2012-2016 Capital Equipment and Technology Report for the Hard Disk Drive Industry

Tom Coughlin
and
Ed Grochowski

COUGHLIN ASSOCIATES
SAN JOSE, CALIFORNIA
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THE AUTHORS

Tom Coughlin, President, Coughlin Enterprises: Tom Coughlin has worked for over 30 years in the data storage industry at numerous companies. He has over 60 publications and six patents to his credit. Tom is active with the IEEE Magnetics Society, IEEE CE Group, SMPTE, IDEMA, and other professional organizations. Tom has served in several IEEE leadership positions. He is the founder and organizer of the Annual Storage Visions Conference, a partner to the annual Consumer Electronics Show as well as the Creative Storage Conference. Coughlin Associates provides market and technology analysis as well as Data Storage Technical Consulting services. For more information go to www.tomcoughlin.com

Ed Grochowski, Computer Storage Consultant: Ed Grochowski is a well known speaker on storage technology. He has a 50+ year career association with the computer industry, 41 of which were with IBM. Ed worked at the IBM Almaden Research Center where his interests included hard disk drive and component evolutionary trends. Ed’s charts are frequently used to describe HDD and storage progress by numerous industry presenters at many conferences. He holds twelve patents and has authored and presented numerous articles on HDD, Flash memory and component technologies. Ed served as Executive Director of DISKCON and the Symposium series for many years. He was a long time coordinator of the 4K-byte sector standards committee, and is a member of the IEEE. For more information see http://edwgrochowski.com
INTRODUCTION
INTRODUCTION

Coughlin Associates is proud to publish this 15th report on capital spending trends in the hard disk drive industry.

Besides the drivers of new technology introductions and volume increases (expected in the long run) the HDD industry faces a serious and unique challenge to supplying HDDs to its customers over the next several months due to the impact of the Thailand monsoon floods in October and November, 2011. We will include the impact of this flooding on our projections for HDD unit growth as well as demand for capital equipment to repair and replace damaged equipment from the flood.

Demand for traditional computer applications shows slow growth and until recently the greatest growth in HDD demand was for mobile computing, consumer and SATA enterprise storage. However the introduction of the iPad and other tablet computers, combined with unfavorable economics in the last year and a half have restricted mobile computer and thus HDD demand from what it had previously been projected. As a consequence of these two factors HDD demand in 2011 was projected to be less than in 2010 (2010 had 16% percent year over year unit growth).

The lower HDD demand before the Thailand flood combined with the reduced HDD and HDD component production capacity are estimated to cause a loss in unit shipment growth estimated at 3% year over year in 2011 and a 3% loss year over year in 2012. The declines are not due to demand slackening but rather to the limited supply of HDDs in CQ4 2011 and through most of 2012. HDDs will be in short supply in CQ4 2011 and much of 2012. In CQ4 2011 we estimate that the supply will be reduced by about 50 M units from projected demand of about 180 M units (CQ3 2011 shipments were just over 175 M units). The 33% decline in HDD availability in CQ4 2011 has resulted in huge price spikes (about 50% higher in CQ4 2011) and price fluctuations (reported as much as 180% price increases in the retail channel in CQ4 2011).

We believe that the results in the Thailand flooding will likely be about 20-30% average price increases over the average sales price (ASP) of HDDs before the flood through most of 2012. With consolidation and continued shortages it is expected that average HDD prices could be 10-15% higher than before the flood in 2013 and later years which will benefit the capital equipment industry for HDDs.

Following is what we wrote in the Digital Storage Technology Newsletter at the beginning of November 2011:

The floods in Thailand have had a major impact on HDD supply. Both major HDD manufacturing facilities and component manufacturers in Thailand are still under
water. WD Thailand facilities produced about 60% of their total HDD production and the Toshiba Thailand facilities are also inundated. In addition, many component suppliers to the HDD industry had plants in Thailand that were flooded. This will reduce the supply of HDDs in CQ4 2011 by perhaps 50-60 M units (out of a pre-flood estimated TAM of 175-180 M units) and supplies will remain constrained through CQ1 2012 and CQ2 2012 and likely throughout 2012. The Seagate and Hitachi GST plants in Thailand were not flooded but they are impacted by component shortages.

Large systems OEMs will not be as quickly impacted as smaller VARs and consumers since they have a fair amount of inventory but they also will be impacted by CQ1 2012 as their inventory is exhausted. The HDD and component companies are working feverishly to move production either to non-flooded areas in Thailand or transfer production out of Thailand, but as you can imagine this can take some time. For example I have been told that it takes 13-17 weeks to bring a slider fab line (making the magnetic recording heads for the HDDs) back on line and the WD slider fab line at Bangpi-in was badly damaged.

Our prognosis is that CQ4 2011 and CQ1 2012 will have a significant shortfall on HDD production while the HDD companies and their component suppliers get back on line. CQ1 is typically the lowest demand quarter but with the shortfall in CQ4 2011 there will be unmet demand from Q4 2011 that will slip into CQ1 2012. By CQ2 2012 HDD production appears likely to remain constrained and this may last throughout most of 2012. With reasonable levels of demand increase shortages in HDD will likely continue at least into CQ3 2012. The bottom line is that we are looking at several quarters of constrained supply which will cause price increases.

However the most recent price increases are probably a reflection of uncertainty about HDD supply rather than actual shortages. As the water drains out of the factories and the damage can be evaluated and equipment can be salvaged and repaired it will be clearer whether equipment must be replaced or repaired. I expect by CQ1 2012 that prices will drop some from recent levels. However with HDD company consolidation and with continued supply constraints we may not see HDD prices as low as we have seen them for some time--for the HDD companies this is good since this could give them the capital they need to bring on the next generations of high capacity products.

In summary there will be a protracted period of supply constraints going into the second half of 2012 for HDDs but the long term prospects of the industry to supply cost effective (in $/GB) storage capacity remains on-track.

Overall repairing and replacing equipment damaged at the HDD companies and their component suppliers will take many months and will cost over $1 B. The following report will include the impact of the floods on capital spending for the HDD industry.
We believe that when the flood issues are resolved—hopefully before the end of 2012, HDD unit volumes can increase to more adequately meet demand. We expect and project in this report that starting in 2013 the industry will experience 14% annual unit growth through the projection period of the report but based upon prior experiences, at the end of a shortage (or recession) situation, demand may be much higher, even greater than 20% annual unit growth. This is very likely to be true in 2013 if production volume can support that growth and if historical trends continue to be valid. Even at 14% annual growth from 2014-2016 we should exceed 1 B drives shipped per year by 2016.

As a consequence of our belief in continued demand for HDDs there will be demand for capital equipment to meet the needs of this growth starting in 2012 and continuing through the projection period—even after capital spending to fix and replace equipment in the flooded Thailand factories is done.

The other projected driver of capital equipment demand—areal density growth and the introduction of new HDD technologies appears to have slowed considerably. The HDD industry projects 20-25% annual areal density growth through the report projection period, and our product introduction charts support this level of growth for the near future. A short term gain in areal density for some applications is expected with shingled magnetic recording but this will have little impact on HDD capital spending. The introduction of heat assisted (or thermally assisted) magnetic recording (HAMR or TAR) looks like it could be first new storage technology requiring appreciable capital equipment investment but HAMR probably will not be significant in HDDs until the end of the projection period—2015 or 2016 for initial real impact of this technology. Thus capital spending to support this technology transition will probably not ramp up until 2014 or 2015.

Bit patterned magnetic media (BPM) using nano-imprinting technology appears to have been pushed out in most technology road maps, until after HAMR introduction. This appears to be primarily due to the projected costs for introducing this technology into production and with the difficulty in creating uniform patterns on media. At this point, besides research orders of BPM equipment, it appears that a production ramp with this technology will be delayed until after the period of the report (2016). However, all the technology road maps project its eventual introduction as areal density of greater than 10 Tbpsi will be impossible without this technology.

This report explores the drivers for new HDD demand growth (or in the next year or so demand recovery), and sets expectations for the growth of production and process, production testing and metrology capital equipment. We will describe the changes in HDD technology and what that will require in terms of production and process equipment. We will look at developments in production test and
metrology driven by the need to minimize the impact of test on total drive and component cost as well as increasing drive yields and reliability.

Some highlights from the 2012 HDD Capital Equipment and Technology Report are:

- We assume 169% growth in HDD capital spending from 2011 to 2016 driven by three factors: unit shipment increases of 167%, the introduction of new HDD technologies such as HAMR and the replacement and repair of equipment damaged in the 2011 Thailand floods.
- Between CQ4 2011 and CQ4 2012 over $1 B in capital spending is expected to repair or replace equipment and facilities damaged in the Thailand floods.
- HDD and component companies have more cash to invest in equipment and technology development in 2012 and 2013, due to higher drive demand, limited drive supply and higher HDD prices.
- Total industry spending on capital equipment in 2012 is expected to be about $2.4 B with 72% of this spent on process equipment, 21% on production test and 7% on metrology.
- Average HDD capital equipment spending per year between 2008 and 2016 is estimated at about 7.2% of HDD industry revenue, with this percentage increasing in the last years of this period due to new technology introductions.
- HDD areal density has slowed to 20-25% annually but 3.5-inch HDDs with storage capacities of 12 TB and 2.5-inch HDDs with 6 TB are expected by 2016.
- Lower AD growth will drive more components per drive and thus more capital spending on head and media production equipment in coming years.
- Industry consolidation and recovery from the Thailand shortages will result in higher HDD prices than 2011 at least until 2014 and likely HDD prices will flatten out about 10-15% higher than in 2011—this will help fund expensive new technology transitions by 2015-2016 and increase areal density growth rates to 40+% CAGR.
- The regular capital equipment cycle likely be re-established by 2014. Capital purchases in 2014 and later will be driven by increasing unit demand (assumed 14% annual growth) as well as the introduction of heat assisted magnetic recording in 2015 and 2016.
- A technology called shingle write recording may provide some additional capacity areal density growth (up to 50%) in the 2012-2014 period but this will likely cause little growth in capital equipment and may not be appropriate for all HDD markets.
- There will be a transition to heat assisted recording starting slowly in about 2015 and 2016 requiring new types of capital equipment and changes in manufacturing processes.
• Testing and metrology equipment growth will lag production process spending as drive companies try to reduce the testing costs of HDDs and components.
• Form factors ratio changes: 2.5-inch HDDs are now dominant and 1.8-inch HDDs appear to be approaching end of life
• Lower flying heights and head and disk changes lead to increasing metrology requirements requiring new measurement technologies as well as tightening of head and disk specifications

Report methodology summary:
• Accuracy of final data is about +/-15%
• Analysis is based on top-down (customer spending trends) and bottom-up (vendor sales trends) from interviews with knowledgeable people in the industry
• Data forming the basis of the model was collected from a combination of public and private sources both domestic and abroad
• We checked revenue/spending numbers with appropriate product pricing and volume calculations
• Future projections (through 2016) are based upon current trends and expected forthcoming developments (volume expansion and technology developments)
• We assume 283% growth in annual capital equipment spending from 2011 to 2016 driven by three factors
  ⇒ Capital spending to replace equipment damaged in Thailand floods
  ⇒ Capital spending to meet new demand
  ⇒ Capital spending to meet new technology requirements such as HAMR
  ⇒ Capital spending to update facilities and processes
• We assume ~77% of HDD and component company total capital spending overall is on process equipment, process test and metrology (remainder on facilities, infrastructure, etc.)

The particular manufacturing spending/revenues categories discussed here are drives; head wafers/sliders/HGAs; as well as disks and disk substrates. The spending in these categories is further broken down into spending/revenue for production process equipment, production testing equipment and metrology equipment. Production and process equipment includes basic assembly and manufacturing tools including automation, contamination control and manufacturing operations. Not included in production and process equipment spending is capital spending on building and basic facility expense such as DI water, gas lines, HVAC, etc. Production test equipment includes drive burn-in racks and testers, certifiers, contamination monitoring equipment as well as servo writers and equipment often classed as metrology equipment but which is used continuously or often on the production line. Metrology equipment refers to
measurement equipment that generally not used on the production line, is used for failure analysis, gauging and standardization, AQL testing, etc.

We have identified in this report, as much as possible, information from both captive and merchant test equipment suppliers. The distinction is important. Merchant suppliers are eager to garner more business from captive suppliers in order to grow their available market. However, captive suppliers in the past have felt that they are better able to tailor test solutions to specific requirements while controlling the technology and diminishing their reliance on outside suppliers. This make/buy decision continues to be a critical element affecting the fortunes of independent test equipment suppliers; however the general trend is to use more outside suppliers.

This report is based upon recent interviews and analysis as well as historical data from prior reports on capital spending by the author(s). Capital spending reported here is estimated to be within about 15% accuracy of total spending by HDD companies, their component suppliers as well as sub-suppliers. In the course of obtaining the information contained in this report we have contacted or visited many test and process equipment companies, most of the disk drive manufacturers, and several head, media, and sub-components suppliers. During our interviews we received information concerning forecasts, expected technology directions and future requirements. We wish to express our thanks to all who contributed their knowledge and foresight.

In compiling this report we have not included all the detailed data we have gathered. As usual if you have any questions or require additional information please contact us. We are open to provide information readily available to us (with due regard for the confidentiality of our sources) or develop it for you on a project basis.
ACKNOWLEDGEMENTS:

This report is the result of extensive interviews and discussions with many people and companies including equipment suppliers as well as their HDD and HDD component customers. The list of companies and universities contacted is extensive and the data we gathered is very comprehensive, not all of which could be included in this report. Our thinking and projections were shaped by many inputs based on our discussions with individuals who took the time from their busy schedules to meet with us. We would like to thank these companies, organizations and individuals for their help and information.

Because of the extensive discussions with industry experts and a comprehensive analysis of the technology and capital equipment market trends, we believe this document is truly an industry-wide view of our industry and we thank all of our information sources and advisors. These ladies and gentlemen have provided a remarkable service to our storage industry which will continue the outstanding technical progress achieved over the past 55 years of the HDD and storage industry.
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