



Veterans Health Administration
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VHA Office of Research & Development

Prosthetics Research Update
Focus on Women's Health Issues
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“Research” vs. “Clinical Care”

- VA’s Office of Research and Development (ORD) is focused on future developments of advanced prosthetics – “what will be someday”.
- VA’s Patient Care Services (PCS) is focused on the needs of Veterans today. What are the most appropriate prosthetic devices available today to best meet a Veteran’s needs?
- Prosthetics and Sensory Aids Service (PSAS) is part of PCS.

Prosthetic and Sensory Aids Service (PSAS)



- In 2008, PSAS established the Prosthetics Women's Workgroup (PWYW), an interdisciplinary collaboration of subject matter experts on Women's Health from across VA.
- The purpose of the PWYW is to enhance the care of women Veterans by focusing on the unique needs of women Veterans and how those needs can best be met by the range of devices provided by PSAS.

Prosthetic and Sensory Aids Service (PSAS)



- PSAS's Orthotic and Prosthetic Services provide:
 - Certified Post-Mastectomy Fitting Services, breast prostheses, mastectomy bras
 - Custom Orthotic & Prosthetic devices to include state-of-the-art artificial limbs and computer augmented braces to include prosthetic feet customized to wear with high heels and custom life-like cosmetic covers (features such as paintable nails, etc).



- The following table depicts PSAS services provided to OIF/OEF/OND women Veterans from 2006-2010. This data includes the full spectrum of items provided by PSAS to those women Veterans, such as wheelchairs, implants, contraceptive devices, eyeglasses, and wigs.

FY	Cost	Uniques*
2006	\$ 609,650	3,173
2007	\$1,027,205	4,479
2008	\$1,706,119	6,649
2009	\$2,736,207	9,495
2010	\$3,656,878	12,597
Grand Total	\$9,736,059	22,794*

*Some multiple visits by same individual over time

Lower Extremity Case Study

- **Problem:** Limb cosmetics are mostly designed for men
 - 100's of prosthetic feet are commercially available
 - Nearly all are male (larger and wider than female feet)
 - Grinding feet to make them fit women's shoes reduces their durability and appearance
- **Solutions:**
 - Understand female perspective on cosmeses (what do they prefer?)
 - Encourage development of female cosmeses
 - Develop scanning & replication technology to mirror the intact limb anthropometry



Lower Extremity Case Study

- Problem: Poor prosthesis fit due to limb volume fluctuations
 - All lower limb amputees experience limb volume fluctuations.
 - Poor volume management results in limb pistoning and leads to skin injuries and loss of mobility
 - Pre-menopausal women are especially vulnerable to this problem, as are women who are pregnant.



Lower Extremity Case Study

- Solutions:
 - Prescription of multiple sockets to accommodate variable limb size during different phases of menstrual cycle
 - Improvements in measurement technologies
 - Improvements in adaptive socket & liner technologies



Lower Extremity Case Study

- **Problem: Prosthetic constraints on footwear versatility**
 - Female amputees often prefer greater versatility for footwear choices than males
 - Prosthetic heel heights are typically 3/8" to 3/4". Few commercial feet allow user adjustments.
 - User mal-adjustments can cause alignment problems and discomfort
- **Solutions:**
 - Develop automatic heel height and alignment systems that adjust to amputee footwear



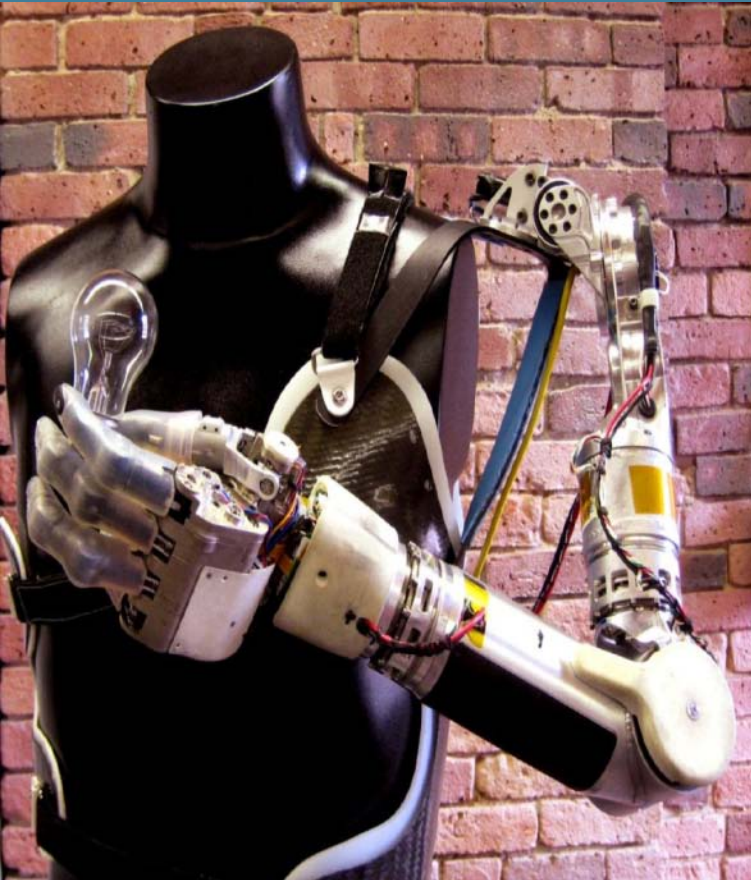
Case Example



Different
Prosthetic
Arms Based
on Individual
Preference



DEKA Gen2 Arm at DoD



Wearing a DEKA Gen2 arm, Mr. Frederick Downs, Jr., former Chief of Prosthetics and Sensory Aids at the VA (now retired), shakes hands with Secretary Gates, while DARPA Director Dugan looks on.



Research Plan Past and Future

- Congressional Hearing 2004
- DARPA's "Revolutionizing Prosthetics 2007/2009"
Programs began in 2005
- VA Prosthetic Arm Optimization Study 2008-2011
(3 VA and 1 DOD site)
- VA Follow-On Studies in Upper Extremity
Prosthetics (plan to include VA and DOD sites)
- Transition to Additional Applications
- Collaborations with other agencies



- Program began 2005
- VA regarded as potential “Transition Partner”
- Two Efforts Funded – Parallel Development for Risk Mitigation
 - RP2007 (DEKA)
 - RP2009 (JHU/APL - Johns Hopkins Univ. Applied Physics Lab)
- DEKA Arm Began Testing in VA 2009
- JHU/APL Arm in Early Planning Stage for Future VA Study

VA Optimization Study 2008-2011



The overall objective of the study is to obtain needed data to advance the development and refinement of the DEKA arm system.

- Determine what, if any, additional improvements in technology and training materials are needed to facilitate acceptance of the DEKA arm and its potential for clinical use.
- Use the information gained from the study to optimize the arm, its software, and training materials for prosthetists, therapists and patients and prepare for future clinical trials.
- Identify characteristics of successful users of the DEKA arm system.

VA Studies of DEKA Arm



Summary of Research Subjects To-Date

Breakdown by Level of Amputation	Total	
	Female/ Total Gen2	Gen3
Transradial	0/8	1
Transhumeral	2/8	3
Transhumeral (used powered shoulder)	1/3	
Shoulder Disarticulation	1/5	
Interscapulo-thoracic (Forequarter)	0/2	
Grand Total	4/26	4

DEKA Arm Video Segment



DEKA Arm Video Segment



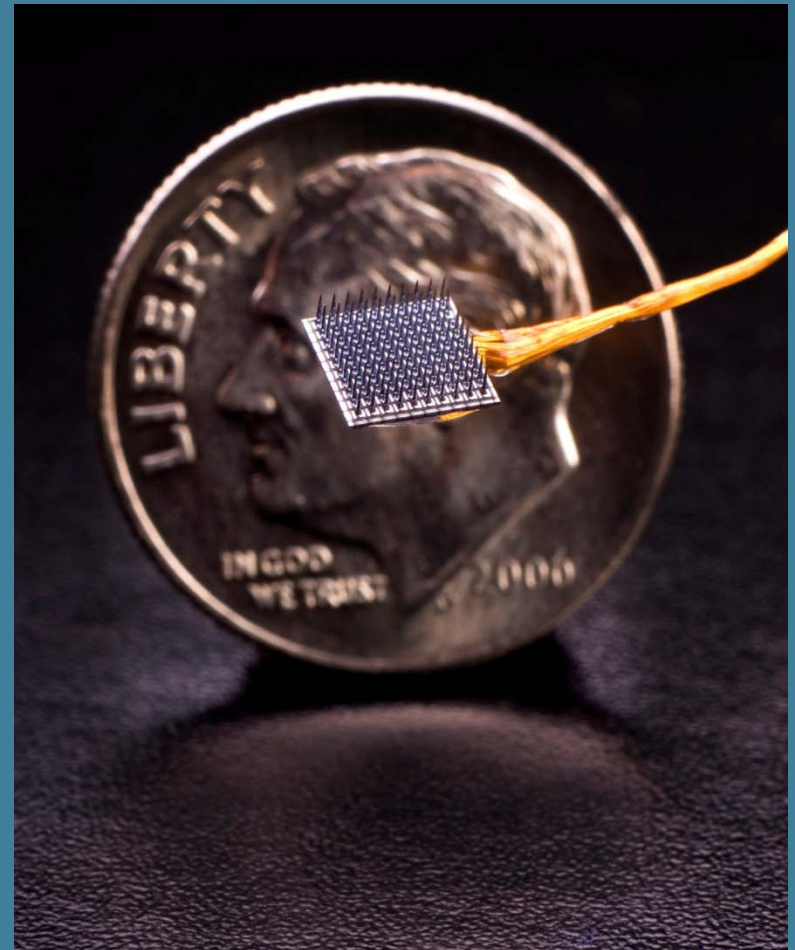
DEKA Arm Video Segment



DEKA Arm Video Segment



- Brain Computer Interface to Control Arms



Conclusion

- Prosthetics and Sensory Aids Service is presently providing the most appropriate prosthetic devices to best serve Veteran's needs
- Advanced Prosthetic Arms hold promise for the future.
- Control by Brain Computer Interface is far in the future, but likely to provide best possible and most natural control of prosthetic arms.

THANK YOU !



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