International Civil Aviation Organization
North American, Central American and Caribbean Office

INFORMATION PAPER

ICAO/IATA/CANSO PBN/3-IP/03
26/06/18

Third ICAO/IATA/CANSO Performance-Based Navigation (PBN) Harmonization, Modernization and Implementation Meeting for the North American, Caribbean and South American (NAM/CAR/SAM) Regions

Mexico City, Mexico, 2 – 6 July 2018

Agenda Item 2: **Implementation of Performance-Based Navigation (PBN) Routes**

2.3 New Performance-Based Navigation (PBN) Routes Proposal and Interregional Initiatives

BRAZILIAN AIRSPACE ROUTING PROPOSAL

(Presented by Brazil)

EXECUTIVE SUMMARY	
This Information Paper is set for present the routing proposal within Brazilian Airspace adjusted for the NAM/CAR/SAM Regions PBN project.	
Strategic Objectives:	• Safety • Air Navigation Capacity and Efficiency • Economic Development of Air Transport • Environmental Protection
References:	• Doc 7030 - *Regional Supplementary Procedures* • Doc 8733 - *Air Navigation Plan – CAR/SAM Regions*

1 Introduction

1.1 Since August 17, 2017, new airways related to the PBN project of the NAM/CAR/SAM Regions have come into force, resulting in distance, fuel burn and greenhouse effect emissions important reductions.

1.2 Brazil has entered in this project with changes in airways attending its major airports: Guarulhos International (SBGR), Galeão International (SBGL), Brasília International (SBBR) and Confins International (SBCF).

1.3 The new operational characteristics of airspace will further enhance the economic gains identified, once a simplified airspace shall contribute to a better air traffic flow and a smaller ATCO workload, thus, allowing ATCO to handle a greater number of airplanes.

2 Discussion

2.1 Proposed routes

2.1.1 The changes proposed are aligned to those worked within NAM/CAR/SAM PBN, with 4 points of entrance in Brazilian airspace, which will direct to the four major international Brazilian airports: SBGR, SBGL, SBBR and SBCF.

2.1.2 Following the actions set forth in the Second ICAO/IATA/CANSO Performance-Based Navigation (PBN) Harmonization, Modernization and Implementation Meeting for the Caribbean (CAR) Region, all publications were prepared to be published and implemented using the AIRAC cycle of 22 June 2017. However, during the 4th teleconference on the Third PBN Meeting, occurred in 31 May 2017, due to problems found by some States to publish their routes on 22 June, it was necessary to postpone the entire new route structure to the AIRAC cycle of 17 August.

2.1.3 Once all material related to the route amendment in Brazil was already ready for publishing and it was sent to be printed and distributed to the users, it was necessary to issue NOTAM postponing the in force date of new routes.

2.1.4 The new routes proposed are presented in the **Appendix** to this Working Paper.

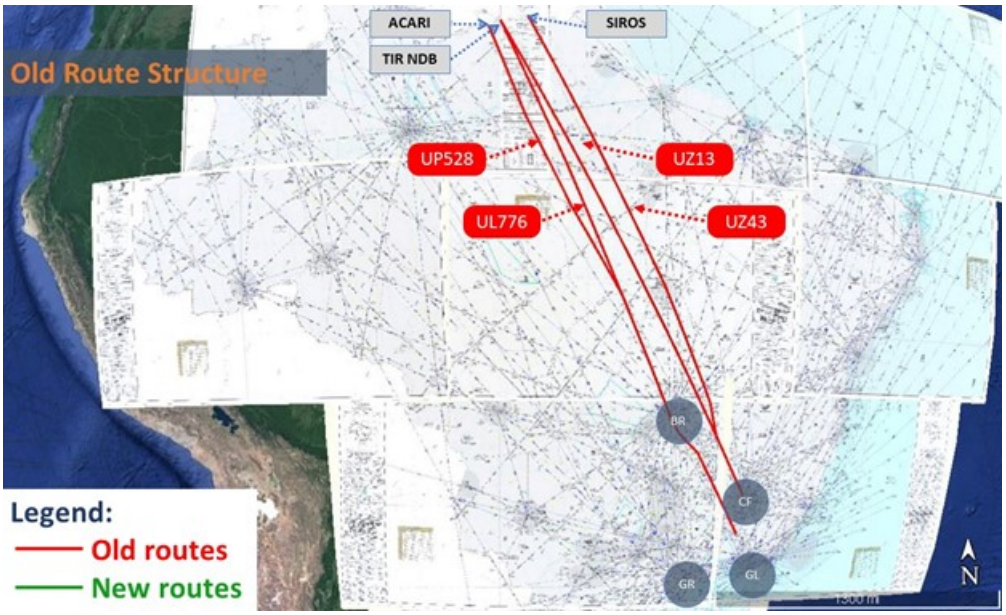


Figure 1 – Previous route structure

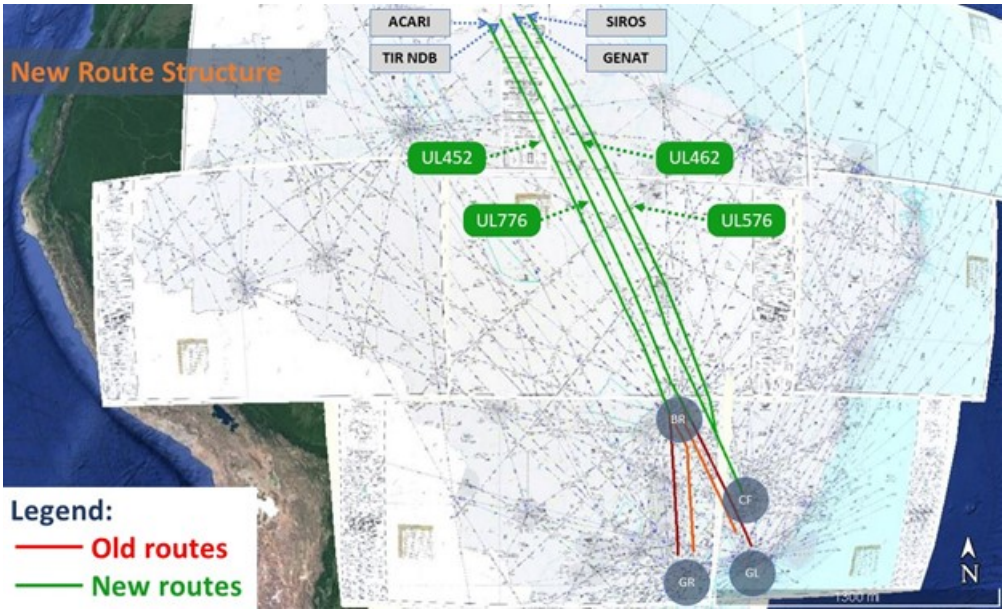


Figure 2 – New route structure

2.2 Efficiency of the proposed routes

2.2.1 To evaluate the efficiency of the proposed changes, a study was conducted comparing the shortest distance between a pair of cities and the distance to be flown using the new routes.

Note: All the distances were calculated using the flight plan tool found in www.skyvector.com

2.2.2 An efficiency index was calculated by dividing the difference between the distances mentioned in the previous paragraph and the optimal distance found between the city pair. The formula used was:

$$Efficiency\ Index = 1 - \frac{(d_{route} - D_{optimal})}{D_{optimal}}$$

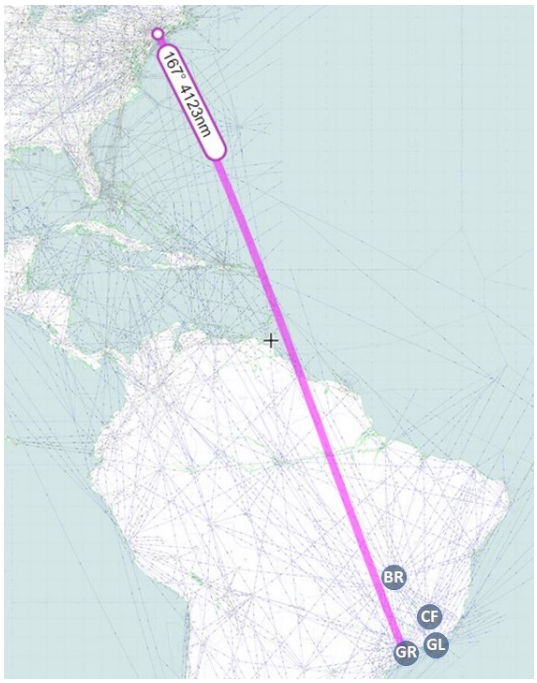
2.2.3 For this study, the departure aerodrome used was KJFK and no departure or approach procedure was employed.

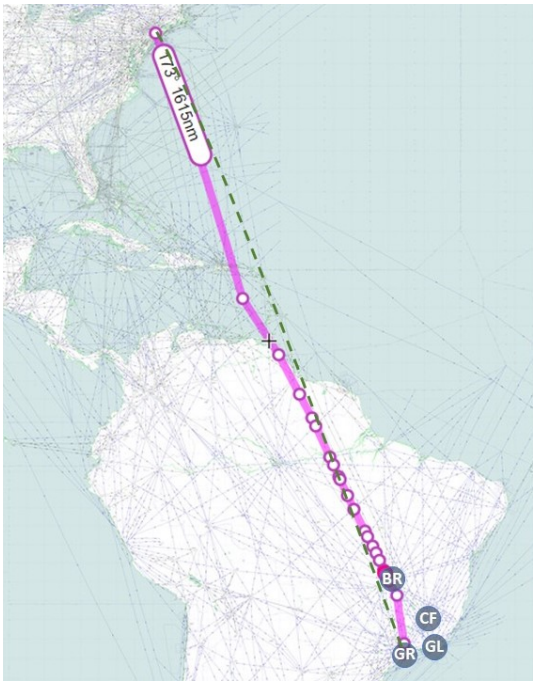
2.2.4 In addition, the study evaluated the efficiency index of the proposed changes in Brazilian airspace, taking as departure point the entry points used in the project (ACARI, TIR NDB, GENAT and SIROS) and the aerodromes served by each route.

2.2.5 The result of the study can be found in Tables 1 to 6 below, as well the routes studied. In every case, the efficiency index found was very high, all over 97%.

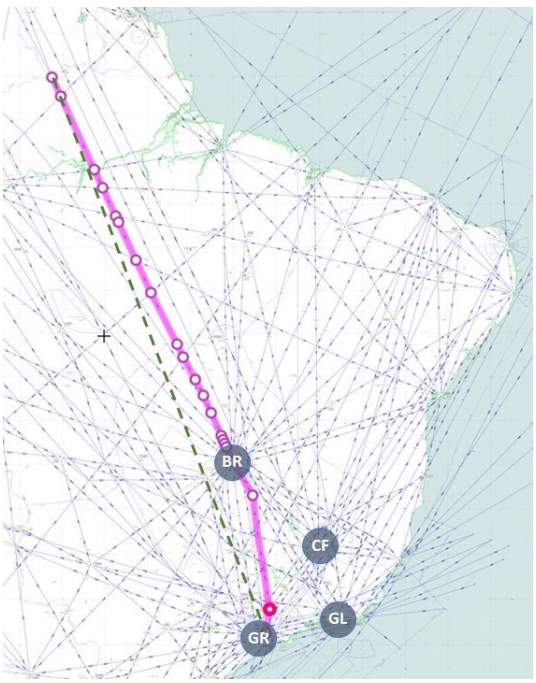
Table 1 – UL452 from KJFK to SBGR

Route	Base distance	Route distance	Difference	Efficiency index
From KJFK	4123.2 NM	4166.4 NM	43.2 NM	98.95%





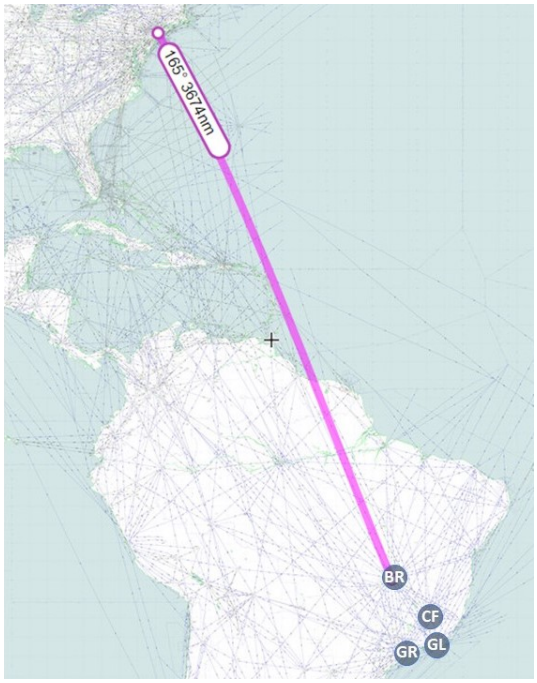
Route	Base distance	Route distance	Difference	Efficiency index
From ACARI	1626.2 NM	1648.9 NM	22.7 NM	98.60%

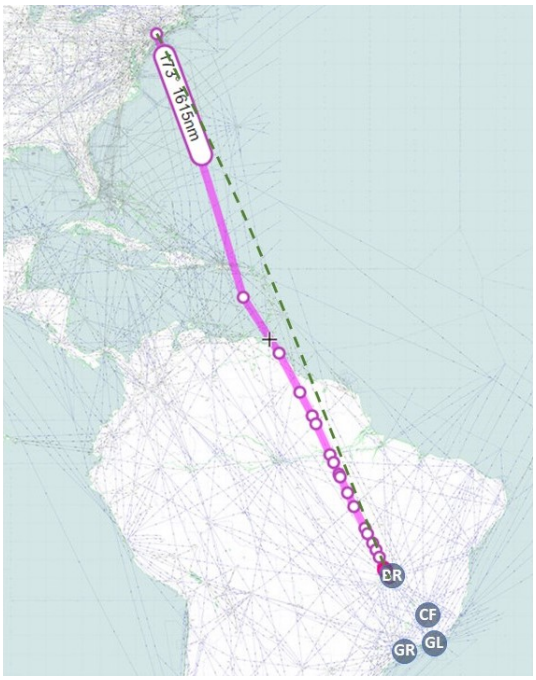


KJFK ANADA MINDA ASASO ACARI TIKBA DARBU DABVO SIPIS PUMKU POPMA IBDAN TOPAM SUDNA DABLI CHORD DOLVI GIGTI PAMOP PUNAT SIGIG BSI UZ6 NIMKI UZ38 MOXEP **SBGR**

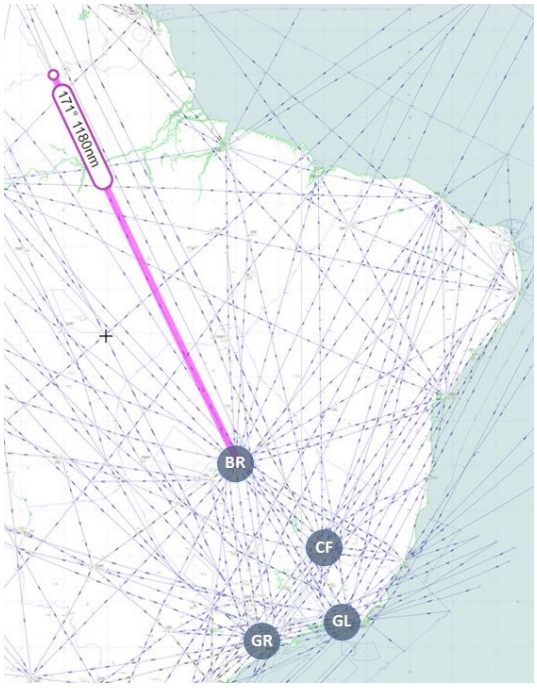
Table 2 – UL452 from KJFK to SBBR

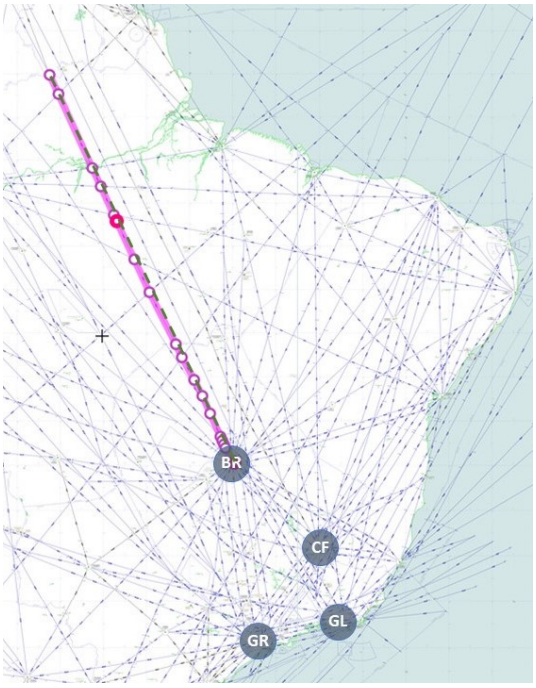
Route	Base distance	Route distance	Difference	Efficiency index
From KJFK	3673,5 NM	3698,1 NM	24,6 NM	99,33%





Route	Base distance	Route distance	Difference	Efficiency index
From ACARI	1180,2 NM	1180,6 NM	0,4 NM	99,97%

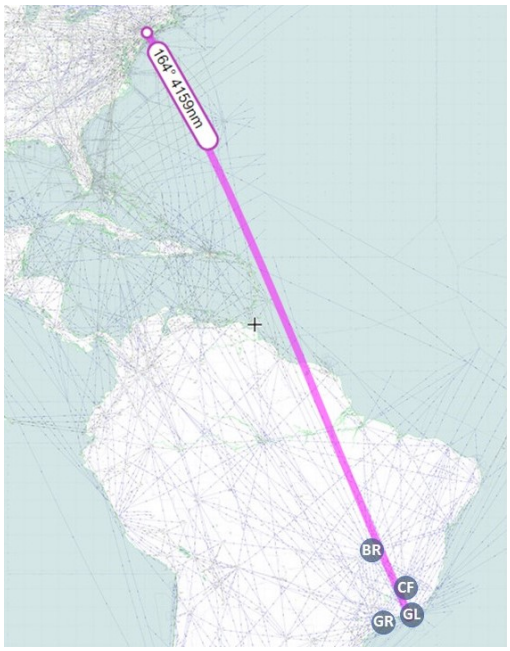




KJFK ANADA MINDA ASASO ACARI TIKBA DARBU DABVO SIPIS PUMKU POPMA IBDAN TOPAM SUDNA DABLI CHORD DOLVI GIGTI PAMOP PUNAT SIGIG **SBBR.**

Table 3 – UL776 from KJFK to SBGL

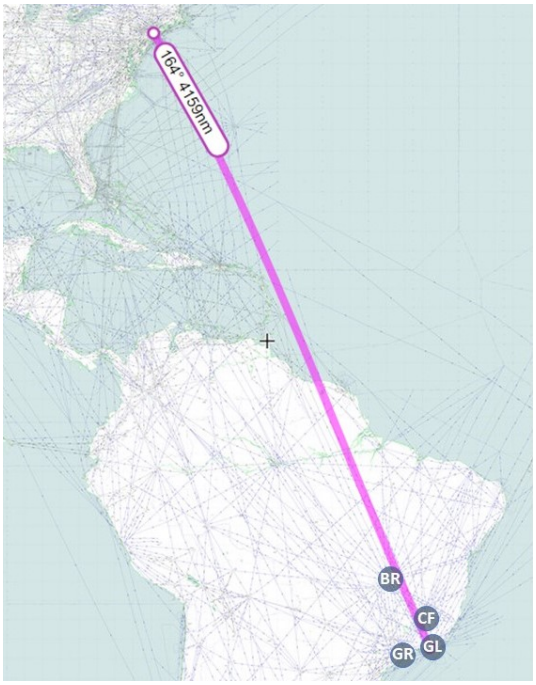
Route	Base distance	Route distance	Difference	Efficiency index
From KJFK	4159,2 NM	4182,5 NM	23,3 NM	99,44%

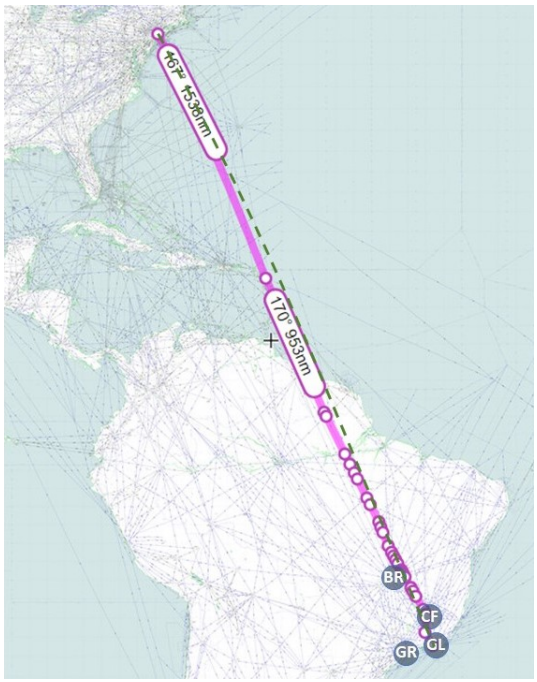


Route	Base distance	Route distance	Difference	Efficiency index
From TIR NDB	1670,0 NM	1674,0 NM	4,0 NM	99,76%

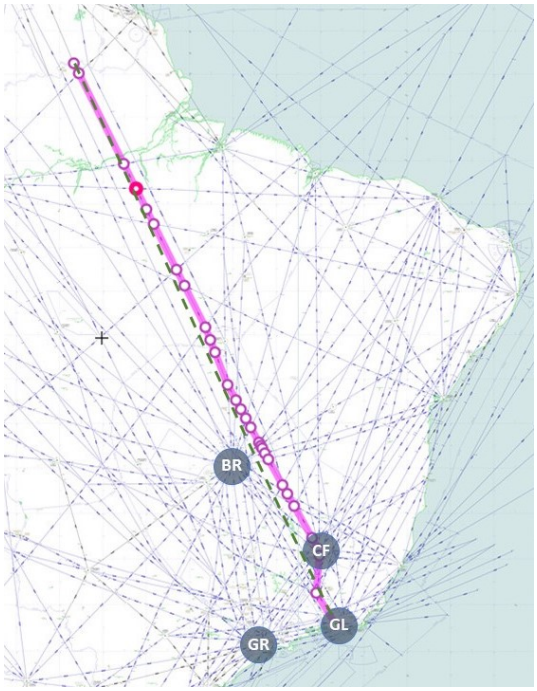
KJFK GEECE KORTO NIDNA TIRIÓS (TIR NDB) OBGUX NUVUG OPVID KOGRI VUROX LUVNU ITALA OPTEN RODOT VARSO SOBOL SIDUG ERVUB PUMBI SIMUV UZ38 MOLTI UZ24 MAVGU **SBGL**

Table 4 – UL462 from KJFK to SBGL				
Route	Base distance	Route distance	Difference	Efficiency index
From KJFK	4159.2 NM	4178.7 NM	19.5 NM	99.53%





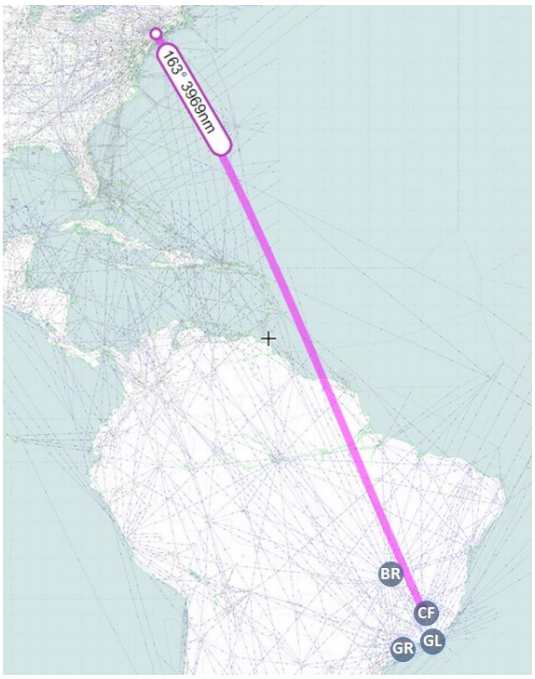
Route	Base distance	Route distance	Difference	Efficiency index
From GENAT	1670.4 NM	1687.3 NM	16.9 NM	98.99% NM



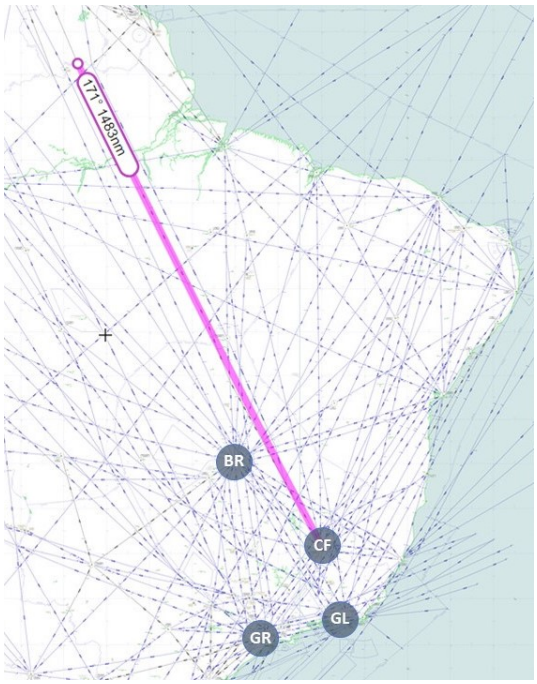
KJFK ANU GENAT UKAMU KAKEK OPGUG DOTSO TODGA OSOVA AKREM ILRIP MUMER TOBKO RUSTE NATIO NIBMO PANDI PAROL PEDAL FLASH ORATE BLUES SELDI AFTER OBGEM LISBO SIDOL CNF BHZ UZ3 MAVGU **SBGL**

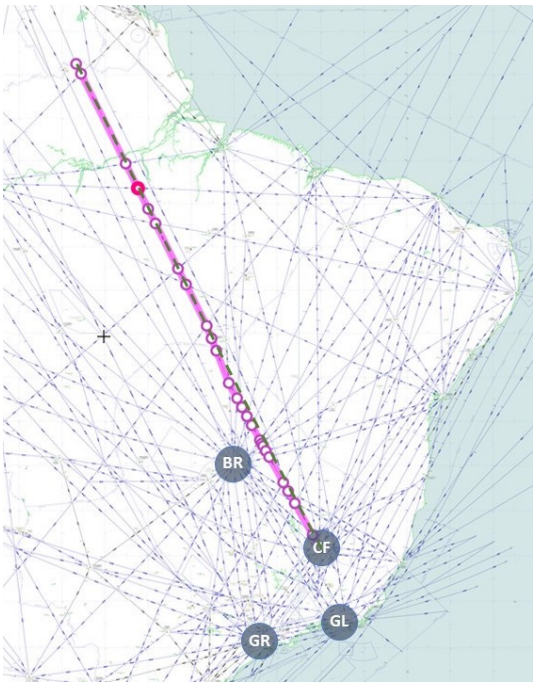
Table 5 – UL462 from KJFK to SBCF

Route	Base distance	Route distance	Difference	Efficiency index
From KJFK	3969,0 NM	3975,4 NM	6,4 NM	99,84%



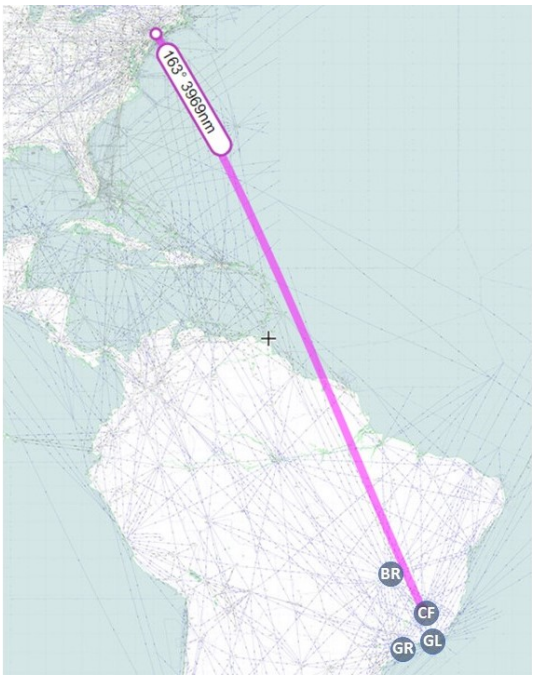
Route	Base distance	Route distance	Difference	Efficiency index
From GENAT	1482,7 NM	1484,0 NM	1,3 NM	99,91%

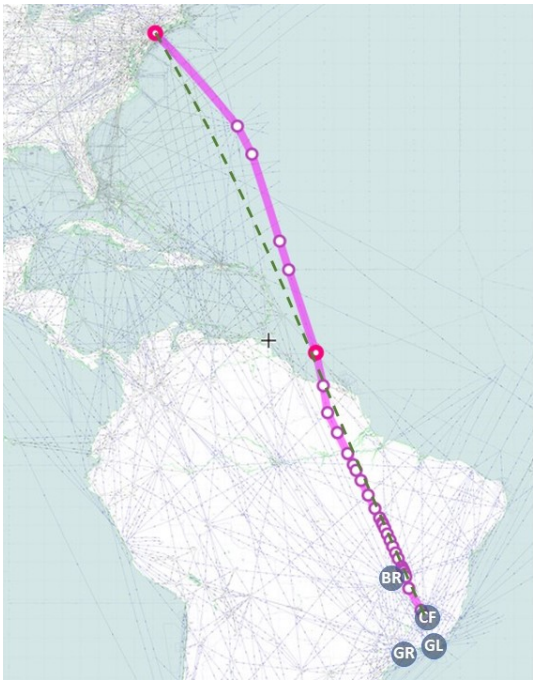




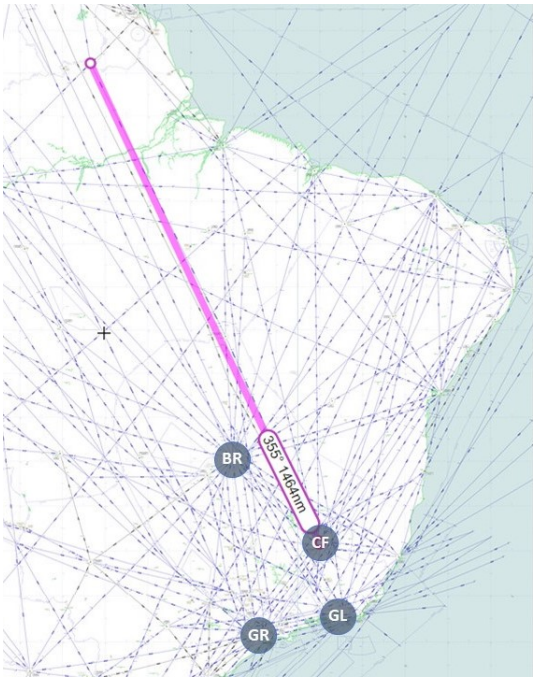
KJFK ANU GENAT UKAMU KAKEK OPGUG DOTSO TODGA OSOVA AKREM ILRIP MUMER TOBKO RUSTE NATIO NIBMO PANDI PAROL PEDAL FLASH ORATE BLUES SELDI AFTER OBGEM LISBO SIDOL **SBCF**

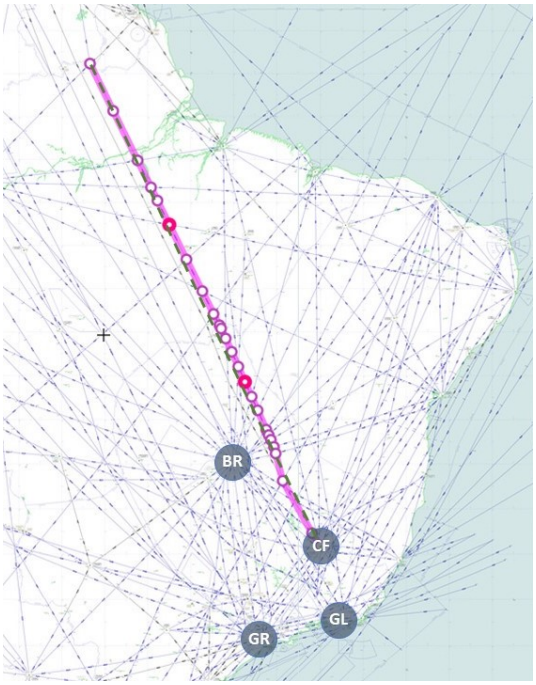
Table 6 - UL576 from KJFK to SBCF				
Route	Base distance	Route distance	Difference	Efficiency index
From KJFK	3969,0 NM	4006,1 NM	+37,1 NM	99,06%





Route	Base distance	Route distance	Difference	Efficiency index
From SIROS	1463,6 NM	1466,3 NM	+2,7 NM	99,81%





KJFK BDA SEAVR RKDIA CITRS TRAPP ZY VOR SIROS KOKDI MASVU GAXAG KOKDO KOGPO ATOGU KOKNI ISOBI OPNUP DENOB PALMAS (PMS) VOR LODEK ISURO NUXOR ISONU ISUSI KOGPU SAPSA MOPLA OCELO ILPOS AFTER SIDOL **SBC**

APPENDIX

UL452

PUNTO SIGNIFICATIVO *SIGNIFICANT POINT*	*LATITUD* *LATITUDE*	*LONGITUD* *LONGITUDE*
ACARI*	**01° 57’ 25.80” N**	**056° 29’ 20.40” W**
TIKBA	01° 03’ 50.52” N	056° 04’ 50.62” W
DARBU	02° 22’ 34.45” S	054° 30’ 30.92” W
DABVO	03° 13’ 51.85” S	054° 07’ 01.50” W
SIPIS	04° 33’ 15.15” S	053° 30’ 34.52” W
PUMKU	04° 50’ 24.96” S	053° 22’ 40.62” W
POPMA	06° 36’ 34.24” S	052° 33’ 38.65” W
IBDAN	08° 07’ 30.07” S	051° 51’20.18” W
TOPAM*	**10° 30’ 28.37” S**	**050° 37’ 52.37” W**
SUDNA	11° 06’ 23.67” S	050° 21’ 08.41” W
DABLI	12° 08’ 16.28” S	049° 46’ 53.62” W
CHORD	12° 51’ 49.20” S	049° 23’ 58.20” W
DOLVI	13° 39’ 50.40” S	049° 02’ 07.20” W
GIGTI	14° 41’ 54.15” S	048° 33’ 42.02” W
PAMOP	14° 52’ 48.00” S	048° 28’ 40.80” W
PUNAT	15° 05’ 59.03” S	048° 24’ 05.15” W
SIGIG	15° 12’ 48.00” S	048° 19’ 39.00” W
BRASÍLIA (BSI)*	**15° 52’ 18.85” S**	**048° 01 18.92” W**

*Significant point of FIR limits, change of direction or end/begining of airway.

This ATS route was planned to accommodate traffic to and from SBBR and SBGR.

Traffic bound to SBGR, after BSI VOR, shall proceed via UZ6 until NIMKI, then, UZ38 until MOXEP position.

Traffic bound to North America will depart from SBGR via UZ26 until BSI VOR, then UL452 until ACARI position.

UL776

PUNTO SIGNIFICATIVO *SIGNIFICANT POINT*	*LATITUD* *LATITUDE*	*LONGITUD* *LONGITUDE*
TIRIÓS (TIR NDB)*	**02° 13’ 08.40” N**	**055° 56’ 30.60” W**
OBGUX	01° 31’ 57.07” N	055° 37’ 07.36” W
NUVUG	02° 15’ 58.06” S	053° 49’ 55.24” W
OPVID	03° 15’ 23.30” S	053° 21’ 54.68” W
KOGRI	04° 37’ 14.43” S	052° 43’ 13.44” W
VUROX	04° 43’ 40.52” S	052° 40’ 10.56” W
LUVNU	07° 06’ 49.40” S	051° 32’ 03.46” W
ITALA	07° 37’ 27.46” S	051° 17’ 23.16” W
OPTEN*	**10° 29’ 39.00” S**	**049° 54’ 06.60” W**
RODOT	11° 23’ 15.04” S	049° 29’ 25.21” W
VARSO*	**14° 19’ 23.40” S**	**048° 06’ 59.40” W**
SOBOL	14° 35’ 40.20” S	047° 56’ 53.40” W
SIDUG	14° 45’ 19.53” S	047° 50’ 53.00” W
ERVUB	14° 55’ 46.31” S	047° 44’ 22.36” W
PUMBI	15° 06’ 03.23” S	047° 37’ 57.14” W
SIMUV*	**15° 33’ 25.72” S**	**047° 20’ 47.90” W**
MOTPI	15º 48’ 43.20” S	047º 11’ 34.80” W
TODIM	16º 01’ 56.00” S	047º 03’38.00” W
SIGER*	**16º 12’ 35.40” S**	**046º 56’ 57.60” W**

*Significant point of FIR limits, change of direction or end/begining of airway.

This ATS route was planned to accommodate traffic to and from SBGL.

Traffic bound to SBGL, after SIMUV, shall proceed via UZ38 until MOLTI, then, UZ24 until MAVGU position.

Traffic bound to North America will depart from SBGL via UM409 until SIGER, then UL776 until TIR NDB.

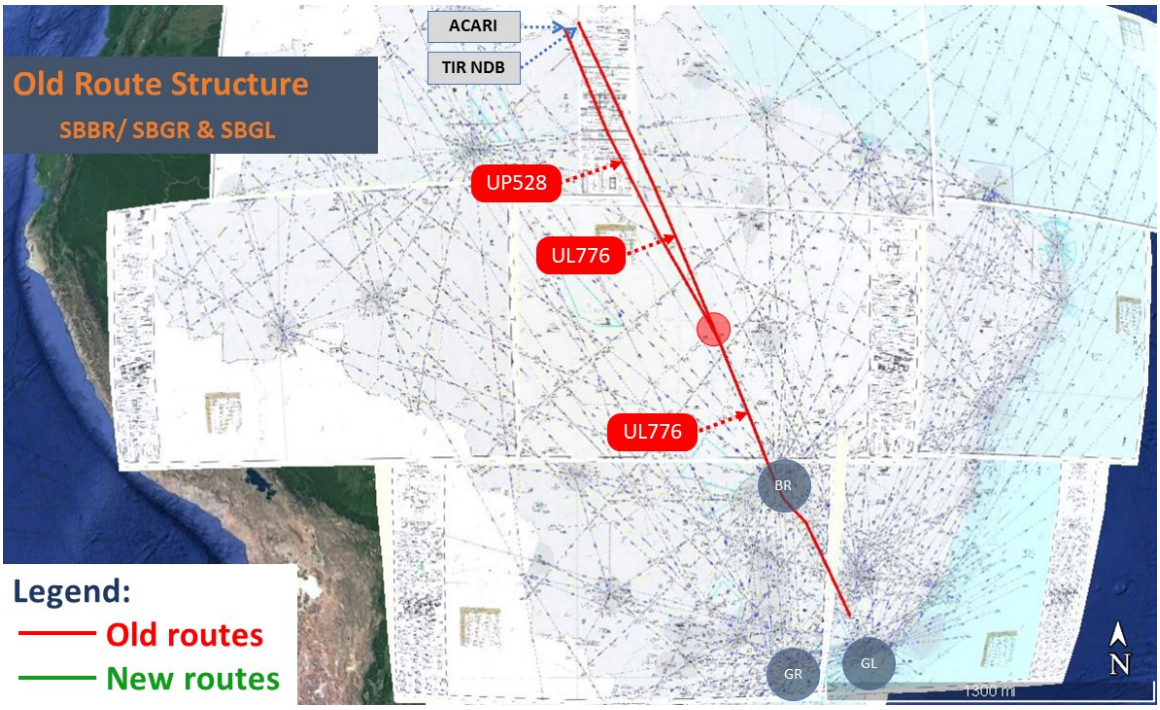


Figure 1 – Old structure for flights to/from SBBR, SBGR and SBGL

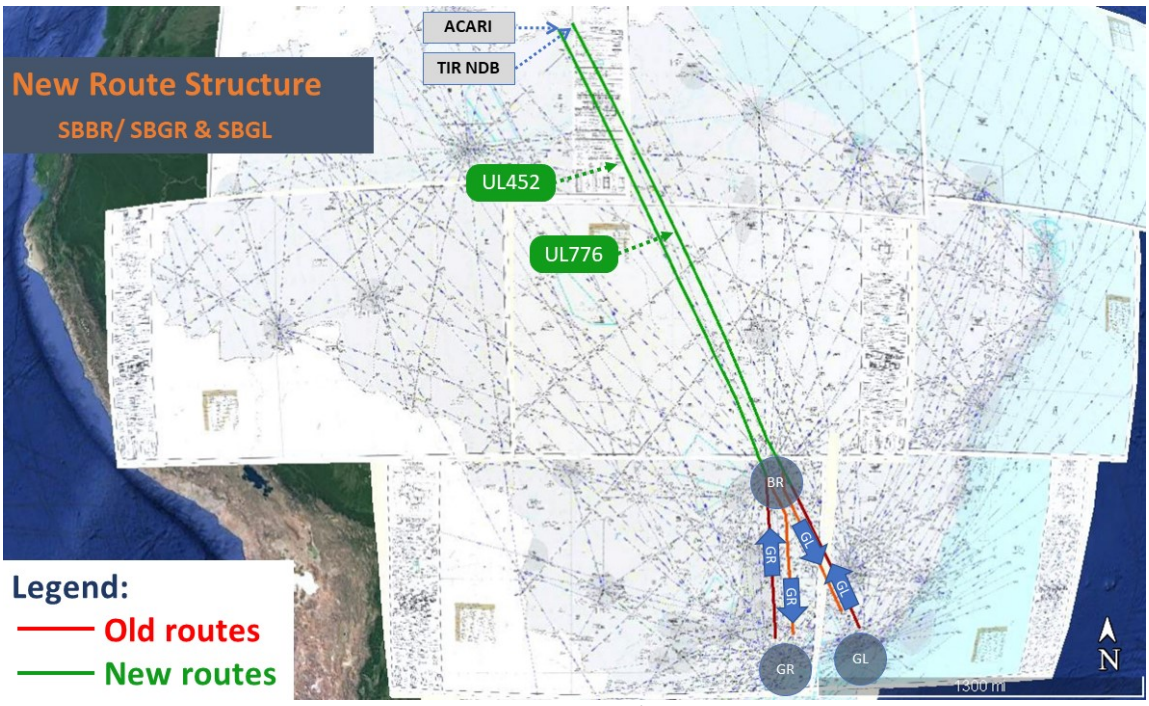


Figure 2 – New structure for flights to/from SBBR, SBGR and SBGL

UL462

PUNTO SIGNIFICATIVO *SIGNIFICANT POINT*	*LATITUD* *LATITUDE*	*LONGITUD* *LONGITUDE*
GENAT*	**02° 30’ 34.91” N**	**055° 20’ 28.52” W**
UKAMU	02° 02’ 48.11” N	055° 06’ 41.07” W
KAKEK	02° 08’ 11.95” S	053° 02’ 14.32” W
OPGUG	03° 16’ 58.72” S	052° 28’ 04.08” W
DOTSO*	**04° 14’ 11.15” S**	**051° 59’ 34.81” W**
TODGA	04° 54’ 55.69” S	051° 39’ 14.66” W
OSOVA	07° 00’ 46.37” S	050° 36’ 06.35” W
AKREM	07° 44’ 41.37” S	050° 13’ 55.82” W
ILRIP	09° 38’ 36.00” S	049° 15’ 59.00” W
MUMER	10° 13’ 18.92” S	049° 02’ 28.22” W
TOBKO	10° 47’ 06.53” S	048° 49’ 15.90” W
RUSTE*	**12° 15’ 27.60” S**	**048° 14’ 28.80” W**
NATIO	12° 57’ 12.60” S	047° 51’ 21.00” W
NIBMO	13° 21’ 25.00” S	047° 37’ 54.00” W
PANDI	13° 46’ 16.20” S	047° 23’ 58.20” W
PAROL	14° 10’ 24.60” S	047° 10’ 24.60” W
PEDAL	14° 51’ 00.00” S	046° 47’ 30.60” W
FLASH	14° 59’ 45.60” S	046° 42’ 32.40” W
ORATE	15° 06’ 39.00” S	046° 38’ 37.80” W
BLUES	15° 19’ 47.40” S	046° 31’ 09.00” W
SELDI	15° 36’ 13.80” S	046° 21’ 53.40” W
AFTER	16° 44’ 30.60” S	045° 42’ 31.20” W
OBGEM	17° 07’ 46.80” S	045° 29’ 06.00” W
LISBO	17° 40’ 01.20” S	045° 10’ 12.00” W
SIDOL	19° 04’ 06.60” S	044° 20’ 35.40” W
CONFINS (CNF)*	**19° 33’ 29.57” S**	**044° 02’ 54.65” W**

*Significant point of FIR limits, change of direction or end/begining of airway.

UL576

PUNTO SIGNIFICATIVO *SIGNIFICANT POINT*	*LATITUD* *LATITUDE*	*LONGITUD* *LONGITUDE*
SIROS*	**02° 28’ 16.80” N**	**054° 41’ 31.80” W**
KOKDI	00° 15’ 51.60” N	053° 36’ 24.00” W
MASVU	02° 02’ 39.00” S	052° 28’ 06.00” W
GAXAG	03° 18’ 01.20” S	051° 50’ 33.00” W
KOKDO	03° 54’ 49.80” S	051° 32’ 59.40” W
KOGPO	05° 02’ 04.80” S	050° 59’ 42.60” W
ATOGU	06° 38’ 59.58” S	050° 11’ 40.96” W
KOKNI	08° 06’ 58.20” S	049° 27’ 27.60” W
ISOBI	09° 09’ 54.00” S	048° 55’ 52.80” W
OPNUP*	**09° 41’ 08.09” S**	**048° 39’ 10.22” W**
DENOB	09° 50’ 09.60” S	048° 34’ 46.20” W
PALMAS (PMS)	10° 17’ 28.00” S	048° 21’ 51.00” W
LODEK	10° 54’ 09.48” S	048° 05’ 17.33” W
ISURO	11° 34’ 59.40” S	047° 46’ 46.20” W
NUXOR	12° 16’ 28.00” S	047° 28’ 12.00” W
ISONU	12° 57’ 06.60” S	047° 09’ 37.20” W
ISUSI	13° 34’ 19.80” S	046° 52’ 37.80” W
KOGPU	14° 26’ 40.80” S	046° 28’ 33.60” W
SAPSA	14° 41’ 22.20” S	046° 21’ 46.20” W
MOPLA	14° 54’ 03.60” S	046° 15’ 53.40” W
OCELO*	**15° 13’ 05.40” S**	**046° 07’ 04.80” W**
ILPOS	15° 31’ 07.20” S	046° 02’ 20.40” W
AFTER*	**16° 44’ 30.60” S**	**045° 42’ 31.20” W**

*Significant point of FIR limits, change of direction or end/beginning of airway.

These ATS route were planned to accommodate traffic to and from SBCF.

Alternatively, it may be used by traffic serving SBGL.

In this case, traffic bound to SBGL, after CNF VOR, shall proceed DCT to BHZ VOR, then, via UZ3 until MAVGU position.

Traffic bound to North America will depart from SBGL via UZ4 until UMKIT, then continue on UZ4 until CNF VOR.

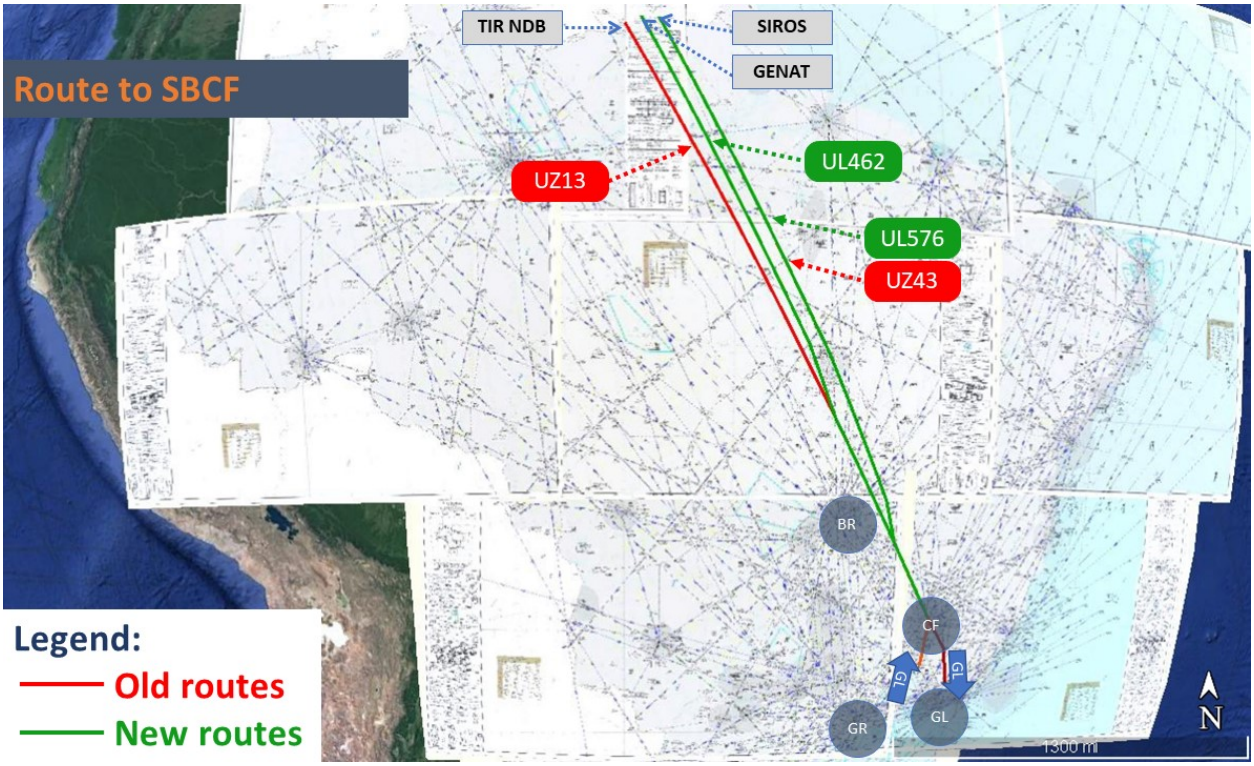


Figure 3 – New structure for flights to/from SBCF.

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