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”
Atmospheric Processes: radiation, chemistry, dynamics
“Climate Change”: Anthropogenic and Solar Forcings

“Space Environment”
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
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
- Knowledge
- Training
- Technology Transfer
- Communications
- Linkages

Local/regional National /Continent Global/planet
Understanding Technology (“hard” “soft”)
Students PDF/Scientists Engineers Collaborative
People Ideas CSA-contracts/-Space Technology
Papers [peer review] CSA/NRCan/EC Media Community
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 House 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 and its Change:
- changes to biosphere, urban and agricultural environments; anthropogenic effects; solar forcings; Canadian Arctic [presence and environment]
ISAS Resources Personnel

6 Professors - 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

- Development Laboratories
  - Field Sites
    - 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
  - Computers
    - PC Workstations (HP-C200, -7151; IBM; OSIRIS-systems), Alphaserver 1000
  - Support Staff
    - Administration, Finances, Stores, Technical

1 NSERC  2 CSA  3 Uof S
ISAS Resources 2007/8 Grants / Contracts/CRC/In Kind: UofS

NSERC
- CRO MFA RTI (Odin SuperDARN e-POP) $434 K
- Discovery Grants $423 K

NSERC (total) $857 K

CSA
- Odin-OSIRIS etc. $420 K
- CGSM/e-POP $329 K

CSA (total) $749 K

CRC
- CRC-Sask-UofS $165 K
- CRC Chair $200 K

CRC (total) $365 K

UofS
- ISAS Budget (+ Contracts) $44 K (+$7 K)
- Offices-Labs Infrastructure $414 K
- 6 Profs $676 K

UofS (total) $1,141 K

Total $3.11 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, 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 Satellites\textsuperscript{4}, Operations-Science\textsuperscript{2,4} 2007/8+
- MOPITT campaigns / ground-based OSIRIS\textsuperscript{2,4} 2006+
- CSA’s SCI-SAT ACE (2003)\textsuperscript{4,2} collaborations 2007/8+
- CMAM atmospheric model, FDAM \textsuperscript{2,3,4,5} (data assimilation and modeling).
- NASA TIMED (2001) satellite + ground-based programs \textsuperscript{2} 2007/8+
- Chinook SWIFT-ARGO Mission\textsuperscript{2,4} In Review
- Canada’s Contribution to SCOSTEP’s CAWSES (Climate And Weather of Sun-Earth System) 2004 – 2008\textsuperscript{2}, and CEDAR\textsuperscript{2}
- Polar Environment Atmospheric Research Lab \textsuperscript{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) \textsuperscript{4,2,5,3} Mission Concept Study \textsuperscript{7,8} 2008/9

\textsuperscript{2} NSERC  \textsuperscript{3} EC (AS&T)  \textsuperscript{4} CSA  \textsuperscript{5} CFCAS  \textsuperscript{6} CFI  \textsuperscript{7} NRCan  \\
\textsuperscript{8} Bristol Aerospace

Cont’d.
ISAS Research Futures (Continued)

GEOSPAC E 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 \(^5\) 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


• “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