Gulf Lines Experiment 2002

GLEX02

Aircraft Data, Final Report

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1 Introduction

The flight data sampled during GLEX02 have been processed. This report describes how the data was sampled and explains the way the data is presented. The data itself and some helpful material in the form of plots of flight paths is delivered on CD-ROM.

The different flight patterns used are described in the next chapter. Chapter 3 gives a detailed overview of all flights and sections of flights used for the data processing. Finally, Chapter 4 describes the data provided on disc.

It is **important** that you read Chaper 4 before working with the data.

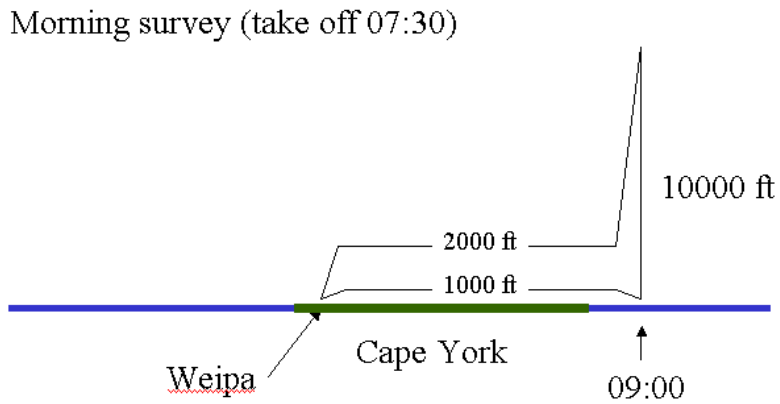
2 Flight Patterns

During the experiment four flight patterns were flown. They are: survey, sea breeze, cloud line and morning glory.

2.1 Survey

The survey is a pattern that consists of level flight paths at different heights alternating with ascents and descents. An example of a typical survey flight is given in Figure 2.1.

Figure 2.1 : Schematic drawing of a typical Survey flight pattern



This example consists of 4 elements of interest: a level flight at 1000 ft, a level flight at 2000 ft, an ascent and a descent. These four elements are part of the whole flight and they are connected by maneuvers flown to position the aircraft for the next element to be flown. These elements are called runs, and only the data of those runs is delivered. During the maneuvering between runs, steep turns are flown which can produce incorrect data.

Level flight runs are called traverses.

Only one survey was flown as a distinct pattern (13/10/02). However, there are other flights were a survey can be extracted (e.g. 07/10/02).

2.2 Sea Breeze

The sea breeze pattern is a set of traverses (i.e. level flight runs) at different heights, i.e. it looks like the survey without ascents and descents. However, it was quite often flown in conjunction with the survey pattern. For example, on 07/10/02, a traverse was flown in 200ft above ground in a west-east direction, about 15 km south of Weipa starting 30 km west of Weipa and extending across the whole of York Peninsula to about 150 km east of Weipa. An ascent was flown at the eastern end of the run. As no sea breeze was found on the east coast of the peninsula the following descent was flown from east to west to about 60 km east of Weipa. A traverse brought the aircraft to the track's western end where another ascent/descent was flown. This was followed by a pure sea breeze pattern consisting of a number of runs at different heights flying between about 20 km west of Weipa to 60 km east of Weipa on a line 15 km south of Weipa.

2.3 Cloud Line

This pattern was flown to explore the cloud lines over the Gulf of Carpentaria. It is a combination of E/W traverses at different heights, and ascents and descents flown about 100 - 200 km west of Weipa.

2.4 Morning Glory

The Morning Glory pattern was flown only once to explore the Morning Glory on 09/10/02. It was flown in an area 400 – 650 km south and 50 to 350 km west of Weipa. Traverses and ascents/descents were combined.

3 Overview of Flights

Table 3.1 lists the flight days and relates them to the actual dates and times flown, the flight pattern and the names of the logger files.

The 8 character logger filename is constructed from month, day, hour and minute of the flight. For example, 10071412 means the file was created on 07 October at 14:12 (the logger time is not related to Local Time, so it can only be used as an indication).

Table 3.1 : Overview of flights

Day	Date	Pattern	Start (LT)	End (LT)	Logger Files
0	06 Oct 2002	test			
1	07 Oct 2002	sea-breeze & survey	14:54	19:51	10071412 10071534 10071735
2	08 Oct 2002	cloud line	08:30	13:54	10080748
3	09 Oct 2002	Morning Glory	05:05	09:39	10090423 10090621 10090644 10090719
4	12 Oct 2002	sea-breeze	16:03	21:29	10121520 10121731
5	13 Oct 2002	survey	09:29	13:38	10130847 10131046 10131054
6	14 Oct 2002	cloud line	06:42	11:50	10140559 10140629 10140730 10140735 10140743 10141010 10141048
7	15 Oct 2002	sea-breeze			10151847 10152331
8	16 Oct 2002	sea-breeze	16:06	22:08	10161422 10161505 10161542 10161644
9	18 Oct 2002	cloud line	07:28	12:10	10180545
10	19 Oct 2002	sea-breeze	13:07	17:36	10191124 10191144 10191247 10191342 10191351 10191421 10191425
11	20 Oct 2002	cloud line	0456	10:00	10200313 10200353 10200402

As already explained before, not all data sampled during a flight can be used. Between two traverses, e.g a flight from east to west followed by a flight from west to east, the aircraft has to turn and climb or descend if the traverses are at different heights. The data during those positioning maneuvers cannot be used and must be discarded. The effect is like cutting sections out of a piece of string. We end up having single strings of data. Each of these strings represents an ascent, a traverse, a descend, etc. They are referred to as runs.

In the following tables, these individual runs are listed for every day. From these tables one can locate any particular run in the data set.

The columns contain:

1 - the logger files sampled on a particular day (refer back to Table 3.1)
2 - the single runs (for naming convention see below)
3 - the direction flown, e.g. E-W means from east to west
4 - the height of the run above ground in feet
5 - start of the run in seconds from the beginning of the logger file under which the run is listed
6 - end of run, also in seconds from beginning of logger file
7 - comments to point out possible inconsistencies in the data which can for instance be caused by a steep turn of the aircraft

The naming conventions of the runs are:

1 - the day of the flight as in the first column of the overview table above (Table 3.1)
2 - the type of the run
    tr - traverse (i.e. straight and level flight)
    up - ascent (the approximate (!) start and end heights are given in column 4)
    dn - descent (the approximate (!) start and end heights are given in column 4)x - flux measurements
    ws - wind square
    cl - circles
    ac - acceleration
3 - the number of the repetition of this particular type of run
4 - for traverses, the average height of the flight is given

The reason for having several logger files for one day is because the logger failed occasionally and had to be restarted. In some cases this means that a run was started in one logger file and finished in the next. This is indicated by giving the run-names the appendix a, b, c.

Table 3.2 : Day 1 - 07 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
10071412	1tr1_200	W-E	200	1220	3801	
	1up1		200-10000	3830	4763	
	1dn1a		10000-8000	4800	4900	
10071534	1dn1b		7500-1700	0	200	
	1tr2_1500	E-W	1500	1039	1931	
	1up2		200-10000	2046	2983	
	1dn2		10000-6700	2990	3184	
	1tr3_5500	W-E	5500	3380	4419	
	1tr4_1500	E-W	1500	4792	5625	
	1tr5_200	W-E	200	5702	6411	
	1tr6_3500	E-W	3500	6680	7254	
10071735	1tr7_200	W-E	200	220	808	turn at S
	1tr8_1000	E-W	1000	927	1476	turn at S
	1tr9_200	W-E	200	1566	2004	turn at S
	1tr10_1700	E-W	1700	2304	3009	turn at S
	1tr11_3500	W-E	3500	3282	3909	
	1tr12_1700	E-W	1700	4153	4964	

Table 3.3 : Day 2 - 08 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
10080748	2up1		200-10000	400	1529	
	2dn1		10000-200	1530	2280	
	2tr1_200	E-W	200	2530	3999	
	2tr2_1300	W-E	1300	4286	4985	
	2tr3_2500	E-W	2500	5250	5920	
	2up2		200-10000	6225	7273	
	2dn2		10000-4900	7334	7720	
	2tr4_4600	W-E	4600	7740	8113	
	2tr5_3500	E-W	3500	8246	8965	turn at S
	2tr6_2500	W-E	2500	9089	9778	turn at S
	2tr7_1300	E-W	1300	9920	10628	turn at S
	2tr8_200	W-E	200	10779	11471	turn at S
	2up3		200-10000	11500	12548	
	2tr9_10000	SE-NW-W	10500	12605	13429	
	2dn3		10000-200	13492	14345	
	2tr10_2500	NW-SW-E	2500	14608	15291	
	2tr11_1300	E-W	1300	15446	16118	Trimble outage turn at S
	2tr12_200	W-E	200	16276	16968	
	2fx1	SW-NE	300	18700	19200	

Table 3.4 : Day 3 : 09 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
1009042	3up1		200-10000	565	1755	
	3dn1		10000-200	1875	2937	
	3tr1_800	NW-SEe	800	3749	6655	rapid height fluctutions at S
	3tr1_800a	NW-SE	800	3749	4500	extract of height fluct'ns of 3tr1
	3tr1_800b	NW-SE	800	4500	6655	remaining level run of 3tr1
	3up2a		200-1500	6890	7077	
10090621	3up2b		1600-10500	1	980	
	3dn2a		10500-7700	1070	1383	
10090644	3dn2b		7500-3500	1	383	
	3tr2_3500a	SE-NW	3500	383	2023	
10090719	3tr2_3500b	SE-NW	3500	1	240	
	3tr3_800	SW-NE-SE	800	1030	3524	change in direction
	3up3		200-10000	3657	4713	
	3dn3		10000-800	4752	5125	

Table 3.5 : Day 4 - 12 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
10121520	4tr1_200	W-E	200	1687	2522	
	4tr2_1000	E-W	1000	2632	3388	
	4tr3_1300	W-E	1300	3479	4285	
	4tr4_1700	E-W	1700	4388	5138	
	4tr5_2200	W-E	2200	5226	6018	
	4tr6_3000	E-W	3000	6141	6839	
	4tr7_200a	W-E	200	7132	7800	
10121731	4tr7_200b			180	496	
	4tr8_1000	E-W	1000	565	1304	
	4tr9_1300	W-E	1300	1514	2264	
	4tr10_1700	E-W	1700	2351	3073	
	4tr11_2200	W-E	2200	3172	4026	
	4tr12_3000	E-W	3000	4151	4815	
	4tr13_4000	W-E	4000	4954	5836	
	4tr14_1700	E-W	1700	6099	6872	
	4tr15_2200	W-E	2200	6976	7818	
	4tr16_3000	E-W	3000	7948	8637	
	4tr17_4000	W-E	4000	8785	9749	
	4tr18_5500	E-W	5500	9969	10714	

Table 3.6 : Day 5 - 13 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
10130847	5tr1_1500	E-W	1500	799	5041	part of run deviates rom straight track
	5up1		1600-8000	5042	5714	
	5dn1		8000-200	5715	6313	
	5tr2_200a	NW-SE	200	6320	7164	
10131046	5tr2_200b	W-E		1	420	
10131054	5tr2_200c			1	1686	
	5up2		200-3000	1686	2054	
	5dn2		3300-200	2054	2497	
	5tr3_200	W-E	200	2497	4872	
	5up3		1600-10000	4872	5837	
	5dn3		10000-1500	5837	6183	
	5tr4_1500	E-W	1500	6183	7000	

Table 3.7 : Day 6 - 14 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
10140559	6tr1_200a	E-W	200	466	1554	
10140629	6tr1_200b	SE-NW-W		1	1758	
	6tr2_500	W-E	500	1951	2594	
	6tr3_900	E-W	900	2750	3343	
	6tr4_1500a	W-E	1500	3568	3645	
10140730	6tr4_1500b			1	230	
10140735	6tr4_1500c			1	213	
	6tr5_2600a	E-W	2600	370	443	
10140743	6tr5_2600b			1	503	
	6up1		3200-10000	589	1427	
	6dn1		10000-200	1450	2155	
	6tr6_200	SW-NE-E	200	2205	2793	
	6tr7_500	E-W	500	2892	3494	
	6tr8_900	W-E	900	3591	4204	
	6tr9_1500	E-W	1500	4325	4967	
	6tr10_3000	W-E	3000	5146	5952	
	6up2		3500-10500	6030	6696	
	6dn2		10500-200	6710	7295	
	6tr11_200	SE-NW-W	200	7365	8204	
	6tr12_500a	W-E	500	8294	8781	
10141010	6tr12_500b			1	484	
10141048						not used – short

Table 3.8 : Day 7 - 15 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
10151847	7tr1_1100	E-W	1100	1453	3489	
	7tr2_1700	W-E	1700	3729	4209	
	7tr3_1400	E-W	1400	4359	5636	
	7tr4_1700	W-E	1700	5900	7161	turn at S
	7tr5_2000	E-W	2000	7377	8752	
	7tr6_800	W-E	800	9098	10311	
	7tr7_1100	E-W	1100	10486	11968	
	7tr8_1400	W-E	1400	12128	13595	
	7tr9_1700	E-W	1700	13761	14649	
	7tr10_1400	W-E	1400	14908	16062	
	7tr11_1700	E-W	1700	16259	16611	
	7tr12_2000	W-E	2000	16810	16900	very short run
10152331	7tr13_1400	W-E-ne	1400	75	1115	in continuation of 7tr12_2000 with change in direction

Table 3.9 : Day 8 - 16 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
10161422	8tr1_200	W-E	200	813	953	
	8tr2_200	E-W	200	1066	1564	
	8tr3_600	W-E	600	1677	2228	
	8tr4_1000a	E-W	1000	2356	2561	
10161505	8tr4_1000b			1	773	
	8tr5_1400	W-E	1400	949	1919	
	8tr6_2000a	E-W	2000	2095	2166	
10161542	8tr6_2000b			1	402	
	8tr7_3000	W-E	3000	568	1175	
	8tr8_4500	E-W	4500	1387	1924	
	8dn1		4500-200	1944	2333	
	8tr9_200	W-E	200	2482	3138	
	8tr10_600a	E-W	600	3276	3694	
10161644	8tr10_600b			1	154	
	8tr11_2000	W-E	2000	297	948	
	8tr12_1400	E-W	1400	1102	2868	
	8tr13_1600	W-E	1600	3065	3418	
	8tr14_1400	E-W	1400	3601	4052	
	8tr15_1200	W-E	1200	4229	4610	
	8tr16_1000	E-W	1000	4772	5217	
	8tr17_1400	W-E	1400	5357	6105	
	8tr18_1600	E-W	1600	6253	6649	
	8tr19_1800	W-E	1800	6795	7148	
	8tr20_1600	E-W	1600	7350	7880	
	8tr21_1600	W-E	1600	8008	8336	
	8tr22_1600	E-W	1600	8492	8889	
	8tr23_1600	W-E	1600	9044	9607	
	8tr24_1600	E-W	1600	9929	10569	
	8tr25_1600	W-E	1600	10831	11234	
	8tr26_1600	E-W	1600	11368	11738	
	8tr27_1600	W-E	1600	11899	12709	

Table 3.10 : Day 9 - 18 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
10180545	9up1		200-1500	850	1255	
	9tr1_1300	E-W	1300	1990	2610	
	9tr2_200	W-E	200	3264	3785	
	9tr3_500	E-W	500	3977	4529	
	9tr4_800	W-E	800	4669	5182	
	9tr5_1200	E-W	1200	5317	5852	
	9tr6_1600	W-E	1600	5982	6537	
	9tr7_2200	E-W	2200	6684	7271	
	9tr8_3000	W-E	3000	7383	7964	
	9up2		3300-10500	8005	8760	
	9dn2		10500-200	8805	9498	
	9tr9_200	E-W	200	9558	10237	
	9tr10_500	W-E	500	10390	10900	
	9tr11_800	E-W	800	11050	11490	
	9tr12_1200	W-E	1200	11627	12050	
	9tr13_1600	E-W	1600	12171	12650	
	9up3		1600-10000	12650	13534	
	9dn3		10000-200	13550	14000	
	9tr14_3000	W-E	3000	14484	15073	

Table 3.11 : Day 10 - 19 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
10191124	10tr1_200a	E-W	200	1135	1201	turn at S
10191144	10tr1_200b			1	887	
	10tr2_500	W-E	500	1019	1778	
	10tr3_1000	E-W	1000	1921	2576	
	10tr4_2500	W-E	2500	2790	3569	
10191247	10tr5_5000	E-W	5000	174	725	
	10tr6_200	W-E	200	1358	1646	turn at S
	10tr7_1000	W-E	1000	1730	2076	
	10tr8_1200	E-W	1200	2200	2412	
	10tr9_1400	W-E	1400	2541	2808	
	10tr10_1600	E-W	1600	2926	3139	
	10tr11_1800a	W-E	1800	3255	3274	
10191342	10tr11_1800b			1	244	
	10tr12_1000a	E-W	1000	422	475	segments of large rectangle flown
10191351	10tr12_1000b	W-E		50	220	
	10tr12_1000c	E-W		270	571	
	10tr13_1200	W-E	1200	695	953	
	10tr14_1400	E-W	1400	1094	1350	
	10tr15_1600	W-E	1600	1479	1763	
10191421	10tr16_1800a	E-W	1800	95	235	
10191425	10tr16_1800b			1	111	
	10tr17_1000	W-E	1000	308	598	
	10tr18_1200	E-W	1200	714	1008	
	10tr19_1400	W-E	1400	1161	1518	
	10tr20_1600	E-W	1600	1632	1917	
	10tr21_1800	W-E	1800	2078	2433	
	10tr22_1000	E-W	1000	2630	2911	
	10tr23_1200	W-E	1200	3045	3330	
	10tr24_1400	E-W	1400	3458	3689	
	10tr25_1600	W-E	1600	3839	4109	
	10tr26_1800	E-W	1800	4248	4497	

Table 3.12 : Day 11 - 20 Oct 2002

Logger File	Run	Direction	Height (ft)	Start (secs)	End (secs)	Comments
10200313	11up1		400-10000	745	2191	
10200353	11dn1		8200-200	1	528	
10200422	11tr1_200	E-W	200	1	326	
	11tr2_500	W-E	500	568	828	
	11tr3_800	E-W	800	1036	3403	
	11tr4_200	W-E	200	3624	4179	
	11tr5_400	E-W	400	4355	4965	
	11tr6_600	W-E	600	5201	5731	
	11tr7_800	E-W	800	5881	6471	
	11tr8_1100	W-E	1100	6669	7174	
	11tr9_1400	E-W	1400	7317	7865	
	11tr10_1600	W-E	1600	7993	8558	
	11tr11_2200	E-W	2200	8683	9251	
	11tr12_3000	W-E	3000	9386	9954	
	11up2		3300-10500	9984	10775	
	11ws1		10500	11185	11420	wind square *
	11cl1		10500	11500	11871	circles *
	11ac1		10500	12198	12491	acceleration *
	11dn2		13000-200	12952	14108	

* These three runs were flown for calibration purposes.

4 Data

The following variables were extracted or calculated:

Table 4.1: Dimension, format and description of the delivered variables

Variable	Dimension	Format	Description	Source
UTCdate	ddmmyy	I 7	UTC Date	date and GPSsec
UTCtime	hhmmss.xx	f 9.2	UTC time in hhmmss and 100th secs	date and GPSsec
GPSsec	seconds	f 9.2	Time in seconds counted from 00:00 UTC each Sunday. 2 decimals	Novatel GPS
tsKT	degC	f 6.2	surface temperature	Heimann KT15
trec_SN	degC	f 6.2	air temperature	Reverse flow PT100
tdML	degC	f 6.2	dew point	cooled mirror, Meteolabor TP-3
qML	g/kg	f 6.2	specific humidity	calculated from tdML and ps_SN
zRAD	m	f 6.1	height above ground	Radar altimeter
Nalt	m	f 7.1	height above MSL	Novatel GPS
ps_SN	hPa	f 7.2	static pressure	Rosemount in nose-cone
uair_SN	m/s	f 7.2	horizonal wind , east-west component	calculated
vair_SN	m/s	f 7.2	horizontal wind, north-south component	calculated
wair_SN	m/s	f 7.2	vertical wind component	calculated
tas_SN	m/s	f 7.2	true air speed	calculated
Nlat	degrees	f 12.6	latitude	Novatel GPS
Nlon	degrees	f 12.6	longitude	Novatel GPS
Ngs	m/s	f 7.2	ground speed	Novatel GPS
Ntrk	degrees	f 5.1	track angle (true)	Novatel GPS
Tpch	degrees	f 6.2	aircraft pitch angle	Trimble GPS
Trll	degrees	f 6.2	aircraft roll angle	Trimble GPS
Tthdg	degrees	f 6.2	true heading	Trimble GPS
txVHF1	Volt	f 4.2	radio mark	
txVHF2	Volt	f4.2	radio mark	

Note:

- **UTCtime**: (1) Leading zeroes are not shown, i.e. 05:09:10 is printed as 50910. (2) Weipa is 10 hrs ahead of UTC. This means that early morning flights have the date of the previous day, e.g. 5tr1_1500 is a traverse flown on 13.10.02 at about 9 am local time. In the ascii-file the date is 12.10.02, the time 23:00.
- **Radio marks**: Some sensors react strongly when the aircraft radio is used producing false measurements. Corrections were applied. The variables most affected are temperature and dew point. The radio marks show the instances where some data were corrected.
- **zRAD**: (1) The radar height is only measured up to about 1450 m. Above this height, zRAD shows its out-of-range value. (2) The instrument is mounted so that it points down vertically when the aircraft is in horizontal flight. All deviations from horizontal flight have an effect on the length of the beam measured. In the extreme, during a steep turn, even close to the ground, zRAD can take on its out-of-range value.

The data is provided in two forms on the attached CD-ROM.

(1) **ASCII format**: The CD-ROM contains a directory called ascii. In ascii are subdirectories for each day, and these hold the actual files for the runs as listed in Tables 3.2 - 3.12. In other words:

- ascii
  - 021007
    - EOS_1tr1_200.dat
    - EOS_1tr2_1500.dat
    - …
  - 021008
  - 021009
  - …

For each run, all variables listed in Table 4.1 are printed with a resolution of 5 Hz.

(2) **Plots**: All data can be viewed in plotted form. They are presented in .pdf files. The main directory is "plots" with the same subdirectory and file naming as in the ascii-directory (with file extension .pdf).

Additionally, a number of plots is provided to help place the runs geographically. Each plots\yymmdd subdirectory contains also

(1) **Track plots**. There is one Track_trk_yymmdd.pdf and one Track_alt_yymmdd.pdf in each subdirectory. The trk-file is an x-y representation of the flight tracks flown during the whole mission while the alt-file is a z-t representation (height vs. time). Both files show the full flight as recorded, not only runs. The x-y axes in the trk-file are shown in km with Weipa being the reference point, i.e. Weipa airport is at x = 0 km and y = 0 km.

(2) **SplitTrack plots**. They are called SplitTrack_EOS_yymmdd.pdf and are representations of the single runs. Each file contains all runs for the day. The traverses are plotted first, then the ascents and descents, then the remaining types. Each run is shown in three frames: a y-z plot, a x-z plot and a x-y plot. x and y are in km from Weipa. In order to be able to determine the direction of the run, the starting point is indicated by an 'S'. The blue curve in the x-s plot represents the topography. The detailed example of a survey and sea breeze flight given in Chapter 2.2 can be reconstructed by looking at Table 3.2 and the plots in \plots\021007\SplitTrack_EOS_021007.pdf.

Important: The data provided can be used to construct profiles of the main variables. They are not suitable to calculate fluxes or for other in-depth research. For these purposes, the resolution must be higher than given and more corrections have to be applied to some data, e.g. zRAD.

For any queries about the data please contact

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