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**A Proof-of-Concept Repository for Learning Objects: Supporting the  
Reuse and Repurposing of Redesigned Courses and Their Content**

**METS as a Container and  
Metadata Approach for Sample Course Content**

**METS Investigation Team  
Michael Pullin, Ph.D.  
<mpullin@unt.edu>**

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# METS as a Container and Metadata Approach for Sample Course Content

## 1. Introduction

In order to build the repository required for the Texas Higher Education Coordinating Board (THECB) proof-of-concept learning object repository (LOR) project, a method must be used to submit the course content. One goal for the project was investigating whether the Metadata Encoding and Transmission Standard (METS) could be used as a mechanism for submitting learning objects (LOs) into the LOR.

This document describes the activities by the METS Investigation Team outlined in the project plan (Work Area C) key activity and task related to the use of METS. This activity is defined as:

- Investigate the use of METS as a container and metadata approach for sample course content.

Some questions the team sought answers to include:

- Can METS be used as a method to ingest learning objects into the repository?
- Can METS be used as an alternative to other learning object containers (e.g., IMS Content Packaging)?

## 2. Information about METS

“The METS [metadata encoding and transmission standard] schema is a standard for encoding descriptive, administrative, and structural metadata regarding objects within a digital library, expressed using the XML schema language of the World Wide Web Consortium” (METS 2007). METS had its start as the response to a need from digital libraries to have a method for storing digital files along with their associated metadata. This method needed to have a structure for keeping digital files connected to their metadata (METS 2005). A METS document can link multiple digital files together as an item and can contain multiple metadata sections for the description of the item.

### 2.1. The Structure of a METS Document

A METS document is composed of up to seven sections; however, only one section (<structMap>) is required. These sections, with the exception of the <metsHdr> section, describe or define a different aspect of a digital object. (The term “digital object” will refer to the combination of a digital file and its associated metadata.)

#### 2.1.1. The <metsHdr> Section

The METS header section includes information about the METS record. No information about the object being described is contained here. The <metsHdr> section from the METS file in Appendix A is below:

```
<metsHdr CREATEDATE="2007-08-16T23:06:12">  
  <agent ROLE="CUSTODIAN" TYPE="ORGANIZATION">  
    <name>THECB Learning Object Repository</name>  
  </agent>  
</metsHdr>
```

#### 2.1.2. The <dmdSec> Section

The descriptive metadata section holds information about the nature and attributes of the digital object. Various schemas may be used for the metadata. In the <dmdSec> section below (taken from Appendix A), MODS is the metadata schema used.

```

<dmdSec ID="dmd_3" GROUPID="dmd_group_2">
  <mdWrap MDTYPE="MODS">
    <xmlData xmlns:mods="http://www.loc.gov/mods/v3" xmlns:xlink="http://www.w3.org/1999/xlink"
    xsi:schemaLocation="http://www.loc.gov/mods/v3 http://www.loc.gov/standards/mods/v3/mods-3-
    1.xsd"><mods:mods xmlns:mods="http://www.loc.gov/mods/v3"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.loc.gov/mods/v3 http://www.loc.gov/standards/mods/v3/mods-3-1.xsd">
      <mods:name>
        <mods:role>
          <mods:roleTerm type="text">author</mods:roleTerm>
        </mods:role>
        <mods:namePart>McMichael, Kelly</mods:namePart>
      </mods:name>
      <mods:extension>
        <mods:dateAccessioned encoding="iso8601">2007-07-27T20:49:34Z</mods:dateAccessioned>
      </mods:extension>
      <mods:extension>
        <mods:dateAvailable encoding="iso8601">2007-07-27T20:49:34Z</mods:dateAvailable>
      </mods:extension>
      <mods:originInfo>
        <mods:dateIssued encoding="iso8601">2007-07-27T20:49:34Z</mods:dateIssued>
      </mods:originInfo>
      <mods:identifier type="uri">http://hdl.handle.net/2188/57</mods:identifier>
      <mods:abstract>This is a single page from Lesson 6. It contains a discussion of the American
      Revolution and several key battles. It also includes information on the Treaty of Paris.</mods:abstract>
      <mods:note type="provenance">Submitted by Bill Watson (wrw0005@unt.edu) on 2007-07-
      27T17:35:46Z
      No. of bitstreams: 5
      06_am_rev.htm: 5436 bytes, checksum: d8a2badd6924b4cf821e1d2c0a47013f (MD5)
      image26.jpg: 28768 bytes, checksum: e1dd14e36a92798ac1a9bfdded357c0fc (MD5)
      image27.jpg: 36273 bytes, checksum: 30ee248798d5136212cba02c210742e0 (MD5)
      image28.jpg: 31946 bytes, checksum: 7ea303e3d1ba718afed2852233ad03d0 (MD5)
      yorktown.swf: 18118 bytes, checksum: efe36d166aa0dc21523aebb5c36a5e3d (MD5)</mods:note>
      <mods:note type="provenance">Approved for entry into archive by Kelly
      McMichael(kmcmichael@unt.edu) on 2007-07-27T20:49:34Z (GMT) No. of bitstreams: 5
      06_am_rev.htm: 5436 bytes, checksum: d8a2badd6924b4cf821e1d2c0a47013f (MD5)
      image26.jpg: 28768 bytes, checksum: e1dd14e36a92798ac1a9bfdded357c0fc (MD5)
      image27.jpg: 36273 bytes, checksum: 30ee248798d5136212cba02c210742e0 (MD5)
      image28.jpg: 31946 bytes, checksum: 7ea303e3d1ba718afed2852233ad03d0 (MD5)
      yorktown.swf: 18118 bytes, checksum: efe36d166aa0dc21523aebb5c36a5e3d (MD5)</mods:note>
      <mods:note type="provenance">Made available in DSpace on 2007-07-27T20:49:34Z (GMT). No. of
      bitstreams: 5
      06_am_rev.htm: 5436 bytes, checksum: d8a2badd6924b4cf821e1d2c0a47013f (MD5)
      image26.jpg: 28768 bytes, checksum: e1dd14e36a92798ac1a9bfdded357c0fc (MD5)
      image27.jpg: 36273 bytes, checksum: 30ee248798d5136212cba02c210742e0 (MD5)
      image28.jpg: 31946 bytes, checksum: 7ea303e3d1ba718afed2852233ad03d0 (MD5)
      yorktown.swf: 18118 bytes, checksum: efe36d166aa0dc21523aebb5c36a5e3d (MD5)</mods:note>
      <mods:physicalDescription>
        <mods:form>Multimedia</mods:form>
      </mods:physicalDescription>
      <mods:language>
        <mods:languageTerm authority="rfc3066">en_US</mods:languageTerm>
      </mods:language>
      <mods:originInfo>
        <mods:publisher>Texas Higher Education Coordinating Board</mods:publisher>
    </mods:mods>
  </mdWrap>
</dmdSec>

```

```

</mods:originInfo>
<mods:accessCondition type="useAndReproduction">This learning object was developed as part of
the Texas Higher Education Coordinating Board's Texas Course Redesign Project (TCRP), and all
intellectual property developed as part of the TCRP is the property of the THECB. The THECB grants to
the organization that developed this learning object a license to sell the intellectual property described in
this RFP to private institutions of higher education, as well as to other institutions of higher education
outside Texas. The profits of such sales will be divided equally between THECB and the developing
organization. The intellectual property developed as part of the TCRP is available without charge to public
institutions of higher education in Texas.</mods:accessCondition>
<mods:subject>
  <mods:topic>George Washington</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>Battle of Saratoga</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>Revolutionary War</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>Yorktown</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>Captain John Paul Jones</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>Treaty of Paris</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>American Revolution</mods:topic>
</mods:subject>
<mods:titleInfo>
  <mods:title>The American Revolution</mods:title>
</mods:titleInfo>
<mods:genre>Lesson</mods:genre>
</mods:mods></xmlData>
</mdWrap>
</dmdSec>

```

### 2.1.3. The <amdSec> Section

The administrative metadata section holds information about the management of the digital objects. A description of the rights associated with the object or technical information is stored here. As above, various schemas may be used for the metadata. METS does not prescribe how any of the metadata standards are to be used; it only provides a container for the metadata. No vocabulary or syntax is defined within METS.

One of the several <amdSec> sections from Appendix A is provided below. In the other <amdSec> sections, PREMIS (PREservation Metadata: Implementation Strategies) is used for the technical metadata.

```

<amdSec ID="license_5">
  <rightsMD ID="rights_4">
    <mdRef LOCTYPE="URL" xlink:type="simple" xlink:href="depositlicense_6.txt" MDTYPE="OTHER"
OTHERMDTYPE="DSpace Deposit License" MIMETYPE="text/plain"/>
  </rightsMD>

```

</amdSec>

#### 2.1.4. The <fileSec> Section

The file section identifies the various files which comprise the digital object. The content of the files can be included within this section or a link to an external location can be provided. Also, files can be grouped forming a structure.

In the <fileSec> section from Appendix A below, each file from the course content is referenced. The <Flocat> element defines the location of the file contents – in this case, the files are all in the same local directory.

```
<fileSec>
  <fileGrp USE="CONTENT">
    <file ID="bitstream_3" MIMETYPE="image/jpeg" SEQ="3" SIZE="36273"
CHECKSUM="30ee248798d5136212cba02c210742e0" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_3" GROUPID="GROUP_bitstream_3">
      <Flocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_291.jpeg"/>
    </file>
    <file ID="bitstream_2" MIMETYPE="image/jpeg" SEQ="2" SIZE="28768"
CHECKSUM="e1dd14e36a92798ac1a9bfded357c0fc" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_2" GROUPID="GROUP_bitstream_2">
      <Flocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_290.jpeg"/>
    </file>
    <file ID="bitstream_5" MIMETYPE="application/x-shockwave-flash" SEQ="5" SIZE="18118"
CHECKSUM="efe36d166aa0dc21523aebb5c36a5e3d" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_5" GROUPID="GROUP_bitstream_5">
      <Flocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_293.swf"/>
    </file>
    <file ID="bitstream_1" MIMETYPE="text/html" SEQ="1" SIZE="5436"
CHECKSUM="d8a2badd6924b4cf821e1d2c0a47013f" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_1" GROUPID="GROUP_bitstream_1">
      <Flocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_289.htm"/>
    </file>
    <file ID="bitstream_4" MIMETYPE="image/jpeg" SEQ="4" SIZE="31946"
CHECKSUM="7ea303e3d1ba718afed2852233ad03d0" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_4" GROUPID="GROUP_bitstream_4">
      <Flocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_292.jpeg"/>
    </file>
  </fileGrp>
</fileSec>
```

#### 2.1.5. The <structMap> Section

The structural map section gives the main structure of the resources which comprise the digital object. Various attributes of the object and its structure may also be defined here (e.g., if the organization is physical or logical). Pointers in this section refer to the files identified in the <fileSec>.

In the <structMap> section from Appendix A below, notice the organization is logical. The primary bitstream (i.e., the main html file that contains the course content and links to the images, flash, etc.) is referenced first; the associated image and flash files are referenced within a <div> section under the primary bitstream. However, interestingly, the primary bitstream is also included in this subsection. The <fptr> tags reference the file descriptions in the <fileSec> (see above). The “FILEID” in this section matches the “ID” in the <file> tag in the <fileSec>.

```
<structMap ID="struct_16" LABEL="DSpace" TYPE="LOGICAL">
  <div ID="div_17" DMDID="dmd_3" ADMID="license_5" TYPE="DSpace Item">
    <fptr FILEID="bitstream_1"/>
    <div ID="div_6" TYPE="DSpace Content Bitstream">
      <fptr FILEID="bitstream_3"/>
    </div>
    <div ID="div_8" TYPE="DSpace Content Bitstream">
      <fptr FILEID="bitstream_2"/>
    </div>
    <div ID="div_10" TYPE="DSpace Content Bitstream">
      <fptr FILEID="bitstream_5"/>
    </div>
    <div ID="div_12" TYPE="DSpace Content Bitstream">
      <fptr FILEID="bitstream_1"/>
    </div>
    <div ID="div_14" TYPE="DSpace Content Bitstream">
      <fptr FILEID="bitstream_4"/>
    </div>
  </div>
</structMap>
```

### 2.1.6. The <structLink> Section

The structural link section includes links between the components of the METS record described in the <structMap> section above. This section can be used, for example, to document hyperlinks between Web pages if the digital object being described is a Web site. It could also record an image linked on a particular Web page.

An example from the METS primer might be helpful. In order to describe the hyperlink from an image on one Web page to another Web page, the <structMap> section might contain <div> elements such as the following:

```
<mets:div ID="P1" TYPE="page" LABEL="Page 1">
  <mets:fptr FILEID="HTMLF1" />
  <mets:div XLINK:LABEL="IMG1" TYPE="image" LABEL="Image Hyperlink to Page 2">
    <mets:fptr FILEID="JPGF1" /> </div>
  </mets:div>
  <mets:div XLINK:LABEL="P2" TYPE="page" LABEL="Page 2"> </div>
</mets:div><mets:fptr FILEID="HTMLF2" /> </div>
```

To indicate that the image file (LABEL="IMG1") from the first Web page hyperlinks to the second html file (LABEL="P2"), the <structLink> section would contain the following:

```
<mets:structLink>
  <mets:smLink xlink:from="IMG1" xlink:to="P2" xlink:title="Hyperlink from JPEG Image on Page 1 to Page 2" xlink:show="new" xlink:actuate="onRequest" />
</mets:structLink>
```

See the discussion in the METS Primer (2007), pages 54-57 for further explanation.

### 2.1.7. The <behaviorSec> Section

The behavior section provides a way to link the digital content with applications associated with that content. For example, this section may link a flash file with the associated flash player. The link to the associated application is made using a <mechanism> element which links to a mechanism object which



may “contain executable code, pointers to executable code, or specifications for binding to network services (e.g., web services)” (METS Primer, 58).

An example from the METS Primer shows displaying an EAD finding guide:

```
<mets:behaviorSec>
  <mets:behavior ID="disp1" STRUCTID="top" BTYPE="display" LABEL="Display Behavior">
    <mets:interfaceDef LABEL="EAD Display Definition" LOCTYPE="URL"
xlink:href=http://texts.cdlib.org/dynaxml/profiles/display/oacDisplayDef.txt />
    <mets:mechanism LABEL="EAD Display Mechanism" LOCTYPE="URN"
xlink:href=http://texts.cdlib.org/dynaxml/profiles/oacDisplaymech.xml />
  </mets:behavior>
```

### 3. Preparing and Submitting Course Content into Repository

Submitting content manually into DSpace is very time-consuming. The METS team investigated the possibility of using METS as the ingest method for inputting records, including files and metadata, into the repository.

#### 3.1. Determining the Ingest Format

DSpace claims to allow METS to be used to create a Submission Information Package (SIP). The SIP can be submitted to the DSpace repository and DSpace will properly process the container’s information. However, no sample SIPs were provided, so the format was unknown to the METS team. In an attempt to solve this mystery, the team decided to try to export a record from the repository. DSpace allows for the METS format to be used for a Dissemination Information Package (DIP), so the team chose a record to export using this format. This allowed the team to analyze the structure of the DIP with the idea that if we could manually create a SIP using this structure, it would be possible to test the submission using METS.

##### 3.1.1. Exporting an Item from DSpace

The DSpace command line tool “dsrun” can be used to execute a packager application. The DSpace Package Importer and Exporter is the package which is used both to import and export records. The documentation for this package is here:

[http://www.dspace.org/index.php?option=com\\_content&task=view&id=144#packager](http://www.dspace.org/index.php?option=com_content&task=view&id=144#packager)

The record selected for export is shown below:

THECB Learning Object Repository: The American Revolution - Mozilla Firefox

File Edit View History Bookmarks Tools Help

THECB Learning Object Repository... x

**Learning Object Repository**  
Texas Higher Education Coordinating Board

**Search THECB LOR**  
   
[Advanced Search](#)  
[Home](#)

**Browse**  
[Disciplines & Courses](#)  
[Titles](#)  
[Subjects](#)  
[Date Published](#)

**Sign on to:**  
[Receive email updates](#)  
[My THECB LOR authorized users](#)  
[Edit Profile](#)  
[Help](#)  
[About DSpace](#)

[THECB Learning Object Repository >](#)  
[History Courses >](#)  
[U.S. History >](#)  
[U.S. History 1 >](#)  
[F. Course Topics >](#)

**Please use this identifier to cite or link to this item:**  
<http://hdl.handle.net/2188/57>

**Title:** The American Revolution  
**Learning Object Type:** Lesson  
**Discipline and Sub-Discipline:** History  
 United States History  
**Subjects:** George Washington  
 Battle of Saratoga  
 Revolutionary War  
 Yorktown  
 Captain John Paul Jones  
 Treaty of Paris  
 American Revolution  
**Summary:** This is a single page from Lesson

THECB Learning Object Repository: The American Revolution - Mozilla Firefox

File Edit View History Bookmarks Tools Help

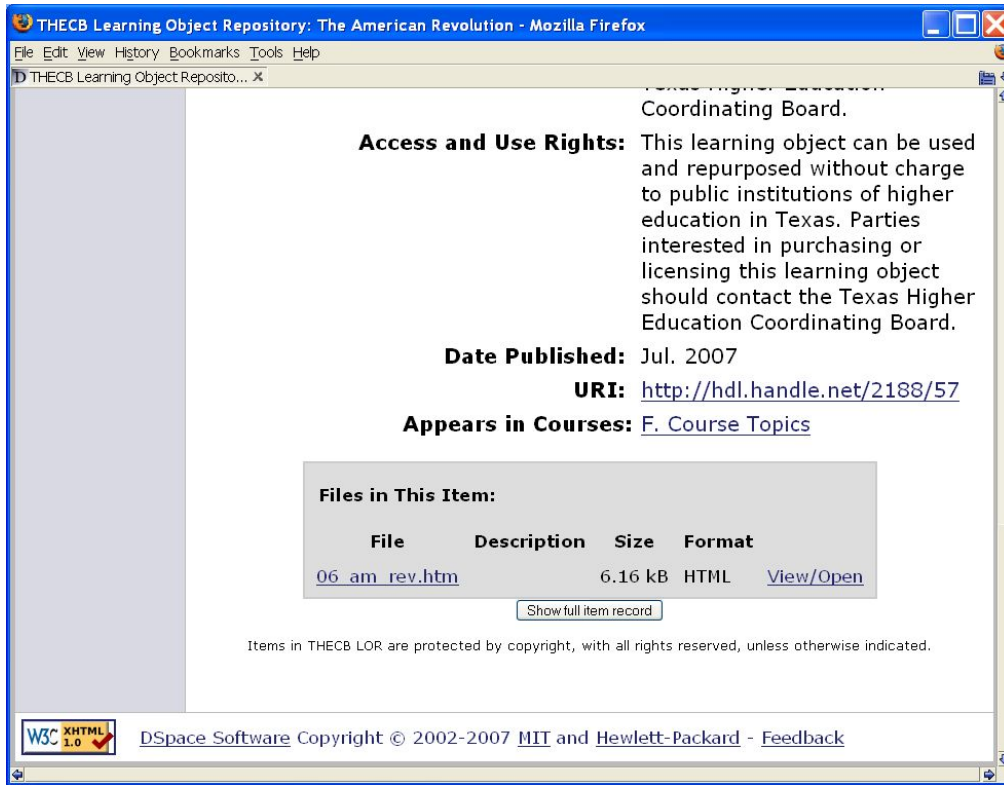
THECB Learning Object Repository... x

6. It contains a discussion of the American Revolution and several key battles. It also includes information on the Treaty of Paris.

**Intended Educational Audience:** Undergraduate Lower Division  
**Instructional Method:** Multimedia Instruction  
**Educational Interactivity Type:** Expositive  
**Educational Interactivity Level:** Low  
**Typical Learning Time:** 20 minutes  
**Difficulty Level:** Low

**Creation and Ownership Information:** Created by the University of North Texas with funding by the Texas Higher Education Coordinating Board as part of its Texas Course Redesign Program. The intellectual property of this learning object belongs to the Texas Higher Education Coordinating Board.

**Access and Use Rights:** This learning object can be used and repurposed without charge to public institutions of higher education in Texas. Parties



The command used to export the record is:

```
home/dspace3/dspace/bin/dsrun org.dspace.app.packager.Packager -e [e-mail address] -d -l 2188/57  
-t METS mets_test.zip
```

where:

- e specifies the user name (e-mail address) authorized to execute this command (removed for security purposes)
  - d specifies that this is a dissemination process
  - l specifies that the next argument is the handle of the item to process; in this case the item handle is 2188/57
  - t specifies that the next argument is the type of the package
- METS is the type of package
- mets\_test.zip is the filename for the exported METS record.

The zip file that is created contains the following files:

- bitstream\_289.htm
- bitstream\_290.jpeg
- bitstream\_291.jpeg
- bitstream\_292.jpeg
- bitstream\_293.swf

- depositlicense\_6.txt
- mets.xml

The htm, jpg, and swf files are the content for the learning object that was exported. The depositlicense\_6.txt file is the license associated with the item in DSpace. And, the mets.xml file is the METS document created as the wrapper for the exported content. The complete METS file is in Appendix A.

### 3.1.2. Analysis of the Exported METS Record

During the export process, a disturbing message was generated. The message indicated that the import/export method using METS utilizes MODS for the descriptive metadata. Additionally, there was no mapping for all DC elements into MODS; therefore, any of the DC metadata that did not map to MODS on the export, would not be available for import. This also meant that if the team were able to create METS records for ingest into DSpace, there would be no way to include all of the metadata selected by the metadata team in the imported record.

Another concern from the exported record is that the filenames are changed from the original. The primary html file ("06\_am\_rev.htm") became "bitstream\_289.htm" (see above). The images which this html file reference also had a name change. For example, "image26.jpg" located in the "images" subdirectory, now was called "bitstream\_290.jpeg" and was located in the same directory as the html file. PREMIS (PREservation Metadata: Implementation Strategies – see <http://www.oclc.org/research/projects/pmwg/> for more information) is used in the XML file to reconnect the old filename with the new. In the <amdSec> section from the METS XML file (see Appendix A) copied below, the <premis:originalName> element contains the original name of the file. The ADMID attribute of the <file> element in the <fileSec> section (copied below) links to the ID attribute of the <amdSec> element.

```
<amdSec ID="techMd_for_bitstream_2">
  <techMD ID="tech_9">
    <mdWrap MDTYPE="PREMIS">
      <xmlData xmlns:premis="http://www.loc.gov/standards/premis"
xsi:schemaLocation="http://www.loc.gov/standards/premis http://www.loc.gov/standards/premis/PREMIS-
v1-0.xsd"><premis:premis xmlns:premis="http://www.loc.gov/standards/premis">
  <premis:object>
    <premis:objectIdentifier>
      <premis:objectIdentifierType>URL</premis:objectIdentifierType>
<premis:objectIdentifierValue>http://zed.lis.unt.edu:8083/dspace/bitstream/2188%2F57/2/image26.jpg</p
remis:objectIdentifierValue>
    </premis:objectIdentifier>
    <premis:objectCategory>File</premis:objectCategory>
    <premis:objectCharacteristics>
      <premis:fixity>
        <premis:messageDigestAlgorithm>MD5</premis:messageDigestAlgorithm>
        <premis:messageDigest>e1dd14e36a92798ac1a9bfded357c0fc</premis:messageDigest>
      </premis:fixity>
      <premis:size>28768</premis:size>
      <premis:format>
        <premis:formatDesignation>
          <premis:formatName>image/jpeg</premis:formatName>
        </premis:formatDesignation>
      </premis:format>
    </premis:objectCharacteristics>
    <premis:originalName>image26.jpg</premis:originalName>
  </premis:object>
```

```

</premis:premis></xmlData>
  </mdWrap>
</techMD>
</amdSec>

....

<fileSec>
<fileGrp USE="CONTENT">
<file ID="bitstream_3" MIMETYPE="image/jpeg" SEQ="3" SIZE="36273"
CHECKSUM="30ee248798d5136212cba02c210742e0" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_3" GROUPID="GROUP_bitstream_3">
  <FLocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_291.jpeg" />
</file>
<file ID="bitstream_2" MIMETYPE="image/jpeg" SEQ="2" SIZE="28768"
CHECKSUM="e1dd14e36a92798ac1a9bfded357c0fc" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_2" GROUPID="GROUP_bitstream_2">
  <FLocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_290.jpeg" />
</file>
<file ID="bitstream_5" MIMETYPE="application/x-shockwave-flash" SEQ="5" SIZE="18118"
CHECKSUM="efe36d166aa0dc21523aebb5c36a5e3d" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_5" GROUPID="GROUP_bitstream_5">
  <FLocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_293.swf" />
</file>
<file ID="bitstream_1" MIMETYPE="text/html" SEQ="1" SIZE="5436"
CHECKSUM="d8a2badd6924b4cf821e1d2c0a47013f" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_1" GROUPID="GROUP_bitstream_1">
  <FLocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_289.htm" />
</file>
<file ID="bitstream_4" MIMETYPE="image/jpeg" SEQ="4" SIZE="31946"
CHECKSUM="7ea303e3d1ba718afed2852233ad03d0" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_4" GROUPID="GROUP_bitstream_4">
  <FLocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_292.jpeg" />
</file>
</fileGrp>
</fileSec>

```

### 3.1.3. Importing the Item into DSpace

To confirm that the exported METS package can be ingested back into DSpace, the package was submitted for import into a different instance of DSpace. The command to ingest the package is:

```

home/dspace1/dspace/bin/dsrun org.dspace.app.packager.Packager -e [e-mail address]
-c 123456789/31 -t METS -w mets_test.zip

```

where:

- c specifies the handle of the collection in which to include the item  
123456789/31 is that collection

- w means to bypass workflow

The imported record is below:

**DSpace 1: THECB Learning Object Repository: The American Revolution - Mozilla Firefox**

File Edit View History Bookmarks Tools Help

DSpace 1: THECB Learning Obj... x (Untitled) x

**Learning Object Repository**  
Texas Higher Education Coordinating Board

**Search DSpace**  
Go  
Advanced Search

- Home

**Browse**

- Communities & Collections
- Titles
- Authors
- Subjects
- By Date

**Sign on to:**

- Receive email updates
- My DSpace authorized users
- Edit Profile
- Help
- About DSpace

DSpace 1: THECB Learning Object Repository >  
History Courses >  
U.S. History >  
U.S. History 1 >  
F. Course Topics >

**Please use this identifier to cite or link to this item:**  
<http://hdl.handle.net/123456789/136>

**Title:** The American Revolution  
**Authors:** McMichael, Kelly  
**Keywords:** George Washington  
Battle of Saratoga  
Revolutionary War  
Yorktown  
Captain John Paul Jones  
Treaty of Paris  
American Revolution  
**Issue Date:** 17-Aug-2007  
**Publisher:** Texas Higher Education Coordinating Board  
**Abstract:** This is a single page from Lesson 6. It contains a

**DSpace 1: THECB Learning Object Repository: The American Revolution - Mozilla Firefox**

File Edit View History Bookmarks Tools Help

DSpace 1: THECB Learning Obj... x (Untitled) x

updates  
My DSpace authorized users  
Edit Profile  
Help  
About DSpace

Captain John Paul Jones  
Treaty of Paris  
American Revolution

**Issue Date:** 17-Aug-2007  
**Publisher:** Texas Higher Education Coordinating Board  
**Abstract:** This is a single page from Lesson 6. It contains a discussion of the American Revolution and several key battles. It also includes information on the Treaty of Paris.  
**URI:** <http://hdl.handle.net/2188/57>  
<http://hdl.handle.net/123456789/136>  
**Appears in Collections:** [F. Course Topics](#)

**Files in This Item:**

File	Description	Size	Format
<a href="#">06_am_rev.htm</a>		5.31 kB	HTML <a href="#">View/Open</a>

[Show full item record](#)

Items in DSpace are protected by copyright, with all rights reserved, unless otherwise indicated.

WSC XHTML 1.0  
DSpace Software Copyright © 2002-2007 MIT and Hewlett-Packard - [Feedback](#)

### 3.1.4. Analysis of the Item in DSpace from Imported METS Record

Even just a brief comparison shows there are major differences between the records – three screenshots for the first; two for the second. A complete comparison shows the following elements were not included in the imported record:

- Learning Object Type
- Discipline and Sub-Discipline
- Intended Educational Audience
- Instructional Method
- Educational Interactivity Type
- Educational Interactivity Level
- Typical Learning Time
- Difficulty Level
- Creation and Ownership Information
- Access and Use Rights
- Date Published

Two other elements were changed from the original:

- Subjects became Keywords
- Summary became Abstract

## 3.2. Issues to Be Addressed to Use METS as Ingest Mechanism for THECB LOR

Even though DSpace allows METS to be used as an ingest method for the LOR, there are issues that need to be addressed if METS is chosen for that function.

### 3.2.1. Division of Metadata

One issue that would need to be addressed in order to be able to use METS as an ingest method is dividing the metadata from each learning object into administrative or descriptive metadata. As noted in section 2.1.3 above, the METS format uses two different sections for metadata. The metadata team would have to map their elements into the two METS metadata sections. Once the decision is made and documented, placing the information in the proper sections would be a simple process.

### 3.2.2. Tools for Creating METS Records

Another issue that needs to be addressed is the method for creating a METS record. The Library of Congress METS homepage has a section devoted to “METS Tools & Utilities” (see <http://www.loc.gov/standards/mets/mets-tools.html>). The METS team downloaded and tested all of these that would work on available platforms (i.e., Windows operating system) and found the tools to be unintuitive with no helps available. Watching the METS Internet mailing list, several people posted their tools-of-choice, so the METS team investigated these.

One tool mentioned was XML Spy, available from [www.altova.com](http://www.altova.com). Several attempts to obtain a trial license key were unsuccessful and a negative comment about XML Spy on the METS Internet mailing list persuaded the METS team to drop that product from consideration.

Another tool that was mentioned on the METS list was Oxygen XML, available from [www.oxygenxml.com](http://www.oxygenxml.com). This tool was a complex and complicated XML editor, along with other capabilities. Manually creating an XML document with this tool was extremely time-consuming and unintuitive. Again, information from the METS list, provided below, suggested that creating METS documents by-hand would be a difficult task.

"But you \*really\* don't want to build all of your METS documents by hand in a production environment. It's too error-prone and they're just so [very] big." (Posting to METS list on July 31, 2007.)

One other tool was tested. The latest version of Dreamweaver (CS3) has XML editing capability. As with the other tools, the XML document had to be built by hand, so it was not much of an improvement over Oxygen XML.

### **3.2.3. Ingest of Multiple Records into DSpace**

One of the desires for METS was that it could be used as a batch ingest method in order to automate the process of getting records into the repository. However, the ingest method for DSpace allows only one record at a time to be included. (The documentation for DSpace cited above states that batch import/export is performed using the "simple archive format.")

## **4. Summary and Conclusions**

Though METS is setup to describe digital objects stored in a repository, the limitations placed on the METS record by DSpace prevent it from being a viable ingest method. First, the lack of a mapping of the DC elements to MODS would prevent the inclusion of a significant part of the metadata associated with the course content records. Second, creating METS records is problematic. Creating the records manually is said to be "too error-prone," yet no tool exists for automated creation. Third, the inability of METS to be used as a batch import method means records would still have to be entered individually, so no time-savings would be gained.



## References

Metadata Encoding and Transmission Standard (2005). Retrieved September 4, 2007 from <http://xml.coverpages.org/mets.html>.

Metadata Encoding and Transmission Standard: Primer and Reference Manual (2007). Retrieved October 29, 2007 from <http://www.loc.gov/standards/mets/METS%20Documentation%20final%20070930%20msw.pdf>.

METS (2007). *METS Official Web Site*. Retrieved September 4, 2007 from <http://www.loc.gov/standards/mets/>.

## Appendix A: METS File for Exported DSpace Item

```
<?xml version="1.0" encoding="utf-8" standalone="no"?>
<mets ID="mets_1" OBJID="hdl:2188/57" LABEL="DSpace Item" PROFILE="DSpace METS SIP Profile
1.0" xmlns="http://www.loc.gov/METS/" xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.loc.gov/METS/ http://www.loc.gov/standards/mets/mets.xsd">
  <metsHdr CREATEDATE="2007-08-16T23:06:12">
    <agent ROLE="CUSTODIAN" TYPE="ORGANIZATION">
      <name>THECB Learning Object Repository</name>
    </agent>
  </metsHdr>
  <dmdSec ID="dmd_3" GROUPLD="dmd_group_2">
    <mdWrap MDTYPE="MODS">
      <xmlData xmlns:mods="http://www.loc.gov/mods/v3" xmlns:xlink="http://www.w3.org/1999/xlink"
xsi:schemaLocation="http://www.loc.gov/mods/v3 http://www.loc.gov/standards/mods/v3/mods-3-
1.xsd"><mods:mods xmlns:mods="http://www.loc.gov/mods/v3"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.loc.gov/mods/v3 http://www.loc.gov/standards/mods/v3/mods-3-1.xsd">
  <mods:name>
    <mods:role>
      <mods:roleTerm type="text">author</mods:roleTerm>
    </mods:role>
    <mods:namePart>McMichael, Kelly</mods:namePart>
  </mods:name>
  <mods:extension>
    <mods:dateAccessioned encoding="iso8601">2007-07-27T20:49:34Z</mods:dateAccessioned>
  </mods:extension>
  <mods:extension>
    <mods:dateAvailable encoding="iso8601">2007-07-27T20:49:34Z</mods:dateAvailable>
  </mods:extension>
  <mods:originInfo>
    <mods:dateIssued encoding="iso8601">2007-07-27T20:49:34Z</mods:dateIssued>
  </mods:originInfo>
  <mods:identifier type="uri">http://hdl.handle.net/2188/57</mods:identifier>
  <mods:abstract>This is a single page from Lesson 6. It contains a discussion of the American
Revolution and several key battles. It also includes information on the Treaty of Paris.</mods:abstract>
  <mods:note type="provenance">Submitted by Bill Watson (wrw0005@unt.edu) on 2007-07-
27T17:35:46Z
No. of bitstreams: 5
06_am_rev.htm: 5436 bytes, checksum: d8a2badd6924b4cf821e1d2c0a47013f (MD5)
image26.jpg: 28768 bytes, checksum: e1dd14e36a92798ac1a9bfdded357c0fc (MD5)
image27.jpg: 36273 bytes, checksum: 30ee248798d5136212cba02c210742e0 (MD5)
image28.jpg: 31946 bytes, checksum: 7ea303e3d1ba718afed2852233ad03d0 (MD5)
yorktown.swf: 18118 bytes, checksum: efe36d166aa0dc21523aebb5c36a5e3d (MD5)</mods:note>
  <mods:note type="provenance">Approved for entry into archive by Kelly
McMichael(kmcmichael@unt.edu) on 2007-07-27T20:49:34Z (GMT) No. of bitstreams: 5
06_am_rev.htm: 5436 bytes, checksum: d8a2badd6924b4cf821e1d2c0a47013f (MD5)
image26.jpg: 28768 bytes, checksum: e1dd14e36a92798ac1a9bfdded357c0fc (MD5)
image27.jpg: 36273 bytes, checksum: 30ee248798d5136212cba02c210742e0 (MD5)
image28.jpg: 31946 bytes, checksum: 7ea303e3d1ba718afed2852233ad03d0 (MD5)
yorktown.swf: 18118 bytes, checksum: efe36d166aa0dc21523aebb5c36a5e3d (MD5)</mods:note>
```

```

<mods:note type="provenance">Made available in DSpace on 2007-07-27T20:49:34Z (GMT). No. of
bitstreams: 5
06_am_rev.htm: 5436 bytes, checksum: d8a2badd6924b4cf821e1d2c0a47013f (MD5)
image26.jpg: 28768 bytes, checksum: e1dd14e36a92798ac1a9bfdded357c0fc (MD5)
image27.jpg: 36273 bytes, checksum: 30ee248798d5136212cba02c210742e0 (MD5)
image28.jpg: 31946 bytes, checksum: 7ea303e3d1ba718afed2852233ad03d0 (MD5)
yorktown.swf: 18118 bytes, checksum: efe36d166aa0dc21523aebb5c36a5e3d (MD5)</mods:note>
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  <mods:form>Multimedia</mods:form>
</mods:physicalDescription>
<mods:language>
  <mods:languageTerm authority="rfc3066">en_US</mods:languageTerm>
</mods:language>
<mods:originInfo>
  <mods:publisher>Texas Higher Education Coordinating Board</mods:publisher>
</mods:originInfo>
<mods:accessCondition type="useAndReproduction">This learning object was developed as part of
the Texas Higher Education Coordinating Board's Texas Course Redesign Project (TCRP), and all
intellectual property developed as part of the TCRP is the property of the THECB. The THECB grants to
the organization that developed this learning object a license to sell the intellectual property described in
this RFP to private institutions of higher education, as well as to other institutions of higher education
outside Texas. The profits of such sales will be divided equally between THECB and the developing
organization. The intellectual property developed as part of the TCRP is available without charge to public
institutions of higher education in Texas.</mods:accessCondition>
<mods:subject>
  <mods:topic>George Washington</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>Battle of Saratoga</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>Revolutionary War</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>Yorktown</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>Captain John Paul Jones</mods:topic>
</mods:subject>
<mods:subject>
  <mods:topic>Treaty of Paris</mods:topic>
</mods:subject>
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  <mods:topic>American Revolution</mods:topic>
</mods:subject>
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  <mods:title>The American Revolution</mods:title>
</mods:titleInfo>
<mods:genre>Lesson</mods:genre>
</mods:mods></xmlData>
</mdWrap>
</dmdSec>
<amdSec ID="license_5">
  <rightsMD ID="rights_4">
    <mdRef LOCTYPE="URL" xlink:type="simple" xlink:href="depositlicense_6.txt" MDTYPE="OTHER"
OTHERMDTYPE="DSpace Deposit License" MIMETYPE="text/plain"/>

```

```

</rightsMD>
</amdSec>
<amdSec ID="techMd_for_bitstream_3">
  <techMD ID="tech_7">
    <mdWrap MDTYPE="PREMIS">
      <xmlData xmlns:premis="http://www.loc.gov/standards/premis"
xsi:schemaLocation="http://www.loc.gov/standards/premis http://www.loc.gov/standards/premis/PREMIS-
v1-0.xsd"><premis:premis xmlns:premis="http://www.loc.gov/standards/premis">
  <premis:object>
    <premis:objectIdentifier>
      <premis:objectIdentifierType>URL</premis:objectIdentifierType>

<premis:objectIdentifierValue>http://zed.lis.unt.edu:8083/dspace/bitstream/2188%2F57/3/image27.jpg</p
remis:objectIdentifierValue>
    </premis:objectIdentifier>
    <premis:objectCategory>File</premis:objectCategory>
    <premis:objectCharacteristics>
      <premis:fixity>
        <premis:messageDigestAlgorithm>MD5</premis:messageDigestAlgorithm>
        <premis:messageDigest>30ee248798d5136212cba02c210742e0</premis:messageDigest>
      </premis:fixity>
      <premis:size>36273</premis:size>
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        </premis:formatDesignation>
      </premis:format>
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    <premis:originalName>image27.jpg</premis:originalName>
  </premis:object>
</premis:premis></xmlData>
    </mdWrap>
  </techMD>
</amdSec>
<amdSec ID="techMd_for_bitstream_2">
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v1-0.xsd"><premis:premis xmlns:premis="http://www.loc.gov/standards/premis">
  <premis:object>
    <premis:objectIdentifier>
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    </premis:objectIdentifier>
    <premis:objectCategory>File</premis:objectCategory>
    <premis:objectCharacteristics>
      <premis:fixity>
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        <premis:formatDesignation>

```

```

        <premis:formatName>image/jpeg</premis:formatName>
    </premis:formatDesignation>
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</premis:object>
</premis:premis></xmlData>
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</techMD>
</amdSec>
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        <mdWrap MDTYPE="PREMIS">
            <xmlData xmlns:premis="http://www.loc.gov/standards/premis"
xsi:schemaLocation="http://www.loc.gov/standards/premis http://www.loc.gov/standards/premis/PREMIS-
v1-0.xsd"><premis:premis xmlns:premis="http://www.loc.gov/standards/premis">
                <premis:object>
                    <premis:objectIdentifier>
                        <premis:objectIdentifierType>URL</premis:objectIdentifierType>

<premis:objectIdentifierValue>http://zed.lis.unt.edu:8083/dspace/bitstream/2188%2F57/5/yorktown.swf</
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                    </premis:objectIdentifier>
                    <premis:objectCategory>File</premis:objectCategory>
                    <premis:objectCharacteristics>
                        <premis:fixity>
                            <premis:messageDigestAlgorithm>MD5</premis:messageDigestAlgorithm>
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                        </premis:fixity>
                        <premis:size>18118</premis:size>
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                            <premis:formatDesignation>
                                <premis:formatName>application/x-shockwave-flash</premis:formatName>
                            </premis:formatDesignation>
                        </premis:format>
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            </premis:premis></xmlData>
        </mdWrap>
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<amdSec ID="techMd_for_bitstream_1">
    <techMD ID="tech_13">
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            <xmlData xmlns:premis="http://www.loc.gov/standards/premis"
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v1-0.xsd"><premis:premis xmlns:premis="http://www.loc.gov/standards/premis">
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                    </premis:objectIdentifier>
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```

```

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  </premis:fixity>
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    </premis:formatDesignation>
  </premis:format>
</premis:objectCharacteristics>
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v1-0.xsd"><premis:premis xmlns:premis="http://www.loc.gov/standards/premis">
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    <premis:objectIdentifier>
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    </premis:objectIdentifier>
    <premis:objectCategory>File</premis:objectCategory>
    <premis:objectCharacteristics>
      <premis:fixity>
        <premis:messageDigestAlgorithm>MD5</premis:messageDigestAlgorithm>
        <premis:messageDigest>7ea303e3d1ba718afed2852233ad03d0</premis:messageDigest>
      </premis:fixity>
      <premis:size>31946</premis:size>
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          <premis:formatName>image/jpeg</premis:formatName>
        </premis:formatDesignation>
      </premis:format>
    </premis:objectCharacteristics>
    <premis:originalName>image28.jpg</premis:originalName>
  </premis:object>
</premis:premis></xmlData>
</mdWrap>
</techMD>
</amdSec>
<fileSec>
  <fileGrp USE="CONTENT">
    <file ID="bitstream_3" MIMETYPE="image/jpeg" SEQ="3" SIZE="36273"
CHECKSUM="30ee248798d5136212cba02c210742e0" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_3" GROUPID="GROUP_bitstream_3">
      <FLocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_291.jpeg"/>

```

```

</file>
<file ID="bitstream_2" MIMETYPE="image/jpeg" SEQ="2" SIZE="28768"
CHECKSUM="e1dd14e36a92798ac1a9bfded357c0fc" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_2" GROUPID="GROUP_bitstream_2">
  <FLocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_290.jpeg"/>
</file>
<file ID="bitstream_5" MIMETYPE="application/x-shockwave-flash" SEQ="5" SIZE="18118"
CHECKSUM="efe36d166aa0dc21523aebb5c36a5e3d" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_5" GROUPID="GROUP_bitstream_5">
  <FLocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_293.swf"/>
</file>
<file ID="bitstream_1" MIMETYPE="text/html" SEQ="1" SIZE="5436"
CHECKSUM="d8a2badd6924b4cf821e1d2c0a47013f" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_1" GROUPID="GROUP_bitstream_1">
  <FLocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_289.htm"/>
</file>
<file ID="bitstream_4" MIMETYPE="image/jpeg" SEQ="4" SIZE="31946"
CHECKSUM="7ea303e3d1ba718afed2852233ad03d0" CHECKSUMTYPE="MD5"
ADMID="techMd_for_bitstream_4" GROUPID="GROUP_bitstream_4">
  <FLocat LOCTYPE="URL" xlink:type="simple" xlink:href="bitstream_292.jpeg"/>
</file>
</fileGrp>
</fileSec>
<structMap ID="struct_16" LABEL="DSpace" TYPE="LOGICAL">
<div ID="div_17" DMDID="dmd_3" ADMID="license_5" TYPE="DSpace Item">
  <fptr FILEID="bitstream_1"/>
  <div ID="div_6" TYPE="DSpace Content Bitstream">
    <fptr FILEID="bitstream_3"/>
  </div>
  <div ID="div_8" TYPE="DSpace Content Bitstream">
    <fptr FILEID="bitstream_2"/>
  </div>
  <div ID="div_10" TYPE="DSpace Content Bitstream">
    <fptr FILEID="bitstream_5"/>
  </div>
  <div ID="div_12" TYPE="DSpace Content Bitstream">
    <fptr FILEID="bitstream_1"/>
  </div>
  <div ID="div_14" TYPE="DSpace Content Bitstream">
    <fptr FILEID="bitstream_4"/>
  </div>
</div>
</div>
</structMap>
</mets>

```