ACC peak saturated capacity assessment

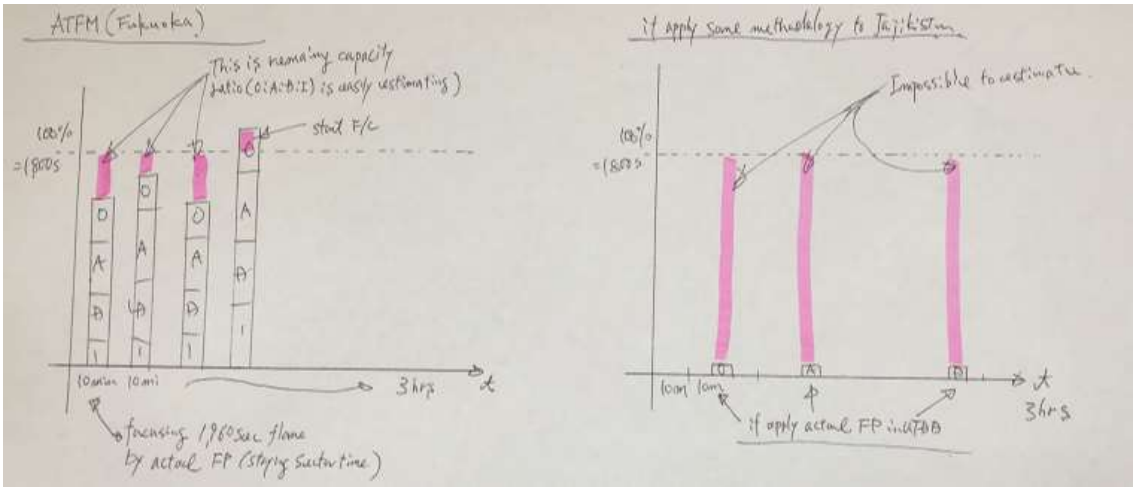
(Tajikistan's original method for optimizing on low density FIR and S/P pair ATC operation)

Tajikistan's Particularity

1) Our FIRs have very low density traffics. (It is difficult to estimate almost of all remained capacity)
2) The definition of capacity was unclear because of there was no real needs or purpose for obtaining the number by TAN.
3) The definition of the capacity has two meanings, physical capacity in the sector and ATC workload capacity per unit hour.
4) Nobody can identify that where is the bottleneck among Tower (RWY), Radar, Approach and ACC.
5) ACC is consisted Surveillance (S=Execute) and Procedure(P=Planning) ATC seats.
6) If less than 5 conflicted aircraft per hour in FIR, the role of S and P ATC can be combined by one ATC.
7) It is impossible to estimate peak saturated ATC workload by actual operation, because usually S and P seats are combined.
8) Inside of ACC pair, P's workload is usually heavy than S's one.
9) Radio communication time with pilot by S is not bottleneck in ACC pair.
10) The edge of Approach area in the West is same as FIR boundary. (Staying time in ACC is zero, but P has work)
11) ACC pair's consideration time has strong correlation with conflict number of airplanes, experience and pair's teamwork.
12) There is no correlation with radio communication with pilot by S and pair's consideration time.

Characteristic of Japanese Methodology (ATFM input parameter)

1) DORA+MMBB is methodology of obtaining "Co-efficient ATC workload" in relation of sector and flight type characteristic.
2) The "Co-efficient ATC workload" is one of input parameter for ATFM software in AIC center.
3) Difficulty index for estimating consideration time for execute ATC is Japanese original modify to DORA.
4) All fixed parameter and indexes are optimized Japanese FIR, equipment and ATC's characteristic in 25 years ago.
5) Original DORA is estimating consideration time by conflict number of airplane and experience.
6) Peak saturated model in ATFM software algorism is used actual flight plan by 30 mins time summation.
7) If usually FIR has 80-90% capacity, it is easy to estimate remaining capacity for coming two hours by actual flight plan.
8) It is impossible to get "Co-efficient ATC workload" by S and P pair in peak from actual survey on S's spent time.
9) Simple average of flight types and various routes and just divided 3,600sec /average of Co-efficient are meaningless.
10) This methodology cannot obtain the fixed number of aircraft as maximum capacities in very low-density FIR.



Characteristic of Russian Methodology

1) This methodology doesn't consider the ratio of flight types on the final number of flights as maximum capacity.
2) Didn't consider two ATC operation in peak conflict situation.
3) All parameter was optimized Russian airspace.

Trial original Methodology.

1) Experienced ACC ATC (P and S) can estimate the ideal times on radio comm(w/pilot), coordination(w/others) and others.
2) There is no appropriate methodology for estimating P and S Pair's consideration times, only experienced ATC can imagine.
3) Combination ration on flight type is Arrival/Departure/Flyover = 20/20/28 per day = 29%/29%/42% (Mar 2018, model)
4) Weighted average of typical SID/STAR and En-route should be used for estimation.

	Flight Type	Weighted Average of staying time model	Weighted Average Co-efficient ATC W/L index (sec/Min)	Flight Type Ratio	Scenario
	Arrival	5.58 Mins or 9.75 Mins (except west Arr)	13.44	29%	
	Departure	7.95 Mins	9.62	29%	
	Flyover	15.07 Mins	5.97	42%	
	Domestic	(10.50 Mins)	7.42		

Purpose of this interview:
In accordance with the ACC operation manual, the role of Surveillance and Procedure seats are able to marge one controller when handling aircrafts are less than five per hours. However, the peak saturated maximum capacity model should be evaluated by two ACC controller's operation under pair's capability (ability and experience) assumptions.
The questioner requires imaginary estimations on realistic but fictional situations by ACC controller's experience.

			Please imagine very normal / ordinal situation for estimating times. (No irregular things)
Staying time	ACC (UTDD FIR)		Average stay time from edge of Dushanbe FIR from/to entry (exit) points of Approach area.
	Approach + Radar		Average stay time form/to entry(exit) to landing (take off).
Spending time by Surveillance	Radio Comm w/pilot		Estimated total voice communication time (bilateral) with pilot in ACC area
	Others (w/o thinking-t)		Estimated other spending times during to monitor the aircraft in the radar screen.
Spending time by Procedural	Communication		Estimated total coordination times with other FIRs, Approach and Meteoroidal.
	Manual Operation		Estimated Rolling paper handling, Computer input, Reading AFTN message and others.
	Others (w/o thinking-t)		Estimated total spending times during the aircraft in ACC area
Thinking & Coordination times by S & P pair	**No conflict case (A1+D1+O2 / hour)**		Imagined thinking time or coordination times between S and P in low conflict situation. **Please imagine, 1 Arrival, 1 Departure and 2 Overfly aircrafts (no overlap) per one hour.**
	Hi conflict case (A7+D7+O15 / hour)		Imagined thinking time or coordination times between S and P in low conflict situation. **Please imagine, 7 Arrival, 7 Departure and 15 Overfly aircrafts (random) per one hour.**
	assumption of pair's characteristic	strong	5 to 10 years experienced S and P controllers, trusted each other.
		weak	less than 5 years experienced S/P and newly obtained rating P/S, need oral communication.
		(alone)	One controller of high ability manages roll of S and P by alone.

Normal Assumption:

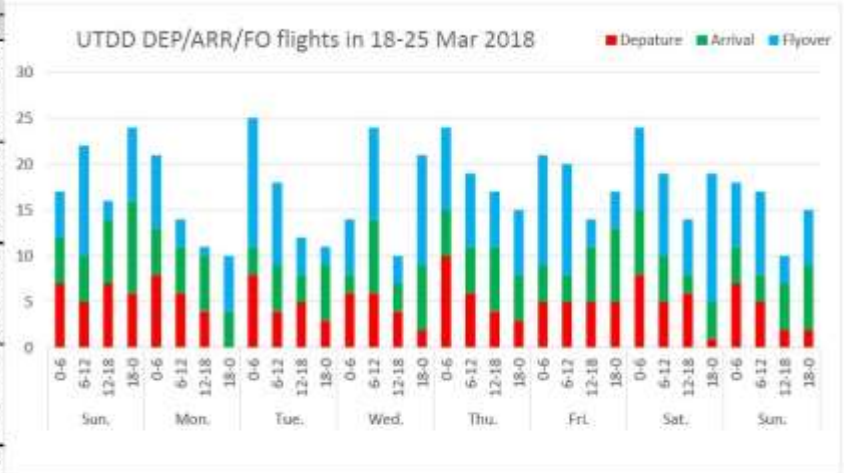
T	Call Sign	Fleet Type	From / to (En-route)	#/ Wk	Ad /d	% /RT	Strg	W/A	Entry/ Exit (RWY09 case)	Staying-T (Min.)		Surveillance normal (S)		Procedural normal (Sec.)			Pair's thinking / cord			
																	No cf	**Hi conflict case**		
										A+R	ACC	Radio	Otr	Com	M/O	Otr		str	wk	alone
A	UT801/3	B762	VKO-DYU	14	2	10%	80		BUTRA(SX)	14	8	R 23	5	25	10	10	10	35	90	50
	SZ202	B739	DME-DYU	7	2	10%	25		ETVIN	10	0	E 0	0	0	10	10	5	5	15	7
	U62953	A320	SVX-DYU	5	2	10%	80		BITBI (SX)	14	6	E 23	5	25	10	10	10	35	110	60
	7J628	B752	DME-DYU	4	2	10%	25		SOPNO	10	0	R 0	0	0	10	10	5	5	15	7
	U62879	A321	LED-DYU	4	2	10%	80		GETLI (PR)	16	2	E 24	5	25	10	10	10	35	110	60
	KC131	E190	ALA-DYU	4	2	10%	137		VADER (JD)	13	15	E 27	5	27	10	10	10	90	110	90
	FZ777	B738	DXB-DYU	3	2	10%	25		SOPNO	10	0	E 0	0	0	10	10	5	5	15	7
	TK254	B739	IST-DYU	3	2	10%	25		SOPNO	10	0	E 0	0	0	10	10	5	5	15	7
	S73295	A320	OVB-DYU	2	1	5%	137		VADER (JD)	13	15	E 27	5	27	10	10	10	90	110	90
	RQ17	B737	KBL-DYU	2	1	5%	135		PINAX (OKTAB)	12	10	E 27	5	25	10	10	10	90	110	90
	SZ304	B733	URC-DYU	2	1	5%	137		VADER (JD)	13	15	E 27	5	27	10	10	10	90	110	90
	YK749	B737	FRU-DYU	1	1	5%	137		VADER (JD)	13	15	R 25	5	27	10	10	10	35	90	50
D	UT802/4	B762	DYU-VKO	14	2	10%	75		27 PR (GETLI)	5	2	R 24	3	25	10	5	10	35	60	40
	SZ201	B739	DYU-DME	7	2	10%	75		PR (GETLI)	7	6	E 28	3	25	10	5	10	35	90	55
	U62954	A320	DYU-SVX	5	2	10%	75		SX (BITBI)	8	9	E 28	3	25	10	5	10	35	90	55
	7J627	B752	DYU-DME	4	2	10%	75		PR (GETLI)	7	6	R 24	3	25	10	5	10	35	60	40
	U62880	A321	DYU-LED	4	2	10%	75		PR (GETLI)	7	6	E 28	3	25	10	5	10	35	90	55
	KC132	E190	DYU-ALA	4	2	10%	78		JD (VADER)	8	13	E 28	3	28	10	5	10	35	110	90
	FZ778	B738	DYU-DXB	3	2	10%	78		PR (SOPNO)	8	6	E 28	3	28	10	5	10	35	90	55
	TK255	B739	DYU-IST	3	2	10%	78		PR (GETLI)	7	6	E 28	3	28	10	5	10	35	90	55
	S73296	A320	DYU-OVB	2	1	5%	78		JD (VADER)	8	13	E 28	3	28	10	5	10	35	110	90
	RQ18	B737	DYU-KBL	2	1	5%	78		OKTAB (PINAX)	7	12	E 28	3	28	10	5	10	35	110	90
	SZ303	B733	DYU-URC	2	1	5%	78		JD (VADAR)	8	13	E 28	3	28	10	5	10	35	110	90
	YK750	B737	DYU-FRU	1	1	5%	78		JD (VADAR)	8	13	R 24	3	28	10	5	10	35	60	40
O	KC---	vary	B350 N-S	21	3	11%	97		VADER/ PINAX	-	21	E 46	3	32	10	5	20	50	120	70
	HY---	vary	A114 N-S	28	4	14%	78		OLRAM/MOSOM	-	4	E 28	3	28	10	5	10	35	90	55
	AC---	B789	A103 N-S	7	3	11%	97		BITBI / PINAX	-	18	E 46	3	32	10	5	20	50	120	70
	YK---	B737	B496G50	3	2	7%	97		ASMAN/ FIRUZ	-	21	R 46	3	32	10	5	20	50	120	70
	VSV--	B752	L177A103	3	2	7%	97		BALUG / PINAX	-	18	R 46	3	32	10	5	20	50	120	70
	KC---	vary	B350 S-N	21	3	11%	93		PINAX/ VADAR	-	21	E 46	3	28	10	5	20	50	120	70
	HY---	vary	A114 S-N	28	4	14%	78		MOSOM/OLRAM	-	4	E 28	3	28	10	5	10	35	90	55
	AC---	B789	A103 S-N	7	3	11%	93		PINAX/ BITBI	-	18	E 46	3	28	10	5	20	50	120	70
	YK---	B737	G50B496	3	2	7%	97		FIRUZ/ ASMAN	-	21	R 46	3	32	10	5	20	50	120	70
	VSV--	B752	A103L177	3	2	7%	93		PINAX/ BALUG	-	18	R 46	3	28	10	5	20	50	120	70
I	7J/SZ--	B752	DYU-LBD	7	1.5	50%	78		SX (BITBI)	8	9	R 24	3	28	10	5	10	35	90	55
	7J/SZ--	B752	LBD-DYU	7	1.5	50%	78		BITBI (SX)	6	12	R 24	3	28	10	5	10	35	90	55

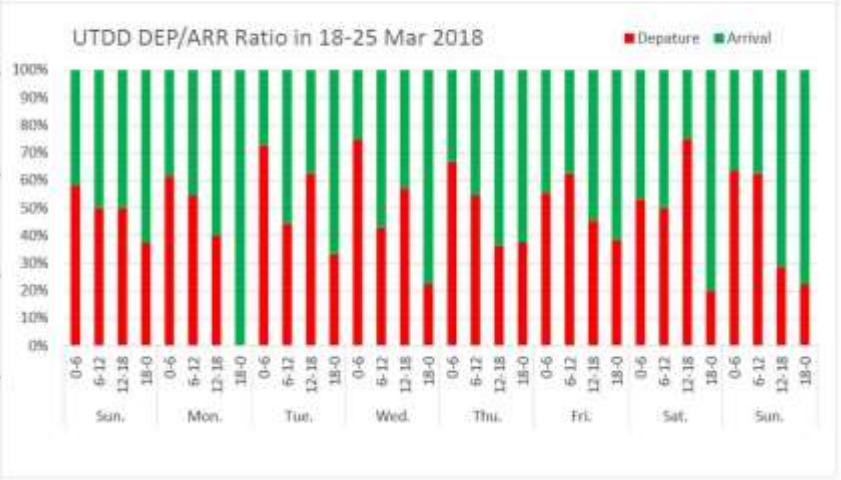
Simple average number of flights per day in each category by Actual Flight in 18-25 March 2018

Arrival	Departure	Flyover	(Domestic)
20.0/day	20.5/day	28.6/day	(2.9/day)
28.9%	29.7%	41.4%	(7.1%)

2018 Mar	Local Time	Departure (DEPT)		Arrival (ARRT)		Flyover (EFT)	(Inner) D-L	(Inner) L-D
18 Su	00:00-06:00	7		5		5	0	2
	06:00-12:00	5	25	5	27	12	2	0
	12:00-18:00	7	(4%)	7	(11%)	2	0	1
	18:00-24:00	6		10		8	0	0
19 Mo	00:00-06:00	8		5		8	0	0
	06:00-12:00	6	18	5	20	3	1	0
	12:00-18:00	4	(6%)	6	(5%)	1	0	2
	18:00-24:00	0		4		6	0	0
20 Tu	00:00-06:00	8		3		14	0	0
	06:00-12:00	4	20	5	17	9	1	0
	12:00-18:00	5	(15%)	3	(11%)	4	1	0
	18:00-24:00	3		6		2	0	0
21 We	00:00-06:00	6		2		6	0	0
	06:00-12:00	6	18	8	20	10	0	1
	12:00-18:00	4	(11%)	3	(10%)	3	0	0
	18:00-24:00	2		7		12	0	1
22 Th	00:00-06:00	10		5		9	0	0
	06:00-12:00	6	23	5	22	8	1	0
	12:00-18:00	4	(4%)	7	(5%)	6	1	3
	18:00-24:00	3		5		7	0	0
23 Fr	00:00-06:00	5		4		12	0	1
	06:00-12:00	5	20	3	21	12	1	0
	12:00-18:00	5	(10%)	6	(14%)	3	0	1
	18:00-24:00	5		8		4	0	0
24 Sa	00:00-06:00	8		7		9	0	0
	06:00-12:00	5	20	5	18	9	0	0
	12:00-18:00	6	(15%)	2	(11%)	6	2	1
	18:00-24:00	1		4		14	0	0
25 Su	00:00-06:00	7		4		7	0	0
	06:00-12:00	5	16	3	19	9	0	0
	12:00-18:00	2	(6%)	5	(0%)	3	0	0
	18:00-24:00	2		7		6	0	0

(% Heavy in ICAO category)





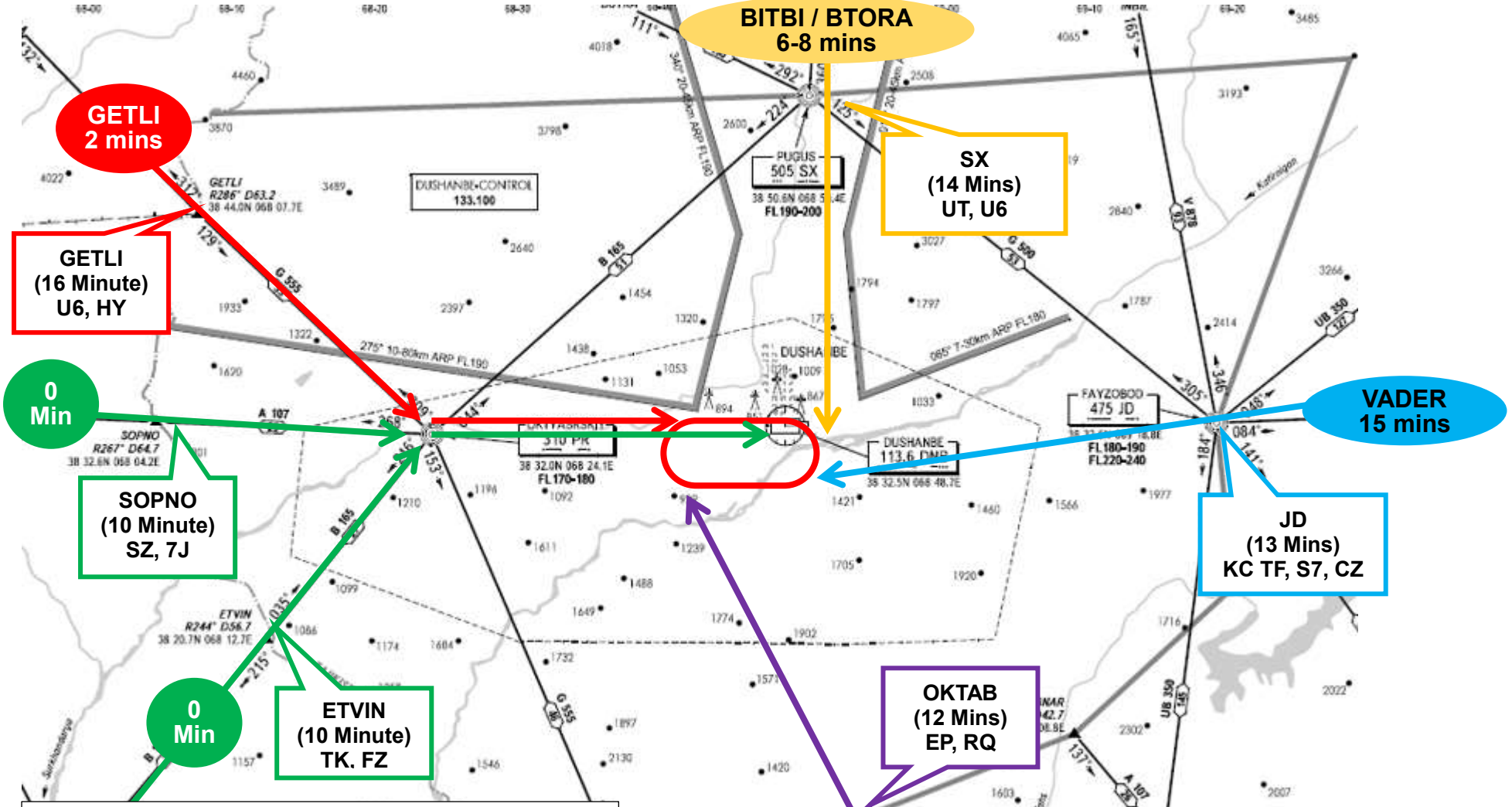
Assumption of irregular (w/o emergency case) factors

	Shift	Irregular situations	
		%	Index
	A	30%	1.35
	B		
	C		
	D		
	E		

% of irregular case happen and Index will be multiplied all figures on normal assumptions

ATC work-load index

Average staying time of Dushanbe FIR Edge to Approach area in “arrival” case



From Uzbekistan FIR:

30 minutes before crossing border (= same as APP) boundary, Uzbekistan ANSP inform to ACC.

Pilot will contact APP, but if upper than FL190, contact ACC.

From Afghanistan FIR:

10 minutes before crossing border (=same as FIR), Afghanistan ANSP inform to ACC.

Average staying time of Dushanbe FIR in “Flyover” case