

**TECHNICAL ADVISORY COMMITTEE  
TO TEXNET AND BUREAU OF ECONOMIC GEOLOGY**

**Meeting Minutes**

Monday, October 7, 2024 – 11:30 a.m. to 2:30 p.m.

**OPENING**

The meeting of the TexNet Technical Advisory Committee was called to order at ~11:30 a.m. on Monday, October 7, 2024.

**PRESENT**

Alexandros Savvaidis, Manager of TexNet  
Brian Stump, Committee Chair  
Mark Boyd, Committee Member  
Jeff Nunn, Committee Member  
Larry French, Committee Member  
Mark Shuster, Interim Director, Bureau of Economic Geology  
Ken Wisian, Associate Director, Bureau of Economic Geology  
Elizaveta Rybina, TexNet Admin Program Coordinator

**ABSENT**

Dave Cannon, Committee Member  
Chris Hillman, Committee Member  
Kris Nygaard, Committee Member  
Aaron Velasco, Committee Member  
Scott Mitchell, Committee Member

A quorum was not present. The meeting went forward for information items only.

**AGENDA FOR OCTOBER 7th, 2024 MEETING**

1. Approval of Minutes of the June 25th, 2024 meeting.
2. Update on the Hiring Plan (5 min)
3. Update on releasing M1.5+ auto-picked events (10min)
4. Budget split (e.g., equipment, maintenance, computer hardware, staff) (15min)
5. Lunch (30min)
6. TexNet operations and research activities (60min)
7. Earthquake Hazard Plan (60min)
8. Biennial Report (45min)
9. Publications and presentations update (5min)
10. Suggestions for the subsequent meetings (10min)

**APPROVAL OF JUNE 25th, 2024 MEETING MINUTES**

The Committee did not review the June 25th, 2024 meeting notes and left final approval to the next meeting with a quorum.

## **HIRING UPDATE**

Alexandros Savvaidis informed the TAC that new recruits list had been finalized. Alexandros also presented the updated TexNet Organogram to the TAC, showing hiring and job title changes in the Field Operations, Seismic Analysts, IT/CS, and Scientific Support:

- Jordan Smith (UTemp), Field Engineer, RSA, was hired on 8/20/2024.
- John Tagle (UTemp), Field Engineer, RSA, was hired on 9/12/2024.
- Michelle Lopez (UTemp), Administrative Associate, was hired on 8/26/2024.
- Andres Gomez, Instrumentation Engineer, employment start date is contingent upon the approval and issuance of the necessary visa.
- Dino Huang was appointed to lead TexNet earthquake analysis group, currently with 40% of his time devoted to research and 60% of his time devoted to earthquake analysis.
- Caroline Breton was appointed to lead TexNet IT/CS group.

## **LUNCH WITH THE NEW TEXNET HIRES**

During lunch there was a general discussion between the TAC and the new hires. The group described their job responsibilities and how they work together responding to TexNet needs.

## **UPDATE ON RELEASING M1.5+ AUTO-PICKED EVENTS**

Alexandros Savvaidis informed the TAC that for the Delaware Basin TexNet reports auto-picked events of M1.5+ as of November 1st, 2023. M1.5+ events are manually reviewed on the next business day. TexNet reviews M1.5+ events going back to 2017 and there are currently more than 30,000 events with this magnitude rate. Two earthquake analysts work full-time on this task to complete TexNet catalog. This backlog is expected to be completed in two years, with priority given to approximately 7,000 M2+ events targeted for completion by September 2025.

As of April 2024, TexNet reports auto-picked M1.5+ events for the Eagle Ford area with the manual review on the next business day. TexNet also reviews the backlog going from January 2024 onward. It is expected to have this backlog completed by November 2024.

For the Delaware Basin and Eagle Ford area all auto picked events from January 2024 and going forward are publicly available.

Starting September 2024, TexNet analyzes M1+ events daily for the Midland Basin and addresses the backlog from January 2024 onward. The backlog is expected to be ready by January 2025. Alexandros Savvaidis emphasized that the seismicity in the Midland Basin differs entirely from the Delaware Basin and Eagle Ford area. Analyzing events with M1+ rate should help with understanding the seismicity trend. The Midland Basin has a backlog of fewer than 1,000 earthquakes. TexNet checks duplicates and performs quality control. The auto picked events on the TexNet catalog website have description that change after they get manually reviewed. Auto picked events are available to the public.

Alexandros explained to the TAC the current process for organizing earthquake events on the website:

- All manually reviewed events
- Auto picked and manually reviewed on the next business day

During the discussion it was suggested to have a separate database only for automatic M1+ events with a disclaimer that those events have not been reviewed or validated. It was decided to return to this discussion during one of the following TexNet TAC meetings.

## **BUDGET**

The TexNet Budget for 2024-2025 (YR2) was discussed and summarized in the following table reflecting two main changes:

- Budget for TexNet’s operations has increased due to additional hiring in this group
- Budget for seismicity analysis decreased due to higher operational expenses

	Spent	Budgeted	
	YR1	YR2	TOTAL
T1- Network Operations (Seismic Stations, Earthquake Catalog)	\$1,700,000.00	\$2,000,000.00	\$3,700,000.00
T2 - Seismicity Analysis (Seismotectonics, Modelling, Software Dev/Evaluation, Machine Learning)	\$1,180,000.00	\$876,581.55	\$2,056,581.55
T3 - Quality Controlled Geodatabases	\$55,000.00	\$57,491.23	\$112,491.23
T4 - Analysis of Human Operations and Seismicity	\$47,000.00	\$47,927.22	\$94,927.22
T5 - Earthquake Hazard	\$50,000.00	\$50,000.00	\$100,000.00
	\$3,032,000.00	\$3,032,000.00	\$6,064,000.00

The TAC discussed the quality-controlled geodatabases item, including the RRC database and subscription based databases, and suggested tracking wells status changes from deep to shallow, coordinating those changes with RRC.

Alexandros Savvaidis also reviewed splitting the budget by categories, with column YR1 showing spent amounts and column YR2 showing the budgeted amounts:

	Categories	Expensed YR1	Budgeted YR2
<b>1</b>	<b>Salaries</b>	<b>\$1,972,967.36</b>	<b>\$2,315,001.87</b>
a	SMU	\$194,106.42	\$165,000.00
b	UH	\$5,464.08	\$0.00
c	UTA	\$1,773,396.86	\$2,150,001.87
<b>2</b>	<b>IT</b>	<b>\$371,296.68</b>	<b>\$199,780.13</b>
a	Computer-Usage	\$46,635.78	\$73,971.00
b	IT-Hardware	\$229,820.80	\$29,000.00
c	IT-Services	\$94,840.10	\$96,809.13
<b>3</b>	<b>Office and PPE Supplies</b>	<b>\$8,497.25</b>	<b>\$10,000.00</b>
a	Office-Supplies	\$6,472.62	\$7,000.00
b	PPE	\$2,024.63	\$3,000.00
<b>4</b>	<b>New Equipment</b>	<b>\$241,142.49</b>	<b>\$0.00</b>

		Categories	Expensed YR1	Budgeted YR2
	a	Seismic Stations	\$241,142.49	\$0.00
<b>5</b>		<b>Equipment Maintenance</b>	<b>\$220,407.00</b>	<b>\$266,705.00</b>
	a	Seismic Stations Replacements	\$181,959.43	\$170,000.00
	b	Seismic Stations Maintenance	\$38,447.57	\$96,705.00
<b>6</b>		<b>Telecommunications</b>	<b>\$133,326.49</b>	<b>\$135,000.00</b>
	a	Services	\$133,326.49	\$135,000.00
<b>7</b>		<b>Travel</b>	<b>\$81,527.66</b>	<b>\$105,513.00</b>
	a	Outreach	\$19,589.76	\$24,793.00
	b	Fieldwork	\$61,937.90	\$80,720.00
<b>8</b>		<b>Balance-Forward</b>	<b>\$2,835.07</b>	<b>\$0.00</b>
		<b>Total</b>	<b>\$3,032,000.00</b>	<b>\$3,032,000.00</b>

The TAC discussed equipment inventory, the need for future adjustments and suggested providing a tracking analysis for planning over the next few years. Due to the aging of the equipment (IT and Seismic Station) there is an increase in maintenance costs. It is considered that the new legislative session request shall include an increase in funding to cover equipment related costs.

## TEXNET OPERATIONS AND RESEARCH ACTIVITIES

Alexandros Savvaidis reported that three new seismic stations deployed from TexNet in 2024-Q3 with two stations in Eagle Ford, funded by TexNet and one in East Texas, funded by operators.

Nine new stations were deployed from operators (one in the Delaware Basin and eight in the Midland Basin) with data provided to TexNet.

Alexandros Savvaidis informed the TAC that the operators share the real time data with TexNet, though TexNet does not have access to the instruments.

Alexandros Savvaidis discussed seismic station installation, noting that most are shallow burial (6 feet or less), and the potential adoption of a new drilling approach for borehole installations.

There are 196 stations deployed and maintained by TexNet, with a total of 376 stations, including the stations from operators and other networks, used in earthquake analysis.

Alexandros Savvaidis noted the increase in seismic station deployment in the Permian Basin and in Eagle Ford area. The plan is to deploy one new station south from the City of Midland due to concerns of seismicity in the area, one new station in Eagle Ford to fill the gap in the western part of the current array, and to move one station located in the eastern part of Eagle Ford, to an adjacent site.

Alexandros Savvaidis reported one damaged station at Cleburne Regional Airport.

Alexandros Savvaidis presented a revised map with proposed 17 of high priority, 11 of medium priority, and 4 of low priority seismic stations in the Midland Basin. The TAC suggested highlighting these needs in the meeting in December by separating the events and proposed distribution of stations into two simpler side-by-side figures, including SRAs defining high priority, medium priority areas, as well identifying the current inventory.

It was suggested to include progress on depth resolution regarding the need for velocity model and to densify the network.

Alexandros Savvaidis updated the TAC on the seismicity pattern in 2024 emphasizing that there has been a seismicity increase in the Midland Basin and slight increase of seismicity in Eagle Ford.

The seismicity pattern in 2024-Q2 identified most of the seismicity in the Delaware Basin. Seismicity also increased in Eagle Ford and in the Midland. Seismicity pattern in 2024-Q3 observed an increase in the Midland Basin.

## **RESEARCH UPDATE**

- TexNet completed the Midland Basin 3D Vp model and is still working on finalizing the Vs model due to limited available data
- Testing Eagle Ford 1D Vp model
- For the Delaware Basin Vp for the southern part is completed and TexNet is working on the northern part as well as on 3D Vs model.
- It is planned to have 3D model for the whole Permian Basin

Alexandros Savvaidis highlighted the work done on maximizing the event detectability on CCS (Carbon Capture and Storage) and EGS (Enhanced Geothermal Systems) describing the tool developed by TexNet. This automated tool designs arrays for seismic monitoring projects using magnitude sensitivity analysis. TexNet method has been already applied to some of CCS monitoring projects. TexNet validates the code using data from its existing networks. The minimum magnitude detected from the deep learning algorithm agrees with the magnitude sensitivity results. The TAC suggested using a similar model for depth estimates.

Alexandros Savvaidis also reported on the deep learning for p-wave first-motion polarity determination and its application in focal mechanism inversion. Polarity determination accuracy reaches around 95%. Machine learning achieves promising results, suggesting that it could be used in the future to provide automatic focal mechanisms that can be reviewed later.

Alexandros Savvaidis reported that seismogenic zones having similar, extensional seismotectonic features were observed North and East of Snyder.

Alexandros Savvaidis addressed complex seismotectonic characteristics in the Midland Basin:

- Earthquake source mechanism pattern of the Midland Basin is a mix of normal and strike-slip faulting, not randomly distributed.
- The two types of faults co-exist, suggesting a structural complexity.
- A rift structure transecting the Midland basin is suggested to accommodate the structural complexity.

Effect of pre-existing fractures on the potential for induced seismicity for hydro storage dam projects:

- TexNet tested the conditions under which a single pre-existing fault along the middle of the reservoir can be activated and result in Reservoir Induced Seismicity
- We used the finite difference numerical modelling code to examine the effect of normal stress and shear stress on fracture failure
- TexNet applied three main scenarios to quantify the conditions under which the fault is going to fail based on Mohr-Coulomb criteria:
  - fracture weakening state at which we increase and decrease the background and water induced shear and normal stress
  - water weakening scenario, where the cohesion is reduced gradually from top to bottom
  - fracture fatigue by weakening the material around the existing fracture
- In 4 out of 6 cases the fracture slips

Alexandros Savvaidis highlighted the following additional research priorities:

1. Network geometry improvement to identify locations for new stations; Midland basin seismic station needs available
2. Decrease the magnitude reported by TexNet for the State; homogenize the magnitude of completeness (Mc) for each basin
3. Update seismotectonic studies for the State; published work for Delaware and Midland Basins, Snyder and Eagle Ford
4. Improve focal mechanism and seismic moment availability using first motion, and amplitude ratio (HASH) and full waveform moment tensor inversion (GISOLA) to improve the data on the rupture zones to the public; submitted for publication

Alexandros Savvaidis provided an update on the software tools:

1. Geomechanics Induced Seismicity Toolkit (GIST) – collaborative Web Tool project with ExxonMobil.
  - Business Logic is finalized.
  - Core code is developed.
  - Working on User Interface / User Experience.
  - Demo to be presented at the annual meeting.
  - This tool is available in the public GitHub repository: <https://github.com/ut-beg-texnet/GIST>
2. Non-Linear Earthquake Location (NonLinLoc) – Software Tool
  - Transferred from Anthony Lomax to TexNet
  - <https://github.com/ut-beg-texnet/NonLinLoc>

Alexandros Savvaidis and the TAC discussed covering updated depth uncertainty and the assessment of those uncertainties, and how improvements could be made with more stations and resources available in the upcoming Annual Review meeting.

The TAC discussed the Biennial Report and its sections suggesting providing data by county and highlighting concerns about hazards and risks. The report will be reviewed by the TAC in November 2024.

The TAC discussed a proposed plan for the Annual Review and TexNet TAC meeting.

#### **SUGGESTIONS FOR THE SUBSEQUENT MEETING Q4-2024**

1. Operations (e.g. status/maintenance, resources) (15min)
2. Biennial Report (45min)
3. Publications and presentations update (15min)
4. Suggestions for the subsequent meetings (15min)

#### **ADJOURNMENT**

Meeting was adjourned at ~2:30 pm by Brian Stump, Committee Chair

**Minutes submitted by:** Elizaveta Rybina, TexNet

**Minutes reviewed by:** Alexandros Savvaidis, TexNet

**Minutes approved on December 3rd, 2024, by:**

Brian Stump, Committee Chair  
Mark Boyd, Committee Member  
Chris Hillman, Committee Member  
Jeff Nunn, Committee Member

Aaron Velasco, Committee Member  
Dave Cannon, Committee Member (via Zoom)