



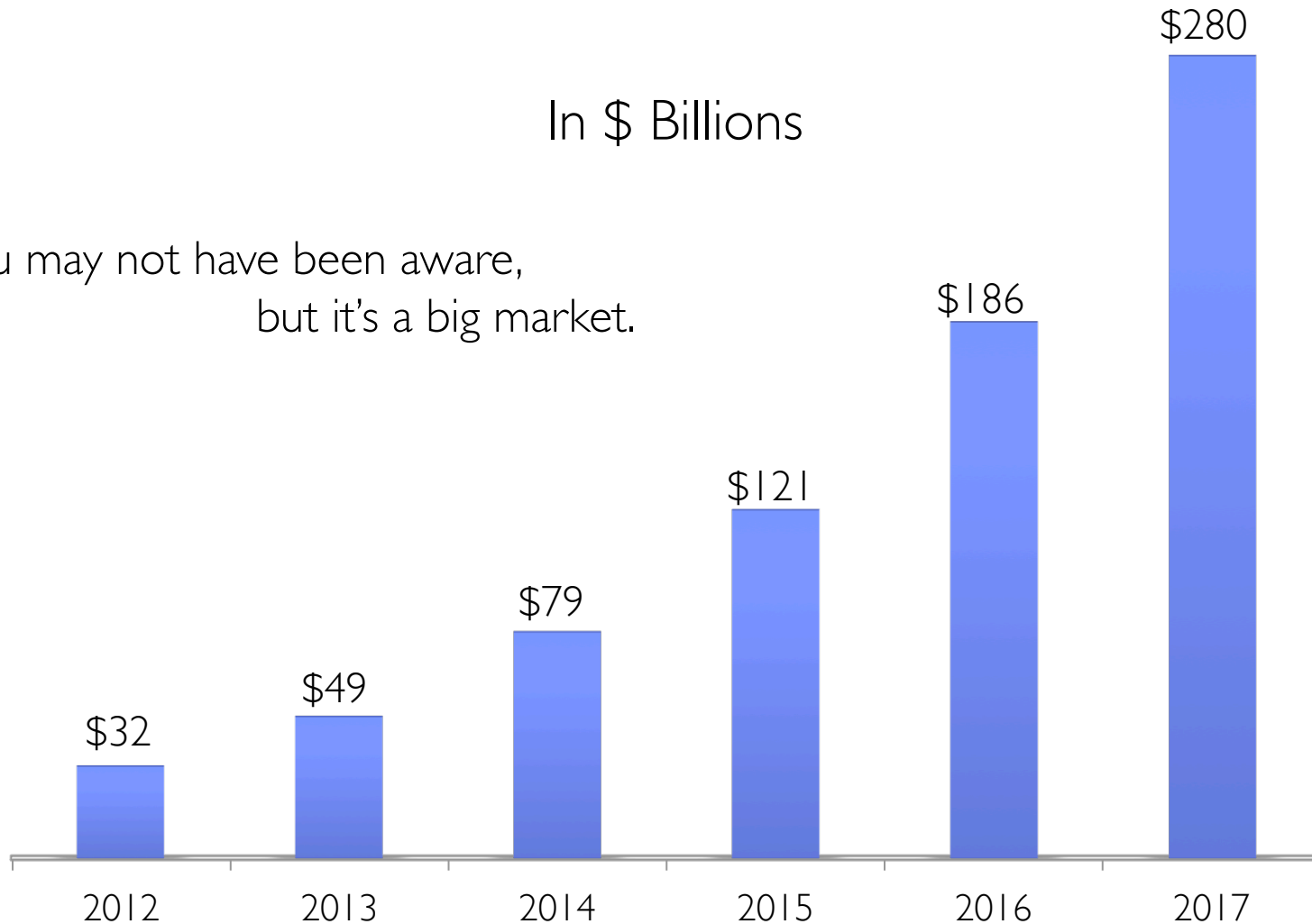
Introduction to **DOTS™**

100 Year Digital Archiving
Safe From Malware, EMP Attacks,
& File Format Obsolescence

The Digital Archiving Market Size

In \$ Billions

...you may not have been aware,
but it's a big market.



Source: IDC – The 2011 Digital Universe Study & 2011 Enterprise Strategy Group Archive TCO Study

The Digital Archive Problem

You have critical digital data that you want to archive for 100 years.

Those files could be...

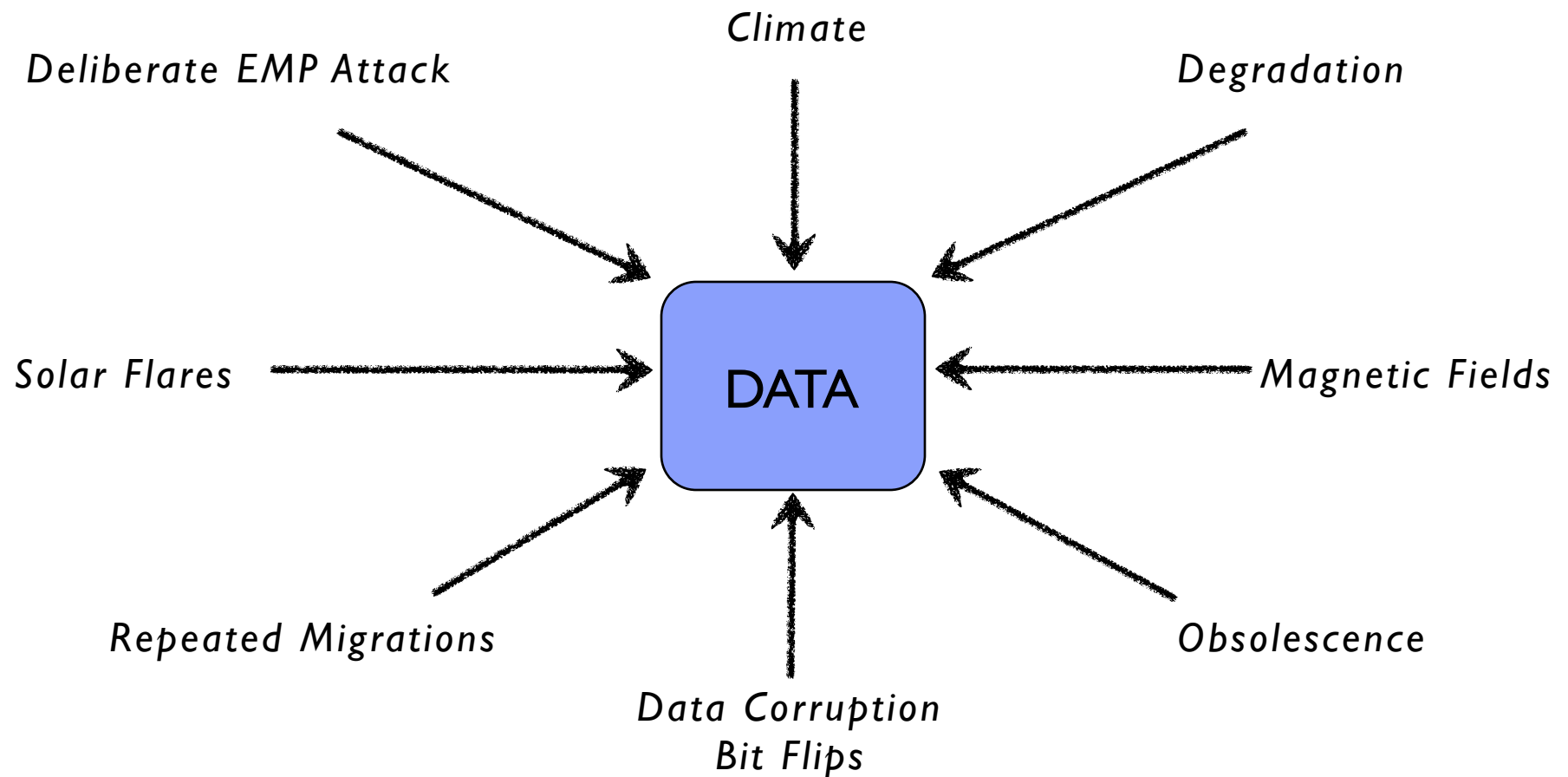
Medical records
Legal records
Business records
Education records
Scientific research
Newspapers
Magazines
Books
Music
Art

Letters
Motion Pictures
Photographs
Historical documents
Government documents
Police records
Census records
Internet records
Financial data
Military records

Surveillance records
Astronomical data
Architectural drawings
Technological specs
Commercial research
Genealogical records
Emails
Web Content
...basically everything

The Digital Archive Problem

What current methods of data storage will encounter in the years ahead...



The Digital Archive Reality

There has **NEVER** been a successful archive media where you cannot **SEE** the information



Group 47 and DOTS™



Over **\$120 million of R&D** invested by KODAK to successfully develop, manufacture, test, and validate DOTS™ archival technology.

GROUP **47**

GROUP 47 was formed to acquire the DOTS™ technology from KODAK, improve upon it using current off-the-shelf technologies, and bring it to market.

Group 47 has raised \$3.4 Million and acquired:

- All 36 related **DOTS** patents
- All Trade Secrets
- All Project Documentation
- Complete Detailed Manufacturing Procedures
- Unobstructed access to past and current Kodak employees who worked on **DOTS**

GROUP **47**

PROPRIETARY

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WITHOUT CONSENT FROM GROUP 47

NEW Patents Awarded to Group 47

(12) United States Patent Rosen	(10) Patent No.: US 9,208,813 B2 (45) Date of Patent: Dec. 8, 2015
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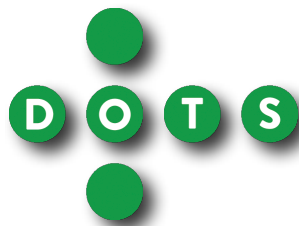
(54) DIGITAL OPTICAL TAPE STORAGE SYSTEM	USP
(71) Applicant: Group 47, Inc. , Woodland Hills, CA (US)	
(72) Inventor: Daniel Scott Rosen , Thousand Oaks, CA (US)	See a

(12) United States Patent Rosen	(10) Patent No.: US 9,508,376 B2 (45) Date of Patent: Nov. 29, 2016
(54) ARCHIVING IMAGERY ON DIGITAL OPTICAL TAPE	USPC 382/164; 369/100, 112, 122; 358/474, 358/487; 347/239, 255 See application file for complete search history.
(71) Applicant: Group 47, Inc. , Woodland Hills, CA (US)	(56) References Cited
(72) Inventor: Daniel Scott Rosen , Thousand Oaks, CA (US)	U.S. PATENT DOCUMENTS
(73) Assignee: Group 47, Inc. , Woodland Hills, CA (US)	4,661,941 A * 4/1987 Bell G11B 7/0031 347/248

- First NEW Patent granted by U.S. Patent Office with multiple claims covering Group 47's unique visual approach for writing and reading digital data.
 - A vast improvement over KODAK's original design.
- The second NEW patent granted covers Group 47's method for archiving images (whether images of photos, videos, or documents) that removes all file format dependencies.
 - The new method for archiving images and sound has quickly become one of the most compelling aspects of **DOTS** for all potential customers, since, with it, **DOTS** can guarantee image and sound files can be read securely decades into the future, without concern for operating system.
- A third patent has been granted, and six additional patents have been filed

DOTS™: Design Principles

- Archival for no less than 100 years
- Data can be **seen**, and recorded in human readable form
- Data is retrieved without sophisticated technology
- Immune to magnetism & can withstand environmental stress
- Same form factor as existing LTO systems
- Compatible with current robotics, commands and LTFS
- One pass read/write of tape & able to support multiple data types
- Hardware devices are backwardly compatible for all previous generations



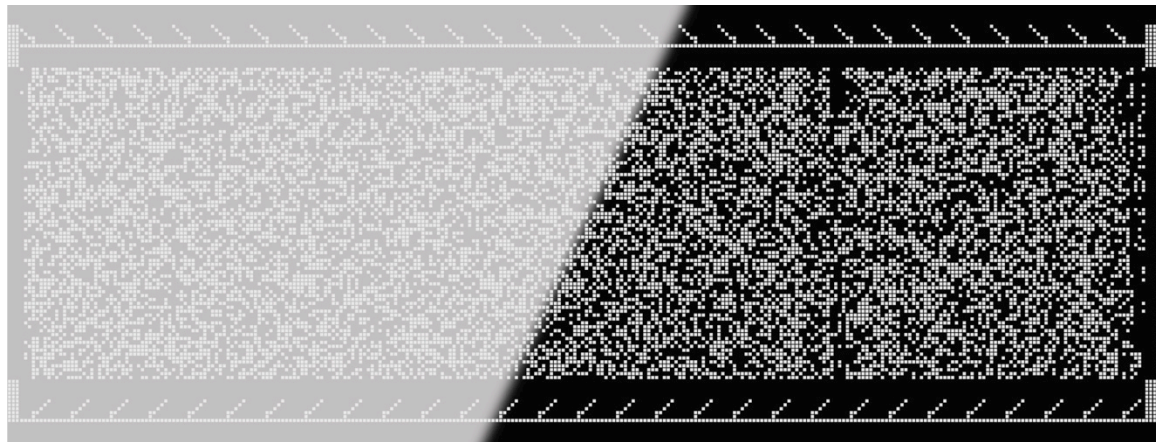
is Green Technology

DOTS eliminates media & energy waste from forced migration, costly power requirements, and rigid environmental control demands

G47 Visual Metal Alloy Storage

An illustration of how data is visually written to DOTS Metal Alloy Tape.
Commercial units will record in excess of 8000 dots across the width of the
 $\frac{1}{2}$ inch media.

The media under
white light



The media under
Polarized light

A photo of a test write to DOTS
media, illustrating the ability to
write binary data, text, and images.
In actual practice, the data
would be microscopic in size.



TCO of Long-Term Digital Archive

PROCESS COMPARISON

To Archive a Petabyte for 5 years with current methods	To Archive a Petabyte for 5 years with DOTS™
• Record to magnetic tape	• Record to DOTS™ media
• Store in a climate-controlled facility	• Store on a shelf at room temperature
• Monitor tape regularly for degradation & re-pack	• Done
• Migrate the data within 3-5 years	
• Risk data loss / corruption due to migration, cosmic particles, solar flares, EMP, media degradation, machine interchange, hardware obsolescence	
• REPEAT 1 time	
TCO = \$151,300	TCO = \$116,865

Parameters

- 1) Magnetic media requires a controlled environment (temperature and humidity). Archival storage vaults for magnetic media have an average monthly cost of \$3.09/cu. ft. of storage, due to the stringent environmental controls.
- 2) DOTS and LTO cartridges are approx. .0083 cu. ft. in size.
- 3) Based on information from a major storage vendor, their cost to migrate one magnetic tape cartridge is \$75.00 plus the cost of the media.
- 4) For this comparison, we are assuming a cost of \$50 per LTO-5 tape and \$140 for DOTS, and that each tape is filled to capacity.

TCO of Long-Term Digital Archive

PROCESS COMPARISON

To Archive a Petabyte for 5 years with current methods	To Archive a Petabyte for 5 years with DOTS™
<ul style="list-style-type: none"> • This may seem like a small delta for one Petabyte, yet the US Intelligence Community alone wants to archive more than 35,000 Petabytes a year... Which translates to a single migration savings of over \$1.2 Billion 	
• REPEAT 1 time	
TCO = \$151,300	TCO = \$116,865

Parameters

- 1) Magnetic media requires a controlled environment (temperature and humidity). Archival storage vaults for magnetic media have an average monthly cost of \$3.09/cu. ft. of storage, due to the stringent environmental controls.
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25 YEARS

To Archive a Petabyte for 25 years with current methods	To Archive a Petabyte for 25 years with DOTS™
• Record to magnetic tape	• Record to DOTS™ media
• Store in a climate-controlled facility	• Store on a shelf at room temperature
• Monitor tape regularly for degradation & re-pack	• Done
• Migrate the data within 3-5 years	
• Risk data loss / corruption due to migration, cosmic particles, solar flares, EMP, media degradation, machine interchange, hardware obsolescence	
• REPEAT 8 times	
TCO = \$606,589	TCO = \$117,180

Parameters

- 1) Magnetic media requires a controlled environment (temperature and humidity). Archival storage vaults for magnetic media have an average monthly cost of \$3.09/cu. ft. of storage, due to the stringent environmental controls.
- 2) DOTS and LTO cartridges are approx. .0083 cu. ft. in size.
- 3) Based on information from a major storage vendor, their cost to migrate one magnetic tape cartridge is \$75.00 plus the cost of the media.
- 4) For this comparison, we are assuming a cost of \$50 per LTO-5 tape and \$140 for DOTS, and that each tape is filled to capacity.

100 YEARS

To Archive a Petabyte for 100 years with current methods	To Archive a Petabyte for 100 years with DOTS™
• Record to magnetic tape	• Record to DOTS™ media
• Store in a climate-controlled facility	• Store on a shelf at room temperature
• Monitor tape regularly for degradation & re-pack	• Done
• Migrate the data within 3-5 years	
• Risk data loss / corruption due to migration, cosmic particles, solar flares, EMP, media degradation, machine interchange, hardware obsolescence	
• REPEAT over 30 times	
TCO = \$2,502,181	TCO = \$118,862

Parameters

- 1) Magnetic media requires a controlled environment (temperature and humidity). Archival storage vaults for magnetic media have an average monthly cost of \$3.09/cu. ft. of storage, due to the stringent environmental controls.
- 2) DOTS and LTO cartridges are approx. .0083 cu. ft. in size.
- 3) Based on information from a major storage vendor, their cost to migrate one magnetic tape cartridge is \$75.00 plus the cost of the media.
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The Competition

- No alternative allows “Save It and Forget It” model
- Data centers with thousand terabyte disk arrays require massive A/C
 - *“Energy costs will emerge as the second-highest operating cost in 70% of worldwide data center facilities.”* Gartner, Inc.
 - *“For every watt consumed by a data center, it requires 4% more energy to cool the equipment.”* The Green Grid
- Magnetic data tape and spinning disk are the only current alternatives for archival data storage

Competing Archival Solutions	Strengths	Weaknesses	Stakeholders
Magnetic Tape (LTO, T-10000)	Many suppliers, open standard	Data loss due to age, magnetic fields, EMP, migration every 3-5 years, corruption due to migration	FujiFilm, HP, IBM, Imation, Oracle, Seagate, SONY, Sun, TDK, etc...
Optical Disk (DVD, CD, etc.)	Immune from magnetic fields, readily available	Small storage capacity Not archival	SONY, MAXELL, Phillips, TDK, Plasmon
Millennia Disk	1000 year archival, difficult to erase	Small storage capacity Requires DVD/BluRay Player Frequency modulation (analog) storage method, not visual	Brigham Young University
Hard Drives (Data Center Server Based)	High speed I/O, random access	Limited life span, massive power needs for cooling, large footprint, data subject to catastrophic loss	IBM, Seagate, Hitachi, Western Digital, all drive Mfr's
"The Cloud"	Inexpensive, dispersion of assets, no onsite storage constraints, access from any Internet connection	No knowledge of where assets are; at the mercy of bandwidth; actual location subject to local jurisdiction	Amazon, AT&T, Google, HP, IBM, Microsoft,...
Holographic Storage	High Density, random access, high bandwidth	Complex technology, still in R&D phase, not yet realized	General Electric, InPhase Technologies

DOTS™ Status Highlights

- Significant pent-up demand from major government & entertainment organizations for a better archiving solution continues to grow
- Successfully completed contract from a US Intelligence Agency demonstrating a proof-of-concept engineering model of the DOTS technology by converting files to visual representations of the data, writing to DOTS metal alloy tape, and reading the files back again.
- Developed new, patent-pending method for archiving photographs and images to the DOTS metal alloy tape [Bit Plane Imagery] that eliminates file format obsolescence issues
- New method has led to increased interest from all potential customers

Summary

- Worldwide exponential growth of data is continuing with no end in sight
- Huge problems with current storage solutions
- **DOTS™** is disruptive technology
- Multi-billion dollar revenue opportunity

GROUP 47 Executive Leadership

- **Rob Hummel** – Founder & President, Group 47 - Has held senior positions at Disney, DreamWorks, SONY, Warner Bros., Technicolor. Recognized leader on motion picture technology, preservation and restoration. Member of Motion Picture Academy's Science and Technology Council.
- **Steve DeWindt** – Chairman & CEO - Senior operating & management executive with strong global P&L management experience & proven track record of driving market share & revenue. Many senior positions including EVP Solium Capital; Chairman & Pres OptionEase; CEO Sparxent; EVP & COO Celergy Networks; President Computer2000; CEO Ameriquet Technologies; President BlueRoads; Director Worldwide Sales Intel.
- **Dan Rosen** – CTO - TRW, Lead Engineer designing and developing weapons, image processing, and intelligence systems for Dept of Defense, DIA, CIA, NSA and other agencies; Dalsa Digital Cinema; CTO, Kodak's Cinesite; Chief Engineer DreamWorks Animation.
- **Jimmy Kemp** – Federal Market - Director Strategic Business Initiatives at Patton Boggs and President Jack Kemp Foundation. Previously VP Development for EnTrust Capital.
- **Jim Minno** – Media Product Development - Previously Director, Kodak Strategic Planning and Bus. Dev. for Motion Pictures. Leader and evangelist for DOTS program development.
- **Dick Sehlin** – Media Technology - Eastman Kodak CTO of Motion Pictures, Retired. World recognized expert in image science and archival storage.

For detailed executive bios go to: <http://www.group47.com/site/index.php/about-group-47/group-47-llc>



Contact

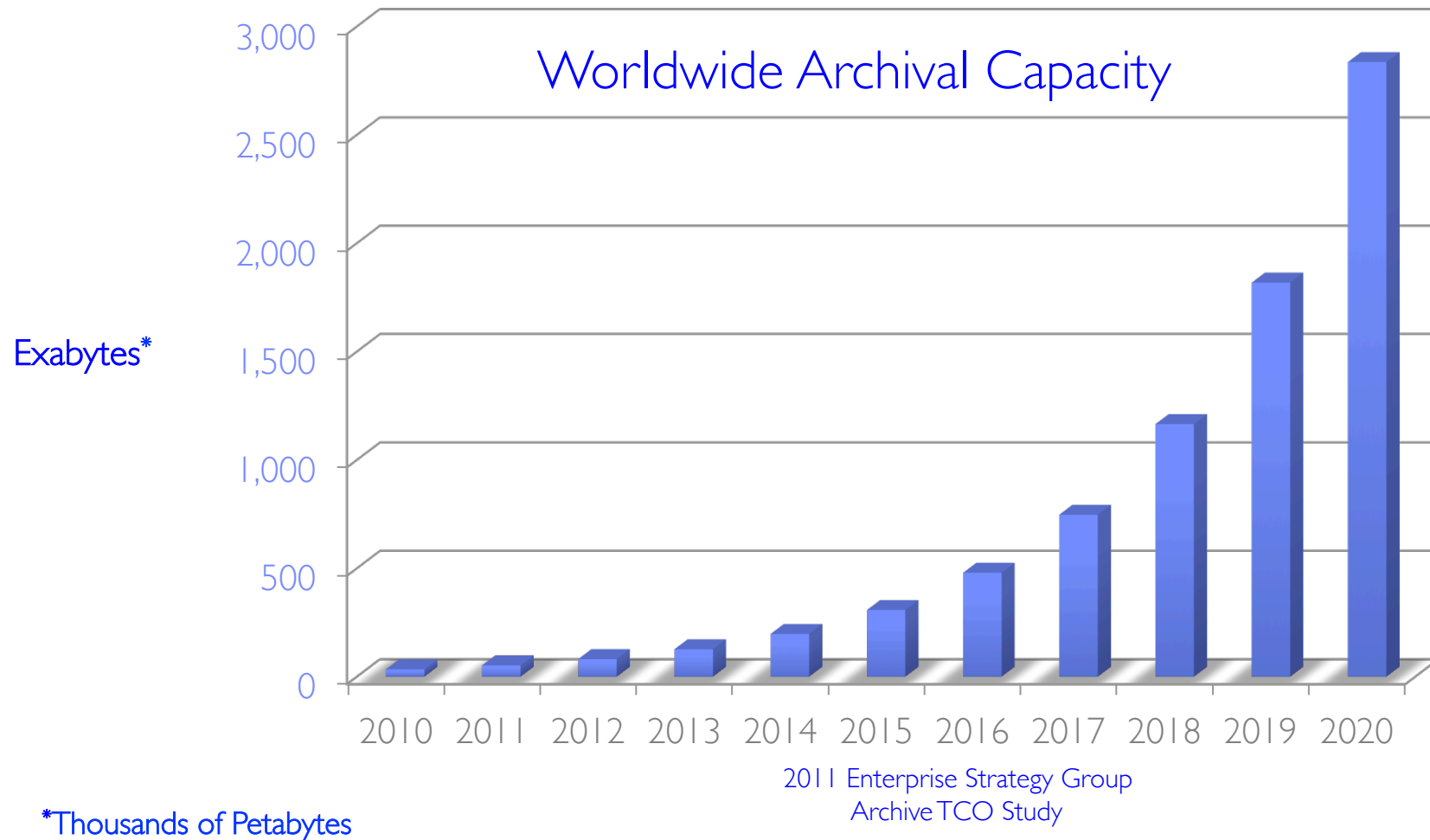
Rob Hummel
President & Founder
+1-818-992-4268
Mobile: +1-818-425-0141
rob.hummel@group47.com

Jimmy Kemp
EVP, Federal Systems
Group 47, Inc.
Washington, D.C.
Mobile: +1-202-439-3654
jimmy.kemp@group47.com



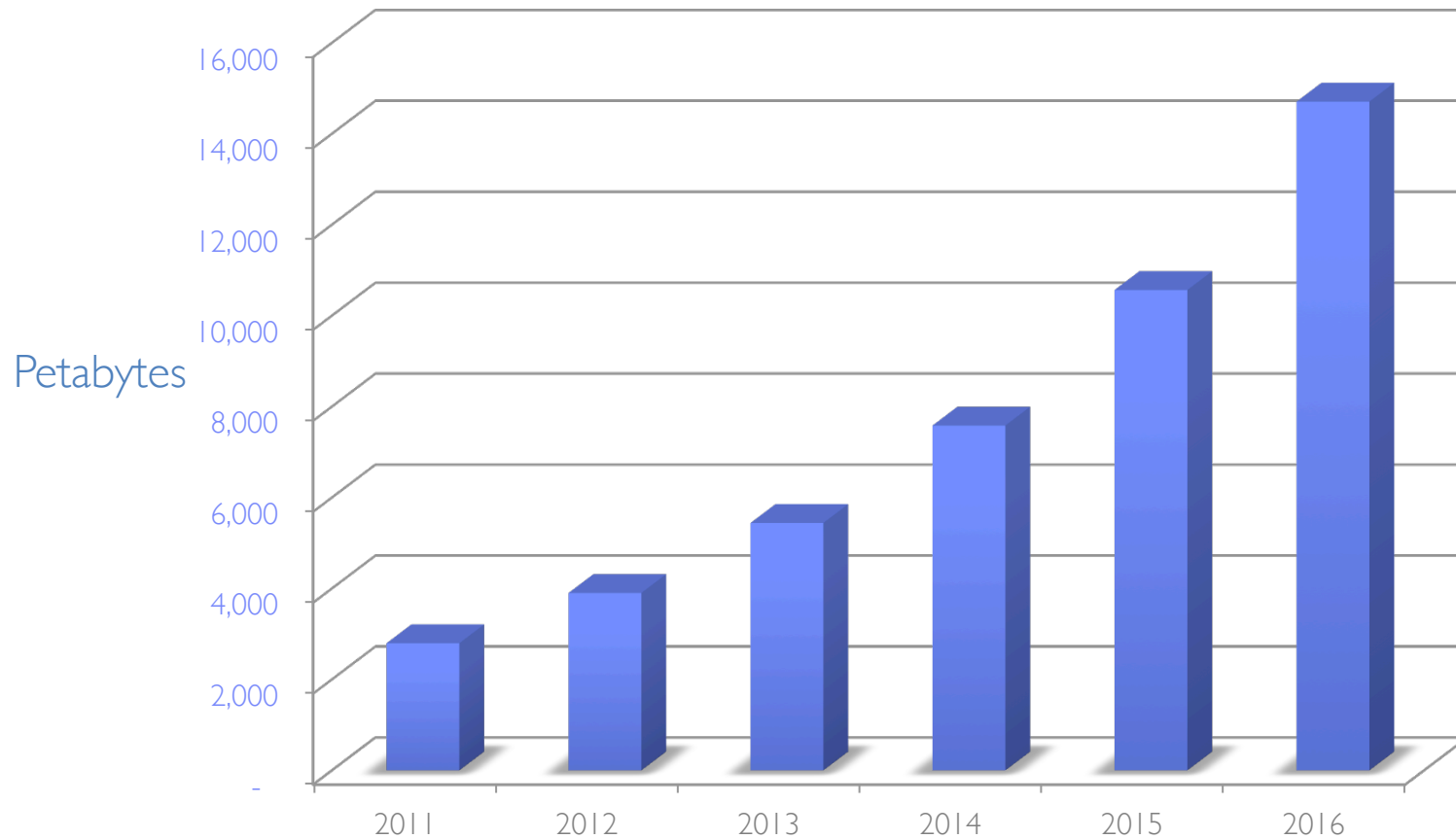
Appendix

Projected Growth for Archiving Digital Data



Projected Growth in Entertainment & Media for Archiving Digital Data

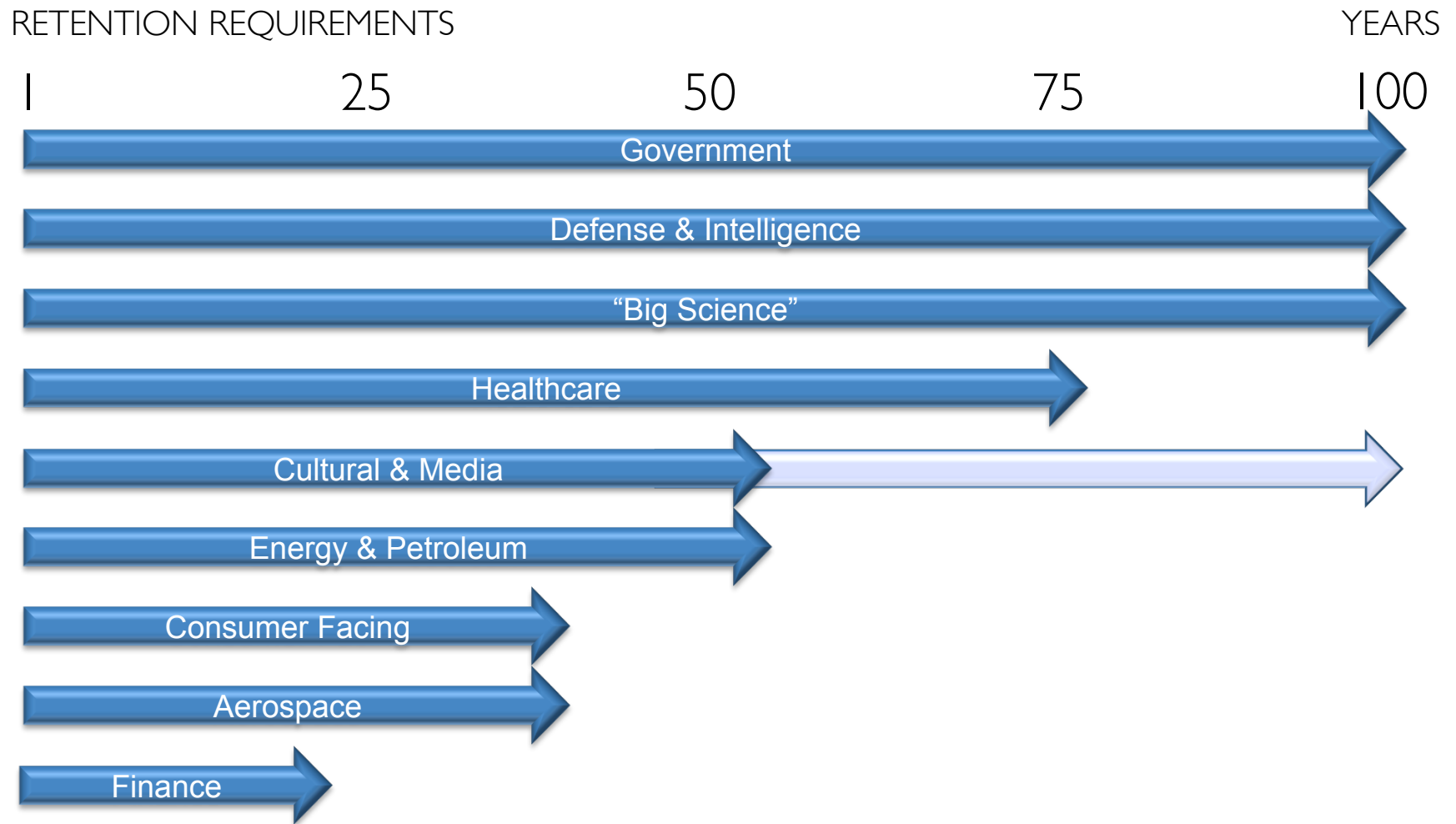
Tape Storage Demand for Archiving & Preservation



2012 Digital Storage for Media and Entertainment Report
Coughlin Associates



Target Markets For **DOTS™** Long Term Archival Storage



Key DOTS Briefing in 2013

CTO Council of the US Intelligence Community



- 90 minute session with CTOs who make recommendations to the members of the Intelligence CIO Council
- Threat of Electro Magnetic Pulse [EMP] attacks to digital data stored on magnetic media is top of mind for this group
- All familiar with longevity problems with magnetic media for archiving [tapes or disk] and the need to continually migrate data
- Also concerned about impact of Solar Events on magnetic media

Examples of Current Digital Archiving Demands

US Federal Market

Intelligence Community Examples

- Intelligence Community is collecting over 8 Exabytes [8,000,000 Terabytes] per week
 - Permanently archiving $\geq 10\%$ [800,000 Terabytes] per week
- National Reconnaissance Office archiving 33 TB of data per hour¹ or 790 TB per day

⁽¹⁾April 2011 interview in Geospatial Intelligence Forum with Dr. Pete Rostan, Director NRO Mission Support Directorate



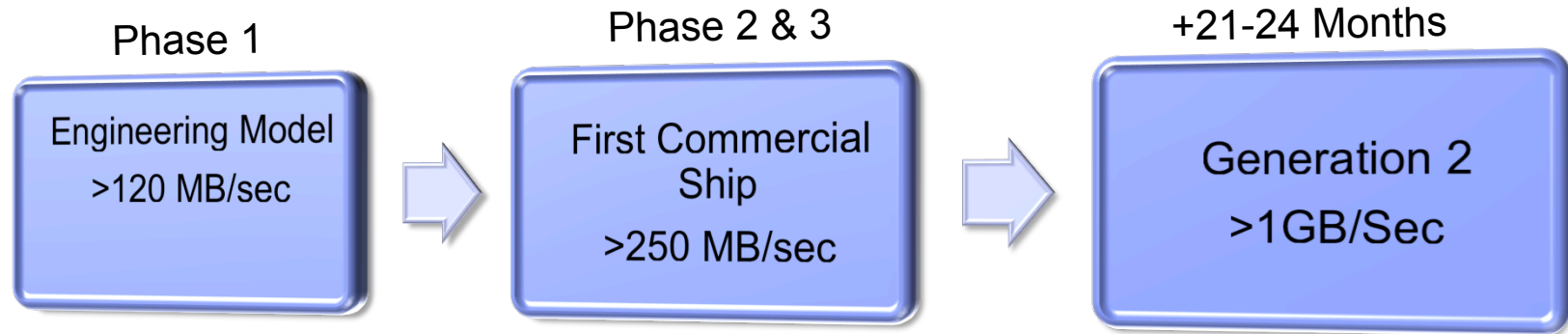
Civilian Agencies and Department of Defense Examples

- Library of Congress - 180 Petabytes of film/video archives
- US National Archives - 80 Petabytes of film/video archives + 1000 Petabytes of other data
 - NASA National Space Sciences Data Center – 52,000 digital volumes [mostly tape]
- Department of Defense – A single Global Hawk UAV gathers ≈ 1.45 Terabytes a day of data



DOTS™ Performance Specifications*

Data Transfer Speed



Cartridge & Media Characteristics



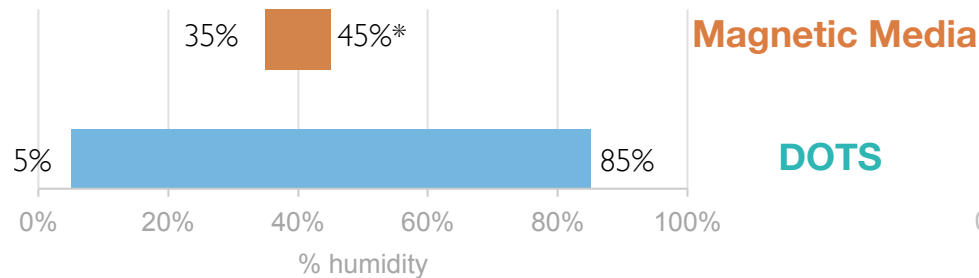
Gen 1 Capacity: 1.2TB Native	Tracks per pass: 10,000
Tape Speed: 30cm/sec	Passes to write entire tape: 1
File System Support: LTFS	Head to Tape Contact: None
Cartridge Dimensions: LTO Standard	Media Life: No less than 100 Years
Cartridge Memory: Capacity TBD	Corrected bit error rate (CBER) of 10 ⁻¹⁸
WORM capable: Yes	EMP/Magnetic Field Sensitivity: None
Tape Thickness: TBD	Long Term Storage Temperature: 16-150°F (-9 – 66° C)
Data, Text and Images: Yes	Long Term Storage Humidity: 5%-85%

*all specification are subject to change without notice or obligation and are presented as best estimate at the time of this document.

Technology Overview

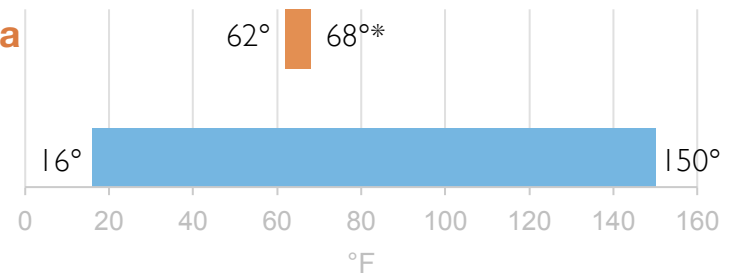
Magnetic Media vs DOTS Visual Metal Alloy Tape

Stable Humidity Range



** US National Archives and Records Administration Guidelines*

Stable Temperature Range



Threat to Archived Data

	Magnetic Media	DOTS
Fingerprints / Human Touch	Corrupted Data	No Impact—Can be wiped off
Magnetic Interference	Corrupted Data	No Impact
Immersion in Water	Corrupted Data	No Impact
Hostile Electromagnetic Environment / EMP	Corrupted Data	No Impact

“Rosetta Leader™”

- *Because DOTS is visual, the leader of every tape will be written with human readable text that will have instructions and images on how to construct an optical reader and a full description (including computer source code) of the exact encoding scheme used to write the data.*
- *Since DOTS supports LTFS, it is possible to set aside space for textual descriptions of what information is contained on that particular tape.*

