EXECUTIVE SUMMARY

of

VISION AND OPTIONS

for the

Future of the US National Strong-Motion Program

Prepared by

The Committee for the Future of the US National Strong-Motion Program

R. Borcherdt, *Chairman*

USGS Members
H. Benz, M. Celebi, A. Frankel, W. Joyner, E.V. Leyendecker, D. Oppenheimer, R. Porcella, C. Stephens, D. Wald

External Advisory Panel Members
B. Bolt, C.B. Crouse, G. Hart, K. Jacob, T. Shakal, C. Stepp

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PREFACE

Purpose of these reports

These reports are presented in response to a charge of the Earthquake Hazards Program Council of the US Geological Survey to "define the future of the USGS National Strong-Motion Program (NSMP)" (Appendix A). The council requested that a "Vision Paper" and an "Options Document" be prepared. Each of these reports is a separate document. The "Executive Summary" of both reports is presented under separate cover.

The content of the reports and the executive summary is organized to the extent possible according to the main charges of the EHRP Program Council. Detailed evaluation of charges and questions posed by the Council with the benefit of modern GIS tools and the recent deliberations of 3 national workshops have yielded substantial new insight regarding the status of strong-motion measurement in the US. These reports are intended as an objective evaluation of the nation's need and capability to record the next major earthquake at locations of most significance for public safety.

Report Timing

The reports were initially requested for FY-98 planning purposes. The reports were partially prepared in response to this request, but delayed in order to include complementary planning efforts completed subsequently. Recommendations of the national workshop, "Vision 2005: An Action Plan for Strong-motion Programs to Mitigate Earthquake Losses in Urbanized Areas", Monterey, CA, April 2-4, 1997 are incorporated (see appendix 1 for an executive summary of the proceedings of this workshop). In addition, recommendations of the national workshop, entitled "Earthquake Engineering and Risk Workshop for USGS 5 Year Plan", January 16-17, 1997, Burlingame, CA are included (see Borcherdt and Frankel, 1997 for a complete set of workshop proceedings).

Authors

This report is based on deliberations of the "Committee on the Future of the National Strong-Motion Program". This committee is comprised of both USGS members and members of the Academic and Professional Community that are international authorities on strong motion data acquisition. The USGS members of the committee developed the initial drafts of the current document, which were then reviewed and revised based on a meeting of the entire committee in Menlo Park on September 23, 1997. H. Benz and G. Hart were not able to attend the workshop.

Charge of the EHRP Program Council

*"The **NSMP** is at a watershed. Its resources have shrunk over the last few years. The project has lost several personnel in the downsizing of the Geologic Division. In addition, like all other projects in the EHRP, the **NSMP** has experienced dwindling budgets for operating expenses. Consequently, the **NSMP** has been faced with meeting high expectations for products and services with declining resources. The outlook for the EHRP promises constrained personnel and financial resources for the foreseeable future. These circumstances and the tenuous current state of the **NSMP** call for a thorough review of the role and practices of the **NSMP** and the development of a plan to redefine and revitalize the **NSMP** mission and products in light of current realities and trends."*

*The Committee on the Future of the **NSMP** is asked to provide two items: a vision paper and options document.*

The vision paper should:

- *Define the role and functions of **NSMP** within the EHRP and the Earthquake Engineering Community,*

- *Address the interface and integration of other strong motion programs and EHRP supported networks including the regional networks, the US National Seismograph Network, the evolving National Seismic System, and the role of the SOS,*
- *Articulate the contributions of the NSMP to the assessment of earthquake hazards and reduction of earthquake losses,*
- *Address opportunities to support NSMP with non-USGS funding including sales of NSMP products.*

The options document should address two constrained funding scenarios:

- *Fixed dollar SIR support, which translates to an effective 5 percent decrease in funding (salaries and operating expenses) with no new hires...,*
- *Level of support remains constant in terms of real purchasing power, with no new hires,*
- Major funding becomes available starting in FY98 (and lasts for 5 years) to upgrade *instrumentation for purposes of real time hazard assessment in urban areas.*

Subsequent questions posed by EHRP Program Coordinator

The EHRP Program Coordinator posed a subsequent set of questions. These questions are addressed on the basis of the information presented in the vision paper and options document. Answers of the individual committee members are included as an appendix in the options document.

Roger D. Borcherdt

October 4, 1997

EXECUTIVE SUMMARY

Vision and Options for the Future of the US National Strong-Motion Program

The *VISION* and *OPTIONS* for the Future of the US National Strong-Motion Program are presented as an answer to the main charges of the EHRP Program Council. They are an objective evaluation of the importance and capabilities of present EHRP monitoring efforts to record the next major earthquake at locations of most significance for public safety. They are presented in separate reports. This document provides an executive summary of both reports.

MISSION

The Mission of the US National Strong-Motion Program is to increase public safety by providing earthquake strong-motion measurements on and near man-made structures to the earthquake engineering community, the scientific community, public agencies, industry, media, and other users for purposes of:

- Improving engineering evaluations and design methods for facilities and systems,
- Providing timely information for post-earthquake alerting, damage assessment, and emergency response action,
- Contributing to a greater understanding of the mechanics of earthquake generation and ground-motion characteristics.

CURRENT STATUS

Technical support staffing and funding for the **NSMP** are at critically low levels. The current status of the **NSMP** as summarized by the EHRP Program Council is stated as follows (Appendix A).

*"The **NSMP** is at a watershed. Its resources have shrunk over the last few years. The project has lost several personnel in the downsizing of the Geologic Division. In addition, like all other projects in the EHRP, the **NSMP** has experienced dwindling budgets for operating expenses. Consequently, the **NSMP** has been faced with meeting high expectations for products and services with declining resources. The outlook for the EHRP promises constrained personnel and financial resources for the foreseeable future. These circumstances and the tenuous current state of the **NSMP** call for a thorough review of the role and practices of the **NSMP** and the development of a plan to redefine and revitalize the **NSMP** mission and products in light of current realities and trends."*

Evaluation by the Committee responsible for this report indicates that the operational staff for the National Strong-Motion Network (NSMN) has decreased to critical levels. These levels are less than network staffing levels that were used to maintain the network prior to passage of the 1977 Earthquake Hazard Reduction Act. EHRP funding and staffing levels as envisioned for the NSMP by passage of the Act have not been realized. Technical staff concerned with network and data center operations has decreased by 12 members since 1981. Ninety percent of the present NSMN uses analog instrumentation developed in the 1950's. No other EHRP supported monitoring program provides strong-motion measurements of the main earthquake at locations of most significance for public safety. The present inability of the US to provide a thorough set of urgently needed strong-motion measurements of the next tragic earthquake throughout stricken areas remains a **major obstacle** to earthquake loss reduction in the United States.

VISION

I - Contributions of Strong-Motion Measurement to Earthquake Hazard Mitigation and Loss Reduction

- Recordings of strong, earthquake-induced shaking on and near damaged structures are critical for reduction of earthquake losses. They are the basis for earthquake resistant design, construction, and retrofit throughout the world.
- Strong-motion recordings of the main earthquake are the basis for scientific understanding of the physics of seismogenic failure, resultant seismic radiation, and its effects on man-made structures.
- Strong-motion data acquired by the **NSMP** since its beginning in 1932 and the CSMIP within the last decade currently provides the basis for earthquake hazard reduction in the US.

II - Relationship of NSMP to Regional and National Networks and other Strong-motion Programs

- Two distinct types of earthquake monitoring efforts are required to record earthquakes.
  1. Records of **"weak motions"** are needed to monitor seismicity at quiet locations on firm to hard rock away from man-made structures. Regional and national networks have evolved to meet this need with the primary user being the Earth Science community.
  2. Records of **"strong-motion"** are needed to record the main earthquake at locations of importance for public safety, namely locations throughout the stricken built environment in noisy locations on and near man-made structures, usually on stiff or soft soils. The **NSMP** was initiated in 1932 to meet this need with the primary user being the Earthquake Engineering community.
- Dramatic increases in urbanization and economic infrastructure based on inadequate strong-motion information requires an urgent and dramatic increase in resources to develop a strong-motion measurement effort of the main shock in and near damaged structures that is in proper balance with weak-motion monitoring efforts for seismicity purposes. Differences in site locations, required instrumentation, and user communities requires that differences in the two types of measurement efforts be respected in order that the nation's urgent need to record the next main earthquake at locations of most significance for public safety and the reduction of future earthquake losses can be achieved.
- A balanced solution to earthquake measurement problem requires an integrated effort, recently exemplified by new coordinated project in the Los Angeles region termed TriNet. This project facilitates the integration of data recorded by separate programs having distinct missions and user communities. Data collected by the programs on different types of instrumentation is rapidly processed by each program and made available for eventual use in a "Virtual Data" center as quickly as technology permits.
- The **NSMP** should dramatically accelerate its efforts to convert analog stations to digital stations in order that on-scale measurements of the main shock in urban areas can be readily incorporated into a "Virtual Data" center and used for real-time hazard assessment, emergency response actions, and a variety of other purposes.

III - Role and Function of the National Strong-motion Program (NSMP) operated by the USGS

- The National Strong-Motion Program (**NSMP**) as mandated by the Earthquake Hazard Reduction Act of 1978 should continue to concentrate on the problem of recording each large and damaging earthquake in the United States on and near man-made structures throughout damaged urban areas. **No other seismic monitoring program** operated by the USGS EHRP

is focussed on this urgent need to record the next tragic earthquake at locations of most significance for public safety.

- The **NSMP** since its beginning in 1932 has provided the fundamental data that is the basis for US building codes, design and construction of critical earthquake resistant structures, scientific understanding of seismogenic failure for the main shock, and most USGS EHRP products.
- The present scarcity of strong-motion recordings is a **major obstacle** to the reduction of future catastrophic earthquake losses to manageable levels.
- An urgent need to record the next major earthquake adequately throughout stricken urban areas requires that instrumentation and recording efforts be increased by nearly **20 times** within the next five to ten years.
- The **NSMP** should maintain and enhance the present National Strong-Motion Network of 850 accelerographs at 540 stations in 33 states and Puerto Rico in cooperation with numerous federal, state, and local agencies.
- The **NSMP** should enhance and continue to operate the National Strong-Motion Data Center (NSMDC) as a critical component of a national "Virtual Data Center" in order to maintain a central national data base at a consistent standard for all of the earthquake-resistant design, retrofit, and construction industry and numerous research and public response communities
- Urgency and national need for strong-motion recordings of each damaging earthquake argues strongly for restoration of **NSMP** funding and staff levels to 1981 levels as quickly as EHRP resources permit.
- The **NSMP** should establish an Advisory Board to assist the USGS in the planning and implementation of the **NSMP** as recommended by the EHRP five year review panel and this committee review.

OPTIONS

Option I -- Constant Level of Program Support ($300K SIR OE)

Implications

- The FY-98 management configuration of the program is a positive step towards getting the **NSMP** back on track.
- Staffing and OE levels for the program are at critical levels. Maintenance of the program at these levels for the next 5 years is considered by the committee equivalent to **a gradual termination of USGS operational responsibility for the NSMP**.

Recommended Actions

- If USGS staffing and funding support for the **NSMP** continues to decrease with no or only limited resources devoted to instrumentation on and near structures, then this decision needs to be clearly articulated by Survey management to the national EHRP community. The urgent national need to thoroughly record the main shock at locations of significance for public safety requires a long-term institutional commitment that serves the needs of the earthquake engineering community.

Option II -- Slightly Increased Level of Support ($300K SIR FY 98 OE; $450K FY 99 and Beyond)

Implications

- This increase in OE represents a welcome increase in funding that helps offset the annual 5 percent increase in total operating costs due to the effects of inflation and escalating staff salaries.
- This increase in OE funding level could be used for specific tasks in approximately the following proportions:
  1. Reduce analog data backlog and improve strong motion data base ($25K per year),
  2. Upgrade analog stations to digital (5 stations per year; ~ $75K),
  3. Acquisition of geotechnical and seismic information required to interpret existing strong-motion data (2 sites per year; ~ $25K).
  4. Initiate development of improved near-real time telecommunication capability for strong-motion stations (7-8 stations per year; $25K).
- Technical support staff for the NSMP has not been replaced with one exception, since funding responsibility for the program was transferred to the USGS in 1981 and passage of the Earthquake Hazard Reduction Act of 1978. As a result, gradual attrition of 12 staff members through retirements has reduced technical program staff levels to levels inadequate to maintain the program.
- Committee consensus is that this option reduces to **gradual termination of USGS operational responsibility for the NSMP, unless staff replacements are in place** within the next 1-2 years.

Recommended Actions

- NSMP technical and operational staffing and funding levels **should be restored to 1977-1981 levels** as soon as feasible.
- NSMP OE levels should be increased to $450K level in FY 98, if possible and subsequently increased at a rate of 10-15% per year for the next 4 years.
- **Replacements of recently retired staff are critical and urgently requested**. Staff replacements are the highest priority need of the NSMP. As a minimum, 7 replacements for 12 staff vacancies in the next year or so are deemed essential for program continuation and satisfactory progress on:
  1. Maintenance of NSMN stations with acceptable maintenance intervals of once a year.
  2. Upgrade of analog to digital stations.
  3. Installation and maintenance of strong-motion telecommunication effort as established for strong-motion components of TriNet.
  4. Establishment of digital strong-motion component of "Virtual Strong-Motion Database" for rapid retrieval and dissemination of data immediately following a major earthquake.
  5. Expansion of instrumentation partnerships with federal, state, and local agencies, and owners of hospitals, emergency-response centers, lifelines, and high occupancy buildings to augment USGS resources as exemplified by the recent initiative to instrument federal buildings (Celebi and Nishenko, 1997).
- Biannual meetings between a subcommittee of the EHRP Program Council and the advisory panel for the NSMP are recommended to improve communication, review progress, evaluate strong-motion recording needs, and facilitate understanding between the needs of regional network operations and the needs of NSMP.

- Establishment of an external advisory committee for the NSMP is a high priority. To expedite receipt of critically needed advice, biannual meetings of the committee on the future of the US NSMP are recommended.

Option III A -- Significantly Increased Level of Support to Permit Real-Time Damage Assessment with Strong-Motion Instrumentation

Implications

- Real-time damage assessment for purposes of structural safety evaluations and guidance for emergency response and recovery actions requires strong-motion measurements in and near man-made structures in densely urbanized areas.
- The large number of instruments with near-real time parameter retrieval that need to be installed throughout densely developed urban areas near and on facilities such as bridges, highway overpasses, hospitals, emergency response centers, fire stations, and airports, and high-occupancy structures offers an exciting possibility to acquire strong-motion measurements that are urgently needed for public safety.

Recommended Actions

- To facilitate implementation of Option III A, the National Strong Motion Program in conjunction with CASMP, COSMOS, and other appropriate groups will:
  1. Develop a plan for implementation of the real-time disaster assessment capability in urban areas working with federal, state, and local emergency response agencies, local governments and private sector companies and organizations responsible for a variety of critical lifelines and structures.
  2. Develop telecommunication and installation plans for strong motion instrumentation in densely urbanized areas with high earthquake risk (Los Angeles, San Francisco, Seattle, Salt Lake City, Memphis, New York, and Boston).
  3. Develop a database of strong motion information that can be rapidly assessed by practicing earthquake engineers, local officials responsible for implementing earthquake resistant design measures, and other users concerned with earthquake loss assessment and earthquake safety.
  4. Provide for long-term maintenance and operation of the system for a period of several decades.
  5. Facilitate establishment in conjunction with CSMIP modern instrumentation standards and configurations appropriate for both the earthquake engineering community and real-time assessment purposes.

Option III B -- Significantly Increased Level of Support to Permit Nation's On-Scale Measurement Needs of the Main Earthquake in Urban Areas to be met in the Next 10 Years

- The significance and urgency of the national need to acquire on-scale measurements of the next tragic main shock at locations in urban areas, suggests that a coordinated national effort needs to rapidly evolve. This effort can and should be conducted in concert with the new real-time hazard assessment effort. However, the overall need for strong-motion measurement is **much broader in scope.** It has a much greater impact on public earthquake safety and requires a much larger set of resources.
- 4,000 modern strong motion instruments being installed since the Kobe tragedy in Japan and 1000 instruments in Taiwan emphasize the urgency and importance of a long-term, broad-based national strong motion network to meet US earthquake loss reduction needs.

Implication of Present Effort

- Continued EHRP support of **NSMP** at levels recommended in Option II combined with the efforts of all other strong-motion programs, ensures that the next large and damaging earthquake in the United States **will not** be adequately recorded in whatever densely urbanized area that might be impacted.

Recommended Actions

- The **NSMP** should help launch a dramatically accelerated program to acquire the needed on-scale measurements of the next damaging US earthquake at locations near and on damaged man-made structures.
- The **NSMP** should continue to conduct long-term partnerships, facilitate integration of efforts and interests of other national and state organizations and develop national and private resources to meet national needs.
- The **NSMP** should serve as an integral and founding member of the national Consortium of Organizations for Strong-Motion Observation Systems (COSMOS) in order to help launch a dramatically accelerated earthquake measurement program for public safety.
- The **NSMP** should continue to integrate the efforts of both the engineering and seismology communities and work to develop improved understanding of the different cultures and user needs.
- Desire and commitment of USGS to operate a significantly expanded **NSMP** primarily for purposes of earthquake engineering should be reviewed and formally confirmed.

REFERENCES

Borcherdt, R.D., and Frankel, A., 1997, Recommendations for EHRP 5-Year Plan, U. S. Geological Survey Open-File Report No. 97-58, 47 pp.

Celebi, M. and Nishenko, S., 1997, Seismic Instrumentation of Federal Buildings: A Strawman Draft Document for Consideration by Federal Agencies, US Geol. Survey Open-file Rept., 97-452.

Stepp, C.J., 1997, *Proceedings, Vision 2005: An Action Plan for Strong-motion Programs to Mitigate Earthquake Losses in Urbanized Areas,* National Science Foundation, Monterey, CA, April 1997.

APPENDIX A -- CHARGE OF THE EHRP PROGRAM COUNCIL

MEMORANDUM October 3, 1996

To: Walter Mooney

From: Robert A. Page Coordinator, Earthquake Hazards Reduction Program

Subject: Charge to form a Committee on the Future of the National Strong Motion Program (NSMP)

The Earthquake Hazards Program Council on August 6, 1996, tasked you with arranging for the preparation of an options document to define the future of the USGS National Strong Motion Program (NSMP). The purpose of this memo is to present you and the Committee on the Future of the NSMP with a charge and with guidelines.

The NSMP is a critical element of the USGS EHRP. It and the national shaking hazard map project are our most important links to the engineering community and are vital components of the national effort to reduce earthquake losses.

The NSMP is at a watershed. Its resources have shrunk over the last few years. The project has lost several personnel in the downsizing of the Geologic Division. In addition, like all other projects in the EHRP, the NSMP has experienced dwindling budgets for operating expenses. Consequently, the NSMP has been faced with meeting high expectations for products and services with declining resources. The outlook for the EHRP promises constrained personnel and financial resources for the foreseeable future. These circumstances and the tenuous current state of the NSMP call for a thorough review of the role and practices of the NSMP and the development of a plan to redefine and revitalize the NSMP mission and products in the light of current realities and trends.

Deliverables

The Committee on the Future of the NSMP is asked to provide two items: a vision paper and an options document.

The vision paper should broadly define the role and functions of the NSMP within the EHRP and within the U.S. earthquake community. The vision for the NSMP should address the interface and integration of strong-motion data acquisition with other large strong-motion programs in the United States and with EHRP-supported regional seismic networks, the U.S. National Seismograph Network, and the evolving National Seismic System. The role of the SOS project should also be incorporated into the vision. The paper should articulate the contributions of the NSMP to the assessment of seismic hazards and reduction of earthquake losses. The vision paper should also address what opportunities exist or should be explored to support NSMP operations with non-USGS funding and by recovering costs through sales of NSMP products.

The options document should define and prioritize the functions, products, and services that the NSMP could be expected to provide within the context of plausible levels of staffing and funding. The options should address two constrained funding scenarios. The first should assume fixed-dollar SIR support for the NSMP with the funding in FY 97 equal to that which was available in FY 95; this scenario translates into an effective 5 percent annual decrease in total funding (salaries and operating expenses) because of the effects of inflation and escalating staff salaries. The second option should assume that the level of support to the project remains constant in terms of real purchasing power. Neither option should assume any new hire. Any increase in personnel must come from reassignment of personnel within the Team. Assumptions about reassignments should be discussed and approved by the Team Chief Scientist. A third option should address the scenario that major funding becomes available starting in FY 98 (and lasts for 5 years) to upgrade seismic instrumentation for the purposes

of acquiring and disseminating real-time earthquake information in urban areas that are currently being monitored by EHRP-supported seismic networks. Peter Ward can provide guidance on what assumptions to use in developing this third option.

Committee Composition

The committee should include at least one person representing the perspective of either the southern or northern California networks and at least one person from Golden. The decision of whether or not to include non-USGS members on the committee is left to you, but it is imperative that the views of the external seismic engineering community and managers of other major strong-motion programs be solicited and carefully considered in preparing the documents. In my view, the committee membership should not exceed five or six. I would like to be advised/consulted about the composition of the committee during its formation.

Timeline

The Program Council set a due date of December 1, 1996. Previously I requested that the committee chair present the preliminary conclusions by October 18 to the EHRP Planning Group in expectation that the Planning Group would be able to complete a first draft of the 5-year (1998-2002) plan for the USGS EHRP by mid-November. The planning timeframe has been extended and a preliminary presentation of the conclusions is no longer necessary.

cc: EHRP Chron, Page Chron, File - NSMP, EQ Program Council via e-mail, John Unger, Steve Bohlen, P. Leahy, RAPage:jac

APPENDIX B -- PURPOSE FOR WORKSHOP ON THE FUTURE OF THE US NSMP

WORKSHOP ON THE FUTURE OF THE US NATIONAL STRONG MOTION PROGRAM

9:00 AM

September, 23, 1997

Menlo Park, CA

Committee on the Future of the US National Strong Motion Program

B. Bolt, C.B. Crouse, G. Hart, K. Jacob, T. Shakal, C. Stepp,

R. Borcherdt (Chm.), H. Benz, M. Celebi, A. Frankel, W. Joyner, E.V. Leyendecker, D. Oppenheimer, R. Porcella, C. Stephens, D. Wald

PURPOSE

This workshop "On the Future of the US National Strong Motion Program" is being help in response to a request of the EHRP Program Council for a thorough review of the program. The purpose of this workshop is to develop consensus reports in response to the council's request for "Vision" and "Options" documents. The reports are intended to address the major charges of the council and be consistent with national recommendations as developed at the national workshop, "Vision 2005: An Action Plan for Strong-motion Programs to Mitigate Earthquake Losses in Urbanized Areas", Monterey, CA, April 2-4, 1997 and recommendations of national workshop, entitled "Earthquake Engineering and Risk Workshop for USGS 5 Year Plan", Burlingame, CA, January 16-17, 1997.

The documents are intended to address directly the nation's earthquake monitoring needs. A principal objective of the Committee is to develop a vision and set of options for recording the next major earthquake near the source and throughout damaged urban areas on and near man-made structures. Your comments and thoughts on how to best achieve this objective from the nation's point of view and from that of the USGS and the **NSMP** are most welcome.

The EHRP program council points out that: "The **NSMP** is at a watershed. Its resources have shrunk over the last few years. The project has lost several personnel in the downsizing of the Geologic Division in addition, like all other projects in the EHRP, the **NSMP** has experienced dwindling budgets for operating expenses. These circumstances and the tenuous current state of the **NSMP** call for a thorough review of the role and practices of the **NSMP** and the development of a plan to redefine and revitalize the **NSMP** mission and products in light of current realities and trends." The workshop is intended to develop a set of recommendations that represent a national consensus consistent with recommendations of previous workshops and other strong-motion and earthquake network monitoring programs.

APPENDIX C -- AGENDA FOR WORKSHOP ON THE FUTURE OF THE US NSMP

Agenda

Committee on the Future of the US National Strong-Motion Program
September 23, 1997
Menlo Park, CA

		Discussion Leader	*Reporter*
9:00	Welcome, Introductions	R. Borcherdt	
9:10	EHRP Program Council Objectives	J. Filson	
9:20	WR EH Team Objectives	J. Dieterich	
9:30	Overview of Vision and Option Documents	R. Borcherdt	
10:00	General Discussion and Comments		C. Stephens
10:15	Break		
10:30	Contribution of Strong-motion Measurement	C.B. Crouse	D. Oppenheimer
10:50	Relationship of **NSMP** to RSN, NSS, & CNSS	H. Benz	W. Joyner
11:20	Relationship of **NSMP** to CSMIP & Other SMIP	T. Shakel	R. Porcella
11:40	Role of **NSMP** in Real Time Hazard Assessment	B.Bolt	E.V. Leyendecker
12:00	Lunch		
1:00	Vision for **NSMP** in EHRP, Eq. Eng., COSMOS	C. Stepp	A. Frankel
1:30	Options I & II with no significant increase for **NSMP**	K.Jacob	M. Celebi
2:30	Option IIIa (Real-time hazard increase)	K.Jacob	D. Wald
2:45	Option IIIb (CASMP increase)	C. Stepp	C.B. Crouse
3:00	Working Break -- Discussion Leader - Reporter Discussions		
3:20	Discussion Leader Summaries	R.Borcherdt	C. Stepp
4:20	Wrap-up Discussion - Summaries	R. Borcherdt	Each member
5:00	Adjourn		