Specification

S-2014-002

Academy Color Encoding System – Versioning System

The Academy of Motion Picture Arts and Sciences

Science and Technology Council

Academy Color Encoding System (ACES) Project Committee

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Summary: This document specifies a Versioning System for Academy Color Encoding System components. The purpose of the Versioning System is to provide a means for identifying and managing periodic ACES system releases that will incorporate new features and improvements.

NOTICES

Revision History

Version	Date	Description
1.0	12/19/2014	Initial Version
1.0.1	04/24/2015	Formatting and typo fixes
1.0.2	11/11/2015	Add ACESutil as new type
	03/29/2016	Remove version number - to use modification date as UID
	06/07/2016	Changes to naming convention for ACES Core Transforms

Related Academy Documents

Document Name	Description
TB-2014-002	ACES Version 1.0 User Experience Guidelines
S-2014-002	ACES Version 1.0 Component Names

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Introduction

The key components of the ACES system are ACES encodings, ACES image files, ACES transforms and associated files, and an ACES clip-level metadata container that describes how the ACES image files were viewed when created or modified. ACES Version 1.0 is the first official release of these components. These components may be enhanced in subsequent releases based on industry requirements. Feedback from ACES Product Partners and end users made it clear that such a dynamic environment requires a clear system for version-control and naming of ACES components.

This document describes the versioning of the engineering components that comprise the ACES System Release to ACES Product Partners. These version numbers are intended to be used within ACES files such as transforms and the ACES clip-level metadata container. A separate document, Academy TB-2014-002, addresses naming and versioning issues as they relate to end-users.

1 Scope

This document specifies the component naming and versioning conventions associated with ACES System components. Examples are provided.

2 References

The following standards, specifications, articles, presentations, and texts are referenced in this text:

Academy TB-2014-002, Academy Color Encoding System Version 1.0 User Experience Guidelines

Academy TB-2014-012, Academy Color Encoding System Version 1.0 Component Names

SMPTE ST 2065-1:2012, Academy Color Encoding Specification

3 Terms and Definitions

The following terms and definitions are used in this document.

3.1 ACESclip

Collection of image files color-managed using the Academy Color Encoding System (ACES).

3.2 ACESclip file, ACES Clip-level Metadata File

Metadata sidecar XML-based file that contains information describing an ACESclip.

3.3 ACES Encodings

Color encoding specifications specified as part of the Academy Color Encoding System, e.g., ACES2065-1, ACEScc, etc.

3.4 ACES File Formats

Digital data containers specified as part of the Academy Color Encoding System, e.g., ACESclip files, ACES Image Container (SMPTE ST2065-4), etc.

3.5 ACES Product Partners

Companies that integrate ACES concepts and components into their products and/or services.

3.6 ACES System

Complete set of components that comprise the Academy Color Encoding System.

3.7 ACES System Release

Published ACES System.

3.8 ACES Transforms

Color transformations specified as part of the Academy Color Encoding System, e.g., Reference Rendering Transform (RRT), Output Device Transforms (ODT), etc.

3.9 CTL files

Files containing Color Transformation Language code. CTL files are the primary documentation for ACES transforms.

3.10 Implementation Transforms

ACES System transforms implemented by ACES Product Partners, likely as a Color Look-up Table or as GPU or CPU code.

3.11 Transform Identifiers

Tags that identify specific ACES Transforms.

4 Specification

In the following definitions, *italics* represent a changeable placeholder. **boldface** represents a required string or character.

4.1 String Formats

ACES system components shall use the following versioning string formats where applicable:

*Type.***a***MajorVersionNumber.MinorVersionNumber.PatchVersionNumber*

or

*Type.Name.***a***MajorVersionNumber.MinorVersionNumber.PatchVersionNumber*

where `Type` is one of the following:

`IDT` – ACES Input Transform (a.k.a. "Input Device Transform")

`LMT` – ACES Look Transform (a.k.a. "Look Modification Transform")

`ODT` – Output Device Transform

`RRT` – Reference Rendering Transform

`RRTODT` – ACES Output Transform (concatenated RRT and ODT)

`InvRRT` – Inverse Reference Rendering Transform

`InvODT` – Inverse Output Device Transform

`InvRRTODT` – ACES inverse Output Transform (concatenated RRT and ODT)

`ACESlib` – ACES library functions for core transforms, e.g., Tonescales

`ACEScsc` – ACES color space conversion transforms

`ACESutil` – utility functions provided with the ACES release, e.g., Adjust_Exposure

ACES system components are assigned a string that serves as a unique identifier for an ACES System Release. This identifier is constructed using a set of tokens as described in this specification so that it will be more human-readable than a typical Universally Unique Identifier (UUID).

If the `PatchVersionNumber` is zero, it may be omitted from the versioning string for simplification. If both the `MinorVersionNumber` and the `PatchVersionNumber` are zero, they may both be omitted from the versioning string for simplification.

4.2 Transform Identifiers

ACES transforms, expressed as CTL files, are assigned a Transform Identifier. The Transform Identifier shall be included with all Product Partner implementations intended to match that ACES transform. The Transform Identifier shall be contained in the transform files as metadata or as a comment. For Academy-supplied transforms, the Transform Identifier shall be contained in an XML tag of `<ACEStransformID>` in the file header.

Product Partner implementation transforms may be intended to match the results of a combined series of ACES CTL transforms, e.g., LMT+RRT+ODT. In that case, all of the relevant ACES Transform Identifiers shall be included in the implementation Transform. The RRT+ODT combination is a unique case that is covered in Section 4.6.4 below.

4.3 User-Friendly Names

ACES Transform Identifiers can be complex and therefore not appropriate for presentation to end users for selection purposes. All transforms shall include "friendly names" as metadata within the transform file that software applications may access them for presentation in their user interfaces. For Academy-supplied transforms, the user-friendly name shall be contained in an XML tag of `<ACESuserName>` in the file header. Recommended friendly names are described in a separate document, "Academy TB-2014-002, ACES Version 1.0 User Experience Guidelines."

4.4 ACES System Release

The ACES System Release consists of a variety of ACES core components and ACES vendor-supplied components.

The ACES System Release version shall use the following versioning convention:

`ACESrelease.a`*`MajorVersionNumber.MinorVersionNumber.PatchVersionNumber`*

The ACES System Release patch version number shall be incremented with bug fixes. New patch versions shall not require an update to all transforms.

The ACES System Release minor version number shall be incremented with non-substantive changes to the existing ACES core components. Minor version releases may include new ACES Core Transforms (e.g. new ODTs) and/or roll-ups of minor ODT enhancements/additions or bug fixes. New ACES System Release minor versions shall not require an update to all ACES core and vendor-supplied components.

The ACES System Release major version number shall be incremented with substantive changes to the ACES core components. When the ACES System Release major version number is changed it will require all core and vendor-supplied components be updated to confirm compatibility with the new ACES major version.

The ACES System Release version will not be incremented when ACES vendor-supplied components are updated.

4.5 ACES Core Components

ACES core components include:

- ACES Core Transforms
- ACES Core Libraries and Utilities
- ACES Core File Formats

4.5.1 ACES Core Transforms

The ACES Core Transforms include the following:

- The Reference Rendering Transform
- Academy-supplied Output Device Transforms
- Academy-supplied Look Modification Transforms
- Color Space Conversion Transforms

Transforms such as the RRT and ODTs rely on sub-functions and constants included in separate CTL files, i.e. ACESlib. ACESlib files often contain more than one sub-function or constant. If a change is made to the code of a sub-function that affects the output of a calling transform, the version of the calling transform's Transform Identifier shall be incremented (even if the code in the RRT, ODT, etc. itself may not have changed). For simple additions or modifications to an ACESlib file that do not affect the numerical output of a calling function, the calling function version Transform Identifier will not be incremented.

Any transform updates that do not change the output of that transform shall not require the Transform Identifier to be incremented - e.g. whitespace changes, modifications to code comments, etc.

Because the results of an ODT depend on the RRT, the version of all ODTs shall be incremented whenever the RRT version is incremented.

4.5.1.1 Reference Rendering Transform (RRT)

The RRT major version number shall match the ACES System Version Major Version number. The RRT Transform Identifier shall use the following versioning convention:

RRT.a*ACESmajorVersionNumber.RRTminorVersionNumber.RRTpatchVersionNumber*

Example Transform Identifiers using this format are:

```
RRT.a1.0.0
```

```
RRT.a1
```

4.5.1.2 Academy-supplied Output Transforms (ODTs)

An ODT's major version number shall match the ACES System Version Major Version number. ODT Transform Identifiers shall use the following versioning convention:

ODT.*Namespace.OutputFormat.***a***ACESmajorVersionNumber.ODTminorVersionNumber.ODTpatchVersionNumber*

Namespace identifies the creator of the ODT. The *Namespace* `Academy` is reserved for Academy-supplied ODTs.

OutputFormat fully describes the device and/or output data format of the ODT.

Example Transform Identifiers using this format are:

```
ODT.Academy.P3D60_48nits.a1.0.0
```

```
ODT.Academy.Rec709_D60sim_100nits_dim.a1.0.0
```

The Academy provides all ODTs in ACES 1.0, although it is anticipated that vendors will provide ACES-compatible ODTs in the future.

4.5.1.3 Academy-supplied Look Modification Transforms (LMTs)

Academy-supplied LMT's major version number shall match the ACES System Version Major Version number. LMT Transform Identifiers shall use the following versioning convention:

LMT.*Namespace.Name.***a***ACESmajorVersionNumber.LMTminorVersionNumber.LMTpatchVersionNumber*

4.5.1.4 Color Space Conversion Transforms

Academy-supplied color space conversions' major version number shall match the ACES System Version Major Version number. Color space conversion Transform Identifiers shall use the following versioning convention:

ACEScsc.*Name.***a***ACESmajorVersionNumber.ACEScscMinorVersionNumber.ACEScscPatchVersionNumber*

4.5.2 ACES Core Libraries and Utilities

Academy-supplied core libraries and utilities' major version number shall match the ACES System Version Major Version number. Core library and utilities Transform Identifiers shall use the following versioning convention:

ACESlib.*Name*.**a***ACESmajorVersionNumber*.*ACESlibMinorVersionNumber*.*ACESlibPatchVersionNumber*

ACESutil.*Name*.**a***ACESmajorVersionNumber*.*ACESutilMinorVersionNumber*.*ACESutilPatchVersionNumber*

4.5.3 ACES Core File Formats

The ACES Core File Formats include the following:

- SMPTE ST 268:2014 (DPX)
- SMPTE ST 2065-4:2013 (ACES Image Container File Layout)
- ACES Clip-level Metadata File (clip-level metadata sidecar)
- Academy-ASC Common LUT Format File (CLF)

The SMPTE standard file formats are versioned according to SMPTE conventions.

ACES Clip Metadata files and Academy-ASC Common LUT Format files shall contain a metadata field that identifies the ACES System Version Number with which they conform, and the required Transform Identifiers of the transforms referenced therein (see "Academy TB-2014-009" and "Academy S-2014-006" for additional details).

4.6 ACES Vendor-supplied components

Certain ACES components, such as Input Transforms and concatenated RRT/ODTs, are shipped by ACES Product Partners and therefore are not constrained to ACES System release schedules. Other ACES components, such as ODTs and LMTs, are likely to be vendor-supplied in the future. Nonetheless, the versioning and naming requirements are the same as for ACES core components in that they must be identified as being compatible with a given ACES major system release.

To enable easier reading and parsing of Transform Identifiers, the sub-strings used for *NameSpace* and *DeviceName* should not contain spaces or periods and should also be limited to the ASCII character set.

4.6.1 Input Transforms (IDTs)

IDT.*NameSpace.DeviceName*.**a***ACESmajorVersionNumber*.**v***IDTversionNumber*

The creator of the IDT shall be identified using the *NameSpace*. When the creator of the transforms is the manufacturer of the camera then the device is not required to repeat the manufacturer name. If the IDT creator is not the camera manufacturer, then the manufacturer name shall be prepended to the *DeviceName*.

Example IDT Transform Identifiers using this format are:

IDT.Sony.F65.a1.v1

IDT.Arri.AlexaEI100T.a1.v2

IDT.Dolby.ArriAlexa.a1.v1

4.6.2 Look Transforms (LMTs)

LMT.*Namespace.Name*.**a***ACESmajorVersionNumber*.**v***LMTversionNumber*

The creator of the LMT shall be identified using the *NameSpace*. The *NameSpace* Academy is reserved for Academy-supplied LMTs. The *Name* shall identify the purpose the LMT serves.

Example LMT Transform Identifiers using this format are:

LMT.Academy.ACES_0_7_1.a1.v1 (Academy-supplied v0.7.1 backwards-compatible transform)

`LMT.ACME.BleachBypass.a1.v1` (ACME Transform, Inc.-supplied bleach bypass LMT compatible with ACES Version 1.0, in the Academy-ASC Common LUT Format)

4.6.3 Output Transforms (ODTs)

ODT.*Namespace.OutputFormat.***a***ACESmajorVersionNumber.***v***ODTversionNumber*

NameSpace shall identify the creator of the ODT. The *NameSpace* `Academy` is reserved for Academy-supplied ODTs.

OutputFormat fully describes the device and/or output data format of the ODT.

Example Transform Identifiers using this format are:

`ODT.ACME.P3D60ProjectorSomeSpecialCalibration.a1.v1`

`ODT.ACME.Rec709_D60sim_100nits_dim.a1.v10`

4.6.4 Concatenated Reference Rendering Transform/Output Transforms (RRT/ODTs)

RRTODT.*Namespace.OutputFormat.***a***ACESmajorVersionNumber.***v***ODTversionNumber*

Namespace shall identify the creator of the concatenated RRT/ODT. The *Namespace* `Academy` is reserved for Academy-supplied concatenated RRT/ODTs.

OutputFormat fully describes the device and/or output data format of the concatenated RRT/ODT, and should use the *OutputFormat* associated with the ODT used in the concatenated transform.

Example Transform Identifiers using this format are:

`RRTODT.ACME.P3d60Projector.a1.v1`

`RRTODT.ACME.Rec709_D60sim_100nits_dim.a1.v1`

`RRTODT.ACME.P3D60ProjectorSomeSpecialCalibration.a1.v1`

`RRTODT.ACME.Rec709_d60sim_8000nits.a1.v1`

4.7 Implementation Version Reporting

ACES implementations shall report the version of the ACES System in use to at least the Minor Version Number. Reporting of the Patch Version Number is optional. For more details, refer to "Academy TB-2014-002."

4.8 ACES Pre-release Versions

Pre-release versions of ACES, i.e., versions prior to Version 1.0, shall use the following version string format:

aPR*majorVersionNumber.MinorVersionNumber.PatchVersionNumber*

Example:

`ACESrelease.aPR0.7.1`

The "**aPR**" designation indicates a version of ACES prior to the Version 1.0 release and the use of any transforms with this designation is deprecated.

5 Use of Version Control

ACES system versioning and Transform Identifiers shall be used by ACES Product Partners to identify ACES components that ship with their products. ACES versioning/naming conventions and Transform Identifiers shall also be used in the ACES Clip-level Metadata File that their products create and/or modify. Doing so enables end users to unambiguously view ACES image files by identifying the correct ACES transform chain

for a given collection of ACES image files.