

**510-EMD-001**

# **Archive Capacity Study for the ECS System**

**Technical Paper**

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# Abstract

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This document provides the estimated ECS archive capacity, in terms of media, tape drives, silos, and archive servers required during FY05 through FY08. Projections are provided on a silo-by-silo basis at each DAAC and the PVC.

**Keywords:** archive, capacity

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## Abstract

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# 1. Introduction

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## 1.1 Purpose

This document provides the estimated ECS archive capacity, in terms of media, tape drives, silos, and archive servers, required during FY05 through FY08. Projections are provided on a silo-by-silo basis at each DAAC and the PVC.

## 1.2 Organization

This paper is organized as follows:

Section 2 discusses the methodology used for this analysis and contains a set of general assumptions that apply to all DAACs. Sections 3 through 7 contain the FY05 through FY08 estimated archive capacity requirements for each DAAC and the PVC.

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## 2. Methodology and General Assumptions

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Each silo at each DAAC was modeled to project fill rate on a quarterly basis through FY 2008. Assumptions were made regarding reprocessing rates, deletion rates, 9940A to 9940B tape migration rates and data backup strategies. The following general assumptions apply to all DAACs.

1. Observed data compression ratios have been used where available. Otherwise, an assumed compression ratio of 1.5 to 1 has been used.
2. Observed daily data volumes have been used where available. Otherwise, daily data volumes, as specified in the EMD Functional and Performance Requirements Specification (F&PRS), have been used.
3. In order to provide additional media for test modes and some of the smaller datasets (e.g., ancillary data, small volume missions), a 95% fill factor was used when computing the additional number of tapes required.
4. A 15% media contingency has been added to all media procurements.
5. The native capacity of a 9940A tape is 60 GB.
6. The native capacity of a 9940B tape is 200 GB.
7. With the exception of ASTER L1A data, Level 1A data is deleted 6 months after it is processed to Level 1B.
8. Historically, data from the forward and reprocessing streams for a given data collection version have been stored on the same set of tapes. While this approach improves archive tape drive utilization, it results in more operations labor to implement a rolling delete strategy because all data on each tape does not become eligible for deletion at about the same time. This causes the DAAC operations staff to have to move data between tapes in order to reuse tapes in a timely fashion. In June 2004, the SDPS archive tape allocation strategy was changed to enable the DAAC to stored data from the forward and reprocessing streams on different tape sets. This virtually eliminates the need to move data between tapes before they can be reused and makes the implementation of rolling delete strategies operationally viable. In order for the benefits of this change to take effect, one reprocessing cycle must be completed with the capability enabled. Therefore, the model assumes that two versions of a data collection are stored until one reprocessing cycle has been completed for each data collection. After that, a six-month rolling delete strategy is assumed for any data collection version that is reprocessed.
9. All missions are assumed to be extended through FY 2008 with the following exceptions:
  - a. Landsat 7 – No additional data accumulation has been assumed and all Landsat 7 data are assumed to be deleted from the LP DAAC archives by 12/2004.

- b. ICESat – GLAS science data collection will stop in 3/2006.
10. *This study has assumed that the archive storage technology used by the EMD Science Data Processing System (SDPS), will continue to be supported through FY 2008. Upgrades have only been recommended where forecasted storage requirements exceed available capacity. StorageTek is projecting that the 9940A tape drive which is used at all DAACs, will reach end of service life in CY 2007. This may require that either the remaining 9940A tape drives at each DAAC be replaced or a special maintenance agreement be negotiated with the vendor. These alternatives will be evaluated as part of EMD COTS refresh activities.*

### 3. LP DAAC Estimated Archive Capacity Requirements

The estimated archive capacity requirements for the LP DAAC are provided in the following subsections. The current archive configuration is presented, followed by a set of assumptions related to archive growth and the phase-in of 9940B tape drives.

#### 3.1 Current Archive Configuration

Table 3-1 shows the current archive configuration as of 5/19/2004.

**Table 3-1. LP DAAC Current Archive Configuration**

Archive Server	Silo	Silo Configuration
e0drg11 (SGI Origin 2000)	1	STK 9940A tape drives = 7 Silo tape capacity = 5,528 Tapes used = 4,061 Tapes unused = 1,163
	3	STK 9940A tape drives = 8 STK 9940B tape drives = 4 STK 9840 tape drives = 6 Silo tape capacity = 5,528 Tapes used = 1,350 (9940) Tapes used = 100 (9840) Tapes unused = 1,298 (9940) Tapes unused = 144 (9840)
e0drg12 (SGI Origin 2000)	2	STK 9940A tape drives = 1 STK 9940B tape drives = 19 Silo tape capacity = 5,528 Tapes used = 2,768 Tapes unused = 2,337

#### 3.2 LP DAAC Archive Growth Assumptions

The following assumptions have been used to estimate the LP DAAC archive capacity requirements through FY 2005:

1. All Landsat 7 data will be deleted and tapes reused by 12/2004.
2. No backup volume groups are required for the major collections.

3. Tables 3-2 through 3-4 specify assumptions for number of existing tapes in each collection, number of GB of data added to each collection per day at a 1X production rate, data compression ratio, and assumed deletion date for the collection (i.e., when the associated tapes can be reused). For MODIS products, the number of tapes needed to store a golden month of data is provided.
4. Table 3-5 specifies the percentage of each collection version that is stored at the beginning of each quarter. Typically, the active version builds up over a period of time as forward processing and reprocessing are performed and the previous version is reduced as rolling deletes are performed. Note that collection versions produced prior to October 2004 are not subject to rolling deletes but kept until the entire collection version is eligible for deletion and then deleted. Terra and Aqua MODIS Version 4 collections have been set to 90% to reflect the actual amount of data stored.

**Table 3-2. Volume Group Assumptions for LP DAAC Silo 1**

Volume Group	Ver	Current	GB/Day	Comp.	Not Used	Not Used	# GM
astl1	1+	1,238	139	1.43			
astperm	1+	113	1	1.40			
asttemp	1+	33	8	1.40			
ancb	1	96	6	1.50			
I7	1+	2,425					
Other	1	156					

**Table 3-3. Volume Group Assumptions for LP DAAC Silo 2**

Volume Group	Ver	Current	GB/Day	Comp.	Not Used	Not Used	# GM
modhi	4+	264	48	3.00			3
mod09l2g	4+	1,025	133	2.90			10
modl2g	4+	1,399	125	2.70			10
modcmg	4+	7	24	1.50			3
Other	1	73					

**Table 3-4. Volume Group Assumptions for LP DAAC Silo 3**

Volume Group	Ver	Current	GB/Day	Comp.	Not Used	Not Used	# GM
mydhi	3+	166	48	3.40			10
myd09l2g	3+	347	133	2.70			10
mydl2g	3+	563	125	3.40			26
mydcmg	3+	20	24	3.40			5
Other	1	354					

**Table 3-5. Percentage of Collection Versions Stored By Quarter**

Collections and Golden Months	Percentage of Collection Stored									
	7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006	
Terra MODIS V4	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Aqua MODIS V3	1.0	1.0								
Aqua MODIS V4	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Terra & Aqua MODIS V5					0.2	0.3	0.5	0.7	0.8	
Terra & Aqua MODIS V6										
Terra MODIS Golden Mo	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Aqua MODIS Golden Mo	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0
Landsat 7	1.0	1.0								

Collections and Golden Months	Percentage of Collection Stored									
	10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008	
Terra MODIS V4	0.9	0.9	0.9							
Aqua MODIS V3										
Aqua MODIS V4	0.9	0.9	0.9							
Terra & Aqua MODIS V5	1.0	1.0	1.0	1.0	0.9	0.8	0.6	0.5	0.4	
Terra & Aqua MODIS V6		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.6	
Terra MODIS Golden Mo	1.0	1.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0	
Aqua MODIS Golden Mo	1.0	1.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0	
Landsat 7										

Given these assumptions, Tables 3-6 through 3-8 show the archive fill rates for each silo given the current archive configuration.

**Table 3-6. LP DAAC Silo 1 Fill Rate**

Volume Group	Ver	Silo 1 Tapes Used (Cumulative)									
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006	
astl1	1+	1,311	1,468	1,625	1,779	1,934	2,091	2,248	2,401	2,556	
astperm	1+	113	114	114	115	116	116	117	117	118	
asttemp	1+	37	46	55	63	72	81	89	98	100	
ancb	1	99	106	113	119	126	133	140	146	153	
I7	1+	2,425	2,425	0	0	0	0	0	0	0	
Other	1	156	156	156	156	156	156	156	156	156	
Total 9940A Tapes		4,142	4,315	2,063	2,232	2,403	2,576	2,749	2,919	3,083	

Volume Group	Ver	Silo 1 Tapes Used (Cumulative)									
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008	
astl1	1+	2,713	2,870	3,023	3,179	3,336	3,492	3,648	3,803	3,960	
astperm	1+	118	119	120	120	121	121	122	122	123	
asttemp	1+	100	100	100	100	100	100	100	100	100	
ancb	1	160	167	173	180	187	193	200	207	214	
I7	1+	0	0	0	0	0	0	0	0	0	
Other	1	156	156	156	156	156	156	156	156	156	
Total 9940A Tapes		3,247	3,411	3,572	3,735	3,899	4,063	4,226	4,388	4,552	

**Table 3-7. LP DAAC Silo 2 Fill Rate**

Volume Group	Ver	Silo 2 Tapes Used (Cumulative)								
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
modhi	4+	366	373	380	390	463	538	616	696	779
mod09l2g	4+	1,062	1,082	1,102	1,131	1,342	1,561	1,787	2,021	2,261
modl2g	4+	1,067	1,087	1,107	1,137	1,349	1,569	1,796	2,031	2,273
modcmg	4+	376	383	390	401	475	553	633	716	801
Other	1	156	156	156	156	156	156	156	156	156
Total 9940A/B Tapes		3,027	3,081	3,135	3,214	3,785	4,377	4,988	5,619	6,270
w/ 3 tapes/day migration		2,601	2,471	2,341	2,240	2,629	3,037	3,464	3,915	4,384

Volume Group	Ver	Silo 2 Tapes Used (Cumulative)								
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
modhi	4+	865	884	931	572	567	563	560	562	563
mod09l2g	4+	2,510	2,566	2,701	1,660	1,645	1,634	1,626	1,632	1,633
modl2g	4+	2,522	2,578	2,715	1,669	1,653	1,642	1,634	1,640	1,641
modcmg	4+	889	909	957	588	583	579	576	578	578
Other	1	156	156	156	156	156	156	156	156	156
Total 9940A/B Tapes		6,942	7,092	7,460	4,645	4,604	4,573	4,553	4,569	4,570
w/ 3 tapes/day migration		4,872	4,838	5,106	2,291	2,250	2,219	2,199	2,215	2,216

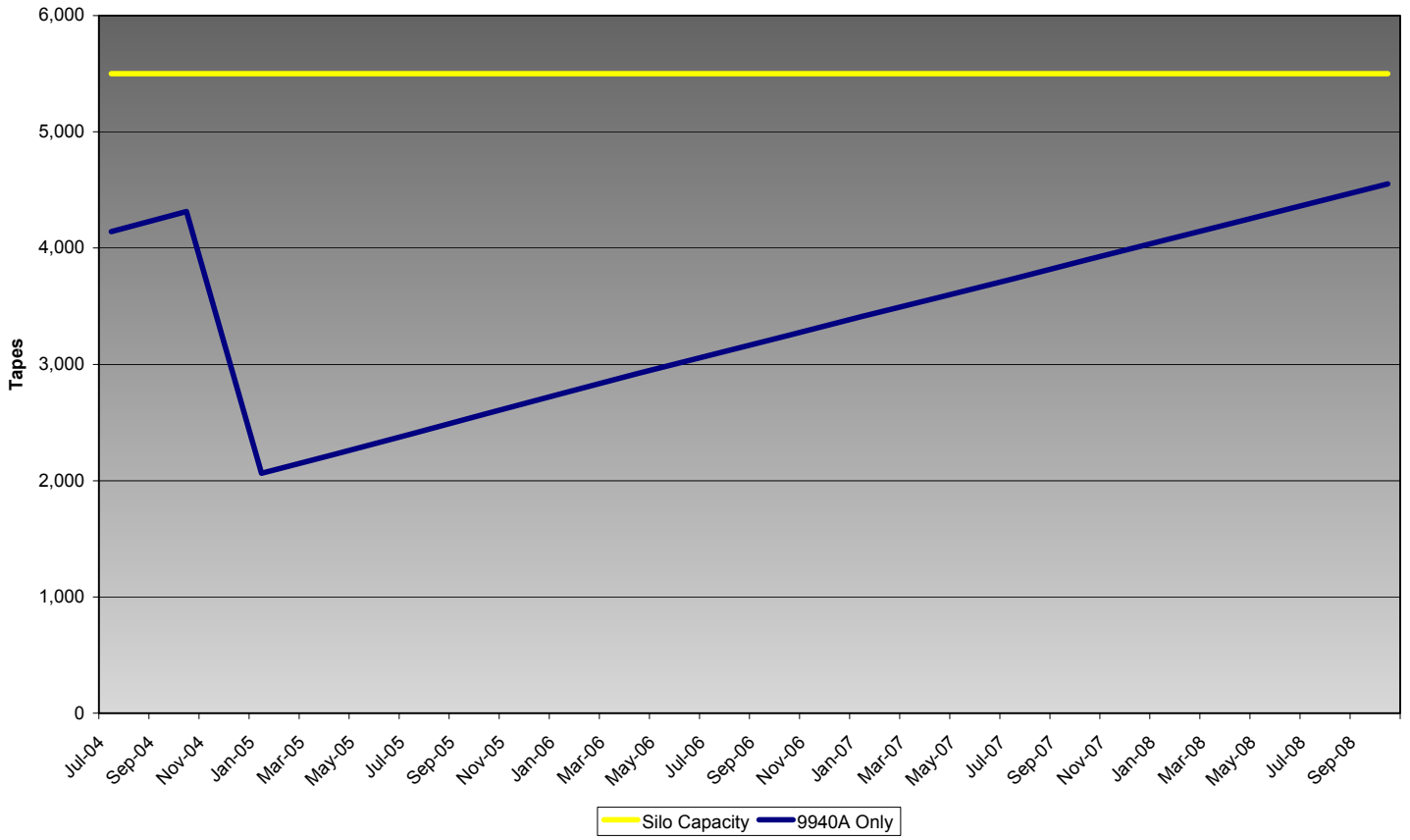
**Table 3-8. LP DAAC Silo 3 Fill Rate**

Volume Group	Ver	Silo 3 Tapes Used (Cumulative)								
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
mydhi	3+	421	442	209	238	284	338	399	467	543
myd09l2g	3+	603	625	520	551	655	768	888	1,015	1,151
mydl2g	3+	1,106	1,160	547	625	746	886	1,046	1,225	1,424
mydcmg	3+	217	227	107	122	146	173	205	240	279
Other	1	354	354	354	354	354	354	354	354	354
Total 9940A/B Tapes		2,702	2,807	1,737	1,890	2,185	2,519	2,891	3,302	3,751

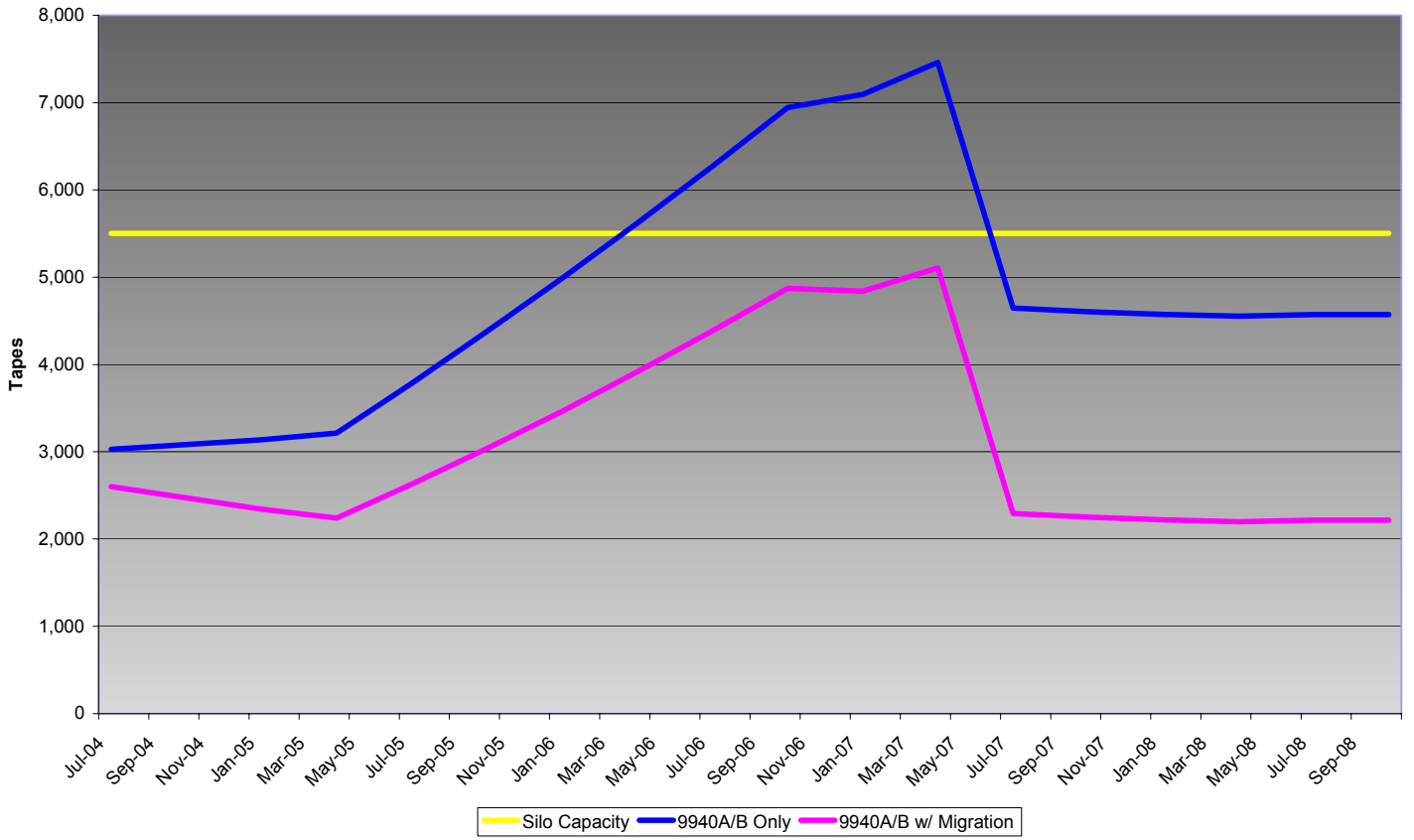
Volume Group	Ver	Silo 3 Tapes Used (Cumulative)								
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
mydhi	3+	626	653	702	502	505	513	524	550	569
myd09l2g	3+	1,295	1,333	1,414	921	918	920	926	946	961
mydl2g	3+	1,644	1,714	1,842	1,317	1,327	1,347	1,377	1,443	1,494
mydcmg	3+	322	336	361	258	260	264	270	282	293
Other	1	354	354	354	354	354	354	354	354	354
Total 9940A/B Tapes		4,241	4,390	4,672	3,352	3,364	3,397	3,451	3,576	3,671

These tables show that LP DAAC has sufficient silo capacity through FY 2008 assuming 9940A tape migration occurs in Silo 2. The assumed migration rate is three 9940A tapes copied per day in each silo. This results in a net gain of two available tapes per day since 9940B capacity is 3.3 times greater than 9940A capacity. The archive fill rates are depicted graphically in Figures 3-1 through 3-3.

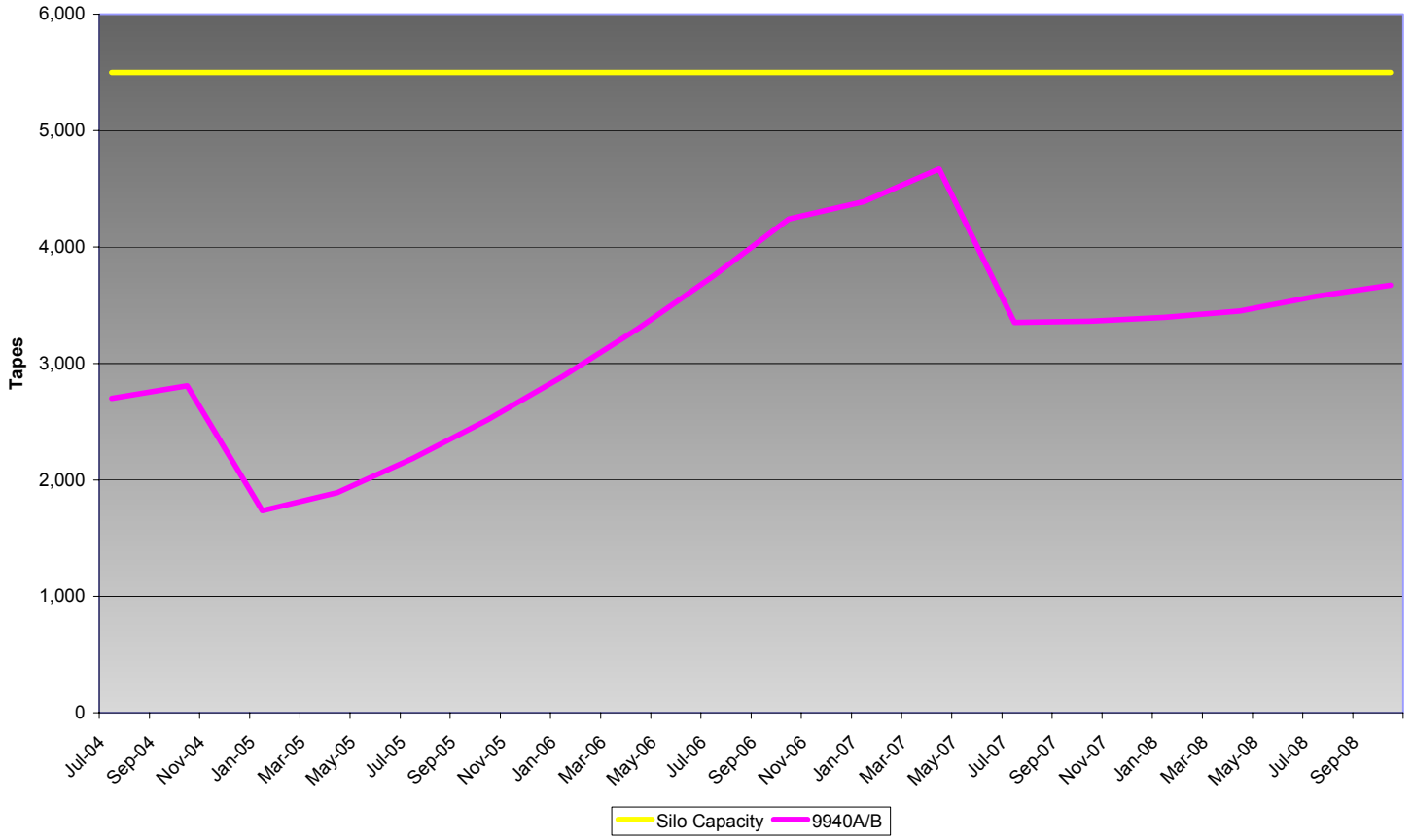




**Figure 3-1. LP DAAC Silo 1 Fill Rate**



**Figure 3-2. LP DAAC Silo 2 Fill Rate**



**Figure 3-3. LP DAAC Silo 3 Fill Rate**

Table 3-9 shows the additional tape media that will need to be procured through FY 2008 to support the required archive capacity.

**Table 3-9. LP DAAC Cumulative Additional Tapes Needed**

<b>Date</b>	<b>New Tapes</b>
7/1/2004	0
10/1/2004	0
1/1/2005	0
4/1/2005	0
7/1/2005	0
10/1/2005	0
1/1/2006	0
4/1/2006	0
7/1/2006	0
10/1/2006	0
1/1/2007	0
4/1/2007	428
7/1/2007	0
10/1/2007	0
1/1/2008	0
4/1/2008	0
7/1/2008	0
10/1/2008	0

## 4. GES DAAC Estimated Archive Capacity Requirements

The estimated archive capacity requirements for the GES DAAC are provided in the following subsections. The current archive configuration is presented, followed by a set of assumptions related to archive growth and the phase-in of 9940B tape drives.

### 4.1 Current Archive Configuration

Table 4-1 shows the current archive configuration as of 5/21/2004.

**Table 4-1. GES DAAC Current Archive Configuration**

Archive Server	Silo	Silo Configuration
g0drg01 (SGI Origin 2000)	1	STK 9940A tape drives = 10 STK 9840 tape drives = 2 Silo tape capacity = 5,528 Tapes used = 3,696 Tapes unused = 1,000
g0drg02 (SGI Origin 2000)	2	STK 9940A tape drives = 15 STK 9840 tape drives = 2 Silo tape capacity = 5,528 Tapes used = 2534 Tapes unused = 1372
g0drg04 (SGI Origin 2000)	3	STK 9940A tape drives = 8 STK 9840 tape drives = 2 Silo tape capacity = 5,528 Tapes used = 3486 Tapes unused = 762
	4	STK 9940A tape drives = 11 STK 9840 tape drives = 2 Silo tape capacity = 5,528 Tapes used = 3170 Tapes unused = 1312
g0drg05 (SGI Origin 300)	5	STK 9940B tape drives = 8 STK 9940A tape drives = 1 STK 9840 tape drives = 2 Silo tape capacity = 5,528 Tapes used = 3209 Tapes unused = 1,682

## 4.2 GES DAAC Archive Growth Assumptions and Analysis

The following assumptions have been used to estimate the GES DAAC archive capacity requirements through FY 2008:

1. Backup copies will be made of the following volume groups. The percentage of data in these volume groups that must be backed up is given in parens.
  - a. anc (100%)
  - b. aqmydocbin (12%)
  - c. modocbin (12%)
  - d. seawifs (100%)
  - e. sorce (100%)
2. Version 0 storage capacity is limited to 22 TB including backup copies. Products are assumed to be pre-compressed.
3. MODIS direct broadcast storage is limited to 100 9940A-written tapes.
4. Tables 4-2 through 4-6 specify assumptions for number of existing tapes in each collection, number of GB of data added to each collection per day at a 1X production rate, data compression ratio, assumed deletion date for the collection (i.e., when the associated tapes can be reused), and for backup volume groups, the percentage of data in the volume group that must be backed up. Backup volume groups are indicated by a “\_b” suffix. For MODIS products, the number of tapes needed to store a golden month of data is provided.
5. Table 4-7 specifies the percentage of each collection version that is stored at the beginning of each quarter. Typically, the active version builds up over a period of time as forward processing and reprocessing are performed and the previous version is reduced as rolling deletes are performed. Note that collection versions produced prior to October 2004 are not subject to rolling deletes but kept until the entire collection version is eligible for deletion and then deleted.

**Table 4-2. Volume Group Assumptions for GES DAAC Silo 1**

Volume Group	Ver	Current Tapes	GB/Day (1X)	Comp. Ratio	Delete By	Backup Percent	# GM Tapes
aqmyd01ss	3	266	25	0.94	1/31/2005		19
aqmyd01ss	4	234	25	0.94			19
aqmydocbin	3	100	34	2.63	1/31/2005		9
auoml0	1	4	8	0.97			
mod000	1	1,002	70	0.97			
modl0	1	649	70	0.97			
mod01ss	3	116			9/30/2004		
mod01ss	4	783	25	0.92			20
modocbin	4	446	45	2.63			12
other	1	96					

**Table 4-3. Volume Group Assumptions for GES DAAC Silo 2**

Volume Group	Ver	Current Tapes	GB/Day (1X)	Comp. Ratio	Delete By	Backup Percent	# GM Tapes
airs000	1	100	13	1.01			
aqmydatmos	3	61	19	2.84	1/1/2005		5
aqmydatmos	4	62	19	2.84			12
aqmydocbin_b	3	46	69	2.58		12%	
aqmydocbin_b	4	42	69	2.58		12%	
aqmydocl2	3	301	136	2.97			31
aqmydocl2	4	135	136	1.65			31
aqmydprods	4	35	22	5.69			3
aqmyd03	3	48	17	1.17			
aqmyd03	4	125	17	1.17			11
anc_b	1	65	2	1.38		100%	
sorce	1	3	0.13	0.82			
modaps	1	2			9/1/2004		
modaps	3	41			9/1/2004		
modaps	4	2			5/1/2007		
modatmos	3	6			3/31/2004		
modatmos	4	164	19	2.92			5
modoc28l2	4	114		2.15			
modocl2	4	627	93	2.92			22
modocl2a	4	39		7.66			
modocl2b	4	56		7.63			
modocmap	4	103	29	4.51			5
modprod	1	2			9/30/2003		
modprod	3	16			3/31/2004		
modprod	4	102	22	5.28			3
Other	1	237					

**Table 4-4. Volume Group Assumptions for GES DAAC Silo 3**

Volume Group	Ver	Current Tapes	GB/Day (1X)	Comp. Ratio	Delete By	Backup Percent	# GM Tapes
airs000	2	69	13	0.98			
airsl1a	1	71			3/31/2004		
airsl1a	2	231	18	1.24			
airsl1b	1	95					
airsl1b	2	305	37	1.09			
aqmyd01	3	183	160	1.73			
aqmyd02a	3	208	144	1.71			
aqmyd02b	3	442	89	1.56			
aqmyd02b	4	368	89	1.56			
aqmydocmap	4	9	39	2.28			6
aqmydprod	3	41	22	5.76			3
hirdls	1	2	2	1.50			
mls	1	2	5	1.50			
oml1	1	5	22	1.50			
pgefai1	1	6	0	2.00			
mod02b	3	23			3/31/2004		
mod02b	4	1,269	89	1.53			41
v0	1	59	200	1.00			
Other	1	98					

**Table 4-5. Volume Group Assumptions for GES DAAC Silo 4**

Volume Group	Ver	Current Tapes	GB/Day (1X)	Comp. Ratio	Delete By	Backup Percent	# GM Tapes
airsl1b	2	110	37	1.05			
airsl2	2	90	10	1.62			
aqmyd03	3	102	17	1.19			11
aqmyd02b	4	13	89	1.67			38
aqmyd02ssh	3	38		1.32			
aqmyd02ssh	4	34	15	1.32			9
aqmydocmap	3	38	39	4.62			6
anc (ancb/ancnb)	1	79	2	1.38			
auancb	1	38	2	1.36			
ph	1	9	2	2.91			
mod01	3	53			9/30/2003		
mod01	4	1,885	160	1.66			
mod02ssh	3	5			9/30/2004		
mod02ssh	4	115	15	1.28			9
mod03	3	12			3/31/2004		
mod03	4	404	17	1.16			11
rtmodl1a	1	43					
Other	1	102					



**Table 4-6. Volume Group Assumptions for GES DAAC Silo 5**

<b>Volume Group</b>	<b>Ver</b>	<b>Current Tapes</b>	<b>GB/Day (1X)</b>	<b>Comp. Ratio</b>	<b>Delete By</b>	<b>Backup Percent</b>	<b># GM Tapes</b>
aqmyd000	1	255	70	0.97			
aqmyd01	3	290	160	1.68	9/1/2004		
aqmyd01	4	221	160	1.68			
aqmyd02a	3	445	144	1.67			61
aqmyd02a	4	235	144	1.67			
mod000	1	121	70	0.97			
mod02a	3	26			3/30/2004		
mod02a	4	1,536	144	1.62			63
Other	1	80					

**Table 4-7. Percentage of Collection Versions Stored By Quarter**

Collections and Golden Months	Percentage of Collection Stored								
	7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
T-MOD V4 L1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
T-MOD V4 Land/Atmos	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
T-MOD V4 Ocean	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A-MOD V4 L1	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A-MOD V3 All Disc	1.0	1.0							
A-MOD V4 All Disc	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
A&T-MOD V5 L1		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
A&T-MOD V5 All Disc		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
A&T-MOD V6 All									
Terra MODIS Golden Mo	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0
Aqua MODIS Golden Mo	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
AIRS Col 1	1.0	1.0							
AIRS Col 2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
AIRS Col 3		0.2	0.4	0.6	0.9	1.0	1.0	1.0	0.9
AIRS Col 4							0.1	0.3	0.4
AIRS Col 5									
Aura Col 1	0.3	0.5	0.8	1.0	1.0	1.0	1.0	0.5	
Aura Col 2					0.5	1.0	1.0	1.0	1.0
Aura Col 3							0.3	0.7	1.0
Aura Col 4									
Aura Col 5									

Collections and Golden Months	Percentage of Collection Stored								
	10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
T-MOD V4 L1	1.0	1.0	1.0						
T-MOD V4 Land/Atmos	1.0	1.0	1.0						
T-MOD V4 Ocean	1.0	1.0	1.0						
A-MOD V4 L1	1.0	1.0	1.0						
A-MOD V3 All Disc									
A-MOD V4 All Disc	1.0	1.0	1.0						
A&T-MOD V5 L1	0.9	1.0	1.0	1.0	0.9	0.8	0.6	0.5	0.4
A&T-MOD V5 All Disc	0.9	1.0	1.0	1.0	0.9	0.8	0.6	0.5	0.4
A&T-MOD V6 All		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.6
Terra MODIS Golden Mo	1.0	1.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0
Aqua MODIS Golden Mo	1.0	1.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0
AIRS Col 1									
AIRS Col 2									
AIRS Col 3	0.7	0.6	0.5	0.3	0.2				
AIRS Col 4	0.5	0.7	0.8	1.0	1.0	1.0	1.0	0.9	0.8
AIRS Col 5					0.0	0.1	0.2	0.3	0.4
Aura Col 1									
Aura Col 2	0.7	0.3							
Aura Col 3	1.0	1.0	1.0	0.8	0.6	0.4	0.1		
Aura Col 4	0.1	0.4	0.6	0.8	1.0	1.0	1.0	1.0	0.9
Aura Col 5						0.1	0.2	0.4	0.5

Given these assumptions, Tables 4-8 through 4-12 show the archive fill rates for each silo. They show fill rates assuming the current 9940A tape drive configurations, as well as, the adjusted fill rates assuming conversion to 9940B tapes drives. The assumed conversion date for silo 1 is 7/1/2005, silo 2 is 1/1/2006, silo 3 is 1/1/2005, and silo 4 is 4/1/2006. Silo 5 already contains 9940B tape drives. In addition, it is assumed that 9940A to 9940B migration will commence after each silo is converted. The assumed migration rate is three 9940A tapes copied per day in each silo. This results in a net gain of two available tapes per day per silo since 9940B capacity is 3.3 times greater than 9940A capacity. One additional 9940B tape drive will need to be purchased for silos 1 through 4 to support migration. The archive fill rates are depicted graphically in Figures 4-1 through 4-5.

**Table 4-8. GES DAAC Silo 1 Fill Rate**

Volume Group	Ver	Silo 1 Tapes Used (Cumulative)								
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
aqmyd01ss	3	266	266	266	0	0	0	0	0	0
aqmyd01ss	4+	234	350	527	630	742	864	1,015	1,154	1,304
aqmydocbin	3+	87	104	127	152	179	209	250	283	319
auoml0	1+	0	7	20	41	81	136	190	206	217
mod000	1	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651
mod01ss	3	116	116	0	0	0	0	0	0	0
mod01ss	4+	779	883	1,023	1,192	1,351	1,520	1,699	1,885	2,082
modocbin	4+	488	534	592	664	728	794	864	936	1,012
other	1	96	96	96	96	96	96	96	96	96
Total 9940A Tapes		3,717	4,007	4,303	4,426	4,828	5,271	5,765	6,212	6,681
w/ 9940B by 7/1/2005		3,717	4,007	4,303	4,426	4,828	4,961	5,109	5,243	5,384
w/ 3 tapes/day migration		3,717	4,007	4,303	4,426	4,828	4,777	4,741	4,695	4,654

Volume Group	Ver	Silo 1 Tapes Used (Cumulative)								
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
aqmyd01ss	3	0								
aqmyd01ss	4+	1,463	1,627	1,806	1,066	1,099	1,131	1,161	1,208	1,235
aqmydocbin	3+	358	398	445	266	274	282	289	305	312
auoml0	1+	221	229	234	256	277	276	281	300	329
mod000	1	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651	1,651
mod01ss	3	0								
mod01ss	4+	2,289	2,498	2,718	1,571	1,598	1,623	1,645	1,686	1,706
modocbin	4+	1,090	1,170	1,258	503	511	519	526	545	551
other	1	96	96	96	96	96	96	96	96	96
Total 9940A Tapes		7,169	7,669	8,209	5,409	5,507	5,578	5,649	5,790	5,879
w/ 9940B by 7/1/2005		5,530	5,681	5,842	5,002	5,032	5,053	5,075	5,117	5,144
w/ 3 tapes/day migration		4,616	4,583	4,564	3,542	3,388	3,225	3,065	2,925	2,768

**Table 4-9. GES DAAC Silo 2 Fill Rate**

Volume Group	Ver	Silo 2 Tapes Used (Cumulative)								
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
airs000	1	100	100	100	100	100	100	100	100	100
aqmydatmos	3+	87	105	128	153	180	209	253	287	323
aqmydocbin_b	3+	98	101	57	60	64	67	72	76	80
aqmydocl2	3+	606	667	446	533	629	732	875	993	1,120
aqmydprods	4+	52	62	76	90	106	124	146	166	187
aqmyd03	3+	242	281	284	339	400	466	548	623	703
anc_b	1	80	83	86	88	91	94	96	99	102
sorce	1	1	2	2	2	2	3	3	3	3
modaps	1	2	2	0	0	0	0	0	0	0
modaps	3	41	41	0	0	0	0	0	0	0
modaps	4	2	2	2	2	0	0	0	0	0
modatmos	3	6	0	0	0	0	0	0	0	0
modatmos	4+	180	204	236	275	312	351	392	435	481
modocl2	4+	901	986	1,093	1,226	1,344	1,467	1,596	1,729	1,868
modocmap	4+	90	102	118	140	159	178	199	221	243
modprod	1	2	2	0	0	0	0	0	0	0
modprod	3	16	16	0	0	0	0	0	0	0
modprod	4+	116	131	152	177	201	226	253	281	310
Other	1	237	237	237	237	237	237	237	237	237
Total 9940A Tapes		2,860	3,123	3,017	3,425	3,824	4,255	4,771	5,250	5,758
w/ 9940B by 1/1/2006		2,860	3,123	3,017	3,425	3,824	4,255	4,771	4,914	5,067
w/ 3 tapes/day migration		2,860	3,123	3,017	3,425	3,824	4,255	4,771	4,734	4,705

Volume Group	Ver	Silo 2 Tapes Used (Cumulative)								
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
airs000	1	100	100	100	100	100	100	100	100	100
aqmydatmos	3+	362	402	453	273	281	289	296	315	321
aqmydocbin_b	3+	85	90	95	32	33	34	35	37	37
aqmydocl2	3+	1,255	1,394	1,560	933	961	988	1,013	1,068	1,091
aqmydprods	4+	210	234	260	153	158	163	167	174	178
aqmyd03	3+	789	878	975	576	594	611	627	653	667
anc_b	1	105	107	110	113	115	118	121	123	126
sorce	1	4	4	4	5	5	5	5	6	6
modaps	1	0								
modaps	3	0								
modaps	4	0								
modatmos	3	0								
modatmos	4+	528	577	628	363	369	375	380	390	395
modocl2	4+	2,013	2,160	2,323	929	944	959	972	1,006	1,017
modocmap	4+	267	291	320	187	190	193	196	203	205
modprod	1	0								
modprod	3	0								
modprod	4+	341	372	405	234	238	242	245	251	254
Other	1	237	237	237	237	237	237	237	237	237
Total 9940A Tapes		6,296	6,844	7,468	4,134	4,225	4,312	4,393	4,562	4,635
w/ 9940B by 1/1/2006		5,228	5,393	5,580	4,579	4,607	4,633	4,657	4,708	4,730
w/ 3 tapes/day migration		4,682	4,663	4,670	3,487	3,331	3,173	3,015	2,884	2,722

**Table 4-10. GES DAAC Silo 3 Fill Rate**

Volume Group	Ver	Silo 3 Tapes Used (Cumulative)								
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
airs000	2	79	100	121	142	163	185	206	227	248
airsl1a	1	71	71	71	0	0	0	0	0	0
airsl1a	2+	192	261	340	429	527	614	705	802	478
airsl1b	1	95	95	95	0	0	0	0	0	0
airsl1b	2+	453	617	804	1,013	1,245	1,451	1,667	1,895	1,130
aqmyd01	3	183	183	183	0	0	0	0	0	0
aqmyd02a	3	208	208	208	0	0	0	0	0	0
aqmyd02b	3	442	442	442	0	0	0	0	0	0
aqmyd02b	4	368	368	368	368	368	368	368	368	368
aqmydocmap	4+	114	137	167	200	235	274	322	366	413
aqmydprod	3	41	41	41	0	0	0	0	0	0
hirdls	1+	2	3	5	6	10	13	15	14	13
mls	1+	5	10	15	20	31	41	48	44	41
oml1	1+	23	46	70	93	139	186	217	201	186
pgefai	4	6	9	12	15	18	21	24	27	30
mod02b	3	23	23	0	0	0	0	0	0	0
mod02b	4+	1,638	1,855	2,151	2,464	2,798	3,153	3,570	3,962	4,375
v0	1	203	395	395	395	395	395	395	395	395
Other	1	98	98	98	98	98	98	98	98	98
Total 9940A Tapes		4,067	4,765	5,367	5,003	5,766	6,516	7,330	8,074	7,430
w/ 9940B by 1/1/2005		4,067	4,765	5,367	4,505	4,734	4,959	5,203	5,426	5,233
w/ 3 tapes/day migration		4,067	4,765	5,367	4,325	4,372	4,413	4,473	4,516	4,141

Volume Group	Ver	Silo 3 Tapes Used (Cumulative)								
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
airs000	2	270	291	312	333	355	376	397	419	440
airsl1a	1	0	0	0	0	0	0	0	0	0
airsl1a	2+	508	537	566	595	603	514	521	492	460
airsl1b	1	0	0	0	0	0	0	0	0	0
airsl1b	2+	1,200	1,270	1,338	1,407	1,424	1,215	1,231	1,163	1,086
aqmyd01	3	0	0	0	0	0	0	0	0	0
aqmyd02a	3	0	0	0	0	0	0	0	0	0
aqmyd02b	3	0	0	0	0	0	0	0	0	0
aqmyd02b	4	368	368	368	0	0	0	0	0	0
aqmydocmap	4+	464	516	573	338	349	359	368	383	391
aqmydprod	3	0	0	0	0	0	0	0	0	0
hirdls	1+	12	11	10	10	10	9	9	9	9
mls	1+	37	34	32	32	32	30	28	28	29
oml1	1+	168	157	146	146	146	135	128	128	133
pgefai	4	33	36	39	42	45	48	51	54	57
mod02b	3	0								
mod02b	4+	4,810	5,249	5,710	3,300	3,356	3,408	3,455	3,540	3,582
v0	1	395	395	395	395	395	395	395	395	395
Other	1	98	98	98	98	98	98	98	98	98
Total 9940A Tapes		7,995	8,574	9,178	6,266	6,359	6,113	6,187	6,193	6,142
w/ 9940B by 1/1/2005		5,402	5,576	5,757	4,884	4,912	4,838	4,860	4,862	4,846
w/ 3 tapes/day migration		4,126	4,116	4,117	3,062	2,906	2,648	2,488	2,308	2,108

**Table 4-11. GES DAAC Silo 4 Fill Rate**

Volume Group	Ver	Silo 4 Tapes Used (Cumulative)								
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
airsl1b	2	110	110	110	110	110	110	110	110	0
airsl2	2+	82	112	146	184	226	264	303	345	206
aqmyd03	3	102	102	0	0	0	0	0	0	0
aqmyd02b	4+	89	267	368	475	593	722	897	1,079	1,271
aqmyd02ssh	3	38	38	0	0	0	0	0	0	0
aqmyd02ssh	4+	50	88	110	133	158	186	224	264	306
aqmydocmap	3	38	38	0	0	0	0	0	0	0
anc (ancb/ancnb)	1	80	83	86	88	91	94	96	99	102
auancb	1	39	41	44	46	48	51	53	56	58
ph	1	10	11	12	13	14	16	17	18	19
mod01	3	53	0	0	0	0	0	0	0	0
mod01	4+	1,885	995	995	995	995	995	995	995	995
mod02ssh	3	5	0	0	0	0	0	0	0	0
mod02ssh	4+	333	377	437	501	569	641	726	806	890
mod03	3	12	0	0	0	0	0	0	0	0
mod03	4+	418	474	549	629	715	805	912	1,012	1,118
rtmodl1a	1	43	48	53	58	63	68	73	78	83
Other	1	102	102	102	102	102	102	102	102	102
Total 9940A Tapes		3,490	2,886	3,012	3,335	3,685	4,053	4,510	4,964	5,150
w/ 9940B by 4/1/2006		3,490	2,886	3,012	3,335	3,685	4,053	4,510	4,964	5,020
w/ 3 tapes/day migration		3,490	2,886	3,012	3,335	3,685	4,053	4,510	4,964	4,838

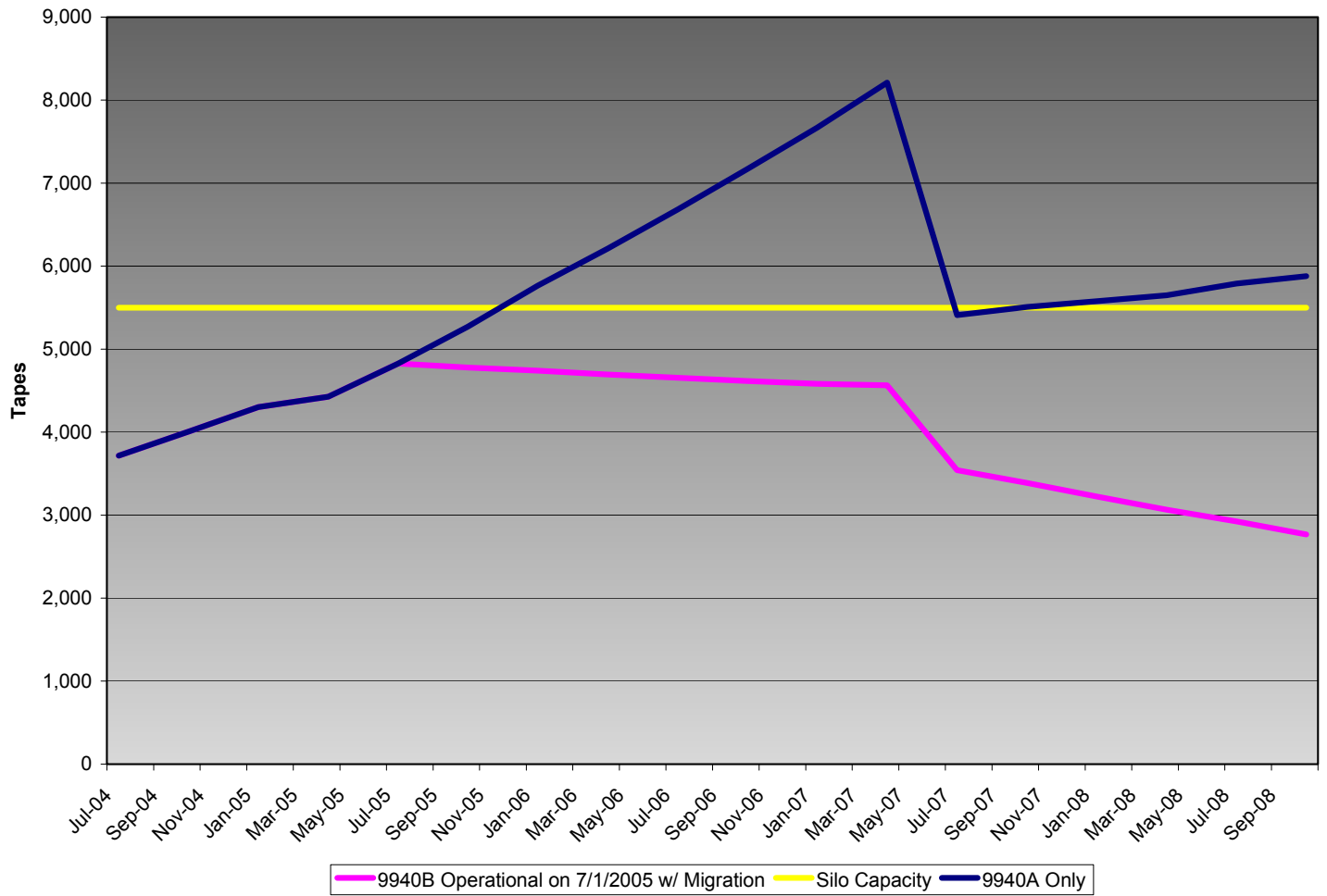
Volume Group	Ver	Silo 4 Tapes Used (Cumulative)								
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
airsl1b	2	0	0	0	0	0	0	0	0	0
airsl2	2+	218	231	243	256	265	248	273	284	296
aqmyd03	3	0	0	0	0	0	0	0	0	0
aqmyd02b	4+	1,474	1,686	1,940	2,115	2,289	2,462	2,633	2,839	3,045
aqmyd02ssh	3	0	0	0	0	0	0	0	0	0
aqmyd02ssh	4+	350	397	453	492	531	570	608	655	702
aqmydocmap	3	0	0	0	0	0	0	0	0	0
anc (ancb/ancnb)	1	105	107	110	113	115	118	121	123	126
auancb	1	60	63	65	67	70	72	74	77	79
ph	1	21	22	23	24	25	27	28	29	30
mod01	3	0								
mod01	4+	995	995	995	995	995	995	995	995	995
mod02ssh	3	0								
mod02ssh	4+	979	1,068	1,162	672	684	694	704	722	730
mod03	3	0								
mod03	4+	1,229	1,341	1,459	844	858	871	884	906	916
rtmodl1a	1	88	93	98	100	100	100	100	100	100
Other	1	102	102	102	102	102	102	102	102	102
Total 9940A Tapes		5,621	6,104	6,650	5,780	6,035	6,259	6,521	6,832	7,122
w/ 9940B by 4/1/2006		5,161	5,306	5,470	5,209	5,285	5,352	5,431	5,524	5,611
w/ 3 tapes/day migration		4,795	4,756	4,740	4,297	4,189	4,072	3,969	3,880	3,783

**Table 4-12. GES DAAC Silo 5 Fill Rate**

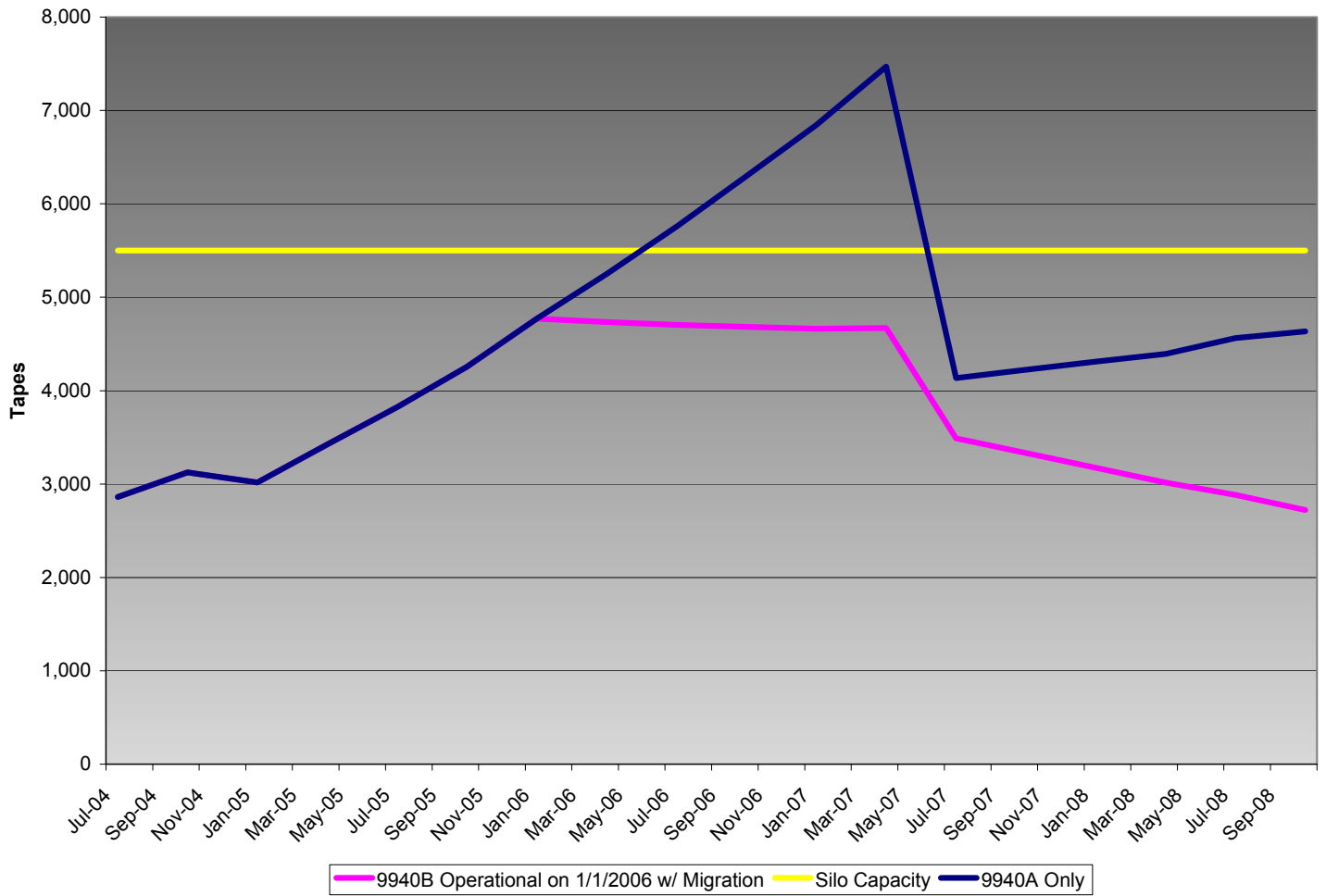
Volume Group	Ver	Silo 5 Tapes Used (Cumulative)								
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
aqmyd000	1	271	306	340	375	409	444	479	513	548
aqmyd01	3	290	0	0	0	0	0	0	0	0
aqmyd01	4+	283	421	559	274	274	274	274	274	274
aqmyd02a	3+	482	570	565	629	702	784	936	1,035	1,143
mod000	1	137	172	206	241	275	310	345	379	414
mod02a	3	26	26	26	0	0	0	0	0	0
mod02a	4+	1,555	1,603	1,660	1,134	1,288	1,452	1,688	1,868	2,059
Other	1	80	80	80	80	80	80	80	80	80
Total 9940A/B Tapes		3,123	3,177	3,438	2,733	3,029	3,345	3,803	4,150	4,518

Volume Group	Ver	Silo 5 Tapes Used (Cumulative)								
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
aqmyd000	1	583	618	652	686	721	756	791	825	860
aqmyd01	3	0	0	0	0	0	0	0	0	0
aqmyd01	4+	274	274	274	274	274	274	274	274	274
aqmyd02a	3+	1,261	1,386	1,818	1,108	1,140	1,170	1,199	1,287	1,313
mod000	1	449	484	518	552	587	622	657	691	726
mod02a	3	0								
mod02a	4+	2,259	2,461	2,718	1,608	1,634	1,658	1,679	1,763	1,782
Other	1	80	80	80	80	80	80	80	80	80
Total 9940A/B Tapes		4,906	5,303	6,060	4,309	4,437	4,561	4,680	4,921	5,036

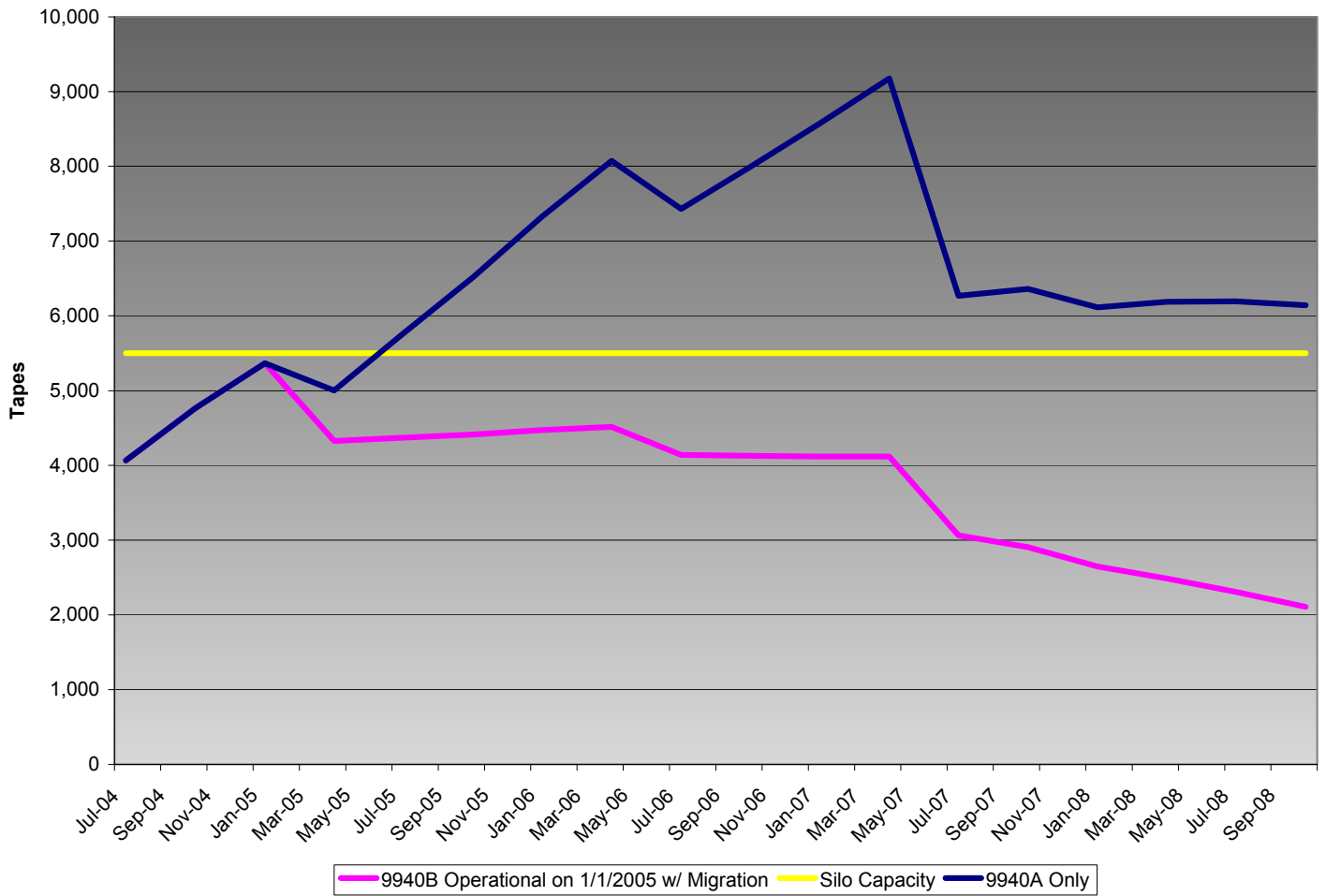




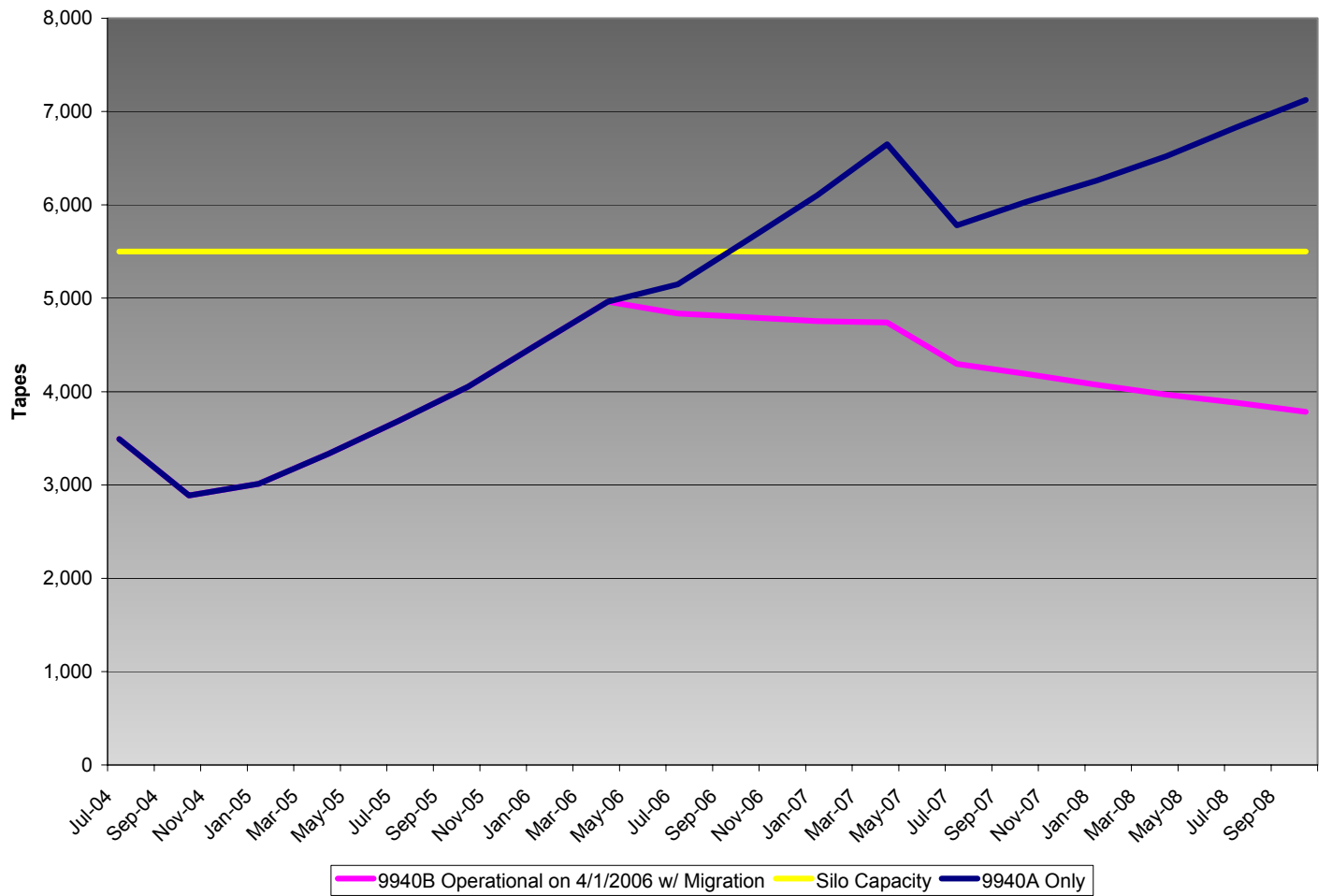
**Figure 4-1. GES DAAC Silo 1 Fill Rate**



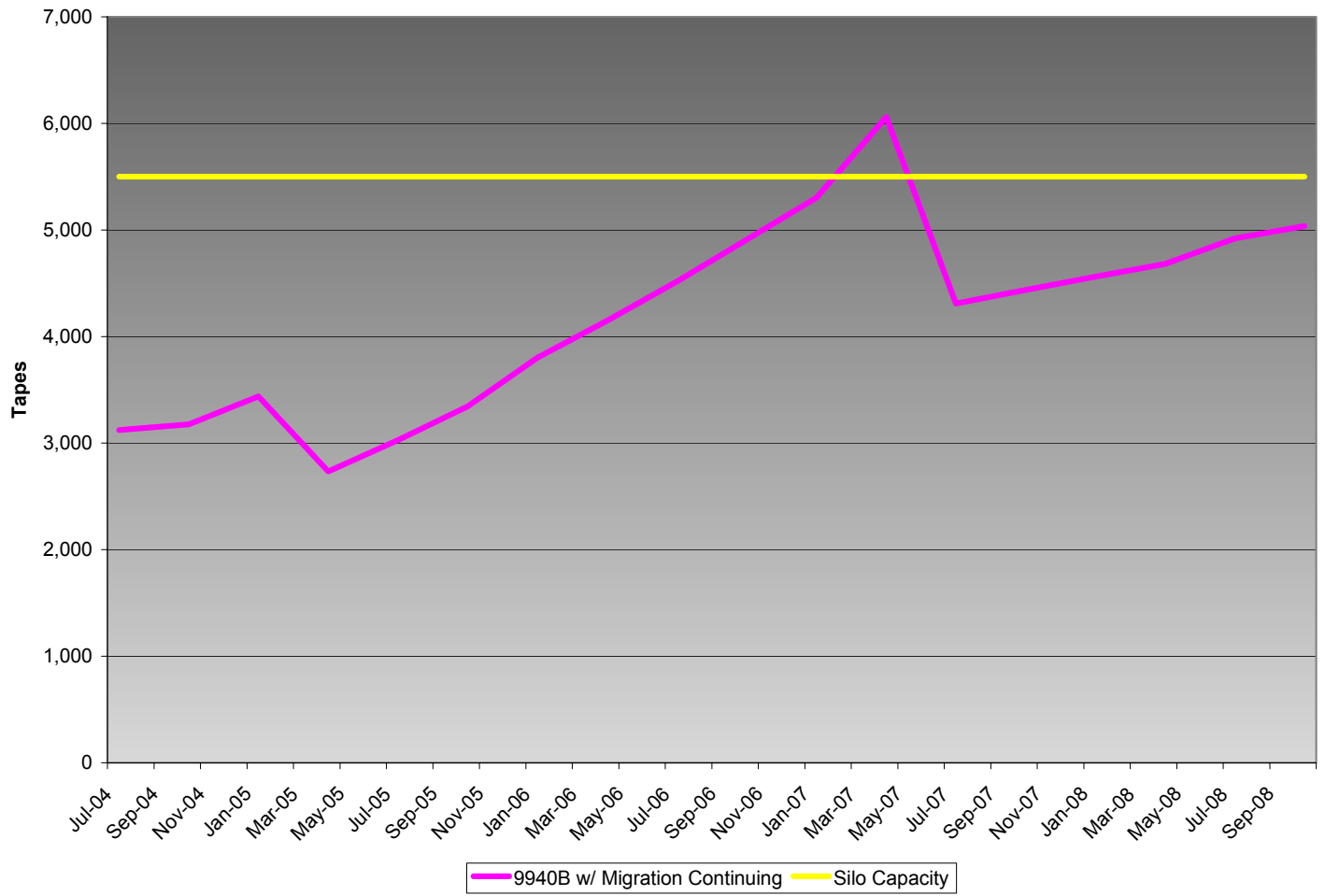
**Figure 4-2. GES DAAC Silo 2 Fill Rate**



**Figure 4-3. GES DAAC Silo 3 Fill Rate**



**Figure 4-4. GES DAAC Silo 4 Fill Rate**



**Figure 4-5. GES DAAC Silo 5 Fill Rate**

Table 4-13 shows the additional tape media that will need to be procured to support the required archive capacity. This assumes that silo conversions to 9940B tape drives happen as scheduled and a three 9940A tape per day migration rate for each silos is achieved following conversion.

**Table 4-13. GES DAAC Cumulative Additional Tapes Needed**

Date	New Tapes Needed
7/1/2004	0
10/1/2004	0
1/1/2005	0
4/1/2005	0
7/1/2005	0
10/1/2005	0
1/1/2006	86
4/1/2006	962
7/1/2006	727
10/1/2006	1,039
1/1/2007	1,376
4/1/2007	2,217
7/1/2007	0
10/1/2007	0
1/1/2008	0
4/1/2008	0
7/1/2008	0
10/1/2008	0

Based on the analysis, the following silos will need to be upgraded to STK 9940B tape drives between FY05 and FY08:

- Silo 1: Silo capacity is exceeded in 12/2005. The upgrade must begin by 3/1/2005 and be completed and turned over to the DAAC by 7/1/2005.
- Silo 2: Silo capacity is exceeded by about ~2,000 tapes between May 2006 and July 2007. Following deletion of MODIS collection 4, storage requirements drop significantly and the silo has sufficient capacity through FY 2008. Either this silo will need to be upgraded by 12/31/2005 or tapes will need to be moved to other silos during the 14-month period when capacity is exceeded. The feasibility of this option will need to be re-evaluated during the first half of 2005 based on actual utilization rates.
- Silo 3: Silo capacity is exceeded in 5/2005. The upgrade must begin by 8/1/2004 and be completed and turned over to the DAAC by 12/31/2004. As part of this upgrade, an additional archive server platform will be added to the DAAC configuration to host silo

3. This is required to ensure scalability of the AMASS file storage management system since the converted silo will have the capacity to store 3.3 times as many files. To reduce costs, an existing SGI Origin 2000 (g0mog) will be reused for this purpose. Note: This upgrade has been approved and is being performed under EMD Task 106 (Synergy FY 2004).

- Silo 4: Silo capacity is exceeded in 9/2006. The upgrade must begin by 11/2005 and be completed and turned over to the DAAC by 3/2006.
- Silo 5: Silo capacity is exceeded by ~560 tapes between 4/2007 and 6/2007. It is recommended that the DAAC mitigate this by reallocating tapes temporarily to other silos.

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## 5. ASDC DAAC Estimated Archive Capacity Requirements

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The estimated archive capacity requirements for the ASDC DAAC are provided in the following subsections. The current archive configuration is presented, followed by a set of assumptions related to archive growth and the phase-in of 9940B tape drives.

### 5.1 Current Archive Configuration

Table 5-1 shows the current archive configuration as of 8/4/2004.

**Table 5-1. ASDC DAAC Current Archive Configuration**

Archive Server	Silo	Silo Configuration
I0drg01 (SGI Origin 2000)	1	STK 9940A tape drives = 13 Silo tape capacity = 5,756 Tapes used = 5,632 Tapes unused = 124
I0drg03 (SGI Origin 350)	2	STK 9940A tape drives = 3 STK 9940B tape drives = 14 Silo tape capacity = 5,622 Tapes used = 2,075 Tapes unused = 3,547

### 5.2 ADSC DAAC Archive Growth Assumptions

The following assumptions have been used to estimate the ADSC DAAC archive capacity requirements through FY 2008:

1. Backup copies of the following data collections are made:
  - a. MISR Level 0
  - b. All MOPITT collections
  - c. All ACRIM collections
  - d. All SAGE collections
  - e. TES Level 0
2. Tables 5-2 and 5-3 specify assumptions for number of existing tapes by instrument, number of GB of data added to each collection per day at a 1X production rate, and data compression ratios.

- Table 5-4 specifies the percentage of each collection version that is stored at the beginning of each quarter. Typically, the active version builds up over a period of time as forward processing and reprocessing are performed and the previous version is reduced as rolling deletes are performed. Note that collection versions produced prior to October 2004 are not subject to rolling deletes but kept until the entire collection version is eligible for deletion and then deleted.

Given these assumptions, Tables 5-5 through 5-6 show the archive fill rates for each silo. The tables show fill rates assuming the current 9940A/B tape drive configurations, as well as, the adjusted fill rates assuming conversion to 9940B tapes drives. The fill rates are depicted graphically in Figures 5-1 through 5-2.

**Table 5-2. Volume Group Assumptions for ASDC DAAC Silo 1**

Volume Group	Ver	Current Tapes	GB/Day (1X)	Comp. Ratio	Not Used	Not Used	Not Used
misrl0	1+	815	36	1.04			
misrl0_b	1+	770	36	1.04			
misrl1	1+	3,304	172	0.94			
misr_other	1+	422	13	1.50			
tesl0	1+	13	33	1.50			
tesl1+	1+	4	31	1.50			
Other	1+	312					

**Table 5-3. Volume Group Assumptions for ASDC DAAC Silo 2**

Volume Group	Ver	Current Tapes	GB/Day (1X)	Comp. Ratio	Not Used	Not Used	Not Used
misrl0_9940A	1+	111	36	1.04			
misrl0_9940B	1+	14	36	1.04			
misrl0_b_9940A	1+	59	36	1.04			
misrl0_b_9940B	1+	7	36	1.04			
misrl1_9940A	1+	492	172	0.94			
misrl1_9940B	1+	551	172	0.94			
misr_oth_9940A	1+	18	13	1.50			
misr_oth_9940B	1+	38	13	1.50			
tesl0	1+	6	33	1.50			
tesl1+	1+	0	31	1.50			
Other	1	899					

**Table 5-4. Percentage of Collection Versions Stored By Quarter**

Collections and Golden Months	Percentage of Collection Stored								
	7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
MISR V2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
MISR V3				0.2	0.4	0.6	0.8	1.0	1.0
MISR V4									0.2
MISR V5									
TES V1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	
TES V2						0.5	1.0	1.0	1.0
TES V3								0.3	0.6
TES V4									
TES V5									

Collections and Golden Months	Percentage of Collection Stored								
	10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
MISR V2									
MISR V3	0.8	0.7	0.5	0.3	0.2				
MISR V4	0.3	0.5	0.7	0.8	1.0	1.0	1.0	0.9	0.8
MISR V5						0.1	0.2	0.3	0.5
TES V1									
TES V2	0.7	0.4	0.1						
TES V3	0.9	1.0	1.0	1.0	0.8	0.6	0.4	0.2	
TES V4		0.1	0.3	0.5	0.7	0.9	1.0	1.0	0.9
TES V5							0.1	0.2	0.4

**Table 5-5. ASDC DAAC Silo 1 Fill Rate**

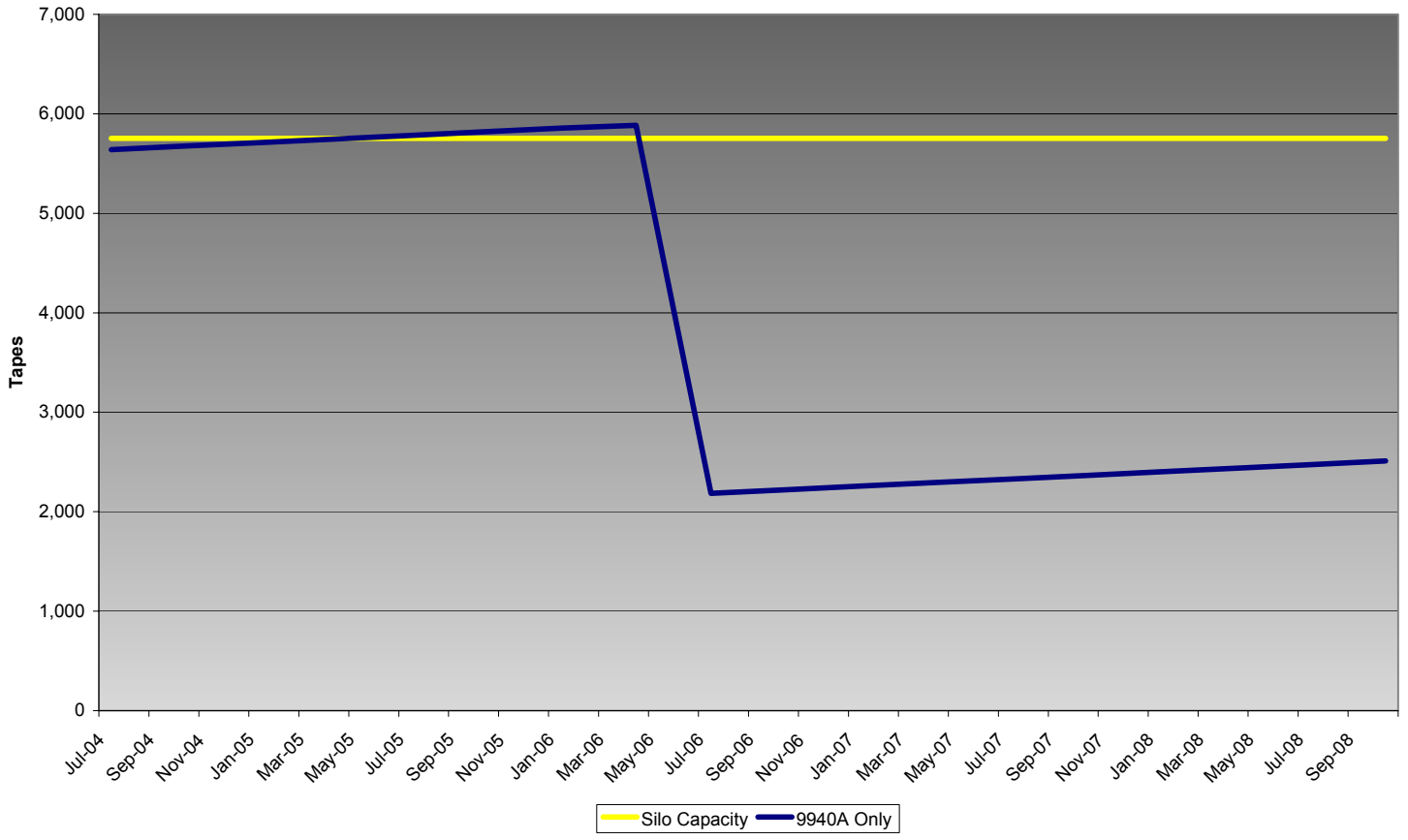
Volume Group	Ver	Silo 1 Tapes Used (Cumulative)								
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
misrl0	1+	815	815	815	815	815	815	815	815	815
misrl0_b	1+	770	770	770	770	770	770	770	770	770
misrl1	1+	3,304	3,304	3,304	3,304	3,304	3,304	3,304	3,304	0
misr_other	1+	422	422	422	422	422	422	422	422	0
tesl0	1+	13	13	13	13	13	13	13	7	0
tesl1+	1+	4	4	4	4	4	4	4	2	0
Other	1+	312	348	384	420	456	492	528	564	600
Total 9940A Tapes		5,640	5,676	5,712	5,748	5,784	5,820	5,856	5,884	2,185

Volume Group	Ver	Silo 1 Tapes Used (Cumulative)								
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
misrl0	1+	815	815	815	815	815	815	815	815	815
misrl0_b	1+	770	770	770	770	770	770	770	770	770
misrl1	1+	0	0	0	0	0	0	0	0	0
misr_other	1+	0	0	0	0	0	0	0	0	0
tesl0	1+	0	0	0	0	0	0	0	0	0
tesl1+	1+	0	0	0	0	0	0	0	0	0
Other	1+	636	672	708	744	780	816	852	888	924
Total 9940A Tapes		2,221	2,257	2,293	2,329	2,365	2,401	2,437	2,473	2,509

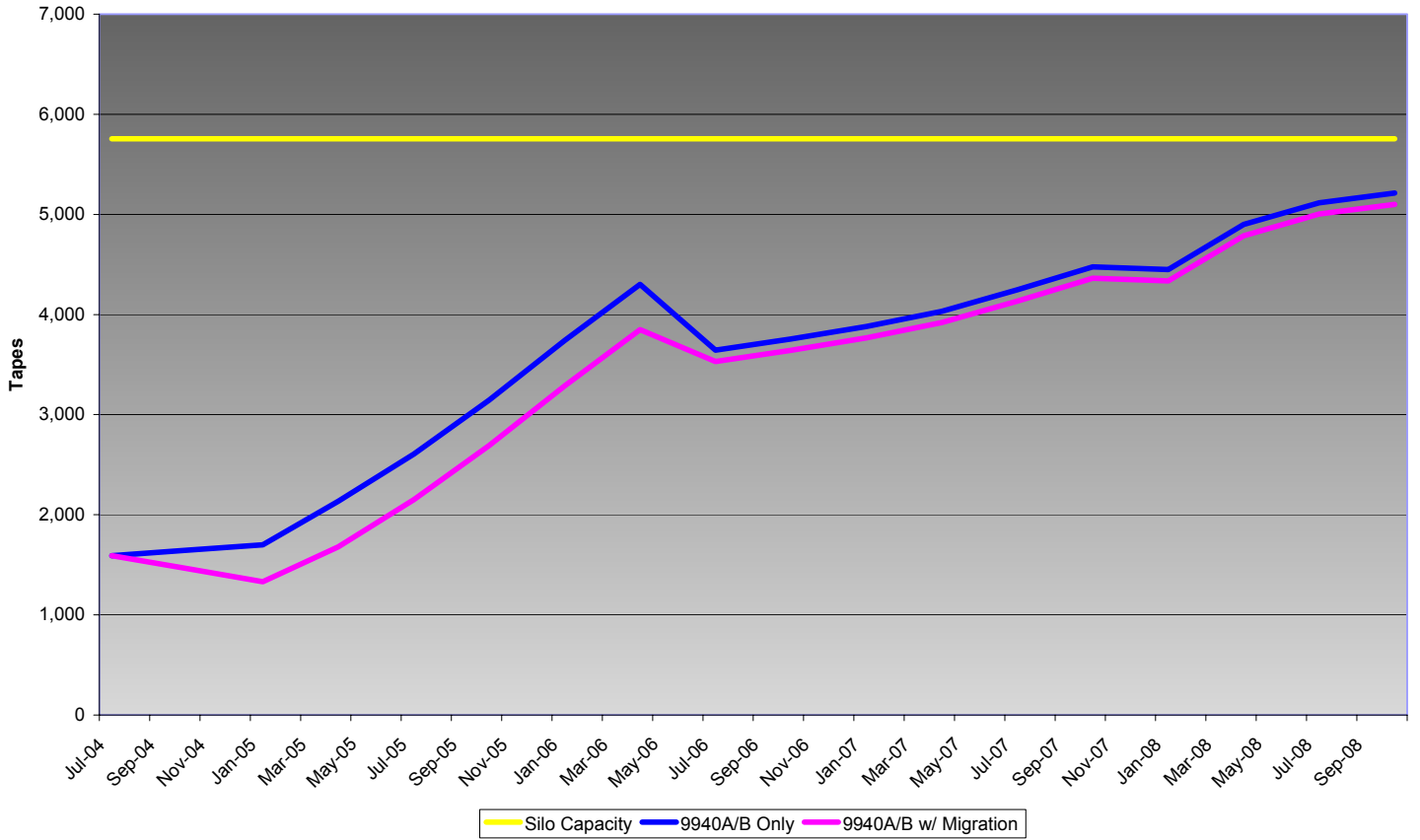
**Table 5-6. ASDC DAAC Silo 2 Fill Rate**

Volume Group	Ver	Silo 2 Tapes Used (Cumulative)								
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
misrl0_9940A	1+	111	111	111	111	111	111	111	111	111
misrl0_9940B	1+	6	22	39	56	72	89	106	122	139
misrl0_b_9940A	1+	59	59	59	59	59	59	59	59	59
misrl0_b_9940B	1+	6	22	39	56	72	89	106	122	139
misrl1_9940A	1+	492	492	492	492	492	492	492	492	0
misrl1_9940B	1+	551	551	551	914	1,313	1,747	2,216	2,718	2,543
misr_oth_9940A	1+	18	18	18	18	18	18	18	18	0
misr_oth_9940B	1+	38	38	38	55	74	95	117	141	120
tesl0	1+	0	11	21	32	42	69	106	107	114
tesl1+	1+	0	10	20	30	40	65	99	100	107
Other	1	312	312	312	312	312	312	312	312	312
Total 9940A/B Tapes		1,592	1,646	1,701	2,134	2,605	3,144	3,741	4,302	3,644
w/ 3 tapes/day migration		1,592	1,462	1,333	1,681	2,152	2,691	3,288	3,849	3,531

Volume Group	Ver	Silo 2 Tapes Used (Cumulative)								
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
misrl0_9940A	1+	111	111	111	111	111	111	111	111	111
misrl0_9940B	1+	155	172	189	205	222	239	255	272	289
misrl0_b_9940A	1+	59	59	59	59	59	59	59	59	59
misrl0_b_9940B	1+	155	172	189	205	222	239	255	272	289
misrl1_9940A	1+	0	0	0	0	0	0	0	0	0
misrl1_9940B	1+	2,587	2,661	2,763	2,895	3,057	2,967	3,349	3,517	3,590
misr_oth_9940A	1+	0	0	0	0	0	0	0	0	0
misr_oth_9940B	1+	123	126	131	137	145	141	159	167	170
tesl0	1+	130	138	144	166	180	197	206	210	203
tesl1+	1+	122	130	135	156	169	186	193	197	191
Other	1	312	312	312	312	312	312	312	312	312
Total 9940A/B Tapes		3,755	3,881	4,032	4,247	4,476	4,449	4,899	5,116	5,213
w/ 3 tapes/day migration		3,641	3,768	3,919	4,133	4,363	4,336	4,785	5,003	5,100



**Figure 5-1. ASDC DAAC Silo 1 Fill Rate**



**Figure 5-2. ASDC DAAC Silo 2 Fill Rate**

Table 5-6 shows that no additional tape media will need to be procured through FY2008 to support the required archive capacity. This assumes a three 9940A tape per day migration rate for silo 2.

**Table 5-7. ADSC DAAC Cumulative Additional Tapes Needed**

<b>Date</b>	<b>New Tapes Needed</b>
7/1/2004	0
10/1/2004	0
1/1/2005	0
4/1/2005	0
7/1/2005	0
10/1/2005	0
1/1/2006	0
4/1/2006	0
7/1/2006	0
10/1/2006	0
1/1/2007	0
4/1/2007	0
7/1/2007	0
10/1/2007	0
1/1/2008	0
4/1/2008	0
7/1/2008	0
10/1/2008	0

The analysis shows that between both silos, ASDC DAAC has sufficient archive capacity through FY2008. No further STK 9940B tape drive archives are required during this period. Silo 1 will exceed capacity by up to 129 tapes for a one-year period starting in 7/2005. It is recommended that the DAAC move additional tapes from silo 1 to silo 2 to mitigate this issue.

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## 6. NSIDC DAAC Estimated Archive Capacity Requirements

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The estimated archive capacity requirements for the NSIDC DAAC are provided in the following subsections. The current archive configuration is presented, followed by a set of assumptions related to archive growth.

### 6.1 Current Archive Configuration

Table 6-1 shows the current archive configuration as of 4/23/2004.

**Table 6-1. NSIDC DAAC Current Archive Configuration**

Archive Server	Silo	Silo Configuration
n0drg01 (SGI Origin 2000)	1	STK 9940A tape drives = 10 Silo tape capacity = 5,528 Tapes used = 265 Tapes unused = 1,316

### 6.2 NSIDC DAAC Archive Growth Assumptions

The following assumptions have been used to estimate the NSIDC DAAC archive capacity requirements through FY 2005:

1. Start of GLAS science data is 2/1/2003.
2. End of GLAS science data is 3/22/2006.
3. GLAS data volume averages 10.9 GB/day/X for the mission life, which includes periods when a laser is on and periods when all lasers are off.
4. Table 6-2 specifies assumptions for number of existing tapes by instrument, number of GB of data added to each collection per day at a 1X production rate, and data compression ratio. For MODIS products, the number of tapes needed to store a golden month of data is provided.
5. Table 6-3 specifies the percentage of each collection version that is stored at the beginning of each quarter. Typically, the active version builds up over a period of time as forward processing and reprocessing are performed and the previous version is reduced as rolling deletes are performed. Note that collection versions produced prior to October 2004 are not subject to rolling deletes but kept until the entire collection version is eligible for deletion and then deleted.

**Table 6-2. Volume Group Assumptions for NSIDC DAAC Silo 1**

<b>Volume Group</b>	<b>Ver</b>	<b>Current Tapes</b>	<b>GB/Day (1X)</b>	<b>Comp. Ratio</b>	<b>Not Used</b>	<b>Not Used</b>	<b># GM Tapes</b>
Terra MODIS	3+	105	40	3.50			7.6
Aqua MODIS	4	63	40	3.50			7.6
AMSR-E	1+	36	8	1.20			
GLAS	1	22	11	1.50			
Other	1	39	0	1.00			

**Table 6-3. Percentage of Collection Versions Stored By Quarter**

Collections and Golden Months	Percentage of Collection Stored								
	7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
Terra MODIS V4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Aqua MODIS V3	0.5	0.5							
Aqua MODIS V4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Terra & Aqua MODIS V5		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
Terra & Aqua MODIS V6									
Terra MODIS Golden Mo	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0
Aqua MODIS Golden Mo	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
AMSR-E Col 1	1.0	1.0	1.0						
AMSR-E Col 2	0.3	0.7	1.0	1.0	1.0	1.0			
AMSR-E Col 3		0.1	0.4	0.7	1.0	1.0	1.0	1.0	0.7
AMSR-E Col 4						0.2	0.4	0.6	0.9
AMSR-E Col 5									
AMSR-E Col 6									
GLAS Col 1-17	1.0	1.0	1.0						
GLAS Col 18	0.5	0.7	1.0	1.2	1.5	1.7	2.0		
GLAS Col 19				0.2	0.5	0.7	1.0	1.0	1.0
GLAS Col 20							0.2	0.5	0.7
GLAS Col 21									
GLAS Col 22									

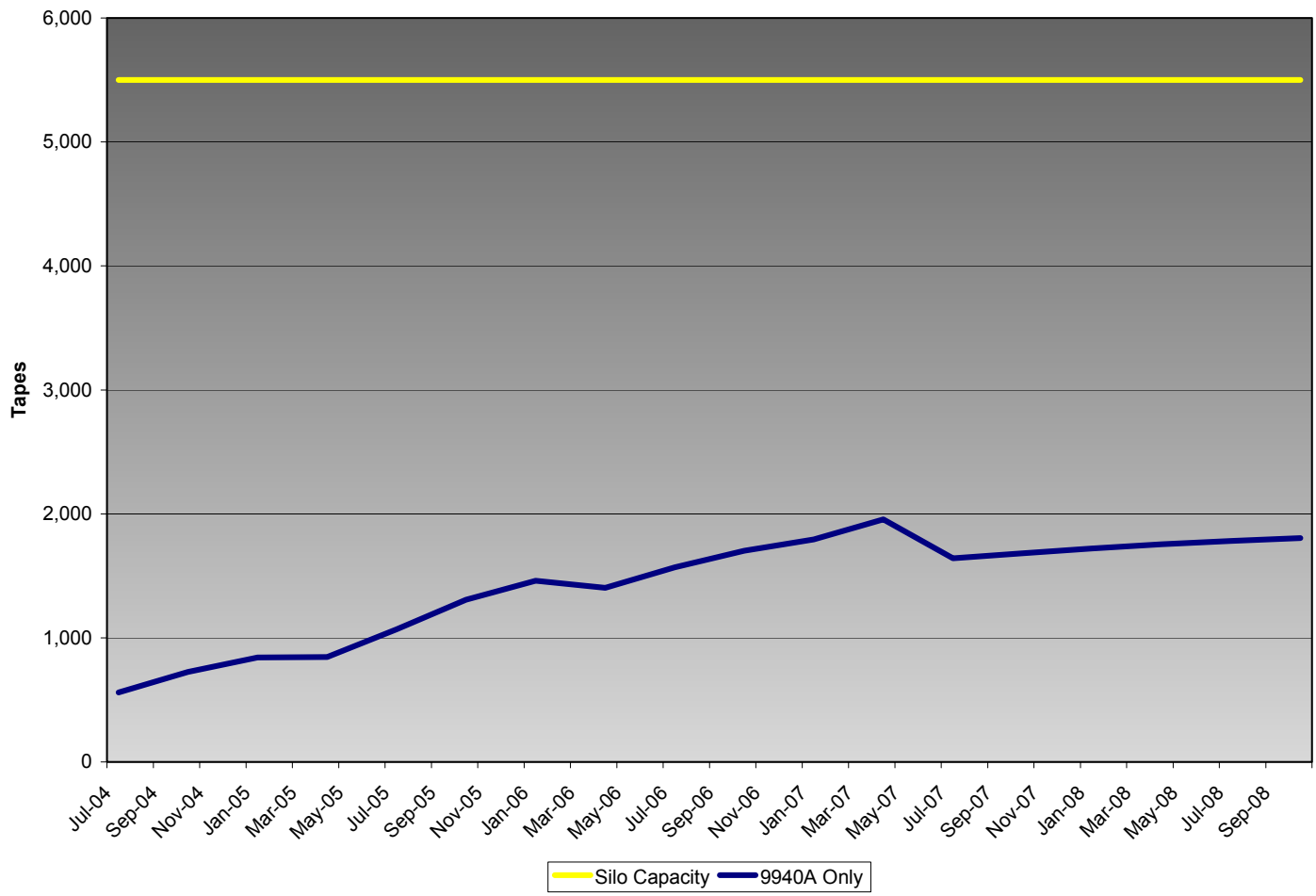
Collections and Golden Months	Percentage of Collection Stored								
	10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
Terra MODIS V4	0.5	0.5	0.5						
Aqua MODIS V3									
Aqua MODIS V4	0.5	0.5	0.5						
Terra & Aqua MODIS V5	0.9	1.0	1.0	1.0	0.9	0.8	0.6	0.5	0.4
Terra & Aqua MODIS V6		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.6
Terra MODIS Golden Mo	1.0	1.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0
Aqua MODIS Golden Mo	1.0	1.0	2.0	2.0	2.0	2.0	2.0	3.0	3.0
AMSR-E Col 1									
AMSR-E Col 2									
AMSR-E Col 3	0.4	0.1							
AMSR-E Col 4	1.0	1.0	1.0	0.9	0.8	0.6	0.4	0.3	0.1
AMSR-E Col 5	0.1	0.2	0.4	0.6	0.7	0.9	1.0	1.0	1.0
AMSR-E Col 6							0.0	0.2	0.3
GLAS Col 1-17									
GLAS Col 18									
GLAS Col 19	0.8	0.5	0.3						
GLAS Col 20	1.0	1.0	1.0	1.0	0.8	0.5	0.3		
GLAS Col 21			0.2	0.5	0.7	1.0	1.0	1.0	0.8
GLAS Col 22							0.2	0.5	0.7

Given these assumptions, Tables 6-4 shows the archive fill rate for the existing silo. The table shows that there is adequate silo capacity through FY 2008 using 9940A tape drives. The archive fill rate is depicted graphically in Figure 6-1.

**Table 6-4. NSIDC DAAC Silo 1 Fill Rate**

Volume Group	Ver	Silo 1 Tapes Used (Cumulative)								
		7/1/2004	10/1/2004	1/1/2005	4/1/2005	7/1/2005	10/1/2005	1/1/2006	4/1/2006	7/1/2006
Terra MODIS	4+	162	195	244	297	354	415	480	548	621
Aqua MODIS	3+	153	183	129	163	202	244	292	342	397
AMSR-E	3+	108	171	252	196	250	300	208	256	258
GLAS	1+	99	136	179	151	225	310	441	219	255
Other	1	39	39	39	39	39	39	39	39	39
Total 9940A Tapes		560	725	842	846	1,069	1,308	1,460	1,404	1,570

Volume Group	Ver	Silo 1 Tapes Used (Cumulative)								
		10/1/2006	1/1/2007	4/1/2007	7/1/2007	10/1/2007	1/1/2008	4/1/2008	7/1/2008	10/1/2008
Terra MODIS	4+	697	775	848	635	646	656	666	674	683
Aqua MODIS	3+	455	515	576	439	453	466	479	492	504
AMSR-E	3+	256	246	272	309	325	340	352	357	361
GLAS	1+	255	219	219	219	219	219	219	219	219
Other	1	39	39	39	39	39	39	39	39	39
Total 9940A Tapes		1,703	1,794	1,954	1,641	1,681	1,721	1,754	1,781	1,805



**Figure 6-1. NSIDC DAAC Silo 1 Fill Rate**

Table 6-5 shows the cumulative additional tape media that will need to be procured through FY2008 to support the required archive capacity. This includes a fifteen percent media contingency on additional tape requirements.

**Table 6-5. NSIDC DAAC Cumulative Additional Tapes Needed**

<b>Date</b>	<b>New Tapes Needed</b>
7/1/2004	0
10/1/2004	0
1/1/2005	0
4/1/2005	0
7/1/2005	0
10/1/2005	0
1/1/2006	0
4/1/2006	0
7/1/2006	0
10/1/2006	140
1/1/2007	245
4/1/2007	429
7/1/2007	0
10/1/2007	0
1/1/2008	0
4/1/2008	0
7/1/2008	0
10/1/2008	0

# 7. PVC Estimated Archive Capacity Requirements

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The estimated archive capacity requirements for the PVC are provided in the following subsections. The current archive configuration is presented, followed by a set of assumptions related to archive growth and the number of 9940B tape drives required to support load testing.

## 7.1 Current Archive Configuration

Table 7-1 shows the current archive configuration as of 9/26/2004.

**Table 7-1. PVC Current Archive Configuration**

Archive Server	Silo	Silo Configuration
p0drg01 (SGI Origin 300)	1	STK 9940A tape drives = 8 STK 9840 tape drives = 7 Tapes used = 189 Tapes unused = 361
p0drg04 (SGI Origin 2000)	2	STK 9940A tape drives = 6 STK 9940B tape drives = 2 STK 9840 tape drives = 9 Tapes used = 312 Tapes unused = 378

## 7.2 PVC Archive Growth Assumptions

The STK 9840 tape drives will be phased out of the PVC and replaced with 9940A tape drives that have that are available from the STK 9940B upgrades at the DAACs. The PVC archives will continue to grow as additional collections of test data are created. However, no additional media procurements are anticipated through FY2008.

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