



Briefing Document

Institute of Space and Atmospheric Studies

A Research Unit within Department of Physics
and Engineering Physics

University of Saskatchewan

www.usask.ca/physics/isas

2007/2008

Institute of Space and Atmospheric Studies (ISAS)

Providing National and International Leadership in Research

“Atmospheric Environment”¹

Atmospheric Processes: radiation, chemistry, dynamics

“Climate Change” : Anthropogenic and Solar Forcings

“Space Environment”²

Solar-Terrestrial Coupling Geospace Knowledge

“Space Weather” “Space Climate”

Programs guided by CSA Workshops of 2005, and their reports: 10 Year Visions
for Solar Terrestrial & Atmospheric Sciences

Professors 1 Ted Llewellyn [E] Alan Manson [E] Doug Degenstein Adam Bourassa

2 George Sofko [E] Sasha Koustov Glenn Hussey Kathryn McWilliams

1 & 2 Jean-Pierre St.-Maurice CRC

ISAS Community

Activities guided by:

VISION STATEMENT

- ◆ Research Local/regional National /Continent Global/planet
- ◆ Knowledge Understanding Technology (“hard” “soft”)
- ◆ Training Students PDF/Scientists Engineers Collaborative
- ◆ Technology Transfer People Ideas CSA-contracts/ Space Technology
- ◆ Communications Papers [peer review] CSA/NRCan/EC Media Community
- ◆ Linkages Collaborations
CSA -SSB EC-AS&T GSC-NRCan NSERC CFCAS

ADVISORY COMMITTEE

- ◆ Govt Agencies and Depts, Local Space Industry, UofS Admin



• Space Environment / Solar-Terrestrial Science

Ionosphere Thermosphere Magnetosphere

- Solar variability and solar wind
- Magnetospheric responses and processes, space plasmas
- Linkages with the ionosphere and thermosphere: ionospheric velocity and electric field patterns, voltage maps, aurora
- **Geospace Monitoring:**
 - *Ground-based observations* full temporal resolution networks
 - *Space-based observations* full global coverage limited temporal resolution
 - *Models, data assimilation*
- **Space Weather and Climate:** Influences upon space vehicles; communications and remote sensing; ground-based energy distribution systems; solar influences upon climate; presence in the Arctic

Atmospheric Environment/Science

Lower and Middle Atmosphere (2-100km)

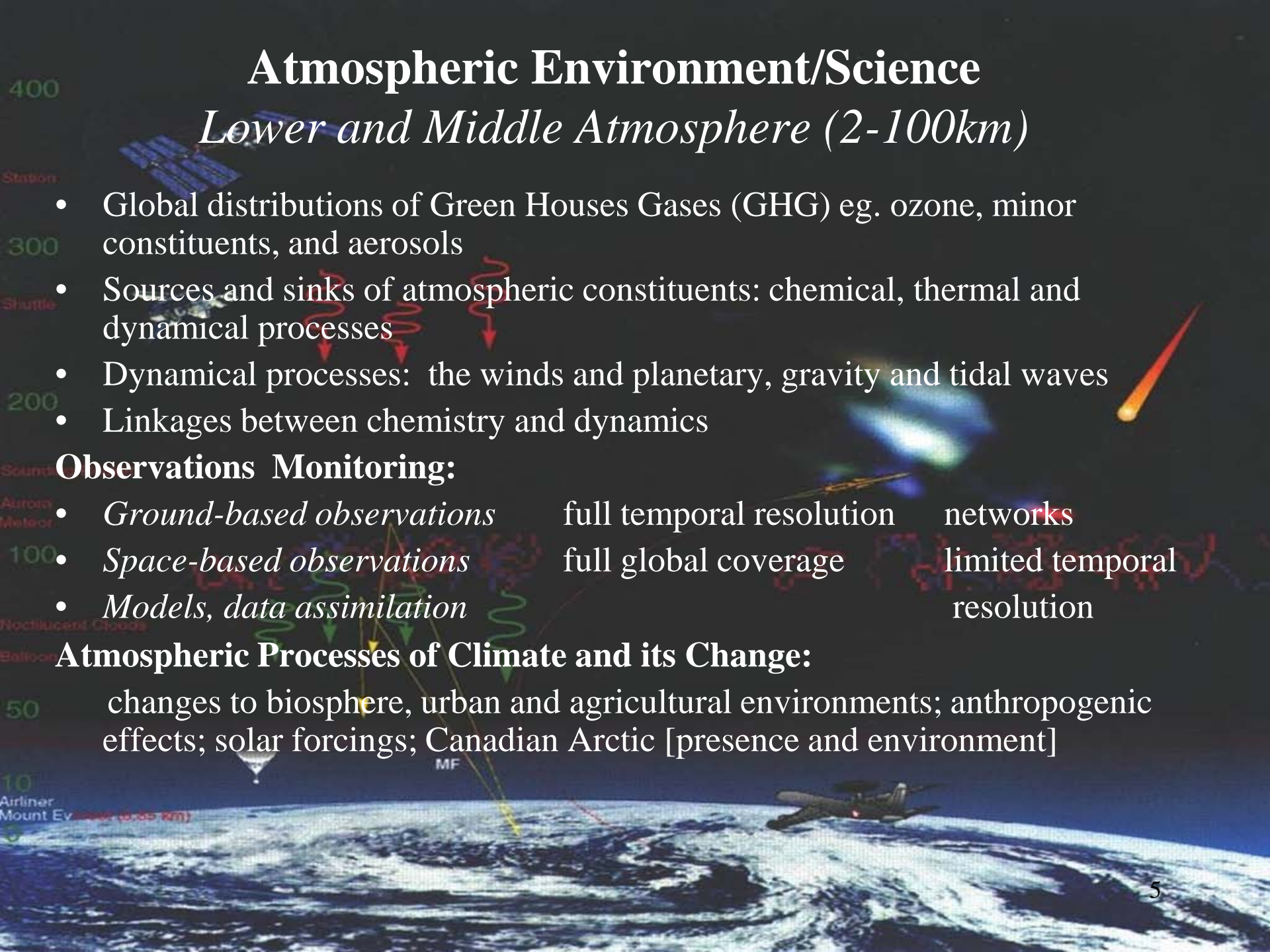
- Global distributions of Green Houses Gases (GHG) eg. ozone, minor constituents, and aerosols
- Sources and sinks of atmospheric constituents: chemical, thermal and dynamical processes
- Dynamical processes: the winds and planetary, gravity and tidal waves
- Linkages between chemistry and dynamics

Observations Monitoring:

- | | | |
|------------------------------------|--------------------------|-----------------------------|
| • <i>Ground-based observations</i> | full temporal resolution | networks |
| • <i>Space-based observations</i> | full global coverage | limited temporal resolution |
| • <i>Models, data assimilation</i> | | |

Atmospheric Processes of Climate and its Change:

changes to biosphere, urban and agricultural environments; anthropogenic effects; solar forcings; Canadian Arctic [presence and environment]



ISAS Resources Personnel

6 Professors ¹ - Principal Investigators + 2 Research Professors (Emeritus)
2 Adjunct Professors
2 Research Associates 3 PDFs 1 Res. Engineer
6 PhD Graduate Students
5 MSc Graduate Students

ISAS Support Staff

Bill Marshall

Technician: optics /electronics lab. supervision, system/site maintenance, system development

Debbie Kowaliuk

Clerical Assistant: personnel, web manager, text graphics, communications

Cindy Jelinski

Admin. Assistant: stores, budget, accounts, space, conferences

¹ Including CRC Chair in "Environmental Sciences"

PEP-ISAS Resources Professors

3 Emeritus 2 “senior” 2 “middle-”, 2 “early-career”

- * Expertise match **PEP undergraduate needs**
 - Engineering Physics
 - Honours (Math- Physics, Comp- Physics)
- * Research themes match **Canadian priorities**
 - CSA/EC/NRCan/CRC \$ bridging opportunities
- * Research activities match **Graduate Student & Career Development Needs**
 - Information Technology and Telecommunications
 - Space Research / Technology
 - Environmental Science / Technology

Strong Professorial strength in ISAS is appropriate

ISAS Resources Systems

A. Existing

General Equipment (test, laboratory)		\$ 100K
VHF radar (Sapphire)		\$ 500K
HF radar (SuperDARN)		\$1200K
SuperDARN (PolarDARN) – [Geospace Monitoring]	CFI	\$ 700K
Network for Northern Studies (CANDAC- PEARL)	CFI	\$ 8M+
MF radar systems (4)		\$1000K
Odin-OSIRIS Satellite		\$ 25M+
Computer systems (incl. work stations)		\$ 200K

	TOTAL	\$3700K+\$M

NB other infrastructure Odin software systems:
\$2000K invested (CSA contracts)

B. Future (will appear in NSERC grant applications, or within CSA program)

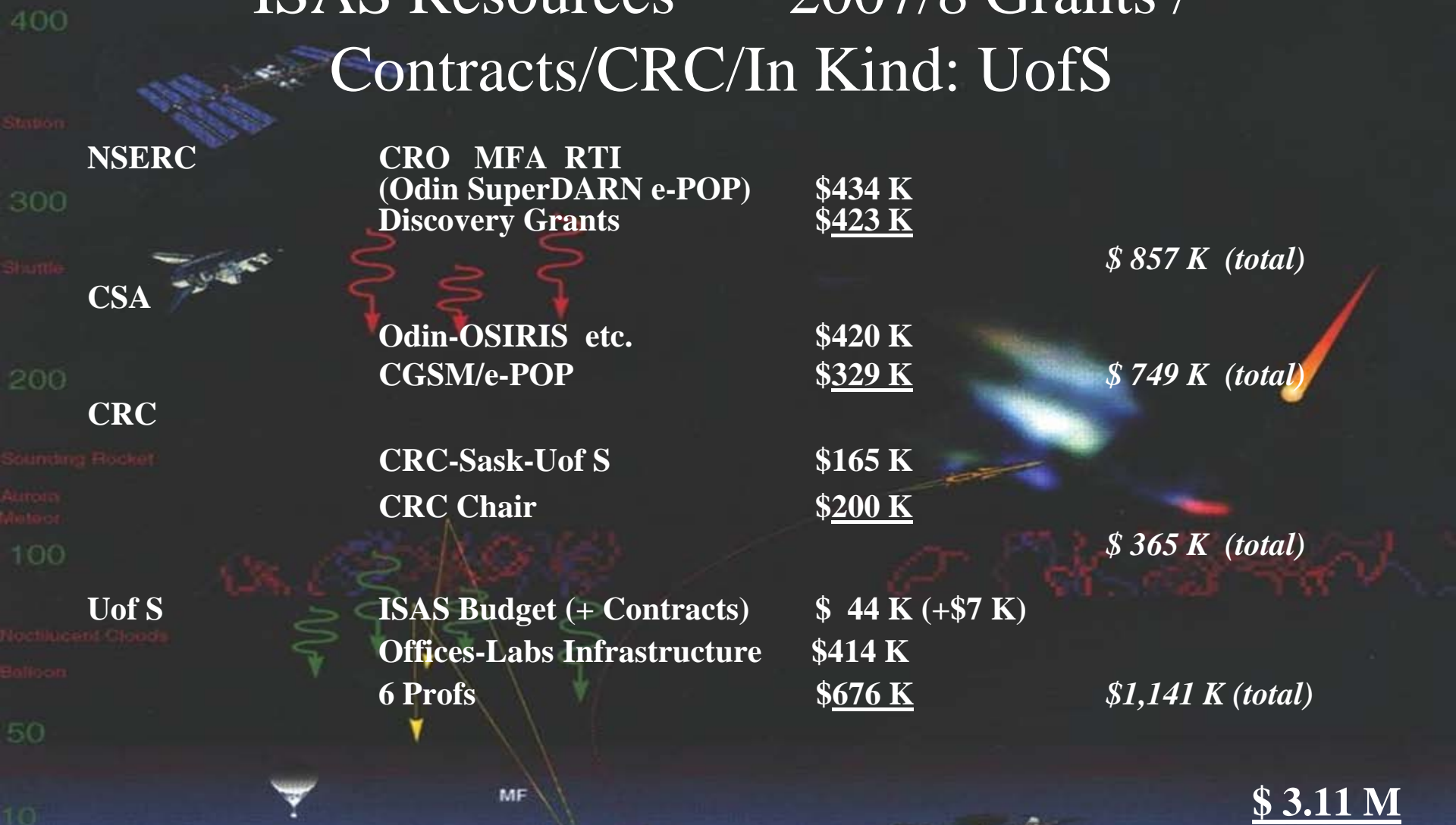
- ◆ Second generation “OSIRIS” systems \$ M
- ◆ **Atmospheric Sciences Global Change Missions** \$ M
- Upgrade to ISAS test equipment \$50K

TOTAL \$ M

ISAS Resources Infrastructure

- Development Laboratories¹
 - Field Sites^{1 3} Park Site (MF radar), Kernen (SuperDARN radar), Physics Roof (Optical), Bakker's Farm (VHF radar), Rabbit Lake (Optical), Platteville, Colorado (MF radar), Tromsø, Norway (MF radar), Prince George BC (SuperDARN), Rankin In., Nunavut (Radar – Optical), PEARL (SKiYMET radar), Eureka, Ellesmere Is
 - Computers¹ PC Workstations (HP-C200, -7151; IBM; OSIRIS-systems²), Alphaserver 1000², SuperDARN Data-Copy Centre
 - Support Staff
 - Administration³
 - Finances³
 - Stores³
 - Technical^{1 2}
- ¹ NSERC ² CSA ³ Uof S

ISAS Resources 2007/8 Grants / Contracts/CRC/In Kind: UofS

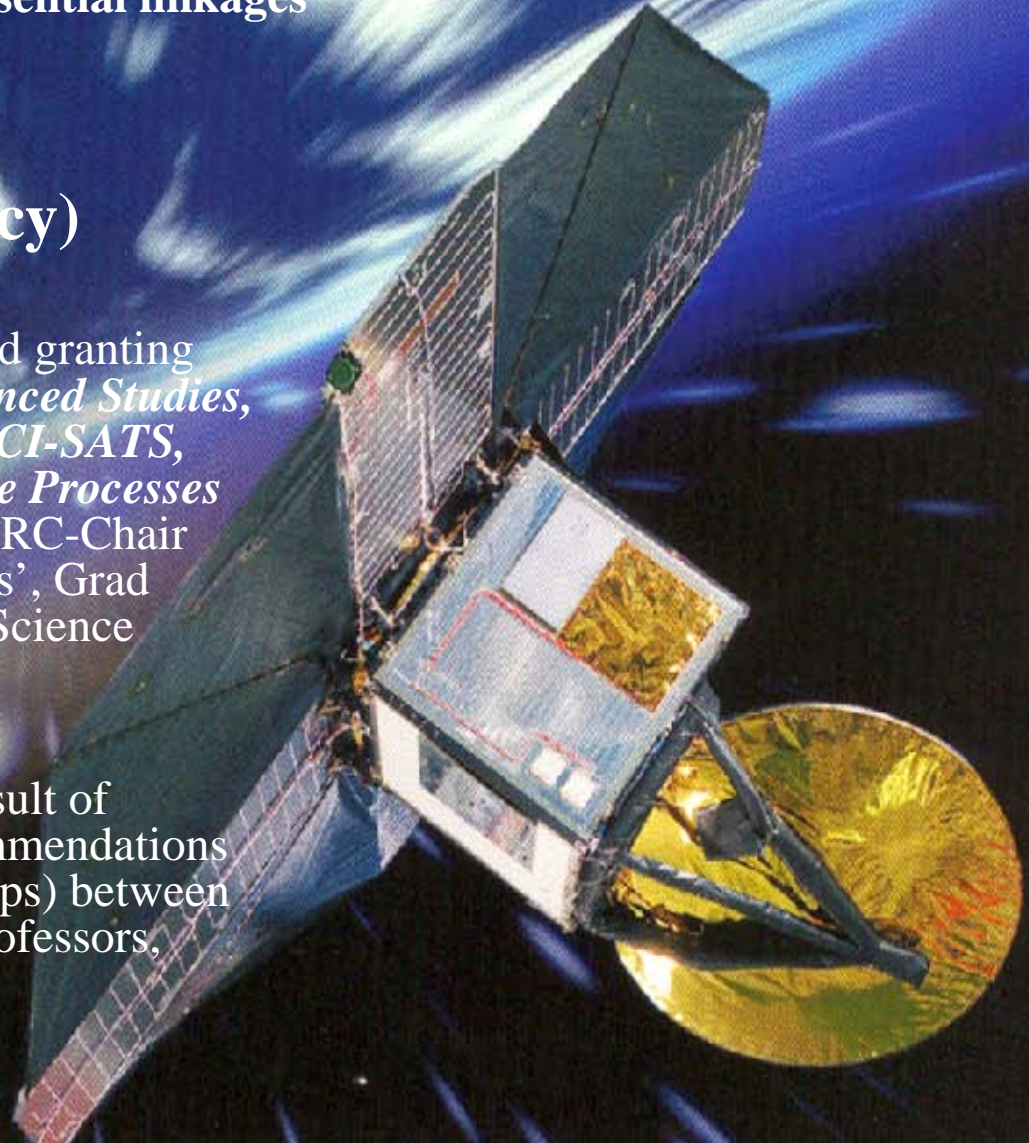


NSERC (Natural Sciences and Engineering Research Council)

- Provides a variety of effective granting opportunities
- Collaborates with the CSA ---- **essential linkages**

CSA (Canadian Space Agency)

- Provides a wide variety of contract and granting opportunities: *Concept Studies, Advanced Studies, Suborbital-vehicle research, Small/SCI-SATS, International Collaborations, Climate Processes Missions*; Prof renewal-facilitation, CRC-Chair support, Visits to Universities/'Groups', Grad student and RA opportunities, Space Science Enhancement .
- Development of these vehicles is a result of Advisory Committee (SAEAC) recommendations and interactions (community workshops) between CSA Staff and University/Industry Professors, Scientists & Engineers



ISAS Research Futures

ATMOSPHERIC Chemistry Dynamics Thermodynamics Pollution

- Odin-OSIRIS (2001) & Terra-MOPITT Satellites⁴, Operations-Science^{2,4} 2007/8+
- MOPITT campaigns / ground - based OSIRIS^{2,4} 2006+
- CSA's SCI-SAT ACE (2003)^{4,2} collaborations 2007/8 +
- CMAM atmospheric model, FDAM^{2,3,4,5} (data assimilation and modeling).
- NASA TIMED (2001) satellite + ground-based programs² 2007/8+
- Chinook SWIFT-ARGO Mission^{2,4} In Review
- Canada's Contribution to SCOSTEP's CAWSES (Climate And Weather of Sun-Earth System) 2004 – 2008², and CEDAR²
- Polar Environment Atmospheric Research Lab^{6,5,2,3,4} at 80N (CANDAC-PEARL) with SKIYMET VHF radar 2006+
- STEP-APOCC (Atmospheric Processes of Climate and its Change, 2006-15)^{4,2,5.3} Mission Concept Study^{7,8} 2008/9

² NSERC

³ EC (AS&T)

⁴ CSA

⁵ CFCAS

⁶ CFI

⁷ NRCan

⁸ Bristol Aerospace

Cont'd.

ISAS Research Futures (Continued)

GEOSPACE Ionosphere Magnetosphere Aurorae Solar Processes

- SuperDARN operation and growth ^{2,4,6} 2006+
- GeoSpace Monitoring/ SuperDARN / PolarDARN ^{6,4,2,7} / CADI ^{2,4} 1999 – 2009
- Collaborations with AMISR at Resolute Bay ^{2,4,6} 2006+
- CSA e-POP satellite ^{4,2} 2006+
- THEMIS (gb CSA) RAVENS ORBITALS SWARM ^{4,2} 2006+
- ILWS Program

² NSERC

³ EC (AS&T)

⁴ CSA

⁶ CFI

⁷ NRCan

Challenges and Opportunities for 2007 - 2012

➤ Improve and expand scope of

“Solar Terrestrial and Atmospheric Science” Research (ISAS)

- Department, College and University levels/ Multidisciplinarity
- Membership in the “School of the Environment & Sustainability”/ Global Change
- Agency linkages CSA EC-AS&T NRCan-GSC CRC Defence R&D NSERC
- Canadian University/ Community linkages

➤ Optimize activities with CRC Chair; “Solar-Terrestrial Environment”, “Atmospheric Environment”, Boundary Layer including Surface Science, Environment.

- “Space Weather” and “Climate Change”
- Links with Biology, Geological Sciences, Geography, Agriculture, Engineering

➤ Professors, the heart of ISAS

- Hire an Atmospheric Science Professor 2009/10 [salary line of Prof Manson]
- Consistency with Department (Physics and Engineering Physics) and Colleges’ needs, and leadership within them.

➤ Response to Serendipity

Appendix 1 ISAS Resources (Summary)

Personnel 33: 6(+1) Professors, 3 Emeritus/ISAS Research Professors,
2 Adjuncts/7 RA or PDF/1 Engineer/ 11 Students/ 3 Support-staff

Systems Radars (MF, HF, VHF) Odin-OSIRIS Satellite
Optical-systems (ground, air) Computers
SuperDARN PolarDARN SKiYMET \$4000K +\$ M

Infrastructure Field sites: Saskatchewan, Canada, International
Development Laboratories Computer-systems

Financial \$ 1.97 M 2007/8 NSERC – CSA – CFCAS Grants / Contracts