

EOS Mission Support Network Performance Report

This is a monthly summary of EMSnet performance testing for December 2004 -- comparing the measured performance against the requirements.

Highlights:

- The "Integrated measurements" continue to be used as the basis for the ratings (where available), and are now incorporated directly in the spreadsheets and charts. These integrated results (as adjusted for the estimated "interference" effect) are believed to be more accurate than the previous method (the sum of the median iperf thrupt and the average MRTG), but are also somewhat lower. This has resulted in some of the ratings dropping one step.
- Mostly stable performance. exceptions:
 - Thrupt drop to JAXA
 - Problems with ERSDAC via APAN
- Added a new ratings category: **Almost Adequate**, in recognition that the requirements include 50% contingency. This rating applies to performance which does not quite meet the requirement, but does meet the requirement with the contingency removed. LaRC → JPL and GSFC → LaRC are now in this category (and would have been previously as well)
- Significant changes in testing are now indicated in Blue, Problems in Red

Ratings:

Rating Categories:

Excellent	: Total Kbps > Requirement * 3
Good	: 1.3 * Requirement <= Total Kbps < Requirement * 3
Adequate	: Requirement < Total Kbps < Requirement * 1.3
Almost Adequate	: Requirement / 1.3 < Total Kbps < Requirement
Low	: Requirement / 3 < Total Kbps < Requirement / 1.3
Bad	: Total Kbps < Requirement / 3

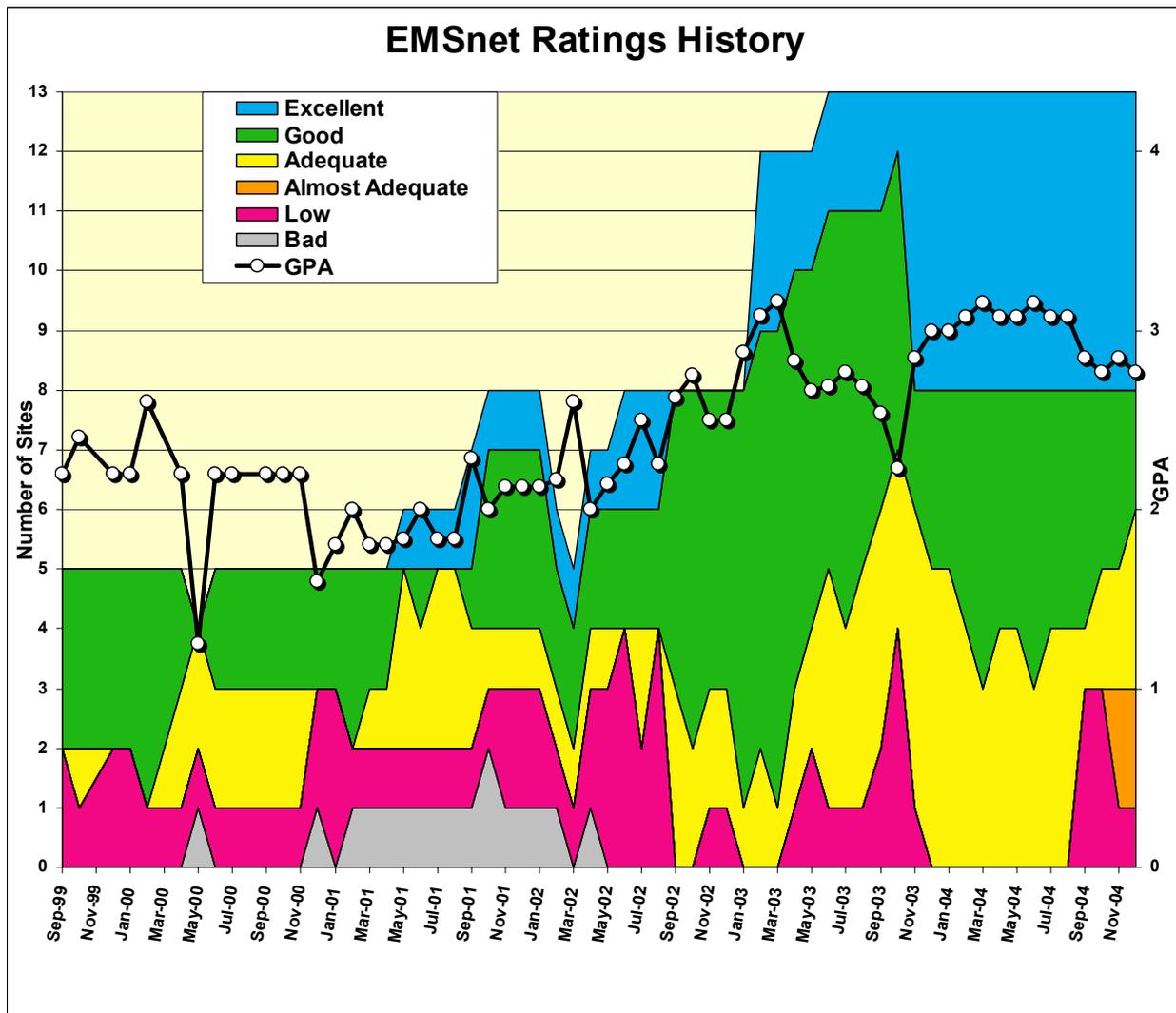
Where **Total Kbps** = Integrated Kbps (where available)
Else = User Flow + iperf monthly average

Ratings Changes:

Upgrades: ↑: None

Downgrades: ↓:
NSIDC → GSFC: Good → **Adequate**

Ratings History:



The chart above shows the number of sites in each classification since EMSnet testing started in September 1999.

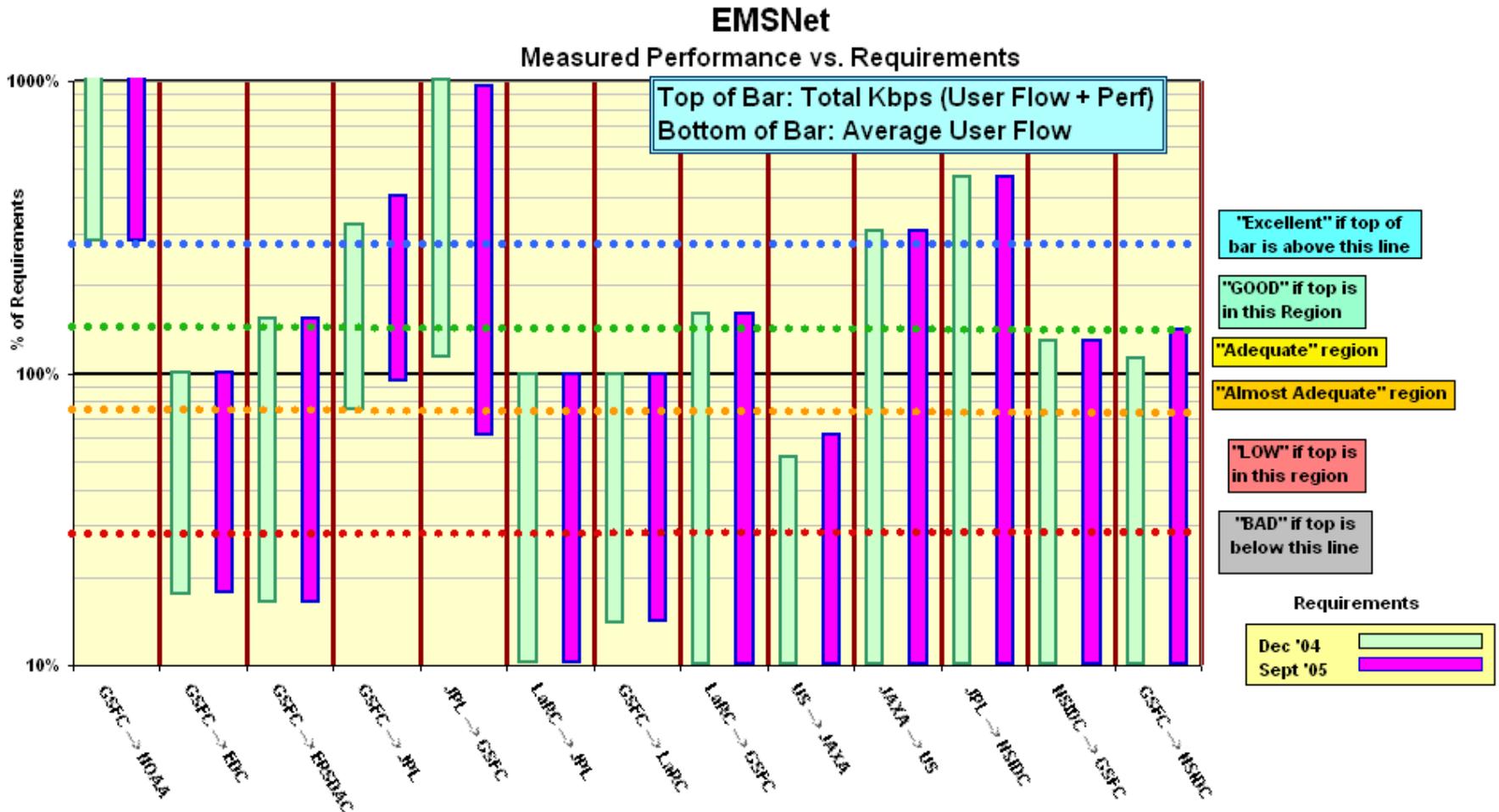
Note that these ratings do NOT relate to absolute performance -- they are relative to the EOS requirements. The GPA is calculated based on:

Excellent:	4
Good:	3
Adequate:	2
Almost Adequate:	1.5
Low:	1
Bad:	0

Network Requirements vs. Measured Performance

December 2004		Requirements (kbps)		Testing								
Source → Destination	Team (s)	Current	Future	Source → Dest Nodes	Avg User Flow kbps	iperf Avg kbps	Total Avg kbps	Integrated kbps	Rating re Current Requirements		Rating re	
		Dec-04	Sep-05						Dec-04	Prev	Sep-05	
GSFC → ASF	QuikScat, Radarsat	n/a	n/a	GSFC-CSAFS → ASF	19	1203	1222	1203	n/a	n/a	n/a	
ASF → JPL	QuikScat, Radarsat	n/a	n/a	ASF → JPL-SEAPAC	545	1302	1847		n/a	n/a	n/a	
GSFC → NOAA	QuikScat	189	189	GSFC-CSAFS → NESDIS	533	2926	3459	2926	Excellent	E	Excellent	
GSFC → EDC	MODIS, LandSat	285361	285361	GSFC-PTH → EDC PTH	68049	272729	340778	287084	Adequate	A	Adequate	
GSFC → ERSDAC	ASTER	568	568	GDAAC → ERSDAC	93	784	877		GOOD	G	GOOD	
GSFC → JPL	ASTER, QuikScat, MLS, etc.	1597	1272	GSFC-CSAFS → JPL-SEAPAC	1192	4956	6148	5136	Excellent	E	Excellent	
JPL → GSFC	AMSR, etc.	625	1155	JPL-PODAAC → GDAAC	705	10910	11615		Excellent	E	Excellent	
LaRC → JPL	TES, MISR	40311	40311	LDAAC → JPL-TES	4093	40212	44304	40215	AA	AA	AA	
GSFC → LaRC	CERES, MISR, MOPITT	58656	58456	GDAAC → LDAAC	8161	58266	66427	58349	AA	AA	AA	
LaRC → GSFC	MODIS, TES	31784	31695	LDAAC → GDAAC	394	50951	51345	50951	GOOD	G	GOOD	
US → JAXA	QuikScat, TRMM, AMSR	1986	1665	GSFC-CSAFS → JAXA	70	731	801	1026	LOW	L	LOW	
JAXA → US	AMSR	512	512	JAXA → JPL-SEAPAC	0	1568	1568		Excellent	E	Excellent	
JPL → NSIDC	AMSR	1342	1342	JPL-PODAAC → NSIDC SIDADS	111	6205	6316		Excellent	E	Excellent	
NSIDC → GSFC	MODIS, ICESAT, QuikScat	13326	13326	NSIDC DAAC → GDAAC	403	16897	17300		Adequate	G	Adequate	
GSFC → NSIDC	MODIS, ICESAT, QuikScat	79868	64118	GSFC-PTH → NSIDC DAAC	5810	90388	96198	90425	Adequate	A	GOOD	
Notes: Flow Requirements (from BAH) include TRMM, Terra , Aqua, QuikScat, ADECO												
				Ratings Summary								
								Dec-04		Req	Sep-05	
								Score		Prev	Score	
*Criteria:	Excellent	Total Kbps > Requirement * 3			Excellent			5	5	5		
	GOOD	1.3 * Requirement <= Total Kbps < Requirement * 3			GOOD			2	3	3		
	Adequate	Requirement < Total Kbps < Requirement * 1.3			Adequate			3	2	2		
	Almost Adequate	Requirement / 1.3 < Total Kbps < Requirement			Almost Adequate			2	2	2		
	LOW	Total Kbps < Requirement / 1.5			LOW			1	1	1		
	BAD	Total Kbps < Requirement / 3			BAD			0	0	0		
				Total				13	13	13		
				GPA				2.77	2.85	2.85		

This graph shows two bars for each source-destination pair. Each bar uses the same actual measured performance, but compares it to the requirements for two different times (October '04, and September '05). Thus as the requirements increase, the same measured performance will be lower in comparison.



Interpretation: The bottom of each bar is the average measured MRTG flow to a site. Thus the bottom of each bar indicates the relationship between the requirements and actual flows. Note that the requirements include a 50% contingency factor above what was specified by the projects, so a value of 66% would indicate that the project is flowing as much data as requested. The top of each bar represents the sum of the MRTG user flow plus the iperf measurement – it is this value which is used as the basis of the ratings

1) ASF

Rating: **N/A**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/ASF_EMS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → ASF	1.36	1.20	0.79	0.02	1.22	1.20
ASF → NESDIS	1.38	1.16	0.42			
ASF → NSIDC	1.40	1.33	0.37			
ASF → GSFC-CSAFS	1.38	1.29	0.41			
ASF → JPL-SEAPAC	1.36	1.30	0.48			

Comments: Thruptut was a little lower but very similar to last month to and from all destinations. The 1.3 mbps total from ASF → all destinations is as expected for a single T1 (1.54 mbps) circuit, as is the 1.2 mbps inbound.

Since the requirement from ADEOS has been deleted, the remaining ASF requirements are very low, and are mostly based on estimated ECS interDAAC queries, not production flows. These flow estimates are not considered reliable enough to use as a basis for testing, so the rating is "N/A".

2) EDC:

Rating: Continued **Adequate**

Web Page: <http://ensight.eos.nasa.gov/Networks/emsnet/EDC.shtml>

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-PTH → EDC-PTH	287.8	272.7	250.7	68.0	340.8	287.1
G-DAAC → EDC LPDAAC	221.6	196.1	128.3			
ERSDAC → EDC via Abilene	6.2	5.3	4.6			
GSFC → EDC via Abilene	7.0	5.9	5.0			
EDC → GSFC via Abilene	97.6	72.6	55.4			

Requirements:

Date	mbps	Rating
Dec 04, Sept '05	285.4	Adequate

Comments:

The rating is based on testing between the GSFC performance test host ("GSFC-PTH"), located outside the ECS firewall and the EDC performance test host ("EDC-PTH"), also located outside the ECS firewall. The comparison of the two results above shows the effect of high levels of loading on the GDAAC and EDC ECS firewalls.

The rating is based on the "Integrated" measurement, presented above, which combines each iperf test with user flow data for the same time period. As usual, this result is lower than the sum of the MRTG and iperf. The 287 mbps integrated measurement is [barely] above the requirement, but below a 30% margin, so the rating remains "Adequate".

New tests were added this month, between EDC (PTH) and ERSDAC, and EDC and GSFC, in support of the planned ERSDAC to EDC ASTER flow, replacing tapes. The route from GSFC is via to MAX, Abilene, peering with vBNS+ in DC. The route from ERSDAC is similar, via APAN from Tokyo to Abilene in Los Angeles, peering with vBNS+ in DC. The similar low thruptut into EDC from both sources, along with the thruptut asymmetry to GSFC indicates a peering problem between Abilene and vBNS+ in DC.

3) JPL:

Ratings: GSFC → JPL: Continued **Excellent**
 JPL → GSFC: Continued **Excellent**
 LaRC → JPL: Continued **Low**

Web Pages:

- http://ensight.eos.nasa.gov/Networks/emsnet/JPL_SEAPAC.shtml
- http://ensight.eos.nasa.gov/Networks/emsnet/JPL_PODAAC.shtml
- http://ensight.eos.nasa.gov/Networks/emsnet/JPL_TES.shtml
- http://ensight.eos.nasa.gov/Missions/terra/JPL_MISR.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → JPL-SEAPAC	6.2	5.0	2.4	1.2	6.2	5.1
GSFC-PTH → JPL-PODAAC	5.6	4.6	2.3	1.2	5.8	4.8
LaRC DAAC → JPL-TES	40.4	40.2	29.5	4.1	44.3	40.2
LaRC DAAC → JPL-MISR	40.7	40.6	28.1			
LaRC PTH → JPL-PTH	41.6	41.5	28.8			
JPL-PODAAC → GSFC DAAC	12.2	10.9	5.3	0.7	11.6	

Requirements:

Source → Dest	Date	Mbps	Rating
GSFC → JPL combined	Dec '04	1.60	Excellent
JPL → GSFC combined	Dec '04	0.63	Excellent
LaRC DAAC → JPL-TES	Dec '04	30.6	Adequate
LaRC DAAC → JPL-MISR	Dec '04	18.5	Adequate
LaRC DAAC → JPL-Combined	Dec '04	40.3	Almost Adequate

Comments:

GSFC → JPL: Performance on this circuit has been mostly stable since the BOP switchover on 15 August '02; well above the requirement; the rating remains "Excellent". The "integrated" data, which combines the iperf and user flow for each individual test, is, in this case (like most other sites) just slightly higher than the iperf results alone, and lower than the sum of the median iperf and average MRTG. This again indicates that adding a small average user flow to the median iperf overstates the true situation.

LDAAC → JPL: Performance testing from LDAAC to JPL-TES has been stable at 40 mbps since testing was restored on Feb 29. Iperf results to JPL-MISR was very similar to TES, as is the results for the new testing from LaRC-PTH to JPL-PTH. The integrated result in this case is also well below the sum of the median iperf and average MRTG.

Note: The measured thrupt is above both the MISR and TES requirements, but below their combined value. However, the MISR requirement is open to some interpretation. The formal QA flow is only 9.7 mbps – this value is used to generate the "combined" requirement. The rating is now based on the "integrated" measurement, which is very slightly below this requirement. But it is above the requirement without adding the contingency so the rating is reclassified as "Almost Adequate".

Note: the science data also flows on the same circuit. If this was added to the requirement, it would push the total MISR flow requirement to 18.5 mbps, and the total requirement to 49.1 mbps, which is higher than the nominal circuit speed. This configuration is based on a management decision to set the circuit capacity at this level to reduce cost, in the expectation that both projects' requirements are bursty and include contingency. Thus the actual requirements of both projects are expected to be met with this circuit capacity.

JPL → GSFC: The requirement from JPL to GSFC includes flows from NASDA and ASF which go via JPL, and includes GSFC and NOAA destinations. Since many of these flows were related to ADEOS, this requirement dropped substantially with the removal of ADEOS. The combined requirement is now only 0.63 mbps, and the combined 12.6 mbps thrupt is more than 3 times that, so the rating remains "Excellent".

4) NSIDC:

Ratings: GSFC → NSIDC: Continued **Adequate**
 NSIDC → GSFC: ↓ Good → **Adequate**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/NSIDC_EMS.shtml

GSFC ↔ NSIDC Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-PTH → NSIDC	91.5	90.4	52.1	5.8	96.2	90.4
GSFC-DAAC → NSIDC	91.1	90.4	53.1	5.8	96.2	90.4
NSIDC → GSFC-DAAC	17.0	16.9	15.1	0.4	17.3	

Requirements:

Source → Dest	Date	Mbps	Rating
GSFC → NSIDC	Dec '04	79.9	Adequate
NSIDC → GSFC	Dec '04	13.3	Adequate

Comments:

GSFC → NSIDC: The rating is based on testing from the GSFC-PTH to the NSIDC DAAC. This GSFC node is outside the GSFC ECS firewall, and has about the same values as the GDAAC. Like most other sites, the "Integrated" results are close to the iperf results, and substantially lower than the sum of the median iperf and average MRTG

The requirement varies from month to month based on planned ICESAT reprocessing. This month the reprocessing is included, raising the requirement from 63 mbps in September. Although the performance was quite stable, it is no longer 30% above the requirement, so the rating remains "Adequate".

NSIDC → GSFC: Performance from NSIDC to GSFC dropped slightly, and is now below 30% above the requirement, so the rating drops to "Adequate".

Other Testing:

Source → Dest	Medians of daily tests (mbps)			Requirement	Rating
	Best	Median	Worst		
JPL → NSIDC-SIDADS	6.21	6.21	4.32	1.08	Excellent
GSFC-ISIPS → NSIDC (iperf)	2.35	1.98	1.53		
GSFC-ISIPS → NSIDC (ftp)	0.47	0.41	0.33		
NSIDC → GSFC-ISIPS (iperf)	16.4	15.7	15.1		
ASF → NSIDC	1.40	1.33	0.37	0.73	Good

Comments:

JPL → NSIDC-SIDADS: Performance has been very steady from JPL since the Aug '02 BOP switchover, exceeding the modest requirement.

GSFC-ISIPS ↔ NSIDC: Performance from ISIPS to NSIDC – both ftp and iperf – dropped about 50% further in December – previously, had a step drop on July 12 (medians were 7 mbps for ftp and 35 mbps for iperf until that date). It appears that send window scaling has been disabled on the ISIPS HP-UX machine. Testing from NSIDC to ISIPS was not affected, and gets very similar thrupt as NSIDC to GDAAC.

ASF → NSIDC: The median thrupt remains more than 30 % above the LASP requirement, so the rating continues "Good".

5) GSFC ↔ LaRC:

Ratings: GDAAC → LDAAC: Continued **Almost Adequate**
 LDAAC → GDAAC: Continued **Good**

Web Page: <http://ensight.eos.nasa.gov/Networks/emsnet/LARC.shtml>

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GDAAC → LDAAC	58.7	58.3	34.6	8.2	66.4	58.4
GSFC-PTH → LaRC-PTH	58.8	58.7	17.6			
GSFC-PTH → LaTIS via PIP	43.2	42.0	4.6			
LDAAC → GDAAC	51.1	51.0	46.2	0.4	51.3	51.0

Requirements:

Source → Dest	Date	Mbps	Rating
GDAAC → LDAAC	Dec '04	58.7	Almost Adequate
GSFC → LaTIS *	Dec '04	0.7	Excellent
LDAAC → GDAAC	Dec '04	31.8	Good

Comments:

GSFC → LaRC DAAC: Performance and user flow from GDAAC to LDAAC was stable. However, only a very small requirement has been attributed to LaTIS at this time, so the LDAAC requirement did not drop much. So the use of the lower integrated measurements (about the same as iperf alone), is slightly below the requirement – but above the requirement without the 50% contingency – so is reclassified as “Almost Adequate” (would have been the same last month).

Testing from GSFC-PTH to LARC-PTH is very similar. Like all other sites, the "Integrated" results are substantially lower than the sum of the median iperf and average MRTG

GSFC → LaTIS: Performance from GSFC-PTH to LaTIS (now via PIP), is well in excess of the [*** possibly understated**] requirement above, and is rated “Excellent”

LaRC → GSFC: Performance remains stable since the June '03 upgrade to meet the backhaul requirements. The FY '04 requirement jumped from 6.8 mbps to 31.7 mbps in Oct '03, to incorporate this backhaul of all LaRC science outflow via GSFC (**which is apparently no longer planned, due to the switch from EMSnet to PIP**). The thrupt is more than 30% above this requirement, so the Jan '04 rating remains "good".

6) NOAA NESDIS:

Rating: Continued **Excellent**

Web Page: http://ensight.eos.nasa.gov/Networks/emsnet/NOAA_NESDIS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → NESDIS	2.93	2.93	1.26	0.53	3.46	2.93
GSFC-CSAFS → NESDIS via MAX	7.16	6.96	4.40			
ASF → NESDIS	1.38	1.16	0.42			
JAXA (NASDA) → NESDIS	1.41	1.25	0.37			
JPL → NESDIS via MAX	3.04	2.71	1.90			

Requirements:

Source → Dest	FY	Mbps	Rating
GSFC-CSAFS → NESDIS	'04	0.19	Excellent

Comments: The dominant flow to NOAA is Quikscat data, from GSFC CSAFS.

Like other sites, the new "Integrated" results are lower than the sum of the median iperf and average MRTG. In this case the 3.16 mbps total iperf + user flow exceeds the 2 x T1 circuit capacity, providing strong evidence that the integrated results are more accurate. Since the thruput is more than 3 times the FY '04 requirement, the rating remains "Excellent".

Note that the flow from JAXA is limited by the TCP window size of the JAXA test source, and the long RTT.

Results from GSFC SAFS to NOAA, via MAX (instead of EMSnet) were also stable, about double the EMSnet performance. Results from JPL, via Abilene to the MAX was also stable, but lower than expected.– the limitation is under investigation.

7) US ↔ JAXA (NASDA):

Ratings: GSFC → JAXA: Continued **Low**
 JAXA → US: Continued **Excellent**

Web Pages http://ensight.eos.nasa.gov/Networks/emsnet/NASDA_EOC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/JPL_SEAPAC.shtml
http://ensight.eos.nasa.gov/Networks/emsnet/GSFC_SAFS.shtml

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL	Integrated
	Best	Median	Worst			
GSFC-CSAFS → JAXA-EOC	1.17	0.73	0.34	0.07	0.80	1.03
JAXA-EOC → JPL-SEAPAC	1.61	1.57	0.75	0.01	1.58	
JAXA-EOC → GSFC-CSAFS	1.45	1.33	0.54			

Requirements

Source → Dest	Date	mbps	Rating
GSFC → JAXA	Dec '04	1.99	Low
JAXA → US	FY '04, '05	0.51	Excellent

Comments: US → JAXA: The requirements above were reduced in November '03, due to the removal of ADEOS flows. However, they have not been reduced yet in regard to the September '04 circuit reduction.

Performance dropped on November 27 from a steady median of about 1.5 mbps to only 1.0 mbps. (Integrated results – Iperf results correspond). The rating was already "Low" – the drop does not change it. The circuit no longer appears to be working nominally. Also note that this case has the integrated thruput is again slightly HIGHER than the sum of the the iperf and MRTG – this indicates a problem with the data collection process.

Note: The requirement still includes 4 ISTs at JAXA for AMSR-E. Each IST has a requirement for 311 kbps, for a total of 1244 kbps. It could be questioned whether JAXA intends to operate all four of the ISTs simultaneously, or whether some ISTs are backups, in which case the network requirements would be reduced to a lower value.

JAXA → US: Performance remained consistent with the reduced ATM PVC. The requirement was reduced in November '03 due to the removal of ADEOS requirements. The rating remains "Excellent".

Note: JAXA has not yet implemented testing with multiple tcp streams, so performance to GSFC is limited by the TCP window size on JAXA's test machine, in conjunction with the long RTT. In order to reflect the actual capability of network, the rating is derived from testing from JAXA to JPL, which uses the same Trans-Pacific circuit, but has a shorter RTT, so will not be limited by the TCP window size. The Trans-Pacific circuit connects into the higher speed domestic EMSnet at JPL, which is not expected to be the limiting factor.

8) GSFC → ERSDAC:

Rating: Continued **Good**

Web Page : <http://ensight.eos.nasa.gov/Networks/emsnet/ERSDAC.shtml>

Test Results:

Source → Dest	Medians of daily tests (mbps)			User Flow	TOTAL
	Best	Median	Worst		
GSFC → ERSDAC via EMSnet	0.79	0.78	0.46	0.09	0.87

Requirements:

Source → Dest	FY	Kbps	Rating
GSFC → ERSDAC	'03 - '05	568	Good

Comments: **EMSnet:** Thruput since June '02, using the 1 mbps ATM connection had been very stable (except for a problem period from 12 November '02 to 3 Jan '03). The requirement was revised down from 668 kbps in November '03, so the total user flow plus iperf is more than 30 % over the requirement, and the rating remains "Good". Flow data is not available on this route, so integrated measurements cannot be calculated.

APAN: It is planned to switch this flow to use APAN in the near future. Testing to support this change has started in October. The results below between GSFC and the Tokyo Exchange Point (to which ERSDAC is connected) show the potential for thrupt to ERSDAC.

Various configurations between GSFC and ERSDAC have been tested, but problems are still evident. The thrupt from ERSDAC to GSFC is working well, limited by the ERSDAC FastE connection. **But from GSFC to ERSDAC, thrupt is limited to about 5 mbps per TCP stream (3 streams were used in the results below). This limitation appears to be due to packet loss rate of about 0.01%.** Since there is no problem with thrupt between GSFC and Tokyo-XP, it is inferred that this loss is between Tokyo-XP and ERSDAC, or within ERSDAC. Further testing is planned.

Source → Dest	Medians of daily tests (mbps)		
	Best	Median	Worst
GSFC-PTH → ERSDAC	17.1	14.9	13.1
ERSDAC → GSFC-PTH	85.6	81.8	14.5
GSFC → Tokyo-XP	117.7	98.7	77.9
Tokyo-XP → GSFC	115.1	112.2	84.9