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LANDSAT 7 DATA EXCHANGE IMPLEMENTATION PLAN

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Executive Summary

This Landsat 7 Data Exchange Implementation Plan provides the U.S. Geological Survey (USGS) and the International Cooperators (ICs) with a clear and concise reference document to assist in the exchange of Landsat 7 image data.

This document is under the control of the Landsat Configuration Control Board (LCCB). Landsat Configuration Change Requests (LCCR) to this document, as well as supportive material justifying the proposed changes, should be submitted to the Mission Management Office (MMO) at the USGS/EROS Data Center in Sioux Falls, South Dakota.

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Contents

Executive Summary	iii
Document Change Summary	iv
Contents.....	1
Section 1 Introduction.....	1
1.1 Purpose	1
1.2 Overview and Background	1
1.3 Goals and Objectives	1
1.4 Expiration	1
Section 2 Data Exchange for Data Quality Validation	2
2.1 Definition	2
2.2 Data Requirements	2
2.3 Media Requirements	2
2.4 Scheduling and Frequency	2
2.5 USGS Validation Procedures.....	2
2.5.1 Raw Computer Compatible (RCC) Data	2
2.5.2 LORp Products	3
2.6 Data Format.....	3
2.7 Data for Validation	3
2.8 Documentation of Validation Results	3
2.9 Waiver of Validation Requirements.....	4
Section 3 Data Exchange for Key Government Programs	5
3.1 Definition	5
3.2 Authorization Requirements.....	5
3.2.1 USGS Authorization.....	5
3.2.2 International Cooperator Authorization	5
3.3 Data Request Procedures.....	5
3.4 Data Delivery Requirements	6
3.5 Data Archive and Distribution Rights for Exchanged Data.....	6
3.6 Data Format.....	6
Section 4 Data Exchange for Loss of Spacecraft Capabilities	7
4.1 Definition	7
4.2 Authorization	7
4.3 Data Transfer Requirements and USGS Support	7
4.4 Data Delivery Requirements	7
4.5 Data Archive and Distribution Rights	7
Section 5 Data Transfers to an International Cooperator	8
5.1 Definition	8
5.2 Authorization Requirements.....	8
5.2.1 USGS Authorization.....	8
5.2.2 International Cooperator Authorization	8
5.2.3 Data Availability	8
Section 6 Funding Mechanisms	9

6.1	Data Exchange for Data Validation	9
6.2	Data Transfers for Key Government Programs	9
6.2.1	Quid Pro Quo	9
6.2.2	Adjustments of the Data Access Fees	9
6.3	Data Transfers to International Cooperators for Short-term Outages	9
6.3.1	Quid Pro Quo	9
6.3.2	Adjustments to Data Access Fees	9
6.4	Data Transfers to USGS due to temporary or permanent loss of spacecraft capability.....	9
Section 7	Plan Implementation.....	11
7.1	Effective Date.....	11
7.2	Data Validation Schedule.....	11
7.3	Contingency Plan for Loss of Landsat Spacecraft Capability.....	11
Appendix A	Abbreviations and Acronyms	12
References	13

Section 1 Introduction

1.1 Purpose

This Implementation Plan defines the conditions and procedures used to implement the Data Exchange Annex of the Memorandum of Understanding (MOU) between the USGS and IC for the direct reception and distribution of Landsat 7 image data.

1.2 Overview and Background

Under the provisions of the Data Exchange Annex, a framework for unilateral and bilateral data exchange is established between the IC and the USGS. The reasons for data exchange include:

- Validating the quality of Raw Computer Compatible (RCC) data and Level Zero Reformatted Distribution Product (L0Rp) products generated by the USGS and the IC
- Acquiring data for key government programs
- Establishing a framework for data transfer to and from an IC
- Providing for data exchange in the event of a loss or limited capabilities to the Landsat 7 spacecraft

1.3 Goals and Objectives

The goals and objectives of the Data Exchange Implementation Plan are as follows:

- Briefly describe the procedures to validate that the approved data exchange formats (RCC and L0Rp) are interchangeable and generated per the appropriate DFCB and product specifications. The Landsat 7 Data Quality Validation Plan details the procedures for data quality validation.
- Define a data exchange procedure for key government programs, of either a US or IC [government] agency, to acquire data from a station's archive in support of scientific research or disaster response
- Define a procedure for acquiring IC Landsat 7 data in the event of a spacecraft anomaly that prevents use of the Solid State Recorder (SSR) or other downlink subsystem(s)
- Define a procedure for ICs to obtain data from the U.S. archive in the event of a short-term loss of [direct] data reception capability

1.4 Expiration

Policies and terms in this plan will expire upon termination of the Landsat 7 MOU between the USGS and the IC.

Section 2 Data Exchange for Data Quality Validation

2.1 Definition

Data quality validation consists of a comparison between the USGS RCC data and/or LORp products generated by an IC in order to verify compliance with appropriate DFCB and product specifications. The procedures for the exchange of data and the process of validation are described in the Landsat 7 Data Quality Validation Plan.

Data exchange for data quality covers both transfers to the USGS from an IC and to an IC from the USGS. The USGS is the primary monitor of data quality for the Landsat Project.

2.2 Data Requirements

ICs are asked twice a year to provide RCC data and/or LORp products to the USGS for validation. The USGS specifies the date, path and row of the data required for validation. RCC data are delivered as subinterval data written to one tape media (see Landsat 7 RCC DFCB), whereas LORp products are delivered as scene products in the Hierarchical Data Format (HDF).

2.3 Media Requirements

The required media for RCC data include Digital Linear Tape (DLT) 7000, DLT 8000, Super DLT (SDLT) or file transfer protocol (FTP). The required media for LORp products include DLT 7000, DLT 8000, SDLT, Compact Disc or FTP.

2.4 Scheduling and Frequency

The ICs are scheduled to provide validation data to the USGS twice a year. Similarly, an IC may request validation data from the USGS once per year. Additional data sets may be provided with the approval of the Landsat Project Manager.

2.5 USGS Validation Procedures

2.5.1 Raw Computer Compatible (RCC) Data

The objectives of the RCC data validation procedures include:

- Verifying that data are of equivalent quality to those generated by the USGS in accordance with the RCC DFCB
- Verifying conformance to the RCC format specification to ensure data provided by multiple stations are readable using standard ingest routines
- Determining that RCC data provided by an IC can be ingested into the USGS archive

An overview of the RCC data validation procedure is as follows:

1. Subinterval data from the IC are ingested into the Landsat 7 Processing System (LPS) for processing.
2. Processing and metadata statistics from the IC provided data are compared with the corresponding USGS subinterval data acquired from the Landsat 7 Solid State Recorder (SSR).
3. Once the IC-provided RCC data are processed to L0Rp, they are processed to a Level 1 Geometrically Corrected (L1G) product and compared by the Image Assessment System (IAS) for image and processing statistics as detailed in Section 2.5.2.

2.5.2 L0Rp Products

The objectives of the L0Rp data product validation procedures include:

- Verifying that data are of equivalent quality to those generated by the USGS in accordance with the L0Rp DFCB
- Verifying conformance to the L0Rp HDF specifications to ensure data provided by multiple stations are readable using standard ingest routines
- Determining that L0Rp products provided by a station can be ingested into a USGS product processing system

2.6 Data Format

The data exchange formats are the L0Rp products in HDF and/or RCC data (see References). L0Rp products are requested as scene products, specified by path/row and acquisition date. RCC data are specified by contact/subinterval and/or time index. Hardcopy documentation of the contents and verification of the RCC data is required and must accompany the tape media transferred to the USGS.

2.7 Data for Validation

In order to ensure a timely completion of the validation procedures, a 2-week turn-around time is required from the collection of the requested data at the ground station to the delivery of the RCC data and/or L0Rp HDF products at the USGS Landsat Project. The station places orders and addresses the logistical issues for ordering and producing the data that the USGS requests for the validation exercises.

2.8 Documentation of Validation Results

The USGS documents the results of the data quality validation each year. Initial distribution is limited to the Landsat Technical Working Group (LTWG) participants. A summary of each station's performance may be made available to the public with the consent of the station.

When the USGS provides data to an IC for validation activities, the IC is required to provide a summary to the USGS of the data validation performed within 60 days after receiving data. Disclosure of the information in this summary is limited to the USGS

and National Aeronautics and Space Administration (NASA)/ Landsat 7 Project Science Office (LPSO). Further distribution requires approval from the USGS.

2.9 Waiver of Validation Requirements

Once each ground station is validated, a waiver of validation requirements may be allowed where the IC can demonstrate, by analysis and example, that the data from a single station is representative of the performance of all administered stations. The waiver allows an IC to provide a single data set that will be used for validation of all the administered stations.

Section 3 Data Exchange for Key Government Programs

3.1 Definition

As described in the MOU Data Exchange Annex, a key government program is one that requires Landsat 7 data for scientific research or emergency disaster relief applications. A key government program must be administered by a government agency or government organization.

Administration of a key government program consists of either a direct activity of a government agency or organization, a subcontracted activity directly managed by a government agency or organization, and/or an activity funded directly by a government agency or organization.

Data exchange for an IC key government program data request is limited to data currently archived in the USGS Landsat 7 archive and visible through the publicly accessible inventory and search system.

3.2 Authorization Requirements

3.2.1 USGS Authorization

The USGS Landsat Project Manager or designee authorizes key government programs to use the provisions of the Data Exchange Annex and certifies that the requesting program meets the criteria set forth in the Annex for a key government program. This person is also responsible for tracking usage of this provision of the Annex to ensure data volume limitations are maintained.

The Landsat Project Manager serves as the final authority in resolving disputes in this application of the Annex.

3.2.2 International Cooperator Authorization

As specified in the Annex, the signatory to the MOU or designee serves as the certifying authority for IC requests for key government program status. All data requests for an IC key government program go through the MOU signatory or designee. This person serves as the single point of contact between requesting programs and the USGS Landsat Project and is responsible for tracking requests to ensure that the specified data volume limitations are maintained.

Under the terms of the Annex, the Landsat Project Manager can increase the number of scenes provided to an IC as part of a key government program.

3.3 Data Request Procedures

Under the terms specified in the Annex, the USGS is permitted to request approximately 300 scenes per year from each IC site/station. Each individual IC is allowed to request approximately 300 scenes per year from the USGS Landsat 7 archive that are visible through the publicly accessible inventory and search system.

Each station, including the USGS, defines procedures for submitting data requests in support of key government programs. Provisions are made to place high-priority, quick turn-around orders for emergency/disaster response activities.

The IC MOU signatory or designee acts as a single point of contact for requesting data from the USGS. The USGS Landsat MMO acts as a single point of contact for receiving and processing data requests from ICs.

3.4 Data Delivery Requirements

Data delivery requirements for scientific application programs are negotiated on a case-by-case basis for each key government program to the mutual agreement of the station, USGS, and key government program.

Standard turn-around time for emergency and disaster response applications is seven or fewer days. Time-critical orders are handled through established User Services procedures and protocols for high-priority order submissions and acquisition requests.

3.5 Data Archive and Distribution Rights for Exchanged Data

As specified in the Data Exchange Annex, data provided to the IC as part of a key government program are subject to the prevailing data policy of the local station unless otherwise negotiated between the USGS, the key government program, and the IC. Data the USGS receives from IC for key government programs are subject to the data policy of the USGS for archiving and distributing the data and subsequently produced data products.

3.6 Data Format

The data exchange formats are the L0Rp products in HDF and/or RCC data as described in Appendix A. The L0Rp products are specified by scene (path and row). The RCC data are specified by contact/subinterval and/or spacecraft time index.

Section 4 Data Exchange for Loss of Spacecraft Capabilities

4.1 Definition

Data exchange for loss of spacecraft capabilities is invoked in response to a temporary or sustained loss of spacecraft capability to record data to the SSR. The USGS MMO determines playback and/or downlink recorded data to support multiple downlinks for emergency situations.

As defined in the Data Exchange Annex, this data exchange is one-way, from an IC to the USGS. Due to the uncertainties in evaluating spacecraft anomalies and the high priority associated with addressing spacecraft issues, the USGS may request data to be exchanged retroactively, from a station's historical archive, from the initial date/time of the outage occurrence(s).

4.2 Authorization

The USGS MMO is the determining authority for implementing a data exchange based on a temporary or permanent loss of system capabilities. Permanent loss of the SSR as defined in the Annex may necessitate renegotiations of the MOU between the USGS and the IC regarding per-scene costs and/or station access fees.

4.3 Data Transfer Requirements and USGS Support

Data is requested on a subinterval (contact) basis, but accounted for on a scene-by-scene basis. Data are delivered in raw serial downlink or raw computer compatible format (as specified in Appendix A and appropriate DFCBs). Data transfers are arranged individually with each station, based on the data format requested/generated and station capabilities.

The USGS may opt to provide specialized data-capture equipment to a site for data collection. Arrangements for installation and operation of this specialized data-capture equipment are negotiated between the USGS and the IC station.

4.4 Data Delivery Requirements

Data delivery turn-around time is 30 or fewer days, from the time a data request is submitted to an IC and the date of data delivery to the USGS.

4.5 Data Archive and Distribution Rights

As specified in the Data Exchange Annex, the USGS will archive, distribute, and generate products and re-distribute the exchanged data in accordance with U.S. Data Policy, unless otherwise negotiated between the USGS and IC. The USGS will distribute data acquired from ICs no earlier than 30 days from the date of acquisition.

Section 5 Data Transfers to an International Cooperator

5.1 Definition

One-way data transfers to an IC are authorized under the Data Exchange Annex to address problems or anticipated problems with Landsat 7 data reception, such as short-term loss of reception capability due to station outages caused by scheduled maintenance or hardware failures.

5.2 Authorization Requirements

5.2.1 USGS Authorization

The USGS Landsat Project Manager or designee gives authorization to use this provision of the Data Exchange Annex and determines if the requesting station meets the criteria set forth in the Annex for data exchange. This person is also responsible for tracking usage of this provision of the Annex to ensure data volume limitations are maintained.

The Landsat Project Manager serves as the final authority in resolving disputes in this application of the Annex.

5.2.2 International Cooperator Authorization

The signatory to the MOU or designee serves as the certifying authority for IC requests for data and tracking requests to ensure that the specified data volume limitations are maintained.

Under the terms of the Annex, the Landsat Project Manager can increase the number of scenes provided to an IC.

5.2.3 Data Availability

Each IC may request approximately 300 scenes per year from the USGS Landsat 7 archive using the publicly accessible inventory and search system. Scenes ordered are limited to those within the IC station reception footprint(s), which have been acquired using the SSR during the time of a station outage. During a planned station outage, an IC may request that the USGS acquire additional coverage using the SSR to the extent that spacecraft resources are available.

Section 6 Funding Mechanisms

6.1 Data Exchange for Data Validation

Data exchanged between the USGS and IC for data validation are provided without any exchange of funds or other compensation. The party generating the data is also responsible for funding shipment of the data to the requesting party.

6.2 Data Transfers for Key Government Programs

Several payment mechanisms may be used based upon agreement between the USGS and the IC. They include quid pro quo, data in lieu of data access fees, or any method of payment agreed to by the parties. In general, the cost-of-reproduction (COR) model is used as a basis for calculating per-scene costs, or a price negotiated between the USGS and the IC.

6.2.1 Quid Pro Quo

Upon mutual agreement of the station and the USGS, data exchange costs may be handled on a quid pro quo basis, whereby an equivalent number of scenes or an equivalent amount of and type of data are exchanged between the station and the USGS. In this case, both the station and the USGS cover their respective costs associated with ordering, data production, and shipping between the station and a designated USGS representative.

6.2.2 Adjustments of the Data Access Fees

At the discretion of the Landsat Project Manager and upon mutual agreement of the station and the USGS, the equivalent value of provided scenes may be counted against the payment of station data access fees.

6.3 Data Transfers to International Cooperators for Short-term Outages

6.3.1 Quid Pro Quo

Upon mutual agreement of the station and the USGS, data exchange costs may be handled on a quid pro quo basis, whereby an equivalent number of scenes are exchanged between the station and the USGS. In this case, both the station and the USGS cover their respective costs associated with ordering, data production, and shipping between the station and a designated USGS representative.

6.3.2 Adjustments to Data Access Fees

At the discretion of the Landsat Project Manager and upon mutual agreement of the station and the USGS, the equivalent value of the requested scenes may be added to the schedule of station data access fees. In general, the standard USGS pricing model is used as a basis for calculating per-scene costs.

6.4 Data Transfers to USGS due to temporary or permanent loss of spacecraft capability

For temporary losses of spacecraft capability, the USGS may request data from the IC and pay for such data by reducing the value of the exchanged data from the data access fees.

For a permanent loss of spacecraft capability, in which the USGS becomes dependent upon ground stations to populate the U.S. archive, the USGS may renegotiate the Cost-sharing Annex of the MOU.

Section 7 Plan Implementation

7.1 Effective Date

The terms, conditions and procedures of this Plan are in effect at the time that the signatory of the MOU signs the Data Exchange Annex.

7.2 Data Validation Schedule

The activities of validating the readability of ground station data are on going. The schedule for data quality validation following the verification of data readability is documented in the Data Quality Validation Plan.

7.3 Contingency Plan for Loss of Landsat Spacecraft Capability

USGS prepares a detailed Contingency Plan to address the technical and programmatic issues involved in collaborating with IC to acquire Landsat 7 data to populate the USGS archive.

Appendix A Abbreviations and Acronyms

COR	Cost Of Reproduction
DFCB	Data Format Control Book
DLT	Digital Linear Tape
EDC	EROS Data Center
EROS	Earth Resource Observation Systems
HDF	Hierarchical Data Format
IAS	Image Assessment System
IC	International Cooperator
IGS	International Ground Station
L1G	Level 1 Geometrically Corrected
L0Rp	Level Zero Reformatted Distribution Product
LCCB	Landsat Configuration Control Board
LCCR	Landsat Configuration Change Request
LPS	Landsat Processing System
LPSO	Landsat 7 Project Science Office
LTWG	Landsat Technical Working Group
MMO	Mission Management Office
MOU	Memorandum Of Understanding
NASA	National Aeronautics and Space Administration
RCC	Raw Computer Compatible
SAIC	Science Applications International Corporation
SDLT	Super DLT
SSR	Solid State Recorder
USGS	U.S. Geological Survey

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Memorandum of Understanding Between the U.S. Geological Survey of the Department of the Interior and the International Cooperator for the Direct Reception and Distribution of Landsat 7 Data, and the draft Annex III for Data Exchange.