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SUCCESSFUL ACTIONS FOR AVIAN HAZARD CONTROL IN BRAZIL

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Abstract

Brazil built one of the world's largest aeronautical infrastructure. The airport net is distributed along its vast territory, which shows a tremendous ecosystem variety. Having a large civilian aircraft fleet and also running second after Venezuela in catalogued bird species, Brazil has had problems related to bird strikes.

Although Brazil has little problem with migratory birds, the threat posed by residents birds in some airports represents a risk to be managed. On the other hand, due to human population growth and poor policies of garbage disposal in the past, nowadays some big airports have in their vicinities open dumps that attract birds. That causes an ever-increasing population growth of a bird species similar to the Black Vulture, the Urubu (*Coragyps atratus*), that survives eating the carrion available in those places.

Therefore, we have faced the rising risk of bird strikes around some airfields. The solution of the problem encompasses many institutions and requires a great variety of measures.

The paper presents some successful actions that have been undertaken by the SIPAER, the Brazilian aviation safety system, to keep the avian hazard under control in Brazil.

KEYWORDS: successful actions, education, landfills, carrion destination, slaughterhouses, legal measures.

1. INTRODUCTION

In Brazil, the bird population growth driven by the increased ecological consciousness and also by some urban disequilibrium, combined with the expansion of air transportation in most of the cities are resulting in a preoccupying increase of the bird strike statistics.

The problem affects a great majority of airports, assuming different characteristics for each peculiar geographic region. Brazil, with one the most diversified bird population region of the world, with almost 1,700 known species, barely have reports of bird strikes with migratory birds. However, because of deficiencies related to urban waste management, Brazil's statistics concerning bird strikes near some big airports are somewhat alarming.

For that reason, an well orchestrated Avian Hazard Control Program (formerly Bird Strike Reduction Program) is established.

This paper intends to present the peculiarities of avian hazard in Brazil and successful actions implemented to reduce the risk of aeronautical accidents due to bird strike.

2. THE BRAZILIAN SCENE

The Federative Republic of Brazil has an area of 8,511,965 sq km (3,319,666 sq mi), holds a population about 160 million and Portuguese is the official language. its capital, Brasilia, was built in only three years, from 1957 to 1960.

Brazil is made up of 26 States plus the Federal District. Thus, besides the Union Government, each state holds its own government structure. The states are divided into counties that also have their own administrative struture. The jurisdiction of each level of government is established by the Federal Constitution, laws and others legal acts. That requires a lot of agreements to solve a problem which root causes are spread into all three governments levels.



Figure 1 - South America and Brazil

The Amazon Basin is a gigantic system of rivers and forests, covering half of Brazil and extending into neighboring countries. The stretch of river known as Rio Amazonas runs between the cities of Manaus and Belém, locations that are being rapidly settled and have had problems relating urban's growth and birds.

The Pantanal, a vast area of wetlands, about half the size of France, lies in the far west of Brazil and extends into the border regions of Bolivia and Paraguay. The Pantanal is a sanctuary for giant river otters, anacondas, iguanas, jaguars, cougars, crocodiles, deer and anteaters, but birds are the most frequently seen wildlife. Cities like Campo Grande and Corumbá also have had problems concerning bird strike.

In spite the fact that some major tributaries of the Amazon River are still unexplored and many species of birds have not been classified yet, Brazil already ranks second for bird species after Venezuela. Unfortunately, some species are under threat because of the depletion of rainforests, desertification in the northeast, poaching in the Pantanal region and coastal pollution. For that reason the Brazilian Research

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Center for Wild Birds Conservation, CEMAVE, which is subordinated to the Ministry of the Environment, is a necessary presence in all matters related to birds, including those involving the Urubu (*Coragyps atratus*, wt 2Kg, 4lb), a bird species similar to the Black Vulture, which survives eating carrion.

Although much of Brazil is scarcely populated, such as the Amazon and Pantanal regions, there are also great metropolis, mainly next the coastal line, like São Paulo and Rio de Janeiro, and some smaller, Porto Alegre, Curitiba, Belo Horizonte, Salvador, Recife, Natal and Fortaleza, among others important cities with bird related problems.

3. THE SIPAER AND THE CENIPA



The SIPAER, Brazilian Aeronautical Accident Prevention and Investigation System, is a well established flight safety structure. The System counts more than 4,000 flight safety specialists spread in large airlines, small aviation companies, aircraft manufacturers, technical centers, airport administrations, military units and commands, traffic control system and aviation schools. The huge systemic structure is directly connected to its central organization, the CENIPA, settled in Brasilia.

The CENIPA, Aeronautical Accident Prevention and Investigation Center, is the Brazilian aviation safety center for military and civil aviation, being responsible for training the SIPAER personal. In addition, the CENIPA controls all investigation proceedings, corrective actions implementation and produces statistics informator and trend analysis studies. Its computerized database holds all accidents and incidents that have happened in Brazil, including the bird strike reports.



4. BIRD STRIKE STATISTICS

To feed the Avian Hazard Control Program database, a form were developed and disseminated throughout the SIPAER for reporting bird strike.

Since the beginning of the CENIPA's database up to the end of the year 2000, have been collected 2,198 reports in which the phases of operation were identified (table 1). Considering the phases of flight that take place at or around the airport (taxiing, take-off, approach, landing and landing roll) and half of the other phases (except the *en route* phase), it is possible to notice that the collisions that occurred at the airports, their traffic area or its proximity represent more than 79% of the total.

Phase of Flight	# of Strikes	% of the Total	Phase of Flight	# of Strikes	% of the Total
Take-off	534	24.30	Climb	112	5.10
Approach	506	23.02	Descent	68	3.09
Landing roll	225	10.24	Landing	125	5.68
Low level flight	193	8.78	Taxiing	13	0.59
En route	134	6.10	Not reported	288	13.1

Table 1. Bird strikes per phase of flight (1980 up to december/2000). Source: CENIPA.

In Brazil, the bird strike is a problem predominantly related to urban areas. Almost all of the main airports are located within the cities.

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The situation is aggravated because many areas close to airports usually are lower priced and inhabited by numerous lower income families, that live without adequate sanitary conditions for their garbage. According to the IBGE - Instituto Brasileiro de Geografia e Estatística –, a Brazilian official survey institution, 13% of the Brazilian urban population do not have their garbage collected in a regular basis. Once the Brazilian's domestic waste is made up of an average of 48% of organic material, the situation represents a large amount of food for the birds.

Airport	# Bird Strikes	City	First Report
1. SBGL	166	Rio de Janeiro	03/1984
2. SBGR	160	São Paulo	08/1989
3. SBPA	108	Porto Alegre	12/1987
4. SBNT	77	Natal	08/1980
5. SBSM	65	Santa Maria	04/1982
6. SBEG	60	Manaus	08/1989
7. SBYS	60	Pirassununga	04/1985
8. SBMN	59	Manaus	08/1982
9. SBRF	57	Recife	10/1981
10. SBSC	55	Rio de Janeiro	03/1988
11. SBSV	50	Salvador	03/1985
12. SBCT	43	Curitiba	10/1988
13. SBBE	42	Belém	10/1985
14. SBFZ	41	Fortaleza	05/1988
15. SBGO	41	Goiania	06/1991
16. SBFL	41	Florianópolis	05/1986
17. SBPV	36	Porto Velho	07/1988
18. SBCO	33	Canoas	10/1986
19. SBVT	30	Vitoria	10/1984
20. SBCG	28	Campo Grande	09/1984
21. SBRJ	23	Rio de Janeiro	08/1984

Table 2. Bird strikes per airport (up to december/2000). Source: CENIPA

A accurate evaluation of the bird strike relation to urban areas can be seen in the table 3.

City	Airports	Bird Strikes
Rio de Janeiro	SBGL / SBSC / SBRJ	244
São Paulo	SBGR / SBSP	181

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Porto Alegre	SBPA / SBCO	141
Manaus	SBEG / SBMN	119

Table 3. Bird strikes per city (1980 up to december/2000). Source: CENIPA

5. CONTRIBUTING FACTORS FOR URUBU'S OCCURRENCE

CENIPA database shows that most of the bird strike events in Brazil were related with the Urubu (*Coragyps atratus*), bird which a wingspan average of 1.5 m (59 inches) and weighting about 1.6kg (3.52 lbs). The bird can be found, almost always in large numbers, either in Manaus or Rio de Janeiro, cities far from each other about 4,000 km.

In 1,126 out of 2,198 strike reports the bird was identified and the participation of each species is showed in the table 4.

Bird Species	# of Total (2,198)	% of Identified Species (1,126)
Urubu (<i>Coragyps atratus</i>)	28.16	54.97
Quero-quero (<i>Vanellus chilensis</i>)	7.55	14.74
Owl	3.14	6.13
Hawk	2.59	5.06
Bacurau (<i>Podager nacunda</i>)	1.96	3.82
Heron	1.87	3.64
Others	5.96	11.64

Table 4. Birds involved in strikes in Brazil (1980 up to december/2000). Source: CENIPA

Analyzing the root causes for Urubu's presence in the airport's vicinities, some basic contributing factors were identified.

Until 1989, about 86% of the Brazilian cities had been disposing their urban waste in open dumps. Frequently, urban waste disposal sites and airports share the same geographical space. Both need to be close enough to the city to make ground transportation cost-effective and require a good road structure. For the same reasons, others bird's attractants activities, like slaughterhouses, tanning industries and fishing industries (when applicable) are found close to airports. Whereas the Urubu eats meat in deterioration available in waste dumps, such activities near the airports place the bird on the aircraft's routes.

Because of Urubu's characteristics, the most common control methods are not effective against it. Falconry does not work, since the Urubu (a top of line raptor) is bigger than falcons and flies in big flocks. Ground deterrents (wailers, gas cannons, chemical products, etc) do not work either since the bird is barely found on the airport surface area, but usually flies on thermals, remaining for long periods in the air, many times disturbing the airports' traffic area, approach or departure paths.

The Urubu is a silvan bird protected by Brazilian's law and, therefore, can not be killed without a very bureaucratic and slow proceeding. There is no natural predator for the Urubu, hence the population growth allowed by the abundance of food remains unbalanced.

6. SUCCESSFUL ACTIONS

In October of 1995, the Ministry of Environment signed a Resolution creating the “A.S.A.”, Airport Safety Area, where it became prohibited the establishment or operation of any bird attractive activity. It includes waste open dumps, slaughterhouses, tanning industries, some agriculture plantations, fish industries, etc. The ASA is circular and has two different sizes: for IFR operating airports it requires a radius of 20km, and for VFR airports, 13km.

Based on the ASA and others legislations, including specific aeronautical acts for the use of areas around the airports, a lot of actions were undertaken for controlling the bird strike hazard. And its about these actions that we are about to talk.

6.1. Rio de Janeiro

Rio de Janeiro, having its 7 million inhabitants jammed between ocean and escarpment, is the Brazilian city most visited by tourists, that arrive by the Rio de Janeiro International Airport – Galeão - Antonio Carlos Jobim (SBGL).

The final approach of the airport's most used runway goes over an location known as Jardim Gramacho, which held an open dump for about 80% of all waste collected in Rio de Janeiro metropolitan area. Because of the garbage available, including carcass of dead animals, flocks of Urubus were usually found in the surface or flying over the area, posing a collision risk to the aircraft on approach.

Nowadays, due to requests done by Aeronautical Authorities, the operational procedures were changed, and the mass occurrence of Urubus has being reduced.

The waste is covered with soil after its disposition and fireworks are used to avoid bird on the small work area, that, in the past, was spread all over the terrain. In addition, the area as a whole was recovered by soil and the toxic liquid deriving from the waste has being treated and does not pollute the adjacent Guanabara Basin anymore. Thanks a lawsuit, the dump, which receives about 9,000 ton of waste every day, will be closed by december of 2004.

The waste dump is not the only reason for the Urubu's presence in the vicinities of the airport and, therefore, others actions have been adopted to get the final approach path to the Rio de Janeiro International Airport free of the Urubus.

6.2. Salvador

Salvador, capital of Bahia State, is a fascinating city loaded with historic buildings. Carnival in Salvador is justly famous and attracts hordes of tourists. The Salvador International Airport - Luís Eduardo Magalhães (SBSV), used to face the same problem of Rio International Airport, the massive presence of Urubus on its final approach.

As a result of the actions taken in Salvador (BA) in accordance with the Avian Hazard Control Program, the state government contracted a consultant to present a program to reduce contributing factors for Urubu's occurrence close to the city airport.

Amid the proposals were suggestions for desatvation of the city waste open dump, known as Canabrava, and guidance for construction and management of a landfill. Nowadays the proposals have been turned into reality.

The Canabrava area, although still operating, has the waste covered with soil. A landfill was established for the metropolis in another area. The new landfill does not attract birds as the garbage is covered with soil immediately after its disposition on the site. To remove the birds for the previous open dump area, the carcass of dead animals are being disposed in a remote site specially chosen.

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The results are excellent. In accordance with a count made in February of 2000, the Urubu's population in Canabrava reduced about 89.8% if compared with that registered in a previous census done in 1996. Hence the bird strike risk was significantly reduced.

Ironically, the funds for the project were partially received from BIRD, International Bank for Reconstruction and Development.

6.3. Natal

Natal, capital of Rio Grande do Norte State, is located in the Northeast region of Brazil. Similarly to Rio de Janeiro and Salvador cities, the massive presence of Urubu in the vicinities of Natal International Airport is caused by deficiencies on the urban waste treatment.

	Urubu	Others	Unidentified
# of Strikes	57	1	18
% of Total	75.0	1.3	23.7

Table 5. Birds involved in strikes in Natal (1981 up to december/2000). Source: CENIPA.

The 1997 rate of bird strike showed more than three bird collisions per 10,000 aircraft movements (take off or landing) for Natal, which means that the city held the highest bird strike rate among the Brazilian airports in that year. Nevertheless, only a few occurrences involved civilian aircraft. Most of the bird strike involved military aircraft flying over the Natal Metropolitan Region, which includes others five cities.

The occurrence of Urubus in the vicinity of Natal International Airport – Augusto Severo (SBNT) is supported by the operation of waste dumps. The dumps' managers were notified by the Aeronautical Authority about the problems caused by their activities and requested to modify their procedures in order to eliminate the food available for the Urubus.

Once the solicitations were not attended in an expeditious manner, some legal proceedings have been adopted based on the ASA Resolution and others legislations. Lawsuits against the waste companies have been sued and the end of waste dump operations were requested by the Union Advocate Office.

The results are good. A landfill will be established for the Natal's Metropolitan Region, which means that the others five cities also will send their urban waste for the landfill. The outcome is that these cities will close their open dumps. The landfill had the approval of the Aeronautical Authority, who consulted CENIPA about technical matters related to bird strike.

Meantime, while the landfill is under construction, the waste dumps are still being operated, but the garbage has been covered with soil and fireworks are being used to keep the birds away.

6.4. The Southern States Airports

The southern States' airports show a predominance of bird strikes involving the Quero-quero (*Vanellus chilensis*), a kind of Lapwing, rather than the Urubu.

In Porto Alegre, capital of the most southern State, sometimes the Quero-quero is found in enormous quantities near the runways where it can find security. During take-off and landings, the birds start flying when they notice the aircraft proximity. Because of this behavior, the usual outcome are strikes against the coming aircraft.

Similar situation is found in Florianopolis, capital of Santa Catarina State, and Curitiba, capital of Paraná State. The statistics for the Southern States as a whole are showed in the table 6.

Bird Species	% of Total (413)	% of Identified Species (195)
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Quero-quero - <i>Vanellus chilensis</i>	23.97	50.77
Urubu - <i>Coragyps atratus</i>	7.75	16.41
Owl	5.33	11.28
Heron	3.15	6.67
Others	7.02	14.87
Not Reported	52.78	

Table 6. Bird strikes in Southern States airports (1982 up to december/2000). Source: CENIPA.

To deal with the Quero-quero in Porto Alegre, Florianopolis and Curitiba falconry trainers were contacted, but the results are not as good as expected. The agreement was done between the INFRAERO, the Brazilian Airport Infrastructure Enterprise, and the falconers.

In order to reduce the Quero-quero presence on those airports, a research about the kind of terrain vegetation coverage less propitious for their occurrence has been proposed by CENIPA to Universities spread all over the country, but the field research is not concluded yet. The idea of vegetation substitution is suitable for airports affected by other bird species.

Brazil has one of the most severe animal protection law in the world. Killing a savage bird in Brazil is a crime with no parole, except if the act is done for feeding necessity. It protects even the Urubu, despite of the risk that it offers for human lives boarding aircraft. Therefore, to free the southern airports of the Quero-queros it will take a long time.

6.5. Positive Outcomes from Bird Strike Seminars

Because of the difficulties in fixing the identified problems, due to the large variety of government institutions and civilian organizations involved, starting in 1995, a series of one-day seminars have been held in the cities with higher bird strike rates. For each seminar are invited each industry and local government department directly or indirectly related to the bird attraction problem, local aviation companies, airport administration, pilots, universities and the media. These seminars' goals are to discuss the local problems with all sectors involved, to present them specific information about bird strike hazardous potential, to call society's attention for the risk, pushing government's authorities to do something about the problem.

During the seminars, are presented the risk of aeronautical accidents caused by bird strikes (most of the audience do not know it until the seminar), the report of the evaluation flights done a few weeks before, the environmental impact of the deficiencies detected, and the legal consequences of an accident caused by bird strike (the source of attraction can be prosecuted). The seminars end with a open discussion with the audience, when solutions are presented and many of the desired actions are finally assumed by the legally responsible parties.

The seminars have been very effective, with a variety of initiatives being performed in most of the cities, but probably the best result has been the increased awareness of all segments of the local society for the risks involved and their responsibilities in reducing them.

Amid others good outcomes are the following:

- Educational Campaigns. In Teresina city, capital of the Piauí State, a strong educational campaign was developed to keep the airport's surrounding area free of bird attractants. The area was cleaned and many outdoors were set on the roads next to the places once used to dispose garbage. The outdoors' message, clear and well illustrated, told why and how to avoid disposing garbage on those places.

- Comics Book. After a seminar held in Maceió city in 1996, local organizations developed a small comic book for children about the bird strike risk. The magazine explains, with very simple language and drawings, the risk of accidents caused by bird collisions, the causes of bird attraction, the effects of such accident and the actions that everyone can take in order to reduce the problem. The comic magazines

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were targeted at low-income children of the outskirts areas that are close to the airport. They were distributed in schools and residences of the region.

- Children performance. Another fortunate product of the Maceió seminar was the creation of a group of children that developed and performed a theatrical presentation about the matter. Presented in the schools of the city, the performance showed exactly the same topics -- risk, causes, effects and corrections to the problem -- educating children about basic sanitary aspects and motivating them to contribute to quality of life improvement.

6.6. The Brazilian Avian Hazard Control Policy

The Brazilian Avian Hazard Control Policy is oriented by CENIPA and has two basis: to avoid the establishment and also to eliminate all bird's attractive activities near or inside of all Brazilian airports.

To avoid the proliferation of bird attractive activities near airports, nowadays CENIPA has been consulted about the agreement of the Aeronautical Authority relative to the establishment of activities with bird attraction potential inside the ASA limits, which covers an circular area based on a 20Km radius around the main airports.

To eliminate the existent bird attractive activities, there is a committee, coordinated by a CENIPA officer, which acts all over the country. Basically, the committee orientates the local authorities and undertakers about the risk of keeping in operation the bird attractive activities. There are serious legal consequences for that, even jail.

The committee also works with airlines, airport managers, federal and state organizations responsible for areas related to the bird strike control matters.

7. CONCLUSION

In Brazil, the air transportation industry has had a tremendous growth during the recent years, achieving traffic volumes and airport movements that compare to some first world countries. At the same time, due to sanitary defficiencies usually associated with the urban waste destination, there is an ever-present risk of bird strike near some important airports.

According to Brazilian laws, the Command of Aeronautics is responsible for the air navigation safety. However, the solutions for most of the major causing factors of bird attraction to airports' vicinities go beyond its constitutional scope. It involves numerous federal, state, municipal and even private sectors, from local governments to wildlife agencies, from waste management to residents associations.

Therefore, the solutions for the risk of accidents caused by bird strikes have encompassed many institutions. To get all society segments involved in the solutions has been the best way to deal with the avian hazard problem in Brazil, and that is done by varied actions.

In this paper some of those successful actions were commented. Because of them Brazil' sky today is safer than yesterday, although still less safer than it will be tomorrow.

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