Boot Study I: Data Organization and IISYS Session

User’s Manual

Jaycor Technical Report J3150.32-00-126

Prepared by:
Bryant L. Sih, Ph.D.
Jaycor

US Army Medical Research and Materiel Command
Contract No. DAMD17-00-C-0031
Award Number: DAMD17-00-C-0031

TITLE: Modeling for Military Operational Medicine Scientific and Technical Objectives (Boot Study I: Data Organization and IISYS Session) (User's Manual)

PRINCIPAL INVESTIGATOR: James H. Stuhmiller, Ph.D.
Bryant L. Sih, Ph.D.

CONTRACTING ORGANIZATION: Jaycor
San Diego, California 92121-1002

REPORT DATE: September 2000

TYPE OF REPORT: Final

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

DISTRIBUTION STATEMENT: Approved for Public Release;
Distribution Unlimited

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision unless so designated by other documentation.
**4. TITLE AND SUBTITLE**  

**6. AUTHOR(S)**  
James H. Stuhrmiller, Ph.D.  
Bryant L. Sih, Ph.D.

**7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)**  
Jaycor  
San Diego, California 92121-1002

**8. PERFORMING ORGANIZATION REPORT NUMBER**

**9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)**  
U.S. Army Medical Research and Materiel Command  
Fort Detrick, Maryland 21702-5012

**10. SPONSORING / MONITORING AGENCY REPORT NUMBER**

**11. SUPPLEMENTARY NOTES**  
Report contains color.

**12a. DISTRIBUTION / AVAILABILITY STATEMENT**  
Approved for Public Release; Distribution Unlimited.

**12b. DISTRIBUTION CODE**

**13. ABSTRACT (Maximum 200 Words)**

**14. SUBJECT TERMS**  
Unclassified

**15. NUMBER OF PAGES**  
52

**16. PRICE CODE**

**17. SECURITY CLASSIFICATION OF REPORT**  
Unclassified

**18. SECURITY CLASSIFICATION OF THIS PAGE**  
Unclassified

**19. SECURITY CLASSIFICATION OF ABSTRACT**  
Unclassified

**20. LIMITATION OF ABSTRACT**  
Unclassified
Table of Contents

CHAPTER 1
INTRODUCTION ...................................................... 1

  Setting up an IISYS Session .......................... 2
    Starting IISYS Boot Study I from the Web .......... 2
    Starting IISYS Boot Study I from a Local Computer 3

CHAPTER 2
DIRECTORY LAYOUT AND FILE NAMING SCHEME ............. 5

  Directory Layout ........................................... 5
  Biomechanic Data File-Naming Scheme .................. 7

CHAPTER 3
IISYS SESSION TUTORIAL ....................................... 9

  Beginning the Boot Study I Session .................. 9
  Read the Executive Summary ......................... 11
  View the Boot Characteristics ....................... 11
  Generate a Ground Reaction Force X/Y Graph .......... 12
  Overlay Additional Curves and Copy Data to the Clipboard 13
  Generate a Tekscan 3D Surface Graph .................. 15
  Exit the Boot Study I Session ......................... 15

CHAPTER 4
BOOT STUDY I IISYS SESSION CONTENTS ..................... 17

  IISYS Context Page Summary Table ..................... 18
  Starting the Boot Study I Session ................... 19

  Home Page .................................................. 21
  Boots & Subject Information Pages ..................... 22
    Boot Information ........................................ 22
APPENDIX B
INSTALLING BOOT STUDY I ON A LOCAL COMPUTER

 Binary Data Installation  43
 ASCII Data Installation  44
 Original Data Installation  44

INDEX  45
Introduction

Because of the large incidence of blisters and other foot injuries associated with ill-fitting boots, the U.S. Army commissioned the Military Performance Division of the U.S. Army Research Institute of Environmental Medicine and the U.S. Army Natick Soldier Center to evaluate 12 boots for performance, efficiency, biomechanics, comfort, and injury. Fourteen subjects hiked, ran, walked, and jumped while various measures of boot performance were collected. This experiment generated over 10,000 files and requires more than 4.7 gigabytes of storage for the original data set. A description of the work and the conclusions drawn can be found in the report “A comparison of 2 current-issue Army boots, 5 prototype military boots, and 5 commercial hiking boots: performance, efficiency, biomechanics, comfort and injury.”

The objective of the Jaycor project is to provide an archival organizational scheme for the data that takes advantage of specialized software to easily select, view, analyze and present the information from Boot Study I.

The original data was received as a combination of files in ASCII, comma-delimited (.csv), and Excel (.xls) formats. The time-based data (e.g. rear foot angle versus time) was converted into General Data Interchange Format (GDIF)—a self-documented ASCII format (.jif) with variable name, units, and description included within the file. The GDIF ASCII format can be read by any text-based application, such as Excel or Notepad. The GDIF ASCII format was then converted into a binary format (.jib) that contains internal directories and pointers for rapid binary access. The GDIF binary format can be accessed by the programs in the Jaycor Data Access Toolkit. In addition, the original data contained computed variables and other nontime-based data.

(e.g. average foot pressure). These quantities were placed in an MS Access database. Other than conversion of format, no modification of the original data was made.

The purpose of this User's Manual is to describe the organization of the data directory structure to allow the user to retrieve data directly from the files, as well as to provide instruction on how to access the data through the IISYS program. The User's Manual does not make conclusions, recommendations, and any other opinions on the methods or results of Boot Study I.

It is suggested that after setting up IISYS (either via the web or by installing to a local computer), users go through the Tutorial (Chapter 3) to become familiar with the data session. This tutorial will provide a starting point to "explore" the data using IISYS. Chapter 4 details each type of Boot Study I data and how to access it from within IISYS. In addition, Appendix A describes Surface Viewer, a program to view Tekscan insole pressure data in 3-dimensions.

**Setting up an IISYS Session**

There are currently two methods to start an IISYS session and gain access to the Boot Study I data: from the Jaycor server via the Web or by installing IISYS and the data on a local computer. Because of the large amount of disk space required to install the data for this study, the preferred method is to access the data via the Web. This has the added benefit of allowing researchers to access the data from any Windows-compatible PC connected to the Internet. In addition, there is a very limited dataset contained on a single CD (Boot Example) for small inquires and demonstration purposes.

The next section describes how to access IISYS and Boot Study I via the Web and from a local computer. How to install the Boot Study I data on a local computer is covered in Appendix B. For information on how to install IISYS on a local computer or how to use IISYS, please see the documentation supplied with the IISYS program.

For Web access, the Boot Study I IISYS session requires a PC-compatible computer with either a Web browser connected to the Internet. For a locally installed session, Windows 95/NT 4.0 (or higher) with Internet Explorer 4.0-5.01 and IISYS version 4.0 is required. A screen resolution of 800 × 600 or higher is recommended.

**Starting IISYS Boot Study I from the Web**

Please refer to Supplemental Instructions: Starting IISYS Boot Study I from the Web.
CHAPTER 1: INTRODUCTION

Starting IISYS Boot Study I from a Local Computer

1. After installing the Boot Study I data (Appendix B), start IISYS on a local computer.

2. From the IISYS File menu, choose Open Session.

3. Navigate through the folders, open the HotFiles folder in the Boot Study I folder and open the BootStudyI ses session file.
Directory Layout and File Naming Scheme

The magnitude and complexity of Boot Study I requires a precise storage and naming system in order to retrieve the data quickly and easily. This chapter explains the directory layout of the data and the file-naming scheme for researchers to locate the three types of data described in the Introduction. Note that understanding the contents of this chapter is not required for users who will be using IISYS exclusively since the program locates the proper data files automatically.

Directory Layout

Because of the large amount of disk space required to contain this project, the data was partitioned into directories depending on file type. The original data (as submitted to Jaycor, Inc. for organization) was preserved in its own folder system (Tests-OriginalData). In addition, biomechanic text-based GDIF (.jif) files were compressed and saved in its own folder system (Tests-BiomechanicsLabJIFData). Binary GDIF (.jib) files were left uncompressed in a directory structure designed for access from an IISYS session (Tests). Within each folder system, the data was categorized based on the experiment or “test” (10 km March, 400 m Max Speed Run, Biomechanics, and O₂ Consumption). The folder layout for each data type can be found in the figures on the following page.
CHAPTER 2: DIRECTORY LAYOUT AND FILE NAMING SCHEME

**Original Data Folder Layout**

- Tests-OriginalData
  - 10kmMarch
  - 400mMaxSpeedRun
- BiomechanicsLab
  - ForcePlatform
  - InvDyn
  - KneeStats
  - RearFootAngle
- Tekscan
  - Tekscan-asf
  - Video

**.jif Data Folder Layout**

- Tests-BiomechanicsLabJIFData
  - Jumping
  - Running
  - Walking

**.jlb Data/ISYS Session Folder Layout**

- Boot Study I
  - Backgnd
- Boots
  - Pictures of boots
  - Database
  - Documentation
  - HotFiles
- Tests
  - 10kmMarch
    - Pictures of 10km March
  - 400mMaxSpeedRun
    - Pictures of Run
- BiomechanicsLab
  - Jumping
    - Pictures of BiomechanicsLabSetup
  - Running
    - UnclearProtocolTrials
  - Walking
  - O2Consumption
Biomechanic Data File-Naming Scheme

The large variety of experimental conditions required the use of a precise file-naming scheme, which was implemented by the researchers during data collection and preserved for this organization. To help further categorize the data into meaningful partitions, folders containing data from an individual experiment were created. In addition to Walking, Running, and Jumping, there were five other experimental parameters that dictated file (and folder) names: Side, Subject, Boot, Pack, and Trial Number. The naming convention can be found in the table below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Identifier</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side</td>
<td>1st Letter</td>
<td>L,R-Tekscan Only</td>
</tr>
<tr>
<td>Subject</td>
<td>s</td>
<td>1-9, A, C-F</td>
</tr>
<tr>
<td>Boot</td>
<td>b</td>
<td>1-12</td>
</tr>
<tr>
<td>Pack</td>
<td>p</td>
<td>0, 1</td>
</tr>
<tr>
<td>Trial</td>
<td>t</td>
<td>1,2,3-walking, no pack</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A,B,C-walking, 60 lb. Pack</td>
</tr>
<tr>
<td></td>
<td></td>
<td>F,G,H-running</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K,L,M-jumping</td>
</tr>
</tbody>
</table>

In addition, the file suffix indicates file type and is defined in the table below.

<table>
<thead>
<tr>
<th>Suffix</th>
<th>Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>_ASF</td>
<td>Tekscan</td>
</tr>
<tr>
<td>_GRF</td>
<td>Computed biomechanic variables</td>
</tr>
<tr>
<td>_RFA</td>
<td>Rear foot angle</td>
</tr>
<tr>
<td>_TAD</td>
<td>Raw force platform data</td>
</tr>
<tr>
<td>_VID</td>
<td>Raw video coordinates</td>
</tr>
</tbody>
</table>
IISYS Session Tutorial

The purpose of this tutorial is to familiarize the user with some of the features of this IISYS session, most notably, the ability to view a set of experimental results from one out of ~3,000 experimental trials with only a few mouse clicks.

Beginning the Boot Study I Session

1. After starting IISYS Boot Study I session (page 2), a window similar to the one below appears. Note the three frames where information will be input and displayed: Context Document, Item List, and Data Viewer.
CHAPTER 3: IISYS SESSION TUTORIAL

2. The Title Page for this project should be visible in the Context Document window.

3. Click on the orange HotSpot in the lower right corner of the Title Page (Next).

4. The ensuing page notes the lack of some data in the Boot Study I session and suggests initializing some parameters to insure that a data set is presented during the session. Because this tutorial will access data that is known to exist, bypass the parameter initialization and click on the orange Hotspot in the lower corner (Next) to move to the Home Page.
CHAPTER 3: IISYS SESSION TUTORIAL

Read the Executive Summary

1. Click on the blue HotSpot to the left of Executive Summary to view the document in Word. Exit Word and return to the IISYS session to continue the tutorial.

View the Boot Characteristics

1. From the Home Page, click on the light blue information HotSpot to the left of Boot Information.

2. Click on a blue numbered hotspot beneath a boot picture (e.g. Boot 6) to show the available information the Item List window.

3. To view the available database information (Name, Weight, Performance Index, etc.), click on the entry containing the green-labeled Item 1.

By moving the mouse pointer over a database field, the field name definition appears on the bottom of the screen.
CHAPTER 3: IISYS SESSION TUTORIAL

4. Enlarged pictures of each boot are also available by clicking on the yellow-labeled Item 2 and Item 3.

5. Return to the Home Page by clicking on the orange HotSpot in the upper right corner of the Context Document window. (This HotSpot is accessible from anywhere in the Boot Study IISYS session.)

**Generate a Ground Reaction Force X/Y Graph**

1. Ground reaction forces and Tekscan foot pressure data are part of the Biomechanic Tests group and can be accessed from the Home Page by clicking on the pink HotSpot next to Tests, followed by the HotSpot next to Biomechanics, and, finally, the HotSpot next to GRF & Tekscan.

   ⊙ Tests ⇒ Biomechanics ⇒ GRF & Tekscan

2. The ensuing GRF & Tekscan Context Document window contains multiple HotSpots to allow the selection of a specific trial quickly and easily. For this tutorial, we will access the data for Walking: Subject 2-Boot 5-No Pack-Trial 1.

3. For “Walking,” select the green HotSpot labeled “W” on the Condition line. Note that the Parameter list in the Item List Window has been updated with your selection.

4. Continue by specifying “Subject 2.” Select the blue HotSpot labeled “2” on the Subject line.

5. For “Boot 5,” select the blue HotSpot labeled “5” on the Boot line.

6. For “No Pack,” select the brown HotSpot labeled “0” on the Load line.

7. For “Trial 1,” select the yellow HotSpot labeled “1” on the Trial line.
8. At this point, the Parameter list in the Item List window should contain five items that uniquely specify the trial to be accessed, as shown below.

9. To specify ground reaction force data, click on the orange HotSpot in the upper right corner of the force platform picture (labeled “F”). This will update the Item List window to contain the ground reaction force and center of pressure components.

10. As shown on the right side of the above figure, have the data automatically graphed using the X/Y Plot Viewer by clicking on an entry in the Item section.

**Overlay Additional Curves and Copy Data to the Clipboard**

1. To add a second time-based plot to the graph, from the X/Y Plot Viewer Options menu, choose Overlay Curves.
2. Click on another entry in the Item section to add the data to the viewer.

3. To output the data from the multiple plots graphed in the viewer, choose Copy from the Edit menu of the X/Y Plot Viewer.

4. Start Excel (or any other text-based application) and choose Edit...Paste. Note that time, the variable names, and units are also pasted into the program. Exit Excel and return to IISYS to continue the tutorial.
CHAPTER 3: IISYS SESSION TUTORIAL

Generate a Tekscan 3D Surface Graph

1. To view the Tekscan foot pressure data, click on the yellow HotSpot labeled “T” in the Context Document window and select a yellow entry in Item section.

2. Start the Tekscan animation by clicking on the Run button in the lower right corner of the Surface Viewer window.

3. Change the view from 3D to 2D by unchecking the check box.

Exit the Boot Study I Session

1. This concludes the tutorial. To quit IISYS and end the Boot Study session, choose Exit from the IISYS File menu.
Chapter

Boot Study I IISYS Session

Contents

This IISYS session contains both the data and reports pertaining to Boot Study I (#000427_0940). The Boot Study I dataset was divided into four experimental datasets: 10 km Hike, 400 m Max Speed Runs, O₂ Consumption, and Biomechanics. In addition, information and pictures of the boots, tests, and subjects can be accessed from this session. The table on the following page summarizes which IISYS Context page each data set is located. After providing the step-by-step process to start the Boot Study I IISYS session, this chapter describes each of the different types of data and how they can be accessed.

Note that because of the size of this study, significant portions of data were not available at publication time and will be added to the project as it becomes available. This includes O₂ Consumption, 10km Hike, and most of the biomechanics analysis of running and jumping. The most complete data set is the biomechanics analysis of walking. Attempting to access missing data will result in a “File not found” error.

✓ Attempting to access missing data will result in a “File not found” error.

🔗 The Context Document window will contain the title of the current experimental dataset and/or subset in blue text.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>400 m Max Speed Run</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pictures</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomechanics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inverse dynamics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot pressure</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knee joint angle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rear foot angle</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kinematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angular</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angular</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative joint angle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rear foot angle</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kinetics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground reaction forces</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center of pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Segment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint reaction forces</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint power</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Raw data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force platform data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Video coordinates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tekscan data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boot Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Performance Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Pictures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Subject Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
CHAPTER 4: BOOT STUDY I IISYS SESSION CONTENTS

Starting the Boot Study I Session

1. After starting IISYS Boot Study I session (page 2), a window similar to the one below appears. Note the three frames where information will be input and displayed: Context Document, Item List, and Data Viewer.

2. Initially, the following Title Page appears in the Context Document window. To continue to the next page, click on the orange HotSpot in the lower right corner (Next).
3. The ensuing page notes the lack of some data in the Boot Study I session and suggests initializing some parameters to insure that a data set is presented during the session. Although not required, it is recommended that user's click on the yellow hotspot to initialize the parameters and continue by clicking on the orange Hotspot in the lower corner (Next) to move to the Home Page.

Important:
The data set is currently incomplete and it is possible to select a set of parameters describing a result that does not exist.

This will result in a "File not found" error.

To initialize the parameters to an existing set of results, click here before continuing: □

After clicking on the above button, click on the "Next" button to continue.
CHAPTER 4: BOOT STUDY I IISYS SESSION CONTENTS

Home Page

The **Home Page** is the starting point for the IISYS session and all the information for Boot Study I can be accessed from this page.

![Home Page Icon]

- **Executive Summary**
- **Full Report**
- **Data**
  - Boot Information
  - Subject Information
  - Tests

If you become "lost" in the IISYS session, you can always return to the **Home Page** by clicking on the Orange HotSpot in the left-hand corner of all other session pages.

The **Executive Summary** and **Full Report** are accessed from the **Home Page**. Clicking on a HotSpot will automatically launch Microsoft Word and open the appropriate file (`\.DOCUMENTATION\BOOT, PHASE I, 12 BOOTS TECH REPORT, NUMBERED REFS.DOC` and `\.DOCUMENTATION\EXECUTIVE SUMMARY.DOC`). In addition, an electronic version of the User's Manual can be found in the documentation directory (`\.DOCUMENTATION\BOOT STUDY I USER'S MANUAL.DOC`).

Clicking on the **Tests** HotSpot brings up the **Tests Page** (page 24), which is the starting point to the largest part of the IISYS session: the experimental datasets and results. Notes on **Boot Information** and **Subject Information** can be found starting on page 22. Note also that clicking on the orange HotSpot in the lower right corner brings you back to the **Title Page**.
CHAPTER 4: BOOT STUDY I IISYS SESSION CONTENTS

Boots & Subject Information Pages

In addition to a few pictures, the "information" pages provide links to a database containing the descriptive data collected on each boot and subject. In addition, Boot Information contains the rankings and performance indices used to make the recommendations and conclusions described in the Full Report.

Both the Boot Information and Subject Information pages can be accessed from almost anywhere within the IISYS session by clicking on the light blue HotSpots containing the letter "i."

The lower half of both the Boot Information and Subject Information pages contain Hotspots to the four major test groups in this study. This allows you to return to a test group without having to return to the Home Page first.

Boot Information

Accessible Data from This Page

Database Viewer
Boot ID, Name, Weight, Height, Rank, Final score, Performance Index, Variable scores

Picture Viewer
Front, Side
CHAPTER 4: BOOT STUDY I IISYS SESSION CONTENTS

Subject Information

Accessible Data from This Page

Database Viewer
   Subject ID, Age, Weight, Height, Activity
   Score, Rank, MOS
The Test Page contains the links to the four major experimental datasets: 10 km Hike, 400m Max Speed Runs, O₂ Consumption, and Biomechanics. (As of the publication time, only 400m Max Speed Runs and Biomechanics were available.) Clicking on a pink HotSpot will link to the appropriate Context Document.

**10 km Hike**

Data for this experiment was not available at publication time.
CHAPTER 4: BOOT STUDY I IISYS SESSION CONTENTS

400 m Max Speed Run

Home ⇒ Tests ⇒ 400m Max Speed Runs

Accessible Data from This Page

Database Viewer
Run time
Picture Viewer
Experimental testing procedures

Run Times

1. To access the 400m maximum speed run times for an individual or group, select the appropriate HotSpots:

Subject (or All Subjects)
Boat (or All Boots)
Load (or Both Loads)
Course (or Both Courses)
CHAPTER 4: BOOT STUDY II SYS SESSION CONTENTS

2. The Parameter list will contain the four items that uniquely specify the trial(s) to be accessed, an example is shown below.

<table>
<thead>
<tr>
<th>Item</th>
<th>Context</th>
<th>User</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBJECT 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOOT 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOAD 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COURSE</td>
<td></td>
<td></td>
<td>Straight</td>
</tr>
</tbody>
</table>

☑ Load the trial(s) into the Item List by clicking on the green HotSpot labeled “T”, as shown by the red circle in the figure on page 20.

3. Access the database by clicking on Item 1 in the Item section and viewing the data in the viewer. For a group of trials, click on Next in the lower right corner of the Database Viewer to view the next run time.

Pictures
To view an enlarged view of the pictures shown in the 400m Max Speed Run Context Document window, click on the appropriate yellow HotSpots below the pictures.

O₂ Consumption
Data for this experiment was not available at publication time.
CHAPTER 4: BOOT STUDY I IISYS SESSION CONTENTS

Biomechanics

Home ⇒ Tests ⇒ Biomechanics

Eight different subsets of data are available from within the Biomechanics experimental dataset and can be accessed by clicking on the appropriate pink or green HotSpots. A brief description of each subset is available in the following pages. Note that the upper portion of the Context Document window contains the HotSpots to set the Parameters (Condition, Subject, Boot, Load, and Trial) for the Biomechanics dataset. These settings can be set now or within any of the subset windows. The Parameter settings are saved between Biomechanic subsets.

It is easy to switch between Biomechanic subsets. Once a subset has been displayed, other subsets can be accessed by clicking on the appropriate pink HotSpot on the left side of the current page. In addition, the current subset’s HotSpot is highlighted in red.

Inverse Dynamic Summary Data

Accessible Data from This Page

Database Viewer

Inverse dynamic file name, 200 variable names
CHAPTER 4: BOOT STUDY II\SYS SESSION CONTENTS

The **Inverse Dynamic Summary Data** contains 200 variables that have been calculated from the various biomechanic values. This data is accessible from any **Biomechanic** page by clicking on the green HotSpot labeled “C.”

In the **Item List** window, All Trials (light green) or an individual trial (dark green) as specified by the **Parameters** can be selected for viewing in the **Database Viewer**.

![By moving the mouse pointer over a database field, the field name definition appears on the bottom of the screen.](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Content</th>
<th>User</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inv Dyn Computed Vars All Trials</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Inv Dyn Computed Vars Specific Trial s1h11w_g1j1b</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 4: BOOT STUDY I IISYS SESSION CONTENTS

Ground Reaction Forces and Tekscan InSole Pressure

Home ➔ Tests ➔ Biomechanics ➔ GRF & Tekscan

This Context Document accesses force platform ground reaction force data as well as Tekscan insole foot pressure measurements. Both the raw and processed data are available for viewing and export.

Instructions on how to use the Surface Viewer can be found on page 35.

Ground Reaction Forces

Accessible Data from This Page

X/Y Plot Viewer
Ground reaction forces, Center of pressure coordinates, Moments
Force platform raw signals

Tekscan InSole Pressure

Accessible Data from This Page

Surface Viewer
Raw Tekscan pressure data

Database Viewer
File name, 80 variable values

29
Kinematics (position, velocity, and acceleration) for the segments as well as the rear foot angle are accessible from this page. The linear and angular data for the foot, shank, thigh, trunk, upper arm, forearm, and head/neck segments are linked to the blue and green HotSpots. Color variations in the Item section of the Item List (as well as P, V, A in the label) indicate level of differentiation and items are plotted with the X/Y Viewer when selected.
CHAPTER 4: BOOT STUDY II

SYS SESSION CONTENTS

Rear foot angle data follows the same color variations as the segment kinematics (angle kinematics only). In addition, the dark green HotSpot labeled "C" in the rear foot angle picture links the Item section of the Item List to display the computed rear foot angle variables (such as maximum and average angle) from the Database Viewer.

**Accessible Data from This Page**

- **X/Y Plot Viewer**
  - Segment linear and angular kinematics
  - Rear foot angle kinematics

- **Database Viewer**
  - File name, 5 rear foot angle variable values
Joint Kinematics

Kinematics (position, velocity, and acceleration) for the joint centers as well as the total body center of mass are accessible from this page. The linear and angular data for the 5th metatarsal, ankle, knee, hip, shoulder, elbow, wrist, head, back, and center of mass segments are linked to the blue and green HotSpots. Color variations in the Item section of the Item List (as well as P, V, A in the label) indicate level of differentiation and items are plotted with the X/Y Viewer when selected.

In addition, the dark green HotSpot labeled “C” near the knee joint links the Item section of the Item List to display the computed knee variables (such as maximum and average angle) in the Database Viewer.

Accessible Data from This Page

X/Y Plot Viewer

Joint linear and angular kinematics

Database Viewer

File name, 5 knee joint angle variable values
Segment Kinetics

Kinetics (forces and moments) for the proximal and distal ends of each segment is accessible from this page. The three forces and moments components (laboratory reference frame X-dir, Y-dir, and Z-dir) for the foot, shank, thigh, trunk, upper arm, forearm, head/neck segments are linked to the violet and orange HotSpots. Color variations in the Item List (as well as dist and prox in the label) indicate distal and proximal kinetics. Items are plotted with the X/Y Viewer when selected.

Accessible Data from This Page
X/Y Plot Viewer
Segment distal and proximal kinetics

---

33
Relative joint angular kinematics (angle, angular velocity, and angular acceleration) as well as joint power, which is the product of relative joint angular velocity and joint moment, are accessible from this Context Document window. In addition, joint moment (repeated from the Kinetics Page) is listed in the Item List due to its involvement in the calculation of joint power. Joint power data is available for the ankle, knee, hip, shoulder, elbow, head, and total body center of mass. Total body center of mass power is given as three components (Laboratory X-dir, Y-dir, and Z-dir) as well as a resultant power.

Note that the hip and shoulder Item Lists contain joint power and relative angle entries for two directions: flexion/extension and abduction/adduction.

**Accessible Data from This Page**

**X/Y Plot Viewer**

Joint power, relative joint angle kinematics, joint moments
Electromyography signals were collected on five muscles during the biomechanics portion of this study (the gastrocnemius, hamstring, erector spinae, rectus abdominis, and quadriceps). Root mean square (RMS) values as a percent of gait cycle are available by clicking on light blue hotspot followed by Item 1 in the Item List.

**Accessible Data from This Page**

**X/Y Plot Viewer**
5 electromyography signals
Raw Video Coordinates

The 3D coordinates of 17 markers that were used in the biomechanic portion of this study are accessible from this Context Document. The markers are grouped as follows: force platform corners, pack/head, arm, upper leg, rear foot angle, and foot. Clicking on the light blue HotSpots adds the appropriate group to the Item List.

Accessible Data from This Page

X/Y Plot Viewer

17 3D videography marker coordinates
Surface Viewer 1.0

Surface Viewer 1.0 displays two-dimensional time-based data as either a 3D surface or 2D contour plot. It is a stand-alone application capable of running within a “container” application such as a web browser or ViewDoc. It also automatically launches from within an IISYS session if needed. Both Surface Viewer and ViewDoc are installed automatically with the standard IISYS installation.

Selected portions of a .jif file formatted for Surface Viewer is shown below. Note that although the data is a three-dimensional array (with time as the first dimension), it is saved as a large single-dimension array (ZDirData). The values of iPage, iXDir, and iYDir allow Surface Viewer to reconstruct the 3D array before plotting.

```c
float( ZDirData[] );
int( iPage );
int( iXDir );
int( iYDir );
float( HoleValue );
float ( Spacing[] );
float( Time[] );

data(iPage) 151;
data(iXDir) 60;
data(iYDir) 21;
data(HoleValue) -9;
data(Spacing) 0.2 0.2;

units(ZDirData, "psi");
units(iPage, "sec");
units(iXDir, "in");
units(iYDir, "in");
units(Spacing, "in");

label(ZDirData, "Boot Study I Tekscan foot pressure data (Noise Threshold 3)");
label(iPage, "Total number of frames");
label(iXDir, "Total number of sensors in Medial Lateral Direction");
label(iYDir, "Total number of sensors in Anterior Posterior Direction");
label(HoleValue, "Treat this value as a missing value");
label(Spacing, "X and Y distance between sensors");
```
APPENDIX A: SURFACE VIEWER 1.0

data(ZDirData)
  -9 -9 -9 -9 0 0 0 0 0 0 0 0 0 0 0 0 0 6.2 8.26 8.26 0 0 0 0 -9 -9
  -9 -9 -9 0 0 0 0 0 0 6.2 6.2 6.2 10.3 16.5 20.7 18.6 12.4
  6.2 0 0 0 -9
  
  .

  -9 -9 -9 -9 0 0 0 0 4.13 6.2 8.26 8.26 8.26 4.13 4.13 0 0 0 -9 -9 -9
  -9 -9 -9 -9 0 0 0 0 0 0 0 0 0 0 0 0 -9 -9 -9 -9 -9 -9

;

data(Time)
  0
  0.01667
  0.03334
  
  .

  2.48383
  2.5005

;
Starting Surface Viewer from a Web Browser

This is not the preferred method to launch Surface Viewer because it is possible to change the .vbd file association to the web browser. (If this happens, see page 40.) The preferred method is to use ViewDoc to run Surface Viewer.

1. Locate and double click ufSurfacePlot.vbd, usually in the ..\Program Files\Jayco\IISYS\Viewers\SurfaceViewer folder.

2. In the Open With dialogue box, select a web browser such as Internet Explorer.

To maintain compatibility with IISYS, make sure Always use this program to open these files is unchecked. See page 40 if a file association problem develops with IISYS.

Starting Surface Viewer from ViewDoc

1. Locate and double click ViewDoc.exe, usually in the ..\Program Files\Jayco\Utility folder.
APPENDIX A: SURFACE VIEWER 1.0

2. Click on the button labeled **Load**.

![Image: The page cannot be displayed]

The page you are looking for is currently unavailable. The Web site may be experiencing technical difficulties, or you may need to adjust your browser settings.

Please try the following:

- Click the **Reload** button, or try again later.
- If you typed the page address in the Address bar, make sure that it is spelled correctly.
- To check your connection settings, click the **Tools** menu, and then click **Internet Options**. On the **Connect** tab, click **Settings**. The settings will be provided by your local area network (LAN) administrator or your Internet service provider.
- If your LAN administrator has enabled it, select **LAN settings** and then click **Advanced**. Make sure the **Use automatic configuration (Proxy Server)** option is selected.
- If you are using a proxy server, type the proxy server address and port number.
- If you have a dial-up connection, select the **Dial-up settings** option, and then click **Properties**. Make sure that the **Dial-up** option is selected.
- If you have tried the above steps and the problem persists, contact your LAN administrator or your Internet service provider.

3. Using the browsing window, locate and open uSurfacePlot.vbd, usually in the `\Program Files\Jaycor\IISYS\Viewers\SurfaceViewer` folder.

⚠️ You may want to create a shortcut to Surface Viewer on the desktop by creating a shortcut for ViewDoc.exe and modifying the **Target Property** of the shortcut to include SurfaceViewer (i.e., "C:\Program Files\Jaycor\Utility\ViewDoc.exe" SurfaceViewer).
Opening and Viewing a File in Surface Viewer

1. After starting Surface Viewer, click on Open File in the lower left corner of the window.

2. Using the Open File dialogue box, select the GDIF file to be viewed.

3. After the file loads, click on Run in the lower right corner of the window.

Surface Viewer Options

Scroll Bar
To view a specific time frame, click and hold the scroll bar slider. Drag the slider to the desired time frame. In addition, the arrows on the end of the scroll bar can be used to increment the plot through a single time step.

3D
This checkbox switches the view from 3D (default) to a 2D contour plot.

InvertX and InvertY
These checkboxes change the view (in both 3D and 2D mode) by flipping either the X or Y axes.
APPENDIX A: SURFACE VIEWER 1.0

**Free Rotation**

Click and hold both the left and right mouse button simultaneously while the cursor is in the plotting area to allow the 3D plot to be freely rotated to any viewing angle.

**Updating the File Association**

If the following dialogue appears when starting SurfaceViewer or IISYS, Windows has inadvertently updated your file associations incorrectly.

To remove the file association, update the “VBD” *File Type*, making sure that the settings are identical to the figure shown below. (Note: you may have to delete the “VBD” setting and create a new one to incorporate all the settings.)
Appendix

Installing Boot Study I on a Local Computer

There are three copies of the data and any one of these copies can be installed on a hard drive. The approximate size of each installation is shown below.

<table>
<thead>
<tr>
<th>CD Disk #</th>
<th>Compressed</th>
<th>Uncompressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>IISYS Session (.jib data)</td>
<td>1-6: --</td>
<td>3.4 GB</td>
</tr>
<tr>
<td>.jib data</td>
<td>7: 0.4 GB</td>
<td>3.4 GB</td>
</tr>
<tr>
<td>Original data</td>
<td>8: 0.4 GB</td>
<td>4.7 GB</td>
</tr>
</tbody>
</table>

Binary Data Installation

To install the binary session from CD #1-6, copy the data on the CD’s to a hard drive, making sure to place the contents of CD #2-6 in the appropriate folders that were created by copying CD #1. The proper directory layout is shown in the .jib Data/IISYS Session Folder Layout diagram on page 6.

The step-by-step instructions are as follows:

1. Create a main folder to contain the session (e.g. D:\Boot Study I).

2. Copy all the folders in CD #1 to the main folder.

3. From CD #2, copy all the folders in
   Boot\ICD_2\Tests\BiomechanicsLab\Walking into ..\Tests\BiomechanicsLab\Walking.

4. From CD #3, copy all the folders in
   Boot\ICD_3\Tests\BiomechanicsLab\Walking into ..\Tests\BiomechanicsLab\Walking.

5. From CD #4, copy all the folders in
   Boot\ICD_4\Tests\BiomechanicsLab\Jumping into ..\Tests\BiomechanicsLab\Jumping.

6. From CD #5, copy all the folders in
   Boot\ICD_5\Tests\BiomechanicsLab\Jumping into ..\Tests\BiomechanicsLab\Jumping.
and all the folders in Boot\CD_5\Tests\BiomechanicsLab\Running into
..\Tests\BiomechanicsLab\Running.

7. From CD #6, copy all the folders in
Boot\CD_6\Tests\BiomechanicsLab\Running into ..\Tests\BiomechanicsLab\Running.

ASCII Data Installation
To install the compressed .jif version of the data, copy the folder Tests-
BiomechanicsLab\IFData on CD #7 to the hard drive, preferably into the main
folder used to install the IISYS Session since the data organization is
identical.

Original Data Installation
To install the compressed version of the original data (as submitted to Jaycor,
Inc. for organization), copy the folder Tests-OriginalData on CD #8 to the hard
drive. This data is not organized in the same manner as the binary or ASCII
files but can be placed in the main folder used to install the binary session.
Index

10 km Hike, 24
3D, 44
400 m Max Speed Run, 25
Biomechanics, 27
Boot Information, 22
center of mass, 32, 35
clipboard, 13
Context Document, 9, 19
Context Page Summary Table, 18
Data Viewer, 9, 19
Directory Layout, 5
  .jib data/IISYS session folder layout, 6
  .jif data folder layout, 6
  Original data folder layout, 6
EMG, 36
Executive Summary, 21
Exit, 15
File Association, 45
File-Naming Scheme, 7
Free Rotation, 45
Full Report, 21
Ground Reaction Forces, 29
Home Page, 21
Installation on a Local Computer
  IISYS Session Installation, 47
  JIF File Installation, 48
  Original Data Installation, 48
Inverse Dynamic Summary Data, 27
InvertX, 44
InvertY, 44
Item List, 9, 19
Joint Kinematics, 32
joint moment, 35
Joint Power, 35
knee, 33
Muscle EMG, 36
O₂ Consumption, 26
overlay curves, 13
Rear foot angle, 31
Relative Joint Angle Kinematics, 35
Scroll Bar, 44
Segment Kinematics, 30
Segment Kinetics, 33
Starting, 19
Starting IISYS, 2
Subject Information, 23
Surface Viewer, 39
  .jif file format, 39
Tekscan, 29
Tests Page, 24
Title Page, 19
total body center of mass, 32, 35
User's Manual, 21
Video, 37
Web, 2