FY04 Technical Program Summary

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Vehicle Technology Directorate -
Langley Site
US Army Research Laboratory
at
NASA Langley Research Center
Hampton, VA 23681-0001

The ARL Vehicle Technology Directorate at the Langley Research Center conducts research in two business areas:

Structural Mechanics and
Loads & Dynamics

Program areas funded under these technical competencies include basic (6.1) and applied (6.2) research in Aviation Technology and Ground Vehicle Technology. The following "Table of Contents" outlines the organization of the work packages and individual research projects within this document.

Aviation Loads & Dynamics Research - 6.1 - 61102 / AH66 / VS1015

VS1015.AL05	Aeroelastic Modeling of Advanced Rotor Configurations
VS1015.AL06	High Performance Piezoelectric Actuator Development
VS1015.AL07	Lightweight Multifunctional Structural Components Development
VS1015.AL08	Fuselage Dynamics and Tail Buffet
VS1015.AR01	Structural and Material Characteristics of Biological Morphologies
VS1015.DC01	Crashworthiness of Composite Frames and Floor Sections
VS1015.DR14	Modeling of Thin Membrane Structures

Ground Vehicle Loads & Dynamics Research - 6.1 - 61102 / AH42 / VS1016

VS1016.DC02	Nonlinear Mechanics of Elastomeric and Composite Structures

Aviation Structural Mechanics Technology - 6.2 - 62211 / A47B / VS2011

VS2011.CA02	SARAP Crash Safety Research Program
VS2011.CD01	Damage Initation and Growth Studies in Tailored Laminates
VS2011.IC02	Skin/Stiffener Debonding Analysis Methods
VS2011.IC03	Exploratory Research on Adaptive Sensors for Composite Rotorcraft
VS2011.IC04	Failure of Rigid Foams
VS2011.IF04	Z-pin Reinforcement Analysis
VS2011.IF08	Fatigue Life Methodology of Metallic Rotorcraft Dynamic Components
VS2011.IF11	Impact Damage Resistance & Tolerance of Thin Skin Composite Sandwich Structure
VS2011.IF12	Reliability-Based Design Methods
VS2011.IN01	Composite Thermal Nondestructive Evaluation
VS2011.IN07	SARAP NDE/Reparability Program

Ground Vehicle Structural Mechanics Technology - 6.2 - 62105 / AH84 / VS2012

VS2012.CA01	Research on Ground Combat Vehicles
VS2012.CA02	Buckling - Vibration Interaction
VS2012.CA03	Analysis of Structural Joints for Ground Vehicles
VS2012.CA04	Inflatable Structures
VS2012.CD01	Selective Reinforcement of Aluminum Structures
VS2012.CD02	Multi-Functional Structures
VS2012.IN07	NDE of Composite Structures Using Laser Ultrasonics
VS2012.IN12	NDE of Electrical Wire Insulation Using Ultrasonics

Aviation Loads & Dynamics Technology - 6.2 - 62211 / A47B / VS2015

VS2015.AA02	High-Speed Aeroelastic Research Models
VS2015.AE03	High-Voltage Electrical Systems
VS2015.AL04	Experimental Investigation of Active Twist Rotor Concepts for Vibratory Load Reductio
VS2015.AL05	Analysis and Design of Active Twist Rotor Blades
VS2015.DC08	Innovative Composite Fuselage Design for Improved Crashworthiness
VS2015.DC09	Soft Soil - Water Impact
VS2015.DC11	Crash Simulation of an ATR42 Aircraft
VS2015.DT01	Applications of Structural Tailoring Concepts

Ground Vehicle Loads & Dynamics Technology - 6.2 - 62105 / AH84 / VS2016

Date Last Modified: 06-JAN-04

BUSINESS SUBAREA:	6.1		LOADS & DYNAMICS	
PE/PRJ/WP#/WP:	61102	AH42	VS1016	Ground Vehicle Loads & Dynamics Research
DIRECTORATE/DIVISION	Vehicle Technology Directorate		Loads & Dynamics	
POC/PHONE:	Dr. F. D. Bartlett, Jr.		(757) 864-3952	

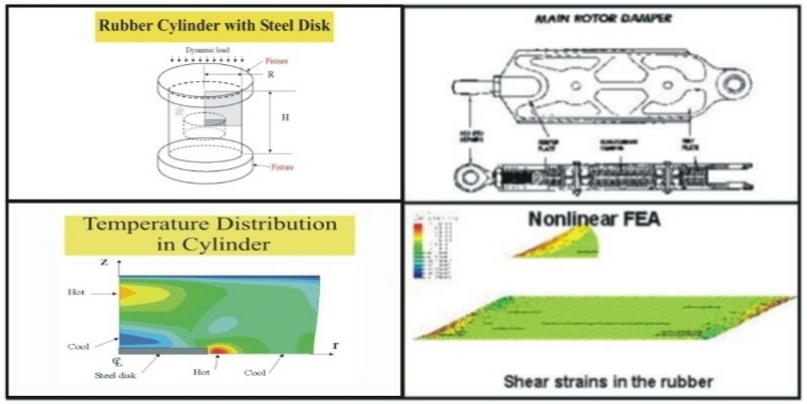
THRUST:

Develop and enhance analytical models for multi-body kinematics and dynamics to support vehicle loads analysis and vibration reduction.

Improve consititutive modeling and implementation of viscoelastic structures, and calibrate their performance with experimental data.

OBJECTIVES:

* Increase performance capability of non-aviation related structural concepts with reduced weight by tailoring the structure for dynamic response.
* Develop techniques to incorporate smart material effects in Finite Element Analysis modeling.
* Improve computational models by incorporating the dynamic properties of rubber materials.
* Provide technology base fto develop next generation of finite element models for rubber material structures.



PROGRAM SCHEDULE:

RESEARCH STUDIES	2003	2004	2005	2006	2007
Nonlinear Mechs of Elastomeric & Composite Structures		▪▪▪▪			

FY04 KEY DELIVERABLES:

⋆Complete work on time-space FEA of viscous beams and plates.

⋆Document results and publish final report.

This chart covers Fiscal Year 2004

Business SUBAREA:	6.1		LOADS & DYNAMICS	
PE/PRJ/WP#/WP:	61102	AH42	VS1016	Ground Vehicle Loads & Dynamics Research

Workyears	2003	2004	2005	2006	2007
ARMY	.95	.4	0	0	0
OTHER	.4	.1	0	0	0

LOADS & DYNAMICS

OBJECTIVE

The objective of this basic research program is to focus on improved methods for predicting the structural response of load carrying elastomer components, particularly for application to vehicle classes other than rotorcraft. However recent interest in viscoelastic "lead-lag" dampers for helicopter rotor system applications have opened a new area of fundamental research. The thrust of this research is to lighten and improve the durability of high performance tires, tank track pads, and other elastomeric items used as structural components used by the Army, Navy, Air Force, and dual-use civilian vehicles by improved computational methods for predicting the response and failure of these elastomeric load carrying load components. In addition, as resources permit, improvements in multi-body dynamic analyses are critical to understanding the non-linear environment of many of our Army vehicles.

APPROACH

The approach involves development of new constitutive theories, which allow for efficient computational modeling of large strain rubber viscoelastic deformations. Applications exist for technology enhancement to support the rubber industry to model viscoelastic effects. The current capability is limited to small dynamic strains superimposed on large static strain. Interaction with the International community in viscoelastic methodology is increasing with particular emphasis on Brunel University in the U.K. Potential University interaction in the U.S., now includes those historically rotorcraft related functions particularly focusing on rotorcraft viscoelastic "lead-lag" damper technology. The leverage and connectivity with NASA is substantial in that the researchers involved in these programs are an integral part of the NASA branches and are able to apply the NASAs research programs in structural dynamics programs to specific Army interests. VSD research is also closely aligned to the Army Research Office, the Army Rotorcraft Centers, and other academic institutions.

SIGNIFICANCE

The ultimate payoff of this joint Army/NASA structural dynamics research will be a better understanding of the dynamic modeling of viscoelastic and multi-body structures in Army ground vehicles, and more effective methods for their prediction. This fundamental research supports DOD Technology Objective: Demonstration of Advanced Rotor Concepts (DARC), the Armys Science and Technology Objectives: Advanced Rotorcraft Aeromechanics Technologies (ARCAT) and Variable Geometry Advanced Technologies (VGART).