Abstract:
Hybrid Disk Drives, the combination of a standard hard disk drive and NAND flash, were introduced in 2007 to an unreceptive market, so why are they making a resurgence today? This technology, which was well conceived but poorly implemented in its first generation, has now been implemented correctly and promises to sweep the PC hard drive market. Objective Analysis’ Hybrid Disk Drive study explains hybrid drive technical principals, its potential market, competing technologies, and how the NAND, PC, SSD, and HDD markets will all be impacted by this new twist on an old technology.

Contents:
Executive Summary
Introduction: Why Are Hybrid HDDs Needed?
Memory Hierarchy Gap
Why the Gap is Growing
Filling the Gap with DRAM
NAND Flash Prices Bring Changes
A New NAND Step in the Hierarchy
NAND SSDs Displace Enterprise HDDs
Adding NAND to the Storage Hierarchy
History of the Hybrid Drive
Early Stages
The HHDA
Samsung
Seagate
Vista Support
Rebirth of the Technology
Intel’s Braidwood
Seagate’s Momentus XT Hybrid HDD
Other Hybrid Drives
What’s Different This Time?
Anatomy of a Hybrid Storage System
New Hybrids Use Internal Managers
What Does this Manager Do?
Hybrid Hard Disk Drive Architecture
Standard HDD Principals
DRAM HDD Caches
DRAM Write Cache Risks
NAND HDD Caches 
Nonvolatility 
NAND’s Idiosyncratic Writes 
Hybrid Drives: A NAND Cache in an HDD

Hybrid HDD Benefits 
Faster Data Access 
Reduced Power Consumption 
Greater Shock Tolerance 
Improved Reliability 
Benefit Summary 
A Case Study: The Seagate Momentus

Can a Hybrid Drive Deliver “Instant-On”?3 
Fast Boot Will Drive Demand

How Much Will It Cost? 
How NAND Costs will Add to HDD Costs 
Cost to the Consumer

Alternatives to Hybrid Drives 
Standard Hard Disk Drives (HDDs) 
Larger DRAM 
NAND Caches External to the HDD 
Boot Drives 
Paired SSD & HDD 
Automatic Data Placement 
Tiering Software 
Replacing the HDD with an SSD

Hybrid Drive Forecast 
Hybrid HDD Forecast

Impact to the NAND Market 
Hybrid Share of Total NAND Market

Summary