleagues and the apparent lack of leadership for three days immediately following the accident combined to create a sense of betrayal among the controllers.

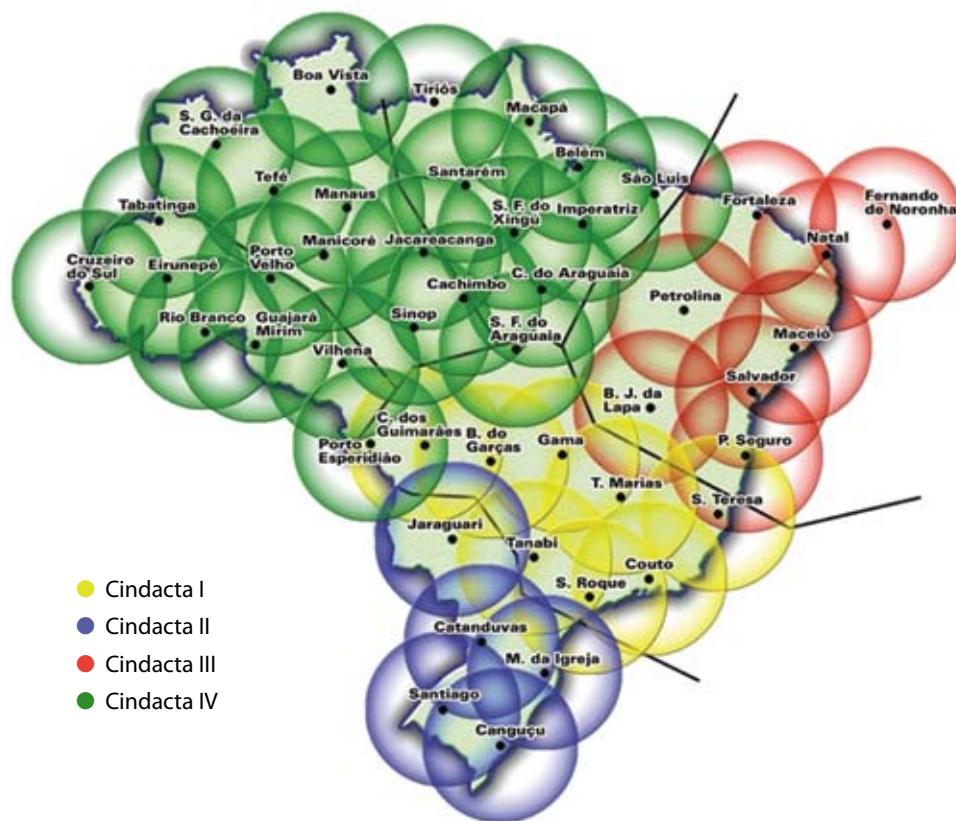
Controller leaders said that the ATCOs decided not to work to extreme limits. Instead of each controller monitoring up to 25 aircraft simultaneously in a sector, they would stick to a maximum of 14. They also leaked to the media news of malfunctioning equipment. Flights began to be delayed throughout the Brazilian network. On and off through the end of the year, hundreds of flights were delayed more than one hour, a dozen flights were cancelled every day, and the situation at major airports was chaotic.



© DECEA



## Brazilian Airspace Coverage



## Note:

Cindacta is a Portuguese acronym for Integrated Air Defense and Air Traffic Control Center

Source: DECEA

**Figure 2**

The initial federal response was indifferent, as if the problem had not reached the magnitude that it had; the first statement by the government held that the problem would be solved soon by hiring an additional 60 ATCOs.

However, another volatile problem then became public. Civil ATC is managed by the Brazilian Air Force (FAB) through its Department of Airspace Control (DECEA). The ATCOs are mostly FAB personnel, but there also are civilian professionals working in the organization, as well as civilian staff providing services to DECEA but hired by Infraero, the airport body. The difference in wages in favor of Infraero ATCOs is significant,

adding an additional element of tension to the situation.

On Nov. 2, the military management began to press ATCOs to work extra hours; the controllers reacted by handling even fewer aircraft. On Dec. 15, an equipment failure at Cindacta I paralyzed most air traffic in Brazil for several hours.

On March 30, this year, controllers at Cindacta I and Cindacta IV at Manaus stopped working, grounding nearly all civil air traffic for several hours. They denied that they were sabotaging the ATC system, creating the crisis. They said they had previously pointed out system weaknesses but had been ignored. They cited “an incompatibility between military life and air traffic control” and stated that

they did not trust their equipment and did not trust their commanders. They said ATCOs were the subject of unjust and overly severe punishment by their military superiors.<sup>2</sup>

In June 2007, the Command of Aeronautics (COMAER), the top executive layer of the FAB, tried to stem the conflict with a tough approach: a few ATCO leaders were jailed for several days, removed from duties at top ACCs and forbidden to talk to the news media without authorization. Some controllers continue at press time to face prosecution in a military court for the original accident or for the job actions that followed.

### A Brief Background

Brazil’s civil aviation infrastructure has been developed with backing of the federal government through FAB and some of its key branches. The Department of Civil Aviation (DAC) eventually became the civil aviation organizational body. When Brazil signed the Chicago Convention in 1944, FAB managed ATC. By the 1970s, an integrated air defense and ATC system was implemented, putting both military and civil aviation operations under a single umbrella. This would save resources in a developing country much in need of upgrading to a world-class airspace environment. The system eventually was

named the Brazilian Airspace Control System (SISCEAB), and its executive body became DECEA.

SISCEAB evolved with the establishment of four Integrated Air Defense and Air Traffic Control Centers, which gave birth to the Portuguese acronym Cindacta. A center would be established at each of the four territorial FIRs in Brazil, starting with Cindacta I in Brasília in October 1976. Thirty years later, the four centers were fully established, including Cindacta II in Curitiba, III in Recife and IV in Manaus (Figure 2). Each of these stations operates an air defense section and an ACC for civil air traffic.

At the same time, a plan was advanced to provide full radar coverage above 29,000 ft for the entire Brazilian territory. A consortium set up by the French firm THOMSON-CSF and the Brazilian Hidroservice engineering company won a bid to provide hardware and software for Cindacta I. Tech-

nological upgrades were implemented in 1991 and 2002. By the late 1990s, with the establishment of Cindacta IV and the full implementation of the Amazon Surveillance System (SIVAM), Brazil achieved total airspace radar coverage. Software upgrades became Brazilian products over time.

Last year, according to DECEA, Brazil had in place a complex air traffic management system, comprising a technological arsenal of 70 primary radars, 81 secondary radars, 16 weather radars, six approach radars, one ground control radar, and myriad navigational aids, including 77 VHF omnidirectional radios (VORs), six distance measuring equipment (DME)/VORs, 95 DMEs, 235 nondirectional beacons, 157 visual approach slope indicators, 18 VHF direction finders, 37 instrument landing systems (ILSs), 24 localizer approach systems (ALSs) and 4,634 VHF/UHF/HF communication radios.

In May 2006, as hardware approached the end of its operational life, DECEA launched a revitalization plan to completely replace navigational aids — 755 pieces of equipment — by 2008/2009. In fact, 16 pieces of equipment were to have been replaced in 2007.

### A Shadow Side

When Public Labor Prosecutor Fábio de Assis Fernandes last year examined ATC labor/management relations, he found it unreasonable to believe that the air transport crisis was due to a bunch of rioting ATCOs. He produced a report that stated, “The problems of the air transport segment in Brazil are old and structural, unknown by civilian society due to the lack of transparency and a control model characteristic of a militarized system.” Emphasis was given to his view that ATCOs cannot be blamed for errors caused by equipment malfunctions. “The responsibility to maintain

© Tamon Takeoka/AirTeamImages.com





adequate radar and radio network operations belongs to the employers. It is undeniable that the existence of failures and poor reliability creates tensions and emotional stresses on the workers who are in the position to provide effective air traffic control.”<sup>3</sup>

Fernandes found support from workplace health specialist Rita de Cássia Araújo, an employee of the Municipal Secretary of Health for the city of São Paulo. Updating a dissertation she wrote in 2000 at the University of São Paulo on the working environment of ATCOs at both the São Paulo–Guarulhos International Airport Control Tower and at the São Paulo Terminal Area Approach Control, she said the situation has improved only slightly. In a recent article, Araújo noted that, “turned scapegoats, controllers’ spirit has hit bottom.”

She emphasized that the military mindset typical of the “political-management context of the Brazilian civil aviation should be considered as contributing to an additional mental and physiological load, wearing out ATCOs. The submission to the rigid hierarchical discipline and other stressful conditions — alternate shifts, low wages, double work shifts, low professional self-esteem and family problems — affect their physical vigilance at work.”

Further, Araújo said that the lack of dialogue between ATCOs and their supervisors would lead controllers to hide latent failures. And those, she points out, “are evident in the heart of systemic structures before an accident happens, introduced by higher hierarchical levels associated with institutional and management layers.” To improve the reliability of a system, she said, those latent failures must be identified.<sup>4</sup>

The Brazilian Court of Audit (TCU) also took a systemic approach. An audit report the TCU released last December states, “The development and growth of air transport, which reflects on the economy, are restrained by the operational capacity of the air traffic control body.” This capacity is dependent on the right coordination of the different agencies related to civil aviation and on “the right availability of budget resources, as the system must expand to respond to the current lack of a link between the growth of flights and the real possibility of controlling a greater number of aircraft,” the report said.<sup>5</sup>

Federal government bodies related to ATC include the Civil Aviation National Council (CONAC), COMAER, airport manager Infraero and the National Civil Aviation Agency (ANAC), which replaced DAC in early 2006 and is now the independent civil aviation regulatory agency, no longer linked to the FAB.

Those bodies should work with close cooperation, but the TCU judged that they were not. DAC had built a professional aviation staff, but ANAC’s first management staff was selected using political criteria and was not up to the challenge. However, after the July TAM Airbus A320 accident at Congonhas, the Minister of Defense was replaced and attempts were made to get those agencies working together in a more

**Military controllers’ wages are noticeably lower than their civilian counterparts in the same facilities.**



efficient way.<sup>6</sup> Changes brought some improvements, but much remains to be done.

Another problem singled out by the TCU is the lack of adequate finance resources to respond to the specific needs of the various players. Basically, resources come from airport and air transport taxes and service fees collected by Infraero. Of the total collected, Infraero should keep 41 percent, up to a maximum of R\$90 million (US\$51.1 million) per year, to cover its own expenses and transfer 51 percent to COMAER, which funds DECEA. The audit report pointed out that Infraero is retaining amounts beyond both its R\$90 million limit and beyond its 41 percent share.

“In the last six years,” says the audit report, “Infraero failed to pass to COMAER some R\$582 million.” As a result, the report says, DECEA had required, for 2004 and 2005, resources of about “R\$715 million and R\$667 million, respectively, for the operation, maintenance, development and modernization of SISCEAB, but was granted R\$468.7 million for 2004 and R\$495 million for 2005.”

The report says that the crisis that began in 2006 was not a surprise, as several technical alerts issued by DECEA and COMAER anticipated the problem well in advance, but the Ministry of Planning and the Civil House of the President of the Republic did not pay attention to those alerts. “The crisis,” states the report, “is no more than a sequence of errors regarding budget cuts on proposals elaborated by DECEA, limitations imposed upon the expenditure of approved budget, indifference to the need to expand and modernize SISCEAB and the inefficient allocation of human resources.”<sup>7</sup>

### A View From the Hot Seat

Air Major Brigadier Ramon Borges Cardoso is the interim General Director of DECEA, which manages some 4,000 aircraft movements every day.

“Airspace control is dependent on a balance with the airport infrastructure and the air transport route network,” Borges said, explaining the situation in Brazil. “Any unbalancing on any of these sectors affects the other two. And this is

happening. While all bodies were linked to COMAER, there was planning management unity. When Infraero was separated, and later ANAC replaced DAC, we lost that.”

The lack of dialogue between government agencies allowed the commercial aviation route network to be structured to pass through two main hubs: Congonhas airport in São Paulo and Brasília International Airport. Any weather problem in Congonhas affected the systemwide route network. If traffic was deviated to São Paulo–Guarulhos International Airport at peak hours, the number of gates there could not accommodate the traffic, and aircraft had to wait on taxiways for gates to open.

This system at press time was being rearranged by ANAC, mostly as a result of the TAM A320 accident in July. Airlines were told to avoid using Congonhas as a hub for domestic long haul operations. As a result of route network restructuring, “Cindacta I’s [share of] air traffic management is to decline from 56 percent of all Brazilian traffic to 40 percent, as traffic will be shifted to Cindacta III in Recife and Cindacta II in Curitiba,” Borges said. “Operational positions will be increased in both ACCs, from eight to 24 consoles in Curitiba and from four to 18 in Recife, by 2017.”

Technology is not an issue, he said. Besides en route radars, Brazil has terminal radars at all major terminal areas. Ten weather radars in the Amazon area and seven in Southern Brazil, the two most critical regions in this aspect, provide sufficient coverage.

“We are implementing monopulse secondary radars, a first step to Mode S, then [we will] implement definitively CSN/ATM [communication navigation surveillance/air traffic management],”



Borges

Borges said. “Automatic dependent surveillance–contract (ADS-C) and controller–pilot data link are being tested on the Europe–South America corridor; digital clearance delivery is to start this year in São Paulo, Rio de Janeiro and Brasília.”

At Cindactas II and III, software is being changed from French products to Brazilian developments produced by Atech, based on DECEA’s specifications. Cindactas I and IV already have new Brazilian software, with CNS/ATM functionalities incorporated.

The largest problem remains staff size: There are not enough ATCOs and not enough technicians. The current force level “does not allow us to keep [controllers] 24 hours of the day in all operational positions,” Borges says. “As we don’t have enough controllers, sometimes aircraft may stay grounded for lack of capacity in airspace control. However, as flight numbers are to keep growing — we expect 12 percent per year growth in the next five years — we’ll be able to respond. Some 600 new ATCOs are to join by the end of 2008.”

That may be of some help, but there’s another obstacle to be overcome. FAB cannot grow its labor force beyond a limit set by law. COMAER now is working with the House of Representatives to change that, allowing a 20 percent increase in labor. The departure of highly qualified personnel seeking better job opportunities also is a challenge.

Poor controller English proficiency is a problem pointed out by ATCOs themselves when they were permitted to talk to the media. Borges disagrees and says there’s a sufficient knowledge of technical phraseology. However, Brazil — plus 129 other countries, he adds — is not ready to meet the International Civil Aviation Organization’s (ICAO’s) language proficiency requirements dead-

line, originally set for next March (see story, p. 25). Under these requirements, ATCOs are expected to be able to communicate at Level 4 — an “operational” proficiency with English — using both technical phraseology and plain English. “We plan to have one English-proficient ATCO at every shift, but it is impossible to have all 4,000 ATCOs [expected for 2009] trained to colloquial English level by then,” he said.

There’s a real problem if you look at it another way, Borges says: “Native English-speaking pilots sometimes speak in high velocity, not worrying about clear pronunciation, using slang. This makes it very difficult for an ATCO to understand them. And sometimes those who fly under FAA [U.S. Federal Aviation Administration] rules do not know and do not employ ICAO [language] rules when flying here. They request procedures that exist in the United States only. . . . The ATCO doesn’t understand what he is asking. We have to work with IATA [International Air Transport Association] and ask them to help pass along to pilots the need to apply ICAO rules here.”

Hierarchical conflicts between ATCOs and their superiors are seen in a linear way by Borges. Military personnel know they will work under military rules, in a military-managed environment, when getting the job, he says. If they don’t enjoy it and want to leave, they are free to do so, he adds, supposedly after their military enlistments expire. Borges maintains there is no problem now that the ATCO leaders whom the management considers “rioters” await military judgment. “Congonhas now has an average of 10 percent of all flights delayed, which is acceptable,” he says.

Demilitarization? “Ten years from now, radars will begin to be phased out for air traffic control; CSN/ATM will

be implemented instead. COMAER’s position is that, by that time, a separation be done. The FAB will provide air defense utilizing radars, and a civil agency and its civil control centers will do air traffic control. Civilian ATCOs would then perform activities today done by military personnel.” ●

*Edvaldo Pereira Lima is an aviation journalist living in Brazil.*

## Notes

1. Data released by CENIPA. Available at press time in Portuguese at <<http://www.cenipa.aer.mil.br/paginas/estatisticas.htm>>.
2. “Manifesto dos Controladores de Vôo” (“Air Traffic Controllers Manifesto”). Released to the media on March 30, 2007.
3. “Relatório das Condições de Trabalho dos Controladores do Tráfego Aéreo” (“Report on the Working Conditions of Air Traffic Controllers”). Released in January 2007.
4. Araújo, Rita de Cássia. “Prevenção ou Punição? Considerações Para Revisão da Lógica no Controle do Tráfego Aéreo no Brasil” (“Prevention or Punishment? Considerations on the Reviewing of Air Traffic Control Logic in Brazil”). Released by the author.
5. “Acórdão 2420/2006 — Plenário — Relatório de Levantamento de Auditoria no Sistema de Controle do Tráfego Aéreo.” Audit report signed by Minister Augusto Nardes. Available at press time in Portuguese at <<http://www.tcu.gov.br/>>.
6. On July 17, 2007, the A320 overran the runway while landing at Congonhas Airport and struck a TAM express cargo facility, killing 199 people, including all aboard. This was the worst air accident ever in Brazil; the second worst was the 737/Legacy midair collision in 2006. The A320 accident stirred a number of changes in the air transport system of Brazil. Minister of Defense Waldir Pires was replaced by Nelson Jobim. There were top management changes at Infraero and ANAC.
7. Nardes.