Appendix XXVI (Con't)

Canadian Space Agency | Agence spatiale canadienne

Canada

FRANÇAIS CONTACT US HELP SEARCH CANADA SITE

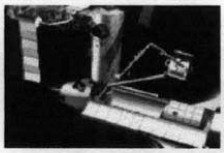
CSA ASC

Mission STS-100/6A

- Mission
- Mission Calendar
- Day-by-Day
- Travel Kit
- Responsibilities
- 3D EVA SpaceSuit
- Chris Hadfield
- Canadarm2
- Media Zone
- KidStation
- Download
- < STS-100 Home

STS-100/6A: Overview

Handshake in space



(click to enlarge)

The Canadarm2 and the Shuttle's Canadarm working together to transfer equipment

When the shuttle's Canadarm was first deployed, Canadians were riveted to their television sets as the arm, with the Canada wordmark displayed proudly on its side, began to move exactly as its developers had planned. Since then the Canadarm has been emblazoned in the nation's psyche as an icon of Canadian "can-do" and has been recognized internationally as a symbol of excellence in robotic technology.

Video: After the Shuttle has docked to the ISS, the Canadarm is used to unload the Canadarm2 and to install it to the Station. The Canadarm2 is then deployed and attaches itself to a power data grapple fixture (PDGF) on the Destiny module. Once attached to Destiny, the Canadarm2 transfers the pallet on which it was transported in the Shuttle, to the Canadarm, which, in turn, puts the pallet back in the Shuttle's cargo bay.

In April 2001, Canadians were once more captivated as Canadarm2, the next-generation robotic arm, was deployed and installed on the International Space Station. But their eyes weren't only on the new Canadarm2. To top it all off, they were also watching as one of their own, Canadian Space Agency Astronaut Chris Hadfield, stepped out of the Shuttle and into Canadian history as the first Canadian ever to perform a spacewalk.

So, even though it was a few months past Christmas, Chris Hadfield spent part of his time on his next Space Shuttle flight unwrapping what he calls "a huge present," **Canadarm2**. The "unwrapping" took place while Hadfield was floating outside the Shuttle as the first Canadian to do a spacewalk. "I'm going outside to help build Canada's piece of the Space Station," he said. "I'm going to be the guy who puts it together and puts it on the Station."

(Left: CSA astronaut Chris Hadfield with the Canadarm2 in the background - click on image to enlarge)

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The main purpose of Mission STS-100/6A was to deliver **Canadarm2,** (also known by its technical name, the Space Station Remote Manipulator System or SSRMS) to the Station, which is currently being assembled piece by piece about 400 kilometres above Earth. This robotic arm is the "construction crane" that will help build and maintain the Station. Getting the arm installed and working is critical to the rest of the construction schedule, which is expected to continue until 2006.

"We would not be able to handle the International Space Station without the Canadarm2. Every single mission will need it," says Savinder Sachdev, Acting Director General of Space Systems for the Canadian Space Agency.

In fact, **Canadarm2** is essential to the very next shuttle mission, STS-104/7A, scheduled for June 2001. "That flight can't go until the Canadarm2 is up and working," said Hadfield. "Canadarm2 needs to be used to lift the next payload, the station airlock."

This airlock will permit astronauts to exit the Station for spacewalks, which are also essential to completing assembly of the Station. The mammoth construction job will require an extraordinary 160 spacewalks, totalling 960 clock hours (or about 1920 man-hours)—more than twice the number of hours accumulated during all previous spacewalks done by NASA astronauts.

In addition to installing **Canadarm2**, Hadfield and his crewmates—including four Americans, one Russian and one Italian—installed an antenna on the outside of the Station and transfered scientific equipment into the Station from the Rafaello Multi-Purpose Logistics Module (MPLM). This is one of three reusable modules provided by the Italian Space Agency that will be used as "moving vans" to transport equipment to and from the Station. Raffaello is the second to visit the Station.

Appendix XXVII

Canadian Space Agency | Agence spatiale canadienne

Canada

FRANÇAIS CONTACT US HELP SEARCH CANADA SITE

CSA ASC

Canadarm2

Mission
Chris Hadfield
Canadarm2
First Steps
Evolution
MD Robotics
3D Viewer
Media Zone
KidStation
Download
< STS-100 Home

Canada's Ticket to the Space Station

In April 2001, the Space Shuttle *Endeavour* delivered a package that was Canada's key to the International Space Station, now being assembled about 400 kilometres above Earth.

Canadarm2

This is when the latest generation robotic arm—**Canadarm2**, the Space Station Remote Manipulator System (SSRMS) — was installed on the Station, with the aid of Canadian astronaut Chris Hadfield.

(Click to enlarge)
Still image with Endeavour's Canadarm (in front) and Canadarm2 (in back)

For Canadians, it was an event comparable to the day when the Canadarm was first lofted above the Shuttle's cargo bay against the backdrop of Earth floating by below. Like the Canadarm, **Canadarm2** is a distinctive Canadian contribution, providing an essential tool without which the Space Station could not function.

In fact, the Station could not even be built without **Canadarm2**. "Every single mission will need it," said Savinder Sachdev, Acting Director General of Space Systems for the Canadian Space Agency.

Click to enlarge

Contributing a robotic arm to the Station was a natural choice for Canada, given the successful track record of the Canadarm.

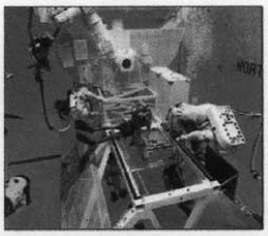
"Robotics was identified as a strategic technology for Canada, it was a self-contained package that Canada could afford, and it was a critical component of infrastructure which gave Canada a particular role and status in building the ISS," said Savinder Sachdev, Acting Director General of Space Systems.

Canadarm2 will play another essential role: it gives Canadian scientists access to the Station's laboratory

http://www.space.gc.ca/csa_sectors/hum_pre/english/flights/sts_100/canadarm/default.html

Appendix XXVII (Con't)

facilities to conduct experiments. It also entitles Canada to send an astronaut to the Station every three years for a tour of duty lasting three to four months.

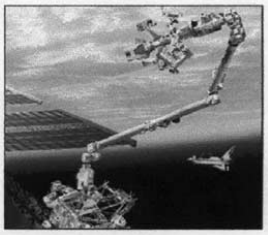


Click to enlarge

The contribution of **Canadarm2** buys Canadians the right to use 2.3% of the laboratory space in the non-Russian part of the Station, as well as access to a platform outside that exposes experiments to open space. CSA is currently working with scientists across Canada to develop future Space Station experiments.

The contribution of technology is also helping Canada pay for its share of the Station's operating costs. CSA will provide another robotic system, known as the Special Purpose Dexterous Manipulator (SPDM), to pre-pay part of these user fees. Credits for supporting the repair and overhaul of **Canadarm2** are also expected to be applied against Canada's user fees.

The Space Station still has to undergo about five years of heavy construction work but for many Canadian scientists, the countdown to being able to do experiments onboard begins as **Canadarm2** takes its first step onto the Station's external structure.



Click to enlarge

▶ **Ground Support**

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Subtask 9

T

Culminating Task

Expectations

- A Liturgical Celebration on the greatness of our God, who is the creator and designer of the universe.

Teaching Strategies

- The teacher will:
  - assign readings from the *Creation Story* in the **Book of Genesis**;
  - review with the students the *Opening and Closing Songs;*
  - assign *Prayers of the Faithful*; and
  - guide students in creating *Spontaneous Prayers.*

Suggested Resources

- Self-Assessment Rubric, **Appendix XXVII**, page 96.
- Liturgical Celebration, *God's Work in Creation and in History,* **Appendix XXVIII**, pages 97-100.

Catholic School Commentary

(1) ***A discerning believer*** formed in the Catholic Faith community who celebrates the signs and sacred mystery of God's presence through word, sacrament, prayer, forgiveness, reflection and moral living. **(OCSGE)**

Assessment

- The Liturgical Celebration will not be assessed by the teacher. A self-assessment rubric will be used by the students to assess the unit as a whole.

Subtask 9

S

Culminating Task

Material

- Self-Assessment Rubric, **Appendix XXVII**, page 96.
- Liturgical Celebration, *God's Work in Creation and in History,* **Appendix XXVIII**, pages 97-100.

Procedures

- Students will participate in the celebration as outlined in Liturgical Celebration Guide.

Further Challenges

Students could:

- dramatize the Creation Story;
- illustrate God's glory and the wonder of the universe with a mural;
- construct a space mobile, using found objects;
- create and perform a tableau of the Creation Story.

Appendix XXVII

Student Name: _____

Date: _____

Canadian Space Exploration Unit — Self-Assessment for use with Subtask 9: Culminating Task from the Grade 6 Unit: Space Exploration and Canada

Expectations for this Subtask to Assess with this Rubric:

Expectations from throughout the unit are to be used with this self-assessment.

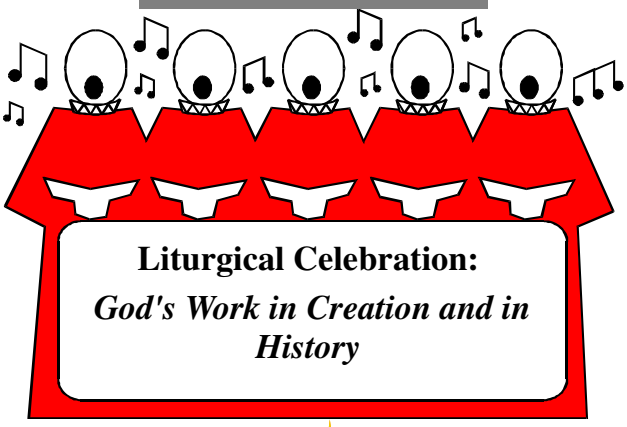
6e24 • read aloud, showing understanding of the material and awareness of the audience;

6e51 • contribute and work constructively in groups;

6a2 • sing and play instruments with expression and proper technique (e.g., with correct breathing, posture, embouchure);

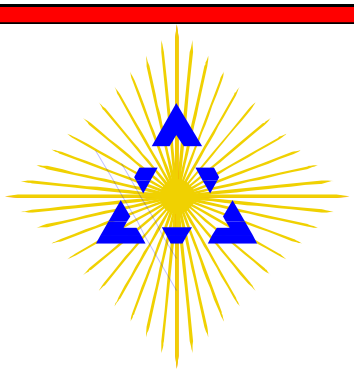
Category/Criteria	Level 1	Level 2	Level 3	Level 4
Work Habits/Home Work - class and homework completion - adherence to timelines - attention to quality	- completes little, if any of the assignments - rarely submits work on time - rarely works with care and attention to detail	- completes more than half the assignments - generally submits work on time - generally works with care	- completes most of the assignments - usually submits work on time - usually works with care	- completes all of the assignments - always submits work on time - always works with care
Teamwork - collaboration - conflict prevention - active involvement - respect for others	- rarely encourages others - rarely works towards achievement of group goals - rarely shows respect for all members of the group	- generally encourages - generally works towards achievement of group goals - generally shows respect for all members of the group	- usually encourages others - usually works towards achievement of group goals - usually shows respect for all members of the group	- always encourages others - always works towards achievement of group goals - always shows respect for all members of the group
Independent Work - problem solving - self-direction - responsibility	- uses only a few strategies - needs teacher assistance to plan - rarely accepts responsibility for own behaviour	- uses some strategies - needs some teacher assistance to plan - sometimes accepts responsibility	- uses several strategies - seldom needs teacher assistance to plan - usually accepts responsibility	- uses a variety of strategies - never needs teacher assistance to plan - always accepts responsibility
Organization - notes - planning - resources	- seldom organized - rarely develops a plan to complete task - uses few resources (e.g., library books, cd-roms)	- sometimes organized - sometimes develops a plan to complete task - uses some resources (e.g., library books, cd-roms)	- usually organized - usually develops a plan to complete task - uses several resources (e.g., library books, cd-roms)	- always organized - always develops a plan to complete task - uses a wide variety of resources
Initiative - approach to learning - risk taking - self-awareness	- rarely shows interest - rarely tries new techniques or approaches - rarely reflects on own progress	- sometimes shows interest - sometimes tries new techniques or approaches - sometimes reflects on own progress	- usually shows interest - usually tries new techniques or approaches - usually reflects on own progress	- always shows interest - always tries new techniques or approaches - always reflects on own progress

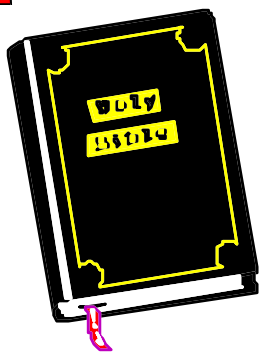
Appendix XXVIII



Liturgical Celebration:

God's Work in Creation and in History





Appendix XXVIII (Con't)

CREATING A MOOD FOR THE CELEBRATION

1. Decorations from the students work; e.g., manipulator arms, Scripture quotes, illustrative material from presentations they have made to the class, Art displays, prayers, etc. The celebration may be in another classroom or area.
2. Lights could be dimmed. Students could be seated in a semi-circle. Quiet music could be played m the background while the students assemble. (quiet instrumental music such as the instrumental side of the Religion program cassette tapes.)
3. Special guests should be invited; e.g., parish priest, principal, parents, another class, religion coordinator, school councils, etc.
4. Students write a personal *hope for the universe* or a *commitment to the universe* to be placed in a basket during the **Final Blessing**.

PREPARATION FOR THE CELEBRATION

Before the teacher announces the **Introduction** and **Purpose of the Celebration**, it is necessary to quiet the students and prepare them for the celebration.

> *Let us all take a few moments, close our eyes, and still our bodies. (pause). Now let us still our hearts and remember that God is with us now, as we come before our God in prayer.*

INTRODUCTION:

Leader: *We welcome all of you who have come together to celebrate with us. Today we are celebrating the greatness of our God, who is the Creator and Designer of our Universe. Throughout this unit, we have had many opportunities to stand back in wonder and awe at the beauty and magnitude of God's creation.*

Let us now express our joy, as we begin this celebration, by singing together our opening song.

OPENING SONG

You Shall Be My Witness from the Grade 6 Religion program manual.

LITURGY OF THE WORD

Tandem reading of ***Genesis*** story of seven days of Creation

Gen. 1: 1-3	- Day One	- one student
Gen. 1: 6-8	- Day Two	- another student
Gen. 1: 9-10	- Day Three	- another student
Gen. 1: 14-17	**-** Day Four	- another student

Appendix XXVIII (Con't)

Gen. 1:20-22	- Day Five	- another student
Gen. 1:26a-27	- Day Six	- another student
Gen. 2:1-4	- Day Seven	- all students

RESPONSE to the Word of God

Leader: *We have just listened to the story of God's creation. We are also reminded that we are called to be co-creator with our God in this Universe.*

Teacher chooses one of the following options; e.g.,

a) Spontaneous Prayer

Let us now take time to express our prayers of praise and thanksgiving.

I thank you Lord for the joy …
I thank you Lord for the wonder of …
I praise you God for ...

b) Prayers of the Faithful

The response is: *Lord hear our prayer*

Let us pray that we will be faithful followers of Jesus by caring for our planet Earth. We pray to the Lord.

Response: *Lord hear our prayer*

Let us pray that our technological advances will be used for the betterment of all people. We pray to the Lord.

Response: *Lord hear our prayer*

Let us pray for people in positions of responsibility that their decisions regarding the environment will be based on Gospel values. We pray to the Lord.

Response: *Lord hear our prayer*

Let us pray for the success of the people working to preserve our environment. We pray to the Lord.

Response: *Lord hear our prayer*

Let us pray for our Canadian Space Team and all who work in the space sciences. We pray to the Lord.

Response: *Lord hear our prayer*

Appendix XXVIII (Con't)

FINAL BLESSING

Have the students gather in a large circle. Each student will be invited to place their personal *hope for the universe* or personal *commitment to the universe* in a basket or globe or circular object. Invite students to raise their right hand and pray the following blessing.

(Place on overhead or chart or all to read this blessing together)

We bless and praise you 0 God of the Universe, creator of all things. We bless each other and pray that we will be faithful in our commitment to care for the Earth. Amen.

Closing Hymn

Lord of the Dance, **Catholic Book of Worship II**, #558