Briefing Document

Institute of Space and Atmospheric Studies

www.usask.ca/physics/isas

May 2006

Institute of Space and Atmospheric Studies (ISAS)

A Research Unit within Department of Physics and Engineering Physics
University of Saskatchewan

Providing National and International Leadership in Research into "Solar-Terrestrial and Atmospheric Sciences":

"Atmospheric Environment" [1]

"Climate Change" Atmospheric Processes

Anthropogenic and Solar Forcings

"Space Environment" [2]

"Space Weather" "Space Climate"

Geospace Solar Influences on Climate

Programs guided by CSA Workshops of 2005, and their reports: 10 year Visions for Atmospheric Sciences , and Solar Terrestrial Sciences in Canada [3]

Professors 1 Ted Llewellyn Alan Manson Doug Degenstein 2,1 Jean-Pierre St.-Maurice
2 George Sofko Sasha Koustov Glenn Hussey Kathryn McWilliams
3 www.space.gc.ca; www.usask.ca/physics/isas

ISAS Community

Activities guided by

VISION STATEMENT

- Research — Local National Global
- Knowledge — Understanding Technology (“hard” “soft”)
- Training — Students Scientists Engineers Collaborative Comprehensive
- Technology Transfer — People Ideas
- Communications — Media Community
- Linkages Collaborations — NSERC CSA[1] EC-AS&T GSC-NRCan

ADVISORY COMMITTEE

- Senior Administrators/ Scientists of Government Agencies, Departments, Industry and U of S, (November, 2001; December, 2004-2007), Chaired by the Dean (College of Arts & Sciences)
- Reporting to the Dean (College of Arts & Sciences)

[1] SAEAC CSA Advisory Committee and the Space Science Branch

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

Atmospheric Environment/Science

Lower and Middle Atmosphere

- 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:

• *Ground-based observations*	full temporal resolution	networks
• *Space-based observations*	full global coverage	limited temporal resolution
• *Models, data assimilation*		

Atmospheric Processes of Climate Change:

anthropogenic effects terrestrial oscillations solar forcings

ISAS Resources (Summary)

Personnel 7 Professors, 3 Emeritus, 28 Scientists/ Students/ Staff/ Support-staff

Systems Radars (MF, HF, VHF) Odin-OSIRIS Satellite
Optical-systems (ground, air) Computers
$3000K +$M

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

Financial $1.56M[MF] 2005/6 NSERC - CSA

ISAS Resources Personnel

7 Professors [1] - Principal Investigators + 3 Emeritus

2 Adjunct Professors

3 Research Associates 3 PDFs 1 Res. Engineer

3 PhD Graduate Students (3 graduate in 2005/06)

13 MSc Graduate Students (2005/2006)

ISAS Support Staff

Bill Marshall	Technician: Optics /Electronics Lab. Supervision, System/Site maintenance, System development
Debbie Kowaliuk	Secretary/Administration
Cindy Jelinski	Assistant (Stores /Accounts)

(Total 38)

[1] Including CRC Chair in “Environmental Sciences”

PEP - ISAS Resources Professors

4 “senior” 6 “middle-”, “early- career”

- Expertise match **PEP undergraduate needs**
  - Engineering Physics
  - Astronomy
  - Honours (Math. Physics Comp. Physics)
- Research themes match **Canadian priorities**
  - programmes $ 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. <u>Existing</u>

General Equipment (test, laboratory)		$ 100K
VHF radar (Sapphire)		$ 500K
HF radar (SuperDARN)		$1200K
SuperDARN (PolarDARN) – [Geospace Monitoring]	CFI	$ 350K
Network for Northern Studies (CANDAC- PEARL)	CFI	$ 8M+
MF radar systems (4)		$1000K
Odin-OSIRIS Satellite		$ 25M+
Computer systems (incl. work stations)		$ 200K

TOTAL		**$3350K+$M**

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

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

♦ Second generation “OSIRIS” systems	$ M
♦ **Atmospheric Sciences Climate Change Missions**	$ M
Upgrade to ISAS test equipment	$50K

TOTAL	**$ M**

ISAS Resources Infrastructure

- Development Laboratories[1]
- Field Sites[1 3] Park Site (MF radar), Kernen (SuperDARN radar), Physics Roof (Optical), Bakker's Farm (VHF radar), Rabbit Lake (Optical), Platteville CO (MF radar), Tromsø, Norway (MF radar), Prince George BC (SuperDARN), Rankin In., Nunavut (Radar – Optical) PEARL (SKiYMET radar), Eureka, Ellesmere Is
- Computers[1] PC Workstations (HP-C200, -715[1]; IBM; OSIRIS-systems[2]), Alphaserver 1000[2,] SuperDARN Data-Copy Centre
- Support Staff [3] Administration Finances Stores Technical[1 2]

[1] NSERC [2] CSA [3] Uof S

ISAS Resources Grants / Contracts

NSERC	CRO MFA RTI		
	(Odin SuperDARN e-POP)	$457 K	
	Discover Grants	$372 K	
			$829 K (total)
CSA			
	Odin-OSIRIS etc.	$380 K	
	CGSM/e-POP	$140 K	
			$520K (total)
CRC			
	CRC-Sask-Uof S	$155K	
			$155K (total)
Uof S	ISAS Budget (+ Contracts)	***$ 44 K***	(+$7 K)

$ 1.56 M

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, Small/SCI-SATS, International Collaborations, Climate Change Missions;*** Prof renewal-facilitation, CRC support, Visits to Universities/'Groups', Grad student and RA opportunities.
- Development of these vehicles is a result of Advisory Committee (SAEAC) recommendations and interactions between CSA Staff and University/Industry Professors, Scientists & Engineers

The CRC Chair
in "Environmental Sciences" within
the Institute of Space and Atmospheric Studies (ISAS)
Department of Physics and Engineering Physics
July 1st 2004

Professor St.-Maurice has a deep expertise and International standing in the area of the "Solar-Terrestrial Environment" including aspects of "Space Weather" and "Climate Change", and the ability to strongly enhance the Programmes within ISAS. In addition, issues of Climate Change, the impact of the sun upon the Terrestrial Environments, and anthropogenic forcing are of significant interest and importance to scientists within Departments of the Colleges of Arts and Science, Engineering and Agriculture. Professor St.-Maurice, with ISAS Colleagues is interacting strongly with such Departments and Research Groups and provides Campus leadership in the area of the Solar-Terrestrial Environment, including aspects of Climate Change and Solar Influences on Climate.

“Research Programme” for the CRC Chair: J-P. St.-Maurice

“My vision is consistent with the Proposal for a “CRC Chair in Environmental Sciences within the Institute of Space and Atmospheric Studies (ISAS)/ Department of Physics and Engineering” that was provided (June 2003) by Dr. Alan Manson (Chair). It is for the Solar Terrestrial Environment group within ISAS to become recognized as the center for ionospheric research in Canada and to be perceived as a major player in ionospheric and thermospheric research on a worldwide basis. Also, that the University be seen as a Canadian focus for studies of linkages between Climate Change effects within the biosphere and atmosphere and variations in solar activity.”

Activities of CRC Chair and ISAS Professors/Scientists with "Climate/ Environmental Change" Community (Profs. St.-Maurice, Manson)

1. *Formation of an "Executive" committee to engage the interest of those involved with Environmental/ Climate Change issues, and to form a (virtual) Centre for such studies.*

2. *Involvement of ISAS colleagues, including the 7 professors, scientists and students, in the campus Climate Change community. The Chair, Alan Manson, will work with The CRC Chair, Professor St.-Maurice on this Program of activities..*

3. *Development of a high profile 'Environmental and Climate Change" Colloquium Series that will engage the campus and City communities, including the media.*

4. *Planning of an annual Workshop focusing upon Environmental/ Climate Change issues. This would include the related Solar Terrestrial and Atmospheric Environments (the strengths of ISAS). New international Programs with which ISAS and the Canadian Space Agency are involved would add penetration and importance to these workshops.*

Challenges and Opportunities for 2006 - 2011

- **Maintain, improve and expand scope of "Atmospheric and Solar Terrestrial Science" Research (ISAS)**
  - Department, College and University levels
  - Agency linkages CSA NSERC EC-AS&T CRC NRCan-GSC
- **Optimize the activities of the CRC Chair: "Solar-Terrestrial Environment" and "Atmospheric Environment"**
  - "Space Weather" and "Climate Change"
  - Links with Biology, Geological Sciences, Geography, Agriculture, Engineering
- **Professors, the heart of ISAS**
  - Effective replacement of senior professors (2006, 2007 and 2008)
  - Consistency with Department (Physics and Engineering Physics) and College needs, and leadership
- **Response to Serendipity**

ISAS Research Futures

ATMOSPHERIC Chemistry Dynamics Thermal-processes Pollution

- Odin OSIRIS and MOPITT Satellite – Systems[4], Operations-Science[2,4] 2005+
- Airborne - MOPITT campaigns / ground - based OSIRIS[2,4] 2005+
- CSA's SCI-SAT ACE[4,2] 2005 +
- **CMAM atmospheric model, FDAM [2,3,4,5] (data assimilation and modeling)**
- NASA TIMED satellite + ground-based programme [2] 2005 +
- **SWIFT Mission[2,4] 2006+**
- Canada's Contribution to SCOSTEP's CAWSES 2004 – 2008[2], and CEDAR[2]
- Arctic Atmospheric ground-based Research [6,5,2,3,4] (CANDAC-PEARL) 2005+
- **Atmospheric Processes of Climate Change Mission (APOCC) [4,2,5.3] 2006 - 2015**
- CSA's Long Term Space Plan III,[4,3,2] 1999 – 2009
- ILWS Program

[2] NSERC [3] EC (AS&T) [4] CSA [5] CFCAS [6] CFI [7] NRCan

ISAS Research Futures (Continued)

GEOSPACE Ionosphere Magnetosphere Aurorae Solar Processes

- SuperDARN operation and growth [2, 4] 2005+
- **GeoSpace Monitoring/ SuperDARN / PolarDARN [6,4,2,7] / CADI [2, 4] 1999 – 2009**
- **Collaborations with AMISR at Resolute Bay [2,4] 2006+**
- **CSA e-POP satellite [4,2] 2006+**
- RAVEN ORBITALS SWARM [4,2] 2005+
- CSA's Long Term Space Plan III [4,2] 1999 – 2009
- ILWS Program

[2] NSERC [3] EC (AS&T)[MF] [4] CSA [5] CFCAS [6] CFI [7] NRCan