**Title**

***Sub-title***

**Use Case:**

Vehicle Readiness: **Metaverse** and other virtual experiences will place new demands on the design of future vehicles, including fundamental technological features. Creating the right infrastructure with new technologies such as 5G, cloud computing and human interfaces (e.g. smart glasses, wearables, biosensors) will be a critical part of this evolution. With the help of mixed reality technologies such as AR or VR, IoT or machine learning and sensor technology, **the physical vehicle will merge with the virtual world to enhance various touchpoints of future mobility**. In this use case, we are explicitly looking for your creative and innovative ideas or solutions to prepare the vehicle for challenges that will arise from future technology trends in order to provide our customers the most immersive experience in a premium way.

"The best way to predict the future is to create it"

Istari can empower BMW to:

* Create a digital twin engineering metaverse for all vehicles in the BMW production fleet
* Fully digitize engineering collaboration and create a digital thread between BMW and Tier 1 suppliers
* Decrease time between design, safety certification, and production
* Drive sustainability by reducing environmental impacts during prototyping phase
* Decrease design and production costs to BMW
* Increase safety of vehicles through iterative testing and digital certification before production

Please provide us the following information:

* Idea Title
* Picture
* Description of Idea:
	+ Software ate the world, but hardware never caught up...until now. Today, we’re verging on a revolution in modeling and simulation technology that, when paired with AI, will unlock the next great era of innovation. Unlike metaverses that entertain us, this new digital world of structures and physics offers an even greater gift: to design and test things faster, cheaper, and greener than the physical universe allows. Sound incredible? It's already transforming industries from Formula 1 to agriculture. Empowering our physical world with this digital one will expand the internet into a future engineering metaverse where any maker can make *anything.* Our universe is too slow for human creativity. The future metaverse is where world-changing ideas will be birthed in the blink of the digital eye.
	+ Aside from the direct value, Istari and BMW will set the precedent for Formula 1-like digitization, opening the door to more digital possibilities. Formula 1 is a remarkable example of digital agility. Using authoritative modeling and simulation (M&S), teams design over 30,000 digital cars per season. Most never physically exist, yet teams still confidently certify their real-world performance and safety. On average, parts are digitally redesigned, tested, and certified every 15 minutes, with over 85 percent improving during a single season. With over 60 percent of each car’s performance determined by edge-of-the-performance-envelope aerodynamics, extrapolation of Formula 1’s rigorous approach to commercial vehicles is achievable.

#

What we can do:

These models will all be “spliced” in such a way that they can be viewed, interrogated and interconnected at scale.

|  |
| --- |
| The Istari "model splicer" is a software tool designed to streamline collaboration and provide controlled access to specific portions of a large-scale engineering model file. It extracts and stores model data in a model-type specific data structure and generates tailored API function scripts for user interaction. By creating a "model splice" or "wrapper" for a specific user application, the model splicer encapsulates the model data and associated API function scripts, allowing stakeholders to access and modify limited portions of the original engineering model file.The term "model splicer" may refer to both the software engine generating the model splices or wrappers, and the API endpoint(s) created through the splicing process. These endpoints link to a digital model file for access to its inputs and outputs, ensuring a modular, streamlined, and secure method for various stakeholders to interact with the digital model according to their specific application requirements. |

Each model will be “spliced” and a web-app will be created that makes it easy for **humans** to interact and understand the Digital Engineering (DE) models as well as an API-interface that will make it easier for **computers** to interact with and understand the DE models. Once these models are turned into machine-readable code, they can be linked, evaluated and input into many different formats.

* Enable BMW to securely share part specifications with their suppliers (e.g., a wall where the CAS could be mounted) via upload to the Istari Platform
* Allow suppliers to share their models and files back to BMW (either with the raw files, or via an Istari Link)
* Create different model splicers for different automobile trim levels (e.g., 330i and 330e)
* Use a CAD model of a part developed in one tool and the outer mold line of a CAD model in another tool to assess whether the part will function within that model line
* Detect changes in requirements or product (specific parametric triggers) and update [notify owners of] appropriate models

How we will do it:

* The workflow can be summarized as follows:
	+ Engineer develops model within a specific domain (e.g., CAD) and uploads it to the Istari Digital Platform
	+ The Istari Digital Platform splices the model(s) and makes it easy for humans to read via a web-app, and easy for computers to read via an API
	+ Engineers of many other disciplines develop related models (e.g, CFD, FEA, MBSE, AFSIM), which are also spliced
	+ A small team of digital engineers use the API endpoints from the models to create a **digital thread** connecting the models, allowing for feedback loops between the models to better understand 1st, 2nd and “N”th order effects
	+ A team of program managers drafts the template for the report document, knowing that certain data needs to be added in, leaving room for the API endpoints from the spliced DE models to provide numbers, graphics, tables and analysis to the report.
	+ When the entire system is linked via a **digital thread**, any update in one model can trigger re-runs of many other models to verify completeness and can automatically be updated in the final reports. **This allows for massive scale concurrent design and certification of highly complex systems.**
* Team Name: Istari
* Use-Case (Vehicle Readiness, In-Car Experience or Virtual Ecosystem): **Vehicle Readiness**
* Attachment
	+ Possible demo video w/BMW branding & voiceover
* User Name (including e-mail of registered user on platform)

**Appendix**

“About Istari” goes here

Istari is a digital engineering company founded by Dr. Will Roper and Dr. Chris Benson. Both founders have notable experience in the United States Air Force and broader DoD and USG and bring that expertise to our company.

**Table 1: Istari Parent Company Corporate Information**

|  |
| --- |
| **Istari, Inc. Corporate Information** |
| CAGE Code | 9BM27 |
| UEI | PBTAP9VEH5N4 |
| Corporate Address | 1511 Creek Side Way, Charleston, SC 29492 |

Istari specializes in aerospace engineering, digital engineering, unmanned aerial systems, and AI/ML. Our expertise is also derived from the two companies that have been acquired by Istari, Inc: Top Flight Technologies and NXTek. Top Flight Technologies pioneered hybrid gas/electric engines and digital test ranges for drones, and NXTek provided critical advancements in linking physics based models to wargaming capabilities.

For this SBIR Phase 3, we will use the company information from our wholly owned subsidiary NXTek, as that is the CAGE code associated with our active SBIR Phase 2 with PEO Weapons.

**Table 2: Istari Wholly Owned Subsidiary NXTek Corporate Information**

|  |
| --- |
| **NXTek Corporate Information** |
| CAGE Code | 8FAM5 |
| DUNS | 117219656 |
| UEI | R6JJDQ8NLMC6 |
| Corporate Address | 1966 Novus Place, Costa Mesa, CA 92627 |

# 1. Pricing and Cost Overview

Istari’s pricing is based on a two-year (24 month) period of performance on a firm-fixed price contract. For labor to support this effort, we anticipate needing roughly 20 full time Istari employees, and roughly four (4) full time equivalent subcontractors and consultants. We also will require travel to the customer site in Dayton, Ohio from our engineering office in Boston, Massachusetts. In addition to Istari labor and travel, we are also leveraging the skills and experience of three subcontractor and consultant services. These services provide subject matter expertise in tradespace modeling, airworthiness and testing, and a broad range of aerospace specific topics.

The total price, which includes Istari and subcontractor labor, travel, and other direct costs, for Digital Prime is $19,982,992.17.

# 2. Labor Rates

Istari labor rates are built from market salary information, GSA schedule information, and these rate levels are built on education and experience competencies. These are Istari unburdened labor rates:

**Table 3: Labor Rates**

| **Labor Category** | **2022 Hourly Rate** | **2023 Escalated Rate** | **2024 Escalated Rate** |
| --- | --- | --- | --- |
| Exec Dir Software | $136.54 | $142.82 | $149.39 |
| Software Engineer VI | $106.54 | $111.44 | $116.57 |
| Software Engineer V | $86.63 | $90.61 | $94.78 |
| Software Engineer IV | $74.28 | $77.70 | $81.27 |
| Software Engineer III | $62.93 | $65.82 | $68.85 |
| Product Manager VI | $106.54 | $111.44 | $116.57 |
| Product Manager V | $94.26 | $98.59 | $103.13 |
| Aerospace Engineer V | $78.12 | $81.71 | $85.47 |
| Aerospace Engineer IV | $73.59 | $76.98 | $80.52 |
| Aerospace Engineer III | $61.29 | $64.11 | $67.06 |

These rates show our 2022 - 2024 rates with an assumed escalation of 4.6%. For salary information, we use the Boston, Massachusetts geographic area for our calculations, as that is the engineering headquarters for Istari.

# 3. Subcontractors and Consultants

Istari subcontractor rates are as follows:

**Table 4: Contractor Rates**

|  |
| --- |
| **Contractor Rates** |
| Dayton Aerospace SME II | $191.00 | $199.79 | $208.98 | Dayton Aerospace Rate |
| Dayton Aerospace Senior Consultant | $147.25 | $154.02 | $161.11 | Dayton Aerospace Rate |
| Diakronos | $169.27 | $169.27 | $169.27 | Senior engineer rate |
| Bill Lewis | $312.50 | $312.50 | $312.50 | SME consultant |

## 3.1 Diakronos

Diakronos will function as a subcontractor to Istari to lend their expertise in tradespace exploration to Digital Prime. While Istari Digital is interested in the unique capabilities of Diakronos Solutions Inc. related to value-driven tradespace analysis and design for changeability in a digital engineering context, Diakronos will provide services to Istari in their SBIR Phase III Project entitled Digital Prime, especially in support of key systems engineering reviews such as ASR (Alternative Systems Review) and SRR (System Requirements Review). These reviews are described in further detail below:

* Alternative Systems Review (ASR) – The ASR is a technical review completed prior to Milestone-A which assesses the preliminary material solutions developed during the Materiel Solution Analysis (MSA) phase. The review examines each proposed material solution(s) to identify which one has the best potential to be affordable, operationally effective, suitable, and can be developed in a timely manner with an acceptable level of risk. The information obtained from the ASR is used in the Milestone-A review to determine if the solutions(s) under review can proceed into the Technology Maturation & Risk Reduction (TD) Phase.
* System Requirements Review (SRR) – The SRR is a technical review conducted during the Technology Maturation & Risk Reduction (TD) Phase to determine the progress a program has made in defining system-level requirements. This review determines the progress of the systems engineering effort and if the effort is on track to meet the capability needs defined in the Initial Capabilities Document (ICD). The SRR is used during the Milestone-B review to determine if a program can process into the Engineering, Manufacturing, and Development (EMD) Phase.
* System Functional Review (SFR) - The System Functional Review (SFR) is held to evaluate whether the functional baseline satisfies the end-user requirements and capability needs and whether functional requirements and verification methods support achievement of performance requirements. At completion of the SFR, the functional baseline is normally taken under configuration control.
* Preliminary Design Review (PDR) – The Preliminary Design Review (PDR) should provide sufficient confidence to proceed with detailed design. The PDR ensures the preliminary design and basic system architecture are complete, that there is technical confidence the capability need can be satisfied within cost and schedule goals and that risks have been identified and mitigation plans established. It also provides the acquisition community, end user and other stakeholders with an opportunity to understand the trade studies conducted during the preliminary design, and thus confirm that design decisions are consistent with the user’s performance and schedule needs and the validated Capability Development Document (CDD). The PDR also establishes the allocated baseline.

Diakronos will provide their expertise in Multi-Attribute Tradespace Exploration (MATE), Epoch-Era Analysis (EEA), and Design for Changeability in a support role, as applied to DoD-relevant system design and analysis. The expected system application for the project is an Unmanned Aerial Vehicle (UAV), or “drone,” that could be of potential interest to the U.S. Air Force.

## 3.2 Dayton Aerospace

Dayton Aerospace will be providing Senior Consultants for subject matter expertise and support for a variety of technical tasks, as well as support for outreach across the Air Force.

The Dayton Aerospace subcontract will be Time and Material (T&M). Dayton Aerospace is a Service-Disabled Veteran-Owned Small Business (SDVOSB) and exempt from Cost Accounting Standards Board (CASB) regulations; DUNS – 12252251; CAGE – 9Y989; Federal Tax ID – 31-1102785. Dayton Aerospace’s accounting system was reviewed by the Defense Contract Audit Agency in September 2001. The review concluded that Dayton Aerospace’s accounting system is adequate for billing under T&M, labor hour, and cost reimbursable line items under T&M contracts and

subcontracts. Dayton Aerospace does not have any known potential or actual specific organizational conflicts of interest. There is no foreign participation proposed underneath this effort.

Dayton Aerospace is a management and technical services consulting firm serving industry and government customers since 1984. Their experts are all retired senior military officers, US Government civilians, or defense industry executives who average over 30 years of experience covering all technical and management disciplines essential to weapon system acquisition and sustainment. Each has held responsible government positions such as center/laboratory commander, system program director, program executive officer, directorate chief, chief engineer, and director of various functional home offices, such as contracting and financial management. Their ongoing support of various defense programs in all phases of the life cycle, for both government and industry clients, ensures their currency in industry best practices and the latest government processes, procedures, and policies.

Dayton Aerospace specializes in providing hands-on support to both government and industry customers using these highly experienced experts. In all cases, their single most important discriminator is the people they use. Dayton Aerospace subject matter experts (SMEs) possess the necessary training, qualifications, experience, and clearances to accomplish all tasks to support this project.

Dayton Aerospace has significant experience in acquisition engineering, systems engineering,

airworthiness certification processes, test and evaluation engineering including flight test, and

technical/management leadership on major acquisition programs.

The total project cost for Dayton Aerospace support of Digital Prime for the full base period of 24 months is $709,034.42.

## 3.3 Bill Lewis

Dr. Bill Lewis will support this project as a subject matter expert consultant. Dr. Lewis has over 46 years’ experience in military flight test and certification with 27 publications on the topic. We have included his extensive resume as Appendix I.

During this project, Dr. Lewis will provide ongoing subject matter expertise for the product development and maturation. He will attend technical meetings as appropriate and communicate with both Istari and USAF personnel to share his insight on how the product can best support flight testing.

His monthly retainer fee of $10,000 guarantees 32 hours of his support per month. We plan to leverage his services for the first year of the base period (12 months) at $10,000 a month for a total cost of $120,000.

# 4. Material

# 4.1 Unmanned System Build

A key aspect of our project is building the physical unmanned aerial system for testing to validate the digital model certification. The UAS has high level requirements but we will build a more detailed bill of materials and associated quotes as we get closer to the manufacturing start date. We built this cost model based on some key assumptions and our team’s deep understanding of manufacturing this kind of UAS for eight years with Top Flight Technologies.

**Key Assumptions:**

* The UAS will be a Group 3 size, greater than 55lb maximum gross takeoff weight (MGTOW) and less than 1,300lbs MGTOW
* The ROM cost will be $4M, with $2M per build cycle
* The manufacturing will take two build cycles
* The manufacturing will commence post-CDR

Going into manufacturing, we will have an UAS manufacturing plan that will include Government review and input. After our CDR is completed on the digital design, we will deliver a complete manufacturing plan of that digital design which will include a full bill of materials (BOM) complete with our supply chain sourced and validated. We will also have a full parts list and digital drawings, as well as full documentation for all systems and subsystems of the UAS. Additionally, we will have full assembly documentation and full testing documentation.

Our estimated cost breakdown for the UAS manufacturing for each cycle is $500K for Istari engineers to create the Manufacturing Plan, $1M for two complete UAS systems (primary and backup), and $500K for management reserve. This totals $2M per cycle, with two full cycles planned for Digital Prime.

The first manufacturing cycle will occur post-MFR and the second cycle will occur post Airworthiness Certification (AWC).

## 4.2 Computational Costs

For this project, we calculated the costs of running high-fidelity models and simulations and used the Amazon Web Services estimating tool to develop our costs for the base period. Our high level assumptions are that one complete run of a high fidelity model takes one week of compute time for roughly 64 graphical processing units (GPUs). We also assume we will need at least four different M&S tools to prove out the model, requiring between five and 10 high fidelity runs of similar magnitude.

**Table 5: Computational Run Costs**

|  |  |  |
| --- | --- | --- |
| **Description** | **Value** | **Reference** |
| AWS Multi-GPU VM (g4dn.12xlarge) - Number of GPUs | 4 | <https://aws.amazon.com/ec2/instance-types/g4/> |
| AWS Multi-GPU VM (g4dn.12xlarge) - Estimated Cost per Hour | $3.91 | <https://aws.amazon.com/ec2/instance-types/g4/> |
| Estimate of required Number of GPUs | 64 | Istari Estimate |
| Estimated Number of Hours for 1 high fidelity model simulation | 168 | Istari Estimate |
| Required number of AWS g4dn.12xlarge instances | 16 | Calculation |
| Number of instance\*hours | 2688 | Calculation |
| Estimated Cost | $10,515.46 | Calculation |
| Estimated Number of Runs Required | 50 | Istari Estimate |
| **Total Estimated AWS GPU cost** | **$525,772.80** |  |

## 4.3 Computational Memory Costs

In addition to compute power from AWS, we also plan on leveraging AWS for computational memory. This vendor was selected due to the best value pricing and security offerings for the data. Our memory requirements center on our understanding that most certification packages range from 100GB to 10TB, which was information shared with Istari by an USAF airworthiness subject matter expert.

**Table 6: Computational Memory Costs**

| **Description** | **Value** | **Reference** | **Notes** |
| --- | --- | --- | --- |
| AWS S3 Cost per Gigabyte ($/GB/Month) | $0.023 | <https://aws.amazon.com/s3/pricing/> | First 50 TB / Month |
| Estimate of required information to be stored (GB) | 50,000 | Estimate from Airworthiness Office |  |
| Estimated Cost per month | $1,150.000 | Calculation |  |
| Number of Months | 24 | Period of Performance |  |
| **Total Estimated AWS Storage cost** | **$27,600.00** |  |  |

## 4.4 Digital Tool Costs

We understand the wide range of potential digital tools our customers and end users may need Istari to use in this project, so we approached the pricing of digital tools using notional tool sets and our informed understanding of what is reasonable to expect in terms of digital tool needs for the base period.

**Table 7: Digital Tool Costs**

| **Description** | **Cost Per License (per year)** | **Number of Licenses Needed** | **Number of Months Needed** | **Total Cost** | **Reference** |
| --- | --- | --- | --- | --- | --- |
| Requirements Tool (IBM Doors) | $12,070 | 2 | 24 | $24,140 | https://www.ibm.com/products/requirements-management/pricing |
| Architecture tool (CAMEO) | 30,405.70 | 4 | 24 | $60,811.40 | ROM quote from vendor |
| Computer Aided Design (CAD) Tool (Solidworks) | $2,780.00 | 2 | 24 | $5,560.00 | https://www.ptc.com/en/products/creo/packages |
| Computer Aided Design (CAD) Tool (NX) | $3444 | 2 | 24 | $6,888 | ROM quote from vendor |
| Low Fidelity Analytical Modeling (Matlab + Toolboxes) | $4,900 | 2 | 24 | $9,800 | ROM quote from vendor |
| ~~Computational Fluid Dynamics (CFD) Tool (Star-CCM+)~~ | ~~$10,000~~ | ~~2~~ | ~~24~~ | ~~$20,000~~ | ~~Order of magnitude assumption~~ |
| ~~Finite Element Analysis (FEA) (Ansys Mechanical)~~ | ~~$22,000~~ | ~~2~~ | ~~24~~ | ~~$44,000~~ | ~~https://www.thepricer.org/ansys-cost/~~ |
| Aerodynamic Modeling Tool (STK) | $10,000 | 2 | 24 | $20,000 | https://www.thepricer.org/ansys-cost/ |
| Electromagnetic Frequency Model (Ansys HFSS) | $36,380 | 2 | 24 | $145,520 | Quote from Vendor |
| ~~Manufacturing Model (Dassault Delmia)~~ | ~~$25,000~~ | ~~2~~ | ~~24~~ | ~~$100,000~~ | ~~Quote from Vendor~~ |
| Product Lifecycle Model (Siemens Teamcenter) | $65,000 | 2 | 24 | $260,000 | Quote from Vendor |
| ~~CADEXchanger~~ | ~~$34,800~~ | ~~1~~ | ~~24~~ | ~~$69,600.00~~ | ~~Quote from vendor~~ |
| Autodesk Eagle Fusion 360 | $409 | 2 | 24 | $1,636.00 | Autodesk website |
| **Total Estimated Digital Tooling Cost** | **$767,955.40** |  |

## 4.5 Computational Hardware Costs

Our intent for these costs is to foster the creation of a supercomputing local cluster for advanced AI and digital engineering development. These products would be used to support Digital Prime project work, especially as the computational demands increase as the project progresses. Having these tools at the Istari work location ensures we avoid the schedule risk of running into computational roadblocks.

**Table 8: Computational Hardware Costs**

| **Item** | **Unit Cost** | **Quantity** | **Total Cost** |
| --- | --- | --- | --- |
| NVIDIA DGX Station A100 | $127,215 | 1 | $127,215 |
| NVIDIA A100 GPU Computing Accelerator - 80GB HBM2 - PCIe 4.0 x16 with Passive Cooling | $13,999  | 8 | $111,992 |
| Dell Alienware High Performance PC | $4,429.99 | 5 | $22,119.95 |
| **Total Cost** | **$261,326.95** |

# 5. Travel

For this project, we project a need to travel to Dayton, Ohio from Boston, Massachusetts 11 times over the course of the two year project. Eleven milestones for this project are a digital report plus meetings that can be virtual or in-person. For this reason, we based our travel on the idea of 11 trips with a six person team for three days. This will provide ample flexibility for the Istari team to travel for project events and milestones.

We based on travel costs on economy airfare rate averages, sourced from Google Flights, and GSA per diem rates for 2022 for the Dayton area. For rental cars, we used the assumption of a rental car for every two team members, so for a team of six we are assuming three rental cars. We sourced our rental car fee information from the Enterprise Rental car calculator for the Dayton airport.

**Table 9: Istari Team Travel**

| **REQUIRED TRAVEL: (Not-to-Exceed Amount; Worse Case) Average Economy Google Flights \*Lodging/M&IE based on FY22 GSA Per Diem Rates. Enterprise Car Rental.** |
| --- |
|  | **Travel From/To - 3-day Trips** | **Travel Staff #** | **Airfare + Tax/Fees** | **\*Lodging** | **\*M&IE 1st Day** | **\*M&IE** | **\*M&IE Last Day** | **Car Rental + Fuel** | **Amount** |
| Trip 1 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| Trip 2 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| Trip 3 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| Trip 4 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| Trip 5 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| Trip 6 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| Trip 7 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| Trip 8 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| Trip 9 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| Trip 10 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| Trip 11 | From Cambridge, MA to Wright Patterson AFB | 6 | $470.00 | $109.00 | $48.00 | $64.00 | $48.00 | $320.00 | $6,048.00 |
| (Total Per Diem/M&IE (includes 3 Days/2 Nights Lodging) |  | $2,820.00 | $1,308.00 | $576.00 | $384.00 | $960.00 | $960.00 |  |
| **Subtotal ODC** |  |  |  |  |  |  |  **$66,528.00** |
| **Direct Cost Overhead Rate** | 0.00% | x ODC |  |  |  |  |  | **$0.00** |
| **Total Other Direct Costs (TODC)** |  |  |  |  |  |  |  **$66,528.00** |

# 6. Intellectual Property

Istari intends to provide full rights to the Government for the aircraft IP developed during this project. There is no specific charge for this IP transfer in our costs and we look forward to future broader collaboration across the enterprise on this technology.

# Appendix I: Subject Matter Expert Consultant Resume

**Dr. William D. Lewis**

299 John Brinkley Road

Shelbyville, TN 37160

 (256) 759-3057

EDUCATION

PhD, Aerospace Engineering, Georgia Institute of Technology

MS, Aviation Management, Embry-Riddle Aeronautical University

MS, Aeronautical Engineering, Air Force Institute of Technology

BS, Applied Science and Engineering, US Military Academy, West Point, NY

Program Manager's Course, Defense Systems Management College, 1993

US Naval Engineering Test Pilot School, Patuxent River NAS, MD, 1986

Army Command and General Staff College, FT Leavenworth, KS, 1985

EXPERIENCE

1. President / CEO, Tennessee Technical Test Team

April 2019 to Present

Serves as the executive of an innovative aerospace firm specializing in rotorcraft and unmanned vehicle design, qualification and operation. Serves as the hypersonics lead for the Army Science Board. Provides strategic guidance and mentorship in establishing science and technology portfolios and business plans for various industrial firms. Campaigns for advances in qualification methodologies for aerospace vehicles; especially complex, integrated cyber-physical systems. Fosters innovative acquisition approaches to accelerate program development timelines. Leads projects of interest for proof of principle tasks including flight testing of the aircraft.

2. Director, Aviation Development Directorate, RDECOM

January 2012 to April 2019

Serves as the Director for Aviation Development, the incumbent manages and directs the execution of the Aviation Science and Technology Program including basic research (6.1), applied research (6.2), and advanced technology development (6.3). The incumbent provides direct management of the Aviation Applied Technology Directorate (AATD), the Aero Flight Dynamics Directorate (AFDD) and the Aviation Systems Integration Facility (ASIF). The AFDD and AATD organizations are responsible for developing, maturing, and the systems engineering support for key aviation technologies in aeromechanics, structures, propulsion, drives, flight controls, human system interface, preliminary design, mission equipment integration, and systems engineering to support the transition to current and future aviation manned and unmanned systems. The incumbent is held accountable for the success of the Army's multi-million dollar aviation science and technology program and the satisfaction of the Army's Project Reliance responsibility for rotorcraft technology. The aviation science and technology program funding is averaging $100 to $130M per year in the current Program Objective Memorandum (POM) and involves all efforts directed towards development of material for new or improved Army rotary wing and fixed wing aircraft, Unmanned Aerial Systems (UAS), and ancillary equipment of critical national importance.  The incumbent also serves as the Director of the National Rotorcraft Technology Center (NRTC) and as such represents the Army in the development, approval and execution of programs conducted by the Center for Rotorcraft Innovation (CRI) and the Vertical Lift Centers of Excellence (VLCOE).

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| Responsibilities involve complex multidisciplinary technology in the rapidly changing fields of manned and unmanned aerial platforms such as; computational fluid dynamics, aerodynamics, propulsion, structures, system integration and systems engineering.  Judgments, decisions, and directions directly and significantly affect the successful accomplishment of many highly technical development efforts that represent major allocations of national resources. The incumbent performs strategic planning of the overall aviation science and technology program and associated manpower, facilities, and equipment requirements and is held accountable for the long-term capability of the RDECOM and AMRDEC to perform the aviation science and technology program mission.  Managerial expertise, creative ability, technical competence, and leadership ability, provide key contributions to basic research and non-systems advanced development programs in the most difficult and challenging areas of national defense. The scope and responsibility of this position is further magnified because of the worldwide and international scope of the program. |
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3. Director, Aviation Engineering Directorate, RDECOM

November 2004 to December 2011

Serves as Director of the Aviation Engineering Directorate, which is responsible for planning, directing, staffing, managing, and controlling broad aviation engineering programs which encompasses development and technical management; complete life cycle engineering development (from concept formulation through development, qualification, production, fielding, and sustainment) of aircraft components, aircraft systems, subsystems and support equipment; technical, development and engineering support to the worldwide operational aircraft fleet; provides Command interface for development and qualification of DA aircraft with PEO/Program/Project/Product Managers and the aerospace industry; manages the assigned developmental and operational aircraft systems and related aviation material for Army Field Commanders, other AMC MSC's, DA, AMCOM, and other RDECOM elements; conducts DA's Airworthiness Qualification and Aeronautical Design Standards Programs as prescribed by AR 70-10 "Test and Evaluation during Development and Acquisition of Material", AR 70-62 "Airworthiness Qualification of U.S. Army Aircraft Systems" which implement Safety of Flight messages, Airworthiness and Contractor Flight Releases, Airworthiness Impact Statements, Source Approval Requests, etc.; identifies deficiencies in fielded equipment; ensures and improves the quality of all aviation material throughout the entire life cycle; evaluates proposed changes; and provides recommended courses of action to managers. Further responsibility includes the planning, programming and management of assigned research and development programs, i.e., Component Improvement Program with a total budget authority of approximately $165M annually. As such, is a principal DA authority on airworthiness and aircraft flight safety. Program responsibility includes airworthiness qualification support of approximately 10,000 fielded Army aircraft (UH-60 Black Hawk, UH-1 Huey, CH-47D Chinook, H-58A/C Kiowa, OH-58D Kiowa Warrior, Fixed Wing, Longbow and AH-64 Apache; development and qualification activities leading to fielding of new systems (AH-64 Longbow, Modernized Utility Black Hawk UH60M, Light Utility Helicopter, Advanced Cargo Aircraft, Unmanned Aerial Vehicles and Armed Reconnaissance Helicopter), and planning for future systems (UH-60 and AH-64, Preplanned Product Improvements, Block Improvements, RECAP, and RESET programs). Additionally, he is responsible for Flight Safety Parts Program and aviation ground support equipment.

4. Branch Chief, Flight Controls and Handling Qualities, AED

March 2004 to November 2004

Responsible for all developmental and fielded flight control airworthiness and handling qualities. Serve as the senior handling qualities representative for specification development. Serve as advocate for improving flight controls and handling qualities for all army aircraft. Monitor contracted and government ground and flight testing of Army aircraft. Work jointly with the S&T community to facilitate air vehicle design improvements. Review and determine operational requirements capabilities for flight controls and handling qualities. Participate on all aircraft development PDR, CDR, IPR and other reviews in support of aircraft developmental efforts. Serve as the subject matter expert on topics relating to flight controls and handling qualities.

5. Chief Engineer, RAH-66 Comanche

February 2003 to March 2004

Responsible for overall design of the Comanche during the development of a Joint ACAT 1D helicopter acquisition program including technical, supportability and cost. Major design areas include airvehicle, sensors, avionics and interoperability, systems engineering and supportability. The Air Vehicle effort requires supervision of multiple disciplines to develop and integrate the airframe, rotor, engine and various subsystems. The Sensors and Armament effort requires supervision and integration of various weapon systems to the air vehicle including 20 MM cannon, rockets, and various missiles. Additionally, the system requires management and development of an Electro-Optical Target Acquisition System and a Night Vision Pilotage System consisting of a Forward Looking Infrared (FLIR), TV Sensors and a LASER Designator. The CNI effort requires management and supervision for the development and integration of the fully integrated, open-architecture, multi-band communication system and the Aircraft Survivability Equipment. An embedded task is the development of airborne mission computers and electronics architecture including options for planned obsolescence. The crew station effort requires the development and integration of the crew station, controls, and a wide field of view helmet mounted display and sighting system. This necessitates the employment of two full motion simulators and many part task simulators. The supportability tasks include maintenance, logistics and training to support the aircraft. This required the development of the life cycle Simulation Support Plan and related equipment. The program employs three Comanche Portable Cockpits for user development efforts including force-on-force simulations, tactics development and crew station design. Additionally, the program is developing a Combat Mission Simulator, a Combat Mission Simulator and various part task trainers. An Interactive Multi-media Instruction program will be used as a portion of the individual training program.

6. Division Chief, RAH-66 Comanche Systems Engineering Division (ELMCO)

July 2002 to February 2003

Responsible for all systems integration and engineering activities during the development of a Joint ACAT 1D helicopter acquisition program. Specific disciplines included Test and Evaluation, Engineering Technologies, Crew Station, Software, Requirements, Aircraft Integration, Configuration Management, Quality Assurance and Manufacturing / Producibility. The complex, fully integrated platform includes a multi-program effort including Air Vehicle, Sensors and Armament and Communication, Navigation and Identification (CNI) components. The Air Vehicle effort requires supervision of multiple disciplines to develop and integrate the airframe, rotor, engine and various subsystems. The acquisition blocking strategy requires a very large, multi-layered, software program for flight controls and integrated capabilities to be developed concurrent with the Air Vehicle. The Sensors and Armament effort requires supervision and integration of various weapon systems to the air vehicle including 20 MM cannon, rockets, and various missiles. Additionally, the system requires management and development of an Electro-Optical Target Acquisition System and a Night Vision Pilotage System consisting of a Forward Looking Infrared (FLIR), TV Sensors and a LASER Designator. The CNI effort requires management and supervision for the development and integration of the fully integrated, open-architecture, multi-band communication system and the Aircraft Survivability Equipment. An embedded task is the development of airborne mission computers and electronics architecture including options for planned obsolescence. The crew station effort requires the development and integration of the crew station, controls, and a wide field of view helmet mounted display and sighting system. The engineering technologies effort includes all disciplines necessary for execution of the above program as well as survivability, E3, weight management, safety and simulations. The requirements group ensures the user requirements are properly decomposed and allocated to lower tier suppliers. Administrative tasks include briefings to OSD / General Officer levels, technical discussions and presentations on the above mentioned technologies, program planning including cost, schedule and performance and contract monitoring using EVMS.

7. Consultant, Avionics Certification (Westar Corporation)

December 2000 to July 2002

Responsible for development of a Certification Program for complex, future avionics systems. Developed Aeronautical Design Standards (ADS) for Instrument Flight Rules, Communications Equipment, Navigation Equipment and Global Air Traffic Management System. Developed a conceptual model for certifying avionics that melds FAA and DOD requirements.

8. Associate Professor, Aviation Systems, University of Tennessee

September 1996 to July 2002

Functioned as chairman of the Aviation Systems program. Responsible for instruction of aviation related materials in support of the Aviation Systems program. Responsible for development and implementation of the Aviation Systems academic program of study. Expanded the program from 2 academic tracts to 5 tracts. Increased the student population by 66% during tenure as Chair. Responsible for facilities, operations and personnel in support of the UTSI Flight Research Facility, including operations, maintenance and budget. Successfully conducted classes in Aviation Systems Overview, Fundamentals of the Helicopter, V/STOL Aircraft, Aircraft Stability and Control, Aircraft Controls, Helicopter Performance Flight Testing, Helicopter Stability and Control Flight Testing, Advanced Flight Test Techniques and Aviation Human Factors for resident and distance students. Utilized various software applications in classes including MATLAB, SIMULINK, CIFER, FLIGHTLAB, CONDUIT and LABVIEW. Pioneered simulation model extraction from flight test for general aviation aircraft using frequency domain techniques. Functioned as course director for the first V/STOL short course offered at UTSI. Additionally, served as director and test pilot for several short courses in Helicopter and Airplane Flight Test Techniques. Obtained research contracts in excess of $600,000 in support of education and research. Served as subject matter expert for Virtual Prototyping of Flight Test Simulation Station for the Army Technical Test Center. Implemented the rotorcraft academic and research efforts at UTSI resulting in acquisition of two fully instrumented helicopters, initiation of several helicopter research programs and cooperative agreements with the US Army, Navy Test Pilot School and various industry partners. Established UTSI as team member on various omnibus contracts in support of research and education at Redstone Arsenal. Led UTSI effort for participation in the Army Aviation Corridor of Excellence (AACE), Sikorsky Aircraft flight test facility relocation, AEDC airfield acquisition and activation. Participated in various research efforts in support of 160th SOAR, AMCOM, PEO Aviation, and various industrial partners.

9. Product Manager, Special Project 132

September 1992 to September 1996 LTC

Responsible for centralized management of all cost, schedule and performance aspects during research, development, acquisition, testing and sustainment of an $85M classified aviation program. Additionally, managed a "Skunk Works" organization of 32 personnel that included technical, budget, security, and contracting and administration personnel with an annual budget in excess of $200 M. Managed programs that involved development and application of state-of-the-art, leading edge technologies requiring a proper balance between risk and cost. Functioned as the technical lead for helicopter development efforts, signature control applications, weaponization including various gun, rocket and missile systems, and systems integration. Employed innovative, streamlined acquisition approaches utilizing nondevelopmental items as appropriate. Functioned as system integrator for several complex mission equipment packages that included integrated communication, navigation, electro-optics and crew resource applications. The electro-optic systems included FLIR, TV and LASER designators. Developed autopilot systems and controls modifications to various aircraft. Developed and managed active and passive ASE for various platforms. Developed cockpit configurations compatible with mission requirements. Functioned as Experimental Test Pilot on various developmental projects. Functioned as the airworthiness official for modification of aircraft.

10. Rotorcraft Flight Simulation Engineer (US Army at Georgia Tech)

August 1989 to September 1992 LTC

Responsible for the procurement, management, development and validation of a $l.6M selective fidelity, manned, real-time rotorcraft flight simulator. Obtained government funding, procured equipment, constructed analytical rotorcraft models using a generic MATLAB based commercial software (FLIGHTLAB) and integrated flight hardware into the system. This effort required procuring hardware, developing models, writing object-oriented code in FORTRAN and C++, managing software configuration, verifying functionality of code, implementing macros to interface with hardware and validating the code using flight-test data. Analytical objects in simulation included: flight controls, rotor dynamics and aerodynamics, fuselage aerodynamics, engine, and various related systems. Functioned as SGI computer system manager and software engineer for the simulation facility. Produced the benchmark research dissertation forassessment of manned weapon system fidelity requirements. Developed the Distributed Interactive Simulation capability for the facility. Conducted both time and frequency domain test techniques for validation. Utilized CIFER for frequency domain validation techniques. Developed a methodology for assessing required simulation fidelity. Participated in working groups to establish the FAA requirements for rotorcraft simulator fidelity. Orchestrated and hosted simulation conferences. Conducted a preliminary design of a coaxial helicopter unmanned aerial vehicle including analyses for performance, structures, controls, dynamics, signature control and systems integration. Major research areas focused on aerodynamics, helicopter design, and control theory including classical, linear (including H∞) and nonlinear techniques for both analog and digital applications.

11. Experimental Test Pilot (US Army Aviation Engineering Flight Activity)

July 1987 to Sept 1989 MAJ

Perform engineering flight tests on experimental, modified and production aircraft and simulators to define performance, flying qualities, airworthiness and fidelity. Subject Matter Expert for simulation validation using flight test. Manage all aspects of flight projects including planning, cost, schedule, maintenance, instrumentation, personnel, airworthiness and reporting. Prepare briefings and technical reports for senior leadership to disseminate test results. Function as the standardization instructor pilot. Served as the unit Inspector General.

12. Aerospace Engineer (US Army Aviation Systems Command)

May 1984 to June 1986

Performed as the engineering team chief for the development of the OH-58D Advanced Helicopter Improvement Program and the Air-To-Air STINGER missile program. Responsible for all engineering development, design criteria, system integration, airworthiness qualification, and flight releases. Developments included the integration of multi-band avionics, airborne computers and ASE. The visionics system included FLIR, TV and LASER designation components. Responsible for approval and certification of all system software. Developed cockpit to accommodate 5th percentile female and 95th percentile male including a fixed Heads-up display and sighting system. Succeeded in solving all engineering efforts of the OH-58D for the Production Milestone. Developed the Airworthiness Substantiation Documentation Report (AQSR) for fleet airworthiness. Planned and executed the OH-58 STINGER program from concept to firing tests. This effort included both the OH-58C / D. Conducted the initial concept study for weaponizing the OH-58D that resulted in the 406 Combat Scout and Kiowa Warrior. Weaponization efforts included applications for roof mounted sighting system, mini-gun, rockets, TOW and HELLFIRE systems.

13. Executive Assistant to Commanding General (US Army)

October 1980 to August 1981

Responsible for organizing calendar, managing staff and coordinating activities of the organization. Performed duties as writer of speeches, briefings and letters for senior army leadership, protocol coordinator, receptionist and administrative assistant.

14. Flight Commander and Instructor (US Army)

March 1979 to October 1980

Responsible for 15 flight instructors that trained students to become combat rated aviators. Managed aircraft and instructor scheduling, academic training and instructor professional development. Additionally, perform duties as an instructor pilot including both platform and flight instruction. Develop, supervise and evaluate student pilots to insure the use of safe and proper flight practices and adherence to applicable Army and FAA flight rules and regulations.

15. Field Artillery Officer (US Army)

March 1976 to March 1979

Responsible for the supervision, performance and career development of a 110-man section. Responsible for maintenance and availability of all associated equipment. Managed, supervised and trained a Nuclear Weapons Assembly team.

FLIGHT EXPERIENCE

Master Army Aviator

Experimental Test Pilot

Standardization Instructor Pilot

Airplane and Helicopter Rated

FAA Commercial Rating: Single/Multi Engine Land and Helicopter

Type rated: S-70, OV-1

Flight Hours: Over 5500 hours total; Over 1600 instructor hours

Aircraft Qualifications: Beech: King Air, Baron, Turbo Mentor

 Sikorsky: Blackhawk

 Boeing: Sea Knight

 Bell: Iroquois (Huey), Kiowa (Jet Ranger)

Additional flight experience: Airplane: F/A-18, F-4, T-2, A-4, T-28,

T-33, A-37, T-38, C-5, C-141, P-3, Variable Stability Lear Jet,

DeHaviland Dove, Twin Otter, Pitts, Spin Training (T-2), Aerobatics

Training, Cessna, Piper, Navion In-flight Variable Stability Aircraft

 Helicopter: Bell 222, Hughes 530, S-76, BK-117, Variable Stability CH-46, Schweitzer 330, SH-60, S-3, Hughes 300C.

RELATED EXPERIENCE

Top Secret SCI Clearance

Level III Certified Acquisition Manager, Test Manager, Engineering

Member Army Acquisition Corps

Honorary Fellow, Vertical Flight Society

Outstanding Leadership Award, NASA

Distinguished Engineering Alumni, Georgia Institute of Technology

Member, Advisory Board for Mechanical Engineering, USMA, West Point, NY

Gold Award of the Order of St. Michael (Army Aviation Association of America)

Department of the Army Civilian of the Year (2018) AAAA

PROFESSIONAL ACTIVITIES

Army Aviation Association of America (VP Programs, 1987-1989), American Helicopter Society (AHS) Redstone Chapter President (2005), AHS Handling Qualities Technical Committee, AHS Test and Evaluation Technical Committee, Society of Experimental Test Pilots, Society of Flight Test Engineers, American Institute of Aeronautics and Astronautics (AIAA), AIAA V/STOL Technical Committee, Association of Unmanned Aerial Vehicles, Rotary International and Boy Scouts of America. Frequent speaker and technical session chairman at AHS symposia and activities. AHS Handling Qualities session chairman, 1996.

VITA

1.An Experimental Study of Thrust Augmenting Ejectors, Masters

Thesis, Air Force Institute of Technology, December 1983.

2. Artificial and Natural Icing Tests of the EH-60A Quick Fix

Helicopter, Technical Report 88-06, US Army Engineering Flight

Activity, June 1988.

3. An Experimental Study of Thrust Augmenting Ejectors, 2nd International Symposium on Fluid Control and Measurement, Sheffield, England, September 1988.

4. Airworthiness and Flight Characteristics Test of the UH-60A Black

Hawk Helicopter Equipped with the XM-139 Multiple Mine Dispensing

System (VOLCANO), Technical Report 86-12, US Army Engineering Flight

Activity, December 1988.

5. Baseline Performance Verification of the 12th Year Production UH60A Blackhawk Helicopter, Technical Report 87-32, US Army Engineering Flight Activity, January 1989.

6. UH-60 Flight Simulator Evaluation, Technical Report 86-23, US Army Engineering Flight Activity, August 1989.

7. UH-60A Synthetic Flight Training System (Device 2B-38) Flight Data Correlation Evaluation, Aerotech 90, October 1990.

8. Aviation Technology Research Plan, Rotary Wing Program,

Development and Evaluation of Performance and Handling Qualities

Criteria for Low Cost, Real Time Rotorcraft Simulators - Phase I

Methodology Development, Final Report No. 101700, The Institute for

Simulation and Training, University of Central Florida, March 1991.

9. Performance and Handling Qualities Criteria for Low Cost, Real

Time Rotorcraft Simulators - A Methodology Development, 47th Annual

American Helicopter Society Forum Proceedings, May 1991.

10. A Parametric Study of a Real-Time Mathematical Model

Incorporating Dynamic Wake and Elastic Blades, 48th Annual American

Helicopter Society Forum Proceedings, June 1992.

11. Development and Validation of a Comprehensive Real-Time AH-64

Apache Simulation Model, 48th Annual American Helicopter Society Forum

Proceedings, June 1992.

12. An Aeroelastic Model Structure Investigation of a Manned Real-Time Rotorcraft Simulator, PhD Thesis, September 1992.

13. An Aeroelastic Model Structure Investigation of a Manned Real-Time Rotorcraft Simulator, 49th Annual American Helicopter Society Forum, May 1993.

14. System Identification Validation of an AH-64 Aeroelastic

Simulation Model, 49th Annual American Helicopter Society Forum, May

1993.

15. Verification and Validation of the Operational Capabilities of a Tactical Engagement Simulation System for the Apache Longbow Attack Helicopter, American Helicopter Society 55th Annual Forum, May 1999.

16. An Experimental Study of Alternate Flow Diverting Devices for the Modified MH-6J Helicopter, American Helicopter Society 55th Annual Forum, May 1999.

17. Determination of Navion Stability and Control Derivatives Using Frequency-Domain Techniques*,* Proceedings AIAA Modeling and Simulation Technologies Conference, August 1999, AIAA Paper No. 99-4036.

18. In-flight Simulators As A Reinforcement Tool For Aircraft Stability and Control Education, 38th Aerospace Sciences Meeting and Exhibit, January 2000, AIAA Paper No. 00-0526.

19. Fundamentals of V/STOL Design With Joint Strike Fighter Applications: An International Cooperative Effort, 38th Aerospace Sciences Meeting and Exhibit, January 2000, AIAA Paper No. 00-0805.

20. Flight-Testing Amateur Built Helicopters, 2001 EAA Airventure, August 2001.

21. Spin Testing of the YAK-52, Society of Experimental Test Pilots East Coast Symposium, April 2002.

22. Flight Testing Amateur Built Helicopters, American Helicopter Society 58th Annual Forum, June 2002.

23. Flight Testing Flow Diverting Devices on an OH-58A+ for Applications to an MH-6 Helicopter, American Helicopter Society 58th Annual Forum, June 2002.

24. Development of an Automated Helicopter Stability and Control Flight Testing Data Collection and Analysis Software System, American Helicopter Society 58th Annual Forum, June 2002.

25. Design of a Flow Diverting Device for OH-58A Helicopters, American Helicopter Society 58th Annual Forum, June 2002.

26. Comanche Developmental Update, 30th European Rotorcraft Forum, September 2004.

27. Comanche Tactics Expert Function, 30th European Rotorcraft Forum, September 2004.

MASTERS THESES

**Student** **Title** **Date**

FLIGHT TESTING

Christopher M. Wilcox The Effects of Trailing Edge-Up May 1997

 Deflection and Center of Gravity

 Position on Aircraft Power Required

 And Drag

Thurmond Lea, III Ski Jump: Launching Into the 21st Century Aug. 1997

Bradley James McKeage Limited Flight Test Development and Aug. 1997

 Evaluation of Prototype G-LOC Detection

 System

Rodney Charlynn Allison A NDI Solution For Taskload Reduction of Dec. 1997

 A/MH-6 Mission Pilots

William Waters, Jr. A Flight Test Evaluation of Seaplane May 1998

 Takeoff Performance With Respect to

 Delta Ratio

Thomas Charles Gurney Carrier Suitability Testing F/A-18E/F May 1998

Eric Brent Treworgy CH-46F Helicopter Automatic Flight Aug. 1998

 Control System Evaluation

Randy Lee Bolding Handling Qualities Evaluation of the Dec. 1998

 Navion Airplane (N66UT) Using

 Frequency Domain Techniques

Jeffrey Scott Bender Flight Testing Amateur Built Dec. 1999

 Helicopters

Jeffrey Alan Karnes Flight Inceptor Prototype Testing to Dec. 1999

 Improve Handling Qualities in the

 V/STOL Jetborne and Semi-Jetborne

 Flight Regimes

David L. Woodbury F/A-18 Single Engine Minimum Control Dec. 2000

 Airspeed: An Investigation of Angle-of-Attack

 and Lateral Weight Asymmetry Effects

Kelly E. McDougall Flight Testing Flow Diverting Devices on Dec. 2000

 an OH-58A+ for Applications to an MH-6

 Helicopter

Alan Davis Development of an Automated Helicopter Dec. 2000

 Stability and Control Flight Testing Data

 Collection and Analysis Software System

Gregg Allen Deetman Performance Evaluation of an OH-58A+ with May 2001

Dimpletape Installed

COCKPIT DESIGN / AVIATION HUMAN FACTORS

Daniel Joseph Krall The Design, Development, and Evaluation Aug. 1997

 of the AN/AVS-7 NVG-HUD Symbology

 for the CH-53F Helicopter

Paul Curtis Schreck Demonstration of a Gimbal Mounted, High Dec. 1997

Resolution Charge Coupled Device (CCD)

Television Camera in Lieu of Direct View

Optics for Air–to-Ground Targeting

Gregory Warren Carter Controlled Flight into Terrain: Human Dec. 1998

 Factor Causes and Technology Cures

Martin Gerard Rollinger An Evaluation of the Man-Machine Dec. 1998

 Interface With the Advanced Tactical

 Airborne Reconnaissance System

 Installed in the F/A-18D Aircraft

Michael Renick Moore HH-60H Armed Helicopter Sub-System May 1999

 Operator Workload Assessment

Thomas William Hofer Implementing Operator-Centered Cockpit May 2000

 Design in the EA-6B ICAP III Aircraft

Gregory Clark Huffman An Evaluation of the Situational May 2000

 Awareness Display Format in the

 F/A-18 Aircraft

Donald J. Parker An Investigation Into Brake Release on Aug. 2000

 The Catapult – a Non-ergonomic Solution

to an Ergonomic Problem in the T-45

Goshawk

AVIATION SIMULATION

William Oefelein Flight Test Matrix Reduction May 1998

Robert Thomas Erdos A Case Study Assessment of Operational May 1999

 Utility for an Advanced Helicopter

 Flight Simulator: The CH-46 Tactical

 Helicopter Mission Simulator

Robert A. Pupalaikis The Development of a Verification May 1999

 And Validation Plan for a Proposed

 Tactical Engagement Simulation

 System for the AH-64D Longbow

 Apache Helicopter

Mark Jackson UH-60 Global Positioning System (GPS) Aug. 2001

Tactical Approach Investigation

AIR VEHICLE DESIGN

Randall George Short Use of Commercial Electronic Components May 1998

 In Missile Systems

Eric Grayson Hicks Experimental Study of Alternative Flow May 1998

 Diverting Devices for the Modified MH-6J

 Helicopter

Nadine Lynelle Lashier Use of Shuttle Orbiter Aerodynamic Data May 1999

 to Validate Accommodation Coefficient

 Models

Matthew P. Mulnick Design of a Flow Diverting Device for Dec. 2000

 OH-58A Helicopters

AVIATION SAFETY

Brett M. Pierson Flight Test Safety: Lessons Learned Aug. 1998

 From An S-3B Flight Test Mishap

 During a Frequency Domain Test

OTHER

Dale L. Zimmerman Non-Thesis: THEF-15 Test and Dec. 1999

 Support Fleet Modernization

 Project